IPPRESIDENT'S MESSAGE

Dear IPPS Members,

We are pleased to invite you to the 9th World Congress on Parasitic Plants, which will be held on Sunday June 3 to Thursday June 7, 2007 in Charlottesville, Virginia. The congress continues a long tradition of regularly assembling the world’s experts on parasitic plants for professional and scientific meetings, which started in 1973 with the first international meeting in Malta. The venue was chosen to be in Virginia, thanks to the long tradition of parasitic plants research in this state, and its significant contribution to the understanding of plant parasitism. Charlottesville is also a very pleasant city, with the historic university that was planned by Thomas Jefferson, third president of the United States, who was not only a gifted architect, but also a scientist.

The Congress will bring together scientists representing a wide spectrum of disciplines, research approaches, and geographical representation of parasitic plant research. Assembling specialists with different perspectives, all focused around the common theme of plant parasitism, provides a stimulating environment for learning, exchanging ideas, meeting with old and new colleagues, and making new acquaintances. The Congress will include presentations on the cutting edge of parasitic plants research and on management technologies of parasitic weeds. A major emphasis in the Congress will be the fostering of interaction among participants.

Please seriously consider attending the Congress, mark the Congress dates in your diary, and indicate your interest in attending the Congress by submitting the preliminary registration form that is included below.

Almost five years have passed since Professor Edward S. Teryokhin has passed away. Professor Teryokhin was one of the most important specialists in broomrape taxonomy, with original contributions to the understanding of parasitic plants. His book on broomrapes, first published in Russian (1988) and then translated into English under the title Weed Broomrapes is a valuable contribution for all students of root parasites, and especially those interested in anatomical, taxonomic, ecological and embryological aspects of these plants. As a deep-rooted revolutionist of broomrape taxonomy, he insisted on separating the two important tribes of the genus Orobanche into two distinct genera: Orobanche and Phelipanche. The name Phelipanche was first given to P. ramosa by Auguste Pomel (1821-1898), a French mines engineer stationed in Algeria, who was very active in the study of North African fauna and flora. Under the developing molecular knowledge, and in particular with the recent studies by Gerald Schneeweiss and his colleagues in Vienna, splitting Orobanche into separate genera is now widely accepted. As a result, we should now use the names Phelipanche ramosa (L.) Pomel and P. aegyptiaca (Pers.) Pomel instead of O. ramosa and O. aegyptiaca.

These aspects and many others, including basic and applied problems with both weedy and non-weedy parasites will be discussed in the coming IPPS Congress, together with a comprehensive discussion on ways for parasitic weeds management.

We are looking forward to meeting you at the Congress!

Danny Joel, IPPS President

9TH WORLD CONGRESS ON PARASITIC PLANTS

Sunday June 3 to Thursday June 7, 2007
Omni Hotel, Charlottesville, Virginia USA

PROGRAM

Contribution and participation from researchers on any weedy and non-weedy parasitic plants is encouraged.

The program will consist of oral presentations and posters. Oral presentations will be invited or selected from submitted preliminary abstracts.
Topics will include but are not limited to the following:

- Evolution and phylogeny of parasitic plants
- Parasite biochemistry and physiology (including molecular biology)
- Floral biology
- Ecology and population biology of parasitic species
- Host-parasite communication (including germination stimulation, haustorial induction, etc.)
- Host and non-host responses to parasitism
- Parasitic weed management
- Regulation and PhytoSanitation
- Or any other aspects, descriptions, approaches and ideas related to parasitic plants.

Participation of students and young researchers is strongly encouraged.

Scientific Advisory Committee

- Jim Westwood, USA (Chair)
- Abdel Gabar T. Babiker, Sudan
- Philippe Delavault, France
- Grama Dhanapal, India
- Atef Haddad, Syria
- Joseph Hershenhorn, Israel
- Erika Maass, Namibia
- Lytton Musselman, USA
- Jeremy Ouedraogo, Burkina Faso
- Alejandro Perez de Luque, Spain
- Julie Scholes, UK
- Simon Shamoun, Canada
- Kushan Tennekoon, Sri Lanka
- Mike Timko, USA
- Maurizio Vurro, Italy
- John Yoder, USA
- Anna Williams, Australia
- Andrea Wolfe, USA
- Koichi Yoneyama, Japan

THE VENUE

Charlottesville and the surrounding area

Charlottesville is home to the University of Virginia and close to several important US historic sites, including Monticello home to Thomas Jefferson and his legacies, the homes of James Monroe, fifth president of the United States, and James Madison, fourth president and author of the Constitution. Dining out in Charlottesville is an experience you won’t want to miss. You’ll find everything from your taste buds desire. The Downtown district alone has more than 50 locally owned restaurants.

Conference Site

The Conference will be held at the Omni Charlottesville. The Omni is a first class conference hotel conveniently located within easy walking distance of many shops and restaurants on the Downtown Mall. Hotel website: http://www.omnihotels.com/FindAHotel/Charlottesville.asp

Local Organizing Committee

- Michael P. Timko - Chair
- Lytton Musselman
- Jim Westwood

REGISTRATION

The registration fee includes admission to all talks and posters, an opening reception, two coffee breaks each day, lunches, a banquet, and a field trip to see local parasites and visit the house, gardens, and plantation of Monticello, the mountaintop home of Thomas Jefferson, third president of the United States, who was not only a gifted architect, but also a plant scientist.

- Approximate registration fee: $380
- Hotel rates: $117/night + tax.

Meanwhile, please provide an indication of your interest in attending the Congress by filling in the form at the end of this newsletter and sending it to Jim Westwood.

INTERNATIONAL SYMPOSIUM ON INTEGRATING NEW TECHNOLOGIES FOR STRIGA CONTROL: TOWARDS ENDING THE WITCH-HUNT

November 5-11, 2006 Addis Ababa, Ethiopia. Sponsored by International Sorghum and Millet Collaborative Research Support Program (INTSORMIL), Purdue University and Ethiopian Institute of Agricultural Research (EIAR).
The parasitic weed *Striga* (witchweed) is the scourge of agriculture in much of Africa, parts of Asia, and even in the United States. *Striga* attacks the major cereal grains and legumes in sub-Saharan Africa, on average halving the already very low yields of subsistence farmers. The *Striga* problem has been a major reason why crop productivity has remained at or below subsistence, leaving poor farmers with no way out of a situation that is only getting worse.

For many decades, research approaches on *Striga* targeted eradication, suppression, or breeding for host crops that support fewer emerged *Striga* plants. Decades of such efforts have led to few successes. More recently, basic research efforts that have focused on the more fundamental biology of the parasite and its association with its hosts have led to a far better understanding of the enemy. That understanding, in turn, led to series of successes in the field that are being expanded slowly throughout Africa. Will these technologies be sustainable or will they fail? Highly successful weeds such as *Striga* have a tendency to evolve resistance to all types of control. Ways to circumvent these pitfalls need to be crafted. As no single method is likely to be perfect, it is clear that proven methods must be integrated with each other. However, integration is often an anathema to basic scientists who are taught to alter single variables at a time in their experiments. That is why we are bringing together key leaders in development of the new knowledge based control strategies—both those that have been successfully deployed in the field and those currently under development that show great promise. Bringing these experts together will allow discussion of strategies that can be integrated with each other to develop more durable and sustainable methods that will be useful for decades to come. For major speakers, we have invited leaders in the field who have been supplying the basic biology, genetics, biochemistry, and molecular information that have offered insights and generated technologies for dealing with *Striga*.

Other scientists (molecular biologists, breeders, agronomists, and social scientists) who have been key in the fight against *Striga* are also invited to engage in structured panel discussions. Together with facilitators who are experts at stimulating people to integrate knowledge into practice, we hope this meeting will provide the forum for crafting new and creative suggestions for a series of integrated management packages that can render effective control of *Striga*.

The symposium is open to all scientists dealing with *Striga* who want to learn and share knowledge. Invited speakers will present lectures and lead discussions. All other participants are encouraged to present posters of their most recent findings and observations. See *Forthcoming Meetings for contact details.*

**HYDNORA RESEARCH AT THE PLANT PARASITE LAB, OLD DOMINION UNIVERSITY, USA**

Our research group in collaboration with University of Namibia and University of Peradeniya, Sri Lanka have been working extensively on the biology of the strange root holoparasite *Hydnora*. The center of diversity of this ancient lineage is southern Africa. We are interested in a broad range of anatomical, ecophysiological, and taxonomic aspects of this bizarre genus.

Specifically we have completed an anatomical study of the novelty of tissue arrangement (homeosis) in the vegetative body of *H. triceps*. Other anatomical problems elucidated include the unique seedling morphogenesis in the group. Work continues on the specific details of the host parasite interface, in relation to nutrient acquisition. Furthermore, we have completed studies of the mineral and stable isotope (13C and 15N) profiles of different *Hydnora*-host associations.

During field work in Namibia and South Africa in 2005, we confirmed the extreme host specificity of *H. triceps* on *Euphorbia dregeana* and the relatively broad ranges of *H. africana* and *H. abyssinca* (syn. H. johannis). In addition, the insect trapping mechanism of the *H. africana* chamber flower was experimentally evaluated, and seed dispersers were identified.

We are currently soliciting tissue samples for a molecular phylogeny of the Hydnoraceae. If you have any interest in this group, locations to report, or wish to collaborate, please do not hesitate to contact us. For further details please consult our website: [http://www.odu.edu/webroot/inst/sci/plant.nsf/pages/hydnora.html](http://www.odu.edu/webroot/inst/sci/plant.nsf/pages/hydnora.html).

**Collaborators:**

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Kushan Tennakoon: [kushant@pdn.ac.lk](mailto:kushant@pdn.ac.lk), Dept. of Botany, University of Peradeniya, Peradeniya 20400 Sri Lanka

Erika Maass: [emaass@unam.na](mailto:emaass@unam.na), University of Namibia, Dept. of Biology, Private Bag 13301 Windhoek Namibia

**CURIOSITIES**

I wonder how many others writing about *Orobanche ramosa* have suffered the problem that at least some versions of
Word including mine (Office Word 2003) automatically correct 'ramosa' to 'ramose'. Key it in quickly and move on and you notice nothing. It happens in both US and UK English. No warning – no wiggly red lines such as come up with all other latin terms, including 'diffusa', 'alata', 'striata' etc. Go into ‘Tools – Auto correct options’ and you find the hundreds of words that are automatically corrected, but no ‘ramosa’. Fortunately, if you insert the instruction that ‘ramosa’ be replaced with ‘ramosa’ all is well!

Chris Parker.

NOTES FROM A ROAMING EDITOR

On a recent visit to the island of Raratonga (Cook Islands) in the S. Pacific it was notable how introduced invasive species were locally dominating both fauna and flora. The only land bird seen in a week was the exotic myna bird from India, introduced to control insect pests of coconut and now utterly dominant. Vegetation was often also dominated by exotics including the dreaded ‘mile-a-minute’ Mikania micrantha, but this in turn was being parasitized at at least one site by Cuscuta campestris. This is perhaps the first report of this species on the islands.

Chris Parker.

COST 849 - PARASITIC PLANT MANAGEMENT IN SUSTAINABLE AGRICULTURE

This programme, funded by European Union via European Science Foundation, has had no new meetings in the past 6 months but is now being wound up. Its final workshop will now be held in Lisbon, Portugal on 23-24 November (not in Israel in October as previously planned). The programmes, abstracts and reports of past meetings, and information on the November meeting, are on the COST849 web-site (http://cost849.ba.cnr.it/) or will be added in due course.

A NEW EWRS WORKING GROUP: PARASITIC WEEDS

A new Working Group ‘Parasitic Weeds’ has recently been established within the European Weed Research Society (EWRS).

Background

Parasitic plants are becoming a severe constraint to Mediterranean and Tropical agriculture on major crops and the efficacy of available means to control them is minimal. The most economically damaging parasitic weeds are members of the genera Striga (witchweeds) and Orobanche (broomrapes). Various species of the latter are important in southern and eastern Europe, the Middle East and North Africa. For example, O. crenata causes huge damage to legume crops (faba bean, lentil, pea and common vetch) in southern Europe; O. cumana threatens sunflower in southern and eastern Europe; O. minor is important in central Europe on clover; O. ramosa attacks sunflower in southern and eastern Europe; O. foetida that cause problems in N. Africa are also present in Europe.

The main focus of research on parasitic weeds has been on their management when infecting important crops. Control strategies have centred around agronomic practices and the use of herbicides, although success has been marginal. Novel integrated control programmes are necessary. In addition, global warming together with changing land use patterns means that some geographical areas and farming systems that do not currently suffer from parasitic weeds in Europe could become affected within coming decades. It is therefore desirable to pre-empt the spread of parasitic weeds and to consider, for example, how quarantine regulations might achieve this.

WG Objectives

The main objective of the WG is to increase the understanding of the interaction between parasitic weeds and their hosts and to implement sustainable means to control the parasites.

The lack of interdisciplinary involvement has been a major factor that has impeded progress in the sustainable control of parasitic weeds. The establishment of the new WG aims to address this deficiency, by including weed scientists who specialize in botany, ecology, plant anatomy, physiology, biochemistry, molecular biology, breeding, plant pathology, chemistry and agronomy. Joint research within the proposed WG will encourage the transfer of fundamental research into control strategies for field application and should ultimately yield sustainable management measures for the variety of parasitic weeds that affect agriculture and forestry in Europe.

The WG will integrate fundamental, biotechnological and marker-technology science and applied research concepts to develop sustainable means of parasitic weed management, integrating cultural practices, genetic resistance, and novel methods of biological- and chemical control.

Research topics to be covered

Considering the involvement of groups with different expertise in the WG, many different fields of research will be covered, including:
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- Parasitic weeds of three different groups: root parasites (mainly Orobanche), climbers (Cuscuta), and mistletoes (mainly Viscum).
- Physiology of parasitism: seed germination, attachment, parasite development, interactions between the host and the parasite.
- Integrated weed management strategies and the economics of controlling parasitic plants.
- Identification, augmentation, exploitation and formulation of biocontrol agents.
- Novel cultural practices.
- Molecular and classical taxonomy and race identification.
- Developmental aspects of host-parasite interaction, including structural, physiological, genetic and molecular agro-ecology of parasitic plants that will have significant implications in the development of control measures.
- Distribution, incidence and importance of the parasitic weeds in Europe, including the invasion and progression of parasitic weeds under predicted global climate change scenarios, as well as evolutionary changes within the species.
- Quarantine measures and regulations for control of spread of parasitic plants.
- Monitoring the parasitic plant populations for frequency of virulence factors and for genetic variation.
- Development and evaluation of methods for screening and assessment of crop resistance to parasitic plants, and identification of both resistance genes and resistance mechanisms.

Proposed activities for the years 2006-07

Formal inauguration of the WG will take place at the International Conference ‘Novel and Sustainable Weed Management in Arid and Semi-Arid Agro-Ecosystems’ to be held at the Hebrew University of Jerusalem, Rehovot, Israel, October 15-20, 2006, and it will have a joint session with the last meeting of the European COST849 action ‘Parasitic plant management in sustainable agriculture’.

A specific workshop on parasitic weeds may be organized in 2007 as part of the EWRS symposium in Norway.

A mailing list is being created for distribution of announcements and requests, and a website is being prepared. Meanwhile, information will be available on the EWRS website (http://www.ewrs.org/).

Contact - Maurizio Vurro
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THESIS


This thesis presents the results of a study on the interaction between the parasitic weed Striga hermonthica (Del.) Benth. and sorghum (Sorghum bicolor [L.] Moench). The main objective of the study was to investigate the effects of time and level of Striga infection on the interaction between host plant and parasite. Consequences for sorghum performance and the growth and development of the parasite were examined. A comparison between two sorghum cultivars differing in level of Striga tolerance, revealed that the absence of a negative effect of Striga infection on photosynthetic rate and a delayed time of first Striga infection both contributed to the lower extent of yield reduction of the tolerant cultivar. Likewise, in an experiment with a wide range of Striga seed infestation levels, it was observed that higher soil infestations levels did not only result in a higher Striga infection level, but also in an advanced time of first Striga infection. The importance of time of infection was further investigated in a pot experiment in which the time of infection was artificially delayed. Striga parasitism and reproduction, and the detrimental effects of Striga on crop performance could be strongly reduced by delaying the time of first infection. Prospects of reducing Striga parasitism by means of cultural control methods that are based on the principle of a delayed onset of Striga attachment were assessed. In a pot experiment, the combination of shallow soil tillage, deep planting and the use of transplants resulted in a four-week delay in first emergence of the parasite, a strongly reduced infection level of the sorghum host and highly improved sorghum yields. Evaluation of these methods under field conditions resulted in a 85% reduction in Striga-infection level, but as no delay in time of parasite infection was established, no beneficial effect on crop yield was obtained. Potential causes of the absence of a delay in Striga infection time under field conditions were discussed and alternative options for establishing a delayed infection in the field were proposed.
Contrary to the announcement in Haustorium 47, one further issue of Sandalwood Research Newsletter (No. 21) was published in March 2006. But all future issues will now be published electronically by James Cook University in PDF format, on www.jcu.edu.au/school/tropbiol/srn/ the web-site on which all back issues can also be found. For any further information and to be included on the SRN email alert list please contact the new editor Tony Page at James Cook University, P.O. Box 6811, Cairns, 4870 Australia (tony.page@jcu.edu.au).

FORTHCOMING MEETINGS

Novel and sustainable weed management in arid and semi-arid agro-ecosystems (also the inauguration of the new EWRS working group ‘Parasitic weeds’), Rehevot, Israel, 15-21 October, 2006. Further information from the Organizing Committee at wgarid@agri.huji.ac.il or visit: www.agri.huji.ac.il/aridconference.

STOP PRESS – ABOVE POSTPONED


International Workshop on faba bean breeding and agronomy, Cordoba Spain, 25-27 October, 2006. Further information from Ana Maria Torres, email: anam.torres.romero@juntadeandalucia.es

International Symposium on Integrating new technologies for Striga control: towards ending the witch-hunt, Addis Ababa, Ethiopia, November 5-11, 2006. Contact: Gebisa Ejeta: gejeta@purdue.edu

9th World Congress on Parasitic Weeds, Charlottesville, Virginia, USA, 3-7 June, 2007. See full notice above.

GENERAL WEB SITES

For the ODU parasite site see: http://www.odu.edu/webroot/instr/sci/plant.nsf/pages/parasite_page

For Lytton Musselman’s Hydnora site see: http://www.odu.edu/webroot/instr/sci/plant.nsf/pages/lecture_sandarticles

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.science.si.edu/parasitic-plants/index.html

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes) see: http://www.rmrs.nau.edu/mistletoe/welcome.html

For information on activities and publications of the parasitic weed group at the University of Hohenheim see: http://www.uni-hohenheim.de/~www380/parasite/start.htm

For information on, and to subscribe to PpDigest see: http://omnisterra.com/mailman/listinfo/pp_omnisterra.com

For information on the EU COST 849 Project and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/

For the Parasitic Plants Database, including ‘4000 entries giving an exhaustive nomenclatural synopsis of all parasitic plants’ the address is: http://www.omnisterra.com/bot/pp_home.cgi

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net

For information on EC-funded project ‘Improved Striga control in maize and sorghum (ISCIMAS) see: http://www.plant.dlo.nl/projects/Striga/

For the work of Forest Products Commission (FPC) on sandalwood, see: www.fpc.wa.gov.au

For past and future issues of the Sandalwood Research Newsletter, see: www.jcu.edu.au/school/tropbiol/srn/

For information on the meetings in Rehevot, Israel, 15-21 October, 2006 (see above), see: www.agri.huji.ac.il/aridconference

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, see: http://africancrops.net/striga/
LITERATURE

Abubacker, M.N., Prince, M. and Hariharan, Y. 2005. Histochemical and biochemical studies of parasite-host interaction of Cassytha filiformis Linn. and Zizyphus jujuba Lamk. Current Science 89: 2156-2159. (Histochemical studies revealed the presence of specialized glandular cells facilitating adhesion of the parasite to the host, and high phosphatase activity in the parasite. Some photosynthesis was detected.)

Adler, L.S. 2003. Host species affects herbivory, pollination, and reproduction in experiments with parasitic Castilleja. Ecology 84: 2083-2091. (Castilleja indivisa grew much more vigorously and was more attractive to pollinators when growing on a lupin host than on a grass. This and other observations confirm that both direct and indirect effects may shape the selective pressures mediating interactions between hosts and parasites.)


Akiyami, K. and Hayashi, H. 2006. Strigolactones: chemical signals for fungal symbionts and parasitic weeds in plant roots. Annals of Botany 97: 925-931. (A full version of the work described in a letter to Nature in 2005, which also formed the basis for a Literature Highlight in Haustorium 47, describing the involvement of strigolactones in the branching of arbuscular mycorrhizae and hence an explanation for the wide occurrence of these compounds in root exudates.)

Andolfi, A., Boari, A., Evidente, A. and Vurro, M. 2005. Metabolites inhibiting germination of Orobanche ramosa seeds produced by Myrothecium verrucaria and Fusarium compactum. Journal of Agricultural and Food Chemistry 53: 1598-1603. (A range of trichothecenes were separated from both species, all of which inhibited germination of O. ramosa but were also toxic to brine shrimps, Artemia salina. Verrucarin E, the main metabolite from M. verrucaria was toxic to neither.)

Arruda, R., Carvalho, L.N. and del Claro, K. 2006. Host specificity of a Brazilian mistletoe, Struthanthus aff. polyanthus (Loranthaceae), in cerrado tropical savanna. Flora (Jena) 201(2): 127-134. (An English version of the paper by Arruda and Carvalho, 2004 (see Haustorium 48), noting most occurrence of Struthanthus on species with rough bark, especially Kielmeyera coriacea, Pouteria ramiflora and Stryx farraginosa.)

Bardgett, R.D., Smith, R.S., Shiel, R.S., Peacock, S., Simkin, J.M., Quirk, H. and Hobbs, P.J. 2006. Parasitic plants indirectly regulate below-ground properties in grassland ecosystems. Nature (London) 439(7079): 969-972. (Showing that Rhinanthus minor has strong direct above-ground effects, increasing plant diversity and reducing productivity, together with indirect below-ground effects, ultimately increasing rates of nitrogen cycling. Thus parasitic plants can act as major drivers of both above- and below-ground properties of grassland ecosystems.)

Bennett, A.E., Alers-Garcia, J. and Bever, J.D. 2006. Three-way interactions among mutualistic mycorrhizal fungi, plants, and plant enemies: hypotheses and synthesis. The American Naturalist 167: 141-152. (A broad-ranging review, commenting that “parasitic plants might also be expected to benefit by feeding on hosts with a mycorrhizal association because they often directly tap into the xylem or phloem of a host plant, thereby avoiding plant defences.”)


Braby, M.F. 2005. Inland breeding records for two mistletoe butterflies (Lepidoptera) from Northern Victoria. Australian Entomologist 32(4): 161-162. (Recording the breeding of Delias harpalyce (Donovan) (Pieridae) and Ogyris abrota (Westwood) (Lycaenidae) on the mistletoe Muellerina eucalyptoides parasitizing Eucalyptus camaldulensis.)

Brand, J., Kimber, P. and Stratfield, J. 2006. Preliminary analysis of Indian sandalwood (Santalum album L.) oil from a 14-year-old plantation at Kununurra, Western Australia. Sandalwood Research Newsletter 21: 1-3. (Results suggest that, while oil quality was good, heartwood volume and oil yield were relatively low and variable, and future plantings need to be with seed from superior oil-producing parent trees.)

A. americanum on P. banksiana. Symptoms of infection usually occurred after 13-15 months.


Calvin, C.L. and Wilson, C.A. 2006. Comparative morphology of epicortical roots in Old and New World Loranthaceae with reference to root types, origin, patterns of longitudinal extension and potential for clonal growth. Flora (Jena) 201(1): 51-64. (A detailed survey of epicortical roots, the most common haustorial type for Loranthaceae outside Africa. Three types are described: basal, cauline and adventitious and their patterns of axis extension – by monochasial sympodium, dichasial sympodium or monopodium. The wide distribution of genera with epicortical roots suggests it is an ancestral trait for aerial Loranthaceae.)


Chlebicki, A. 2005. Some species of the genus Diatrype from the Czech Republic preserved in PRM, BRNM and KRAM. Czech Mycology 57(1/2): 117-138. (One species of Diatrype, possibly D. disciformis, recorded on Loranthus europaeus.)


Colquhoun, J.B., Eizenberg, H. and Mallory-Smith, C.A. 2006. Herbicide placement site affects small broomrape (Orobanche minor) control in red clover. Weed Technology 20: 356-360. (Neatly demonstrating that control of O. minor by imazamox depends on translocation of herbicide from the foliage to the roots of the host clover where it is absorbed directly from the host and/or via exudation into the rhizosphere.)

Combes, C. 2005. The art of being a parasite. Chicago, USA: University of Chicago Press. 291 pp. (Translated from the French by Daniel Simberloff this book is primarily concerned with animal parasites, but of potential relevance to plants.)

Cooney, S.J.N. and Watson, D.M. 2005. Diamond firetails (Stagonopleura guttata) preferentially nest in mistletoe. Emu, Journal of the Royal Australasian Ornithologists Union 105: 317-322. (Although mistletoe (unspecifed in abstract) accounted for no more than 2.3% of the canopy, 30% of the nests of the bird S. guttata were in mistletoe.)

Cooney, S.J.N., Watson, D.M. and Young, J. 2006. Mistletoe nesting in Australian birds: a review. Emu, Journal of the Royal Australasian Ornithologists Union 106(1): 1-12. (Contrary to the curious title, this paper comprehensively reviews the nesting of birds in mistletoe, adding excellent data from Australia, where 217 species from 29 families are recorded using mistletoes for nesting (though none are obligate users), increasing the known world-wide occurrence from 43 to 60 bird families. Suggesting various reasons for the habit, including micro-climatic effects and greater safety from predators.)


Demirkan, H. 2005. (Investigation on allelopathic effects of some plant materials on the growth of Orobanche ramosa L.) (in Turkish) Ege Üniversitesi Ziraat Fakültesi Dergisi 42(3): 45-54. (Various effects observed when a range of plant materials were incorporated into the soil.)


Himalayas. Journal of Japanese Botany. 80(1): 27-36. (An inventory of the mistletoes of this region included 8 species in Loranthaceae (4 Scurrula spp., Taxillus vestitus, Helixanthera ligustrina, Macrosolen cochinchinensis and Loranthus odoratus) and 4 Viscum spp. Hosts included 95 tree species in 45 families. Loranthaceae generally had wider host range than Viscum spp. Degraded marginal forests, sunny warm slopes and ridges below 3000 m were most favoured sites.)


Dicko, M.H., Gruppen, H., Barro, C., Traore, A.S., van Berkel, W.J.H. and Voragen, A.G.J. 2005. Impact of phenolic compounds and related enzymes in sorghum varieties for resistance and susceptibility to biotic and abiotic stresses. Journal of Chemical Ecology 31: 2671-2688. (Showing that levels of proanthocyanidins and particularly 3-deoxyanthocyanidins, in sorghum seeds are useful markers for resistance to a range of biotic stresses, including Striga, while content of phenolics is not.)

Dobbertin, M., Hilker, N., Rebetez, M., Zimmermann, N.E., Wohlgemuth, T. and Rigling, A. 2005. The upward shift in altitude of pine mistletoe (Viscum album ssp. austriacum) in Switzerland - the result of climate warming? International Journal of Biometeorology 50(1): 40-47. (Noting the frequent occurrence of V. album on Pinus sylvestris and the increased mortality of infected trees. Also the upper limit of distribution is now 1,250 m, compared with 1,000-1,100 m found in a survey 100 years ago. Calculations suggest this limit could be 1,600 m by 2030.)

Domina, G. and Scibetta, S. 2006. Research on Orobanche crenata management in Sicily from the 19th to the early 20th century. Phytoparasitica 34: 111-114. (Discussing hand pulling, use of resistant cultivars, late sowing and sowing density as techniques being used or researched currently – in early 21st century, not early 20th.)


El-Halmouch, Y., Benharrat, H. and Thalouarn, P. 2006. Effect of root exudates from different tomato genotypes on broomrape (O. aegyptiaca) seed germination and tubercle development. Crop Protection 25: 501-507. (In comparisons of tomato cultivars with wild species, the most resistant were Lycopersicum pennellii LA 716, L. hirsutum PI 247087, L. pinnatifolium hirsute and L. chilense LA 1969. The exudates from the first two of these were less stimulatory than those from the cultivars, while that from L. pennellii LA 716 was distinctly inhibitory.)

Elzein, A., Kroschel, J. and Leth, V. 2006. Seed treatment technology: an attractive delivery system for controlling root parasitic weed Striga with mycoherbicide. Biocontrol Science and Technology 16(1/2): 3-26. (Gum arabic, carboxymethylcellulose (CMC) and pectin were compared as seed-coating materials combined with microconidia or dried chlamydospores of Fusarium oxysporum (Foxy 2). In pot experiments chlamydospores in gum Arabic gave best results, reducing germination of S. hermonthica by at least 70%.)

Evidente, A., Andolfi, A., Fiore, M., Boari, A. and Vurro, M. 2006. Stimulation of Orobanche ramosa seed germination by fusicoccin derivatives: a structure-activity relationship study. Phytochemistry 67: 19-26. (Comparing 25 analogues and derivatives of fusicoccin and cytogenin for stimulant activity on O. ramosa and concluding that the most important structural feature for activity appears to be the primary hydroxy group at C-19, and noting that the highly active diazacyethyl derivative of fusicoccin could be readily synthesized and perhaps used for suicidal germination.)


Fraga, P., Garcia, Ó. and Pons, M. 2003. (Notes and contributions to the knowledge of the flora of Minorca (V.) (in Spanish) Bolletí de la Societat d’Història Natural de les Balears 46: 51-64. (Recording Orobanche santolinae for the first time in Minorca, Balearic Islands.)

Ghosheh, H.Z., Al-Tamimi, E. and Hameed, K.M. 2006. Effect of olive jift and sublethal glyphosate applications on faba beans (Vicia faba). Acta Agronomica Hungarica 54(1): 61-68. (Confirming that faba beans were not significantly affected by being grown in soil amended up to 50% with olive jift (a milling byproduct, reported to suppress Orobanche spp. in Jordan), nor by foliar sprays of glyphosate at 40 g a.i./ha.)

24-49% reduction in germination of *S. asiatica* in a Petri dish assay.


Grenz, J.H., Manschadi, A.M., DeVoil, P., Meinke, H. and Sauerborn, J. 2005. Assessing strategies for *Orobanche* sp. control using a combined seedbank and competition model. *Agronomy Journal* 97: 1551-1559. (Describing the development of a model combining *Orobanche crenata* seedbank dynamics and *Vicia faba*/*O. crenata* competition within the simulation framework of the Agricultural Production Systems Simulator (APSIM). Yet to include some external factors, such as temperature, but giving indications close to field observation and helping to emphasize the need for integrated systems for long-term reduction.)


Gundry, A.L., Slate, J., Press, M.C. and Scholes, J.D. 2006. Elemental sulphur and chicken manure for the control of branched broomrape (*Orobanche ramosa*). *Crop Protection* 25: 47-51. (Elemental sulphur up to 12 t/ha had no influence on crops or *O. ramosa*. Chicken manure at 20 t/ha reduced *O. ramosa* and increased yield in both aubergine and potato.)


Hedberg, A.M., Borowicz, V.A. and Armstrong, J.E. 2005. Interactions between a hemiparasitic plant, *Pedicularis canadensis* L. (Orobanchaceae), and members of a tallgrass prairie community. *Journal of the Torrey Botanical Society* 132: 401-410. (In pot studies with all combinations of *P. canadensis* with *Andropogon gerardii*, *Solidago canadensis* and *Desmodium canadense*, the parasite had moderate effect on *S. canadensis* but little or none on the others. Competitive relationships between these host species were not affected, but in natural prairie, species richness was positively correlated with increasing *P. canadensis* cover.)


Humphrey, A.J. and Beale, M.H. 2006. Strigol: biogenesis and physiological activity. *Phytochemistry* 67: 636-640. (Reviewing recent work on biosynthesis and mode of action of strigolactones, and suggesting that they may be more widely distributed and have a greater physiological significance than has hitherto been appreciated.)

Hunsberger, L.K., Autio, W.R., DeMoranville, C.J. and Sandler, H.A. 2006. Mechanical removal of summer dodder infestations and impacts on cranberry yield. *HortTechnology* 16(1): 78-82. (Partial removal of *Cuscuta groenovii* from cranberry (*Vaccinium macrocarpon*) with bamboo rakes reduced weed cover substantially but had less effect on total parasite biomass and no beneficial effect on crop yield.)

Idžošić, M., Pernar, R., Ljšak, Z., Ždelar, H. and Ančić, M. 2005. (Hosts of yellow mistletoe (*Loranthus europaeus* Jacq.) and intensity of infestation in the area of the forest administration Požega.) (in Croatian) *Sumarski List* 129(1/2): 3-17. (A survey recorded *L. europaeus* most commonly on *Quercus petraea*, also on *Q. robur*, *Q. pubescens* and *Q. prinettoo*, least on *Q. cerasis* and not at all on *Q. rubra* or *Castanea sativa*.)


Iuoras, M., Stanciu, D., Ciucă, M., Năstase, D. and Geronzi, F. 2004. Preliminary studies related to the use of marker assisted selection for resistance to *Orobanche cumana* Wallr. in sunflower. *Romanian Agricultural Research* 21: 33-37. (Describing efforts to find RAPD and SSR markers associated with the *Or5* resistance trait.)

Janjic, V., Marisavljevic, D. and Pavlovic, D. 2005. (Dodder and its control.) (in Serbian) *Biljni Lekar (Plant Doctor)* 33: 590-595. (Noting the increasing importance of *Cuscuta trifoli and C. campestris* in lucerne and red clover in Serbia, the differences between the two species, and some methods of control.)

Jeet Ram, Beena Tewari and Chanda Pant. 2006. Infestation of oak trees by the flowering parasite (*Taxillus vestitus* (Wall.) Danser) at Nainital in Uttarakhand. *Current Science* 90: 562-563. (Occurrence of *T. vestitus on Quercus leucotrichophora and Q. floribunda* was greatest on older trees on disturbed sites, perhaps due to lopping of the trees.)

Karadžić, D., Lazarov, V. and Milenkovic, M. 2004. The most significant parasitic and saprophytic fungi on
common mistletoe (*Viscum album* L.) and their potential application in biocontrol. Glasiščki Sumarski Fakulteta, Univerzitet u Beogradu 89: 115-126. (Recording a total 22 species of fungus on *Arceuthobium oxycedri, Loranthus europaeus* and *Viscum album* in Serbia, among which Botryosphaeria dothidea causes leaf spot on many trees and shrubs, while Gibberidea visci and *Sphaeropsis visci* occur on *V. album*, the latter considered to be of potential interest for biocontrol.)

Kenaley, S., Howell, B. and Mathiasen, R. 2006. First report of *Cladoscolea cupulata* on *Pinus douglasiana* and *P. herrerai* in northern Mexico. Plant Disease 90: 681. (C. *cupulata* (Loranthaceae) caused little apparent damage to host trees.)


Kenaley, S., Howell, B. and Mathiasen, R. 2006. First report of *Cladoscolea cupulata* on *Pinus douglasiana* and *P. herrerai* in northern Mexico. Plant Disease 90: 681. (C. *cupulata* (Loranthaceae) caused little apparent damage to host trees.)


Kenwar, R.M., Adhikari, N. and Devkota, M.P. 2005. Indigenous use of mistletoes in tropical and temperate regions of Nepal. Banko Jankari. 15(2): 49-53. (The paper discusses the traditional uses in Nepal of *Viscum* (Linn.) flowering between *Neotyphodium uncinatum* and the aphid *Aulacorthum solani*. Showing that uptake of defensive mycotoxins from the endophyte-infected host grass enhances the resistance of the hemiparasitic plant to the aphid, increasing the parasite’s vigour and in turn reducing that of the grass host.)


López-Curto, L., Márquez-Guzmán, J. and Díaz-Pontones, D.M. 2006. Invasion of *Coffea arabica* (Linn.) by *Cuscuta jalapensis* (Schlecht): in situ activity of peroxidase. Environmental and Experimental Botany 56(2): 127-135. (Emphasising and discussing the importance of peroxidase in the penetration of the outer host tissues by the *Cuscuta* haustorium. Also referring to the probable participation of free radicals in the invasion process.)

Lye, D. 2006. Charting the isophasic endophyte of dwarf mistletoe *Arceuthobium douglasi* (Viscaceae) in host apical buds. Annals of Botany 97: 953-963. (Using novel techniques to demonstrate that the endophyte of *A. douglasi* is much more extensive in the host, *Pseudotsuga menziesii* than previously realised, reaching into dormant buds from which it is able to infect and develop in the following season’s growth.)

Mackes, K., Sheperd, W. and Jennings, C. 2005. Evaluating the binding properties of clear wood
specimens produced from small-diameter ponderosa pine trees. Forest 55(10): 72-80. (Reporting some significant reduction in elasticity in timber from Pinus ponderosa trees infected by Arceuthobium vaginatum.)


Mariam, E.G. and Suwanketnikom, R. 2004. Effect of nitrogen fertilizers on branched broomrape (*Orobanche ramosa* L.) in tomato (*Lycopersicon esculentum* Mill.). Kasetsart Journal, Natural Sciences 38: 311-319. (In pot experiments in Ethiopia, rates of urea, ammonium sulphate and ammonium nitrate up to 276 kg/ha and goat manure up to 30 t/ha reduced *O. ramosa* and improved tomato yield but highest rates of ammonium salts caused some crop damage.)

Mariam, E.G. and Suwanketnikom, R. 2004. Screening of tomato (*Lycopersicon esculentum* Mill.) varieties for resistance to branched broomrape (*Orobanche ramosa* L.). Kasetsart Journal, Natural Sciences 38: 434-439. (In pot experiments in Ethiopia, a number of tomato varieties showed partial resistance, supporting 7-13 rather than 31-33 shoots of parasite, as in the most susceptible varieties Caribe and Floradade, but yields were still reduced. A variety ‘South Africa’ showed some degree of tolerance.)


Mayer, A.M. 2006. Pathogenesis by fungi and by parasitic plants: similarities and differences. Phytoparasitica 34: 3-16. (A review, cautioning that while many superficial similarities exist between pathogenesis by fungi and parasitic plants, the differences are far greater. Parasitic plants have many unique features.)

McDonald, G.I., Richardson, B.A., Zambino, P.J., Klopfenstein, N.B. and Kim, M.S. 2006. *Pedicularis* and *Castilleja* are natural hosts of *Cronartium ribicola* in North America: a first report. Forest Pathology 36(2): 73-82. (Presenting evidence for *P. racemosa* and *C. miniata* behaving as alternate hosts of the pine blister rust, *C. ribicola*, as well as *Ribes* spp.)


Menkir, A. 2006. Assessment of reactions of diverse maize inbred lines to *Striga hermonthica* (Del.) Benth. Plant Breeding 125: 131-139. (Sixteen new inbred lines of maize supported significantly fewer attached parasites compared with the susceptible inbred check.)

Menkir, A., Kling, J.G., Badu-Apraku, B. and Ibi kunle, O. 2006. Registration of 26 tropical maize germplasm lines compared with the susceptible inbred check.)


Miller, M.R., White, A. and Boots, M. 2006. The evolution of parasites in response to tolerance in their hosts: the good, the bad, and apparent commensalism. Evolution 60: 945-956. (No reference to parasitic plants but this thoughtful analysis is fully relevant to them.)

Motti, R. and Ricciardi, M. 2005. (The flora of the Phlegraen Fields (Gulf of Pozzuoli, Campania, Italy).) (in Italian) Webbia 60: 395-476. (In a survey, 748 taxa were recorded, including *Orobanche arenaria*, a new record.)

Mousavi, A. 2005. Walnut as new host for mistletoe *Viscum album* in Zandjan province. Iranian Journal of Forest and Range Protection Research 3(1): 91-95, 105. (In this province of Iran *Arceuthobium oxycedri* is an important cause of die-back in *Juniperus excelsa*, while *V. album* is recorded on a range of hosts including walnut, *Juglans regia*.)

Mueller, R.C. and Gehring, C.A. 2006. Interactions between an above-ground plant parasite and below-ground ectomycorrhizal fungal communities on pinyon pine. Journal of Ecology (Oxford) 94: 276-284. (Pinyon pine (*Pinus edulis*) infected by *Arceuthobium divaricatum* had lower shoot growth. Higher mistletoe infestation was associated with higher ectomycorrhizal colonization, a shift in the dominance of ascomycete fungi, increased
fungal inoculum under the crowns of the host, and increased numbers of pine seedlings.)


Nelson, D.A. 2005. Evaluation of Penstemon as host for Castilleja in garden or landscape. Native Plants Journal 6: 254-262. (Confirming P. strictus to be a suitable host for Castilleja integra and C. indivisa but noting that the micro-environment may need to be balanced for best results.)


Osadebe, P.O. and Akabogu, I.C. 2006. Antimicrobial activity of Loranthus micranthus harvested from kola nut tree. Fitoterapia77(1): 54-56. (Extracts in various solvents were obtained from L. micranthus in Nigeria. A methanol extract showed the best activity against Escherichia coli and Bacillus subtilis while a petroleum ether extract showed best antifungal action.)

Ouyang Jie, Wang Xiao Dong, Zhao Bing and Wang Yu Chun 2005. Enhanced production of phenylethanoid glycosides by precursor feeding to cell culture of Cistanche deserticola. Process Biochemistry 40: 3480-3484. (The production of phenylethanoid glycosides was enhanced by adding pre-cursors phenylalanine, l-tyrosine, sodium acetate and phenylacetic acid to cell cultures. Phenylalanine could increase production by 75%.)

Pâcuareanu-Joita, M., Stanciu, D., Petcu, E., Baranciu, S. and Sorega, I. 2005. Sunflower genotypes with high oleic acid content. Romanian Agricultural Research 22: 23-25. (Selective breeding program identified lines that have improved oil quality and resistance to O. cumana.)

Page, T., Tate, H., Tungon, J., Sam, C., Dickinson, G., Robson, K., Southwell, I., Russell, M., Waycott, M. and Leakey, R. 2006. Evaluation of heartwood and oil characteristics in nine populations of Santalum austrocaledonicum from Vanuatu. Sandalwood Research Newsletter 21: 4-7. (S. austrocaledonicum is native to Vanuatu and is an important source of income. Broad sampling across six islands showed wide variation in sandalwood oil yield and quality. The results will contribute to a programme of domestication aimed at diversifying the genetic base, reducing pressure on depleted natural resources and enhancing local livelihoods.)


Perez de Luque, A., Rubiales, D., Cubero, J.I., Press, M.C., Scholes, J., Yoneyama, K., Takeuchi, Y., Plakhine, D. and Joel, D.M. 2005. Interaction between Orobanche crenata and its host legumes; unsuccessful haustorial penetration and necrosis of the developing parasite. Annals of Botany 95: 935-942. (Concluding from detailed microscopy that the unsuccessful penetration of O. crenata into legume roots cannot be attributed to cell death in the host but is mainly associated with lignification of host endodermis and pericycle cells at the penetration site.)

Pérez-de-Luque, A., Lozano, M.D., Cubero, J.I., González-Melendi, P., Rísueño, M.C. and Rubiales, D. 2006. Mucilage production during the incompatible interaction between Orobanche crenata and Vicia sativa. Journal of Experimental Botany 57: 931-942. (Mucilage and other substances secreted by the parasite block host vessels and obstruct the parasite supply channel, thus contributing to failure of the parasite on resistant V. sativa.)

Pérez-de-Luque, A., González-Verdejo, C.I., Lozano, M.D., Dita, M.A., Cubero, J.I., González-Melendi, P., Rísueño, M.C. and Rubiales, D. 2006. Protein cross-linking, peroxidase and β-1,3-endoglucanase involved in resistance of pea against Orobanche crenata. Journal of Experimental Botany 57: 1461-1469. (In resistant wild relatives of pea, development of O. crenata was stopped in the host cortex. Accumulation of hydrogen peroxide, peroxidases, and callose were detected in neighbouring cells, apparently associated with protein cross-linking in the host cell walls. A peroxidase and a β-1,3-endoglucanase are differently expressed in cells of the resistant host.)

Procházka, F. 2005. (Distribution of Viscum album subsp. album on different host trees in the center of its occurrence distribution near Nová Hospoda location (distr. Písek, South Bohemia)) (in Czech) Sborník Jihočeského Muzea v Českých Budějovicích, Přírodověd. Vědy 45: 61-69. (Careful recording of tree hosts revealed lower numbers of host spp. towards the edges of the distribution of V. album.)
Pusz, I.F., Bardocz, S., Pusztai, A. and Ewen, S.W.B. 2006. Suppression of growth of tumour cell lines in vitro and tumours in vivo by mistletoe lectins. Histology and Histopathology 21(1/3): 285-299. (Providing supporting evidence that mistletoe lectins from both European and Korean Viscum spp. are able to induce an anti-angiogenic response in the host suggesting that the anti-metastatic effect observed on a series of tumour cell lines in mice is in part due to an inhibition of tumour-induced angiogenesis and in part due to an induction of apoptosis.)


Pusz, W. 2005. (Mycoherbicides, or the possibility of utilizing fungi for restricting weed infestations.) (in Russian) Ochrona Roslin 50(11): 30-32. (A brief history of biological weed control, including mention of the use in the former Soviet Union of Alternaria to control Cuscuta spp.)


Radi, A., Dina, P. and Guy, A. 2006. Expression of sarcotoxin IA gene via a root-specific tobr promoter enhanced host resistance against parasitic weeds in tomato plants. Plant Cell Reports 25: 297-303. (Transgenic tomato plants expressing the sarcotoxin gene from an insect showed strong inhibition of Orobanche aegyptiaca growth and significantly increased yield as compared with non-transgenic ones.)


Rietman, L.M., Shamoun, S.F. and van der Kamp, B.J. 2005. Assessment of Neonectria neomacrospora (anamorph Cylindrocarpon cylindroides) as an inundative biocontrol agent against hemlock dwarf mistletoe. Canadian Journal of Plant Pathology 27: 603-609. (An inoculum of N. neomacrospora applied to swellings on Tsuga heterophylla caused by Arceuthobium tsugense caused significant reduction in parasite shoots when swellings were first ‘wounded’ but had little effect when they were not.)

Rodenburg, J., Bastiaans, L., Kroppf, M.J. and van Ast, A. 2006. Effects of host plant genotype and seedbank density on Striga reproduction. Weed Research 46: 251-263. (Studying the influences of crop variety on seed production of Striga hermonthica and concluding that, although cultivars such as N13, IS9830 and SRN39 greatly reduce seed production, only at very low infestation levels would the use of these varieties alone lead to a reduced seed-bank.)

Ross, C.M. and Sumner, M.J. 2005. Early endosperm and embryo development of the dwarf mistletoe Arceuthobium americanum (Viscaceae). International Journal of Plant Sciences 166: 901-907. (Embryology in parasitic plants has long drawn attention because of the extreme reduction in the embryo sac of holoparasites. The development of a cell wall from vesicles as the zygote dislodged from the embryo sac has not previously been reported in angiosperms though the relationship of this phenomenon to parasitic plants is not clear.)


Rubiales, D., Pérez-de-Luque, A., Fernández-Aparico, M., Sillero, J.C., Román, B., Kharat, M., Khalil, S., Joel, D.M. and Riches, C.R. 2006. Screening techniques and sources of resistance against parasitic weeds in grain legumes. Euphytica 147: 187-199. (A detailed and thoughtful review of screening techniques in relation to pathogen variation and sources of resistance, primarily in respect of grain legumes but of potential relevance also to cereals. Concluding that combination of different resistance mechanisms into a single cultivar can provide durable field resistance, and that this can be achieved by the use of in vitro screening methods combined with marker-assisted selection techniques.)

Rubiales, D., Moreno, M.T. and Sillero, J.C. 2005. Search for resistance to crenate broomrape (Orobanche crenata Forsk.) in pea germplasm. Genetic Resources and Crop Evolution 52: 853-861. (Screening of 575 accessions of pea against O. crenata yielded no complete resistance and the quantitative resistance observed was highly influenced by environmental conditions. This could be sufficient to prevent damage in ‘normal’ years but not in others.)

Serafini, M., Corazzi, G., Poli, F., Piccin, A., Tomassini, L. and Foddai, S. 2005. Phenylpropanoid glycosides in Italian Orobanche spp., sect. Orobanche. Natural Product Research 19: 547-550. (Orobanchoides and verbascoside were both detected in O. gracilis (typical form), O. teucrii, O. alba and O. caryophyllacea but not in O. gracilis f. citrina.)


Simier, P., Constant, S., Degrande, D., Moreau, C., Robins, R.J., Fer, A. and Thalouarn, P. 2006. Impact of nitrate supply in C and N assimilation in the parasitic plant Striga hermonthica (Del.) Benth (Scrophulariaceae) and its host Sorghum bicolor L. Plant, Cell and Environment 29: 673-681. (Demonstrating that sorghum tolerates much higher levels of nitrate than S. hermonthica. The latter copes with lower levels of N by converting it to asparagine, but is seriously damaged by higher levels, above 500 mg N per host plant.)


Stanton, S. 2006. Registration of ‘Korobalen’ cowpea. Crop Science 45: 2648-2649. (The new variety Korobalen has resistance to aphids, to a range of diseases, and to the Malian strain of Striga gesnerioides.)

Touré, M.A. and Singh, B.B. 2005. Registration of ‘Tiemarifing’ cowpea. Crop Science 45: 2648. (The new variety Sangarakar has resistance to aphids, to a range of diseases and to both Striga gesnerioides and Alectra vogelii. It also stimulates germination of Striga hermonthica.)

Touré, M.A. and Singh, B.B. 2005. Registration of ‘Sangarakar’ cowpea. Crop Science 45: 2648. (The new variety Sangarakar has resistance to aphids, to a range of diseases and to both Striga gesnerioides and Alectra vogelii. It also stimulates germination of Striga hermonthica.)

Vasey, R.A., Scholes, J.D. and Press, M.C. 2005. Wheat (Triticum aestivum) is susceptible to the parasitic angiosperm Striga hermonthica, a major cereal pathogen in Africa. Phytopathology 95: 1294-1300. (In spite of the rarity of reports of Striga occurrence on wheat in the field, this study confirmed that modern cultivars of wheat, Hereward and Chablis, and a range of ancestral Triticum and Aegilops spp., all supported the germination and development of S. hermonthica and were severely damaged by it.)

Vasic, M., Stafforini, M. and Torres, N. 2003. (Floristic records from the Balearic Islands (XVII).) (in Spanish) Bolletí de la Societat d’Història Natural de les Balears

Wilson, C.A. and Calvin, C.L. 2006. An origin of aerial parasitism in one Old World clade of mistletoes, Viscum album, an important problem in coniferous forests in Turkey.)

Wisler, G.C. and Norris, R.F. 2005. Symposium: interactions between weeds and cultivated plants as related to management of plant pathogens. Weed Science 53: 914-917. (Noting the role of Cuscuta spp. in the spread of pathogens such as cucumber mosaic virus.)


Yonli, D., Traoré, H., Hess, D.E., Sankara, P. and Séremé, P. 2006. Effect of growth medium, Striga seed burial distance and depth on efficacy of Fusarium isolates to control Striga hermonthica in Burkina Faso. Weed Research 46: 73-81. (In pot experiments a range of isolates of ‘Fusarium spp.’, F. equiseti and F. oxysporum (34-Fo) grown on compost or on chopped sorghum straw and mixed into the top 5 cm of sterilised soil all reduced Striga emergence and increased sorghum growth, but compost proved superior. The inocula were somewhat less effective against Striga buried at 10 cm, than at 5 cm depth. Isolate 34-Fo gave best results.)


Westbury, D.B. and Davies, A. 2005. Yellow rattle – its natural history and use in grassland diversification. British Wildlife 17(2): 93-98. (A useful review of the biology of R. minor and the history of its fall and rise in popularity as a grassland species. Concluding that, although its efficacy in increasing species diversity is complex, depending on site specifics, it can be a useful agent for positive change in species-rich grassland restoration.)


Wilson, C.A. and Calvin, C.L. 2006. An origin of aerial branch parasitism in the mistletoe family, Loranthaceae. American Journal of Botany 93: 787-796. (Presenting molecular and morphological evidence that the root-parasitic Nyctisia floribunda is ancestral to the family; that aerial parasitism has had multiple origins; that the first aerial parasites had epicortical roots; and that the origin of aerial parasitism in one Old World clade involved epiphytic growth following germination on tree branches, without any climbing intermediate.)


Yonli, D., Traoré, H., Hess, D.E., Sankara, P. and Séremé, P. 2006. Effect of growth medium, Striga seed burial distance and depth on efficacy of Fusarium isolates to control Striga hermonthica in Burkina Faso. Weed Research 46: 73-81. (In pot experiments a range of isolates of ‘Fusarium spp.’, F. equiseti and F. oxysporum (34-Fo) grown on compost or on chopped sorghum straw and mixed into the top 5 cm of sterilised soil all reduced Striga emergence and increased sorghum growth, but compost proved superior. The inocula were somewhat less effective against Striga buried at 10 cm, than at 5 cm depth. Isolate 34-Fo gave best results.)


HAUSTORIUM 49

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9TH WORLD CONGRESS ON PARASITIC PLANTS
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Return this form to Jim Westwood, Dept. of Plant Pathology, Physiology and Weed Science, Virginia Tech, Blacksburg, VA 24061-0331, USA. email westwood@vt.edu or fax: (+1-) 540-231-7477).
MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

The IPPS wishes you a happy festive season and a peaceful and happy 2007. We all wish that the New Year will bring a better understanding of parasitic plants, and new breakthroughs in our ability to control parasitic weeds.

In addition to celebrating the birth of a new year, we are also happily celebrating the issue of the 50th edition of Haustorium, the well established Newsletter of the parasitic plant research community. It is my pleasure to send our special thanks and appreciation to the dedicated founding Editors of Haustorium and honorary members of the IPPS, Chris Parker and Lytton Musselman, for their immense long lasting contribution in distributing updated knowledge on parasitic plants to all parts of the world, gathering pieces of information on a variety of aspects of parasitic plant biology and on the management of parasitic weeds, for the benefit of us all.

The first issue of Haustorium was published in December 1978, aiming to present a form of communication that ‘would meanwhile serve a useful purpose in keeping workers in contact with each other and with research results which are not always readily accessible to all concerned’, with main emphasis on Orobanche and Striga.

And indeed, during almost thirty years since it was first published, Haustorium reflected the important progress in the knowledge and understanding of parasitic plants, and even more so, in our ability to control Orobanche and Striga. Haustorium is and has been an important source of information, and a valuable link for new acquaintances between those interested in parasitic plants.

While the main reports during the early years of Haustorium were on taxonomic, anatomical and physiological aspects of parasitic plants, the recent issues also report on significant progress in molecular research of parasitic plants, with emphasis on three main areas: (a) genome studies of parasitic plants, including evolutionary, genetic and physiological considerations; (b) the development of new resistances against parasitic weeds either directly by genetic engineering or indirectly by the employment of herbicide resistance; and (c) the development of molecular markers for diagnostic purposes, and for marker-assisted selection, serving more efficient breeding of various crops for resistance against parasitic weeds.

Another encouraging development of the last decade is the availability of a number of effective means for the control of Orobanche and Striga in some important crops like maize and tomato. While almost no means for the control of parasitic weeds were available in the seventies and eighties, we now have at least two groups of herbicides (sulfonylureas and imidazolinones) that can effectively control parasitic weeds in low doses.

These aspects and many others will be presented and discussed in the coming Parasitic Plants Congress in Charlottesville (USA) next June. We are looking forward to your registration and scientific contribution to the success of the Congress (for more information see: http://www.cpc.vt.edu/wcoopp/index.html).

Daniel M. Joel   IPPS President
HAUSTORIUM 50 January 2007

GUEST EDITORIAL

I am very appreciative of having been asked to set down some thoughts at the 50th issue of ‘Haustorium’. Needless to say, the first item on the agenda is to thank the members of the Editorial Team for their splendid work in keeping ‘Haustorium’ going. It is quite impossible to keep abreast of all publications in this diverse field, and the network that radiates out from the Editorial Team has been invaluable to many of us. May ‘Haustorium’ long continue!

When I look back over the decades since my 1969 book I am both astonished at the accomplishments and worried about some trends which we see around us. In some areas, progress has been uneven. I do not pretend to be “on top of” the agricultural aspects of parasitic plants, but it seems to me that the early promise of control of the terrible Striga problems in Africa seems to be fading, and the same might be said in the Orobanche area. Innumerable field trials have been done on a local basis - but the face of starvation continues to stare at us in many places where Striga is rampant. Effective control seems to be beyond our grasp. Many of us know that there are significant sociological and political dimensions here which complicate things even further. Looking at the positive side, it is rather remarkable that no economically important parasites have followed our footsteps to lands where they could do serious damage. For years I have sensed the danger, for example, of Aeginetia making its way to the sugarcane fields of Hawaii and tropical America. Considering the amount of present international travel, it is a miracle that it has not happened yet.

My own interests, from the beginning, have been of a structural and systematic sort and that bias, naturally, colors my view of what has been accomplished. I feel that the systematics of mistletoes has progressed strikingly in the most recent decades. Brian Barlow has done a splendid job in updating the mistletoes of Australasia, and the magnificent monograph of African mistletoes by Roger Polhill and Del Wiens has set a standard not likely to be reached by anyone else. Africa is a “dark continent” no longer in the mistletoe world. In the neo-tropics, I am struggling to make at least the larger genera a bit more transparent, but have a long ways to go. In the (new) Orobanchaceae, a thorough monograph of Harveya has just appeared, and I am told a monograph of the Santalaceous Thesium is on the way. It is essential that such monographic studies continue. More and more, they will incorporate vital molecular information. But the backbone of structural information is still feeble in places. As Soltis and Soltis wrote a few years ago, future work “will require new morphological and molecular data for many groups, including both a search for new characters and filling in data” for many groups. In what used to be called Scrophulariaceae, molecular data have produced great upheavals. All parasites of this alliance are now united with Orobanchaceae, the older family name. In Santalales, Dan Nickrent and coworkers are looking forward to a resolution of phylogenetic affinities which, no doubt, will have some surprising results.

I cannot avoid a feeling of sadness that some aspects of the study of parasitic plants have very nearly been sidelined. Although some individual physiological contributions have been made, what do we really know about the physiology of mistletoes or Orobanchaceae that we didn't know 40 years ago? The crucial penetration into host tissues is no better understood than it was a century ago: the statement that it probably requires a combination of physical and enzymatic processes almost reads like a tired mantra. With a couple of bright exceptions (I am thinking of Brian Fineran's remarkable study of Nystea floribunda, for example, but also the recent Arceuthobium publication by David Lye), the same can be said for haustorial structure. There are still several families in which the structure of the haustorial interface is practically unknown (Lemnoaceae, Balanophoraceae, Hydnoraceae). With the exception of a superficial study on Psittacanthus, and Jim Mauseth's work on Tristerix aphyllus, no anatomical information is available in this area for any tropical Loranthaceae, whether in the Old or in the New World. We can never understand parasitism until we have an adequate grasp of haustorial structure. It is my hope that the next generation may fill many of these serious gaps. The continuance of ‘Haustorium’ will be a significant help in the future.

Job Kuijt
Dept. of Biological Sciences, University of Victoria, BC, Canada.

HOW HAUSTORIUM HAPPENS

Publication of the 50th issue of this newsletter and its success as an organ of information on parasitic plants is something that the two of us could not have imagined. Therefore, we thought it would be appropriate if we were to give some history on the newsletter which we have jointly edited since its inception.

The primordium of Haustorium goes back to Chris’ involvement with the EWRC (European Weed Research
to carry the burden, we were able to use funds accruing from sale of spare copies of the Proceedings of the 3rd Symposium in Syria, kindly donated to IPSPRG by The International Center for Agricultural Research in Dry Areas (ICARDA). When those funds were exhausted we were supported for one year by the Crop Protection Programme of the UK Department for International Development. By this time (2000) an increasing number of copies were being distributed by email and since then the reduced costs of mailing have once more been borne by ODU. We are immensely grateful to ODU for its long-term support.

Since the first issue there has been a gradual development of content, the main change being the steady increase in coverage of Literature items which reflected the increased time Chris had available to scout for these and devise suitable brief summaries, as well as the plethora of new research endeavours. For some years now the aim has been to include ALL items of relevance that we encounter. Since closure of the Long Ashton Research Station, Bristol, and removal of its library, this has depended increasingly on CAB International’s Weed Abstracts but this does not cover all items of interest and we are glad to have attention drawn to those that might otherwise be missed. While Chris is mainly responsible for the summaries, we are grateful to Jim Westwood for help with those that are beyond our competence. While we have no wish to become a fully-fledged journal we have included brief research notes and would welcome more, in addition to relevant news items.

Composition and formatting of each issue happens on Chris’ home computer in a very cluttered study/second bedroom with a wonderful view over Bristol and the Mendip Hills beyond. Electronic copies go out from there but for the postal copies a printed version is sent over to Lytton at ODU in another seaport, Norfolk, Virginia (and the type locality for *Cassia pentagona*) for reproduction and mailing. Communication between the two of us has not always been perfect – our computers do not seem to understand each other, and there have been moments of tension, but we get it together in the end and have so far resisted all take-over bids. With the creation of the International Parasitic Plant Society (IPPS), there have been new Editors appointed, first Jim Westwood and then Diego Rubiales but they have both been very cooperative and allowed us to continue much as before. If serious suggestions for modification of editorial policy are proposed we shall be glad to cooperate but we do insist for the time being that distribution of the newsletter should continue to be independent of IPPS membership.

Rewarding to both of us is the tremendous progress in understanding parasitic plants since our humble newsletter was founded at the Faculty of Agriculture of the University of Khartoum over a quarter century ago. It is not uncommon to find in the archival literature references to articles published in Haustorium, clear indication of its acceptance and stature. If this newsletter has truly functioned as a haustorium in linking host researchers with different plants in different countries, we are sincerely thankful.

It has been interesting to report the creation of a new EWRS Parasitic Weed Research Group after a lapse of over 30 years, and we look forward to exploring ways in which we may interact. As always we welcome any suggestions for extra content and would like to see more of a Correspondence section with readers expressing and exchanging views on any relevant subject. For instance, perhaps not everyone agrees with Job Kuijt’s...
appraisal of the lack of progress in some lines of research. Why not let us know your own thoughts.

Chris Parker and Lytton Musselman.

9TH WORLD CONGRESS ON PARASITIC PLANTS
CALL FOR ABSTRACTS

Sunday June 3 to Thursday June 7, 2007 at Omni Hotel, Charlottesville, Virginia USA

Important reminder: The Congress is fast approaching; please note that March 1 is the deadline for abstract submission and early registration. Make your plans to attend today!

Register and submit abstracts at: www.cpe.vt.edu/wcopp

We are looking forward to seeing you at the 9th World Congress on Parasitic Plants in Charlottesville, Virginia this June. We are planning a program featuring speakers from around the world, representing the best in parasitic plant research. We will discuss both biological and agronomical aspects of parasitic plants. In keeping with the tradition of past parasitic plant symposia, the Congress will embrace diverse scientific disciplines aimed at understanding all parasitic species. In addition to oral presentations, ample time will be available for viewing posters and informal discussion with colleagues.

A new programmatic feature of this Congress is the inclusion of a special, cross-disciplinary lecture featuring cutting edge research that may not focus directly on parasitic species, but nevertheless provides new perspective into parasitism. Our speaker for this is Maria Harrison, who will discuss her research on signaling between plants and arbuscular mycorrhizal fungi. Recent reports have demonstrated that arbuscular mycorrhizal fungi increase hyphal branching in response to the same strigolactone signals that trigger germination in Striga and Orobanche. Dr. Harrison is well-known for her molecular studies of AM fungi and her participation in the Congress is certain to stimulate more thinking about parallels between symbiotic fungi and parasitic plants.

We are also pleased to feature Jeffrey Palmer as an invited speaker. A long-time contributor to the understanding of evolution in parasitic plants, he will provide an update on recent research into horizontal gene transfer involving parasitic species.

In addition, we have invited several plenary lectures from our colleagues on applied and basic aspects of parasitic plant management. Additional speakers will be selected from the submitted abstracts.

We are also planning a rich Poster Exhibition that will cover all aspects of parasitic plants research. This will provide an opportunity for personally presenting and discussing your current research with colleagues who are specifically interested in your work. A special Poster Session will allow ample time for poster discussion.

Please make your plans today to attend the Congress, and do not delay registration. A registration form is provided at the end of this newsletter.

Special cross-disciplinary lectures:
- Maria Harrison (Boyce Thompson Institute for Plant Research, Cornell University, USA) Special cross-disciplinary lecture: ‘The arbuscular mycorrhizal symbiosis: genomics approaches to dissect development and function’
- Jeffrey Palmer (Indiana University, USA) ‘Horizontal gene transfer gone wild in parasitic and other flowering plants’

Invited plenary lectures:
- Fred Kanampiu (CIMMYT, Kenya) ‘Striga weed management options under smallholder agriculture in Africa’
- Alejandro Perez de Luque (IFAPA-CICE, Spain) ‘Mechanisms of resistance to parasitic plants: from field screening to laboratory microscopic studies’
- Julie Scholes (University of Sheffield, UK) ‘Host gene expression in response to parasitism’
- Koichi Yoneyama (Utsunomiya University, Japan) ‘Qualitative and quantitative differences of strigolactone exudation determine host specificity of root parasites Orobanche and Striga.’

Charlottesville Virginia is a wonderful setting for a conference in June. The Omni hotel is located within easy walking distance of numerous restaurants and shops. The area is known for its natural beauty and proximity to historic sites, providing plenty of entertainment options for accompanying spouses and family. The weather should be pleasant, as June temperatures in Charlottesville average a high of 84 F (29 C) and low of 62 F (17 C). See you in Charlottesville,

Jim Westwood (Program Chair)
Mike Timko (Local Organizing Committee Chair)
TOWARDS ENDING THE WITCH-HUNT?


The completion of the current phase of the International Sorghum and Millet Collaborative Research Support Program (INTSORMIL) was the catalyst for bringing together the Striga research community in Addis Ababa from 5 – 11 November 2006. With generous support from USAID the symposium ‘Integrating New Technologies for Striga control: ending the Witch-hunt’ provided the platform for more than 60 workers from 20 countries in Africa, Europe and USA. The meeting and subsequent field trip to eastern Ethiopia was most ably organized by the Ethiopian Institute of Agricultural Research in collaboration with Purdue University, USA. This was the most comprehensive gathering of Striga researchers for some time. The meeting discussed how to build on our current understanding, to make use of emerging research methods and practical technologies to ensure widespread impacts on the lives of the millions of resource-poor households which are affected by these weeds. A list of the presentations made at the meeting is included later in this newsletter. These are being collated into a book that will summarise our current knowledge.

The meeting conveyed a spirit of considerable optimism that at long last the many years of cumulative research on the biology and management of Striga are bearing fruit with increasing dissemination and adoption of the current generation of resistant or tolerant cultivars and locally adapted management practices. We never cease to be amazed by the complexities of the parasite/host association. While many questions remain, the meeting reviewed some completely new insights that have been made possible by advances in analytical techniques with emerging molecular methods promising much in the near future.

Results from studies of the chemical signaling involved in Striga germination, the molecular basis of host detection by parasites and of allelochemicals associated with Desmodium opens up the possibility of engineered resistance in hosts and the development of enhanced activity from trap crops. John Toder (University of California, Davis, USA) described work to identify the genes involved in production of the chemicals associated with haustorial formation in the facultative parasites Triphysaria as a route to identifying target genes for future engineering of resistance to parasitic weeds. These are being searched for through the analysis of mapping populations generated from interspecific crosses of Triphysaria. These can parasitise other species in the genus but not themselves. Possibilities include the use of haustorial translocated RNA that is inhibitory for critical functions in the parasite, targeting genes that effect the reduction of quinines to semi-quinones in the parasite root at the critical phase of haustorial formation. Recent work from Harro Bouwmeester (Wageningen University, The Netherlands) suggests an important role for mycorrhiza. These use strigolactones to identify the presence of their hosts. Critically there appears to be reduced Striga stimulant production from mycorrhiza infected sorghum roots. Mycorrhiza, furthermore, are implicated in phosphate uptake by host plants, particularly on poor soils. This raises the possibilities that phosphate levels may be part of the explanation of why Striga is such a problem as soil fertility declines and that soil nutrient management practices that optimize mycorrhiza colonization may also reduce Striga infestation. Work at Wageningen has also investigated maize mutants with no carotenoids. These stimulate little or no Striga germination suggesting that carotenoids are important in the synthesis of strigolactones. Further understanding of this pathway may lead to opportunities for knocking out strigolactones in engineered hosts. John Pickett’s ( Rothamsted Research, UK) group has investigated the allelochemicals produced by Desmodium that appear to be responsible for the death of Striga seedlings in the ‘push-pull’ system. Elucidation of the pathway leading to the production of these uncinonanes leads to the possibility that this could be searched for or engineered into food legumes including beans and cowpeas for use in inter-crops or rotation with cereals on Striga infested land.

Working with Striga resistant rice lines Julie Scholes (University of Sheffield, UK) has been working to unravel the molecular genetic basis of resistance by studying quantitative trait loci. The aim is to identify QTLs associated with resistance that are homologous in sorghum and to identify host genes that are either up or down regulated during infection. Those that are up-regulated in association with Striga defense reactions in the host could be pyramided to provide durable resistance. Work on the genetic analysis of resistance in cowpea to S. gesnerioides and Alectra vogelii is now well advanced as part of the international Cowpea Genomics Initiative. Mike Timko (University of Virginia, USA) has used mapping populations to identify molecular markers. These are now available for the response of cowpea to different S. gesnerioides races. Markers are also under development for sorghum. Cecile Grenier (Purdue University, USA) described progress to develop cultivars incorporating resistance from N13 through a process of marker assisted selection and participatory variety selection. The combination of markers and use of the gel bioassay

Comment [CR1]: Chris is this true?
to check for lines with low stimulant production provides a more reliable process to select for resistance than traditional field screening methods.

The considerable efforts to develop the use of fungal biocontrol systems, particularly in West Africa were discussed by Alan Watson (McGill University, Canada) and Fenton Beed (Institute of Tropical Agriculture, Benin), particularly those based on Fusarium oxysporum. Although effective in on-farm trials, there has been no progress to date to perfect or promote durable delivery systems to farmers. The institutional challenges are immense; particularly for sorghum or open pollinated maize crops that are commonly established from farm-saved seed making reliable seed dressing with fungal spores difficult.

The meeting heard of farmer adoption of outputs of research to develop Striga resistant cereal cultivars, and suppression of the parasite by use of the 'push-pull' or herbicide tolerant maize systems. Gebisa Ejeta (Purdue University) described the complex of traits that can be employed to confer resistance in sorghum. Breeding work at Purdue led to seed of a number of Striga resistant sorghum lines with the low stimulant trait being made available to national programmes for field evaluation in Africa. Tesfaye Tesso (Ethiopian Institute of Agricultural Research) and Ambonenesiwe Mbwaga (Uyole Agricultural Research Institute, Tanzania) described how selection and validation with farmers has led to the release and promotion of Purdue lines as the cultivars 'Gubiye' and 'Abshir' in Ethiopia and 'Hakika' and 'Wahi' in Tanzania. In Ethiopia some 100,000 households have now received seed while promotion activities in Tanzania have been initiated in nine districts with seed multiplication and demonstrations. The emphasis is on Integrated Striga Management based on the use of the resistant cultivars linked to inter-cropping with cowpea or groundnut and application of manure. For farmers with dairy cattle, the 'push-pull' system described by Zeyaur Khan (International Centre for Insect Physiology and Ecology, Kenya) produces valuable fodder from the Desmodium inter-crop that also contributes to maize stemborer control and Striga suppression. This system was being used by over 6,000 farmers by 2006, largely in areas with over 700 mm rainfall per season. The challenge is now to find selections of Desmodium that are adapted to the lower rainfall areas and to demonstrate that these can be used here without a detrimental competitive impact on maize yield. Also from Kenya, Fred Kanampiu (International Maize and Wheat improvement Centre) highlighted the increasing adoption of herbicide tolerant maize now that the 'Strigaway' herbicide seed dressing has become commercialized. More than 15,000 demonstrations of the technology have been undertaken of the herbicide tolerant cultivar ‘Kajongo’. Problems remain of retaining herbicide activity in the maize root zone during periods of high rainfall and work is underway to develop a slow release formulation of the herbicide imazapyr to use as a seed dressing. A dynamic public/private partnership has ensured that the herbicide tolerant maize has become available to farmers in Kenya but in many countries the lack of efficient seed distribution systems constrains out-scaling of the technology.

Sustained donor and national government support for Striga research has been a perennial problem. The scale of the Striga pandemic is just too great for the limited human resource capacity of many national programmes in Sub-Saharan Africa to deal with without a wider range of scientific expertise that comes from international collaboration. It is to be hoped that the potential for the increasing farm-level impact of our research to date and particularly the exciting future opportunities highlighted by the meeting can be used to demonstrate the very real value of previous funding. This is vital if we are to attract the greatly increased level of support from development agencies and foundations that will be needed to make a truly significant impact on the problem across Sub-Saharan Africa.

The meeting organizer Dr Gebisa Ejeta, the leader of Striga research for INTSORMIL and Purdue University, was honored for his contributions to combating Striga in Ethiopia and across Africa in a presentation made on behalf of the Ethiopian Government by H.E. Addisu Legesse, Deputy Prime Minister and Minister of Agriculture. Meeting participants added their congratulations for this well deserved award.

Charlie Riches
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LITERATURE HIGHLIGHT- VOLATILE CHEMICAL CUES

A recent paper in Science (Runyon et al., 2006.) demonstrates that volatile substances are influential in guiding newly germinated seedlings of Cuscuta pentagona (= C. campestris) towards the host tomato. There was some tendency also to grow towards wheat (a non-host), but when there was a choice between the two hosts, a significant majority ‘selected’ tomato. Of a range of 7 volatiles emitted by undamaged tomato, β-phellandrine, β-myrcene and α-pinene were shown to have a significant influence on the directional growth of
eliminated the possibility of interference by effects of light or moisture. Conversely, the work of Benvenuti et al. showed a phototropic response resultant in over 60% growing towards a light source with a high far-red to red ratio (represented by dark green leaves of sugar beet) and only about 30% towards one with a high red to far-red ratio (represented by pale green leaves of sugar beet). Interposing a sheet of glass did not influence the result, thus presumably precluding the possibility of chemotropic response to volatiles. It is of interest to consider the relative importance of these chemotropic and phototropic influences, as they affect Cuscuta spp.

Although the influence of the gas ethylene is well known to influence germination of the seeds of root parasites such as Striga spp., these results represent the first known report of volatile substances influencing directional growth of a parasitic species and raise interesting questions regarding other possible situations for such an influence. There have been a number of demonstrations of chemotropic behaviour in the seedlings of Striga spp. [e.g. Saunders, 1933; Williams, 1961] but remarkably little interest in examining the phenomenon further. I was interested in the importance of this phenomenon and asked a mathematician (Brian Bartlett) to help calculate the chances of Striga seedlings locating host roots of different diameter from different starting distances (Dixon and Parker, 1984).

His calculations suggested that seedlings germinating within 2 mm of a root 1 mm in diameter or within 1 mm of a root 0.5 mm in diameter had only a 1 in 4 chance of making contact with the root in the absence of any chemotropic influence, and those germinating further away had correspondingly reduced chances of making contact. Our assumption at that time was that the modestly positive chemotropism demonstrated towards susceptible sorghum varieties in our tests was a response to a gradient of the germination stimulant or other root-exuded substance in solution. However, on reflection, it would seem just as possible that volatiles could be involved, and that crop varieties could differ sufficiently in their volatile output to affect their susceptibility to the parasite. We look forward to hearing of studies which pursue this neglected aspect of root parasite physiology.

Comments on this ‘Highlight’ will be warmly welcomed.

References:


Chris Parker.

FIRST REPORT OF OROBANCHE AEGYPTIACA PERS. PARASITISM ON PARTHENIUM Hysterophorus L. AND ARGEMONE MEXICANA L. IN INDIA

The two economically important species of Orobanche in India are O. cernua L. and O. aegyptiaca Pers. The primary hosts of O. cernua L. (sensu lato, including O. cumana) are solanaceous crops and members of Asteraceae, mainly sunflower and safflower (Krishnamurthy et al., 1977), while O. aegyptiaca Pers. has the widest host range, parasitizing many members of Solanaceae, Leguminaceae, Brassicaceae and several other families. In India, it is a major parasite on tobacco in parts of Karnataka, Andhra Pradesh, Tamil Nadu and Gujarat, rapeseed-mustard in parts of Gujarat, western Uttar Pradesh, Rajasthan, Haryana, Chattisgarh, and in tomato and potato in Karnataka. The infestation of O. aegyptiaca was first observed in the fields of rapeseed and mustard at Pulses and Oilseeds Research Station, Berhampore, West Bengal, during the rabi (dry) season of 1971 – 72 by Bandypadhyay and Mukherjee (1973). Now it is occurring in rapeseed and mustard fields of West Bengal, India especially in the district of Murshidabad.

While studying the parasitism of O. aegyptiaca in rapeseed-mustard during rabi season, 2005-06, the present author noticed that two noxious weeds, Parthenium hysterophorus L. of family Asteraceae and Argemone mexicana L. of family Papaveraceae are parasitized by O. aegyptiaca in a field of rapeseed-
mustard of this research station. Both P. hysterophorus and A. mexicana are annual herbaceous weeds and are widespread and problematic causing a menace now in many parts of West Bengal and other states of India. They have a very high rate of fecundity, and adaptability to grow under adverse and highly stressed climatic conditions. Seeds of these weeds are disseminated by air, water, soil, animal etc. They may pose an additional potential threat to various crops, if they serve as an alternative host for Orobanche spp., particularly in rapeseed-mustard crops.

This is the first report of occurrence of O. aegyptiaca parasitism on P. hysterophorus and A. mexicana from West Bengal, India. Similar reports have been made from Karnataka, India by Bhat et al. (1990), where O. crenata has parasitized P. hysterophorus and from North Bihar, India by Deo Singh (2003), where Orobanche was found parasitizing Parthenium in a tobacco field. Though Orobanche spp. have been recorded parasitizing members of the family Papaveraceae, no such reference is available that A. mexicana is also parasitized by O. aegyptiaca. The parasite formed distinct haustoria on the roots of both P. hysterophorus and A. mexicana. To prevent the spread of Orobanche spp., P. hysterophorus and A. mexicana need also to be controlled in rapeseed-mustard fields. The seeds of these genera are very similar to those of the crop and it is difficult to differentiate them. They may also adulterate mustard seeds for oil extraction.

References:

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COST 849 AND EWRS
Present and future coordination on parasitic weed research at the European level

A number of Orobanche species are of major importance in Europe: O. crenata causes huge damage in legume crops in Southern Europe; O. cumana threatens sunflower in Southern and Eastern Europe; O. minor is widespread in clover; O. ramosa attacks potato, tobacco, tomato and hemp. Species such as O. foetida that cause problems in other areas, are also present in Europe. Striga is not an agricultural problem in Europe, but there is strong involvement of European scientists in Striga research that can benefit the Third World. Other parasitic plant species like Viscum and Cuscuta are widespread and attract the attention of many European research groups.

COST is an instrument of the European Commission supporting co-operation among scientists and researchers across Europe. COST action 849 (Parasitic Plant Management in Sustainable Agriculture) has served during the past 6 years (2001-2006) as a platform to stimulate active interfacing among botanists, ecologists, anatomists, physiologists, biochemists, molecular biologists, breeders, plant pathologists, weed scientists, chemists, and agronomists, towards informal and formal join research projects. The lack of interdisciplinary involvement had been seen as a major factor that impeded progress in the sustainable control of parasitic weeds. Thus COST 849 aimed to establish a focal point of research on Parasitic Weeds in Europe. The main interest raised has been parasitic weed management, acknowledging the urgent need to re-evaluate control methods in the light of recent developments in crop breeding and molecular genetics and to place these within a framework that is compatible with current agronomic practices.

COST 849 Action has been carried out in accordance with the provisions of COST, that provided an annual budget (variable among years, with an average of 80,000 Euros/year) for organisation of meetings and short stays, but not for research. The Action was coordinated by a Management Committee (MC) with representatives of the 18 signatory countries (Austria, Bulgaria, Cyprus, Croatia, Denmark, France, Germany, Greece, Hungary, Italy, Israel, the Netherlands, Portugal, Romania, Serbia, Slovakia, Spain, UK), with Diego Rubiales (CSIC, Spain) as Chairperson and Danniel Joel (ARO, Israel) as Vice Chairperson. Activities were organised with four Working Groups (WG), each one with a coordinator appointed by the MC: WG1: biology and ecology of parasitic plants,
coordinated by Dr. Jos Verkleij (the Netherlands); WG2: parasitic plant – pathogen and pest interaction, coordinated by Dr. Maurizio Vurro (Italy); WG3: genetic resistance, coordinated by Dr. Danny Joel (Israel); and WG4: integrated control, coordinated first by Dr. Charlie Riches and then by Dr. Alistair Murdoch (UK).

Major activities have been annual scientific meetings and workshops, whose programmes and proceedings, when applicable, have been displayed on the Action web site (http://cost849.ba.cnr.it/). Experts were invited to the meetings to present their progress and to facilitate interaction. This involved around 80 invitations per year. In addition to this, 41 scientists, either students or seniors, benefited from short stays (from 1 to 10 weeks) to learn or apply techniques in another country. In these ways COST 849 has helped in coordination of existing financed research on parasitic weeds at the different labs in different countries. Now that activities of COST 849 have come to an end, it is time to review the progress achieved. Certainly, the parasitic weed problems are not all solved, but there has been a valuable, if insufficient, push that needs to be maintained by any possible means.

A promising new tool has now been established in the form of the Working Group on “Parasitic Weeds” within the European Weed Research Society (EWRS) (http://www.ewrs.org) with the mission to facilitate coordination, to increase the understanding of the interaction between weeds and their hosts, and to implement sustainable means to control the parasites. The inaugural meeting of the EWRS Parasitic Weeds Working Group was held at Oieras, Lisbon, November 23-24, 2006, in conjunction with the closing meeting of COST 849. A mailing list is being created by the coordinator (Dr. Maurizio Vurro, maurizio.vurro@ispa.cnr.it) in order to easily circulate news on any initiative related to Parasitic Weeds. We all hope that this new platform will serve to keep helping to prevent the spread, if not to eradicate parasitic weeds. The contribution of researchers on this initiative will certainly be crucial.

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MEETINGS

See http://cost849.ba.cnr.it/ for full abstracts.

Papers presented were:

Wegmann - Germination physiology as a target for Orobanche control.
Pérez-de-Luque - Mechanisms of resistance to broomrape (Orobanche spp.): what have we learned during the last five years?
Thalouan - Selection for resistance and characterization of its mechanisms.
Vurro - Biological sources for means to control parasitic weeds.
Hershenhorn - Integrated broomrape control: sanitation, resistant lines, chemical and biological control – can we combine them together?
Bouwmeester - Strigolactones, signals for friends and enemies.
Joel - Does the germination stimulant for O. cumana differ from strigolactones?
Matusova - Germination stimulant(s) perception by parasitic plants.
Goldwasser - Initial identification of tomato root stimulants inducing Orobanche seed germination.
Chachalis - Potential use of Nijmegen-1 and smoke water solutions to deplete Orobanche ramosa seed banks in Greece.
Fernández-Aparicio and Evidente - Specific responses of Orobanche species to Trigonella foenum-graecum root.
Zwanenburg - Natural germination stimulants as a lead for parasitic weed control.
Streibig - Germination of Striga hermonthica in response to Sorghum.
Dor - Interaction between F. oxysporum f. sp. orthoceras and Fusarium solani - two Orobanche cumana biocontrol agents.
Cagáň and Tóth - Distribution of Orobanche and Cuscuta species in Slovakia and possibilities of their biological control.
Economou - Marine algae as a means for Orobanche biocontrol.
Melero-Vara - Virulence of European populations of O. cumana.
Pacurená-Joita - Resistance and the development of virulent O. cumana races in sunflower crop in Romania.
Lyra - Application of RAPDs in identification of broomrapes.
Satovic - Genetic variability among *O. foetida* populations collected in Morocco.
Simier - Molecular characterization of metabolic pathways involved in *O. ramosa* development.
Aly - Parasitic weed control based on a key metabolic gene silencing in *O. aegyptiaca*.
Batchvarova - Genetic transformation as a tool for broomrape control.
Slavov - Mutagenesis and haploidy as means for obtaining resistant tobacco forms to *Orobanche ramosa*.
Hershenhorn - The resistant mechanism of *Orobanche* populations collected in Morocco.
Delavault - Molecular analysis of sunflower resistance to *O. cumana*.
Eizenberg - Precision agriculture and modeling - a novel approach in controlling *Orobanche*.
Rubin - Effect of herbicides inhibiting amino acid biosynthesis on *Cuscuta spp.* and *Orobanche*.
Montemurro - *In vitro* experiments on the control of *O. ramosa* with glyphosate in tomato.
Raranciu - Chemical control of *O. cumana* by imidazolinone herbicides.
Emeran - *Orobanche crenata* control in Egypt.
Uludağ - *Orobanche* control in potatoes in Turkey.
Riches - Green manures in Tanzania: a *Striga* management technology whose time has come?

**International Symposium on Integrating new technologies for *Striga* control: towards ending the witch-hunt. Addis Ababa, November 5-11, 2006.**
Proceedings of this meeting are being prepared for publication. See website below for more detail.

Papers presented and discussed were:

Gebisa Ejeta, The *Striga* scourge in Africa: a growing pandemic?
Patick Rich, Biology of host-parasite interactions in *Striga* species.
John Yoder, Host detection by root parasites: insights from transcriptome profiles.
Harro Bouwmeester, Germination of *Striga* and chemical signalling involved: a target for control methods.
John Pickett, Chemical studies on *Striga* control by *Desmodium* and opportunities for developing this trait in edible bean legumes.
Lyton Musselman, Biological diversity among and within *Striga* species: implications for control and potential spread.

Alan Watson, What can *Fusarium oxysporum* do in the battle against *Striga*?
David Sands, Genetically enhancing virulence of pathogens for weed control: why, how, and results.
Fenton Reed, Biocntrol: a critical component of integrated *Striga* management.
Jonathan Gressel, Transgenic biocontrol agents to overcome evolutionary barriers.
Fred Kanampiu, Success with the low biotech of seed-coated imidazolinone-resistant maize.
Cecile Grenier, Marker-assisted selection for *Striga* resistance in sorghum.
Julie Scholes, Genomic approaches to *Striga* control.
Anic de-Framond, Effects on *Striga* parasitism of transgenic maize armed with RNAi constructs targeting essential *S. asiatica* genes.
Gebisa Ejeta, Dissecting the complex trait of *Striga* resistance to simpler components for effective breeding of sorghums with high level of resistance to *S. hermonthica*.
Abebe Menkir, Breeding maize with broad-based resistance to *Striga hermonthica*.
Boukar Ousmane or Mike Timko, Genetic analysis of resistance to *Striga gesnerioides* in cowpeas.
Issoufou Kapran, Ingression of *Striga* resistance genes into African sorghum landraces.
Tesfaye Tesso, An integrated *Striga* management option offers effective control of *Striga* in Ethiopia.
Joel Ransom or Abdel Gabar Babiker, Integrating crop management practices for *Striga* control.
Fasil Reda, Cultural and cropping systems approach for *Striga* management - a low cost alternative option in subsistence farming.
Zeyaur Khan, Field developments on *Striga* control by *Desmodium* intercrops in a ‘Push-Pull’ strategy.
Ambonesigwe Mbwaga, Integrated *Striga* management for improved sorghum production to meet market demands in Tanzania.

Hugo de Groote, Economic analysis of *Striga* control in maize.

**THESIS**

Bista, A (Ph.D. B.R.A.Bihar University, India, February, 2005)

**Studies on Biology and Ecology of Seed Germination of *Orobanche solmsii* C.D.Clarke.**

Out of 150 *Orobanche* species known, only four species are reported to occur in Nepal. Among them *O. aegyptiaca* Pers and *O. solmsii* C.D Clark. prevalent in oilseed (Brassicaceae) and in tobacco (Solanaceae) fields respectively, while *O. alba* and *O. caeruleascens* are reported to occur in wild habitats in Nepal. I studied *in vitro* seed germination tests by a Petri-dish method to...
In my studies, I found progressive loss of seed viability of the seeds stored at room temperature and optimum seed germination was observed in nine months old seeds. This could be taken as an ecological adaptation of seeds to remain dormant over the unfavorable wet season following shedding. The results of the moisture test suggested that Orobanche seeds are unable to survive for a long period in waterlogged conditions. This could be the reason for low incidence of the parasite in fields used for rice. Seed germination studies conducted at different temperatures showed that the parasite prefers a narrow range of temperature, around 20°C for preconditioning and around 25°C for post-conditioning/germination. The relationship of temperature and percentage of seed germination could help determine the appropriate sowing date to avoid Orobanche infection in the field.

In response to different pH, in vitro germination of Orobanche seeds was highest slightly acidic condition. The study suggests the application of agricultural lime to acidic soils. In an experiment in which different hormones were used to germinate Orobanche seeds, GA3 (100 ppm) substantially enhanced Orobanche seed germination when applied during the preconditioning period (100 ppm); NAA showed inhibitory effects while kinetin failed to stimulate germination at any of the concentrations tested. This suggests that GA3 can break seed dormancy to some extent if applied during pre-conditioning period.

The experiment also showed that most of the phenolic compounds tested on Orobanche seed germination had inhibitory effects. These phenolic compounds have also been reported to be released in the soil from the host plant roots and acts as allelochemicals. Understanding the effects of phenolic compounds could be helpful in the suppression of Orobanche parasitization in the field condition provided they do not cause negative effects on host plants.

I have presented the results of seed germination tests in different plant root extracts extracted in different solvents in order to determine the polarity nature of the natural germination stimulant(s). It showed that the polarity of stimulatory chemicals for seed germination present in root extract of host plants corresponds to a value close to that of hexane and ethyl acetate, and the stimulant(s) exist in more than one form. This could be an important step towards the identification of natural germination stimulant(s) of O. solmsii.

Finally, I studied the effects of different nutrients chemicals in seed germination during pre and post-conditioning period. The study showed that all forms of nitrogen are not equally effective in reducing Orobanche seed germination. The additional outcome of the present study are (i) the inhibitory effect is more pronounced when the chemicals are applied during pre-conditioning period compared to their application during post-conditioning period and, (ii) the ammonium forms of nitrogen inhibit more than the nitrate forms, while urea has an intermediate effect. The inhibitory performance of ammonium forms of nitrogen explains why the chemical applied in Orobanche infested fields suppresses the emergence of parasitic plants.

(Editors' note: Dr Bista has followed earlier authors (including Khattri et al., 1991 and Bharati, 1989) in using the name O. solmsii for the species attacking tobacco in Nepal. However, Dr Khattri himself, writing in Haustorium in 2002, concluded that the name O. solmsii was being misused in Nepal in place of O. cernua. Flora of Bhutan, Flora of Pakistan, and Flora of China all describe O. solmsii as a yellow-flowered species, while O. cernua has purplish coloration. The editors believe that the above thesis work involves O. cernua rather than O. solmsii.)

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For details of the 9th World Congress on Parasitic Plants see: http://www.cpe.vt.edu/wcopp/index.html

For information on the International Parasitic Plant Society, past and current issues of Haustorium, etc. see: http://www.ppps.vt.edu/IPPS/

NB. For past and current issues of Haustorium note that the ODU site http://web.odu.edu/haustorium is under revision and does not currently include issues 46-49. A new site http://www.odu.edu/~lmusselm/haustorium/ will be functioning in the near future.
For the ODU parasite site see:  
http://www.odu.edu/webroot/instr/sci/plant.nsf/pages/parasitic_page

For Lytton Mussleman’s *Hydnora* site see:  
http://www.odu.edu/webroot/instr/sci/plant.nsf/pages/lecturesandarticles

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see:  
http://www.science.siu.edu/parasitic-plants/index.html

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes) see:  
http://www.rmrs.nau.edu/misteltoo/welcome.html

For information on, and to subscribe to PpDigest see:  
http://omnisterra.com/mailman/listinfo/pp_omnisterra.com

For information on the EU COST 849 Project and reports of its meetings see:  
http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see:  
http://www.ehrs.org/

For the Parasitic Plants Database, including ‘4000 entries giving an exhaustive nomenclatural synopsis of all parasitic plants’ the address is:  
http://www.omnisterra.com/bot/pp_home.cgi

For a description and other information about the *Desmodium* technique for *Striga* suppression, see:  
http://www.push-pull.net

For information on EC-funded project ‘Improved *Striga* control in maize and sorghum (ISCIMAS) see:  
http://www.plant.dlo.nl/projects/Striga/

For the work of Forest Products Commission (FPC) on sandalwood, see:  
www.fpc.wa.gov.au

For past and future issues of the Sandalwood Research Newsletter, see:  
www.jcu.edu.au/school/tropbiol/srn/

For information on the work of the African Agricultural Technology Foundation (AATF) on *Striga* control in Kenya, see:  
http://africanecrops.net/striga/

To view the list of presentations and participants at the *Striga* meeting in Addis Ababa, November 2006, see:  
http://www.agry.purdue.edu/strigaconference/index.htm l

**LITERATURE**

Ahonsi, M.O. and Emechebe, A.M. 2005. *In-vitro* whole-seedling assay for evaluating non-host crop plant induction of germination of witch weed seeds. African Crop Science Journal 13(1): 61-69. (An *in vitro* whole-seedling assay*, involving the growth of individual 2-3-day old crop seedlings in Petri dishes was compared with the *cut-root* method for comparing different varieties of legume for stimulation germination of *Striga hermonthica*. Both techniques showed groundnut more active than cowpea or soya bean. There was much variation with both techniques but the new method proved at least as efficient, while being simpler and requiring less time, labour and materials.)


Alcántara, E., Morales-García, M. and Díaz-Sánchez, J. 2006. Effects of broomrape parasitism on sunflower plants: growth, development, and mineral nutrition. Journal of Plant Nutrition 29: 1199-1206. (Studying mineral content of the crop host as affected by *Orobanche cumana* in Spain, noting reductions in calcium, manganese and zinc in leaves of parasitized plants while differences were less significant for potassium, phosphorus, iron and copper.)

An SuSun, Lee AiYoung, Lee CheolHeon, Kim DoWon, Hahn JeongHee, Kim KeaJeung, Moon KeeChan, Won YoungHo, Ro YoungSuck and Eun HeeChul. 2005. Fragrance contact dermatitis in Korea: a joint study. Contact Dermatitis 53: 320-323. (Patch tests showed high frequencies of positive response to sandalwood oil, from *Santalum album* L.)

Ayongwa, G.C., Stomph, T.J., Emechebe, A.M. and Kuyper, T.W. 2006. Root nitrogen concentration of sorghum above 2% produces least *Striga hermonthica* seed stimulation. Annals of Applied Biology 149: 255-262. (Showing steeply declining germination of *S. hermonthica* between 1% and 2% root nitrogen. Above this level there was zero germination using root exudates but low germination using cut roots. Lag between N application and effective influence on germination was 5 days.)

Badu-Apraku, B. and Menkir, A. 2006. Registration of 16 extra-early maturing *Striga* resistant tropical maize inbred lines. Crop Science 46: 1400-1401. (Registering 16 lines TZEEI 1 to TZEEI 16 (Reg. No. GP-473 to GP-485, PI 641251 to PI 641266), with moderate resistance to *Striga* as well as resistance to streak, rust and blight.)
of Weeds Science 54: 923-927. (Excellent selective control in the rather inadequate abstract, but apparently a fields and fallow with 'rice fields with broomrape (bank, and 88% increase in productivity from 2 years of seed of g/ha. Optimal treatment was from 20 g/ha applied 100 0 post-emergence applications of imazamox from 10-40 1.04 mm on a seed shaker, was able to detect a single round-hole perforation sieve with a hole diameter of.

Weed Science 54: 923-927. (Excellent selective control in the rather inadequate abstract, but apparently a fields and fallow with 'rice fields with broomrape (bank, and 88% increase in productivity from 2 years of seed of g/ha. Optimal treatment was from 20 g/ha applied 100 0 post-emergence applications of imazamox from 10-40 1.04 mm on a seed shaker, was able to detect a single round-hole perforation sieve with a hole diameter of.

Weed Science 54: 923-927. (Excellent selective control in the rather inadequate abstract, but apparently a fields and fallow with 'rice fields with broomrape (bank, and 88% increase in productivity from 2 years of seed of g/ha. Optimal treatment was from 20 g/ha applied 100 0 post-emergence applications of imazamox from 10-40 1.04 mm on a seed shaker, was able to detect a single round-hole perforation sieve with a hole diameter of.
ex vivo, and in vivo. Journal of Clinical Immunology 26: 347-359. (The most interesting clinical long-term effect is the bystander stimulation of various memory T cells that might mediate in vivo antitumor and antinfectious T-cell response under mistletoe-extract immunization.)

Hernández-Benítez, R., Cano-Santana, Z. and Castellanos-Vargas, I. 2006. (Incidence of infection by Arceuthobium globosum grandidicale (Hawksw. & Wiens) in Pinus hartwegii Lindl.) (in Spanish) Ciencia Forestal en Mexico 2005 Vol 30(07): 79-86. (Showing that 77% of P. hartwegii trees taller than 2 m were infected by A. globosum, while only 2% of the individuals shorter than that height were damaged.)


Khan, Z., Nyangol, D., de Groote, H., Rutto, E., Kikafunda, J., Odhiambo, G., Rwiza, I., Vanlauwe, B., Pickett, J. and Wadhams, L. 2006. Integrated pest and soil management to combat Striga, stem borers and declining soil fertility in maize. In: Sweetmore, A., Kimmins, F. and Silverside, P. 2006. Perspectives on Pests II. Achievements of research under UK Department for International Development Crop Protection Programme 2000-2005. Ashford, UK. Natural Resources International Ltd. pp. 79-81. (A review of on-farm studies in Kenya, Tanzania and Uganda confirming the value of Desmodium intercropping to suppress S. hermonthica in maize under relatively wet conditions, while the use of herbicide-resistant maize varieties in conjunction with imidazolinone herbicide was more reliable in drier conditions. Fertilizer and rotation treatments were also included.)

Khalita, R.K., Pathak, K.C., Khatri, P.K. and Anup Chandra. 2006. Severe infestation of mistletoe on Gymelina arborea (Roxb.) in the state of Mizoram. Indian Forester 132: 381-384. (Describing Scurrula parasitica as a severe parasite of G. arborea, and apparently restricted to this host at this location (but occurring on a wide range of hosts in Bhutan – C.P.).)


LiangXiao, Wang LianSheng, Zhao JuYing, Li QuSheng and Zhao MiXia. 2006. Occurrence and biocontrol of Orobanche cumana on tobacco and sunflower. Acta Phytopathologica Sinica 36: 466-469. (Shoveling of Fusarium sp. strain 1.2, a strain used to control Orobanche infesting tobacco, gave over 90% control of O. cumana. Strain 1.2 was safe to wheat, maize, cotton, tobacco and sunflower. The toxins produced in liquid culture inhibited Orobanche seed germination.)


Lins, R.D., Colinquhou, J.B. and Mallory-Smith, C.A. 2006. Investigation of wheat as a trap crop for control of Orobanche minor. Weed Research 46: 313-318. (A range of 6 soft wheat varieties, a durum wheat (Triticum turgidum) and a triticale (T. hexaploide) all stimulated germination of O. minor and greatly reduced parasitisation of a following crop of red clover grown in the same pots.)


Mathiasen, R.L. and Daugherty, C.M. 2005. Comparative susceptibility of conifers to western hemlock dwarf mistletoe in the cascade mountains of Washington and Oregon. Western Journal of Applied Forestry 20(2): 94-100. (A survey of 26 conifer stands in N.W. USA confirmed western hemlock as the only principal host of Arceuthobium thunbergii ssp. tsugense, while Abies amabiliis, Abies procera and Tsuga mertensiana were occasional hosts.)

Mathiasen, R.L., Seddles, A. and Senicu, S. 2006. First report of Arceuthobium hondurense and Struthanthus deppeanus in Nicaragua. Plant Disease 90: 1458. (Populations of A. hondurense recorded at three new locations on Pinus tecumam and at one on P. oocarpa. S. deppeanus was observed at one site on P. tecumam and at another on P. oocarpa.)


cm of the soil. This product is safe for most other plant species.


Mishra, J.S., Moorthy, B.T.S. and Manish Bhan. 2005. Efficacy of herbicides against field dodder (Cuscuta campestris) in lentil, chickpea and linseed. Indian Journal of Weed Science 37(3/4): 220-224. (Pendimethalin pre-emergence at 1 kg/ha was selective and increased yields in lentil, linseed, chickpea. A mixture with imazaquin was selective only in chickpea, while glyphosate, 50 g/ha, showed selectivity in linseed only.)

Mishra, J.S., Moorthy, B.T.S. and Manish Bhan. 2006. Relative tolerance of linseed (*Linum usitatissimum*) varieties to dodder (Cuscuta campestris) infestation. Indian Journal of Agricultural Sciences 76: 380-382. (Yield reduction of 14 linseed varieties due to *C. campestris* varied from 7% in the relatively tolerant Garima to 44% in the most susceptible J 23.)


Moliner-Ruiz, M.L., Melero-Vara, J.M., Garcia-Ruiz, R. and Dominguez, J. 2006. Pathogenic diversity within field populations of Orobanche cumana and different reactions on sunflower genotypes. Weed Research 46: 462-469. (Reporting somewhat complex results, but confirming the high resistance of sunflower genotype P96 to races F and E of *O. cumana*. Type L86 resisted race F but was, unusually, susceptible to race E. Also showing that there are significant variations between subpopulations of race F.)

Mooney, K.A. and Linhart, Y.B. 2006. Contrasting cascades: insectivorous birds increase pine but not parasitic mistletoe growth. Journal of Animal Ecology 75: 350-357. (Excluding birds from *Pinus ponderosa* parasitised by *Arceuthobium vaginatum* resulted in increased damage to pine from aphids, but did not influence insect damage on *A. vaginatum*. Results are discussed in terms of food web theory, intraguild predators and trophic cascades.

Mossahebi, G.H., Okhovat, S.M. and Damadi, M. 2005. Determination of the races of potato virus X and its host range in Karaj, Damavand and Ardabil, Iran. In: Gullino, M.L. (ed.) Communications in Agricultural and Applied Biological Sciences70(3): 431-433. (Potato virus X was transmitted mechanically but not via unspecified *Cuscuta* sp.)


Nizhamiding, K., Tuniyazi, Y. and Ma DeYing. 2006. (Establishment of technique system of integration dodder management on alfalfa in Xinjiang.) (in Chinese) Xinjiang Agricultural Sciences 43:180-185. (Reviewing the distribution and control of *Cuscuta* spp., including the use of biological control.)


Riches, C.R. 2006. Green manures in Tanzania: a technology whose time has come. TAA Newsletter September 2006: 21-22. (A further account of the work on green manures Crotalaria, Canavalia and Mucuna which farmers are adopting enthusiastically to improve soil fertility and hence yields of rice and maize, while greatly reducing Striga asiatica infestations.)

Reblin, J.S., Logan, B.A. and Tissue, D.T. 2006. Impact of eastern dwarf mistletoe (Arceuthobium pusillum) infection on the needles of red spruce (Picea rubens) and white spruce (Picea glauca): oxygen exchange, morphology and composition. Tree Physiology 26: 1325-1332. (Confirming P. glauca to be more susceptible to A. pusillum than P. rubens but failing to explain the difference in terms of the effects of the parasite on host carbon balance.)

Riches, C.R. 2006. Green manures in Tanzania: a technology whose time has come. TAA Newsletter September 2006: 21-22. (A further account of the work on green manures Crotalaria, Canavalia and Mucuna which farmers are adopting enthusiastically to improve soil fertility and hence yields of rice and maize, while greatly reducing Striga asiatica infestations.)

Rodenburg, J., Bastiaans, L. and Kropff, M.J. 2006. Characterization of host tolerance to Striga hermonthica. Euphytica 147: 353-365. (Pot studies with four sorghum varieties and different levels of infection suggested that for resistant genotypes, tolerance can best be quantified as a reduced relative yield loss per emerged Striga plant, whereas for less resistant genotypes the maximum relative yield loss can best be used. Complications of screening for tolerance under field conditions are discussed.)

Ross, C.M. 2005. A new way of describing meiosis that uses fractal dimension to predict metaphase I. International Journal of Biological Sciences 1(3): 123-125. (Despite its parasitic nature (making it difficult to culture) dwarf mistletoe has received considerable attention for its peculiarities in meiotic behaviour. This paper is the latest in a series of these studies with broad implications for meiosis in the plant kingdom and beyond.)


SAFGRAD. 2005. Collaborative Striga Research and Control Project 2002-2004 Achievements. Oagadougou, Mali: SAFGRAD. 34pp. (In a collaborative project between 7 W. African countries, a range of improved maize varieties averaged 40% yield benefit and 41 % less S. hermonthica in over 200 farmer trials. Combinations of the improved variety with legume rotation or intercropping showed little further yield benefit but was believed to have reduced Striga seed-bank.)


Samaké, O., Stomph, T.J., Kropff, M.J. and Smaling, E.M.A. 2006. Integrated pearl millet management in the Sahel: effects of legume rotation and fallow management on productivity and Striga hermonthica infestation. Plant and Soil 286: 245-257. (One year of cowpea followed by 3 years pearl millet/cowpea intercrop yielded the same total millet as 4 years continuous sole-crop pearl millet, while the cowpea harvested was a bonus. Preceding fallow for 2 years reduced S. hermonthica and increased millet yield. Longer fallow up to 7 years reduced Striga further, but did not eliminate it.)


Secomb, N. 2006. Defining the distribution of branched broomrape (Orobanche ramosa L.) by tracing the movement of potential vectors for the spread of seed. In: Preston, C., Watts, J.H. and Crossman, N.D. (eds) 15th Australian Weeds Conference, Adelaide, September 2006: 614-617. (O. ramosa was found to be moved from farm to farm mainly via farm machinery and livestock, with contaminated crop seed or hay being less often responsible.)


resistant to major diseases, while IT97K-205-8 and 
IT97K-499-35 also have combined resistance to major 
diseases and insects. The latter has shown consistently 
high yield.)

restore germination of Orobanche seeds that are 
conditioned under water stress and suboptimal 
temperature. Australian Journal of Agricultural 
Research 57: 1195–1201. (Seeds of O. ramosa, O. 
egyptiaca and O. minor, germinated less well in 
response to GR24 following conditioning at sub-optimal 
temperature and moisture: but germination levels were 
largely restored when various combinations of GA3, 
brassinolide and fluridone were applied in conjunction 
with the GR24.)

Steuer-Vogt, M.K., Bonkowski, V., Scholz, M., Fauser, C., 
Licht, K. and Ambrosch, P. 2006. (Influence of ML-1 
standardized mistletoe extract on the quality of life in 
head and neck cancer patients.) (in German) HNO, 
Hals-, Nasen-, Ohrenärzte 54: 277-286. (In a study 
invoking regular injections of mistletoe extract ML-1 
into 200 patients over a 60 week period, no 
improvements in the quality of life in head and neck 
cancer patients were demonstrated.)

Tarfa, B.D., Kureh, I., Kamara, A.Y. and Maigida, D.N. 
2006. Influence of cereal-legume rotation on soil 
chemical properties, crop yield and Striga control. 
Journal of Agronomy 5: 362-368. (Recording increases 
in soil organic matter and maize yield in maize 
following soyabean or cowpea, compared with 
continuous maize. Effects on S. hermonthica and soil 
pH not clear from the abstract.)

Teryokhin, E.S. 2004. The origin of "dust" seeds in 
parasitic and mycoparasitic angiosperms: a hypothesis 
for symbioses. Beiträge zur Biologie der Pflanzen 
(2001) 72: 381-397. (The late Edward Teryokhin 
contributed immensely to our understanding of 
parasites. In this posthumous paper he returns to one of 
his early research interests, the morphology of seeds. 
Like mycotrophs, seeds of many parasitic plants are 
remarkably reduced.)

Torres, A.M., Román, B., Avila, C.M., Satovic, Z., 
Rubiales, D., Siliero, J.C., Cubero, J.I. and Moreno, 
M.T. 2006. Faba bean breeding for resistance against 
biotic stresses: towards application of marker 
technology. Euphytica 147: 67-80. (A review of faba 
bean breeding, containing a section that concisely 
summarizes challenges and progress in breeding 
resistance to O. crenata.)

Torres, M.J., Tomilov, A.A., Tomilova, N., Reagan, R.L., 
Yoder, J.I. 2005. Pschorp, a parasitic plant EST 
database enriched for parasite associated transcripts. 
BMC Plant Biology 5(24): http://www.biomedcentral.com/content/pdf/1471-2229-
2-24.pdf  (Describing the generation of a database 
containing over nine thousand sequences generated 
from suppression subtractive libraries enriched for 
transcripts regulated in Triphysaria roots exposed to 
Arabidopsis roots or DMBQ. The web site also provides 
BLAST functions and allows keyword searches of 
functional annotations.)

Véronési, C., Benharrat, H., Delavault, P. and Simier, P. 
2006. (Resistance of rape-seed to branched broomrape.) 
(in French) Phytoma – La Défense des Végetaux 599: 
45-47. (Oil-seed rape variety ‘Darmor’ proved highly 
resistant to Orobanche ramosa compared with variety 
‘Yudal’. Kinetic studies of enzymes showed an early 
build-up of lipoxygenase and peroxidase after infection 
and suggest these may have a role in resistance.)

Potential use of isothiocyanates in branched broomrape 
eradication. In: Preston, C., Watts, J.H. and Crossman, 
N.D. (eds) 15th Australian Weeds Conference, Adelaide, 
September 2006: 629-632. (Confirming useful 
germination stimulant activity on O. ramosa from 
myth isothiocyanate, 2-phenylethyl isothiocyanate and 
2-propenyl isothiocyanate. Activity of root exudates of 
number of Brassica species, assumed due to release of 
brassinolides /isothiocyanates, was high in some tests 
but inconsistent.)

Warren, P. 2006. The branched broomrape eradication 
program in Australia. In: Preston, C., Watts, J.H. and 
Crossman, N.D. (eds) 15th Australian Weeds Conference, Adelaide, 
(Reviewing the Australian eradication programme for 
Orobanche ramosa which currently affects over 6,000 
ha. Now in its 8th year and costing A$4M per annum, 
the campaign involves, research, quarantine across an 
area of nearly 200,000 ha, methyl bromide fumigation 
and other procedures to prevent new seed production.)

Westbury, D.B., Davies, A., Woodeock, B.A. and Dunnett, 
N.P. 2006. Seeds of change: the value of using 
Rhinanthus minor in grassland restoration. Journal of 
Vegetation Science 17: 435-446. (Seeding R. minor into 
various types of species-poor grassland was shown to 
suppress grass growth and increase species- diversity in 
some instances but depended on a range of factors. 
Establishment of R. minor was improved by sward 
scarification.)

Williams, A.M., Virtue, J.G., DeCear, C. and McInerney, 
T. 2006. Sampling challenges in detecting branched 
broomrape seed bank decline. In: Preston, C., Watts, 
J.H. and Crossman, N.D. (eds) 15th Australian Weeds 
(Discussing problems in the use of DNA analysis in 
the sampling of soils for surviving seeds of O. ramosa 
following comparisons of methyl bromide with possible 
replacement fumigants.)

Yonli, D., Hess, D. E., Abbasher, A.A., Sérémé, P. and 
Sankara, P. 2005. Biological control of witch weed in 
fields of Burkina Faso using isolates of Fusarium
oxysporum. African Crop Science Journal 13(1): 41-47. (Belatedly reporting studies from 1997/98 which showed no significant differences between 15 isolates of F. oxysporum and achieved about 50% reductions in biomass and emergence of S. hermonthica in both years.)


ERRATA

We regret that the final two pages of our last issue, Haustorium 49, were omitted from the printed copy sent from Old Dominion University. These are included in the copy on the Haustorium web site but if printed copies are needed, please email Lytton Musselman at lmusselm@odu.edu.

HAUSTORIUM 50

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Conference Registration Form

9th World Congress on Parasitic Plants
June 3-7, 2007
Omni Charlottesville Hotel • Charlottesville, Virginia

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Dear IPPS Members,

Last June we have enjoyed the very successful 9th World Congress on Parasitic Plants, which was carefully organized by our American colleagues in Virginia. Both the scientific program and the venue were perfectly prepared, and allowed both oral and poster presentations with fruitful discussion on key issues in parasitic plants research and parasitic weed management. All Congress abstracts can be found at [http://www.cpe.vt.edu/wcopp/Abstracts_Final.pdf](http://www.cpe.vt.edu/wcopp/Abstracts_Final.pdf). A review of the scientific presentations, kindly prepared by Chris Parker, is given below.

Experts and students from more than twenty countries attended the Congress, and the pleasant venue plus the weather conditions also allowed enjoying the pleasant atmosphere of downtown Charlottesville. The tour to Monticello and the visit to a local winery added a glimpse into the US history and the local wine industry.

This is an opportunity to thank, again, the Local Organizing Committee chaired by Mike Timko, who did an excellent job in preparing all Congress details. We are also grateful to Jim Westwood, Lytton Musselman and Mike Timko for putting together an excellent scientific program with the aid of the International Scientific Advisory Committee, which represented various aspects of research and development related to parasitic plants.

Please visit [http://www.cpe.vt.edu/wcopp/photos.html](http://www.cpe.vt.edu/wcopp/photos.html) for a selection of photographs taken during the Congress. We are happy to announce that the next IPPS Conference will be in Turkey during the first half of June 2009. We are presently negotiating the details, and will send you the first Circular as soon as we have more details.

This is my last message to you as president of the IPPS. Jim Westwood, who currently serves as Vice-President, will become the new IPPS President, and we will soon have elections for a new Executive Committee. A detailed announcement on the elections will be given separately.

Daniel M. Joel
IPPS President
A series of papers on genomic studies and evolution of parasitic plants included a masterly review by Dan Nickrent on the different modes of aerial and root parasitism in the Santalales, and the evidence for 5 separate evolutionary origins of parasitism in that group, based on intensive DNA and fossil studies. Further papers explored the evolution and phylogenetic relationships within other groups of parasitic plant - by Funk et al. (presented by Kirsten Krause) on Cuscuta; by Sasa Stefanovic and Costea also on Cuscuta; and by Schneeveiss et al. on Orobanche. Chris Thorogood presented preliminary evidence for host specificity leading to speciation in British Orobanche spp.

Another invited paper dealt with the newly established link between germination stimulants for parasitic plants, and the arbuscular mycorrhizae, for which these substances area vital signal (topic of a Literature Highlight in Haustorium 47). In a wide-ranging and detailed review Maria Harrison described the morphology and development of the mycorrhiza and the fact that about 80% of all plant species can be infected. She also explored the molecular events and specific genes that underlie development and functioning of the symbiosis.

Related papers on germination included one by Plakhine et al. (presented by Danny Joel) which surprisingly showed that there appear to be genes responsible for suppressing spontaneous germination and a certain combination of genes in hybrids from Orobanche cernua and O. cumana could result in high levels of spontaneous germination. Koichi Yoneyama presented a paper by Xie et al. in which the full range of strigolactones was reviewed, 6 new structures described, and the structure of ‘electrol’ re-investigated, showing it to be an acetate of ‘orobanchol’. They conclude that most host species (and many unaffected by parasitic plants) exude several different strigolactones. Another important finding was the effect of reduced phosphorus in increasing stimulant exudation in both legumes and in sorghum. Harro Bouwmeester described work on the biosynthesis of the strigolactones from carotenoids, suggesting that they should be referred to as ‘apocarotenoids’ rather than ‘sesquiterpene lactones’. A step in the biosynthetic pathway could be blocked by the herbicide fluridone, and low doses applied to rice could be shown to reduce attack by Striga hermonthica. Yukihiro Sugimoto described the use of aseptic plant tissue cultures of several species for copious production of stimulant substances, identified mainly as strigol or 5-deoxystrigol. The latter proved equal to GR24 for stimulation of S. hermonthica and O. crenata and 10-fold more active on O. minor.

Among several papers on post-germination events, one presented by Andrew Palmer, suggested that elevated cytoplasmic calcium is among the very earliest responses to exposure of S. asiatica to the xenognosin DMBQ, occurring within 15 minutes. The involvement of hydrogen peroxide and NADPH oxalate were also discussed. Ralf Kaldenhoff had explored gene expression in Cuscuta reflexa and its host tomato and shown the importance of cysteine protease production in Cuscuta tissue. He had shown that application of a polyepptide inhibitor of cysteine protease activity could lead to death of the Cuscuta. This concept is the subject of a patent. John Yoder presented detailed work by Tomilov et al. which explored the genes involved in haustorial development in Triphysaria. With nearly 12,000 gene sequences now generated from Triphysaria, analyses of haustorial initiation are producing intriguing findings, such as a connection between touch and haustorial formation.

Jay Bolin introduced many of us to the interesting structure and physiology of the African Hydnora spp., plants with an almost totally subterranean habit, without stomata and extremely resistant to desiccation. Isotope studies confirm that all carbon derives from the host, while levels of P and K are much higher in the parasite than in the host. Studies on the mistletoe, Viscum album, presented by Michiel de Mol confirmed direct vessel to vessel connections at the host-parasite interface, allowing mass transport of water and nutrients. Philippe Simier presented work by Draie et al. exploring in detail the enzyme systems involved in sucrose metabolism in the tubercles of Orobanche ramosa. Mike Timko then described the latest studies exploring the range of biotypes of Striga gesnerioides, their specificity to particular host species or cowpea varieties, and mapping the relevant resistance and avirulence genes in host and parasite.

A further invited paper from Julie Scholes discussed the molecular basis of susceptibility and resistance to Striga, describing detailed exploration of the up- and down-regulation of genes in both host and parasite and seeking to relate these to the various types of resistance mechanism observed. Many hundreds of genes appear to be involved.

There were then 3 papers presented by Ms Gunathilake on Triphysaria, Jim Westwood (for Roney et al.) on Cuscuta, and Radi Ali on Orobanche, describing the intriguing phenomenon of ‘trafficking’ of double-stranded RNA molecules between host and parasite. Ali et al. showed how the phenomenon could perhaps be exploited for ‘silencing’ key metabolic genes in the parasite – mannose 6-phosphate reductase could be
inhibited and significant reduction of _O. aegyptiaca_ achieved on suitably transformed tomato.

Moving on to a more ecological level, Duncan Cameron described how species richness could be enhanced by the introduction of _Rhinanthus minor_ into a plant community, thanks to selective suppression of susceptible grass species, while non-grasses showed resistance based on a hypersensitive response or host lignification. Darryl Miguel described the problem of _O. ramosa_ in S. Australia, which has caused some 100,000 ha to be placed under quarantine. Studies suggest very slow loss of viability in the seed bank, and the need for chemical treatments to enhance seed loss and/or prevent new seed production. A commercial pine oil product has given up to 95% reduction but results are variable and large volumes of water required lead to very high costs of application. Studies by Janice Alers-Garcia suggest that _Cuscuta gronovii_ tends to select and grow more successfully on larger individuals of the host plant _Pilea pumila_. Alistair Murdoch reviewed work on the influence of temperature on the after-ripening, conditioning and germination of _Orobanche_ and _Striga_ spp. and discussed the potential design and use of predictive models based on these data.

Alex Pérez de Luque reviewed the topic of resistance mechanisms and incidentally made a plea for the term ‘haustorium’ to be reserved for the organ once it had made vascular connection with the host: prior to that it should be referred to as the ‘appressorium’. Yasutomo Takeuchi then presented a paper by Kusumoto et al. on the induction of resistance in _Trifolium_ and rice via salicylic acid-mediated defences. Application of BTH to clover reduced attack by _O. minor_ and application of tiadinil to rice reduced attack by _Aegilops indica_. Julien de Zélicourt described work exploring the resistance of sunflower var. LR1 to race E of _O. cumana_, which suggested a major role for the peptide defensin.

A final session on Management and Control began with an invited paper from Fred Kanampiu who gave a detailed description of the development and use of the herbicide imazapyr as a seed-dressing for control of _Striga_ spp. on naturally herbicide-resistant maize. The treatment has been commercialised since 2005 and is proving successful in East Africa. It can be used in conjunction with inter-planted legumes, provided they are at least 12 cm from the maize row. Hanan Eizenberg then described a minirhizotron technique for monitoring underground development of _Orobanche_ tubercles as a means of validating a Growing Degree Days model, designed to ensure optimum timing of herbicide application. Hilary Sandler described the problem from _Cuscuta gronovii_ in cranberry and described valuable results on the germination behaviour of seeds over the years following shedding, allowing more effective timing of flooding and chemical control methods. A further paper on the _O. ramosa_ problem in Australia was presented by Anna Williams who described the development of a Growing Degree Days model on which to base the optimum timing of herbicide treatments. Djibril Yonli reported on studies with a range of _Fusarium_ isolates for suppression of _S. hermonthica_ in Burkina Faso. Promising results were obtained even when inoculum was placed up to 10 cm away from the sorghum planting hole. Simon Shamoun provided an update on the development of _Colletotrichum gloeosporioides_ and _Neomectria neomacrospora_ for biocontrol of _Arceuthobium tsugense_ in Canada, which is of increased concern with the prohibition on clear-cutting and consequent persistence of old heavily infected trees. Both organisms had proved partially effective, though some wounding of host tissue may be needed for maximum effect. Combinations of the two are to be tested. A final presentation by Charlie Riches described the successful results achieved with green manure crops, especially _Crotalaria ochroleuca_ for control of _S. asiatica_ in rice and maize in Tanzania. Crop yields were often doubled following treatment, compensating for the lost season of food-crop cropping, and farmers were adopting the practice with enthusiasm.

Among the 39 posters there was a study on _Cuscuta_ spp. in Taiwan (Chiang et al.); demonstration of the increased production/exudation of stimulant at reduced phosphate levels, a phenomenon not previously well-documented (Lopez-Raez et al.; Yoneyama et al.); identification of orobanchol as the major _Orobanche_ stimulant exuded by _Arabidopsis thaliana_ (Goldwasser et al.); an effect of trehalose in increasing germination of _Orobanche minor_ (Okazawa et al.); evidence for suberization and protein cross-linking in the cell walls of the sunflower variety HE-39999 resistant to race F of _O. cumana_ (Echevarría-Zomeño et al.); a series of studies on the virulence of different accessions of _Medicago trunculata_ on a range of hosts and the associated variations in resistance mechanism and germination stimulation activity, all of potential value in the study of host-parasite interaction (Fernández-Aparicio et al.; Lozano-Baena et al. (x2); Castillejo et al.); identification of a _Streptomyces_ isolate in Jordan, with potential for control of _Orobanche cernua_ (Saadoon et al.); a study suggesting no correlation of tocopherol levels with carotenoid or chlorophyll content in _Cuscuta_ spp., suggesting an unrelated function (van der Krooj et al.); a study showing generally excellent but not completely reliable control of _Cuscuta_ spp. by glyphosate in Roundup Ready alfalfa (Lanini et al.); evidence for reduced hydraulic conductivity in the stems of spruce trees infected by _Arceuthobium_.

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Epipogium aphyllum (Heller seed treatment, and synergism with resistant cultivars)

Social events included a welcome reception on the first evening, a field trip to the home of President Jefferson at Monticello which was rounded off with a visit to the Jefferson Winery, and a banquet, at which a number of elder statesmen of the community were honoured. Bob Eplee, Doug Worsham and Chris Parker were presented with ‘Legacy Awards’, while Yasutomo Takeuchi, Binne Zwannenburg, Jose Ignacio Cubero (not present), Klaus Wegmann and Patrick Thaluarn (not present) were recognised as ‘Significant Contributors’.

Jim Westwood, Mike Timko and others on the organising committee are to be congratulated on a superbly planned meeting and an excellent choice of venue - the hotel and its setting were ideal.

Chris Parker.

A DIFFERENT KIND OF PARASITIC PLANT: A BRIEF HISTORY OF MYCO-HETEROTROPHY AND EPIPARASITISM

Debunking the myth of saprotrophic plants

Some 400 species of plants, termed myco-heterotrophs (Leake 1994), lack chlorophyll but do not form haustorial connections to other plants and are nourished instead by forming (parasitic) associations with fungi (Smith & Read 1997). Most of these plants have commonly been referred to as “saprophytes” on the assumption that they obtain carbon directly from decaying soil organic matter. Indeed the myth of the “saprophytic” plant has been perpetuated by florists through to the current day; even the New Atlas of the British Flora (Preston et al., 2002) describes the myco-heterotrophic Neottia nidus-avis, Corallorhiza trifida, Epipogium aphyllum and Monotropa hypopitys as “saprophytic perennial herbs of rotting vegetation” despite the absence of evidence for this (Leake 2005).

Myco-heterotrophy has evolved in both lower plants such as the myco-heterotrophic liverwort Cryptothallus mirabilis and on at least five separate occasions in higher plants in the dicotyledonous families; Monotropaceae (and the closely related Pyrolaceae), Polygalaceae and Gentianaceae which combined represent 12% of myco-heterotrophic species (Leake 1994). The remainder belong to two orders of the monocotyledons; Triuridales and the Orchidales (Leake 1994). Job Kuijt highlighted this disparity commenting on the abundance of (myco)heterotrophs in the monocotyledonous plants and the extreme contrast with haustorial parasitism which occurs exclusively in dicotyledonous plants (Kuijt 1969).

Myco-heterotrophy in the orchids

Perhaps the most studied of all plant families with myco-heterotrophic species are the orchids. There are estimated to be around 200 species of achlorophyllous or largely achlorophyllous orchids but all orchids in fact begin their lives with a myco-heterotrophic growth phase. Like many haustorial parasitic plants, orchids produce prodigious numbers of minute dust seeds, typically in excess of 100,000 seeds per plant that do not have sufficient seed reserves to germinate unaided, instead orchids engage in a symbiosis with fungal partners where by the fungus supplies the developing orchid seedling with all of the carbon and mineral nutrients it requires for establishment (Smith & Read 1997). Whilst some orchids never produce chlorophyll, the majority of adult orchids are green and putatively photosynthetic. As green adults, orchids were believed to continue in this parasitic habit throughout their lives but recent evidence has cast doubt on this dogma demonstrating that the green orchid Goodyera repens can, as an adult, supply its fungal symbiont, Ceratobasidium cornigerum, with carbon (Cameron et al. 2006) in return for mineral nutrients (Cameron et al. 2006 & 2007) suggesting the potential for mutualism in the symbiosis. Thus, as with the haustorial parasites, it appears there is a continuum from autotrophy to heterotrophy (holoparasitism) in the orchids.

Epiparasitic myco-heterotrophs

The source of carbon for fungi parasitised by myco-heterotrophic plants falls into two distinct categories. Firstly, myco-heterotrophs may form associations with fungi which gain their carbon saprotrophically from organic matter. It is important to make the distinction that we do not imply that myco-heterotrophs are directly saprophytic, they parasite fungi, but their fungal partners may gain carbon saprotrophically, and/or be weakly parasitic on other plants. Typically but not
exclusively, these fungi belong to the polyphyletic Rhizoctonia complex. Secondly, some myco-
hetrotrophic plants are associated with fungi that obtain their carbon through forming mutualistic mycorrhizal symbioses with other autotrophic plants and are thus in tripartite symbiosis with the myco-heterotroph connected to an autotrophic plant through a shared fungal network (Bidartondo et al. 2004). These plants are referred to as the epiparasites (Bidartondo et al. 2002), the “epi” prefix referring to the indirect nature of the parasitism of the co-associated plant (and being distinct from epiphytic plants which rely on structures such as other plants for mechanical support). Moreover, using radioactive $^{14}$C tracers, carbon transfer has been directly demonstrated from green plant (Betula pendula) though an ectomycorrhizal fungal network to the largely achlorophyllous orchid Corallorhiza trifida (McKendrick et al. 2000). This epiparasitic mode of nutrition has underpinned the convergent morphology of myco-heterotrophic and haustorial parasitic plants.

**Parallels and contrasts between epiparasitic plants and haustorial holoparasites**

Heterotrophic plants, such as the enigmatic “Ghost orchid” Epipogium aphyllum, have long been considered botanical curiosities and in the past they have even been inaccurately included in parasitic genera. Indeed, before being described by Linnaeus in 1753, Monotropa hypopitys (Monotropaceae) was considered to be an Orobanche (Leake 1994)! At one level such confusion is not surprising given the striking convergent morphology of myco-heterotrophs and haustorial holoparasites. Both exhibit highly reduced leaves, often to scale leaves or bracts, contain little or no chlorophyll and produce prodigious numbers of seeds that depend upon host-derived cues to initiate germination as they cannot establish in the absence of a host plant (for haustorial holoparasites) or fungus (for myco-heterotrophs).

In summary, there is no doubt that the epiparasitic myco-heterotrophs and haustorial holoparasites are physiologically very different in terms of their carbon acquisition strategies from other plants. In the case of the epiparasites the connection to the host plant is a fungal “bridge” whereas in the haustorial holoparasites the physiological bridge is the haustorium, but beneath this they are functionally the same, they are parasitic on other plants!

**References:**


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(Editors’ note: in the light of the discussion above, Haustorium will in future include reference to literature on at least some ‘saprophytic’ higher plants.)

**OFFICIAL LAUNCH OF PUSH-PULL TECHNOLOGY**

The ‘push-pull’ technology that has been under development by ICIPE (International Centre for Insect Physiology and Ecology) for the past 10 years was given an official launch at ICIPE’s Mbita Point station on the shores of Lake Victoria, Kenya, in early July 2007 (see Butonyi, 2007 a,b). The technique, as described in Haustorium 37, was developed for control of stem-borers (Busseola and Chilo species) in maize, Desmodium spp. being grown as an intercrop to repel the adult moths and Napier grass (Pennisetum purpureum) grown around the field edges to attract the moths to lay their eggs which hatch, but fail to develop on this species. After some years it was noticed that Striga hermonthica was being suppressed by the Desmodium and extensive trials confirmed that the parasite was massively reduced while soil fertility was enhanced and maize yields greatly increased. The technique has been used successfully by over 10,000 farmers in Kenya and Uganda and has now been shown to work well also with sorghum. The aim now is to extend the technique to reach 20,000 farms by the end of 2009. Apart from benefiting from improved cereal yields, farmers find they have sufficient fodder from the Desmodium and Napier grass to be able to keep a cow and improve their nutrition and farm income. Dr Zeyaur Khan and his colleagues at ICIPE are to be
congratulated on this highly successful and promising development. See the following item for news of further efforts to understand how it works.

Chris Parker.

A PROJECT TO ELUCIDATE THE DESMODIUM EFFECT ON STRIGA

In studies by ICIPE and Rothamsted Research, it has been demonstrated that the suppressive effect of Desmodium spp. on Striga can be provided by passing water over the roots of Desmodium and then into soil containing the Striga and maize seeds. Furthermore, when Desmodium was grown in water with nutrients but without soil, the water captured the activity, which could then be transferred to the Striga and maize seeds in soil, and again conferred control of the parasite. Fractionation of the chemicals from the water affecting this control identified a fraction that reduced radicle growth of the parasite. Chemicals from this fraction have been identified. However, the exact way in which these chemicals work to prevent Striga infestation has not been determined. Thus, the aim of a new BBSRC (Biotechnology and Biological Science Research Council)-funded project between the University of Sheffield (Professor Julie Scholes and Professor Malcolm Press) and Rothamsted Research (Professor John Pickett and Dr Tony Hooper) is to identify the stage(s) of the Striga lifecycle affected by the inhibitory compounds present in Desmodium root exudates, to purify some of these compounds and to use them to test the hypothesis that they are responsible for the suppression of Striga seen in the field. Finally, the root exudates of another legume that is commonly used in molecular studies, Lotus japonicus, that we know also produces root exudates that inhibit Striga radicle growth, will be examined to determine whether they contain compounds that suppress Striga infection. Although L. japonicus would not be agronomically suitable for practical control of Striga, the wealth of genomic information and tools available for this model legume would enable the biosynthetic pathways involved in the synthesis of the novel flavones to be elucidated in the future.

Julie Scholes. University of Sheffield.

CUSCUTA JAPONICA IN CALIFORNIA

Tim Tidwell of California Department of Food and Agriculture has drawn our attention to the unwelcome appearance of the Asian species Cuscuta japonica in California. A total 159 infestations have now been documented, apparently resulting from the deliberate introduction of seed from Asia in the form of e.g. compressed dodder cakes, for use as traditional Chinese medicine. They occur mainly in urban areas settled by residents with Asian background. Such importations should not include any viable seed, but many samples are being tested and found to germinate. C. japonica is a robust species occurring on fruit trees, including apple and citrus, and on woody ornamentals and is capable of completely smothering its host. In northern California, where most infestations have occurred, flowering may occur but no seed set has yet been observed. This is partly attributable to the lateness of flowering, followed by cool conditions, but also to the self-incompatibility of the species - even large infestations may be clonal, having developed by vegetative spread from a single seed. Aerial survey is being considered as a means of monitoring high risk areas. Fears are that it will occur further south where winter conditions are less severe, allowing seed-set and spread. C. japonica has also been found in Texas and South Carolina. This note is based on the report by Hrusa and Kelch, 2006, listed below, and on personal communication with Tim Tidwell, Carla Markmen and R. Marushia.

Chris Parker.

REQUESTS

Host records for Orobanche species

Dr Yaakov Goldwasser is looking for published and non-published data on the WEED host range of Orobanche spp. (data regarding Striga spp. will be interesting as well). In case of any publication, the source of the material will be acknowledged. Please email to: gold@agri.huji.ac.il

Seed samples of Orobanche and other parasitic species

Bristol University is currently developing a parasitic plant bed at the University of Bristol Botanic Garden. Seed has been collected from a variety of species this year, but we would very much appreciate seed from other sources to cultivate a wide variety of plants. We currently have seed from Orobanche minor, O. elatior, O. ramosa, O. crenata, O. amethystea, O. gracilis and O. foetida as well as seed from Cistanche phelypaea. We are particularly interested in obtaining seed from rare or endangered species in Europe or elsewhere, and those that would not be difficult to cultivate in a temperate climate. If you have any seed that you would be willing to donate, we would very much like to hear from you (we are willing to exchange).

Please contact: Chris Thorogood - email chris.thorogood@bristol.ac.uk
OBITUARY

Professor Ostin Chivinge

Haustorium readers will wish to join me in remembering the life of Professor Ostin Chivinge of Harare, Zimbabwe who died in a road traffic accident in February. Ostin was one of the first African scientists to make a career in weed science. He worked tirelessly to alert the international research community to the issues and to encourage funding and research student projects to focus on the weed problems, including Striga, of smallholder farmers in both Zimbabwe and southern Africa. Ostin learnt his trade as a member of the Weed Research Team at Henderson Research Station before joining the University of Zimbabwe. In a distinguished academic career he went on to become head of the Crop Science Department, Dean of Agriculture and subsequently Pro-vice Chancellor of the University. Ostin was equally at home with academics, researchers, local decision makers as well as extension officers and farmers in the communal areas. He will be remembered in many ways, not least for his enthusiasm for good science which truly benefited farmers and in striving to make Zimbabwe a better place for everyone. I had the honour of working with Ostin on a number of weed management projects and was privileged to share his friendship. The leadership he gave to weed science in southern Africa and his commitment to assisting farmers to combat Striga will be greatly missed.

Charlie Riches, Natural Resources Institute, UK.

FOR SALE

Johansson D. Ecology of vascular epiphytes in West African rain forest. Uppsala, 1974. 129 pp Euro 34. Payment accepted in US$ and GB£. Visa and Eurocard/Mastercard accepted. Postage by standard mail, and handling are extra. For E.C. customers, price does not include 6% VAT.
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MEETINGS

IPPS 9th World Congress on Parasitic Plants, Charlottesville, VA, USA, 3-7 June 2007. Papers and posters presented at this meeting were as follows. There is no publication from this meeting. Abstracts are available at the conference website (http://www.cpe.vt.edu/wcopp/index.html).

PRESENTED PAPERS:

Alers-Garcia, J. and Bever, J.D. - Size dependent parasitism of Cuscuta gronovii: its implications on host population size structure and dynamics.
Aly, R. et al. - A new approach to parasitic weed control based on silencing of a key metabolic gene in the parasite.
Bolin, J.F. et al. - Stable isotope and nutrient relationships of the root holoparasite Hydnora (Hydnoraceae) in southern Africa.
Cameron, D.D. et al. - Rhinanthus minor as an ecosystem engineer: understanding the mechanistic basis of parasitic plant-induced changes in community structure.
de Mol, M. and Heller, A. - Sap slow from host to mistletoe: an anatomical approach
de Zélicourt, A. et al. - Molecular analysis of resistance mechanisms to Orobanche cumana in sunflower.
Draie, R. et al. - The sucrose-degrading enzymes in Orobanche ramosa. Characterization and involvement in growth, cell wall synthesis and starch accumulation.
Eizenberg, H. et al. - Temporal thermal and special model for Orobanche management.
Funk, H. et al. - Complete DNA sequences of the plastid genomes of two parasitic flowering plant species, Cuscuta reflexa and Cuscuta gronovii.
Gunathilake, P. et al. - Macromolecular trafficking from host plants into the hemiparasitic plant Triphysaria versicolor.
Harrison, M.J. - The arbuscular mycorrhizal symbiosis; genomics approaches to dissect development and function.
Kaldenhoff, R.W.E. - Molecular events during Cuscuta infection.
Kanamipiu, F. - Striga weed management options under smallholder agriculture in Africa.
Miegel, D. et al. - Seedbank and seedbank management of Orobanche ramosa in South Australia.
Nickrent, D.L. and Vidal-Russell, R. - The evolutionary origins of aerial parasitism in Santalales.
Palmer, A.G. et al. - Calcium mediated transduction of haustorial inducing signals in Striga asiatica.
Palmer, J. - Horizontal gene transfer gone wild in parasitic and other flowering plants.
Pérez-de-Luque, A. - Mechanisms of resistance to parasitic plants: from field screenings to laboratory microscopic studies.
Plakhine, D. et al. - Non-stimulated spontaneous germination of Orobanche is genetically controlled.
Riches, C.R. and Mbwaga, A.M. - Green manure: a Striga management technology whose time has come?
Roney, J.K. et al. - Trafficking of host mRNAs into dodder: A new frontier in host-parasite cCommunication.
Sandler, H.A. - Integrating germination patterns, chemical, and nonchemical options to manage swamp dodder in Massachusetts cranberry production.
Shamoun, S.F. et al. - Development of a biological control strategy for management of hemlock dwarf mistletoe in coastal British Columbia, Canada.
Stefanovic, S. and Costea, M. - Reticulate evolution in the parasitic genus Cuscuta (dodders; Convolvulaceae).
Sugimoto, Y. et al. - In vitro production of strigolactones by plant root cultures.
Thorogood, C.J. et al. - Speciation and host specificity in Orobanche.
Timko, M.P. et al. - Deciphering the interaction of Striga with hosts and non-hosts.
Tomilov, A. et al. - Early haustorium development in Triphysaria: A view from inside the nucleus.
Wegmann, K. - 2000 Years of observation, knowledge and research on Orobanche.
Williams, A.M. and Virtue, J.G. - Calculation of growing degree days to determine optimum timing of herbicide application for control of branched broomrape Orobanche ramosa in pastures.
Xie, X et al. - Qualitative and quantitative differences of strigolactone exudation determine host specificity of root parasites Orobanche and Striga
Yonli, D. et al. - Integrated Striga hermonthica management based Fusarium.

POSTER PRESENTATIONS:
Ahom, R.I. and Okereke, O.U. - Varietal differences in ability of sesame and pigeon pea as trap crops to induce suicidal seed germination in Striga hermonthica (Scrophulariaceae).
Alers-Garcia, J. et al. - Parasite mediated maternal effects in bitter and sweet lupins.
Aouali, S. et al. - Genetic diversity among Orobanche crenata ecotypes revealed by RAPD and AFLPs markers, in Algeria.
Castillejo, M.A. et al. - Differential expression proteomics to investigate responses and resistance to Orobanche crenata in legumes.
Chachalis, D. and Murdoch, A.J. - Potential use of Nijmegen-1 and smoke water solutions to deplete Orobanche ramosa seed banks in Greece
Chiang, M.Y. et al. - Cuscuta species in Taiwan: molecular differentiation and related findings.
Dhanapal, G.N. et al. - Integrated management of broomrape in India.
Dubé, M-P. and Belzile, F.J. - Genetic variability among five races of Striga gesnerioides (Willd.) Vatke detected by ISSR, AFLP and cpSSR analysis.
Dunlavey, R. et al. - The influence of Arceuthobium pusillum infection on the hydraulic architecture of white spruce stems.
Dzomeku, I.K. and Murdoch, A.J. - Studies on seed dormancy, germination and seedling emergence of Striga hermonthica
Echevarria-Zomeño, S. et al. - Histochemical analysis of defense responses involved in resistance of sunflower (Helianthus annuus) to Orobanche cumana.
Elzein A. et al. - Synergy between Striga-mycocoherbicides 'Fusarium oxysporum f.sp. strigae' and resistant cultivars under field conditions: step towards integrated Striga control in Africa.
Fan, Z.W. et al. - Induced host resistance as a control method for parasitic weeds.
Fernández-Aparicio, M. et al. - Yield losses in pea as a function of Orobanche crenata levels of infection.
Gharib, C. et al. - Germination and viability of Cuscuta spp. (dodder) seeds after digestion in sheep rumen.
Goldwasser, Y. et al. - Identification of the stimulants produced by Arabidopsis italiana responsible for the induction of Orobanche seed germination.
Haddad, A. and Pala, M. - Significance of parasitic weeds for food legumes in Syria.
Heller, A. et al. - Colonization of F. oxysporum f.sp. strigae (Foxy 2) on roots of sorghum plants and its implication for Striga control using a seed treatment delivery system: an anatomical study.

Höniges, A. et al. - Ecological and physiological investigations on Orobanche species in the spontaneous flora of Romania.

Lanini, W.T. et al. - Dodder (Cuscuta pentagona) control in Roundup-ready alfalfa.

Liu, Y. et al. - Gene regulation during haustorial development and shoot initiation in Striga asiatica.

Lopez-Raez, J.A. et al. - The biosynthesis of the tomato germination stimulants is promoted by phosphate starvation.

Lozano-Baena, M.D. et al. - Analysis of Medicago truncatula resistance against Orobanche crenata using cytochemical techniques.


Matusova, R. and Bouwmeester, H.J. - The strigolactone germination stimulants of the plant-parasitic Striga and Orobanche spp are derived from the carotenoid pathway.

Okazawa, A. et al. - Trehalose promotes seed germination of a holoparasitic plant, Orobanche cumana Sm.

Pacureanu-Joita, M. et al. – AO-548, a sunflower inbred line, carrying two genes for resistance against a new highly virulent Romanian population of Orobanche cumana.

Palmer, A.G. et al. - ROS production and semagenesis in pathogenesis.

Saadoun, I. et al. - Biological control of Orobanche cernua seed germination utilizing an indigenous actinomycete isolate in Jordan.

Takagi, K. et al. - Photoresponse analysis of phytochrome A in the non-photosynthetic parasitic plant; Orobanche minor Sm.


Ueda H. et al. - Molecular analysis of Lotus japonicus response against Orobanche aegyptiaca and Striga hermonthica parasitism.

van der Kooij, T.A.W. et al. - Characterization of the tocochromanol content and composition of different species of the parasitic flowering plant genus Cuscuta.

Yoneyama, K. et al. - Nitrogen and phosphorus deficiencies promote the production and exudation of 5-deoxystrigol in sorghum.

Yoshida, S. and Shirasu, K. - Agrobacterium-mediated transformation of Striga hermonthica.

FORTHCOMING MEETINGS

The International Conference ‘Novel and Sustainable Weed Management in Arid and Semi-Arid Agro-Ecosystems’, Rehovot, Israel. Please note that the deadline for abstract submission was September 1st, 2007. Later submission will be possible for poster presentations only. A Session on Parasitic Weeds is being organized jointly with the EWRS Working Group on Parasitic Weeds. See the conference website: http://agri3.huji.ac.il/aridconference or contact: Dr Baruch Rubin, Faculty of Agricultural, Food and Environmental Science, Hebrew University of Jerusalem, Rehovot 76100, Israel. E-mail: rubin@agri.huji.ac.il

The 5th International Weed Science Congress, June 23 to 27, 2008, in Vancouver, Canada. Session 13 - Management of parasitic weeds, will include one invited talk and 8 other presentations to be selected from the abstracts submitted. The topics will be: Biology and evolution (to include genomics etc.) Germination sequence (to include chemistry etc.) Host-parasite interrelations in agro-ecosystems (to include modelling etc.) Host resistance Management and control efforts Conference information is available at: http://iws.ucdavis.edu/5intlweedcong.htm or contact: Koichi Yoneyama, yoneyama@cc.utsunomiya-u.ac.jp or Joachim Sauerborn, sauerbn@uni-hohenheim.de

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For abstracts from the 9th World Congress on Parasitic Plants see: http://www.cpe.vt.edu/wcopp/index.html

For information on the International Parasitic Plant Society, past and current issues of Haustorium, etc. see: http://www.ppws.vt.edu/IPPS

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml
For the ODU parasite site see:
http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Lytton Musselman’s *Hydnora* site see:
http://www.odu.edu/webroot/instr/sci/plant.nsf/pages/lecturesandarticles

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see:
http://www.science.siu.edu/parasitic-plants/index.html

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes) see:
http://www.rmrs.nau.edu/mistletoe/

For information on, and to subscribe to PpDigest see:
http://omnisterra.com/mailman/listinfo/pp_omnisterra.com

For information on the EU COST 849 Project and reports of its meetings see:
http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/

For the Parasitic Plants Database including ‘4000 entries giving an exhaustive nomenclatural synopsis of all parasitic plants’ (last updated 2003), the address is:
http://www.omnisterra.com/bot/pp_home.cgi

For a description and other information about the Desmodium technique for *Striga* suppression, see:
http://www.push-pull.net

For information on EC-funded project ‘Improved *Striga* control in maize and sorghum (ISCIMAS) see:
http://www.plant.dlo.nl/projects/striga/

For the work of Forest Products Commission (FPC) on sandalwood, see: www.fpc.wa.gov.au

For past and future issues of the Sandalwood Research Newsletter, see: www.jcu.edu.au/school/tropbiol/srn/

For information on the work of the African Agricultural Technology Foundation (AATF) on *Striga* control in Kenya, see: http://africanrncrop.net/striga/

To view the list of presentations and participants at the *Striga* meeting in Addis Abeba, November 2006, see:
http://www.agry.purdue.edu/strigaconference/index.html

For information on the 5th International Weed Science Congress, June, 2008, in Vancouver, Canada see:
http://iws.ucdavis.edu/5intlweedcong.htm

LITERATURE

* indicates web-site reference only

Abadie, J-C., Püttsepp, Ü., Gebauer, G., Faccio, A., Bonfante, P. and Selosse, M-A. 2006. *Cephalanthera longifolia* (Neottieae, Orchidaceae) is mixatrophic: a comparative study between green and nonphotosynthetic individuals. Canadian Journal of Botany 84: 1462-1477. (No mention of parasitism, but a study in Estonia shows that albino *C. longifolia* gained 100% of their carbon from ectomycorrhizal fungi in Thelophoraceae, versus 33% for green individuals, and that surrounding trees (*Juniperus* and *Pinus* spp.) ‘…were likely the ultimate carbon source.’)

Abdel-Kader, M.M. and El-Mougy, N.S. 2007. Applicable control measure against *Orobanche ramosa* in tomato plants. Australasian Plant Pathology 36: 160-164. (Reporting successful suppression of *O. ramosa* in tomato by application of *Trichoderma harzianum* and *T. viride* to the planting medium, with or without a following application of glyphosate.)

Abdulai, M.S., Denwar, N.N. and Haruna, M. 2006. Combating the menace of *Striga hermonthica* infestation: an integrated approach adopted in North-Eastern Ghana. Journal of Agronomy 5: 617-620. (Three *Striga*-resistant maize varieties ACR 94 TZE Comp 5-W, ACR 97 TZL Comp 1-W and IWD STR C1 recorded lower *Striga* infestation and produced up to 70% more grain than the farmers' maize. Rotation of these varieties with soyabean ‘may be one of the best and practical methods of *S. hermonthica* control.’)


Albert, M., Belastegui-Macadum, X. and Kaldenhoff, R. 2006. An attack of the plant parasite *Cuscuta reflexa* induces the expression of *attAGP*, an attachment protein of the host tomato. Plant Journal 48: 548-556. (Concluding that *C. reflexa* infection induces a signal in the host leading to expression of tomato *attAGP*, which promotes the parasite's adherence.)

Reporting effects of pruning on *C. loniceroides* on *S. bonplandiana* trees in an urban area. Significance of ‘grafiklike’ in title not clear.

Ameloot, E., Verheyen, K., Bakker, J., de Vries, Y. and Hermy, M. 2006. Long-term dynamics of the hemiparasite *Rhinanthus angustifolius* and its relationship with vegetation structure. Journal of Vegetation Science 17: 637-646. (Concluding that the main fluctuations in *R. angustifolius* population are due to spring droughts. Abundance is correlated positively with forbs and negatively with grasses.)


Amusa, N.A. 2006. Microbially produced phytotoxins in the mistletoe *Phylogenetic relationships and ecological speciation in the mistletoe* *Tristerix* (Loranthaceae): the influence of pollinators, dispersers, and hosts. American Journal of Botany 94: 558-567. (DNA analysis supported the transfer of two *Tristeris* spp. (T. verticillatus and T. penduliflorus) from the *Metastachys* subgenus of the *Tristeris* subgenus.)

Badu-Apraku, B., Menkir, A., Fakorede, M.A.B., Lum, A.F. and Obeng-Antwi, K. 2006. Multivariate analyses of the genetic diversity of forty-seven *Striga* resistant tropical early maturing maize inbred lines. Madycla 51: 551-559. (Principal component analysis of 47 maize inbred lines suggested 4 clusters. Eight lines combined high grain yield with reduced *Striga* attack.)


Bhatt, D.C., Patel, P.K. and Dodia, S.K. 2006. Various hosts of two species of *Cuscuta* L. Journal of Economic and Taxonomic Botany 30(1): 170-171. (Listing 104 hosts of *Cuscuta 'chinensis'* (possibly *C. campestris?*) and *C. reflexa* in Gujarat, India, none being common to both species.)

Botanga, C.J. and Timko, M.P. 2006. Phenetic relationships among different races of Striga gesnerioides (Willd.) Vatke from West Africa. Genome 49: 1351-1365. (AFLP analysis suggested that genetic variability within and among populations of each of the 5 previously recognized races of cowpea-parasitic S. gesnerioides was extremely low, and also revealed 2 new races, from Senegal and Benin. Molecular markers were identified for each race. A race specific to Indigofera hirsuta was genetically distinct.)


Braby, M.F. and Trueman, J.W.H. 2006. Evolution of larval host plant associations and adaptive radiation in pierid butterflies. Journal of Evolutionary Biology 19: 1677-1690. (The ancestral host of the family Pieridae appears to be Fabales, with multiple independent shifts to other orders, including three to Santalales. There were later shifts from Brassicaceae to mistletoes (Loranthaceae?) and from mistletoes to mistletoe hosts.)

Butonyi, C. 2007. ICIPE unveils new method to fight weed. Daily Nation (Kenya) Tuesday 10 July, 2007. (Reporting the launch of the ‘push-pull’ technology for control of stem borers and Striga hermonthica, after 10 years of development. See news item above.)


Cameron, D.D. and Seel, W.E. 2007. Functional anatomy of haustoria formed by Rhinanthus minor: linking evidence from histology and isotope tracing. New Phytologist 174: 412-419. (Showing that the lack of occurrence of R. minor on forbs such as Plantago lanceolatum and Leucanthemum vulgare is associated with resistance mechanisms which prevent connection with the host xylem.)

Chaudhary, M.A. and Muhammad Aslam. 2005. Biological and climatic factors responsible for dieback of juniper in Ziarat, Balochistan. MycoPath 3(1/2): 17-22. (Arceuthobium oxycedri affected 33% of Juniperus excelsa in the Sasnak locality, but insect and fungal problems were more widespread and responsible for most of the dieback in Ziarat.)

Chen XueLin, Jing GuoHai and Guo Hui. 2007. Ornamentation characteristics of seed coats in nineteen plants of Pedicularis from alpine meadow in east Qinghai-Xizang plateau and its ecological significance. Acta Pratagriculae Sinica 16(2): 60-68. (Describing 4 types of ornamentation in 19 species of Pedicularis and discussing their possible evolution.)


De Vega, C. and de Oliveira, R.C. 2007. A new procedure for making observations of embryo morphology in dust-like seeds with rigid coats. Seed Science Research 17(1): 63-67. (A successful procedure for seeds of Cyrtisus hypocistis and C. ruber involved successive treatments with Franklin's and Jeffrey's softening fluids and then with Herr's clearing fluid.)


Dimic, D. and Kauzlarić, Ž. 2006. (The occurrence of common mistletoe (Viscum album ssp. abietis/Wiesb./Abromeit) on silver fir (Abies alba Mill.) in Gorski Kotar (Croatia).) in Croatian) Glasnik za Šumske Pokuse, 2006, No. Posebno izdanje 5: 365-376. (A. alba heavily infected by V. album in 3 localities. Vigour of V. album was greater in trees on silicate soils than on dolomitic limestone.)

Dimitrova, T. 2004. Check of Amaranthus blitoides W. var. reverchonii Th. - an element of the control of Cuscuta epithymum Murr in lucerne (Medicago sativa L.). Bulgarian Journal of Agricultural Science 10: 579-582. (Amaranthus blitoides acts as a host of C. epithymum and enhances the Cuscuta problem in lucerne. Satisfactory control achieved by combination of S-metolachlor before lucerne emergence and imazethapyr 3 days after cutting infected growth.)

Dor, E., Evidente, A., Amalfitano, C., Agrelli, D. and Herschenhorn, J. 2007. The influence of growth conditions on biomass, toxins and pathogenicity of Fusarium oxysporum f. sp. orthoceros, a potential agent for broomrape control. Weed Research 47: 345-352. (Shaking led to highest rate of biomass accumulation of F. oxysporum; but the greatest pathogenicity against several Orobanche spp., perhaps associated with the toxic metabolites fusaric acid and 9,10-dehydrofusaric acid, was obtained under illumination, without shaking.)

Douthwaite, B., Schulz, S., Olanrewaju, A.S. and Ellis-Jones, J. 2007. Impact pathway evaluation of an integrated Striga hermonthica control project in northern Nigeria. Agricultural Systems 92: 201-222. (Discussing the extension techniques including impact pathway evaluation, believed to have been helpful in the dissemination of Striga control techniques, involving improved crop varieties and the growing of soyabeans.)

Dzomkeu, I.K. and Murdoch, A.J. 2007. Effects of prolonged conditioning on dormancy and germination of Striga hermonthica. Journal of Agronomy 6: 29-36. (Studies with different temperatures, urea concentrations and water stress showed that optimum temperature for conditioning was lower at high concentrations of urea, while optimum conditioning period decreased with both water stress and with high urea concentration.)

Echevarria-Zomeño, S., Pérez-de-Luque, A., Jorrín, J. and Maldonado, A.M. 2006. Pre-haustorial resistance to broomrape (Orobanche cumana) in sunflower (Helianthus annuus): cytochemical studies. Journal of Experimental Botany 57: 4189-4200. (In studies with race F of O. cumana and the resistant sunflower var. HE-39999 root tubercles were never observed, resistance being associated with accumulation of phenolic compounds, browning of both parasite and host tissues, and suberization and protein cross-linking in the sunflower cell wall.)

Eizenberg, H., Lande, T., Achdari, G., Roichman, A. and Herschenhorn, J. 2007. Effect of Egyptian broomrape (Orobanche aegyptiaca) seed-burial depth on parasitism dynamics and chemical control in tomato. Weed Science 55: 152-156. (Increasing depth of placement delayed and reduced emergence and biomass of O. aegyptiaca, but some emerged from 30 cm. Herbicide sulfosulfuron prevented emergence of O. aegyptiaca from all depths but its efficacy in preventing attachment and development below ground was best when seeds were at 6 cm and negligible when at 30 cm.)


Escher, P. and Rennenberg, H. 2006. Influx of double labelled glutamine into mistletoes (Viscum album) from the xylem sap of its host (Abies alba). Plant Physiology and Biochemistry 44: 880-884. (Results suggest the glutamine is metabolised in the V. album, the C component being distributed to metabolic sinks, while N is over-supplied, and remains mainly in the stem.)

Fan, Z.W., Buschmann, H. and Sauerborn, J. 2007. Prohexadione-calcium induces sunflower (Helianthus annuus) resistance against the root parasitic weed Orobanche cumana. Weed Research (Oxford) 47: 34-43. (Results suggest that PHDC reduces O. cumana infection by inducing host resistance. Lignification is not induced but free phenolics play an important role in the response, which is stronger in the more resistant var. HA89 than in var. Albena.)
Fan, Z.W., Buschmann, H., Müller-Stöver, D. and Sauerborn, J. 2007. Main effects and interactions among acibenzolar-S-methyl, a biocontrol fungus and sunflower cultivar on control of Orobanche cumana Walk. Journal of Plant Diseases and Protection 114(2): 76-81. (The ‘plant activator’ acibenzolar-S-methyl (ASM) applied 3 times as a soil drench at 5 mg/l soil, and the biocontrol fungus Fusarium oxysporum f. sp. orthoceras each gave substantial suppression of O. cumana, while the combination gave improved reliability.)

Finall, A.I., McIntosh, S.A. and Thompson, W.D. 2006. Subcutaneous inflammation mimicking metastatic malignancy induced by injection of mistletoe extract. British Medical Journal 333(7582): 1293-1294. (Reporting the case of a woman with subcutaneous inflammation mimicking metastatic malignancy induced by subcutaneous injections of mistletoe (Viscum album) extract self-administered at 20 mg, three times a week for the previous 12 months.)


Gillespie, M., Hodkinson, I.D., Cooper, E.J., Bird, J.M. and Jönsson, I.S. 2007. Life history and host-plant relationships of the rare endemic Arctic aphid Acrithosiphon calvulus in a changing environment. Entomologia Experimentalis et Applicata 123: 229-237. (Describing the life cycle of A. calvulus in Spitzbergen where it is closely synchronized with the phenology of Salix polaris but also occurs on Pedicularis hirsuta.)

Gondola, I. 2006. (Control of broomrape (Orobanche ramosa L.) in herbicide resistant tobacco.) (in Hungarian) Növényvédelem 42: 537-543. (Confirming complete selective control of O. ramosa by chlorosulfuron at 8 g/ha in chlorosulfuron-resistant tobacco derived from protoplast culture.)


GRAIN (Spain) 2006. Swapping striga for patents: yet another quick fix for Africa’s farmers? Seedling October 2006: 5-9. (Discussing the new ‘Clearfield’ or ‘Strigaway’ technology involving herbicide-treated crop seed for Striga control, as developed by CIMMYT and BASF, and raising serious doubts about its suitability to traditional farmers in Kenya, and concluding that it is ‘a misguided attempt to introduce a complex, expensive and risky technological solution into African farming systems.’)

Guchu, S.M., Yenesew, A., Tsanuo, M.K., Gikonyo, N.K., Pickett, J.A., Hooper, A.M. and Hassanali, A. 2007. C-methylated and C-prenylated isoflavonoids from root extract of Desmodium uncinatum. Phytochemistry 68: 646-651. (A number of components of a root extract which induced germination of Striga hermonthica were identified but none individually stimulated germination.)

Gupta, R.S. and Kachhawa, J.B.S. 2007. Evaluation of contraceptive activity of methanol extract of Dendrophthoe falcata stem in male albino rats. Journal of Ethnopharmacology 112(1): 215-218. (‘It is concluded that D. falcata methanol stem extract showed a significant effect on fertility in male rats as reported in folk remedies.’)

Gworgwor, N.A. 2007. Trees to control weeds in pearl millet. Agronomy for Sustainable Development 27(2): 89-94. (Observing that millet growing under the canopy of Faidherbia albida trees was completely free of S. hermonthica and yielded up to 3 times that outside the canopy.)

Harbaugh, D.T. and Baldwin, B.G. 2007. Phylogeny and biogeography of the sandalwoods (Santalum, Santalaceae): repeated dispersals throughout the Pacific. American Journal of Botany 94: 1028-1040. (Analysis of DNA sequences suggest an origin of Santalum in Australia with at least 5 presumed bird-assisted dispersal events outwards to different Pacific islands, including the Hawaii group. Also suggesting that several recognized sections are not monophyletic and need revision.)

Harsha, V.H., Hebbar, S.S., Shripathi, V. and Hegde, G.R. 2006. Additions to the host-range of Cassytha filiformis L. (Cassythaceae) recorded in the Uttara Kannada District of Karnataka State (India). Journal of Economic and Taxonomic Botany 30: 231-234. (Listing 35 hosts of C. filiformis in 24 families, 3 of these being monocot.)


thought to originate from deliberate introduction as an Asian herbal remedy. It may flower but fails to set seed thanks to self-incompatibility and climate. See note in text above.)


Idžojtic, M., Glavaš, M., Zebec, M., Pernar, R., Dasovic, M. and Pavlus, N. 2005. (Infestation of silver fir (*Abies alba* Wiesb./ Abrom.) in Croatia.) (in Serbian) Šumarski List, 129: 559-573. (In the areas surveyed, 28% of *A. alba* were infested by *V. album*. Not all infested trees showed damage, but all the trees in the least healthy category were infested.)

Iuoras, M., Stanciu, D., Ciucă, M., Joita, M.P., Năstase, D. and Costache, S.M. 2006. (Preliminary research related to marker assisted selection in sunflower for *Orobancha cumana* Wallr. resistance.) (in Romanian) Cercetări de Genetică Vegetală si Animală 9: 27-34. (Work to identify a marker associated with the *Or* resistance gene locus failed to find a tightly linked marker, but three SSR markers segregated in different proportions.)

Jäger, S., Winkler, K., Pfüller, U. and Scheffler, A. 2007. Solubility studies of oleic acid and betulinic acid in aqueous solutions and plant extracts of *Vismum album* L. Planta Medica 73(2): 157-162. (Discussing solubilities as relevant to extraction methods for compounds with anti-tumour properties.)

Jiang Fan, Timergalina, L., Kudoyarova, G., Jeschke, W.D. and Hartung, W. 2007. Growth and development of the facultative root hemiparasite *Rhinanthus minor* after removal of its host. Functional Plant Biology 34: 237-245. (After removal of the host (barley) shoot, *R. minor* continued to grow strongly. It grew stronger roots and closed its stomata during the day. It may also have benefited from degradation of host roots.)


Joel, D.M. 2007. Direct infection of potato tubers by the root parasite *Orobancha aegyptiaca*. Weed Research 47: 276-279. (Reporting attachment and penetration of potato tubers by secondary haustoria of *O. aegyptiaca*. The parasite was also attached to the roots of potato but not to stolons or sprouts. This may be the first report of attachment of an *Orobancha* sp. to shoot tissue.)


Khalik, K.N.A. 2006. Seed morphology of *Cuscuta L.* (Convulvulaceae) in Egypt and its systematic significance. Feddes Repertorium 117: 217-224. (SEM and light microscopy used to distinguish 8 taxa of *Cuscuta* in Egypt, and a key prepared.)

Khan, Z.R., Midega, C.A.O., Hassanali, A., Pickett, J.A. and Wadhams, L.J. 2007. Assessment of different legumes for the control of *Striga hermonthica* in maize and sorghum. Crop Science 47: 730-736. (Inter-planting sorghum or maize with cowpea, *greengram* (*Vigna radiate* L.) or *crotalaria* (*Crotalaria ochroleuca*) resulted in some useful reduction of *S. hermonthica* though much less than *Desmodium uncinatum*. which provided nearly complete suppression. Only *Desmodium* in sorghum, and cowpea, crotalaria and *Desmodium* in maize gave significant increases in crop yield.)

maize. *S. hermonthica* was reduced 89-100%, stem-borers by 67-85% and sorghum yields increased by 63-140%.


Lejeune, A., Constant, S., Delavault, P., Simier, P., Thalouarn, P. and Thoiron, S. 2006. Involvement of a putative Lycopersicon esculentum wall-associated kinase in the early steps of tomato - *Orobanche ramosa* interaction. PMPP Physiological and Molecular Plant Pathology 69(1/3): 3-12. (Suggesting that a wall-associated kinase increases early in tomato roots and in cell suspensions challenged with *Orobanche ramosa*.)


Mabrouk, Y., Zourgui, L., Sifi, B., Delavault, P., Simier, P. and Belhadj, O. 2007. Some compatible *Rhizobium leguminosarum* strains in peas decrease infections when parasitised by *Orobanche crenata*. Weed Research (Oxford) 47: 44-53. (Two isolates of *Rhizobium*, P.SOM and P.1236 did not directly affect germination of *O. crenata*, but when pea roots were inoculated, there was reduced germination and increased necrosis of the parasite, apparently associated with enhanced activity of peroxidases and phenylalanine ammonia lyase.)

Malkomes, H.P. 2006. (Influence of neem products on higher plants and its possible usage for sucker and weed control - an overview.)(in German) Gesunde Pflanzen 58: 93-98. (Neem products had been tested for control of *Orobanche* and *Striga* but with inadequate effect.)

Maširevic, S. and Malidža, G. 2006. (Problem and control of broomrape.)(in Serbian) Biljni Lekar (Plant Doctor) 34: 353-360. (Reviewing the importance of *O. cumana* on sunflower in Serbia and referring to use of resistant hybrids and imidazolinone herbicides.)

Mathiasen, R.L. and Daugherty, C.M. 2006. Additional taxonomic studies of *Arceuthobium pendens* (Viscaceae): a rare dwarf mistletoe from Central Mexico. Madroño 53(1): 69-71. (Reporting new data on the morphology, phenology and host reaction of this rare parasite on *Pinus orizabensis* in Mexico.)

Mathiasen, R., Howell, B. and Garnett, G. First report of *Arceuthobium aureum* subsp. aureum in Mexico. Plant Disease 91: 469. (*A. aureum* observed on a few trees of *Pinus maximinoi* causing serious damage to some.)

Mathiasen, R., Sediles, A. and Sesnie, S. 2006. First report of *Arceuthobium hondurensis* and *Sruthanthus deppeanus* in Nicaragua. Plant Disease 90: 1458. (Both species recorded on *Pinus tecunumanii* and *P. oocarpa*.)

Menkir, A. and Kling, J.G. 2007. Response to recurrent selection for resistance to *Striga hermonthica* (Del.) Benth in a tropical maize population. Crop Science 47: 674-684. (A maize composite subjected to 6 cycles of recurrent selection claimed to show a remarkable 24% improvement in yield per cycle under *S. hermonthica* infestation.)

Mikó, P. and Gulyás, A. 2007. (Investigation of the distribution and pathogenicity of sunflower broomrape (Orobanche cernua Loefl./*Orobanche cumana*...
15-37. (Including the situation of Orobanche cumana in sunflower.)

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productivity, and reduced *Striga hermonthica*, from improved strip-cropping systems involving minimum fertilizer and pesticide applied to two rows of a densely planted improved cereal, sorghum or maize, and four rows of a densely planted, improved cowpea variety. Crop residues are fed to small ruminants in enclosures and manure is returned to the fields. Tested on 2000 farms and claimed to be popular.


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(Recording detailed anatomical observations on *Viscum coloratum* and *Loranthus tanakae*.)

Westerman, P.R., van Ast, A., Stomph, T.J. and van der Werf, W. 2007. Long-term management of the parasitic weed *Striga hermonthica*: strategy evaluation with a population model. Crop Protection 26: 219-227. (Use of a model demonstrates that crop varieties producing low levels of stimulant risk perpetuating or increasing the *Striga* seedbank. Alternative strategies are discussed.)


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Yen FengLin, Wu TzuHui, Lin LiangTzung and Lin ChunChing, 2007. Hepatoprotective and antioxidant effects of *Cuscuta chinensis* against acetaminophen-induced hepatotoxicity in rats. Journal of Ethnopharmacology 111(1): 123-128. (The seeds of *C. chinensis*, known as Tu-Si-Zi, are used medicinally to improve kidney and liver conditions. This study suggests that the ethanolic extract of *C. chinensis* can prevent hepatic injuries from APAP-induced hepatotoxicity in rats and this is likely mediated through its antioxidant activities.)


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**HAUSTORIUM 51**

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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

Greetings and best wishes for 2008!

A new year brings new opportunities, challenges, and changes. Indeed, IPPS has already experienced one significant change in leadership this year. Danny Joel stepped down as President of IPPS in January and I am moving into this position from my previous role as Vice President. This is actually part of a planned change in how we manage the organization of the Executive Committee, and I will say more on this in a moment.

But let me begin by expressing my appreciation to Danny for his hard work on behalf of the society. Danny was instrumental in formalizing IPPS as an official society in 2001. He provided a large share of the leadership prior to and during the formative years, and then went on to be elected President of IPPS in 2005. Under his leadership we have had successful meetings in Durban (South Africa), Charlottesville (USA), and are already planning the next meeting in Turkey. Of course we still expect to find Danny actively participating in conferences and publishing his research, but he has earned a rest after providing seven years of outstanding leadership to IPPS.

IPPS is a young society and we are still tuning its engine to make it run smoothly. Among our challenges is how to replace officers of the society while maintaining continuity of leadership. Our initial model was to hold reelections for the entire Executive Committee (President, Vice President, Treasurer, Secretary and Members at Large) every four years, which corresponded to the cycle of major conferences. However, wholesale turnover of leadership is not healthy for a society, so we propose to modify this to begin electing half the positions in the Executive Committee every two years such that overlap is maintained. Under this plan the Vice President will ascend to the Presidency to ensure continuity in that key position. This is consistent with the way leadership roles transition in other academic societies. We will soon be holding elections to fill the offices of Vice President, Secretary, and one Member at Large, but more information on this will be sent in a separate mailing. I encourage you to nominate, vote, and be active in your society.

Another change (that was actually initiated last year) is the schedule for the next major Congress on Parasitic Plants. The majority sentiment expressed at the last congress was that we would be better served by decreasing the span of time between major conferences. To this end we have selected Kusadasi, Turkey as a destination for 2009 (see separate announcement in this issue). The local organizing team, led by Yildiz Nemli and Ahmet Uludag, has already been busy planning and the venue looks to be exceptional. This should be a convenient destination for members from Europe, the Middle East, and Africa, so plan now to attend.

Of course, not everything changes. IPPS remains committed to fostering research and education on all aspects of parasitic plant science. We continue to draw our membership from a wide range of disciplines to address the many wonders and problems posed by parasitic plants. IPPS will continue to work to meet the needs of this diverse group, and to create mechanisms to facilitate the exchange of ideas and technologies. I look forward to the challenges and rewards of working with you and invite all members to feel free to contact me with input on all matters related to IPPS.

Jim Westwood
IPPS President
Dear Colleagues,

It is with great pleasure that I invite you to the 10th World Congress on Parasitic Plants, to be held from 8 to 12 June, 2009 in Kusadasi, Turkey. Preparations are already well underway for a fantastic meeting that will embrace all aspects of parasitic plant research.

You may notice that this conference is occurring sooner than the 3-5 year interval that has traditionally separated major parasitic plant symposia, but there is good reason for this change. The rate of progress in parasitic plant research has been accelerating in recent years, and new approaches and resources have led to breakthroughs in parasite evolution, biology, ecology, host-parasite communication, and host response to parasitism. The future holds even more promise. However, despite these advances in knowledge, parasitic weeds continue to devastate crops in much of the world and farmers have few new tools at their disposal. For these reasons, participants at the 9th World Congress on Parasitic Plants agreed that a two year cycle for major meetings would provide a better timeframe for advancing our work. Thus, in 2009 we will again assemble the world’s foremost experts on parasitic plants with the objective of furthering the state of our science.

Jim Westwood
IPPS President

Dear Colleague,

Last year the Working Group "Parasitic Weeds" was established within the European Weed Research Society, and I am the Contact Point for this working group. All the information on that can be found at the Official EWRS website at http://www.ewrs.org.

NOTES ON THE AFRICAN STRIGA ASIATICA SPECIES COMPLEX

The main objective of this brief note is to shed light on the differences among the species in the Striga asiatica cluster in Africa namely S. asiatica, S. hirsuta, S. lutea. The fourth species in this cluster is morphologically unique and will be discussed at the end of this message.

As a further step to keep the community connected, as promised I have created a moderated mailing list. The aim of that is to facilitate the exchange of information and news related to the parasitic weed research. Subscribers could be able to send messages to the list (or to receive them from it) regarding, for example, requests of general information, requests or announcement of publications or conferences, news about new students, projects, activities, etc. If you are interested in joining the list, please click on the following link: http://muffin.area.ba.cnr.it/mailman/listinfo/parasiticweeds and follow the easy instructions to register. It will take only a couple of minutes. In order to avoid any spam message, the list will be a moderated one, so that only people belonging to it will be able to send and receive messages, which will be further filtered by the moderator.

Please consider that being part of the EWRS WG "Parasitic weeds" and/or subscribing the list does not mean that you have to become a member of the EWR Society. Of course, that will be very welcomed. Moreover, the list is not restricted to European scientists.

Should you have any further questions, please do not hesitate to contact me.

Maurizio Vurro, Istituto di Scienze delle Produzioni Alimentari – CNR, via Amendola 122/O - 70125 - Bari – Italy maurizio.vurro@ispa.cnr.it
five but in 

\textit{S. asiatica} it can be up to 8 in which case the teeth are unequal in length.

The number of rows of hairs on the lower surface of the leaves and bracts is a unique and most dependable feature that distinguishes \textit{S. hirsuta} from \textit{S. lutea}. \textit{Striga hirsuta} has a single row of stiff hairs running along the margins and mid rib of its leaves and bracts. \textit{Striga lutea} has 2 rows of hispid hairs along the margin and mid rib of its leaves and bracts. \textit{Striga lutea} plants are characteristically tall (up to 40 cm) and lack branches but when branched there are typically just two branches. \textit{Striga hirsuta} on the other hand is most often branched and the plants are the shortest (10 cm) in this cluster. Flower color can be of various shades of red and yellow and cannot be used alone in identification. \textit{Striga asiatica} flowers are typically red with yellow throat. Flowers of \textit{Striga lutea} are usually yellow and \textit{S. hirsuta} are typically red but any of these species may occasionally have flowers of various shades of red, sometimes on the same plant. This is not unusual as the corolla color is controlled by few genes.

There are also distinct differences in the geographical range of these species. Until the late eighties and early nineties \textit{S. asiatica} was very largely confined to southeastern USA. In these areas \textit{S. asiatica} is commonly restricted to its agronomic hosts in the agro-ecosystems. Then it was reported from Kenya in the late 80’s and Togo in West Africa in the early 90’s. Our \textit{Striga} surveys in West Africa and Sudan in the 80’s and Ethiopia as recent as 2007 revealed that \textit{S. asiatica} is not established as a widespread problem north of the equator, though it does occur sporadically on crops in several countries in West and East Africa. In November of 2007 we traveled for 15 days (October 27 – November 10) surveying \textit{Striga} in Ethiopia. We reached as far south as Caves Omar and Megalo southeast of the Bale Region, North to Mekele just south of the Eritrean boarder, and east to Dire Dawa Region close to the Somali borders. We encountered \textit{Striga asiatica} once (and only two plants) in a demonstration farm. However, in 1985/86 Chris Parker found \textit{S. asiatica} with various corolla colors ranging from brown, red and orange sporadically attacking sorghum and maize, often quite seriously, in Hararghe and Gamo Gofa Regions of Ethiopia. \textit{S. asiatica} had not previously been reported as a problem in Ethiopia (Parker 1988). Forms with little branching and bright scarlet flowers (\textit{S. lutea}?) were also occasionally encountered attacking wild grasses without harming crops (Sherif, Fessehaie, and Parker 1987). \textit{Striga asiatica} is also known from a few collections in the Nile Delta in Egypt. These observations clearly suggest that the presence of \textit{S. asiatica} north of the equator is relatively recent compared to its establishment in southern Africa. As suggested by Berner and his team (1994), contaminated crop grains are the main source of \textit{Striga} spread in Africa.

\textit{S. hirsuta} and \textit{S. lutea} are present all over Africa but commonest in west and central parts of the continent, especially the savannah grassland from Senegal to Ethiopia. While \textit{S. asiatica} is predominantly confined to crop fields \textit{S. hirsuta} and \textit{S. lutea} are rarely problems on crops and are confined to natural grasslands.

\textit{Striga elegans} is the fourth species in this cluster however it is rarely confused with any of the other species in this cluster. It has brilliant scarlet flowers with yellow throats and dense compact inflorescence. Its distribution is limited to south and east Africa reaching its northern range in Kenya. \textit{Striga elegans} has not been reported as a threat to crops. Our research showed that it is more closely related to \textit{S. asiatica} than to the other two species in the cluster. No molecular study has yet been done to determine their phylogenetic relationships but it is more likely that \textit{S. elegans} is the wild relative of \textit{S. asiatica}. The two were sympatric in South Africa and definitely native to the region. A group of researchers from Old Dominion University, University of Georgia, and State University of New York-Oswego are studying the systematics of the genus \textit{Striga} and its various cluster groups.

For a fuller account of \textit{Striga} species in Africa refer to Mohamed \textit{et al.} below.

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References:
THREE NEW STRIGA-RESISTANT COWPEA VARIETIES FROM IITA

A three-year study by the International Institute of Tropical Agriculture (IITA) has resulted in the development of three new cowpea varieties with genetic resistance to *Striga* *gesnerioides*. These new cowpea varieties should enable Africa-based partners and farm institutions (NARS) to bring technical assistance directly to hard-hit farmers concentrated in Senegal, Mali, Burkina Faso, Niger, Benin and Cameroon. Cowpea production across sub-Saharan Africa (SSA) accounts for over 65 percent of world output, impacting on poverty and nutrition levels among more than 10 million in drought-prone areas.

The latest research was supported by $900,000 in funding provided jointly by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the Generation Challenge Program (GCP) of The Consultative Group on International Agricultural Research (CGIAR). IITA’s longstanding effort to alleviate infestations of *S. gesnerioides* has been further augmented through a new GCP initiative aimed at doubling cowpea and other legume production in drought-prone areas in SSA and South Asia, with additional funding provided by the Bill and Melinda Gates Foundation of U.S.A.

In dry areas of Nigeria, *Striga* losses have reduced cowpea productivity from 2-3 tons per hectare to 0.37 tons of annual output. ‘There is a huge potential for cowpea crops to contribute to nutrition and income growth in Africa’s dry and semi-arid regions,’ said Dr. Satoru Muranaka, project leader based at IITA in Kano, Nigeria. ‘Because of crop damage still inflicted by cowpea *Striga*, we hope our findings will contribute to greater food security in the dry and arid regions of SSA.’

Comprising over 25% protein, cowpea provides food, sales income and residual bi-products for use as livestock feed. As a drought-tolerant crop, cowpea is adapted to dry or arid environments where rainfall is low and erratic, soils less fertile and other crops habitually fail. Cowpea also contributes to soil fertility through its ability to fix nitrogen, vital to rotational cropping systems in marginal areas.


NEW UK-FUNDED RESEARCH ON STRIGA

The UK Biotechnology and Biological Sciences Research Council (BBSRC) and the UK Department for International Development (DFID) have joined forces to announce £7M of new research to harness the UK’s world-class bioscience research base to address the challenges facing agriculture and food security in developing countries. Under this flagship initiative - Sustainable Agriculture Research for International Development (SARID). Twelve grants have been awarded to projects which will utilize cutting edge technologies to develop sustainable agriculture solutions for farmers and communities in the developing world. The newly funded projects are collaborations between UK scientists and scientists from institutions and Universities across Africa, Asia and South America. Two of these 12 projects relate to *Striga*:

**Saving staple foods from witchweed attack**

Maize is the staple food for half of the population of sub-Saharan Africa, but unfortunately it is also susceptible to damage from pests and parasitic weeds, which can result in total yield loss. Parasitic witchweed is a major culprit. Researchers from the UK and Kenya are looking at new ways of tackling witchweed. Research has shown that when desmodium, a nitrogen-rich legume, is grown amongst maize, it can increase the yield from less than one tonne per hectare to over five tonnes by preventing witchweed from growing. A chemical in desmodium has been identified which interferes with the development of witchweed, the big question is ‘how?’ In this new study, the international team of researchers will look to identify the enzyme responsible for creating the chemical that disrupts growth of witchweed. With this information they will then be able to breed edible crop legumes, which when intercropped with maize, not only prevents witchweed from attacking the valuable maize but also provide another human food source.

**Collaborators:** Rothamsted Research, UK; and International Centre of Insect Physiology and Ecology, Kenya

**Contact:** Dr. Tony Hooper Tony.hooper@bbsrc.ac.uk

**Defeating the witchweed famine threat**

Many important subsistence crops, relied on by billions of people, are at risk of attack from a noxious parasitic plant - witchweed. Over 40% of the cereal-producing areas of sub-Saharan Africa are infested with the parasite and the livelihoods of some of the world’s poorest farmers are threatened. Researchers from the UK, India and Senegal are using SARID funding to find ways to produce crops resistant to witchweed. Currently, the most commonly used strategies to reduce the impact of witchweed are hand weeding, improving soil fertility and growing some crops which are not...
attacked by the parasite, but these methods are costly and largely ineffective. Producing crops resistant to witchweed would improve the stability of food supply for people who rely on crops such as sorghum, maize, millet and rice. Researchers from the University of Sheffield have already identified some rice varieties that are resistant to attack by witchweed. The next step for the international team of researchers is to identify what makes these varieties resistant and which genes play a role. Once this is known, they will look for similar genes in other cereals and explore the possibility of breeding cereals with increased resistance to witchweed.

Collaborators: University of Sheffield, National Institute of Agricultural Botany, UK; International Crops Research Institute for the Semi Arid Tropics, India; and African Rice Centre, Senegal.

Contact: Professor Julie Scholes
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NATIONAL SCIENCE FOUNDATION FUNDS PARASITIC PLANT GENOME PROJECT

Gene sequence information for some important parasitic plants will become available within the next few years thanks to a recently funded project by the US National Science Foundation’s Plant Genome program (http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0701748). The project was funded to explore the sequences of genes associated with parasitism in the Orobanchaceae family. This “Parasitic Plant Genome Project” (PPGP) will compare three related species that differ distinctly in level of parasitism in order to elucidate the genes responsible for – or resulting from – the evolutionary transition from autotrophism to heterotrophism. The three focal species will include the facultative parasite (Triphysaria versicolor), the photosynthetically competent obligate parasite (Striga hermonthica), and the obligate holoparasite (Orobanche ramosa). The availability of a sequenced genome for the closely related non-parasite Mimulus guttatus provides a fully autotrophic out-group to further enhance this approach. We plan to concentrate efforts on sequencing genes that are expressed at key stages of parasite development, centering on haustorium development and establishment in the host. Although the project does not allow full genome sequencing, it should provide sufficient information to propel parasitic plant science into the genomics era.

A major impact of this project will be the public release (project website to be announced shortly) of an extensive set of gene sequences from a group of related plants that encompass an enormous breadth of morphological and physiological diversity. This will relieve a major constraint to research on the molecular biology of parasitic weeds, for which few gene sequences have heretofore been available. Thus, a major goal for the project is to facilitate work on Striga and Orobanche that will contribute to the development of effective control strategies for these weeds. We intend that the information and bioinformatics tools produced by this project will be accessible to all researchers and we welcome input from the entire parasitic plant research community on how to make the data useful and user-friendly. To this end, we are planning an outreach component of this project that will involve collaboration and international scientific exchange between US and developing country researchers. We specifically invite research groups that have needs for training in genomics and bioinformatics to contact us to discuss potential partnerships.

The PPGP team:
James Westwood, Virginia Tech (westwood@vt.edu)
Claude dePamphilis, Penn State University
Michael Timko, University of Virginia
John Yoder, UC Davis

CONGRATULATIONS

Congratulations to Gebisa Ejeta on his recent appointment as Distinguished Professor of Agronomy at Purdue University.

THESIS

Mónica Fernández-Aparicio (PhD, University of Córdoba, 18 January 2008) Perspectives for Orobanche crenata control in legumes by genetic resistance and alternative control practises (supervised by D. Rubiales & A. Pérez-de-Luque)

The weedy root parasite Orobanche crenata constitutes a serious threat to grain and forage legumes in the Mediterranean and Western Asia. Control strategies have centred around agronomic practices and the use of herbicides. Resistance breeding is hampered by scarcity of proper sources of resistance and of a reliable and practical screening procedure. In this PhD we identified sources of resistance and studied the defence reactions involved both in the field, in pot, and in mini-rhizotron experiments and studied the possibility of control by intercropping.

A wide range of responses to crenate broomrape were identified both in cultivated lentil (Fernández- Aparicio, et al. 2008a) and in wild Lens relatives (Fernández- Aparicio, et al. 2008b), although complete resistance
was not detected. Low infection seemed to be based on a combination of various escape and resistance mechanisms from lower root density, lower induction of Orobanche seed germination, and reduced establishment of broomrape radicles. In order to identify alternative systems for ulterior genetic and genomic analysis, we studied early stages of the interaction between M. truncatula accessions and a range of Orobanche species. We found significant differences in the induction of germination and in the number of attachments supported (Fernández-Aparicio, et al. 2008c).

Root exudate of 22 plant species was applied separately to seeds of 9 broomrape species, finding various levels of specialization in the Orobanche species. A wide range of species are described as potential trap crops due to their ability to induce germination on several Orobanche species to which they are resistant. Many of the species that stimulate the germination of these last two groups of broomrapes are not infected, being resistant in a later stage of the infection process, representing interesting examples of trap crops. The crude root exudate of fenugreek stimulated both O. ramosa and O. crenata seed germination. Active fractions of root exudate stimulated germination of broomrape species in a differential pattern (Fernández-Aparicio, et al. 2008d).

Our field experiments showed that O. crenata infection on faba bean and pea is reduced when these host crops are intercropped with oat (Fernández-Aparicio, et al. 2007) and with fenugreek (Trigonella foenum-graecum) (Fernández-Aparicio, et al. 2008c), the mechanism for reduction of O. crenata infection apparently being inhibition of O. crenata seed germination by allelochemicals released by oat and fenugreek roots. Fenugreek root exudates were extracted with organic solvent and fractionated giving several fractions, two of which showed moderate and strong inhibition of O. crenata seed germination. The most active metabolite is a new monosubstituted trioxazonane, named by us trigoxazonane (Evidente et al. 2007).

References:

Fernández-Aparicio, et al. 2008a (see Literature item below)
Fernández-Aparicio, et al. 2007. (see Literature item below)
Evidente et al. 2007. (see Literature item below)

BOOK REVIEWS


This recent peer-reviewed volume is a product of the International Symposium ‘Integrating New Technologies for Striga Control: Towards Ending the Witch-hunt’ held November 2006 in Addis Ababa, Ethiopia. Published in 2007 by World Scientific Publishing and edited by the conference chair Gebisa Ejeta and committee member Johnathan Gressel, this represents a significant contribution to the Striga literature. It includes 24 chapters by 70 co-authors, many of whom are leaders in the field.

The chapters are well organized by topic and include helpful reviews of the numerous approaches to combating Striga. The first sections, including host-parasite chemical signalling, molecular marker assisted crop breeding, and progress in the genetic basis of Striga resistance, underscore advances in biotechnology and genomics. Appropriately, the largest section emphasizes agronomic options and reviews integrated Striga management and the downstream socio-economic effects of these control programs. The final section includes chapters focused on the soil borne fungus Fusarium oxysporum as a bio-herbicide against Striga and the process of increasing pathogen virulence.

Due to the proliferation of journals and the increasingly compartmentalized world of modern science, this volume provides a timely synthesis of the state of Striga research. The research assembled here reflects the current direction of Striga control and as the editors emphasize, each approach to control is unlikely to succeed independently without true integration.

Jay F. Bolin, Dept. of Biological Sciences, Old Dominion University, Norfolk VA 23529
Biology and management of weedy root parasites.

Our apologies for the delay in reviewing this most valuable publication. It is in the form of a journal review but with 84 pages and about 350 references it has most of what you would expect of a book, and together with the volume reviewed above, helped persuade the authors of Parker and Riches to forgo the pain involved in updating their volume from 1993. Where the first volume above deals only with Striga, this deals slightly more comprehensively with Orobanche, though both are dealt with in very considerable detail (the less important genera in the old Scrophulariaceae receive only passing mention). It was completed in 2006 and covers most of the significant literature up to that time, including developments in biotechnology, plant genomics and genetic engineering. One disappointing omission is the lack of reference to the work with Desmodium species and their potential role in control of Striga spp.

Chris Parker.

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the 10th World Congress on Parasitic Plants in Turkey, 2009, see: http://www.ippsturkey.com/

For abstracts from the 9th World Congress on Parasitic Plants see: http://www.cpe.vt.edu/wcopp/index.html

For information on the International Parasitic Plant Society, past and current issues of Haustorium, etc. see: http://www.ppws.vt.edu/IPPS/

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasite site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Lytton Musselman’s Hydnora site see: http://www.odu.edu/webroot/instr/sci/plant.nsf/pages/lecturesandarticles

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes) see: http://www.rmrs.nau.edu/mistletoe/

For information on, and to subscribe to PpDigest see: http://omnisterra.com/mailman/listinfo/pp_omnisterra.com

For information on the EU COST 849 Project and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/

For the Parasitic Plants Database including ‘4000 entries giving an exhaustive nomenclatural synopsis of all parasitic plants’ (last updated 2003), the address is: http://www.omnisterra.com/bot/pp_home.cgi

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net

For information on EC-funded project ‘Improved Striga control in maize and sorghum (ISCIMAS) see: http://www.plant.dlo.nl/projects/striga/

For the work of Forest Products Commission (FPC) on sandalwood, see: www.fpc.wa.gov.au

For past and future issues of the Sandalwood Research Newsletter, see: www.jcu.edu.au/school/tropbiol/srn/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, see: http://africancreps.net/striga/

To view the list of presentations and participants at the Striga meeting in Addis Abeba, November 2006, see: http://www.agry.purdue.edu/strigaconference/index.html

For information on the 5th International Weed Science Congress, June, 2008, in Vancouver, Canada see: http://iws.ucdavis.edu/Sinflweedcong.htm
LITERATURE


Aksoy, E., Özemuz, S. and Uygur, F.N. 2006. (Determination of natural insect enemies of broomrape species (Orobanchaceae) and investigation on using possibilities of Phytomyza orobanchia Kalt. (Diptera: Agromyzidae) for biological control.) (in Turkish) Türkiye Herboloji Dergisi 9(1): 10-17. (Insects attacking Orobanchaceae spp. in Kilis and Mersin regions of Turkey included Phytomyza orobanchia, Phytomyza sp., Drosophilus buscki, D. melanogaster, Liriomyza huidobrensis and Nasonpyza sp.)

Alali, F.Q., Tawaha, K., El-Elimat, T., Syouf, M., El-Fayad, M., Abularia, K., Nielsen, S.J., Wheaton, W.D., Falkinham, J.O.,III and Oberlies, N.H. 2007. Antioxidant activity and total phenolic content of aqueous and methanolic extracts of Globimetula cupulata. Product Research 21: 1121-1131. (Among 95 Jordanian plants: an ICBG project. Natural content of aqueous and methanolic extracts of Globimetula cupulata (DC) Van Tieghem (Loranthaceae) were evaluated for their antioxidant activity using DPPH and ABTS methods and total phenol contents were evaluated using the Folin–Ciocalteu method. The results indicated that the aqueous extract was the most active in terms of antioxidant and phenolic content.)


Annapurna, D., Rathore, T.S. and Joshi, G. 2007. Effect of potting medium ingredients and sieve size on the growth of seedlings of sandalwood (Santalum album) in root trainers. Indian Forester 133: 179-188. (Describing the optimum potting medium for rearing S. album on Cajanus cajan.)

Artanti, N., Ma'arifa, Y. and Muhammad Hanafi 2006. Isolation and identification of active antioxidant compound from star fruit (Averrhoa carambola) mistletoe (Dendrophthoe pentandra) and Cleridendron splendens. Indian Journal of Agricultural Sciences 77: 462-463. (An ethanol extract of D. pentandra growing on A. carambola showed antioxidant activity apparently attributable to a flavonol glycoside, quercetin-3-O-rhamnoside.)

Ashok Yadav, Banga, R.S., Balyan, R.S., Malik, R.K. and Punia, S.S. 2007. Evaluation of herbicides against dodder (Cuscuta reflexa) infesting the hedges of bougainvillea (Bougainvillea purpurea) and cleridendron (Cleridendron splendens). Indian Journal of Agricultural Sciences 77: 462-463. (Glyphosate 5% was safe and effective on both shrubs, while higher doses were damaging. Glufosinate and 2,4-D ester were ineffective. ‘Cleridendron’ presumably = Clerodendrum splendens)


Ayandele, A.A. and Adebiyi, A.O. 2007. The phytochemical analysis and antimicrobial screening of extracts of *Olas subscorpioidea*. African Journal of Biotechnology 6: 868-870. (Alkaloids, steroids, and flavonoids were detected in ethanolic extracts from the stems of *O. subscorpioidea* which inhibited a range of bacteria and fungi at 5-45 mg/ml. Aqueous extracts were less active.)

Babalola, O.O., Sanni, A.I., Odhiambo, G.D. and Torto, B. 2007. Plant growth-promoting rhizobacteria do not pose any deleterious effect on cowpea and detectable amounts of ethylene are produced. World Journal of Microbiology & Biotechnology 23: 747-752. (In work with cowpea as a trap crop to reduce *Striga hermonthica*, *Enterobacter sakazakii* 8MR5 and two strains of *Pseudomonas* significantly increased biomass and pod weight of cowpea.)

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Badu-Apraku, B. 2007. Genetic variances and correlations in an early tropical white maize population after three cycles of recurrent selection for *Striga* resistance. Maydica 52: 205-217. (Detailed genetic testing suggests that the early maturing population, TZE-W Pop DT STR has sufficient genetic variability to warrant further selection for *Striga* resistance.)

Badu-Apraku, B., Menkir, A. and Lum, A.F. 2007. Genetic variability for grain yield and its components in an early tropical yellow maize population under *Striga hermonthica* infestation. Journal of Crop Improvement 20(1/2): 107-122. (Concluding that there was adequate variation in *Striga* resistance in an early maturing yellow maize population, TZE-Y Pop DT STR, for further selection to be worthwhile.)


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Beuth, J., Ko, H.L., Schneider, H., Tawadros, S., Kasper, H.U., Zimst, H. and Schierholz, J.M. 2006. Intratumoral application of standardized mistletoe extracts down regulates tumor weight via decreased cell proliferation, increased apoptosis and necrosis in a murine model. Anticancer Research 26: 4451-4456. (Extracts of *Viscum album* showed significant activity against a human ductal breast carcinoma cell line and decreased tumour weight in mice.)


Billings, S.A., Schaeffer, S.M. and Evans, R.D. 2004. Soil microbial activity and N availability with elevated CO$_2$ in Mojave Desert soils. Global Biogeochemical Cycles 18(1): GB1011. (Results with *Larrea tridentata* and *Krameria erecta* indicate that elevated CO$_2$ may alter soil microbial activity and hence lead to increases in plant-available N when soil moisture is available.)


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Braby, M.F. 2006. Evolution of larval food plant associations in Delias Hübner butterflies (Lepidoptera: Pieridae). Entomological Science 9: 383-398. (A phylogenetic study of Delias spp. considers that their original host plants were Loranthaceae. Currently 77% of hosts are in Loranthaceae, 14% in Santalaceae and 8% in Viscaceae with only 1% on non-parasitic hosts in Euphorbiaceae.)


Brunet, J. 2006. (Orobanche reticulata found at a new site in Skåne, S Sweden.) (in Swedish) Svensk Botanisk Tidskrift 100: 301. (O. reticulata is reported parasitizing Cirsis oleraceum under shade of Fraxinus excelsior.)


Burckhardt, D. and Wyniger, D. 2007. The systematic position of Psylla phorodendri Tuthill with comments on the New World genus Freysuila Aleman (Hemiptera, Psylloidea, Aphalaroidinae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 80(1/2): 63-70. (Describing adult and larval characters of Freysuila phorodendri (renamed from Psylla phorodendri), which develops on Phoradendron spp. in Arizona and California, USA.)

Carlo, T.A. and Aukema, J.E. 2005. Female-directed differentiation. In: Deil, U., Theissen, G. and Ferrandiz, C. (eds) Annals of Botany 100: 621-630. (Suggesting that tepal-derived petals have evolved independently in the major lineages of the core eudicots (i.e. asterids, Santalales and rosids) while staminodial petals have arisen only in a few isolated cases where petals had been previously lost.)


de Craene, L.P.R. 2007. Are petals sterile stamens or bracts? The origin and evolution of petals in the core eudicots. In: Scutt, C.P., Theissen, G. and Ferrandiz, C. (eds) Annals of Botany 100: 621-630. (Suggesting that tepal-derived petals have evolved independently in the major lineages of the core eudicots (i.e. asterids, Santalales and rosids) while staminodal petals have arisen only in a few isolated cases where petals had been previously lost.)

degroote, H., Wangare, L. and Kanampiu, F. 2007. Evaluating the use of herbicide-coated imidazolinone-resistant (IR) maize seeds to control Striga in farmers' fields in Kenya. Crop Protection 26: 1496-150. (Reporting on-farm trials which showed a small but highly profitable yield benefit from the use of herbicide in conjunction with hybrid maize, and suggesting ways of improving farmer interest.)


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essentially similar in different hosts. Unlike most parasitic plants, *Cytinus* has well-developed phloem in its endophyte.)

Devkota, M.P. and Glatzel, G. 2007. Comparative haustorium morphology and vegetative reproduction in the Old World genus *Scurrula* L. (Loranthaceae) from the Central Nepal Himalayas. Flora (Jena) 202: 179-193. (Comparing the structure of haustoria and endophytic systems of *Scurrula elata*, *S. gracilifolia*, *S. parasitica* and *S. pulverulenta*. Haustoria did not differ significantly, but 3 types of endophyte are distinguished – sinker, flanging, and flanging with radial shaft.)

Die, J.V., Dita, M.A., Krajinski, F., González-Economou, G., Lyra, D., Sotirakoglou, K., Fasseas, H. 2007. Identification by suppression subtractive hybridization and expression analysis of *Medicago truncatula* putative defence genes in response to *Orobanche crenata* parasitization. PMPP Physiological and Molecular Plant Pathology 70(1-3): 49-59. (Eighty-one genes apparently up-regulated in *M. trunculata* infected by *O. crenata* included some thought to be related to the jasmonic acid pathway or to be involved in cell wall modifications, but also many novel genes not matching entries in the main *M. trunculata* sequences collections.)


Die, J.V., Dita, M.A., Krajinski, F., González-Economou, G., Lyra, D., Sotirakoglou, K., Fasseas, H. 2007. Identification by suppression subtractive hybridization and expression analysis of *Medicago truncatula* putative defence genes in response to *Orobanche crenata* parasitization. PMPP Physiological and Molecular Plant Pathology 70(1-3): 49-59. (Eighty-one genes apparently up-regulated in *M. trunculata* infected by *O. crenata* included some thought to be related to the jasmonic acid pathway or to be involved in cell wall modifications, but also many novel genes not matching entries in the main *M. trunculata* sequences collections.)


Dzomeku, I.K. and Murdoch, A.J. 2007. Modelling effects of prolonged conditioning on dormancy and germination of *Striga hermonthica*. Journal of Agronomy 6(2): 235-249. (Changes in germinability potential during conditioning were consistent with the hypothesis that loss of primary dormancy precedes induction of secondary dormancy. An additive mathematical model is developed.)


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Germishuizen, G., van Jaarsveld, E.J. and Condy, G. Gronovii

Ghanam, I., Barakat, R. and Al-Masri, M. 2007. Biological control of Egyptian broomrape (Orobanche aegyptiaca) using Fusarium spp. Phytopathologia Mediterranea 46: 177-184. (Testing 125 Egyptian isolates of Fusarium and selecting a number of F. oxysporum and O. solani with good activity against O. aegyptiaca and no observed damage to tomato.)

Gibot-Leclerc, S., Pinochet, X. and Sallé, G. 2006. (Broomrapes (Orobanche ramosa) as parasite of winter oilseed rape: an extension risk under observation.) (in French) OCL - Oléagineux, Corps Gras, Lipides 13: 200-205. (Discussing the increasing problem of O. ramosa in rapeseed in Central West region Poitou-Charentes and possibilities for preventing its further spread.)


Gonzáles, W.L., Suárez, L.H., Guíñez, R. and Medel, R. 2007. Phenotypic plasticity in the holoparasitic mistletoe Tristerix aphyllus (Loranthaceae): consequences of trait variation for successful establishment. Evolutionary Ecology 21: 431-444. (Results suggest that the successful adaptation of T. aphyllus to the long spines of its host cactus Echinopsis chilenensis via long radicles are due to the plasticity in radicle length, rather than selection for this character.)


Grenz, J.H. and Sauerborn, J. 2007. Mechanisms limiting the geographical range of the parasitic weed Orobanche crenata. Agriculture, Ecosystems & Environment 122: 275-281. (An interesting analysis confirming that temperature and seasonality of rainfall are critical and concluding that suitable conditions outside the Mediterranean exist in parts of the monsoon, savanna and winter-dry climate regions of Central America, Africa, Australia and South Asia.)

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Hedwall, S.J. and Mathiasen, R.L. 2006. Wildlife use of Douglas-fir dwarf mistletoe witches' brooms in the southwest. Western North American Naturalist 66: 450-455. (Witches’ brooms caused by Arceuthobium douglasii in Douglas fir were most often used by red squirrel, Tamiasciurus hudsonicus.)

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Irwin, M.T. 2007. Living in forest fragments reduces group cohesion in diademed sifakas (Propithecus diadema) in eastern Madagascar by reducing food patch size. American Journal of Primatology 69: 434-447. (Studies on P. diadema suggest that decreased cohesion in groups in fragmented habitat results from their increased reliance on mistletoes and other small resources, which causes them to spread out among multiple patches.)

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Physiology 145: 437-449. (Describing two accession of M. trunculata with differing modes of resistance to Orobanche crenata, one expressed before tubercule formation and the other after tubercules had become attached.)

Luo HongXia, Lin ShaoHua, Ren FaZheng, Wu LiPing, Chen LiShui and Sun Yan 2007. Antioxidant and antimicrobial capacity of Chinese medicinal herb extracts in raw sheep meat. Journal of Food Protection 70: 1440-1445. (Extracts of Santalum album were among the most effective of 10 tested for antimicrobial activity.)

Ma DeYing, Chai Yan, Yushanjiang Tuniyazi, Liu Ying, Zhao Li and Dilibaiyer 2007. A study on seed traits of parasitic weeds Cuscuta sp. in Xinjiang farmland. Xinjiang Agricultural Sciences 44: 429-433. (External and internal morphological characters of seeds are described for C. approximata, C. campestris, C. europaea, C. epilimum, C. chinensis, C. monogyna, C. eupulata and C. australis, and a key prepared.)


Mabrouk, Y., Simier, P., Delavault, P., Delgrange, S., Sifi, B., Zourgui, L. and Belhadj, O. 2007. Molecular and biochemical mechanisms of defence induced in pea by Rhizobium leguminosarum against Orobanche crenata. Weed Research 47: 452-460. (Further elucidation of the mechanism by which certain strains of Rhizobium reduce infection by O. crenata, confirming the involvement of genes enhancing activity of oxidative lipoygenase and the phenylpropanoid/isoflavanoid pathways, leading to accumulation of phenolics and the phytoalexin pisatin.)


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Mathiasen, R.L. 2007. First report of durangana dwarf mistletoe, Arceuthobium vaginatum ssp. durangense, on Pinus cooperi and P. engelmannii in Mexico. Plant Disease September 2007: 1201. (Reporting A. vaginatum ssp. durangense, also known as A. durangense, in Durango province, Mexico, forming brooms and causing serious damage on P. engelmannii but lesser damage and no brooms on P. cooperi.)

Mathiasen, R.L. and Daugherty, C.M. 2007. Arceuthobium tsugense subsp. amabilae, a new subspecies of hemlock dwarf mistletoe (Viscaceae) from Oregon. Novon 17(2): 222-227. (Describing a new subspecies A. tsugense subsp. amabilae parasitic mainly on Abies amabilis, A. procera, and Tsuga mertensiana, but also parasitizing several other Abies, Tsuga and Pimus spp.)

McCartney, J., Stringer, I.A.N. and Potter, M.A. 2007. Feeding activity in captive New Zealand lesser...
short-tailed bats (*Mystacina tuberculata*). New Zealand Journal of Zoology 34: 227-238. (Nectar from *Metrosideros excelsa* (Balanophoraceae) was a minor component in the diet of *M. tuberculata*.)

Medel, R., Vergara, E., Silva, A. and Kalin-Arroyo, M. 2004. Effects of vector behavior and host resistance on mistletoe aggregation. 85(1): 120-126. (Results provide evidence that aggregation of the mistletoe *Tristerix aphyllus* on its cactus host *Echinopsis chilensis* is influenced by the behaviour of its avian seed vector *Mimus thenca* and the spines of the host.)


Melnick, S.J. 2006. Developmental therapeutics: review of biologically based CAM therapies for potential application in children with cancer: Part I. Journal of Pediatric Hematology and Oncology 28(4): 221-230. (Reviewing complementary and alternative medicine (CAM) therapies that have potential anticancer activity with a focus on those agents that may be active in childhood cancer, including extracts of *Viscum.*)

Metzger, J.O. and Bornscheuer, U. 2006. Lipids as renewable resources: current state of chemical and biotechnological conversion and diversification. Applied Microbiology and Biotechnology 71(1): 13-22. (Suggesting potential use for santhalic acid from *Santalum album*.)

Meulebrouck, K., Ameloot, E., Verheyen, K. and Hermy, M. 2007. Local and regional factors affecting the distribution of the endangered holoparasite *Cuscata epithymum* in heathlands. Biological Conservation 140(1/2): 28-18. (Studies in Belgium suggest abundance of *C. epithymum* depends mainly on canopy structure, and is favoured most by young *Calluna vulgaris.*)


Mourão, F.A., do Carmo, F.F., Ratton, P. and Jacobi, C.M. 2006. (Hosts of *Struthanthus flexicaulis* (Loranthaceae) in ironstone in Quadrilatero Ferrifero, Minas Gerais.) (in Portuguese) Lundiana 7(2): 103-109. (The host range of *S. flexicaulis* included over half the woody species in the localities surveyed.)


Müller-Stöver, D. and Sauerborn, J. 2007. A commercial iron fertilizer increases the survival of *Fusarium oxysporum* f. sp. *orthoceras* propagules in a wheat flour-kaolin formulation. Biocontrol Science and Technology 17: 597-604. (The proportion of surviving propagules of *F. oxysporum* was significantly increased after adding iron chelate of EDDHA to the formulation.)


Olakojo, S.A. and Olaoye, G. 2007. Response of maize (*Zea mays* L.) to different nitrogen fertilizer formulations under *Striga lutea* (Lour.) artificial infestation. Tropical and Subtropical Agroecosystems 7(1): 21-28. (In a factorial pot experiment, the use of a *Striga*-resistant genotype in combination with nitrogen fertilizer in the form...
of calcium ammonia nitrate, but not ammonium sulphate, reduced 'S. lutea' (= S. asiatica) infestation and enhanced crop growth.)

Oujide, M.G. and Adeogun, S.O. 2006. Assessment of cocoa farmers’ farm hygiene and farm maintenance practices in Ondo State of Nigeria. Karnataka Journal of Agricultural Sciences 19: 339-343. (A survey suggested that few farmers bothered to remove mistletoes, although they probably did affect productivity.)

Orhan, D.D. and Orhan, I. 2006. Fatty acid composition of Viscum album subspecies from Turkey. Chemistry of Natural Compounds 42: 641-644. (Linoleic, oleic and palmitic acids were highest in V. album ssp. album growing on apricot trees. Arachidic acid was found only in ssp. austriacum and ssp. abietis.)


Panetta, F.D. and Lawes, R. 2007. Evaluation of the Australian branched broomrape (Orobanche ramosa) eradication programme. Weed Science 55: 644-651. (Describing a model designed to help monitor the progress of an eradication programme and suggest improvements. In the Australian instance, a means of rapidly reducing soil seed populations is identified as a priority for exploration.)

Papchenkov, V.G. 2007. Rare and new hybrid plants in the Middle Volga basin. Botaniceskii Zhurnal, 92: 929-937. (Recording a hybrid in the genus Euphrasia.)


Pérez-de-Luque, A., Lozano, M.D., Moreno, M.T., Testillano, P.S. and Rubiales, D. 2007. Resistance to broomrape (Orobanche crenata) in faba bean (Vicia faba): cell wall changes associated with prehaustorial defensive mechanisms. Annals of Applied Biology 151: 89-98. (Resistance to O. crenata is associated with reinforcement of cell walls in the cortex by callose deposition, and lignification of endodermal cells.)


Raffone, G. 2006. (Faunistic remarks on Italian Calliphoridae (Diptera Brachycera).) (in Italian) Bollettino della Società Entomologica Italiana 138(2): 149-155. (Quoting records of 31 species of Calliphoridae on Bellardia polita.)


Rao, M.D. 2007. Seed coat micro sculpturing of weed species of Scrophulariaceae. Advances in Plant Sciences 20(1): 299-303. (The sculpturing of seeds of Bacopa monnieri, Striga angustifolia, Sopubia delphinifolia and Stemodia viscosa are described and a key devised based on these characters.)

Rao, M.N., Ganeshaiah, K.N. and Shaanker, R.U. 2007. Genetic diversity was greatest in the Deccan populations of Santalum in peninsular India. Genetic diversity of 19 populations of Santalum in peninsular India. Genetic diversity was greatest in the Deccan Plateau.

Ravi Marigoudra, Sanjeev Kyatappanavar, Ramesh Rathod and Krishna, A. 2004. Vegetation studies in Bairambe in Uttara Kannada District. Karnataka Journal of Agricultural Sciences 17: 878-880. (In a Terminalis forest Santalum album was abundant as saplings and had a high Importance Value Index.)

Rawat, P.S., Suresh Chandra and Anil Khaneja 2007. Mortality of Pinus wallichiana by dwarf mistletoe in Uttarkashi. Indian Forester 133: 937-944. (Recording 70% occurrence of Arceuthobium minutissimum in a blue pine forest in Uttar Pradesh, India, causing 15% mortality.)


Rietman, L.M., Shamoun, S.F. and van der Kamp, B.J. 2006. Development of a biological control strategy to mitigate hemlock dwarf mistletoe in silviculture systems: Neoeectria neomacrospora hemlock dwarf mistletoe pathosystem. BC Journal of Ecosystems and Management 7(1): 30-35. (Non-clearcutting forestry practices are expected to result in increased infestation of western hemlock by Arceuthobium tsugense. Trials with a potential inundative biocontrol organism Neoeectria neomacrospora showed 38% reduction in healthy shoots of the parasite.)


Rodriguez-Cabal, M.A., Aizen, M.A. and Novaro, A.J. 2007. Habitat fragmentation disrupts a plant-disperser mutualism in the temperate forest of South America. Biological Conservation 139(1/2): 195-202. (Confirming that fragmentation of forest and consequent reduction in abundance of Dromiciops gliroides can result in reduction or even extinction of the mistletoe Tristerix corymbosus, whose dispersal depends on that endemic marsupial.)

Román, B., Satovic, Z., Alfaro, C., Moreno, M.T., Kharrat, M., Pérez-de-Luque, A. and Rubiales, D. 2007. Host differentiation in Orobanche foetida Poir. Flora (Jena) 202: 201-208. (Study of RAPD markers confirmed a distinction between populations of O. foetida parasitising chick pea and fava bean. There was a corresponding difference in germination of seeds on the respective hosts.)

Rümer, S., Cameron, D.D., Wacker, R., Hartung, W. and Jiang Fan 2007. An anatomical study of the haustoria of Rhinanthus minor attached to roots of different hosts. Flora (Jena) 202: 194-200. (The reactions in root tissue of different hosts to penetration by R. minor varied from very mild in Fabaceae, to strong lignification in Poaceae, suberisation in Leucanthemum vulgare and complete localised cell destruction in Plantago lanceolata.)

Sanilkumar, M.G. and Thomas, K.J. 2007. Fringe plants of Muriyad wetlands (part of Vembanad-Kol Ramsar site) and its economic importance. Journal of Economic and Taxonomic Botany 31(1): 123-132. (Noting that the fringe areas of Muriyad wetlands support the threatened medicinal plant *Santalum album.*)


Schmalholz, M. and Kiviniemi, K. 2007. Relationship between abundance and fecundity in the endangered grassland annual *Euphrasia rostkoviana* ssp. *fennica*. Annales Botanici Fennici 44(3): 194-203. (Noting an Allee effect, i.e. a reduced fecundity in small and sparse populations, of this already declining species.)

Schneeweiss, G.M. 2007. Correlated evolution of life history and host range in the nonphotosynthetic parasitic flowering plants *Orobanche* and *Phelipanche* (*Orobanchaceae*). Journal of Evolutionary Biology 20: 471-478. (Studies support the hypothesis that narrow host specialization is associated with predictable resources (i.e. long-lived hosts) and a wide host range with unpredictable (i.e. short-lived) hosts.)

Schoenbeck, M.A., Swanson, G.A. and Brommer, S.J. 2007. β-Glucuronidase activity in seedlings of the parasitic angiosperm *Cuscuta pentagona*: developmental impact of the β-glucuronidase inhibitor saccharic acid 1,4-lactone. Functional Plant Biology 34: 811-821. (Results suggest a role for β-glucuronidase in the early stages of development of *C. pentagona.*)


Shang ZhiQiang and Zhang XiGuo 2007. Taxonomic studies of *Pseudospiropes* from Yunnan, China. Mycotaxon 100: 149-153. (Describing 2 new species of *Pseudospiropes*, including *Pseudospiropes ximeniae* saprophytic on dead branches of *Ximenia* spp.)


Sharma, R.K., Bahukhandi, D. and Agarwal, D.K. 2007. Biological management of *Orobanche* with *Fusarium oxysporum* - a new record from India. Indian Phytopathology 60: 275-276. (Recording the natural occurrence of *F. oxysporum* on *O. ramosa* in rapeseed mustard, seriously damaging the parasite and providing healthier crop in the patches affected.)

Shen Hao, Hong Lan, Ye WanHui, Cao HongLin and Wang ZhangMing 2007. The influence of the holoparasitic plant *Cuscuta campestris* on the growth and photosynthesis of its host *Mikania micrantha*. Journal of Experimental Botany 58: 2929-2937. (A detailed analysis of the influence of *C. campestris* on various growth parameters of *M. micrantha* which was almost completely killed by the parasite after 70 days infection.)


Siliero, J.C., Cubero, J.I., Fernández-Aparicio, M. and Rubiales, D. 2005. Search for resistance to crenate broomrape (*Orobanche crenata*) in *Lathyrus*. Lathyrus Lathyrism Newsletter 4: 7-9. (Among 11 *Lathyrus* species tested, *L. clymenum* and *L. ochrus* showed high levels of resistance to *O. crenata*. *L. choranthus* allowed tubercle development but no emergence. All other species including *L. annua* and *L. aphaca* were susceptible.)


Tan DeYuan, Guo QuanShui, Liu YuJun, Ma Chao
Tang Ya, Xie JiaSui and Sun Hui 2007. The HAUSTORIUM 52 January 2008 22
Tang Ya, Xie JiaSui and Sun Hui 2007. Pollination
Tang YiMei, Li ZhongJin, Wang ShiXiang, Liu
Tran Dang Khanh, Luong Chi Cong, Tran

metabolism reaction of Haloxylon parasitized by Cistachne deserticola. Forest Research, Beijing 20: 495-499. (In Haloxylon parasitized by C. deserticola, chlorophyll and relative water contents were decreased and proline and malondialdehyde contents increased.)

Tang Ya, Xie JiaSui and Sun Hui 2007. Pollination ecology of Pedicularis muscoides H. L. Li subsp. himalayaca Yamazaki from alpine areas of Western Sichuan, China. Arctic, Antarctic, and Alpine Research 39: 481-487. (Pollination of the depauperate P. muscoides was exclusively by queens of four bumblebee species, especially Bombus frisianus working at ground level. Results suggest coadaptation between Pedicularis and bumblebee pollinators.)

Tang Ya, Xie JiaSui and Sun Hui 2007. The pollination ecology of Pedicularis rex subsp. lipkyana and P. rex subsp. rex (Orobanchaceae) from Sichuan, southwestern China. Flora (Jena) 202: 209-217. (Reporting the mechanisms by which flowers of P. rex are pollinated by bumblebees.)


Tennakoon, K. U., J. F. Bolin, L. J. Musselman, and E. Maass. 2007. Structural attributes of the hypogeous holoparasite Hydnora triceps Drège & Meyer (Hydnoraceae). American Journal of Botany 94(9): 1439-1449. (Showing that the underground structures are anatomically roots and that the distinctive “bumps” that can form haustoria arise exogenously. The photo featured on the cover of this issue of the journal won first prize for Jay Bolin in a national competition.)

Tran Dang Khanh, Luong Chi Cong, Tran Dang Xuan, Sun Joo Lee, Dong Soo Kong, and III Min Chung 2008. Weed-suppressing potential of dodder (Cuscuta hygrophilae) and its phytotoxic constituents. Weed Science, 56(1):119-127. (Dried, ground material of C. hygrophilae from a mountainous area of N. Vietnam (host not noted) had allelopathic effects on weeds when incorporated into soil at 0.5-2 t/ha, apparently due to especially high levels of cinnamic acid (37 mg/g). methyl cinnamate, myristic acid and dihydro-5,6-dehydrokavain may also have contributed.)

Tusenius, K.J., Spoek, A.M. and van Hattum, J. 2005. Exploratory study on the effects of treatment with two mistletoe preparations on chronic hepatitis C: biochemical and quality of life improvement. Arzneimittel Forschung 55: 749-753. (Noting favourable results with Viscum extracts Iscador or Abnoba comparable to glycyrrhizin, and having the advantage of easy administration and low cost.)

Uddin, S. J., Shilpi, J.A., Middleton, M., Byres, M., Shoeb, M., Nahar, L. and Sarker, S.D. 2007. Swarnalin and cis-swarmalin, two new tetrahydrofuran derivatives with free radical scavenging activity, from the aerial parts of Cuscuta reflexa. Natural Product Research 21: 663-668. (A mixture of the two new derivatives was shown to have scavenging activity about one order lower than the reference control quercetin.)

Uematsu, K., Nakajima, I., Yamaguchi, I., Yoneyama, K. and Fukui, Y. 2007. Role of cAMP in gibberellin promotion of seed germination in Orobanche minor Smith. Journal of Plant Growth Regulation 26: 245-254. (Adenosine 3',5'-cyclic monophosphate (cAMP) is shown to accumulate during conditioning of O. minor seed and to act in conjunction with gibberellin in germination.)

Umucalilar, H. D., Gülsen, N., Coskun, B., Hayırlı, A. and Dural, H. 2007. Nutrient composition of mistletoe (Viscum album) and its nutritive value for ruminant animals. Agroforestry Systems 71(2): 77-87. (V. album ssp. album from almond plum and willow was analysed and fed to cows. In general it was low in protein, moderate in fibre, and high in minerals.)


van Mourik, T.A. 2007. Striga hermonthica seed bank dynamics: process quantification and modelling. Tropical Resource Management Papers 92: 123 pp. (Results of a PhD study quantifying recruitment, survival to maturity, and fecundity of S. hermonthica in the field in sorghum in Mali and in pearl millet in Niger, as affected by intercropping. A model was devised, suggesting that intercropping with a trap crop could be more effective in reducing Striga seed bank than rotation with a trap crop.)

Vipan Guleria. 2006. *Santalum album* Linn. in Himachal Pradesh: to optimize media and polybag size for raising containerized seedlings. Indian Forester 132: 894-898. (Concluding that the optimum conditions for *S. album* in this area included 6" x 9" polybags and a growing medium containing 1:1:2 ratio of soil:sand:FYM.)

Voronkova, N.M. 2007. Effects of cryoconservation on the viability of the seeds and fruits of some species in the Moneron Island (Sakhalin Region). Rastitel'nye Resursy 43(3): 34-41. (Germination of *Pedicularis schistostegia* was not significantly affected by cryopreservation.)


Wang Hu, Li WenWei, Cai DingFang and Yang Ru. 2007. Protecting effect of *Cistanche* extracts on MPP*-induced injury of the Parkinson's disease cell model. Journal of Chinese Integrative Medicine 5: 407-411. (Pretreatment with *Cistanche* extracts have a protective effect on the MPP*-treated SH-SYSY cell line, and its down-regulation of GADD153 may contribute to the effect.)


Winkler, E. and Heiniken, T. 2007. Spread of an ant-dispersed annual herb: an individual-based simulation study on population development of *Melampyrum pratense*. Ecological Modelling 203: 424-438. (Describing the development of a model for the spread of *M. pratense* in a forest habitat in NE Germany and concluding that dispersal of seeds by ants over distances of 1-2 m was indispensable for explaining the observed population spread.)


Ye Guan, Peng Hua, Fan MingSong and Huang ChengGang 2007. Ellagic acid derivatives from the stem bark of *Dipentodon sinicus*. Chemistry of Natural Compounds 43(2): 125-127. (Describing a number of new ellagic acid derivatives from *D. sinicus* (Santalales).)


Zermane, N., Souissi, T., Kroschel, J. and Sikora, R. 2007. Biocontrol of broomrape (Orobanche crenata Forsk. and Orobanche foetida Poir.) by Pseudomonas fluorescens isolate Bf7-9 from the faba bean rhizosphere. Biocontrol Science and Technology 17: 483-497. (Among 337 bacterial samples isolated from Orobanche plants and from faba bean rhizosphere, strain Bf7-9 of Pseudomonas fluorescens showed high biocontrol activity against both O. crenata and O. foetida, and positively influenced faba bean growth. P. marginalis strain Nc1-2 also reduced O. crenata.)


(N.B. over 20 other papers in the same journal, not listed here, report results with various proprietary products, each containing 4 to 16 ingredients which included Cuscuta chinensis seeds, and/or in some cases Cistanche deserticola, Scruurula parasitica, Santalum album or Cynomorium songaricum, for treatment of a wide range of problems including diabetes, chronic obstructive pulmonary disease, infertility in women, vascular dementia, chronic aplastic anaemia, and cancer, generally with some beneficial effect.)
MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

I am pleased to announce the results of the recent IPPS elections. But first, I want to thank everyone who participated in this important process, including anyone who made a nomination, agreed to be nominated, or voted in the election. Judging by the high level of interest and the quality of the nominees, we should feel very good about the health of our society.

Congratulations to Koichi Yoneyama, Hanan Eizenberg, and Julie Scholes for being elected to office. As described in the last issue of Haustorium, we have moved to a system in which we replace only half of the Executive Committee every two years in order to maintain continuity within the leadership. Thus, the full list of IPPS officers is now:

President – Jim Westwood (continuing)
Vice President – Koichi Yoneyama (newly elected)
Secretary – Hanan Eizenberg (newly elected)
Treasurer – Philippe Delavault (continuing)
Editor – Diego Rubiales (continuing)
Member at Large – Julie Scholes (newly elected)

I also want to express deep gratitude to Fred Kanampiu and Grama Dhanapal for their service to the society as Members at Large. Thanks also to Koichi Yoneyama for his work as Secretary, and we look forward to his continued involvement as Vice President.

With this new administration in place, I hope we can continue to build the society membership and activities. As you will notice from the articles and literature in this issue, the quantity and quality of work on parasitic plants is constantly increasing, and research on these organisms has never been more exciting. Please plan now to attend the 10th World Congress on Parasitic Plants, to be held in Kusadasi, Turkey June 8-12, 2009 (See the separate announcement in this issue). This conference is being organized by Diego Rubiales (Chair of the Scientific Steering Committee) and Ahmet Uludag (Chair of the Local Organizing Committee). It is a beautiful venue in which to enjoy great science.

Sincerely,

Jim Westwood, IPPS President

OROBANCHE CRENATA IN SUDAN: HISTORY, DISTRIBUTION AND MANAGEMENT

Faba bean (*Vicia faba*), has been planted in northern Sudan since time immemorial along the fertile strip of alluvial soils of the Nile valley extending north, on both banks of the Nile, from Khartoum to Wadi Halfa, 2800 km north on the Egyptian border. The crop is an important source of protein for a major sector of the populace, particularly in urban areas. It is also of significant economic importance to farmers. Other major crops in the area include lentil, chickpea, wheat, maize, tomato onion and berseem. The total area under leguminous crops is about 80 thousand hectares, 70% of it planted to faba bean, yielding about 70 thousand metric tons annually, constituting about 70% of the country's needs. Faba bean is a low input crop, unlike wheat, and farmers usually use no fertilizers; and the crop is not susceptible to bird damage. Furthermore, faba bean improves soil fertility and increases productivity of subsequent crops. The importance of faba bean in Sudan is expected to assume new dimensions as socioeconomic changes associated with population pressure, increased urbanization and immigrations to cities, increase demand. Moreover, the projected expansion of irrigated agriculture in northern Sudan, fostered by the recently constructed Hamdab dam, is expected to at least double the area under faba bean. More than 400,000 ha of land are expected to be brought under cultivation.

Production of faba bean is threatened by the root parasitic weed *Orobancha crenata*. The parasite is a recent introduction into Sudan and was first reported in 2000/2001 on an area of about 2 ha at Ed Debiba in...
Merowe governorate in northern Sudan. It was speculated that the parasite seeds were introduced, involuntarily, as contaminants of faba bean seeds from Egypt. Besides faba bean the parasite attacks several other legumes including lentil and chickpea. A limited survey undertaken in 2001/2002 over 158 ha in Ed Debiba revealed that 94% of the area under faba bean was infested. A second survey in 2002/2003 revealed that the parasite had spread into a stretch of about 60 kilometers along the Nile on either side of the original infestation. A third survey conducted in the Northern state in 2003/2004 showed that the parasite had spread along about 160 kilometers including El Selaia basin (the most important and productive area of faba bean in Sudan). Isolated infestation foci were reported in the bordering River Nile state. A national survey, undertaken at harvest, in 2004/2005 indicated that the infested area in the Northern state was about 9% of the total area (33.6 thousand ha) under faba bean. The infestation was highest in Merowe governorate where the parasite was first reported. In the River Nile State the parasite was reported from 28 sites, infesting 1% of the total area (33.734 thousand ha) under the crop. In both States infestation varied from light to heavy. A national survey conducted in 2005/2006 revealed the presence of the parasite in 99 sites in the River Nile State. Of these sites 35 were islands. The infested area had risen to 4.4% of the total area under faba bean. In the Northern State the parasite was reported from 20 sites. The decrease in number of infested sites in the Northern state is due to abandonment of faba bean planting.

The parasite was probably introduced in the 1990s when increased urbanization and market demands led to importation of faba bean from neighbouring countries. The high quality, and high price of some of the introduced varieties enticed farmers to grow them locally. The parasite, unnoticed, multiplied, naturalized and has become a problem. The wide spread of the parasite is consistent with its invasive nature, lack of natural enemies, lack of awareness about the parasite, its biology, reproduction, methods of spread, the nature of its association with its host, its debilitating effects, and a series of malpractices. Hand-pulled *Orobanche* spikes are piled in the fields, thrown into the river or onto adjoining roads. Fields were normally grazed immediately after harvest and crop residues were used as animal feed. Land is limited, and mono-cropping of faba bean is the predominant practice; individual holdings are small, 0.5-4 ha, farm equipment including tractors and threshers are in short supply and are in common use. Moreover, faba bean seeds from infested fields are transported over long distances and used for seeding. Spread of *Orobanche* species, as is the case with many invasive alien weeds, occurs through dispersal and repeated establishment of satellite foci from a founder population. Like other root parasitic weeds no single measure provides effective control and an integrated approach comprising preventive, cultural, biological and chemical methods needs to be adopted. Control of the parasites is further compounded by existence of hosts from among wild plant species. Apart from faba bean, chickpea and lentil the parasite is found growing on *Malva parviflora*, a common weed in northern Sudan, and on an *Euphorbia* species.

To-date *O. crenata* occupies a small proportion of the area under faba bean (4-9%). However, infestation foci are scattered all over the cultivated area. It is worth mentioning that the bulk of the area under faba bean is restricted to the Nile valley north of Khartoum. If the parasite is not contained and controlled faba bean production in Sudan will be at stake.

Education is the most important element in thwarting *Orobanche* spread. Farmers, professional agriculturists and policy makers should understand and recognize the consequences of allowing spread of *O. crenata*. For farmers who do not have an infestation, proactive prevention is their best management strategy. A regional project entitled ‘Training on *Orobanche* Management in Leguminous Crops’ (TCP/INT/3004) was sponsored by the FAO in the period 2004-2005. The project used Farmer Field Schools (FFS) as the primary means of increasing farmers’ awareness on crop production practices and *Orobanche* management. Nine FFS were supported by the programme. Farmers and policy makers, through training in FFS, back-stoppings, field visits, lectures, radio and television messages, leaflets, brochures articles in local news papers and a national workshop held in Khartoum in April 2005, were made cognizant of the parasite, its life-cycle, means by which the parasite spread, role of malpractices in the noticeable rapid spread of the parasites together with available methods of control. The importance of starting with clean crop seeds from known sources or cleaning seeds from unknown sources by sieving, washing with water and repacking in new clean containers prior to planting was emphasized. The role of *Orobanche* seed size, productivity, viability and seed bank in soil in the spread and perpetuation of the parasite together with the importance of crop rotation and detection surveys in *Orobanche* spread, control and decision making were stressed.

In general, movement of farm equipment from *Orobanche* infested areas into uninfested areas is restricted. Fields with light or spotty infestations may be cropped with faba bean but emergent *Orobanche* spikes are hand-pulled before seed shedding. However, in the case of heavy infestations crop rotation is obligatory.
Rotation with crops such as berseem, maize, wheat, onion and sorghum for several years is encouraged. Subsequent faba bean crops are sprayed with imazethapyr (50 g a.i./ha) as a pre-emergence treatment followed by two sprays of glyphosate (60 g a.i./ha) as post-emergence treatments. Three sprays of glyphosate alone (60 g a.i./ha each) as post-emergence treatments commencing at flowering are equally effective. Remaining Orobanche spikes are hand-pulled at harvest and fields are ploughed to discourage grazing.

Detection surveys, regulatory measures which focus on prevention of movement of viable seeds are recommended. To this effect the federal ministry of agriculture prohibits import of faba bean without prior consent. Importation is restricted to border trade and the imported seeds are to be examined and their freedom from Orobanche seeds has to be ascertained and certified. Local governments passed internal regulations prohibiting movement of faba bean seeds from infested areas into Orobanche-free areas. Animal grazing, movement of farm equipment (unless thoroughly cleaned) and use of crop residues from infested fields as animal feed are prohibited. Local governments also monitor and document O. crenata spread and distribution annually, locate infested sites, determine intensity of infestations and accordingly advise farmers on how to deal with infestations and on whether to plant faba bean next season or seek an alternate crop.

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LITERATURE HIGHLIGHT

Strigolactones - a new class of plant hormones?

A forthcoming issue of the journal Nature contains a remarkable pair of articles on strigolactones. Two research groups have arrived at the conclusion that these compounds play a role in suppressing branching in plants. Using sets of genetic mutants of pea, rice and Arabidopsis, they have demonstrated that mutants with a phenotype characterized by prolific branching are deficient in strigolactones, and conversely, that addition of GR24 restores the wild type branching pattern. Other researchers have previously proposed the existence of a new class of hormones that act in coordination with auxin and cytokinin to control axillary bud growth in plants, and it now seems that strigolactones – or their derivatives – correspond to these hormones.

Aside from the impact of this work on understanding plant development, it has implications for parasitic plant research. Among these is the realization that several genes important in not only strigolactone synthesis, but also its downstream signal transduction pathway, are already known and can be used to further understand mechanisms of strigolactone action. For long-time parasitic plant researchers the biggest impact of this news may be in realizing that strigolactone detection is not at all unique to parasitic plants. In fact, it would seem that the strigolactone hormone is an evolutionary ancient signal, dating back to the earliest branching plants. This may explain why so many plants produce strigolactones, regardless of whether they are hosts of parasites. Thus, parasitic plants are not unusual in being able to detect strigolactones, but rather are unique in having modified the signal to meet their needs for host detection.

With the contribution of these papers, three biological functions for strigolactones have now been shown. They suppress branching in plants, induce branching in arbuscular mycorrhizal fungi, and stimulate germination of parasitic plant seeds. There is certain to be an increase in work on these chemicals, and it will be interesting to see what develops next.


Jim Westwood

THE 5TH INTERNATIONAL WEED SCIENCE CONGRESS, 23-27 JUNE 2008, VANCOUVER CANADA.

A report on the session ‘Management of parasitic weeds’:

The successful management of parasitic weeds (Striga and Orobanche species) is a continuing challenge due to the complexities of the host-parasite interaction. Although many questions remain to be answered the papers presented in this session revealed new insights into host-parasite biology that will impact the design of control strategies in the future.
Kaori Yoneyama (University of Utsunomiya Japan) has been examining the effect of nutrient deficiencies (nitrogen and phosphorus singly and in combination) on the exudation of strigolactone germination stimulants, orobanchol, orobanchol acetate and 5-deoxystrigol from the roots of a range of plant species. Strigolactones not only stimulate germination of parasitic plants but are also responsible for hyphal branching of arbuscular mycorrhizal fungi. Kaori demonstrated that the effects of N and P deficiencies on strigolactone production by roots varied with plant species, for example, in Trifolium pratense and Medicago sativa P deficiency promoted exudation of orobanchol and orobanchol acetate whereas in sorghum 5-deoxystrigol production was increased by both N and P deficiency. The effects of nutrient deficiencies on the production of strigolactones has implications for management strategies based on improving soil fertility and may also provide an explanation for the observation that plants infected with mycorrhizal fungi appear to produce less strigolactones than uninfected plants.

Identifying host genotypes that provide resistance to Striga is a major focus of Striga research. Pyrimiding of resistance genes or Quantitative Trait Loci (QTL) for different types of resistance could be a cost effective control strategy. Heiko Parzies (University of Hohenheim, Germany) and colleagues from Africa have undertaken a large Marker Assisted Backcrossing (MAB) programme to introgress QTL for Striga resistance from a resistant sorghum durra line (N13) into adapted, farmer preferred sorghum varieties (FPSVs). Seven FPSVs from Kenya, Eritrea, Sudan and Mali were selfed twice following two backcrosses to produce many lines with up to four Striga resistance QTL. These lines are currently being evaluated for Striga resistance in field trials in Kenya, Sudan and Mali and initial results are very promising; in many lines Striga resistance is as good as that of the donor line N13. Heiko also reported that out crossing rates of some FPSVs varied with seed system and farmer management practices leading to clear recommendations for maintaining the stability of the improved varieties. Julie Scholes and colleagues (University of Sheffield UK) have identified sources of resistance in rice cultivars to Striga. QTL underlying the strong resistance phenotype in the cultivar Nipponbare to one ecotype (population of seeds) of S. hermonthica have been identified and will be of use in MAB programmes. It was clear however that a particular rice cultivar exhibited different degrees of resistance to different species and ecotypes of Striga and different rice cultivars exhibited different degrees of resistance to the same ecotype of Striga. An Amplified Fragment Length Polymorphism (AFLP) analysis was undertaken to genotype individual parasites (from one ecotype of S. hermonthica) growing on a very susceptible, a partially resistant and a highly resistant rice cultivar. The study revealed clear genetic differentiation between the subpopulations of Striga attached to the different host cultivars illustrating the importance of understanding the genetics of parasite virulence as well as host resistance (host-parasite specificity) in order to breed cultivars with durable resistance for use in different agro-ecosystems.

Successful and durable control of parasitic plants is likely to result from an integrated or combined control strategy. Abebe Menkir and colleagues (IITA, Ibadan, Nigeria) reported a study to combine a herbicide resistance gene with naturally occurring polygenic resistance to control S. hermonthica in maize. As well as improving the resistance of maize to Striga the combination of these control strategies should minimise the risk of the evolution of herbicide resistance in S. hermonthica populations. Inbred lines and experimental hybrids that combined the imazapyr resistance gene with polygenic resistance to S. hermonthica were developed and tested in the field. Under Striga infestation the best six herbicide resistant hybrids in combination with the herbicide seed treatment yielded approximately 8-10 times more grain per ha than the susceptible check cultivar. Even without the seed treatment the hybrids yielded 6 to 9 times more grain per ha than the susceptible check leading to the suggestion that the hybrids could be planted without seed treatment in infested fields in alternate years to delay the emergence of herbicide resistant S. hermonthica populations whilst still maintaining a good yield.

The development of a system to deliver Striga mycoherbicides (Fusarium oxysporum f.sp. strigae) and selected fungicides as a seed treatment to control both S. hermonthica and fungal diseases on maize was discussed by Abuelgasim Elzein (University of Hohenheim, Germany). Promising progress has been made in the development of the seed treatment technology. Some fungicides were compatible with the biocontrol agent and in field trials in West Africa significant reductions in Striga emergence were observed. A second study of the efficacy of Fusarium oxysporum f.sp. orthoceras for the control of Orobanche cumana was presented by Dorette Muller-Stover (University of Copenhagen). In pot experiments in a greenhouse, emergence of Orobanche was reduced by 80% in the presence of the biocontrol agent but in field trials in Israel and Bulgaria across two seasons results were more variable illustrating that the efficiency of the biocontrol agent was influenced by environmental conditions. Further work is underway to
identify the key biotic and abiotic factors affecting the success of the biocontrol strategy.

Herbicides are frequently used to control *Orobanche aegyptiaca* on tomatoes in Israel and the success of this control strategy is correlated with infestation level, and the rate and timing of application of the herbicide. In order to optimise the application of herbicides and to improve the efficacy of control in a field situation *Hanen Eizenberg* (ARO Ramat Vishay, Israel) described the development of a Decision Support System (DSS) named ‘Pick-It’ for use by farmers for the rational control of the parasite. Initial results look extremely promising and the system is currently being evaluated in commercial tomato fields.

There has been much interest in the possibility of engineering resistance to parasitic plants particularly by silencing parasite specific genes although success has been limited to date. *Radi Aly* (ARO, Newe-Yaar Research Centre, Israel) reported considerable progress in the silencing of a gene encoding mannose 6-phosphate reductase (M6PR) in *Orobanche aegyptiaca*. This enzyme is involved in the regulation of mannitol production in the parasite, a process essential for successful uptake of water and nutrients from the host. Tomato was transformed with a construct designed to silence the parasite M6PR gene. Following infection of the tomato plants with *Orobanche* RT-PCR revealed much lower levels of mRNA of M6PR in *Orobanche* tubercles (indicating some gene silencing) and a greater number of dead tubercles. These results are promising and the silencing of further parasite specific genes is being investigated.

Finally, *Kazuteru Takagi* (Osaka University, Japan) reported a study of the phytochrome A (phyA) photoreceptor in *Orobanche minor*. As *Orobanche* is non photosynthetic it was hypothesised that the signalling pathway related to photosynthetic control may be altered in this parasite in relation to a chlorophyll containing plant but that functions relating to morphogenesis would be retained. A comparison of the amino acid sequence of phyA from *Orobanche* and *Arabidopsis* revealed a large number of unique amino acid substitutions. The photoreponses of *Orobanche* and *Arabidopsis* were also shown to differ markedly suggesting a different function for the phyA photoreceptor in the two plants. Further analyses are currently underway using transcriptomics and metabolomics to further our understanding of the function of phyA in *Orobanche*. Julie Scholes, University of Sheffield.

**NOTE:** Several other sessions at the Congress included papers on parasitic plants. See below under MEETINGS for a full listing of all relevant papers and posters.

**MISTLETOE IN TUMOUR THERAPY: BASIC RESEARCH AND CLINICAL PRACTICE, 4TH MISTLETOE SYMPOSIUM**

Treatment with mistletoe preparations is one of the most important methods of complementary oncology. This is why the 4th international and interdisciplinary mistletoe symposium was held at the Europäisches Bildungszentrum Nonnweiler-Otzenhausen from 8th to 10th November 2007. More than 110 scientists and doctors from different therapy approaches and scientific disciplines, manufacturers of mistletoe preparations and representatives of authorities came together in the Europäisches Bildungszentrum Nonnweiler-Otzenhausen (Saarland) to present and discuss the current status of ‘Mistletoe in Tumour Therapy’, from basic research through to clinical practice, in 51 contributions. The symposium was organised and sponsored by the Karl und Veronica Carstens Stiftung and the Gesellschaft Anthroposophischer Ärzte in Deutschland (GAÄ – German Society of Anthroposophical Doctors) together with the Gesellschaft für Arzneipflanzenforschung (GA – Society for Medicinal Plant Research), Gesellschaft für Phytotherapie (GPhyt – Society for Phytotherapy), Deutsche Pharmazeutische Gesellschaft (DPHG – German Pharmaceutical Society) and Zentralverband der Ärzte für Naturheilverfahren und Regulationsmedizin (ZAEN – Central Association of Doctors in Naturopathic and Regulation Medicine). The Arbeitsgemeinschaft für Pharmazeutische Verfahrenstechnik (APV – International Association for Pharmaceutical Technology) was a co-operation partner. As in the previous three symposia, the organisational director was Dr. Rainer Scheer from Carl Gustav Carus-Institut in Niefern-Öschelbronn. The members of the scientific organisation committee were: Prof. Dr. Susanne Alban (Kiel), Prof. Dr. Hans Becker (St. Ingbert), Prof. Dr. Ulrike Holzgrabe (Würzburg), Prof. em. Dr. Dr. h.c. mult. Fritz H. Kemper (Münster), Prof. Dr. Wolfgang Kreis (Erlangen), Dr. Harald Matthes (Berlin) and Prof. Dr. h.c. mult. Heinz Schilcher (Immenstadt).

**Interdisciplinary symposium**

The diversity of standpoints of the organising associations and speakers lent this symposium its particular character. It took place in a constructive atmosphere, which is typical of this series of symposia held every four years. The aim of these meetings is to create a forum for discussion, enabling participants to
review current studies and the latest findings. It is hoped that doctors (whether in general or hospital practice), pharmacists and health insurance companies will get an idea of the use and current state of scientific knowledge about mistletoe extracts in basic research and therapy, but also identify their potential and their limitations. The symposia are also intended to bring about factually based dialogue and stimulate further research.

**Mistletoe preparations: good new studies**

The contributions dealt with current and important topics from the fields of biology, pharmacy and pharmacology. In detail, these involved the effects of different ingredients, immunological and clinical results as well as reports from clinical practice through to clinical trials aimed at identifying specific effects or demonstrating the efficacy of mistletoe preparations. As in the previous symposia, advances in the scientific as well as the medical sphere could be identified. The participation of a number of young researchers should again be highlighted. Naturally the eight summary papers, 33 short papers and 10 posters focused on clinical subjects. Prof. Dr. Stefan F. Martin (Skin Clinic, Freiburg University Hospital) talked about the dual role of inflammation in cancer: on the one hand the rather tumour-promoting effect of chronic inflammation and, on the other hand, the acute inflammation that can be exploited for therapeutic purposes, in relation to which the role of mistletoe preparations was discussed. The importance of mistletoe in oncology today was highlighted by two clinicians from the perspectives of anthroposophical medicine (Dr. Boris Müller-Hübenthal, Filderklinik, Filderstadt) and herbal medicine (Dr. Peter Holzhauer, Veramed-Klinik am Wendelstein, Brannenburg ). Other topics were studies on the efficacy and safe use of mistletoe preparations, alone or as an adjunct to standard oncology treatments (surgery, chemotherapy) with the aim of producing a beneficial effect on the immunosuppression caused by the standard therapies. Various instruments of clinical research were used, such as controlled (randomised and non-randomised) studies and cohort studies, but also observational studies which reflect everyday clinical practice more closely, as well as case histories and reports of clinical experience, mainly concerning breast cancer patients but other tumour entities as well. The patients’ quality of life, which was reduced by side effects associated with therapy and the disease, was improved in many cases.

The influence of mistletoe extracts on leukaemia and lymphomas was another focal point. Again there were clinical and preclinical reports that there are no identifiable risks of using mistletoe extracts in this context. Another presentation dealt with mistletoe therapy in paediatric oncology. In addition to the whole range of clinical trials, there were questions about dosage, pharmacokinetic studies, through to the development and validation of new mistletoe-specific instruments for clinical testing, such as Cancer Fatigue or Internal Coherence questionnaires, and the development of a database embracing both hospital and general practice, which is an instrument of health services research. Several speakers dealt with methodological questions. For instance, Dr. Matthias Rostock (Tumour Biology Clinic, Freiburg) presented results of the Cochrane Review, the latest meta-analysis in which 21 randomised clinical trials were comparatively reviewed. Dr. Gunver S. Kienle (Institute of Applied Cognitive Science and Medical Methodology, Bad Krotzingen) gave an overview of other systematic study reviews and their analysis, stressing that the critical evaluation of a therapy mainly depends on the quality of the method, meaningfulness in medical and medicinal terms and relevance to practice. It became clear from the discussion that comparisons should also take account of the diversity of the mistletoe preparations tested. It is difficult to conduct randomised clinical trials with mistletoe preparations because people often cannot be randomised, i.e. they are understandably reluctant to leave their therapy to chance, and because patients in the non-mistletoe group frequently still take mistletoe, which means the real difference from the mistletoe group is diminished. In addition, the dosage regimen in mistletoe therapy is usually determined on an individual basis, which is why this essential approach in clinical practice cannot always be tested in a rigid trial regimen. In his summary paper, Dr. Harald Matthes (Havelhöhe Community Hospital, Berlin) therefore contrasted health service research with randomised clinical trials and commented on the use of this instrument in complementary oncology.

It was particularly pleasing that the BfArM (Federal Institute for Drugs and Medical Devices) was represented at this symposium for the first time, in a presentation by Dr. Christiane Kirchner on the ‘Regulatory classification of mistletoe preparations’. The non-clinical part of the symposium was divided between pharmacy/biology and preclinical aspects. In the pharmaceutical section Prof. Dr. Wolfgang Kreis (Pharmaceutical Institute of Erlangen University) reported on advances in the structural analysis of ingredients of mistletoe. Other scientific reports covered particular characteristics of different mistletoe ingredients, their interactions with each other and galenical subjects such as liposomes and the further pharmaceutical development of mistletoe preparations. Biology was represented by chronobiological and specific questions about the host trees of mistletoe. In the preclinical sphere Prof. Dr. Reinhold Klein (Medical Clinic, Tübingen University Hospital) gave an overview...
of ‘Effects of mistletoe extracts on immuno-competent cells in vitro and in vivo’, while subjects covered in short papers and posters included apoptosis, cytotoxicity and again the exclusion of tumour stimulation by mistletoe extracts.

Abstracts freely available on the internet
The abstracts were published in English in the journal Phytomedicine (Elsevier-Verlag). The abstracts are freely available on the internet and can be downloaded as pdf files via www.ScienceDirect.com (go to Phytomedicine, Volume 14, Supplement 2) so that anybody with an interest in the subject can quickly find out all about the Mistletoe Symposium. In addition, the full text of all the contributions is expected to be published in a book by the end of 2008, which will appear in KVC Verlag Essen. Further information about the symposium can be found at www.mistelsymposium.de.

Next Mistletoe Symposium in 2011
In view of the success of this meeting, the participants and organisers agreed that the next Mistletoe Symposium should be held in November 2011, again in Nonnweiler.

Dr. Rainer Scheer, Carl Gustav Carus-Institut, Niefern-Oschelbronn

PRESS RELEASES

‘The witch is dead’
(Extract from IITA press release 5 May 2008)

IITA (International Institute for Tropical Agriculture) and its partners have found a way to control the scourge of witchweed (Striga hermonthica) in Sub-Saharan Africa through a biocontrol agent. Striga infests some 50 million hectares of cereal crops, ~ specifically maize, sorghum and millet, causing farmers an estimated US$ 7 billion in annual losses and affecting over 300 million people in the region. Developed by a team led by IITA plant pathologist Dr. Fen Beed with partners from the University of McGill (Canada) and University of Hohenheim (Germany), the technology utilizes certain strains of Fusarium oxysporum (F. oxysporum) to fight the parasitic weed. The technology is cheap, environment-friendly and safe as the fungus specifically targets witchweed. The fungal strains tested originated from Ghana, Mali and Nigeria but, like witchweed, they are common throughout semi-arid Africa. The fungus can be easily grown in sterile water containing sorghum waste. The hard part was finding a way to coat seeds with it. Through experimentation, the team found that spores of the fungus can be mixed with liquefied gum Arabic - an organic adhesive extracted from trees and commonly found in many SSA countries - without harming the fungus. The mixture is coated onto the seeds, dried then planted. The fungus remains viable for long periods, making the seeds amenable to storage. The fungus could also be directly dispersed into soil holes where the seeds are to be planted. The treated seeds produce crops that are free of the parasitic weed.

‘We cannot say that the witch is dead or soon will be,’ Beed says, ‘but we definitely have found an extremely effective component of an Integrated Pest Management strategy to kill her- and one that is safe, practical, affordable and sustainable for farmers.’ However, he cautions that the technology is not a one-off and stand-alone solution to the witchweed problem. He says that the technology ‘has a greater chance of success if combined with other approaches such as the use of resistant varieties, pre-emergence herbicides and adding organic matter to the soil, thereby improving its richness and providing an environment that is conducive to beneficial microorganisms such as the biocontrol fungus,’ ‘Now that we have a cost-effective method to control witchweed, the next step is to scale out its use and to get it into the hands of farmers at the soonest possible time’, he ends.

(We hope to have further news of this development in the next issue – Ed.)

‘Fighting the parasitic weed Striga’

Scientists from Kansas State University have developed a method that could contribute to the international effort to eradicate Striga, a parasitic weed, from African fields. The weed costs $6 billion in crop damage every year in Africa. Underground, Striga parts connect to sorghum roots and feed on them, reducing yield dramatically and sometimes even destroying entire fields.

The method involves treating sorghum seeds with an inexpensive, low-toxic herbicide. "As the sorghum grows, the seed treatment will kill the Striga. All of these new technologies are being developed in Manhattan, and we are testing the seeds in Africa to select the right herbicide, rate, landrace, seed treatment, and other factors," explained Kassim Al-Khatib, one of the scientists involved in the study. Treated seeds are currently being tested in Mali and Niger with successful results.

The news article is available at http://www.oznet.ksu.edu/news/topstory.asp (from CropBiotech Update March 19, 2008)
‘Crop breeders on verge of beating Africa’s most noxious weed using cutting edge science technique’

Nairobi, Kenya - Agricultural researchers have successfully identified and transferred genes that confer resistance to Africa’s most deadly weed (*Striga*) using the novel marker assisted selection technique successfully for the first time in the history of crop breeding in Africa.

Researchers have managed to confer resistance to *Striga* in sorghum, overcoming a barrier that has for decades held back scientists’ efforts to protect key food crops - sorghum, millet, maize and rice, from this destructive weed. These crops are primary food sources for 300 million people across sub-Saharan Africa.

*Striga* (*Striga hermonthica*), also known as witchweed, destroys between 40 to 100 percent of a complete season’s crop, its annual crop damage across Africa estimated at seven billion dollars (US$7 billion). Currently, the weed threatens to wipe out cereal crops in most of Western Kenya and Eastern Uganda, national agricultural research institutes in the two countries have warned.

"Scientists have searched for the solution to *Striga* damage using a variety of methods, but without much success," says Dr Dionysious Kiambi, a molecular geneticist with the International Crops Research Institute for Semi-Arid Tropics (ICRISAT). "Through marker assisted selection, we have determined the precise segments of the sorghum genome known to confer *Striga*-resistance and have transferred them to farmer-preferred varieties through conventional breeding with very promising results".

Marker assisted selection is a new technique which entails use of genetic landmarks (markers) to tag and transfer specific genes or group of genes that control characteristics of interest such as improved crop productivity, resistance to diseases or pests, or tolerance to stresses like floods and drought. This is the first time the technology has been used successfully for crop improvement in Africa.

ICRISAT scientists has been working with national and international collaborators for several years experimenting with marker assisted selection in search for *Striga* resistance genes from other sorghum varieties conserved in gene-banks across the world. They found one sorghum variety (N13), that is neither high-yielding nor drought-tolerant, to possess the highly sought after *Striga*-resistance genes.

Segments of the N13 sorghum DNA containing genes for *Striga*-resistance were tagged with markers and crossed with farmer varieties using conventional breeding. The use of markers enabled scientists to precisely transfer only the *Striga*-resistance genes to farmer-preferred sorghum varieties without jeopardising farmer-desired characteristics such as drought-tolerance and higher yields.

"We had to make sure that other genetic information from N13 was not transferred to farmer varieties alongside the qualitative trait loci with *Striga*-resistance. We were not replacing any genetic components of farmer varieties, we are just adding to it," says Dr Kiambi. "The resulting variety is almost identical to the original farmer variety plus the component that confers *Striga* resistance."

ICRISAT has been collaborating with scientists from the University of Hohenheim in Germany and national agricultural research institutes of Eritrea, Kenya, Mali and Sudan. The team has to date created five *Striga*-resistant sorghum varieties whose initial trials on-station have been able to ward off *Striga* attacks, some as effectively as the donor parent, sorghum N13. In Kenya, Mali and Sudan, scientists are currently testing the new witchweed-resistant varieties in farmer fields.

Researchers in Africa have for decades experimented with a number of "potentially successful" techniques for managing this deathly weed including breeding for *Striga* tolerance in various crops, promotion of rotational cropping of cereals with legumes such as groundnuts, cowpeas and soybean in order to break the weed’s breeding circle, as well as the use of biological and herbicidal control methods.

Africa’s resource-poor farmers manage *Striga* primarily by weeding, a pointless, back-breaking activity which comes too late. By the time the crop sprouts, the weed, whose seeds reside in the soil, has long-since attached to plant roots and begun sapping off plant nutrients in earnest. *Striga* is a prolific seed producer, whose seeds lie dormant in the soil for up to two decades.

Crop breeders are enthusiastic about marker assisted breeding because it significantly reduces the duration required to produce improved crop. While conventional breeding is a hit-or-miss technique that requires scientists to wait for the crops to grow to maturity in order to observe expression of desired traits like *Striga*-resistance, marker assisted breeding enables scientists to check for the transfer of the trait as early as when the plant is only two weeks old, and focus on plants with the desired trait. This has more than halved the amount
of time crop breeders need to develop improved varieties.

If the on-station results are successfully replicated on-farm, Africa's biggest cereal crop menace - *Striga* - may well be reigned in, boosting agricultural production, food security and farmer incomes across the continent.

**Plant parasite ‘wiretaps’ host**

The following is adapted from a press release dated July 30, 2008:

New research shows that chemical signals from the host, called RNA, plant pass deep into the parasite, dodder (*Cuscuta* spp.). A parasitic plant that sucks water and nutrients from its plant host also taps into its communications traffic, a new report finds. The research could lead to new ways to combat parasites that attack crop plants. Professor Neelima Sinha and colleagues at the UC Davis Section of Plant Biology studied dodder vines growing on tomato plants in the lab. They found that RNA molecules from the host could be found in the dodder up to a foot (30 cm) from the point where the parasite had plumbed itself into the host.

Plants often use small RNA molecules as messengers between different parts of the plant. In a paper published in Science in 2001, Sinha's group showed that RNA could travel from a graft into the rest of the plant and affect leaf shape. Plants can also use specific RNAs to fight off viruses. Picking up these RNA messengers could help the parasite synchronize its lifecycle with that of the host plant, Sinha said. "It might be important for the parasite to know when the host is flowering, so it can flower at the same time," before the host dies, she said.

Sinha's lab holds a grant from the Rockefeller Foundation to research plant parasites, notably *Striga*, which attacks maize crops in Africa. *Striga* cannot be imported into the U.S., so dodder serves as a model system. Ultimately, the researchers hope to use host RNA to trigger a change in the parasite that kills it or makes it less damaging, Sinha said. Finding that host RNA molecules are transported through the parasite is a step in characterizing the system, she said.

A paper describing the work is published online by the journal New Phytology. Co-authors on the paper are UC Davis postdoctoral researcher Rakefet David-Schwartz, graduate students Steven Runo and Brad Townsley, and Jesse Machuka of Kenyatta University, Kenya.

**REVIEWS**


This profusely illustrated book is a worthy successor to Job Kuijt’s seminal Parasitic Flowering Plants, published in 1969 and widely acknowledged as the beginning of modern research on parasitic vascular plants. So it is fitting that this volume should be dedicated, in part, to Job Kuijt and to share the same title as his book.

Like its worthy predecessor, Heide-Jørgensen’s volume covers most areas of these plants’ biology. Reflecting the author’s earlier work on anatomy, the structure of the haustorium is well described both with excellent micrographs as well as helpful interpretive diagrams. The section on *Parasitaxus usta*, based on the careful work of Feild, will help to finally clarify the nutritional relationships of this mycotroph which lives in close association with its fungal component and another gymnosperm, *Falcatifolium taxoides*.

The bulk of the book is a survey of the families and a majority of the genera of parasitic plants. Each genus treatment covers the taxonomy, distribution, floral biology, animal interactions, and a large amount of other data. The taxonomic hierarchy is based on the phylogeny of the Angiosperm Phylogeny Group at the time of writing. Thus, Rafflesiaceae, for example, no longer includes *Pilostyles* and other groups. The parasitic Scrophulariaceae are placed in the Orobanchaceae (though at least once referred to as parasitic scrophs). Reflecting recent research, there is a section on the role of parasitic plants in their respective ecosystems as well as a chapter on crop parasites. All of these treatments have copious full color illustrations taken by parasitic plant researchers throughout the world.

Going through this book is like seeing one a favorite black and white movies in color as so much of the work reviewed here was first published in black and white.
Among these are the careful investigations of the parasitism of *Exocarpos* by Fineran, numerous studies by Kuijt, and many others. So much information has been garnered and presented in color for the first time.

The quality of the color reproductions deserves note. I have seen many of the plants in the field and therefore am pleased at the accuracy of the color reproduction. Kudos to the publisher for such wonderful color!

While attempts are made for the book to be accessible to the non-specialist, in reality this is a book for botanists. Including a box to explain the plant cuticle and a box for photosynthesis do little for the non-biologist. Asterisks by such words as endemic that lead the reader to the glossary are a distraction. While the text is unappetizing, the book is such a sumptuous presentation of the wonderful form and color and charm of these plants that a non botanist can feast on it.

On the other hand, the professional botanist who might consider this as a source for literature references will be sorely disappointed. For reasons not clear, the literature cited section is truncated and uneven. There are numerous references, for example, to Heide-Jorgensen’s work and that of Fineran but not a single citation for De Pamphilis or Nickrent who have both contributed so much to our understanding of evolution and phylogeny of parasitic plants. Many other examples could be noted.

It is unfortunate that such a volume was not more carefully edited. There are numerous spelling errors (Californica for California, *Ogyris* for *Osyris*, New Yersey for New Jersey, and so many more.

This is an expensive book at 99 Euros but not excessive considering the hundreds of full color pictures.

To many of us, Kuijt’s classic cannot be improved on even though it is almost forty years old and black and white. The heuristic value of that work has proven remarkable over the decades. I wish the same for Heide-Jorgensen’s book which will be required reading for every parasitic plant worker.

Lytton John Musselman, Old Dominion University.


My first response to this review was amazement at how different the content was compared to mistletoe literature I reviewed ten and twenty years ago. At that time, to use the words of the present authors, mistletoe was much more of a fiend then a friend. Mistletoe taxonomy was also a lot less complicated and, as is obvious from this review, poorly understood. In short, this is a valuable, readable account of mistletoes.

The overall biology of mistletoes is treated and the reader is given a clear understanding of the parasitic life style followed by the pathogenic effects of these parasites, an area of research especially well studied in the Pacific Northwest region of the United States.

A survey of mistletoe taxonomy and phylogenetics occupies almost one quarter of the body of the text—a section that some readers will find wearying but information that is nonetheless essential to understand the groups, especially since so much has been learned only in the past few years and has yet to find its way into the literature.

Another aspect of mistletoes that is receiving considerable study, well reviewed in this paper, is their role in ecosystems. For example, it has been shown that some mistletoes sequester elements in their leaves that help nourish the host tree when those fall. On the other hand, trees that are heavily infested with mistletoes can have decreased populations of mychorrhizal fungi. The relationship with fire, an essential factor in many of the plant communities where mistletoes occur, is explained.

In contrast to many earlier papers, control of mistletoes is covered rather briefly but there is consideration of management for control by removing mistletoes (manual removal is still the best way) and management for wildlife habitats and as endangered species. And a few mistletoes are managed for commerce including those harvested for wood roses and Christmas decorations.

This helpful well-illustrated review will be the main reference for anyone interested in mistletoes. With more than 200 references, it is a valuable resource for plant pathologists, parasitic plant specialists, ecologists, and anyone drawn to these fascinating plants.

Lytton John Musselman, Old Dominion University
MEETINGS

5th International Weed Science Congress, Vancouver, Canada, 22-27 June, 2008. Posters and papers on parasitic plants presented at this meeting were as follows. Proceedings (abstracts) from the meeting will be available on a web-site yet to be announced. Meanwhile a CD can be purchased via the IWSS website (http://iws.ucdavis.edu/) – click HERE to update membership – click BUY – change number of years membership to 0 – enter $15 payment if a member, $25 if not.

Posters:
Mitra Ghotbi et al. - Comparison of nutritional effects on sporulation, desiccation tolerance and virulence of two isolates of *Fusarium oxysporum* in order to introduce an effective biocontrol agent of *Orobanche aegyptiaca*.

Khalid Hameed et al. - Biological control of broomrape (*Orobanche cernua*) seed germination utilizing an indigenous actinomycete isolate in Jordan.

Abuelgasim Elzein et al. - Does vacuum-packaging atmosphere enhance shelf-life of *Striga*-mycoherbicidal products containing *Fusarium oxysporum* f.sp. *stigae* during storage.

Mustapha Haidar and Chadi Gharib - Companion barley for *Orobanche crenata* control in organic broad bean.

Eva Kohlschmid et al. - *Fusarium oxysporum* - an antagonist of the holoparasitic weed *Orobanche ramosa*.

Gualbert Gbe’hounou et al. - Discovery of *Merremia tridentata* subsp. *angustifolia* as a wild host of *Striga gesnerioides* in the Republic of Benin: a benefit of Farmer Field School.

Hilary Sandler - Importance of germination patterns and herbicide application for the control of swamp dodder, *Cuscuta gronovii*, in Massachusetts cranberry production.

Benesh Joseph et al. - GR24 induces germination through distinct metabolic changes in *Orobanche minor* seeds.

Yaakov Goldwasse et al. - Disinfection of broomrape seeds on agricultural equipment with didecyldimethyl ammonium bromide.

Zoheir Ashrafi et al. - Effect of soil solarization, a nonchemical method, on the control of Egyptian broomrape (*Orobanche aegyptiaca*) and yield improvement in greenhouse grown cucumber.

Jamal Qasem - Parasitic weeds of the Orobanchaceae family and their natural hosts in Jordan.

Korne et al. - Host and habitat specificity of the *Cuscuta* species in Hungary.

Jamal Qasem - Mistletoes (*Viscum cruciatum* Siebr. ex Boiss. and *Loranthus acaciae* Zucc) and their hosts in Jordan.

Sirus Hasannejad et al. - *Erwinia carotovora* as a stimulant agent for *Orobanche aegyptiaca*.

Sirus Hasannejad et al. - Evaluation of *Erwinia carotovora* and three isolates of *Fusarium oxysporum* as biological control agents of Egyptian broomrape (*Orobanche aegyptiaca*).

Oumar Ouedraogo - Biological control of *Striga hermonthica* by the use of *Polygala rarifolia* on maize in Burkina Faso.

Girija Vijayaraghavan and Chirathadam Abraham - Phanerogamic parasite on fruit crops of Kerala.

Tom Lanini - Dodder (*Cuscuta pentagona*) control in processing tomato (*Lycopersicon esculentum*).

Sirus Hasannejad and Saber Mirzaii - Effects of some medicinal plant extracts on *Orobanche cernua* seed germination.

Ahmet Uludag and Yildiz Nemli - Parasitic flowering plants in Turkish flora.

Friday Ekeleme et al. - The Influence of sowing date and *Striga hemonthica* on the yield of different varieties of sorghum (*Sorghum bicolor*).

Somayeh Foruzesh et al. - Evaluating the possibility of chemical control of broomrape.

Nadia Zermame - New options for biocontrol of parasitic weeds of the genera *Orobanche* and *Cuscuta*.

Majid Amini Dehghi et al. - Host-range and factors enhancing the virulence and desiccation tolerance of *Fusarium oxysporum* as promising biocontrol agent of *Orobanche aegyptiaca*.

Barakat Abu Irmaileh - *Trichoderma* is a promising bioagent for controlling *Orobanche* in tomato.

Mou-Yen Chiang et al. - Host-specific *Colletotrichum* for control of field dodder (*Cuscuta campestris*).

Paul But et al. - A tale of three dodders for the biocontrol of *Mikania micrantha* in Hong Kong.

Paul But et al. - Application of fresh vegetative cuttings of dodders for the biocontrol of *Mikania micrantha*.

Oral presentations:
Rosemary Ahom et al. - Management of *Striga hermonthica* (Del) Benth in *Zea mays* with *Sesamum indicum* and *Glycine max* as intercrops and nitrogen fertilization in Benue State, Nigeria., University.

Julie Scholes - Can resistant cereals solve the *Striga* weed problem in Africa.

Kazuteru Takagi et al. - Photoresponse analysis of phytochrome A in a non-photosynthetic parasitic plant, *Orobanche minor* Sm.
Radi Aly et al. - Gene silencing of mannose 6-phosphate reductase in the parasitic weed Orobanche aegyptiaca.

Kaori Yoneyama et al. - How mineral nutrients affect the exudation of strigolactones, germination stimulants for root parasitic weeds.

Hanan Eizenberg et al. - Developing a decision support system (DSS) for Orobanche aegyptiaca control in tomato.

Heiko Parzies et al. - Introgression of quantitative trait loci (QTL) for Striga resistance into adapted sorghum landraces through marker assisted backcrossing in sub-Saharan Africa.

Abebe Menkir et al. - Combining an herbicide resistance gene with natural polygenic resistance to control Striga hermonthica (Del.) Benth in maize.

Abuelgasim Elzein et al. - Co-delivering of Striga-mycorrhicides with fungicides using seed treatment technology: compatibility, field efficacy and implication.

Dorette Müller-Stöver et al. - Field applications of F. oxysporum f.sp. orthoceras for the control of Orobanche cumana Wallr.

Dionyssia Lyra et al. - Exploratory spatial analysis of noxious Orobanche data in Greece.

Kassim Al-Khatib et al. - Managing Striga infestation with metsulfuron and imazapyr seed treatments in grain sorghum landraces through marker assisted backcrossing in sub-Saharan Africa.

Aijan Jusupova et al. - Control of the field dodder on sowings of sugar beet and alfalfa.

Koichi Yoneyama et al. - Characterization of strigolactones, plant derived signals for symbiosis and parasitism.

Chad Brommer et al. - Strategies and innovations in the control of Striga asiatica.

Forthcoming Meetings


The organizers are: Jakub Tesitel, Milan Stech and Jan Leps, Dept. of Botany, Faculty of Science, University of South Bohemia. (A report on this meeting will be included in the next issue)

The Conference ‘Managing Parasitic weeds: integrating science and practice’ will be held in Ostuni – Italy, 21-26 September 2008. Jointly organised by OECD and EWRS. Full details were provided in Haustorium Extra2 mailed 13 May, 2008.

Co-Directors:
Maurizio Vurro, Bari, Italy - maurizio.vurro@ispa.cnr.it
Jonathan Gressel, Rehovot, Israel - jonathan.gressel@weizmann.ac.il

The 10th World Congress on Parasitic Plants will be held in Kusadasi, Turkey, June 8-12, 2009. Contribution and participation from researchers, industry and all relevant people on any weedy or non-weedy parasitic plants is encouraged. The programme will consist of oral presentations and posters. Oral presentations will be invited or selected from submitted preliminary abstracts. Contact for scientific queries: Ahmet Uludag (secretary@ippsippsturkey.com). For registration and accommodation queries: Deniz Yanar Servi (info@ippsturkey.com). Or refer to the conference website: www.ippsturkey.com.

Canopy Conference, Bangalore, October 2009—mistletoe session

Dear colleagues interested in mistletoes,

The organizers of this conference are looking into the possibility of organizing a symposium on the topic of canopy biota that exist in human-affected habitats, particularly in pasture trees, plantations, secondary forests, and urban habitats. The symposium could also address canopy animals and micro-organisms. Such topics as forest fragmentation, genetic isolation, and restoration ecology could be addressed. This topic could be of considerable interest to many persons engaged in mistletoe work and would fit very well with the objectives of the IUFRO working group on mistletoes. India would be an interesting place to visit, because it has a high diversity in mistletoes and quite a few colleagues there are interested in mistletoes.

If anyone is interested to contribute to a mistletoe session at the Canopy Conference 2009, could they please send the following information to Prof. Glatzel before October 4, 2008:

Ref.: mistletoe session, Bangalore
Name, E-mail address, WEB-link
Topic/title of a possible contribution
Could you help in organizing?

Professor Gerhard Glatzel
Institute of Forest Ecology, UNI BOKU Vienna
Peter Jordan-Strasse 82, A-1190 Vienna, Austria
email: gerhard.glatzel@boku.ac.at
GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the 10th World Congress on Parasitic Plants in Turkey, 2009, see: http://www.ippsturkey.com/

For abstracts from the 9th World Congress on Parasitic Plants see: http://www.cpe.vt.edu/wcopp/index.html

For information on the International Parasitic Plant Society, past and current issues of Haustorium, etc. see: http://www.ppws.vt.edu/IPPS/

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasite site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Lytton Musselman’s Hydnora site see: http://www.odu.edu/webroot/instr/sci/plant.nsf/pages/lecturesandarticles

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes) see: http://www.rmrs.nau.edu/mistletoe/

For information on the 2nd symposium ‘Biology of Non-weedy Hemiparasitic Orobanchaceae’ see: http://botanika.prf.jcu.cz/hemiparasites

For information on the 10th World Congress on Parasitic Plants in Kusadasi, Turkey, June 8-12, 2009, see: www.ippsturkey.com

For information on the 10th World Congress on Parasitic Plants in Kusadasi, Turkey, June 8-12, 2009, see: www.ippsturkey.com

For information on the EU COST 849 Project and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/

For the Parasitic Plants Database including ‘4000 entries giving an exhaustive nomenclatural synopsis of all parasitic plants’ (last updated 2003), the address is: http://www.omnisterra.com/bot/pp_home.cgi

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net

For information on EC-funded project ‘Improved Striga control in maize and sorghum (ISCIMAS)’ see: http://www.plant.dlo.nl/projects/striga/

For the work of Forest Products Commission (FPC) on sandalwood, see: www.fpc.wa.gov.au

For past and future issues of the Sandalwood Research Newsletter, see: www.jcu.edu.au/school/tropbiol/srn/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, see: http://africancrops.net/striga/

To view the list of presentations and participants at the Striga meeting in Addis Ababa, November 2006, see: http://www.agry.purdue.edu/strigaconference/index.htm

For information on the 5th International Weed Science Congress, June, 2008, in Vancouver, Canada see: http://iws.ucdavis.edu/5intlweedcong.htm

LITERATURE

* indicates web-site reference only


Abbes, Z., Kharrat, M., Delavault, P., Simier, P. and Chaïbi, W. 2007. Field evaluation of the resistance of some faba bean (Vicia faba L.) genotypes to the parasitic weed Orobanche foetida Poiret. Crop Protection 26(12): 1777-1784. (Reporting 3 lines of faba bean with resistance to the increasing problem of O. foetida in Tunisia; Baraca (also resistant to O. crenata), Bader and XBJ90.03-16-1-1-1.)

banche.htm (A useful review of the extent and seriousness of *Orobanche* infestations in Europe and the Near East, prepared under the FAO Project TCP/INT/3004. Including the information that *O. crenata* is becoming a serious problem in Sudan.)


Akiyama, K. and Hayashi, H. 2006. Chemical identification of strigolactones as a host-recognition signal for arbuscular mycorrhizal fungi. Regulation of Plant Growth & Development 41(2): 141-149. (An earlier paper on this topic, not previously noted.)


Amico, G.C., and Nickrent, D.L. 2007. A molecular phylogeny of the mistletoe genus *Tripodanthus* (Loranthaceae). Darwiniana 45: 61-63. (Using chloroplast DNA sequences, plants of *T. acutifolius* from Peru and Bolivia occurred in a clade sister to *T. flagellaris* from Argentina, and this clade was sister to plants of the former species from Brazil and eastern Argentina, thus rendering *T. acutifolius* paraphyletic.)

Amico, G.C. and Nickrent, D.L. 2007. Phylogeography of the Argentine mistletoe, *Ligaria cuneifolia* (Loranthaceae). Darwiniana 45: 63-64. (Chloroplastic DNA sequences obtained from 33 localities show this species is monophyletic with two plants from Peru being sister to the remaining clades from Argentina, Bolivia, Brazil, and Chile.)

Amusan, I.O., Rich, P.J., Menkir, A., Housley, T. and Ejeta, G. 2008. Resistance to *Striga hermonthica* in a maize inbred line derived from *Zea diploperennis*. New Phytologist 178(1): 157-166. (Penetration of *S. hermonthica* was largely prevented at the endodermis of the selected inbreds, while those that did penetrate showed reduced growth.)


Ashawat, M.S., Saraf Shailendra and Saraf Swarnlata 2007. Biochemical and histopathological studies of herbal cream against UV radiation induced damage. Trends in Medical Research 2(3): 135-141. (Showing useful protective effects from a cream containing many ingredients including *Euphrasia officinale*.)

Asiach, O., Nurhannah, M.Y. and Mohd Ilham, A. 2007. Determination of bioactive peptide (4.3 kDa) as an aphrodisiac marker in six Malaysian plants. Journal of Tropical Forest Science 19(1): 61-63. (Results suggest that a *Rafflesia* sp. may contain a bioactive peptide that increases the testosterone level in rat Leydig cells.)


Babalola, O.O. and Odhiambo, G.D. 2008. Effect of inoculation with *Klebsiella oxytoca* ‘10mkr7’ on
Striga suicidal germination in Zea mays. World Applied Sciences Journal 3(1): 57-62. (In a pot study, inoculation with the rhizobacterium K. oxytoca increased Striga infestation in maize. Abstract suggests K. oxytoca ‘could stimulate suicidal germination’ but not clear if this was observed.)


Bar-Nun, N., Sachs, T. and Mayer, A.M. 2008. Another new species of Orobanche (Rafflesiaceae) from Luzon, Philippines: R. leonardi. Blumea 53: 223-228. (This is the eighth new species to be named from the Philippines and the fourth from Luzon Island.)

Barcelona, J.F., Pelser, P.B., Cabutaje, E. and Bartolome, N.A. 2008. A new species of Rafflesia (Rafflesiaceae) from Luzon, Philippines: R. leonardi. Blumea 53: 223-228. (This is the eighth new species to be named from the Philippines and the fourth from Luzon Island.)


Brand, J.E., Fox, J.E.D., Pronk, G. and Cornwell, C. 2007. Comparison of oil concentration and oil quality from Santalum spicatum and S. album


Brault, M., Betsou, F., Jeune, B., Tuquet, C., Sallé, G., Braby, M.F. and Nishida, K. 2008. Safety response of stimulated B-CLL lymphocytes of *O. ramosa* in rapseseed, tobacco and hemp, and detecting the existence of 3 pathovars, having greatest virulence on their respective host crops.


Burdock, G.A. and Carabin, I.G. 2008. Safety assessment of sandalwood oil (*Santalum album* L.). *Food and Chemical Toxicology* 46(2): 421-432. (Sandalwood oil has anticarcinogenic, antiviral and bactericidal activity but is not mutagenic. There is occasional irritation or sensitization but the authors conclude that the oil is safe at present use levels.)


Chen, S.Y., Kuo, S.R., Chien, C.T., Baskin, J.M. and Baskin, C.C. 2007. Germination, storage behaviour and cryopreservation of seeds of *Champeerea manillana* (Opiliaceae) and *Schefflera octophylla* (Araliaceae). *Seed Science and Technology* 35(1): 154-164. (Seeds of *C. manillana* lost viability faster at -20°C than at 4 or 15°C, but retained full viability in liquid N (-196°C) for 12 months.)

Chen Hong, Jing FuChun, Li ChangLing, Tu PengFei, Zheng QiuSheng and Wang ZhengHua 2007. Echinacoid prevents the striatal extracellular levels of monoamine neurotransmitters from diminution in 6-hydroxydopamine lesion rats. *Journal of Ethnopharmacology* 114(3): 285-289. (Concluding that an extract from *Cistanche salsa* could be of value in treating Parkinson’s disease.)


Choi SangHoon, Park KwanHa, Yoon TaekJoon, Kim JongBae, Jang YongSuk and Choe ChungHyeon 2008. Dietary Korean mistletoe enhances cellular non-specific immune responses and survival of Japanese eel (*Anguilla japonica*). *Fish & Shellfish Immunology* 24(1): 67-73. (Concluding that KM-110, an extract of *Viscum album var. coloratum* could be utilized as a promising immuno-stimulating substance for a diet in aquaculture.)


David-Schwartz, R., Runo, S., Townsley, B., Machuka, J. and Sinha, N. 2008. Long-distance transport of mRNA via parenchyma cells and phloem across the host-parasite junction in *Cuscuta*. New Phytologist 179: 1133-1141. (Showing movement of mRNAs from tomato and alfalfa into dodder and indicating host parenchyma cells as origins for the messages: mRNA was stable up to 20 cm in the host. See also item above ‘Plant parasite wiretaps host.’)


Davis, C.C., Latvis, M., Nickrent, D.L, Wurdack, K.J. and Baum, D.A. 2007. Floral gigantism in Rafflesiaceae. Science 315: 1812. (Using over 11,000 bp of sequence data, Rafflesiaceae s. str. were nested within Euphorbiaceae. Quantitative analyses of floral size evolution showed a 79-fold increase over 46 million year period.)


de Groote, H., Wangare, L., Kanampiu, F., Odendo, M., Diallo, A., Karaya, H. and Friesen, D. 2008. The potential of a herbicide resistant maize technology for *Striga* control in Africa. Agricultural Systems 97(1/2): 83-94. (A survey designed to assess the potential for introduction of imazapyr-resistant maize established that 70% of farmers in the *Striga*-prone area of 246,000 ha in W. Kenya have *Striga* and most would be willing to purchase the seed, suggesting a demand for at least 2000 tons annually.)


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Escher, P., Peuke, A.D., Bannister, P., Fink, S., Hartung, W., Jiang Fan and Rennenberg, H. 2008. Transpiration, CO₂ assimilation, WUE, and stomatal aperture in leaves of Viscum album (L.): effect of abscisic acid (ABA) in the xylem sap of its host (Populus x euramericana). Plant Physiology and Biochemistry 46(1): 64-70. (Showing that raised levels of ABA in the droughted host do not influence levels in the parasite; also that ABA levels in leaves of V. album are relatively high and it is presumed the stomata have low ABA-sensitivity.)


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Fernández-Aparicio, M., Emeran, A.A. and Rubiales, D. 2008. Control of Orobanche crenata in legumes intercropped with fenugreek (Trigonella foenum-graecum). Crop Protection 27(3/5): 653-659. (Concluding that inhibition of germination by allelochemicals from fenugreek roots may explain the reduction of O. crenata infection (confirmed by Evidente et al., 2007 – see Haustorium 52).)


Frajman, B. and Schönswetter, P. 2008. Notes on some rare Orobanche and Phelipanche species (Orobanchaceae) in Croatia. Acta Botanica Croatica 67(1): 103-107. (Orobanche salviae and O. alsatica are reported for the first time in 100 years. O. lasertasii-sileris, and P. lavandulaceae also recorded.)

Freudentstein, J.V. and Senyo, D.M. 2008. Relationships and evolution of matK in a group of leafless orchids (Corallorrhiza and Corallorhizinae; Orchidaceae: Epidendroideae). American Journal of Botany 95(4): 498-505. (Characterizing relationships among these mycoheterotrophs, and building a case for this group to shed light on the transition from autotrophy to heterotrophy in plants.)

Fu GuiFang, Chen Min, Cui GuangHong, Xiao SuPing and Huang LuQi 2007. Comparative anatomy research on Cistanche deserticola and Cistanche tubulosa. China Journal of Chinese Medicine and Pharmacy 22(12): 840-843. (Confirming distinctive anatomy in the two species, and noting greater adaptation to arid conditions in C. deserticola than in C. tubulosa.)

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(The structural and functional relations between the 
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discussed.)

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(pp. (Including update on Arceuthobium.)

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Regulation 55(1): 21-28. (Showing that although A. 
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Matusova, R., Danoun, S., Portais, J-C., 
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branching mutant pea rmsf, is shown to be deficient 
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application of GR24. See also literature highlight 
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Gong Fang, Ma YanHui, Ma AnLun, Yu QiWen, Zhang 
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and Zhang DongQing 2007. A lectin from Chinese 
Mistletoe Increases γδ T cell-mediated cytotoxicity 
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Acta Biochimica et Biophysica Sinica 39(6): 445- 
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A., Barandiaran, X., Cubero, J.I. and Román, B. 
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flowers of the parasite.)

Grenz, J.H., Iştoc, V. A., Manschadi, A.M. and 
(Helianthus annuus) and sunflower broomrape 
(Orobanche cumana) as affected by sowing date, 
resource supply and infestation level. Field Crops 
Research 107(2): 170-179. (Infestation affected by 
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Grewell, B.J. 2008. Parasite facilitates plant species 
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1481-1488. (The main host for Cuscuta salina was 
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57(10): 665-678. (Concluding that the extract 
Iscador ‘might have the effect of prolonging overall 
survival of ovarian cancer patients. In the short term, 
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toxicological evaluation of Dendrophthoe falcata 
stem extract in male albino rats. Journal of Herbs, 
Spices & Medicinal Plants 13(3): 37-46. (Showing 
that oral administration of crude methanol extract of 
D. falcata stem can lead to sterility in male rats.)

Effect of methanolic extract of Dendrophthoe 
falcata stem on reproductive function of male albino 
(Concluding that D. falcata brought about the 
inhibition of spermatogenesis.)

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Botany 20(5): 409-416. (Genetic analysis confirms 
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and weeds of cereals, and its potential for other 
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611-621. (Another general review of the ‘push-pull’ technique, controlling *Striga* and stem borers.)

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Hock, S.M., Wiecko, G. and Knezevic, S.Z. 2008. Molecular responses of sorghum to purple witchweed (*Striga hermonthica*) parasitism. Weed Science 56(3): 356-363. (30 sorghum genotypes that are up-regulated in response to *Striga* parasitism were studied in cultivars of sorghum differing in susceptibility. In the most susceptible cultivar jasmonic acid-responsive genes were induced while salicylic acid responsive genes were suppressed. In less susceptible cultivars the salicylic acid responsive genes were induced.)


Hiraoka, Y. and Sugimoto, Y. 2008. Molecular responses of sorghum to purple witchweed (*Striga hermonthica*) parasitism. Weed Science 56(3): 356-363. (30 sorghum genotypes that are up-regulated in response to *Striga* parasitism were studied in cultivars of sorghum differing in susceptibility. In the most susceptible cultivar jasmonic acid-responsive genes were induced while salicylic acid responsive genes were suppressed. In less susceptible cultivars the salicylic acid responsive genes were induced.)


Horneber MA, Bueschel G, Huber R, Linde K, Rostock M. Mistletoe therapy in oncology. 2008. *Cochrane Database of Systematic Reviews* 2008, Issue 2. Art. No.: CD003297. DOI: 10.1002/14651858.CD003297.pub2. (http://www.cochrane.org/reviews/en/ab003297.html) (Re claims that *Viscum album* extracts stimulate the immune system, improve survival, enhance quality of life and reduce adverse effects of chemotherapy in cancer patients, the review, based on meta-analysis of 21 studies, found ‘not enough evidence to reach clear conclusions about the effects on any of these outcomes’. However, more research is justified and ‘patients receiving mistletoe therapy should be encouraged to take part in future trials.’)


Idžojtic, M., Glašaš, M., Zebec, M., Pernar, R., Becarevic, J., Glova, K. and Plantak, S. 2007. (Yellow mistletoe and white-berried mistletoe on the area of the forest administrations Našice and Osijek.) (in Croatian) Šumarski List 131(3/4): 125-135. (In the areas surveyed, *Loranthus europaeus* occurred mainly on *Quercus* spp., while *Viscum album* was mainly on *Fraxinus pennsylvanica*, *Populus* spp., *Robinia pseudacacia* and on walnut.)

Idžojtic, M., Glašaš, M., Zebec, M., Pernar, R., Beuk, P. and Prigl, I. 2006. (Intensity of infection with yellow mistletoe and white-berried mistletoe on the area of the forest administrations Vinkovci and Nova Gradiška.) (in Croatian) Šumarski List 130(9/10): 399-409. (Reporting widespread occurrence of *Loranthus europaeus* on *Quercus* spp. but rarely abundant or damaging, while *Fraxinus angustifolia* was sometimes more severely infected by *Viscum album*.)

Irwin, M.T. 2008. Feeding ecology of *Propithecus diadema* in forest fragments and continuous forest. International Journal of Primatology 29(1): 95-115. (Noting the importance of the fruits of the mistletoe *Bakerella clavata* (Loranthaceae) in the diet of *P. diadema* in Madagascar.)

Janakat, S. and Al-Thnaibat, O. 2008. Anti-lipoperoxidative effect of three edible plants extracts: *Viscum album*, *Arum dioscoridis* and *Eminium spiculatum*. Journal of Food Quality 31(1): 1-12. (Results suggest that these plants can be used as a condiment during food processing, to improve the quality, enhance flavour, increase the nutritional value and increase the shelf life of processed foods.)


Jeanmonod, D. 2007. (Typification of a few broomrape taxa (*Orobancheae*).) (in French) Candollea 62(2): 193-204. (Five *Orobanche* spp in Corsica are represented by lectotypes – *O. amethystea* ssp. *castellana*, *O. rapum-genistae*, *O. rigens f. corsica*, *O. rigens* var. *migricans* and *Phelypaea nana*; and two by holotypes – *O. minor* and *O. crenata*.)


Jin Fuping, Hua Guohui. Ma Yongqing, Wang DeSheng and Yuan Cuiping 2008. Effect of traditional Chinese medicinal herb extracts on *Orobanche minor* seed germination. Acta Botanica Boreali-Occidentalia Sinica 28(4): 777-783. (Some 240 traditional Chinese medicinal herbs were screened. Those causing greater than 50% stimulation or inhibition of *O. minor* germination are listed.)


Kabambe, V.H., Kauwa, A.E. and Nambuzi, S.C. 2008. Role of herbicide (metalachlor) and fertilizer application in integrated management of *Striga asiatica* in maize in Malawi. African Journal of Agricultural Research 3(2): 140-146. (Reporting variable results of metalachlor herbicide, reducing *S. asiatica* in one season, not another. NPK fertilizer tended to increase *Striga* emergence but also greatly increased yields.)

Kabambe, V.H., Kanampiu, F., Nambuzi, S.C. and Kauwa, A.E. 2007. Evaluation of the use of herbicide (Imazapyr) and fertilizer application in integrated management of *Striga asiatica* in maize in Malawi. African Journal of Agricultural Research 2(12): 687-691. (Concluding that fertilizer use is the single most important factor in increasing maize yield under *S. asiatica* infection, while herbicide use is important for reducing emergence.)

Kamara, A.Y., Menkir, A., Chikoye, D., Omoigui, L.O. and Ekeleme, F. 2007. Cultivar and nitrogen fertilization effects on *Striga* infestation and grain yield of early maturing tropical maize. Maydica 52(4): 415-423. (*Striga*-tolerant maize varieties ACR 94TZECOMP5-W and ACR 94TZECOMP5-Y showed lower *Striga* emergence, higher yield and better response to N than a susceptible check under *Striga* infestation.)

Kang TaeBong, Song SeongKy, Yoon TaekJoon, Yoo Yung Choon, Lee Kwan Hee, Her and Kim Jong Bae 2007. Isolation and characterization of two Korean mistletoe lectins. Journal of Biochemistry and Molecular Biology 40(6): 959-965. (Showing that isolectins in *Viscum coloratum* have varied bioactivities and that ‘KML-IIL’ may be developed as an anti-cancer agent.)


Karg, S. 2008. Direct evidence of heathland management in the early Bronze Age (14th century B.C.) from the grave-mound Skelhøj in western Denmark. Vegetation History and Archaeobotany 17(1): 41-49. (*Cuscuta epithymum* L. was found in 31% of the sod samples which were otherwise dominated by *Calluna vulgaris*.)

Karkanis, A., Bilalis, D. and Efthimiadou, A. 2007. Tobacco (*Nicotiana tabacum*) infection by branched broomrape (*Orobanche ramosa*) as influenced by irrigation system and fertilization, under East Mediterranean conditions. Journal of Agronomy 6(3): 397-402. (Drip irrigation was
superior to sprinkler irrigation and/or green manuring, reducing O. ramosa over 70%.
Kawachi, N., Fujimaki, S., Sakamoto, K., Ishioka, N.S., Matsushashi, S. and Sekimoto, H. 2008. Analysis of NO3 interception of the parasitic angiosperm Orobanche spp. using a positron-emitting tracer imaging system and 15NO3: a new method for the visualization and quantitative analysis of the NO3 interception ratio. Soil Science and Plant Nutrition 54(3): 408-416. (The nitrogen nutrient interception ratio for an Orobanche sp. growing on Trifolium pratense was about 70%)
Kelly, D., Ladley, J.J. and Robertson, A.W. 2007. Is the superior to sprinkler irrigation and/or green imaging system and quantitative analysis of the NO3 interception ratio. Soil Science and Plant Nutrition 54(3): 408-416. (The nitrogen nutrient interception ratio for an Orobanche sp. growing on Trifolium pratense was about 70%)
Kelly, D., Ladley, J.J. and Robertson, A.W. 2007. Is the superiority to sprinkler irrigation and/or green visualization and quantitative analysis of the NO3 interception ratio. Soil Science and Plant Nutrition 54(3): 408-416. (The nitrogen nutrient interception ratio for an Orobanche sp. growing on Trifolium pratense was about 70%)

Kenaley, S., Mathiasen, R. and Harner, E.J. 2008. Striga visualization and quantitative analysis of the NO3 interception ratio. Soil Science and Plant Nutrition 54(3): 408-416. (The nitrogen nutrient interception ratio for an Orobanche sp. growing on Trifolium pratense was about 70%)

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Khan, Z.R., Midega, C.A.O., Amudavi, D.M., Hassanali, A. and Pickett, J.A. 2008. On-farm evaluation of the ‘push-pull’ technology for the control of stemborers and Striga weed on maize in western Kenya. Field Crops Research 106(3): 224-233. (A study involving 280 farmers comparing ‘push-pull’ plots with maize monocrop and net benefits were higher in the first year, than mono-cropping or intercropping with beans, but costs were comparable or lower in subsequent years and net benefits were highly favourable.)


Khan TranDang, Cong LuongChi, Xuan TranDang, Lee SunJoo, Kong DongSoo and Chung IIIMin 2008. Weed-suppressing potential of dodder (Cuscuta hygrophiila) and its phytotoxic constituents. Weed Science 56(1): 119-127. (Dried material of Cuscuta hygrophiila suppresses weeds in rice at 1-2 t/ha, apparently due to its content of cinnamic acid, dihydro-5,6-dehydrokavain, and methyl cinnamate.)

Khan TranDang, Cong LuongChi, Xuan TranDang, Lee SunJoo, Kong DongSoo and Chung IIIMin 2008. Weed-suppressing potential of dodder (Cuscuta hygrophiila) and its phytotoxic constituents. Weed Science 56(1): 119-127. (Dried material of Cuscuta hygrophiila suppresses weeds in rice at 1-2 t/ha, apparently due to its content of cinnamic acid, dihydro-5,6-dehydrokavain, and methyl cinnamate.)

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Kim EunYoung, Kim EunKyoung, Lee HyunSam, Sohn YoungJoo, Soh YunJo, Jung HyukSang and Sohn NakWon 2007. Protective effects of Cuscutae semen against dimethylnitrosamine-induced acute liver injury in Sprague-Dawley rats. Biological & Pharmaceutical Bulletin 30(8): 1427-1431. (Results suggest that the product from Cuscuta chinensis may be useful in preventing fibrogenesis after liver injury.)

Kim EunYoung, Kim EunKyoung, Lee HyunSam, Sohn YoungJoo, Soh YunJo, Jung HyukSang and Sohn NakWon 2007. Protective effects of Cuscutae semen against dimethylnitrosamine-induced acute liver injury in Sprague-Dawley rats. Biological & Pharmaceutical Bulletin 30(8): 1427-1431. (Results suggest that the product from Cuscuta chinensis may be useful in preventing fibrogenesis after liver injury.)


Kohlen, W. and Bouwmeester, H.J. 2007. (Below-ground communication: the triangular relation between host plant, parasitic plant and mycorrhizal fungus.) (in German) Gewasbescherming 38(4): 145-149. (Reviewing the topic of strigolactones and their dual role.)


M. 2007. Synthesis and seed germination stimulating activity of some imino analogs of strigolactones. Bioscience, Biotechnology and Biochemistry 71(11): 2781-2786. (Among the tested compounds, 3-pyridyliminoacetonitrile showed higher germination of O. crenata than GR24, demonstrating that it is not always essential to have the Michael acceptor of the C-D ring junction moiety which has been proposed necessary for activity.)


showing their exudation markedly reduced by phosphate.)


Ma Lijie, Chen GuiLin, Jin Shangwu and Wang Chenxia 2008. The anti-aging effect and the chemical constituents of Cynomorium songaricum Rupr. In: Gardner, G. and Craker, L.E. (eds) Acta Horticulturae 765. (C. songaricum is widespread in Mongolia and western China, mainly on Nitraria spp. and is used medicinally, as is Cistanche, as an anti-oxidant and to enhance kidney function. Key constituents are listed, including catechin.)

Ma XuePing, Kong BaoHua, Ye Min and Duan YunHui 2007. Selecting materials of antiviral activity to tobacco mosaic virus infection from some plant extracts. Southwest China Journal of Agricultural Sciences 20(5): 1023-1026. (Extracts causing significant inhibitory effect included Cuscuta chinensis.)

Maara, N.T., Karachi, M. and Ahenda, J.O. 2006. Effects of pre-germination treatments, desiccation and storage temperature on germination of Carissa edulis, Vangueria madagascariensis and Ximenia americana seeds. Journal of Tropical Forest Science 18(2): 124-129. (Seeds of X. americana (Olacaceae) lost some viability on drying but otherwise retained good viability for at least 3 months.)


*McNeal, J.R., Arumugunathan, K., Kuehl, J.V., Boone, J.L. and de Pamphilis, C.W. 2007. Systematics and plastid genome evolution of the cryptically photosynthetic parasitic plant genus Cuscuta (Convolvulaceae). BMC Biology 5(55): (13 December 2007) (http://www.biomedcentral.com/content/pdf/1741-7007-5-55.pdf) (Suggesting that the phylogeny of the genus Cuscuta is much more complex than is traditionally recognised. Complete loss of photosynthesis is limited to a small group of species found mainly in South America.)


Malécot, V. and Nickrent, D.L. 2008. Molecular phylogenetic relationships of Olacaceae and related Santalales. Systematic Botany 33: 97-106. (The study, using nuclear and chloroplast genes for all but two of the genera showed the family to be composed of seven clades.)


Maruyama, S., Yamada, K. and Tachibana, H. 2008. Cistanche salsta extract induced apoptosis in the

Mathiasen, R.L. and Daugherty, C.M. 2008. Distribution of red fir and noble fir in Oregon based on dwarf mistletoe host specificity. Northwest Science 82(2): 108-119. (Identification of fir species, red (_A. magnifica_) and noble (_A. procera_), confirmed by their susceptibility or tolerance to *Arceuthobium tsugense* spp. *mertensianae* and *amabile._)

Mathiasen, R.L., Daugherty, C.M., Howell, B.E., Melgar, J.C. and Sesnie, S.E. 2007. New morphological measurements of *Psittacanthus angustifolius* and *Psittacanthus pinicola* (Loranthaceae). Madroño 54(2): 156-163. (Reporting new measurements and information on host range (mainly *Pinus* spp.) and distribution of these two species in Central America.)


Meyer, A., Rynpiewski, W., Celiewicz, L., Erdmann, V.A., Voelter, W., Singh, T.P., Genov, N., Barciszewski, J. and Betzel, C. 2007. The mistletoe lectin I - phloretamide structure reveals a new function of plant lectins. Biochemical and Biophysical Research Communications 364(2): 195-200. (Suggesting that the binding of phloretamide to lectin I from European *V. album* may be part of a defence whereby the parasite prevents the growth hormone of the host from interfering with its own regulatory system.)


Mor, A., Mayer, A.M. and Levine, A. 2008. Possible peroxidase functions in the interaction between the parasitic plant, _Orobanche aegyptiaca_, and its host, _Arabidopsis thaliana_. Weed Biology and Management 8(1): 1-10. (Proposing that peroxidases may generate extracellular reactive oxygen species (ROS) which loosen the cell wall of the host to facilitate penetration. Or, the ROS facilitates root elongation of the parasite.)

Mu Ping, Gao Xue, Jia ZhongJian and Zheng RongLiang 2008. Natural antioxidant pedicularioside G inhibits angiogenesis and tumourigenesis in vitro and in vivo. Basic and Clinical Pharmacology and Toxicology 102(1): 30-34. (A phenylpropanoid glycosides isolated from Pedicularis striata has distinct antioxidant activity.)

Muhanguzi, H.D.R., Obua, J. and Oryem-Origa, H. 2007. The effect of human disturbance on tree species composition and demographic structure in *Cassava* epithymum. Seed Science Research 18(1): 25-34. (Concluding that a proportion of seeds remains physically dormant in spring and thus forms a persistent seed bank, reducing the risk of a total reproductive failure in a particular bad year.)


O. cumana 48(2): 169-178. (Showing that some old samples of _O. cumana_ seed included some race F, suggesting this is indigenous to Spain and not introduced.)

Peterson, R.L. 2007. *Journal of Traditional Medicines* 25(1): 24-27. (suggested that the binding of phloretamide to lectin I from European *V. album* may be part of a defence whereby the parasite prevents the growth hormone of the host from interfering with its own regulatory system.)

Pityopus californicus. 2008. Germination stimulant from root exudates of _Takano, Y., Ioka, Y., Nabeta, K. and Yoshihara, T._ (concluding that a proportion of seeds remains physically dormant in spring and thus forms a persistent seed bank, reducing the risk of a total reproductive failure in a particular bad year.)

Pityopus californicus. 2008. Germination stimulant from root exudates of _Takano, Y., Ioka, Y., Nabeta, K. and Yoshihara, T._ (concluding that a proportion of seeds remains physically dormant in spring and thus forms a persistent seed bank, reducing the risk of a total reproductive failure in a particular bad year.)

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Muir, K., Byrne, M., Barbour, E., Cox, M.C. and Fox, J.E.D. 2007. High levels of outcrossing in a family trial of Western Australian sandalwood (*Santalum spicatum*). Silvae Genetica 56(S): 222-230. (S. spicatum is generally out-crossing but can be selfed and progeny show no disadvantage from in-breeding.)


Mulliken, T. and Schippmann, U. 2007. CITES management of parasitic plants, including outcrossing species. *Cytinaceae* were sister to *Muntingiaceae* and phylogenetic methods were used to show that general summary of recent molecular phylogenetic and molecular evolutionary studies on parasitic flowering plants.)

Nadal, S., Moreno, M.T. and Román, B. 2008. Control of *Orobanchaceae* *crenata* in *Vicia narbonensis* by glyphosate. Crop Protection 27(3/5): 873-876. (Spraying glyphosate 35-67 g/ha twice, at tubercle stage and 2 weeks later suppressed *O. crenata* and increased yields.)


Păcuranu-Joita, M., Vrânceanu, A.V. and Stanciu, D. (50 Years of sunflower breeding at Fundulea.) (in Romanian) Analele Institutului National de Cercetare-Dezvoltare Agricolă Fundulea 75: 173-194. (Referring to the importance of Orobanche cumana and the successes in breeding for resistance to it.)


Papchenkov, V.G. 2007. Floristic records in the Middle Volga basin. Botanicheskiĭ Zhurnal, 92(10): 1580-1587. (Noting new records for Melampyrum solstitiale and ‘Orites’ (Odontites?) hellman.)


Park JeongMi, Manen, J.F. and Schneeweiss, G.M. 2007. Horizontal gene transfer of a plastid gene in the non-photosynthetic flowering plants Orobanche and Phelipanche (Orobanchaceae). Molecular Phylogenetics and Evolution 43: 974-985. (Phelipanche harbors a second copy of the plastid gene rps2 which appears to be from Orobanche. The transfer of this gene through a common host is postulated.)

Patto, M.C.V., Diaz-Ruiz, R., Satovic, Z., Román, B., Pujadas-Salvá, A.J. and Rubiales, D. 2008. Genetic diversity of Moroccan populations of Orobanche foetida: evolving from parasitising wild hosts to crop plants. Weed Research (Oxford) 48(2): 179-186. (A population of O. foetida attacking Vicia sativa in Morocco was genetically most related to others attacking Scorpiurus muricatus. The most genetically distinct population was one attacking Ornithopus sativus.)


*Qiu YunPing, Chen MinJun, Su MingMing, Xie GuoXiang, Li Xin, Zhou MingMei, Zhao AiHua, Jiang Jian and Jia Wei 2008. Metabolic profiling reveals therapeutic effects of Herba Cistanches in an animal model of hydrocortisone-induced ‘kidney-deficiency syndrome’. Chinese Medicine 3(3) 3 (10 March 2008) (http://www.cmjournal.org/content/3/1/3/abstract) (The extract, presumably from Cistanche deserticola, caused systemic recovery from hydrocortisone-induced metabolic perturbation in rats.)


Rajasugunasekar, D., Mohan, V. and Kunhikannan, C. 2007. First report of plant parasite Helicanthus elastica (Ders.) Dans. in Allanthus plantation in Tamil Nadu. Indian Forester 133(9): 1277-1280. (Helicanthus elastica (Loranthaceae) seen severely affecting the growth and survival of A. excelsa.)
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Rasthra Vardhana 2007. Plant's havoc by Cuscuta spp. in district Meerut U.P. India. Plant Archives 7(2): 917-918. (C. reflexa recorded on 102 host species, and Cuscuta capitata, Cuscuta chinensis and Cuscuta hyalina recorded on 1, 2 and 5 hosts respectively.)

Rasthra Vardhana 2007. Plant's havoc by Cuscuta spp. in district Ghaziabad U.P. India. 921-922. (C. reflexa recorded on 108 host species, and Cuscuta capitata, Cuscuta chinensis and Cuscuta hyalina recorded on 1, 3 and 5 hosts respectively.)


Robertson, A.W., Ladley, J.J. and Kelly, D. 2008. Does height off the ground affect bird visitation and fruit set in the pollen-limited mistletoe Peraxilla tetrapetala (Loranthaceae)? Biotropica: 40(1): 122-126. (No. In New Zealand, the bellbird (Anthornis melanura) visits flowers at all levels.)


Rogers, Z.S., Malécot, V. and Sikes, K.G. 2006. A synoptic revision of Olax L. (Olacaceae) in Madagascar and the Comoro Islands. Adansonia 28(1): 71-100. (Describing 8 species of Olax, six of which are endemic to Madagascar including three newly described: O. antsiranensis, O. capuronii and O. mayottensis.)


Roxburgh, L. and Nicolson, S.W. 2008. Differential dispersal and survival of an African mistletoe: does host size matter? Plant Ecology 195(1): 21-31. (Greater abundance of Phragmanthera dischallensis on taller Acacia sieberana trees in Zambia is mainly due to the preferential perching habits of the seed-dispersing birds.)


Sanjaya, Bagyalakshmi Muthan, Vittal, T.S.R.A. and Rai, R. 2006. Micropropagation of an endangered Indian sandalwood (Santalum album L.). Journal of Forest Research 11(3): 203-209. (Media are described in which multiple shoots were induced from nodal shoot segments and rooting stimulated before planting out successfully in the field.)

Schneeweiss, G.M. 2008. List of actual and potential broomrape pest species. (http://www.botanik.univie.ac.at/plantchorology/PestSpeciesOrobanche.pdf) (A detailed up-to-date appraisal of the importance and distribution of Orobanche spp. in Europe, Near East and N. Africa, prepared in conjunction with the COST 849 project. It provides scores (1-4) for importance in each crop, for 7 ‘major’ species (including O. foetida), and 4 ‘minor’ species (causing no higher than level 1 damage). Also listing 11 further ‘potential’ problem species which need monitoring.)

186. (Reviewing recent developments in basic research.)


Shaw, D.C., Huso, M. and Bruner, H. 2008. Basal area growth impacts of dwarf mistletoe on western hemlock in an old-growth forest. Canadian Journal of Forest Research 38(3): 576-583. (Growth of trees over 13 years was not affected by light or moderate infestation by Arceuthobium tsugense but severe infection caused 16-46% reduction in growth.)


Shishkova, S., Rost, T.L. and Dubrovsky, J.G. 2008. (Using of crops as trap for infection in older trees.)


Shishkova, S., Rost, T.L. and Dubrovsky, J.G. 2008. (Using of crops as trap for infection in older trees.)


Siomi, K., Vazan, S., Jamshidi, S. and Alimohammadi, R. 2007. (Using of crops as trap for Orobanche aegyptiaca management in tomato in greenhouse conditions.) (in Persian) Journal of New Agricultural Research 3(8): 37-44. (Trifolium alexandrinum, flax and sorghum were most effective trap crops for O. aegyptiaca. Soybean was among the least active.)


Stanton, S. 2007. Effects of dwarf mistletoe on climate response of mature ponderosa pine trees. Tree-Ring Research 63(2): 69-80. (Results suggest that Arceuthobium-infected trees are more sensitive to climatic factors than uninfected trees and may be useful for dendroclimatic analyses.)

Suetsugu, K., Kawakita A., and Kato, M. 2008. Host range and selectivity of the hemiparasitic plant Thesium chinense (Santalaceae). Annals of Botany 102: 40-55. (T. chinense is shown to have a wide host range attaching to 22 spp. in 11 families, but with a possible preference for Lespedeza juncea and Eragrostis curvula.)


Sujetovienë, G. and Stakënæs, V. 2007. Changes in understory vegetation of Scots pine stands under the decreased impact of acidifying and eutrophying pollutants. Baltic Forestry 13(2): 190-196. (Melampyrum pratense among the understory species which increased in occurrence as pollution decreased.)

Sun ZhongKui 2008. Biosynthesis of germination stimulants of parasitic weeds Striga and Orobanche. Thesis. Wageningen University, Netherlands: Wageningen University. 115 pp. (Discussing the cloning and characterization of a maize carotenoid cleavage dioxygenase gene (ZmCCD1), and its relevance to germination stimulants in Arabidopsis and rice.)

Suzuki, K., Dohzono, I. and Hiei, K. 2007. Evolution of pollinator generalization in bumblebee-pollinated plants. Plant Species Biology 22(3): 141-159. (Showing that 3 bumblebee species are equally effective pollinators of Melampyrum roseum, but lead to self-pollination; seed production is then reduced by abortion of selfed embryos.)

Szymańska, R. and Kruk, J. 2008. Tocopherol content and isomers' composition in selected plant species. Plant Physiology and Biochemistry 46(1): 29-33. (Cuscuta epithymum and C. japonica both shown to contain γ-tocopherol and 6-tocopherol. C. japonica was exceptional by the complete absence of α-tocopherol.)


Tang Ya, Xie JiaSui and Sun Hui 2007. Pollination ecology of Pedicularis muscosoides H. L. Li subsp. himalayaca Yamazaki from alpine areas of Western Sichuan, China. Arctic, Antarctic, and Alpine Research 39(3): 481-487. (Exclusively pollinated by queens of 4 bumblebee species over a very short flowering period.)


Tassin, J., Barré, N. and Bouvet, J.M. 2008. Effect of ingestion by Drepanoptila holosericea (Columbidae) on the seed germination of Santalum austrocaledonicum (Santalaceae). Journal of Tropical Ecology 24(2): 215-218. (Germination was enhanced following passage through the bird D. holosericea.)


Tusenius, K.J., Spoek, A.M. and van Hattum, J. 2005. Exploratory study on the effects of treatment with two mistletoe preparations on chronic hepatitis C: biochemical and quality of life improvement. Arzneimittel Forschung 55(12): 749-753. (Results suggest an improvement of liver inflammation and thus possibly reduction of the long term complications, viz cirrhosis and liver cancer. V. album preparations ‘have the advantage of easy administration and low cost.’)

Vanlauwe, B., Kanampiu, F., Odhiambo, G.D., de Vidal-Russell, R. and D. L. Nickrent. 2007. A molecular phylogeny of the feathery mistletoe family Loranthaceae: origins of aerial parasitism in Santalales. Molecular Phylogenetics and Evolution 47: 523-527. (Two chloroplast genes and morphological characters were analyzed for nearly all species in the genus and the resulting trees generally agreed with the existing taxonomic classification.)

Vidal-Russell, R. and D. L. Nickrent. 2008. The first mistletoes: origins of aerial parasitism in Santalales. Molecular Phylogenetics and Evolution 47: 523-527. (Two chloroplast genes and morphological characters were analyzed for nearly all species in the genus and the resulting trees generally agreed with the existing taxonomic classification.)

van Mourick, T.A., Bianchi, F.J.J.A., van der Werf, W. and Stomph, T.J. 2008. Long-term management of Sesbania sesban or cowpea reduced the seedbank in rice. The suppression on cedar elm (Ulmus crassifolia) was more damaging than the bark beetle infestations.)

Vidal-Russell, R. and Nickrent, D.L. 2008. Evolutionary relationships in the showy mistletoe family (Loranthaceae). American Journal of Botany 95: 1015-1029. (60 of the 73 genera of Loranthaceae were analyzed using chloroplast and nuclear genes. The molecular phylogeny confirms that Neottia asiatica is sister to the remaining genera and that aerial parasitism arose once in the family.)

Vinogradova, T.N. 2008. Some peculiarities of propagation biology of Neottia asiatica (Orchidaceae) from Petropavlovsk-Kamchatsky environs. Botanicheskiĭ Zhurnal 93(4): 541-552. (N. asiatica spreads by seed (over 4000 per shoot) and root suckers. It is an obligate mycosymbiotroph, but mycorrhiza infection is not consistent.)

Wagner, M.L., Ricco, R.A., Ranea, F.G. and Gurni, A.A. 2007. (Comparative study of phenolic compound in different population of Phoradendron liga (Gill.) Eichl. - Viscaceae from Argentina.) (in Spanish) In: Martinez, J.L. and Garcia, J. (eds) Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas 6(5): 301-302. (P. liga is common in Argentina and is used traditionally as a hypertensive agent. Studies showed levels of flavonoids differed according to locality.)


Watson, W.T. and Martinez-Trinidad, T. 2006. Strategies and treatments for leafy mistletoe (Phoradendron tomentosum (DC.) Engelm. ex. Gray) suppression on cedar elm (Ulmus crisafolita Nutt.).
(Regrowth of P. tomentosum controlled by removing the branch on which it grew, removing the parasite and caulking over the point of removal, or applying naphthalene acetic acid and black paint after removal.)


Ye PengLin, Wu TzuHui, Lin LiangTzung, Cham ThauMing and Lin ChunChing 2008. Nanoparticles formulation of Viscum chinensis prevents acetalominphoned-induced hepatotoxicity in rats. Food and Chemical Toxicology 46(5): 1771-1777. (Showing that a nanoparticle formulation of C. chinensis extract substantially increased hepatoprotective effect in rats.)

Ye PengLin, Wu TzuHui, Lin LiangTzung, Cham ThauMing and Lin ChunChing 2008. Concordance between antioxidant activities and flavonol contents in different extracts and fractions of Viscum coloratum. Food Chemistry 108(2): 455-462. (Confirming that extracts of seeds of C. chinensis have anti-oxidant properties, supporting their traditional use as dietary additives to food, but showing an ethanol extract would be more beneficial than a water extract.)


http://www.botanyconference.org/engine/search/ind ex.php?func=detail&aid=594 (This new acliophyllous species is parasitic on the roots of the tree Hedysorus mexicanum (Chloranthaceae), distinguished from other Orobanchaceae by 1) strongly 5-ribbed ovary and fruit; 2) production of 5 parietal placentae; 3) unusual anthers in which the pollen sacs are more or less embedded in the expanded filament apex; 4) regularly pantohexaporate pollen grains.)


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**HAUSTORIUM 53**

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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

Happy New Year and best wishes for 2009. We are now just a few months away from our next Parasitic Plant Congress, which will take place from June 8-12 in Kusadasi, Turkey. The setting, a beautiful Mediterranean resort, promises to provide a wonderful atmosphere for discussion and relaxation. Of course the scientific program will also be excellent, showcasing the best research in all aspects of parasitic plants. If you have not already done so, start planning your contribution and be sure to note the March 20 deadline for abstract submission. More information on the meeting and the abstract submission process is provided later in this issue in the Forthcoming Meetings section.

As a new feature of our meeting, we plan to give prizes for best student and poster presentations. We hope this will add some fun to the proceedings and give a few people the nice surprise of some extra spending money in Kusadasi.

On a more administrative note, I want to update you on some subjects under discussion by the Executive Committee. In order to enhance our mission of fostering research and education on parasitic plants, we want to overhaul the society website to make it more useful for IPPS members and the general public. To this end we are exploring the option of hiring of a professional website manager who can help us develop more features and improve the overall quality of the site. However, taking on new financial obligations requires that we also have reliable income from dues, and this means that we need a stable membership and an improved mechanism for collecting dues. It has been our past practice to collect dues primarily in association with meeting registration, which is convenient, but means that members who miss a meeting have their membership lapse with no easy way to renew it. Although in practice we have still counted such people among the active members, this leads to less income and confusion when it comes to election time or making special offers to members. To resolve this, we are revisiting our dues collection mechanism and hope to integrate it into the redesigned website so that payments would take place independent of meetings. We hope the result will be a system that provides the society with a clear membership, predictable income, and improved service to our members. I will provide more information as we progress with our plans, but welcome any input from you during this process.

Sincerely,

Jim Westwood, IPPS President

ISSN REGISTRATION

Haustorium now has its own ISSN number!

The National Serials Data Program (NSDP) at the Library of Congress has made an ISSN assignment for Haustorium (online version) - ISSN 1944-6969.

HOST SPECIFICITY AND SPECIATION IN PARASITIC PLANTS

Host specificity as a driver of speciation

Parasitic plants show considerable variation in their host specificity. For example, while some European species of Cuscuta can infect hundreds of taxonomically diverse families, others such as Rafflesia spp. in Southeast Asia parasitize just one or two species of Tetrastigma vine (Nais, 2001). Although the potential host range of parasitic plants is often broad, the performance of the parasite may be suboptimal on all but a few hosts (Press and Graves, 1995). It has been suggested that host-generalist strategies may have evolved among heterogeneous plant communities where parasites can infect many potential hosts. Conversely, where host availability is more stable, the
selective advantages of host specificity may outweigh the disadvantages of suboptimal growth on secondary hosts (Norton and DeLange, 1999). However host specificity in parasitic plants is related not just to the abundance and diversity of potential hosts, but also to physiological constraints such as host susceptibility and resistance; host specificity in parasitic angiosperms is usually a consequence of both the parasite’s ability to recognize and attack the host plant, and the resistance of that host plant (Marvier and Smith 1997; Yoder 2001).

Parasites that are isolated on hosts with distinct ecologies may be subject to genetic divergence. For example phytophagous insects (like parasitic plants) are discriminate users with respect to the host plants on which they feed. This pattern of host specificity appears to have driven genetic divergence, and ultimately speciation in these insects (Funk et al., 2002). Parasitic plants have received comparatively less attention than these ‘model’ insects from evolutionary biologists. This may be because host range determination in parasitic plants is problematic (Norton and DeLange, 1999). For example root parasites such as Orobanche spp. often flower a considerable distance from their host. In addition, many parasitic plants are also experimentally intractable such as the tropical Rafflesia spp., hence cross-infection experiments useful for determining host range are practically impossible to conduct. Thus, our understanding of host specificity as a potential catalyst for speciation in parasitic plants lags behind that of holoparasites, a similar pattern of host-driven speciation in parasitic plants is now emerging.

Several investigations have revealed evidence of host-mediated genetic divergence in hemiparasitic mistletoes in the Santalales. Early work by Clay et al. (1985) used reciprocal transplant experiments which demonstrated that Phoradendron spp. had a greater fitness when cultivated on the local host species compared with those transplanted to novel hosts. This host specificity appears to have led to the evolution of races which are morphologically similar, but physiologically distinct. Later research using molecular approaches confirmed the presence of host-driven divergence in other mistletoe species; for instance, Nickrent and Stell (1990) used isozyme data to identify two distinct host races of hemlock dwarf mistletoe (Arceuthobium tsugense), in which genetic diversity has been influenced by both geographic location and host range. Similarly, a molecular analysis using AFLPs of the dwarf mistletoe A. americanum on its Pinus hosts, revealed that both geographical isolation and host identity have contributed to genetic race formation in this species (Jerome and Ford 2002). Glacialiations and founder effects may have structured the genetic diversity of Arceuthobium taxa, and the host races identified by this research may be in a state of incipient speciation. Host specificity has also led to genetic divergence among races of the European mistletoe (Viscum album). Host-specific subspecies of V. album have been identified which are morphologically indistinct, yet chloroplast DNA (cpDNA) and nuclear DNA internal transcribed spacer (nDNA ITS) sequence data support their separation into genetically distinct races (Zuber and Widmer 2000). Taken together, these findings suggest that host race formation may have been an important promoter of taxonomic complexity and speciation in mistletoes, and potentially among other hemiparasites.

**Host-driven speciation in holoparasites**

Investigations into the taxonomic and phylogenetic relationships among the holoparasites have been hindered by their extreme reductions in morphology and genome size (dePamphilis and Palmer 1990). Nonetheless, a handful of studies indicate that host specificity may also have influenced patterns of speciation in this poorly understood group. Holoparasites often show patterns of extreme specialisation. For example in the broomrape genus (Orobanche), most species have a very narrow host range (Schneeweiss, 2007), and some are more-or-less restricted to a single host species for example: O. serbica on Artemisia alba; O. luzorum on Berberis vulgaris; and O. lassepitii-sileris on Laserpittium siler. On the other hand, a few species have evolved a very broad host range, for example O. minor parasitizes a diverse range of angiosperms from at least 16 orders in both the monocots and eudicots (Thorogood et al., in preparation). However cultivation experiments have shown that races of O. minor that are physiologically adapted to particular hosts may exist (Musselman and Parker 1982). Furthermore, molecular marker data indicate that this species comprises morphologically cryptic taxa which are isolated from gene flow by host specificity (Thorogood et al., 2008). For example, populations of O. minor parasitizing sea carrot (Daucus carota ssp. Gummerfer) are genetically isolated from Trifolium-specific populations in Britain by differences in host ecology, and by inbreeding.

Phylogenetic analyses have recently placed the holoparasitic family Cytinaceae as sister to the recently described neotropical Muntingiaceae in the Malvales (Nickrent, 2007). Cytinus spp. in the Mediterranean and Macaronesia show marked trends in their host specificity, and are restricted to hosts within the Cistaceae. For example C. hypocistis occurs on several Cistus spp. and Halimium spp., however populations
appear to show patterns of specificity at a local level (Thorogood and Hiscock, 2007). In addition, molecular AFLP data also indicate that distinct races have evolved alongside infrageneric sections of the Cistaceae at a regional level in the Mediterranean Basin (de Vega et al., 2008). Thus, in the Cytinus genus, host specificity appears to have been an important driver of genetic divergence among local populations, and speciation on a regional scale.

In summary, host race formation, coupled with cryptic morphology, may have contributed to the taxonomic complexity associated with parasitic plants. Given our rudimentary understanding of the evolution of many families, and the complexity of host-parasite relationships, host specificity may be an underestimated driver of speciation in parasitic plants.

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THE POTENTIAL OF RHIZOBIUM MUTANTS FOR BIOLOGICAL CONTROL OF OROBANCHE CRENATA

Pea (Pisum sativum L.) is the most widely grown grain legume in Europe and the fourth-most in the world. Orobanche crenata is a root holoparasitic plant which constitutes the major constraint for pea cultivation in the Mediterranean area and Middle East. The most feasible method of control is breeding for resistant genotypes although little resistance is available within cultivated pea (Rubiales et al., 2003). Different mechanisms involved in resistance against Orobanche have been identified in several host species, such as cell wall deposition, vessel occlusion, accumulation of phenolic compounds, necrosis as in the hypersensitive response (HR) (Goldwasser et al., 2000).

Gene expression associated with phytoalexin synthesis and jasmonic acid (JA) pathways have been described in the host while parasitic plant-plant interaction is established (Griffitts et al., 2004, Joel and Portnoy 1998, Westwood et al., 1998). Although it has been demonstrated that some genes associated with the salicylic acid (SA) pathway are not induced in the host by Orobanche infection (Griffitts et al., 2004), the efficacy to decrease the level of Orobanche infection by exogenous application of the SA synthetic analogue benzothiadiazole (BTH) (Sauerborn et al., 2002), demonstrates that defence against Orobanche is inducible through the SA pathway.

Pea (Fabaceae) is able to establish species-specific symbiosis with Rhizobium leguminosarum bv. viceae. This symbiotic coexistence is established by a complex signal exchange initiated by the exudation of phenolic compounds by the host roots, mainly flavonoids. These compounds activate the expression of a number of genes in the symbiotic bacteria which induce the secretion of a signal molecule called the Nod factor. Nod factor is a key molecule in the specific recognition of the host by the symbiotic bacteria which triggers in the host a number of responses which allow the symbiotic colonization (Perret et al., 2000). In a Rhizobium-legume compatible interaction, defences mediated by different regulatory signals are induced in the legume plant. However this defence is transitory and the legume plant rapidly recognizes the compatible Rhizobium as a partner.

Some compatible Rhizobium strains have been reported to decrease O. crenata infections in pea, being a defence mediated through activation of oxidative process, LOX pathway and production of possible toxic compounds, including phenolics and pisatin, inhibiting germination of O. crenata seeds and causing a
browning reaction in germinated seeds (Mabrouk et al., 2007).

On the other hand, Martínez-Abarca et al., 1998 demonstrated that an increase in SA is observed when the plants are inoculated with an incompatible Rhizobium unable to synthesize the Nod factor. It leads us to think of the possibility to induce defence against Orobanche, mediated through the SA pathway, by the inoculation of incompatible Rhizobium. To achieve that, we treated _O. crenata_-inoculated peas with _R. leguminosarum_ 248, mutant _nodC_ and we found a reduction of 74% in _O. crenata_ infection. This mutant is altered in respect to the production of the protein NodC which directs the synthesis of the chitin oligosaccharide backbones of _Rhizobium_ LCOs (Kamst et al., 1997). Our results suggest that the use of _nodC_ _Rhizobium_ mutants to stimulate defence in _Orobanche_ susceptible pea plants mediated by SA pathway.

References:
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**STRIGA ASIATICA IN NEPAL**

_Striga asiatica_ (L.) Kuntze is an annual serious root parasite in many crops like sorghum, corn, sugarcane, and millet. It is the most widespread witchweed in the world and causes great economic loss in agriculture. The flower color varies; it can be red, deep red, white, pale pink, or yellow. Leaves are opposite, linear, entire, sessile, rough with small prickles or scabrid-like sand paper. The plant remains grey or green even after drying.

This weed was collected in Nawalparasi district, Nepal. Nawalparasi is one of the six districts of Lumbini zone covering terai, inner terai, and hilly areas. Geographically, it lies between 26° 12'-27° 47' north latitude and 86° 36'-84° 35' east longitude with altitude ranging from 100-1936 m. The specimen was collected in 1991 by Dr. Jagat D Ranjit in a field of mixed cropping of maize, pigeon pea and millet. The flower color was light pink. Researchers, technicians and farmers are not very familiar with this weed. The presence of _S. asiatica_ in this country is a threat and the weed must be considered a serious problem no matter how little the field is infested. Voucher specimens are preserved in the Agronomy Division, Nepal Agriculture Research Council (NARC), in Khumaltar.

Jagat D. Ranjit
Lytton J. Musselman
UPDATES FROM THE PARASITIC PLANT CONNECTION

September 2008
It may seem from the long period of time between this and the last report that nothing was being done to the Parasitic Plant Connection (http://www.parasiticplants.siu.edu/). Such is not the case! There have been a number of updates and, as you would expect, additions of numerous photographs. A number of family alliances have changed owing to information obtained from molecular data. This is especially true for members of Santalales. Within this order, two new genera have been named (Staufferia and Pilgerina, both in ‘Santalaceae’ from Madagascar) and among holoparasitic Orobanchaceae, the genus Eremitilla was named and described. Previous molecular work placed Rafflesiaceae sensu stricto in Malphighiales, but additional work showed it is related to Euphorbiaceae. The original study that separated Cynomoriaceae from Balanophoraceae also showed the latter to be affiliated with Santalales. This result has been confirmed by two additional and independent studies. From these, it should be apparent that there is much work taking place with parasitic plants and that interest in them is increasing.

December 2008
The widespread use of digital cameras has resulted in a virtual explosion of photographs on the internet! Moreover, these armies of professional and amateur photographers are sharing their photos with the world by posting on web sites such as Flickr and Picasa web. I have recently conducted a series of searches, mainly on the Flickr web site, for photographs of parasitic plants. This resulted in literally thousands of hits, many of which are of species not previously shown on the Parasitic Plant Connection. Several hundred links to individual photos or photo sets were then added. This method of sharing photos has the benefit of not requiring separate server space for image storage but has a possible down side if these links are not stable over time. Enjoy the richness and diversity that adding these links provides!

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PRESS RELEASES

‘Four new cowpea varieties released’ 30 October 2008

The Savanna Agricultural Research Institute of the Council of Scientific and Industrial Research has released four new varieties of cowpea that have the potential to increase significantly the level of production from 50 to 100 per cent and also the income of cowpea producers. A statement issued by the Director of Crop Services of the Ministry of Food and Agriculture named the varieties as Bawutawuta, Songotra, Padi-Tuya and Zaayura. It said the newly developed varieties were tested under sole and additive series intercropping conditions in on-station trials for three years (2005-2007) and adaptive trials with farmers for another three years (2006-2008). They were developed to address the constraints of low yield potentials of existing varieties, susceptibility to insect pests and Striga gesnerioides infection, poor soil fertility and terminal drought which militate against cowpea production.

The varieties, the statement said, were adapted to sole cropping conditions, with grain yield variations of 1.6 to 2.5 tons per hectare in the Guinea Savanna zone compared with 0.75 to 1.2 tons per hectare in the Sudan savanna zone. It said through the formal and informal sensory evaluations, these varieties had been shown to have very good cooking qualities for kosei, watse and tubani preparations. ‘These varieties combined high yields and relatively larger grain sizes with high levels of resistance to aphids, bruchids and Striga gesnerioides and therefore have the potential of reducing the cost of production and storage.’

Cowpea is one of the most important grain and fodder legume crops in Ghana and over 75 per cent of annual national output is realised in the three northern regions, which lie within the Guinea and Sudan Savannah zones.

Ghana News Agency

‘More yield, less crop loss from new Striga-resistant maize’ 18 December 2008

IITA, Ibadan, Nigeria – Maize farmers in West and Central Africa (WCA) could soon enjoy increased harvests and reduced crop losses due to Striga with the introduction of two new resistant varieties - TZLComp1Syn W-1 (Sammaz 16) and IWDC2SynF2 (Sammaz 15) - developed by IITA in partnership with
the Institute for Agricultural Research (IAR), Zaria, Nigeria.

Sammaz 16, a late-maturing maize variety, produces 3.2 tons per hectare under heavy Striga conditions. Even under extreme infestation, harvest loss from this variety is less than 10%. It also exhibits significantly less Striga damage and supports fewer emerged parasites than the susceptible farmers' varieties. It also has good plant and ear qualities and is highly-tolerant to root and stalk lodging. The crop could be harvested within 110-120 days.

On the other hand, Sammaz 15, an intermediate-maturing variety, could yield 4.42 tons per hectare, which is 23% higher than the average production of local varieties under Striga infestation. Aside from being resistant to Striga, Sammaz 15 is also highly-tolerant to root and stalk lodging, has good ear and plant aspects, and excellent husk cover. The crop is ready for harvest 100-110 days after planting.

These varieties, which have been released early this month, were tested in crop trials conducted by IITA and IAR in Northern Nigeria. ‘The results of trials of Sammaz 15 and Sammaz 16 show great potential for increased maize production not only in Nigeria but also in other countries in the WCA Region by cutting losses due to Striga and, consequently, boosting farmers' incomes,’ says Abebe Menkir, IITA maize breeder.

In the moist savannah of coastal and central Sub-Saharan Africa, Striga, or witch-weed, causes maize yield losses amounting to about US$ 7 billion yearly and adversely affecting the livelihoods and food security of more than 130 million people dependent on the crop in these regions. The parasitic plant is endemic in Africa and constitutes the most important biotic constraint to cereal production, with infested areas estimated between 21 to 50 million hectares.

‘There are several options available for the control of Striga in maize, but the most economically-feasible, easily accessible, safe and sustainable approach is the use of resistant or tolerant cultivars that resource-poor farmers can cultivate solely or in combination with cultural management options as well as in rotation with legumes that promote suicidal Striga germination,’ adds Menkir.

In the past few years, buoyed by the recent global food crisis, maize has seen a significant increase in demand, with utilization of the crop for food, feed and other industrial uses hitting well over 100 million tons per annum. Africa produces about 26 million tons of maize annually, with Nigeria contributing about 7 million tons.

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MEETINGS


The first symposium on the biology of non-weedy hemiparasitic (ex-)Scrophulariaceae held in Wageningen, the Netherlands in 2004 was organised by Dr Siny ter Borg and colleagues as a discussion forum for parasitic plant researchers working in a non-agronomic context. That first meeting had a strong focus on the community level impacts of parasitic plants, especially Rhinanthus species. In the latest meeting, organised by Milan Stech, Jakub Těšitel and Jan Lepš at the University of South Bohemia, Czech Republic, there was a shift in focus to a more diverse range of topics from molecular systematics and conservation genetics to whole organism physiology and mathematical modelling.

Duncan Cameron and colleagues (Universities of Sheffield, Würzburg and Beijing Normal University) investigated the properties of nitrogen-fixing, leguminous hosts that make them such good hosts for Rhinanthus minor. Cameron et al. hypothesised that compatible amino acids that are easily assimilated by the parasite may underpin the host quality of legumes for R. minor. Through investigation of host and parasite amino acid profiles, N content, ABA relations and haustoria anatomy Cameron et al. showed that the ability of the host to fix N per se did not underpin host quality; rather the high susceptibility of these hosts and the well developed haustoria formed as a result appear to be the primary factors influencing host quality in the legumes. Fan Jiang and colleagues (Beijing Normal University and the Universities of Sheffield and Würzburg) also investigated the physiology of nutrient acquisition by R. minor harnessing the physiological dichotomy between the polyol-rich parasite (primarily mannitol) and its largely polyol-free host barley. Using this host-parasite system, Jiang et al. investigated the role of mannitol in the acquisition of the essential micro nutrient boron, known to form phloem-soluble complexes with polyols.
such as mannitol. Using the incremental flow model technique, Jiang et al. provide the first quantitative evidence for boron partitioning showing significantly more B recycling in the parasite compared with that in the host. Ai-Rong Li and Kai-Yun Guan (Kunming Institute of Botany, China) again looked at nutrient acquisition this time focussing on the relative importance of arbuscular mycorrhizas for the uptake of nutrients by Chinese species of Pedicularis. Li et al. showed that despite the assumptions that parasitic plants are generally non-mycorrhizal, the majority of the Pedicularis species studied engage in tri-partite symbioses forming arbuscular mycorrhizal associations with fungi whilst also forming haustoria on host plants. Li et al. demonstrated that arbuscular mycorrhizal associations significantly enhance the growth of colonised plants and thus conclude that Pedicularis has at least two trophic strategies in its life, parasitism of other plants and mineral nutrient acquisition via mycorrhizal fungal symbionts. In the two subsequent presentations, Pavel Fibich and Jan Lepš (University of South Bohemia, Czech Republic) employed mathematical modelling to investigate the influence of community productivity on the effects of hemi-parasites on host communities. At low and intermediate productivities, the host and parasite are able to co-exist with the parasite dominating in the former scenario and the host in the latter scenario. In communities with high productivity, the persistence of the parasite is unstable and can go extinct in the community as a result of increased competition for light. Following the predictions of Fibich and Lepš, Ondřej Mudrák and Jan Lepš (University of South Bohemia) provided experimental support showing that the extent of parasite-induced suppression of the grasses in a community facilitated by Rhinanthus minor is strongly influenced by the nutrient status of the soil with R. minor mortality highest and parasite-induced suppression of the grasses lowest under high nutrient conditions.

The shifts in the physiology of R. minor during its transition between free-living plant and parasitizing a host were investigated by Fan Jiang and colleagues (Beijing Normal University and University of Würzburg). Jiang et al. removed the barley host of R. minor 14 days after attachment; these ‘host-free attached’ plants were similar in terms of their growth and development when compared with parasites still attached to their host. However, in contrast with attached parasites, host-free attached parasites developed ‘normal’ stomatal behaviour. Two explanations for these changes were discussed; 1) the supply of dissolved organic nitrogen by the degrading host root system and 2) a possible increase in growth promoting soil microorganisms using the degrading host root system as a substrate. Renate A. Wesselingh (Université Catholique de Louvain, Belgium) investigated variation in flowering time in Rhinanthus angustifolius. Early flowering ‘vernal’ and late flowering ‘aestival’ ecotypes were identified; vernal ecotypes flower early, have few branches and are relatively small while aestival plants are bigger, have more branches and flower in mid-season. These differences are linked to the number of nodes produced before the first flower. Moreover, within-population differences in flowering time may also be explained by differences in node number, just as among ecotypes. In the final talk of the session, Feng Gao (University of Sheffield) presented preliminary work for her PhD project investigating the effects of Pedicularis and Castilleja on host communities and their potential use to manage urban landscapes due to the high amenity value of these parasites.

The Melampyrum-Rhinanthus-Euphrasia group forms a clade within the hemiparasitic Orobanchaceae, and represents an important component of the European flora. However the phylogenetic relationships within this group are only poorly resolved. Jakub Těšítel and colleagues (University of South Bohemia) aimed to resolve the phylogenetic relationships within this group to a very fine detail using taxa from all genera. The initial results based on nDNA ITS sequence data are largely concordant with recent phylogenetic studies of this family. They showed the presence of a perennial life history and plants with rhizome as a plesiomorphy in the evolution of the whole group, except for the most basal genus Melampyrum and hypothesised that the annual life cycle (a predominant feature of the majority of European species), appears to have evolved independently on multiple occasions. Jerome Vrancken and Renate A. Wesselingh (Université Catholique de Louvain) investigated large-scale genetic relationships between Rhinanthus minor and R. angustifolius. Interestingly, this study revealed a disparity between cpDNA and nDNA data, which appears to be the result of past and current gene flow between these species. R. minor and R. angustifolius were found to share common cpDNA haplotypes. An analysis of the geographic distribution of these shared haplotypes revealed a pattern of asymmetric introgression, and possible chloroplast capture of R. minor by R. angustifolius. In addition, AFLP data indicated the presence of hybridisation events, confirmed the pattern of asymmetric introgression identified by cpDNA data, and also suggested that R. minor is less affected by inter-specific gene flow than R. angustifolius. Véronique Ducarme and Renate A. Wesselingh (Université Catholique de Louvain) further investigated natural hybridization between Rhinanthus minor and R. angustifolius using a
dominant marker-based approach. RAPDs and ISSRs identified bilateral introgression, but gene flow to *R. angustifolius* appeared to be more prominent. Investigations into the breeding systems of these species revealed that *R. angustifolius* is mostly outcrossing whereas *R. minor* is largely selfing; the higher outcrossing rate of *R. angustifolius* has probably increased the probability of backcrossing with this species. Finally, a hydric variation study showed that *R. angustifolius* was as fit as *R. minor*, or out-competed this species under all conditions investigated, suggesting a lower environmental resilience may have contributed to the decline of *R. minor* observed in natural populations.

Chris Thorogood and colleagues (University of Bristol) discussed their investigations into the host specificity of *Orobanche minor*, and how this process may have driven ecological divergence. Populations of *O. minor* parasitizing red clovers and sea carrots in Northern Europe were morphologically continuous, yet genetically distinct according to ISSR markers and SCAR-based sequence data. These genetic races were then cultivated in a reciprocal cross-pollinations revealed that populations of *O. minor* are selfing and probably inbreeding, which may reinforce patterns of genetic and physiological divergence. Together, these data suggest that host specificity may be an important driver of speciation in parasitic plants such as *O. minor*. Milan Štech and colleagues (University of South Bohemia) gave an outline of a new project investigating genetic variation and phylogeographic patterns in the taxonomically complicated *Melampyrum subalpinum* group in central Europe. Hybridisation, coupled with an unusual diversity of ecological niches and host plants are proposed to have contributed to the taxonomic complexity of this group in Central Europe. This three-year study will combine investigations into phenotypic plasticity and morphometric analysis with genetic approaches to overcome the taxonomic difficulties associated with this group.

In the final session Rhiannon Crichton (RBG Edinburgh and University of Aberdeen, UK) gave an outline of her PhD project investigating the ‘Conservation genetics of *Melampyrum sylvaticum*’, a nationally scarce hemiparasite in the UK that has suffered a 70% loss in distribution over the last 100 years. Rhiannon aims to discover how best to manage the genetic diversity of *M. sylvaticum* in the UK. In the concluding presentation of the meeting, Jakub Těšitel and colleagues (University of South Bohemia) discussed their investigation into the genetic diversity in the *Melampyrum sylvaticum* group in the Alps, Carpathians and Hercynian Massif. The evolutionary history of the complex was investigated using geometric morphometrics, along with nDNA ITS and cpDNA *trnL-trnT* sequence data. Data from all markers corroborated two distinct groups: a western lineage and an eastern lineage. The pronounced molecular differentiation of these lineages indicates they may be of Pleistocene origin, and suggests they may constitute distinct species. Transitional populations may therefore be the result of recent hybridisation between these lineages. Furthermore, the data refuted the traditional delimitation of the Carpathian microspecies *M. herbichii* and *M. saxosum*, highlighting the importance of a combined morphometric and molecular marker-based approach.

A special issue of the journal “Folia Geobotanica” will be published in late 2009/early 2010 highlighting the developments in understanding the biology of non-weedy members of the Orobanchaceae presented at the meeting.

Duncan Cameron (University of Sheffield, UK)

Chris Thorogood (University of Bristol, UK)

Papers presented:

Jana Bubníková and Jan Lepš - The interaction of fertilization and removal of *Rhinanthus minor* on sward productivity, species cover and diversity.

Duncan Cameron et al. - Does legume nitrogen fixation underpin host quality for the hemiparasitic plant *Rhinanthus minor*?

Jan Chlumský and Milan Štech - Genetic diversity and distribution of *Melampyrum subalpinum* group in the Central Europe: preliminary preview.

Rhiannon Crichton - Conservation genetics of *Melampyrum sylvaticum*.

Véronique Ducarme and Renate A. Wesselingh - Ecological and genetic aspects of natural hybridization between *Rhinanthus minor* and *R. angustifolius*.

Pavel Fibich and Jan Lepš - The model of population dynamics of root hemiparasitic plants along a productivity gradient.

Feng Gao - Role of hemiparasites in the development of the naturalistic herbaceous vegetation.

Fan Jiang et al. - Growth and development of the facultative root hemiparasite *Rhinanthus minor* after removal of its host.

Fan Jiang et al. - Mobility of Boron-polyol complexes in the hemiparasitic association between *Rhinanthus minor* and *Hordeum vulgare*: the effects of nitrogen nutrition.

Ai-Rong Li and Kai-Yun Guan - Nutrient strategies of root hemiparasitic *Pedicularis* (Orobanchaceae) from the northwest of Yunnan Province, China.

This international meeting, attended by thirty participants from 11 countries, was arranged by the European Weed Research Society (EWRS) Parasitic Weeds Research Group with financial support from the Cooperative Research Programme of OECD (Organisation for Economic Co-operation and Development), the National Research Council of Italy and the Weizmann Institute, Israel.

‘The group discussed how new ideas, new approaches, new solutions, or new methodologies coming from different fields of application are beginning to and may further be used in the field as the science progresses. They described and discussed how each technology should be integrated with others to synergistically effect reliable control, while reducing weed seed banks so that susceptible crops can be part of a rotation. A further aim of the conference was to create a network of new recruits and experienced scientists that could have, find or create new opportunities to collaborate in this field of science that requires a global collaborative approach. In this perspective, links have also been created with scientists working with many other host-parasite interactions, or with symbiotic interactions. This is because parasitic weeds can interact, for example, with the host plants using the same root signals used by plants to attract their symbiotic organisms, such as rhizobia or arbuscular mycorrhizal fungi; mechanisms of plant resistance can have common pathways with phytopathogenic fungi; molecular approaches can have the same procedures as the study of other plant species.

Hence this small conference was proposed and organized, with a restricted number of top scientists working on many different aspects of plant parasitism, or in closely related fields, sharing their ideas and expertise, and bringing solutions from theory to practice, from the lab to the field.’

(from EWRS Newsletter)

The papers presented are listed below. They are not discussed or summarised here as they will be published in a special issue of Pest Management Science, to appear later in 2009. This issue consists of peer-reviewed research papers and reviews arising from the meeting. The issue is edited by Jonathan Gressel at the Weizmann Institute of Science in Israel, and Maurizio Vurro at the National Research Council in Italy. For more information on the issue, please email Alexandra Carrick (alcarric@wiley.com). The Table of Contents is available from maurizio.vurro@ispa.cnr.it

Single print copies of this exciting issue are available for sale to readers for 85 US$ + p&p – a 50% discount on the standard issue price. There will be a limited print run, so please order soon to avoid disappointment. To order, email cs-journals@wiley.co.uk or phone +44 1243 843335.

The individual papers will be listed and reviewed in the next issue of Haustorium. However, abstracts of four other contributions which will not be included in the Pest Management Science issue also appear below.

Presenting authors and titles (full authorship not indicated)

Erwin Balazs, Maurizio Vurro and Jonathan Gressel – Introduction.
Chris Parker - Observations on the current status of Orobanche and Striga problems worldwide.
John Yoder - Engineering host resistance against parasitic weeds with RNA interference.
Koichi Yoneyama - Strigolactones; structures and biological activities.
Harro Bouwmeester - Strigolactones: ecological significance and use as a target for parasitic plant.
control.
Binne Zwanenburg - Structure and function of natural and synthetic signaling molecules in parasitic weed germination.
Daniel M. Joel - Is seed 'conditioning' essential for Orobanche germination?
Consuelo M. De Moraes and Mark C. Mescher - Hormone-mediated plant defence responses to parasitic plants and other antagonists.
Maria J. Harrison - Laser microdissection and its application to analyze gene expression in the arbuscular mycorrhizal symbiosis.
David G. Lynn - Parasitic angiosperms, semagenesis, and general strategies for plant-plant signaling in the rhizosphere.
Jianxiong Li, Karolina E. Lis, and Michael P. Timko - Molecular genetics of race specific resistance of cowpea to Striga gesnerioides. (not presented)
Julie D. Scholes - A major QTL for resistance of rice to the parasitic plant Striga hermonthica is not dependent on genetic background.
James H. Westwood - RNA translocation between parasitic plants and their hosts.
Alejandro Pérez-de-Luque - Nanotechnology for parasitic plant control.
Antony M. Hooper - New genetic opportunities from legume intercrops for controlling Striga spp. parasitic weeds.
D Rubiales - Breeding approaches for crenate broomrape (Orobanche crenata Forsk.) management in pea (Pisum sativum L.).
Maurizio Vurro - Natural metabolites for parasitic weed management.
Alan Watson - Integrating Fusarium oxysporum f. sp. strigae into cereal cropping systems in Africa.
Jonathan Gressel - Transforming a NEP1 toxin gene into two Fusarium spp. to enhance mycoherbicide activity on Orobanche – failure and success.
Brian G. Rector - A sterile-female technique proposed for control of certain parasitic and intractable weeds: advantages, shortcomings, and risk management.
Sarah J Hearne - Control; the Striga conundrum.

Maurizio Vurro and Jonny Gressel are to be thanked and congratulated on the excellent arrangements for this meeting, not least for the excellence of the food, which at one point included a delicacy specially prepared by Maurizio – marinated Orobanche crenata. Recipe provided on request!

Chris Parker.

Abstracts of 4 additional items presented at the above meeting:

Unravelling the strigolactone biosynthetic pathway: nutrient deficiency and ABA regulation
Juan Antonio Lopez-Raez1, Wouter Kohlen2, Tatsiana Charnikhova1, Radoslava Matusova1, Patrick Mulder2, Carolien Ruyter-Spira1, Catarina Cardoso1, Francel Verstappen1,2, Harro Bouwmeester1,3
1 Laboratory for Plant Physiology, Wageningen, The Netherlands
2 RIKILT, Institute of Food Safety, ditto
3 Plant Research International, ditto

Strigolactones are signalling molecules playing a double role in the rhizosphere as host detection signals for arbuscular mycorrhizal (AM) fungi and root parasitic plants, and acting as a shoot branching inhibition hormone. Strigolactones are biosynthetically originating from carotenoids through the action of carotenoid cleavage enzymes. The biosynthesis of these signalling compounds is tightly regulated by environmental conditions such as nutrient availability, mainly phosphate (Pi). However, although it is known that limited-Pi conditions improve the production and/or exudation of strigolactones, there is no information concerning the effect of these stress conditions on the enzymes involved in strigolactone production. We have recently demonstrated that tomato is a good system to study the production and regulation of these important signalling compounds. Here, we focus on the biosynthetic origin of strigolactones, and an analysis of Pi starvation-induced changes in gene expression in tomato roots using a microarray study is described. In addition, the relationship of these signalling compounds with the carotenoids and the hormone abscisic acid (ABA) will be discussed.

Maize germination stimulants characterization and quantification.
Tatsiana Charnikhova1, Juan Antonio Lopez-Raez1, Patrick Mulder2, Bart Steenbergen1, Jacques Vervoort1, Pieter de Waard3, Muhammad Jamil1 and Harro Bouwmeester1
1 Laboratory of Plant Physiology, Wageningen, The Netherlands
2 RIKILT, Institute of Food Safety, ditto
3 Laboratory of Biochemistry, ditto

Maize (Zea mays) is an important food crop in North and South America, Africa, Asia, Europe and is a host of the devastating root parasitic weed Striga hermonthica (Bouwmeeter et.al.2003; Matusova et.al. 2005). In this study, germination stimulants for
root parasites produced by different cultivars of maize such as Dent, A188, H99, hybrids A188xH99, WH 502, HP3253 and maize mutants were investigated.

Characterization and quantification of strigolactones in maize root exudates were done by comparing retention times, MRM transitions and MS²-spectrums of germination stimulants with those of strigolactone standards (sorgolactone, strigol, orobanchol, 5-deoxystrigol, solanacol and orobanchyl acetate) using ultra performance liquid chromatography coupled to tandem mass spectrometry (UPLC-MS/MS).

In maize Dent roots exudates we found 5-deoxystrigol, strigol and sorgolactone. Maize cultivars A188 and H99 and maize hybrids A188xH99, WH 502, HP3253 were found to exude small amounts of known strigolactones such as orobanchol, strigol, orobanchyl acetate, sorgolactone but also 5 unknown (new) germination stimulants. Their tentative identification and structure elucidation by LC/MS/MRM, MS² and NMR will be discussed.

References:

Chemical control of broomrape – an overview
Joseph Hershenhorn

Department of Phytopathology and Weed Research, Newe Ya’ar Research Center, Israel. josephphe@volcani.agri.gov.il

During the last decades chemical control demonstrated great success in controlling various weeds. However, field success in the control of the weedy root parasites Orobanche and Striga was scarcely documented. The only herbicides known to control broomrapes belong to the aceto lactate synthase (ALS) inhibiting herbicides – sulfonylureas and imidazolinones. However, the main obstacle in achieving adequate broomrape control is the low safety margin of these two groups of herbicides toward most of the crops, which are sensitive to the parasite. Since the main developmental stages of the parasite occurs underground, there is a lack of knowledge as to the rates needed for effective herbicide control, the number of applications, and above all the timing of application. The sulfonylurea herbicides are active through the soil solution. Therefore, overhead irrigation is needed to drive the herbicide into the relevant soil profile. On the other hand the imidazolinones act systemically, penetrating the plant through the crop foliage, translocated to the infected roots, and sucked by the attached parasite until reaching a lethal dose which kills it.

A successful protocol for controlling Orobanche aegyptiaca in processing tomato was developed in Israel and registered for commercial use. The successful control in heavily infested fields involves three sulfosulfuron applications followed by overhead irrigation (by sprinklers or moving pivot) and two applications of imazapic starting at 63 days after planting.

During the last 3 years, minirhizotron camera observations were made in experiments conducted in commercial processing tomato fields in various climatic regions in Israel. The observations enabled us to define the dynamics of O. aegyptiaca development as correlated with Growth Degree Days (GDD). It also enabled defining the length of time, in GDD units, during which the herbicide remains active in soil. Based on the minirhizotron information, a decision support system (DSS, named Pick-It ver.1.0) was developed. The DSS is intended for use by the growers in Israel. It directs the grower to the most effective treatments for broomrape control according to the estimated infestation level in his field.

The effect of branched broomrape (Orobanche ramosa) infection on fruit quality of tomato.
Longo A.M.G., Lo Monaco A. and Mauromicale G.

Dipartimento di Scienze Agronomiche, Agrochimiche e delle Produzioni Animali, Università degli Studi di Catania, Catania, Italy. e-mail: amg.longo@unict.it

Branched broomrape (Orobanche ramosa L.) is the most widespread and damaging of the broomrape species, affecting large areas of solanaceous (primarily tobacco, potato, tomato and eggplant) crops, across the Mediterranean Basin, North Africa and Asia. In Italy, it is responsible for significant yield losses in tobacco, cabbage and both field- and greenhouse-grown tomato. Needless to say, fruit quality and composition are important components to improve the marketable value of tomatoes but no data are available in the literature about the influence of the broomrape. The aim of the present research was to evaluate the changes in physical characteristics and chemical composition of tomatoes in relation to branched broomrape infection. The field study was conducted, over the 2004-2005
season, on the coastal plain of Siracusa (Sicily), southern Italy. In order to grow tomato plants both in the absence and in the presence of branched broomrape, the experimental area, naturally infested by *O. ramosa* before the experiments, was first solarized by covering with a 30 µm transparent polyethylene film from 2 July to 17 September 2004. Two days after planting, branched broomrape seed was mixed with finely sieved sand and placed in a soil layer at a depth of 10-15 cm uniformly around the host plant. Over the harvesting period physical (fresh weight, dry matter, colour, firmness, mesocarp thickness, and seed number) and chemical fruit determinations (reducing sugar, soluble solids, ash content, titratable acidity, pH and vitamin C) were carried out. Under the specific condition of these experiments, the presence of branched broomrape was significantly and clearly associated with a reduction of fresh and dry weight, mesocarp thickness, red colour, firmness, titratable acidity, reducing sugars, soluble solid, ash and vitamin C content of tomatoes. On the contrary, the number of seeds per fruit significantly increased in infected plants.


The pathogenic composition of *Orobanche cumana* populations in sunflower fields has rapidly changed in recent years, with new aggressive races causing heavy damage in particular in Eastern Europe, Turkey and Spain. For this reason more than eighty participants, from fifteen countries attended the *Orobanche*-sunflower meeting in Antalya (Turkey) on 30 November - 3 December 2008. The meeting was carefully organized by the Trakya Agricultural Research Institute in collaboration with the Turkish Plant Breeders Association, the International Sunflower Association and the FAO, and chaired by Dr Yalcin Kaya. The venue was a pleasant ‘All Included’ hotel on the Turkish Mediterranean coast, which allowed calm and fruitful discussions.

The meeting was mainly dedicated to reports on new *Orobanche* resistances in sunflower and to a detailed discussion of the identification of the new *O. cumana* races in the various countries of broomrape distribution. Therefore most of the participants were people involved in sunflower breeding.

After two introductory lectures on biological aspects of host-parasite interaction, the meeting included an update on the broomrape problem in various countries, and detailed discussions on the use of IMI (imidazolinone resistant) sunflower cultivars in combination with resistance to *O. cumana*, and on the combination of vertical and horizontal *Orobanche* resistance mechanisms in the same genotype for more durable resistance. Molecular studies to identify QTLs associated with broomrape resistance genes, as well as pyramidization of different resistance genes and combination of different resistance mechanisms have also been presented in the conference. The need to integrate any treatment of broomrape within the context of the management of other weeds in sunflower fields has been emphasized.

This topic will be further discussed during the coming IPPS Congress in June 2009. We will then have a special session on the distribution of the various *O. cumana* races and their identification by sunflower differentials and by molecular markers, and will also dedicate time for the discussion of integrated *Orobanche* management in sunflower and in other crops.

Some of the papers listed below will be published in ‘Helia’.

Danny Joel

Papers presented:

Höniges, A. *et al.*. *Orobanche* resistance in sunflower.


Bülbüll, F. *et al.* - Broomrape (*Orobanche* spp.) problem in the eastern Mediterranean region of Turkey.


Christov, M. *et al.* - The wild species *Helianthus* - source of resistance to the parasite *Orobanche cumana*.

Jinga, V. *et al.* - Behavior of some sunflower cultivar at the broomrape attack in Romania.

Gontcharov, S.V. *et al.* - Sunflower breeding for resistance to the new broomrape race in the Krasnodar region of Russia.

Hladni, N. *et al.* - The use of new Rf inbred lines originating from interspecific population with *H.*
Melero-Vara, J.M. et al. - The performance of sunflower hybrids resistant to race F of *Orobanche cumana* Wall. in naturally infested fields.

Kaya, Y. et al. - The evaluation of broomrape resistance in sunflower hybrids.

Antonova, T.S. et al. - The virulence of broomrape (*Orobanche cumana* Wallr.) populations on sunflower in some regions of Northern Caucasus.

Gunduz, O. and Goksoy, A.T. - Determination of superior hybrid combinations in sunflower and testing hybrid performance in broomrape (*Orobanche cumana* Wallr.) infested areas.


Dicu, G. et al. - Improving sunflower for resistance to *Orobanche* and sulfonylureas herbicides - sunflower hybrid PF100.

Esmaailifar, A. et al. - Control of broomrape in Iran.

Demirci, M. and Kaya, Y. - Status of *Orobanche cernua* Loefl. and weeds in sunflower production in Turkey.

**FORTHCOMING MEETINGS**

The 10th World Congress on Parasitic Plants will be held in Kusadasi, Turkey, June 8-12, 2009. Contribution and participation from researchers, industry and all relevant people on any weedy or non-weedy parasitic plant is encouraged. The programme will consist of oral presentations and posters. The Organizers and Scientific Committee will select speakers for the session topics on the website from the submitted abstracts. Therefore, if you wish to be considered for a talk, please submit your abstract by March 20. Submit your abstract on the web site http://www.ippseturkey.com/default.asp?link=abstract. The abstracts will be disseminated to symposium registrants in a Symposium Abstract Book. Each abstract will be one page. To submit abstract:

1. Compose the body of your abstract using 10 point and Arial font in your own word processing programme. Please limit it to 300-350 words. Please check spelling and grammar. Do not include either the title of your abstract or the authors’ names and addresses in that text, the title and authors will be entered separately.

2. When you are ready to submit your abstract, have available the names, addresses and e-mails of your co-authors (if any). Please indicate presenting/attending author.

3. Please indicate two sessions in the order of relevance.

The scientific committee will allocate your presentation depending on all submissions.

**Sessions:**

- Evolution and phylogeny of parasitic plants
- Parasite biochemistry and physiology (including molecular biology)
- Ecology and population biology of parasitic species
- Host-parasite communication (including germination stimulation, haustorial induction, etc.)
- Host and non-host responses to parasitism
- Parasitic weed management (including economics)
- Regulation and phytosanitation
- Breeding for parasitic plant control
- Special topics 1: biological aspects of mistletoes (or hemiparasites)
- Special topics 2: climate change and parasitic plants
- Special topics 3: *Orobanche cumana*

4. Please show your preference as oral or poster. However, the ultimate decision will be made by the scientific committee.

5. Submit your abstract online no later than March 20, 2009.

6. For oral presentations, presenting author should register before April 17, 2009.

7. For poster presentations one author should register before May 2, 2009 to have your abstract published.

Organization Committee

Contact for scientific queries: Ahmet Uludag (secretary@ippsipurkey.com). For registration and accommodation queries: Deniz Yanar Servi (info@ippsturkey.com). Or refer to the conference website: www.ippseturkey.com.

**GENERAL WEB SITES**

For individual web-site papers and reports see

**LITERATURE**

For information on the International Parasitic Plant Society, past and current issues of Haustorium, etc. see: http://www.ppws.vt.edu/IPPS/

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml (now updated and functional)
For information on the 10th World Congress on Parasitic Plants in Kusadasi, Turkey, June 8-12, 2009, see: http://www.ippsturkey.com

For abstracts from the 9th World Congress on Parasitic Plants see: http://www.cpe.vt.edu/wcopp/index.html

For the ODU parasite site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Lytton Musselman’s Hydnora site see: http://www.odu.edu/webroot/instr/sci/plant.nsf/page/lecturesandarticles

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes) see: http://www.rmrs.nau.edu/mistletoe/

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For the Parasitic Plants Database including ‘4000 entries giving an exhaustive nomenclatural synopsis of all parasitic plants’ (last updated 2003), the address is: http://www.omnisterra.com/bot/pp_home.cgi

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au

For past and future issues of the Sandalwood Research Newsletter, see: http://www.jcu.edu.au/mbil/srn/index.html (Contents of issues 22 and 23 have not been noted in Haustorium – to be included in Haustorium 55)

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga management’ newsletters, see: http://www.aatf-africa.org/

LITERATURE

*A indicates web-site reference only


Adrian-Romero, M., Blunden, G., Patel, A.V., Armstrong, N., Meléndez, P. and Cuervo, A.C. 2007. Betaines and N-methylprolines from Venezuelan plants. Natural Product Communications 2(8): 863-868. (N-methylprolines were isolated from four species of Loranthaceae (unspecified in abstract).)
Aflakpui, G.K.S., Bolfrey-Arku, G.E.K., Anchirinah, V.M., Manu-Aduening, J.A. and Adu-Tutu, K.O. 2008. Incidence and severity of Striga spp. in the coastal savanna zone of Ghana: results and implications of a formal survey. Outlook on Agriculture 37(3): 219-224. (65% of farmers surveyed reported Striga (presumably S. hermonthica) in maize, 5% each in cowpea (presumably S. gesnerioides) and in millet. Occurrence had apparently increased greatly over the past 40 years.)


Alexandrov, V. and Dimitrov, S. 2007. Response of introduced sunflower hybrids to broomrape (Orobanche cumana W.). Bulgarian Journal of Agricultural Science 13(5): 521-527. (Of 16 introduced hybrids, none were immune but one was ‘resistant’ and 9 showed moderate resistance.)


Ameloot, E., Verlinden, G., Boeckx, P., Verheyen, K. and Hermy, M. 2008. Impact of hemiparasitic Rhinanthus angustifolius and R. minor on nitrogen availability in grasslands. Plant and Soil 311(1/2): 255-268. (In a study conducted in Belgium, presence of the Rhinanthus spp. resulted in reduced grass and legume growth and hence reduced total N in above ground vegetation. Total N in the soil was increased but was relatively less available.)


Baburabdul, O.O. and Odhiambo, G.D. 2007. Klebsiella oxytoca '10mkr7' stimulates Striga suicidal germination in Zea mays. Journal of Tropical Microbiology and Biotechnology 3(2): 13-19. (Suggesting that the rhizobacterium K. oxytoca is a plant growth promoter and can stimulate suicidal germination of Striga hermonthica.)


Bacieczko, W. and Myśliwy, M. 2008. The distribution of Orobanche pallidiflora Wimm. & Grab. in Poland. Folia Universitatis Agriculturae Stetinensis, Agricultura, Alimentaria, Piscaria et Zootechnica 260(5): 5-13. (The rare and endangered O. pallidiflora occurs at only 40 sites in Poland. Distribution and habitat are described.)


Barea, L.P. 2008. Nest-site selection by the Painted Honeyeater (Granttiella picta), a mistletoe specialist. Emu – Austral Ornithology 108(3): 213-220. (Nesting of this bird species was predominantly in Acacia homalophylla, the principal host for Amyema quandang, while at least half these nests were in the mistletoe itself.)

Barina, Z. and Pifkó, D. 2008. New or interesting distributions and habitat are described.)


Barea, L.P. 2008. Nest-site selection by the Painted Honeyeater (Granttiella picta), a mistletoe specialist. Emu – Austral Ornithology 108(3): 213-220. (Nesting of this bird species was predominantly in Acacia homalophylla, the principal host for Amyema quandang, while at least half these nests were in the mistletoe itself.)


in Rafflesiaaceae, of 20 to 90 cm/million years, and concluding that they could continue to get bigger.


Benvenuti, S. 2008. (Parasitization dynamics and seed dispersal of dodder (Cuscuta campestris) on host-weeds present on winter-wheat stubbles.) (in Italian) In: Brunelli, A. (ed.) Giornate Fitopatologiche 2008, Cervia (RA), 12-14 marzo 2008, Volume 1: 485-492. (Noting a very high seed-bank of C. campestris seeds, of 10,000 to 20,000/m² and very low annual germination of 1%. Also the importance of weed hosts, especially Ammi majus, and the need to destroy them soon after crop harvest to prevent parasite seed production.)


Büssing, A., Tröger, W., Stumpf, C. and Schietzel, M. 2008. Local reactions to treatments with Viscum album L. extracts and their association with T-lymphocyte subsets and quality of life. Anticaner Research 28(3B): 1893-1898. (Results indicate that the induction of moderate local reaction in response to V. album extract application was associated with better T cell function and quality of life than when a strong reaction occurred.)


Cazetta, E. and Galetti, M. 2007. (Fruigivory and host specificity in the mistletoe Phoradendron rubrumb (L.) Griseb. (Viscaceae). (in Portuguese) Revista Brasileira de Botânica 30(2): 345-351. (The main hosts of P. rubrum were Tabebuia ochracea and Melia azedarach and the main seed dispersers were the birds Euphonia chlorotica and E. cyanoecephala.)

Čebovic, T., Spasic, S. and Popovic, M. 2008. Cytotoxic effects of the Viscum album L. extract on Ehrlich tumour cells in vivo. Phytotherapy Research 22(8): 1097-1103. (Recording a significant reduction in the incidence of cancer in mice that received the V. album extract compared with the control group, possibly due to induction of oxidative stress in the Ehrlich tumour cells.)

Chan ShunWan, Li Sha, Kwok ChingYee, Benzie, I.F.F., Szeto YimTong, Guo DeJian, He Xiaoping and Yu HoiFu, 2008. Antioxidant activity of Chinese medicinal herbs. Pharmaceutical Biology 46(9): 587-595. (Among 40 herbs tested, Taxillus sutchuenensis was among the highest in antioxidant activity and/or total phenolic content.)

Chhikara, A. and Friedman, C.M.R. 2008. The effects of male and female Arceuthobium americanum (lodgepole pine dwarf mistletoe) infection on the
relative positioning of vascular bundles, starch distribution, and starch content in *Pinus contorta* var. *latifolia* (lodgepole) needles. Botany 86(5): 539-543. (A. *americanum* greatly reduced starch grains in the needles of *P. contorta*. Male parasites had a greater effect on the positioning of vascular bundles than did female parasites.)


Conklin, D.A. and Geils, B.W. 2008. Survival and sanitation of dwarf mistletoe-infected ponderosa pine following prescribed underburning. Western Journal of Applied Forestry 23(4): 216-222. (Results indicate that under-burning can be a viable tool to manage *Arceuthobium* spp. in *Pinus ponderosa*, given sufficient fire intensity.)

Córdoba, E., González-Verdejo, C.I., Die, J., Román, B. and Nadal, S. 2008. First report of *Orobanche crenata* on *sulla* (*Hedysarum coronarium*) in Andalusia, southern Spain. Plant Disease 92(12): 1709. (*H. coronarium* grown following a previous crop of *Vicia narbonensis* which had been heavily infested with *O. crenata*, was also lightly infested – possibly the first report of infestation of this host.)

Costea, M., Aiston, F. and Stefanovic, S. 2008. Species delimitation, phylogenetic relationships, and two new species in the *Cuscuta gracillima* complex (Convolvulaceae). In: Graham, S.W. and Bruneau, A. (eds) Special Issue: Systematics Research. Botany 86(7): 670-681. (Eight taxa are described, including the new spp. *C. punana* from Ecuador and *C. vandevenderi* from Mexico. *C. colombiana* is redefined to include *C. aristeguiae*, and *C. deltoidea* is broadened to encompass *C. serruloba*. A taxonomic key, descriptions, and illustrations are provided.)

Cumbleton, P. 2008. *Castilleja*: saying goodbye to the host. Plantsman 7(4): 218-221. (Reporting that many *Castilleja* spp. can be grown without a host, and particularly recommending *C. miniata*, *C. pruinosa*, *C. applegatei* and *C. chromosa* as ornamentals.)


Darwish, D.S., Abdalla, M.M.F., Saber, H.A. and Sedik, M.T. 2007. Investigations on faba beans, *Vicia faba* L. 22 - Reaction of six faba bean genotypes and *Orobanche* to the herbicide glyphosate. Egyptian Journal of Plant Breeding 11(1): 401-409. (Best overall results were recorded from the higher (54g/seed) dose of glyphosate and for variety Cairo 2, and the worst from variety Giza 2.)


Demrbas, S. and Acar, O. 2008. Superoxide dismutase and peroxidase activities from antioxidative enzymes in *Helianthus annuus* L. roots during *Orobanche cumana* Wallr. penetration. Fresenius Environmental Bulletin 17(8a): 1038-1044. (Characterizing the activities of these antioxidative enzymes in roots of parasitized sunflower cultivars Pioneer 4223, Sanay, and Isera. Higher activity during first week after inoculation is linked to resistance in the Pioneer cultivar.)

Dugje, I.Y., Kamara, A.Y. and Omoigui, L.O. 2008. Influence of farmers' crop management practices on *Striga hermonthica* infestation and grain yield of maize (*Zea mays* L.) in the savanna zones of northeast Nigeria. Journal of Agronomy 7(1): 33-40. (Maize variety 97 TZL Comp-1-W was resistant and gave improved yields in southern and northern Guinea savannas but not in Sudan savannah. Other practices with beneficial effect included rotation with soyabean or groundnut, 100 kg N/ha and three hoe weedings.)

implicated in a wide variety of plant functions, including response to parasitic plants.


Engdal, S. and Nilsen, O.G. 2008. Inhibition of P-glycoprotein in Caco-2 cells: effects of herbal remedies frequently used by cancer patients. Xenobiota 38(6): 559-573. (A mistletoe (presumably *Viscum album*) herbal extract was the most active of a number of herbal remedies tested.)

Engdal, S., Steinsbekk, A., Klepp, O. and Nilsen, O.G. 2008. Herbal use among cancer patients during palliative or curative chemotherapy treatment in Norway. Supportive Care in Cancer 16(7): 763-769. (A very few patients used mistletoe (*Viscum album*) preparations in conjunction with conventional chemotherapy.)

Fernández-Aparicio, M., Pérez-de-Luque, A., Prats, E. and Rubiales, D. 2008. Variability of interactions between barrel medic (*Medicago truncatula*) genotypes and *Orobanche* species. Annals of Applied Biology 153(1): 117-126. (Accessions of *M. truncatula* show little variability in their resistance to *O. crenata* but such differences are shown on *O. nana* and some other *Orobanche* species. The genetic variation observed for induction of germination and subsequent attachment will be useful for isolating and characterising genes involved in early stages of *Orobanche*-host plant interaction.)

Fernández-Aparicio, M., Sillero, J.C. and Rubiales, D. 2009. Resistance to broomrape species (*Orobanche* spp.) in common vetch (*Vicia sativa*). Crop Protection, 28: 7-12. (Reporting infestation of *V. sativa* by *O. crenata*, *O. aegyptiaca* and to *O. foetida*. Describing resistance in cultivar Mezquita which is demonstrated early against *O aegyptiaca* resulting in reduced tubercle formation, but later against *O. crenata* resulting in retarded tubercle development.)

Fidan, I., Ozkan, S., Gurbuz, I., Yesilyurt, E., Er, D., Yolbakan, S. and Imr, T. 2008. The efficiency of *Viscum album* ssp. *album* and *Hypericum perforatum* on human immune cells *in vitro*. Immunopharmacology and Immunotoxicology 30(3): 519-528. (Results suggest these extracts may be used as an adjuvant treatment option for immune activation in immuno-suppressed patients.)


French, G.C., Hollingsworth, P.M., Silverside, A.J. and Ennos, R.A. 2008. Genetics, taxonomy and the conservation of British *Euphrasia*. Conservation Genetics 9(6): 1547-1562. (The diploid *E. vigursii* and *E. rivularis* form morphologically and genetically definable units, but the tetraploid taxa show varying degrees of overlap, complicating the task of designing conservation measures.)

Fuju, N. 2007. Chloroplast DNA phylogeography of *Pedicularis ser. Gloriosa* (*Orobanchaceae*) in Japan. Journal of Plant Research 120(4): 491-500. (Results suggest that the continental species, *P. sceprium-carolinum* and *P. grandiflora* are ancestral and there was subsequent differentiation into the two Japanese lineages, *P. gloriosa*, *P. iwatenis* and *P. ochiatana* in one and *P. nipponica* in the other.)

Ganesan, S., Manikandan, P. and Sekar, R. 2008. Angiospermic parasitic plants and their hosts in the southern districts of Tamil Nadu, India. Journal of...
Economic and Taxonomic Botany 32(1): 63-71. (Eighty-four host species belonging to 35 families are infested by 14 parasitic plants (unspecified in abstract), including one root parasite.)


Geng XingChao, Tian XueFei, Tu PengFei and Pu Haustorium 54 December 2008 19

Guo YiQing, Kim KilUng, Lee InJung, Yoder, J.I. and Shin DongHyun, 2008. Haustorium induction of parasitic plant: a new bioassay method to determine allelopathic potential. In: Kong, C.H. and Labrada, R. (eds) Allelopathy Journal 22(2): 371-378. (The allelopathic effects of 3 rice cultivars were correlated with different ROS (reactive oxygen species) activity and with their tendency to cause haustorium initiation in Triphysaria versicolor, suggesting this species can be used to evaluate the allelopathic potential of plant species.)


Huang TsurngJuhn, Chen YiYen, Li YenPing, Hung ChengYu, Chiang TzenYuh and Chou ChangHung, 2008. Isolation and characterization of microsatellite loci in Pedicularis verticillata L. using PCR-based isolation of microsatellite arrays (PIMA). Conservation Genetics 9(5): 1389-1391. (Suggesting that the results can be used in the conservation of this endangered species, of value in Chinese medicine.)


Huang TsurngJuhn, Chen YiYen, Li YenPing, Hung ChengYu, Chiang TzenYuh and Chou ChangHung, 2008. Isolation and characterization of microsatellite loci in Pedicularis verticillata L. using PCR-based isolation of microsatellite arrays (PIMA). Conservation Genetics 9(5): 1389-1391. (Suggesting that the results can be used in the conservation of this endangered species, of value in Chinese medicine.)


decline. Where mistletoe incidence is great it can be presumed that silver fir is significantly damaged.

Ikie, F.O., Schulz, S., Ogunyemi, S., Emechebe, A.M. and Togun, A.O. 2007. Influence of legume cropping patterns and organic/inorganic soil amendments on Striga seedbank and subsequent sorghum performance. Advances in Environmental Biology 1(1): 11-19. (Showing that trap-crops soybean and cowpea produced results similar to those obtained with ethylene, while urea reduced the S. hermonthica seedbank and improved sorghum yield. Poultry manure tended to increase Striga infestation.)


Jayasuriya, K.M.G.G., Baskin, J.M. and Baskin, C.C. 2008. Dormancy, germination requirements and storage behaviour of seeds of Convolvulaceae (Solanales) and evolutionary considerations. Seed Science Research 18(4): 223-237. (Seeds of 46 species germinated after imbibition (following scarification), except those of Cuscuta europaea, which is reported to display combinational dormancy.)


Kabambe, V.H., Kanampiu, F. and Ngwira, A. 2008. Imazapyr (herbicide) seed dressing increases yield, suppresses Striga asiatica and has seed depletion role in maize (Zea mays L.) in Malawi. African Journal of Biotechnology 7(18): 3293-3298. (Imazapyr seed dressings greatly suppressed emergence and flowering of S. asiatica, but contrary to the title, the abstract suggests there was no significant increase in maize yield. In the following season, without further treatment there were again good reductions of S. asiatica, but without effect on maize yield.)

Kabambe, V., Katunga, L., Kapewa, T. and Ngwira, A.R. 2008. Screening legumes for integrated management of witchweeds (Alectra vogelii and Striga asiatica) in Malawi. African Journal of Agricultural Research 3(10): 708-715. (Among soybean varieties Kudu was highly susceptible to A. vogelii, but Bossier and Ocepara-4 were relatively resistant and have potential as trap crops for S. asiatica, along with pigeon peas and green manure crops of mucuna and crotalaria which are immune to Alectra.)


From chloroplasts to "cryptic" plastids: evolution of plastid genomes in parasitic plants. Current Genetics 54(3): 111-121. (A current review of the contributions of parasitic plants to understanding plastid genomes, including discussion of new insights into matK and Rubisco based on their loss or retention in parasitic species.)


Kudi, T.M. and Abdulsalam, Z. 2008. Costs and returns analysis of Striga tolerant maize variety in Southern Guinea Savanna of Nigeria. Journal of Applied Sciences Research 6: 649-651. (Striga-tolerant varieties were highly profitable giving a gross margin of Naira 94479.21/ha compared to Naira 15683.73/ha for the farmers’ varieties.)

*Kilimo Trust, 2008. Program 2 - Unlock cereal production potential in East Africa by eliminating the Striga threat. http://www.thekilimotrust.org/index.php?option=com_docman&task=doc_view&gid=17 (Describing an ambitious 12 year project for reducing the losses to Striga in East Africa. The first 6 year programme, already begun with baseline studies is estimated to cost $23 million. We hope to include more on this and the (related?) AATF projects in Haustorium 55.)

Kostov, T. and Pacanoski, Z. 2007. Weeds with major economic impact on agriculture in Republic of Macedonia. Pakistan Journal of Weed Science Research 13(3/4): 227-239. (Noting that tobacco, sunflower, tomato, lucerne and clover were favoured hosts for Orobanche spp. (O. cumana and O. ramosa) and Cuscuta spp. (C. arvensis and C. ephidium) in Greece. Also noting occurrence of Rhinanthus major and Melampyrum arvense in cereal crops.)

Krause, K. 2008. From chloroplasts to "cryptic" plastids: evolution of plastid genomes in parasitic plants. Current Genetics 54(3): 111-121. (A current review of the contributions of parasitic plants to understanding plastid genomes, including discussion of new insights into matK and Rubisco based on their loss or retention in parasitic species.)
in vitro of Cuscuta chinensis Lam. Journal of Tropical and Subtropical Botany 16(3): 279-282. (Recording successful callus maintenance for over 12 months and regeneration of shoot growth in suitable culture solutions.)


Li Yang, Zhao YanLi, Huang Ning, Zheng YongTang, Yang YongPing and Li XiaoLi, 2008. Two new phenolic glycosides from Viscum articulatum. Molecules 13(10): 2500-2508. (Two new glucopyranosides.)


Lin ZhenJian, Lu XiaoMing, TianJiao, Fang YuChun, Gu QianQun and Zhu WeiMing, 2008. GPR12 selections of the metabolites from an endophytic Streptomyces sp. associated with Cistanche deserticola. Archives of Pharmacal Research 1(9): 1108-1114. (Among compounds detected, only tyrosol can promote an increase of intracellular cAMP special on GPR(G-Protein-Coupled Receptor)12 transfected cells, suggesting it may be a possible ligand for GPR12.)


Long ShuSheng, Lendzemo, V., Kuyper, T.W., Kang ZhengSheng, Vierheilig, H. and Steinkellner, S. 2008. A simple staining method for observation of germinated Striga seeds. Seed Science Research 18(2): 125-129. (Among a range of dyes tested, Blue (Geha) ink in 5% acetic acid is recommended to make Striga radicles more conspicuous and readily counted in germination assays.)


López-Ráez, J.A., Charnikhova, T., Mulder, P., Kohlen, W., Bino, R., Levin, I. and Bouwmeester, H. 2008. Susceptibility of the tomato mutant high pigment-2th (hp-2th) to Orobanche spp. infection Journal of Agricultural and Food Chemistry 56(15): 6326-6332. (In spite of the high carotenoid content of the mutant tomato, strigolactone production was lower, resulting in reduced susceptibility to Orobanche aegyptiaca.)


Magnusson, M. 2008. (Orobanche elatior in Skåne, southernmost Sweden.) (in Swedish) Svensk Botanisk Tidskrift 102(3/4): 163-176. (O. elatior is classified as endangered in Sweden. Its main hosts are Centaurea scabiosa and perhaps C. jacea. It is threatened by encroachment of nitrophilous herbs and by Prunus and Crataegus scrub. Early burning, grazing or cutting are beneficial.)

Mahadevappa, S.G. and Bhanumurthy, V.B. 2007. Relative efficacy of trifluralin and imazethapyr for weed control in lucerne (Medicago sativa L.). Progressive Research 2(1/2): 73-75. (Pre-emergence imazethapyr at 0.2 kg ha was superior to trifluralin for control of Cuscuta (Ccampestris) and the crop was free of the weed up to 60 days after sowing.)


Technology Foundation. 82 pp. (Reviewing the uptake by, and perception of, farmers of the use of herbicide/herbicide-resistant maize, and/or Desmodium for control of S. hermonthica. Noting good results where adopted, but problems of supplying the inputs and adequate extension.)

Maruyama, S., Akasaka, T., Yamada, K. and Tachibana, H. 2008. Cistanche salsa extract acts similarly to protein-bound polysaccharide-K (PSK) on various types of cell lines. Journal of Traditional Medicines 25(5/6): 166-169. (Results suggest that C. salsa is a biological response modifier similar to PSK and exerts an immuno-modulatory effect on both cellular and humoral immunity, and a direct anti-cancer effect.)

Maruyama, S., Yamada, K. and Tachibana, H. 2008. Immunomodulatory factors in Cistanche salsa. Journal of Traditional Medicines 25(3) 87-89. (C. salsa is used as a medicinal tonic in Japan. An extract induced growth inhibition and apoptosis in the human Burkitt’s lymphoma cell line Namalwa, apparently due to at least 2 active ingredients, possibly polysaccharides.)


Mauromicale, G., lo Monaco, A. and Longo, A.M.G. 2008. Effect of branched broomrape (Orobanche ramosa) infection on the growth and photosynthesis of tomato. Weed Science 56(4): 574-581. (O. ramosa strongly reduced shoot growth of tomato by acting as a sink for assimilate, but also by reducing the efficiency of carbon assimilation via a reduction in leaf chlorophyll content and photosynthetic rate.)


Meyer, A., Rypniewski, W., Szymanski, M., Voelter, W., Barciszewski, J. and Betzel, C. 2008. Structure of mistletoe lectin I from Viscum album in complex with the phytohormone zeatin. Biochimica et Biophysica Acta, Proteins & Proteomics 1784(11): 1590-1595. (Crystals of a complex of lectin-1 from Viscum album and the hormone zeatin were grown on the International Space Station. Diffraction data demonstrate the ability of mistletoe to protect itself from the host transpiration regulation by absorbing the host plant hormones as part of a defence mechanism.)


Mounnissamy, V.M., Kavimani, S., Balu, V. and Quine, S.D. 2008. Effect of ethanol extract of Cansjera rhedii J. Gmelin (Opiliaceae) on hepatotoxicity. Journal of Pharmacology and Toxicology 3(23): 158-162. (‘Treatment of rats with the ethanol extract significantly altered the serum marker enzymes and antioxidant level near to normal against paracetamol-intoxicated rats.’)


Mulvaney, C.R., Molano-Flores, B. and Whitman, D.W. 2006. Is insect herbivory contributing to the threatened status of Agalinis auriculata (Orobanchaceae) in Illinois? Journal of the Torrey Botanical Society 133(4): 560-565. (Concluding that herbivory by the tree cricket Oecanthus nigricornis, the moth Endothenia hebesana and the butterfly Junonia coenia, combined with habitat loss and other biotic constraints may hinder the recovery of A. auriculata.)

Murai, Y., Kokubugata, G., Yokota, M., Kitajima, J. and Iwashina, T. 2008. Flavonoids and anthocyanins from six Cassytha taxa (Lauraceae) as taxonomic markers. Biochemical Systematics and Ecology 36(9): 745-748. (Results from the study do not support the hypothesis that C. pubescens and C. filiformis var. duripraticola are conspecific but confirm that C. filiformis var. duripraticola is a variety of C. filiformis, and that C. pergracilis is distinct. Other Japanese and Australian species studied were. C. muellerii (close to C. pubescens) and C. glabella (close to C. pergracilis).)

Murray, S. 2008. Rare genetic find delivers high-quality sandalwood oil. Partners in Research for Development. July/October: 22-23. (Discussing the potential of Santalum austrocaledonicum and S. lanceolatum as superior sources of sandalwood oil in Vanuatu and in Queensland, Australia.)


Nanni, B. and Ragozzino, E. 2007. (Fusarium for biological control of Orobanche ramosa.) (in Italian) Informatore Agrario 63(10): 92-93. (Noting the potential of F. oxysporum.)

* Naseri, M.K.G., Anvari, A. and Badavi, M. 2007. (Spasmolytic effect of Cuscuta pentagona fruit aqueous extract on rat ileum.) (in Persian) Scientific Journal of Kurdistan University of Medical Sciences 12(2): pe9-pe20. 2. http://www.muk.ac.ir (C. pentagona (Convolvulaceae) has been used in Iran for gastrointestinal disorders. Results suggest that its spasmolytic effects are mediated via calcium channels.)


Nwanosike, M.R.O. 2005. Evaluation of mistletoes (Tapinanthus sp.) on the ornamental plants and trees in selected academic and research institutions in Zaria, Nigeria. Journal of Agriculture, Forestry and Social Sciences 3(2): 86-91. (Dalbergia sissoo, Gmelina aborea, Khaya senegalensis, Thevetia nerrifoliea, and Azadirachta indica were all severely infested with Tapinanthus sp. (and/or other spp.)? Some stands of D. sissoo were completely killed.)


Ollerton, J., Stott, A., Allnutt, E., Shove, S., Taylor, C. and Lamborn, E. 2007. Pollination niche overlap between a parasitic plant and its host. Oecologia 151(3): 473-485. (In the system Orobanche elatior and its host Centaurea scabiosa, the bumblebee Bombus pascuorum is a common pollinator, but there is no evidence for serious competition.)


Orr, A.G. 2008. Competition for larval food plant between Delias argenthona (Fabricius) and Delias nigrina (Fabricius) (Lepidoptera: Pieridae) in coastal wallum habitat in Southern Queensland. Australian Entomologist 35(1): 27-35. (Larvae of both D. argenthona and D. nigrina feed on the mistletoes Dendrophthoe vitellina and Muellerina celastroides but Diplatia furcata is utilised only by D. argenthona, and Amyema congener only by D. nigrina.)


Parveen, Z., Deng YuLin, Saeed, M.K., Dai RongJi, Ahamad, W. and Yu YuHong, 2007. Antinflammatory and analgesic activities of Thesium chinense Turcz extracts and its major flavonoids, kaempferol and kaempferol-3-O-glucoside. Yakugaku Zasshi = Journal of the Pharmaceutical Society of Japan 127(8): 1275-1279. (The ethyl acetate extract of T. chinense and the two flavonoids showed significant anti-inflammatory and analgesic activity, but the chloroform extract was inactive.)

Park JeongMi, Manen, J.F., Colwell, A.E. and Schneeweiss, G.M. 2008. A plastid gene phylogeny of the non-photosynthetic parasitic Orobanche (Orobanchaceae) and related genera. Journal of Plant Research 121(4): 365-376. (Analysis of the plastid gene rps2 appears to be a good tool for resolving relationships within Orobanche, but less useful for related lineages. Over 70 taxa from Orobanchaceae are included in the analysis.)

Patil, V.L. and Angadi, S.S. 2008. Effect of management practices on Striga incidence, quality, yield and economics of sorghum. Plant Archives 8(1): 185-188. (Field trials in Karnataka, India, failed to show a benefit from farmyard manure in controlling Striga...


Piao, Â.L., Detanico, B.C., Jesus, J.F., Lhullier, F.L.R., Nunes, D.S. and Elisabetsky, E. 2008. Effects of Marapuama in the chronic mild stress model: further indication of antidepressant properties. Journal of Ethnopharmacology 118(2): 300-304. (The study supports the traditional claims, in the Amazon, for antidepressant properties for ethanol extracts from *Psychotetalia olacoides* (Olacaceae) and additionally suggests that they prevent stress-induced HPA (hypothalamo-pituitary-adrenal axis) hyperactivity.)

Prider, J., Facelli, J.M., Watling, J. and Virtue, J. 2008. *Cytisus scoparius* plants infected by the native parasitic plant *Cassystha pubescens* have reduced growth and reproductive output. Proceedings of the 16th Australian Weeds Conference, Cairns Convention Centre, North Queensland, Australia, 18-22 May, 2008: 193. (Infection by *C. pubescens* prevents the expansion of leaf and flower buds and reduces fruiting by about 50%. Effects tended to be localised to the infected branches of the host.)

Qin, Xiaoqiong, Yang, SeungHuan, Kepsel, A.C., Schwartz, S.H. and Zeevaart, J.A.D. 2008. Evidence for abscisic acid biosynthesis in *Cuscuta reflexa*, a parasitic plant lacking neoxanthin. Plant Physiology 147: 816-822. (Confirming that isolated stem tips of *C. reflexa* accumulated ABA, and showing synthesis from 9-cis-violanthins and 9-cis-neoxanthins, via xanthoxin.)

Quested, H.M. 2008. Parasitic plants - impacts on nutrient cycling. Plant and Soil 311(1/2): 269-272. (Commenting on the paper by Ameloot *et al.* (see above) and noting that their results reinforce the need to include parasitic plants in community and ecosystem theory.)


Rani, K., Zwanenburg, B., Sugimoto, Y., Yoneyama, K. and Bouwmeester, H.J. 2008. Biosynthetic considerations could assist the structure elucidation of host plant produced rhizosphere signalling compounds (strigolactones) for arbuscular mycorrhizal fungi and parasitic plants. Plant Physiology and Biochemistry 46(7): 617-626. (Postulating structures for strigolactones that have been isolated but for which so far the structure has not been elucidated; also proposing structures of strigolactones that may be discovered in the future.)

Rocca, M.A. and Sazima, M. 2008. Ornithophilous canopy species in the Atlantic rain forest of southeastern Brazil. Journal of Field Ornithology 79(2): 130-137. (The flowers of *Psittacanthus dichrous* (Loranthaceae) are visited primarily by hummingbirds. Perching birds also visit the flowers, but destroy them.)

Rogers, Z.S., Nickrent, D.L. and Malécott, V. 2008. *Staufferia* and *Pilgerina*: two new endemic monotypic arborescent genera of Santalaceae from Madagascar. Annals of the Missouri Botanical Garden 95(2): 391-404. (Two new genera, *Staufferia* and *Pilgerina*, are described and illustrated, together with the features distinguishing them from *Okoubaka* and *Scleropyrum* respectively.)


208-225. (Noting that Acanthosyris paulo-alvinii (Santalaceae) is classified as at critical risk.)


Slocum, M.G. and Mendelsssohn, I.A. 2008. Effects of three stressors on vegetation in an oligohaline marsh. Freshwater Biology 53(9): 1783-1796. (Occurrence of Cuscuta pentagona (in Louisiana, USA) was favoured by herbicide application.)


Swarbrick, P.J., Huang, K., Liu, G., Slate, J., Press, M.C. and Scholes, J.D. 2008. Global patterns of gene expression in rice cultivars undergoing a susceptible or resistant interaction with the parasitic plant Striga hermonthica. New Phytologist 179(2): 515-529. (Resistant rice responded to parasitism as if to a microbial pathogen, with up-regulation of defence genes including pathogenesis-related proteins, pleiotropic drug resistance ABC transporters, genes involved in phenylpropanoid metabolism and WRKY transcription factors. Susceptible plants down-regulated gene expression associated with plant growth regulator signalling and metabolism, biogenesis of cellular components and cell division.)


Development 20(6): 86. (Xenmia americana (Oleaceae) among 20 species studied.)


Thorogood, C.J., Rumsey, F.J., Harris, S.A. and Hiscock, S.J. 2008. Host-driven divergence in the parasitic plant Orobanche minor Sm. (Orobanchaceae). Molecular Ecology 17(19): 4289-4303. (Using ISSR and SCAR techniques to show distinct genetic differences between populations of O. minor parasitizing clover or wild carrot and concluding that host specificity may be an important driver of allopatic speciation in parasitic plants.)

Timus, A. and Croitoru, N. 2007. The state of tobacco culture in Republic Moldova and phytosanitary problems of tobacco production. Rasteniev’dni Nauki 44(3): 209-212. (Orobanche ramosa and Cuscuta spp. listed among the most harmful weeds. And noting some herbicide treatments that are used.)

Tomilov, A.A., Tomilova, N.B., Wrobleswki, T., Michelmore, R. and Yoder, J.I. 2008. Trans-specific gene silencing between host and parasitic plants. Plant Journal 56(3): 389-397. (Host plants expressing a silencing gene construct for GUS transmit the silencing signal to Triphysaria and reduce GUS expression in the parasite near the point of attachment. The signal was also able to move from one host plant to another through a section of parasite root bridging the two hosts.)

Toshkova, T. 2007. (Broomrape - distribution, biology, control methods.) (in Bulgarian) Agricultural Science (Selskostopanska Nauka) 40(5): 11-20. (Geographical distribution, biology, hosts, economic importance, and control of Orobanche species are described, presumably for Bulgaria.)


Radovi - Šumarski Institut Jastrebarsko 43(1): 31-38. (Silver fir in Bosnia-Hercegovina is seriously threatened by V. album ssp. abietis. High infestation reduced needle biomass and increased susceptibility to pathogens and pests.)


Vicas, S., Rugină, D. and Socaciu, C. 2008. Antioxidant activities of Viscum album's leaves from various host trees. Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Agriculture 65(1): 327-332. (V. album from 5 hosts in Romania, Acer campestre, Malus domestica, Fraxinus excelsior, Populus nigra and Robinia pseudoacacia were compared in vitro. That from R. pseudoacacia had the highest antioxidant activity, that from P. nigra the least, just under half.)
Vicas S.I. and Socaciu, C. 2007. The biological activity of European mistletoe (Viscum album) extracts and their pharmaceutical impact. Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Agriculture 63/64: 217-222. (Deducing that lectins and visctoxins are not the only active components of V. album extracts. Also reviewing recent studies on the cytotoxic activity of mistletoe extracts on tumour cells, and the role of V. album in diabetes and hypertension.)

Vidal-Russell, R. and Nickrent, D.L. 2008. Evolutionary relationships in the showy mistletoe family (Loranthaceae). American Journal of Botany 9(8): 1015-1029. (The 3 relict root-parasitic genera, Naytsia, Atkinsonia and Gaiadendron (with chromosome number x = 12) are supported as successive sister taxa to the remaining 70 genera which form a monophyletic group of aerial parasites, divided into one clear sub-tribe Loranthinae (x = 9) and a more weakly supported Psittacanthinae (x = 8) containing the S. American Tristerix and Notantha and the New Zealand genus Tupeia.)


Wang Yan, Deng Min, Zhang ShuYan, Zhou ZheKun and Tian WeiXi, 2008. Parasitic loranthus from Loranthaceae rather than Viscaceae potently inhibits fatty acid synthase and reduces body weight in mice. Journal of Ethnopharmacology 118(3): 473-478. (Tests on mice showed the activity of extracts from 11 species of Loranthaceae was vastly greater than those from Viscum articulatum or V. liquidambaricola in inhibiting fatty acid synthesis, confirming the potential for Taxillus chinensis and other Loranthaceae in control of obesity.)

Wegge, P. and Kastdalen, L. 2008. Habitat and diet of young grouse broods: resource partitioning between Capercaillie (Tetrao urogallus) and Black Grouse (Tetrao tetrix) in boreal forests. Journal of

Ornithology 149(2): 237-244. (Melampyrum sylvaticum is consumed by capercaillie, more than by black grouse (in Norway), associated with the occurrence of this species in the more insect-rich Vaccinium vegetation favoured by the capercaillie.)


Wickett, N.J., Zhang, Y., Hansen, S.K., Roper, J.M., Kuehl, J.V., Plock, S.A., Wolf, P.G., de Pamphilis, C.W., Boore, J.L. and Goffinet, B. 2008. Functional gene losses occur with minimal size reduction in the plastid genome of the parasitic liverwort Anoera mirabilis. Molecular Biology and Evolution 25(2): 393-401. (Anoera mirabilis is a parasitic liverwort that exploits an existing mycorrhizal association between a basidiomycete and a host tree. It is the only known parasitic seedless land plant with a completely non-photosynthetic life history. The pattern of genome evolution is comparable with that in parasitic angiosperms but suggests that its plastid genome is in the early stages of decay following the relaxation of selection pressures.)


Wölffle, U. 2008. (Ximenia americana.) (in German) Zeitschrift für Phytotherapie 29(3): 150-153. (Providing a detailed overview of X. americana (Olacaceae) and its uses in traditional medicine in Africa, due to its antibacterial and antiviral effects, and for its edible pulp.)


Wurochekke, A.U., Anthony, A.E. and Obidah, W. 2008. Biochemical effects on the liver and kidney of
rats administered aqueous stem bark extract of *Xemenia americana*. African Journal of Biotechnology 7(16): 2777-2780. (Extracts of *Xemenia* (not *Xemenia americana* (Olacaceae) apparently caused liver damage but did not affect kidneys.)


Yang FuSheng, Li YuFei, Ding Xin and Wang XiaoQuan, 2008. Extensive population expansion of *Pedicularis longiflora* (Orobanchaceae) on the Qinghai-Tibetan Plateau and its correlation with the Quaternary climatic change. Molecular Ecology 17(23): 5135-5145. (Studies of chloroplast DNA suggest that the southeast Tibetan plateau was either a refuge for *P. longiflora* during the Quaternary climatic change or is the place of origin of the species. The present wide distribution of the species has resulted from ‘recent’ population expansions dated back to 120,000-17,000 years ago.)


Yoneyama, K., Xie XiaoNan, Sekimoto, H., Takeuchi, Y., Ogasawara, S., Akiyama, K., Hayashi, H. and Yoneyama, K. 2008. Strigolactones, host recognition signals for root parasitic plants and arbuscular mycorrhizal fungi, from Fabaceae plants. New Phytologist 179(2): 484-494. (A range of strigolactones was detected in 12 species of Fabaceae, including *Lupinus albus*, a non-host of AM fungi, but in the latter, their exudation was not increased by N and P deficiencies as in other legumes.)

Yu Hua, Yu FeiHai, Miao ShiLi and Dong Ming, 2008. Holoparasitic *Cuscuta campestris* suppresses invasive *Mikania micrantha* and contributes to native community recovery. Biological Conservation 141(10): 2653-2661. (Surveys at 4 sites in Guangdong Province, China, conclude that *C. campestris* introduced 1-5 years previously, had provided increasingly effective control of *M. micrantha* without undesirable effects on non-target species.)

Zahran, E., Sauerborn, J., Elmagid, A.A., Abbasher, A.A. and Müller-Stöver, D. 2008. Granular formulations and seed coating: delivery options for two fungal biological control agents of *Striga hermonthica*. Journal of Plant Diseases and Protection 115(4): 178-185. (Best results (almost complete control of *S. hermonthica* and greatly improved sorghum growth) were obtained with *Fusarium Abuharaz* (FA) formulated in ‘Pesta’. Formulation in alginate, and seed dressings were somewhat less effective.)

*Zhongkui Sun, Hans, J., Walter, M.H., Matusova, R., Beekwilder, J., Verstappen, F.W.A., Zhao Ming and Bouwmeester, H.J. 2008. Cloning and characterisation of a maize carotenoid cleavage dioxygenase (ZmCCD1) and its involvement in the biosynthesis of apocarotenoids with various roles in mutualistic and parasitic interactions. Planta 2 DOI 10.1007/s00425-008-0781-6 (http://www.springerlink.com/content/048m047j71486972/fulltext.pdf) (CCD1 expression was increased in response to root colonization by arbuscular mycorrhizal fungi, but is not considered to be part of the pathway leading to strigolactone synthesis.)

Znamenskaya, V.V. and Yurov, V.A. 2008. (Under control of the quarantine service.) (in Russian) Zashchita i Karantin Rasteniĭ 2008(2): 48-49. (*Cuscuta campestris* listed among quarantine pests of the Voronezh region/)

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NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be down-loaded from the IPPS web-site (see above).
MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

Thanks to all of you who attended the 10th World Congress on Parasitic Plants in Kusadasi, Turkey this past June. I think all would agree that the meeting was a resounding success. In every way there were signs of progress and gathering momentum for our society.

First of all, the attendance was strong. With 118 participants, it was just shy of our largest meeting ever. Moreover, the participants represented an astounding 37 different nations and nearly every continent. The ‘World’ adjective in World Congress is well deserved!

The program included the usual wide variety of topics and Diego Rubiales and members of the Scientific Committee deserve credit. The program is reviewed in more detail in a separate article below, but was remarkable in terms of the breadth of coverage of different parasites. In addition to the usual abundance of presentations on Striga and Orobanche, the program included substantial talks on several other parasitic species, as well as some comprehensive regional reviews of parasitic weeds.

The venue was spectacular. Soaked by the sun and rich history of the area, participants appeared to enjoy the “all inclusive” concept of the Pine Bay resort. For those of you who were unable to attend, this was an all-you-can-eat-and-drink deal within the hotel. Perhaps this is why there was so much dancing by the participants (late night at the disco and even on the tour bus!). Ahmet Uludag and his team are to be congratulated for their work with the local arrangements.

We took a few moments to induct some new honorary members to the society. Danny Joel and André Fer were awarded Honorary Memberships, based on their long careers of contributions to understanding parasitic plants and their instrumental roles in the initiation and leadership of the IPPS.

Of course we still have much work to do. We have more questions than ever about parasitic plants, and despite some encouraging reports about control, the problem of parasitic weeds remains acute in most of their ranges. I look forward to hearing about the latest progress at our next meeting, which is set for 2011 in Italy. The lead organizers are Maurizio Vurro handling local arrangements and Hanan Eizenberg coordinating the program. We expect that meeting will continue the tradition of great science and good fun.

Sincerely,

Jim Westwood, IPPS President

CALL FOR PHOTOS

As part of our new IPPS website we would like to have a variety of photos featuring the beauty and fascinating biology of parasitic plants. The pictures will be used to enhance the attractiveness of the site and help generate more interest in our work. Please take a few moments now to submit just 2 or 3 of your favorite images.

Some guidelines:

- All photos are welcome (best are clear and attractive, but may show any aspect of parasitic plant research – e.g., damaged crops, micrographs, etc.)
- Don’t reduce the image quality (we may want to crop them)
- Include species names or short description of the photo
- Send photos to westwood@vt.edu

Thanks for your contributions to our society.

Jim Westwood
MEETING REPORT

10th World Congress on Parasitic Plants, Kusadasi, Turkey, June 8-12, 2009

This international meeting, arranged by the International Parasitic Plant Society, was attended by 118 participants from 37 countries, presenting over 100 papers and posters. After a welcome from Mr Kamil Tabak representing the Turkish Ministry of Agriculture, the meeting was opened with remarks from IPPS President Jim Westwood, and Chairmen of the Organizing and Scientific Committees, Ahmet Uludag and Diego Rubiales. Papers and posters presented are listed below.

An opening lecture by Prof. Bob Zimdahl emphasised the role of ethics in science and the need for all involved to re-examine their motives and judgment at all levels of their work.

A first invited presentation from Danny Joel presented convincing evidence for the long-evolved distinction between the two main sections of the Orobanche genus and called for the future mandatory use of Phelipanche for O. ramosa etc. This generated lively discussion but no consensus for change.

In the second invited lecture, Dr Marc-André Selosse presented interesting evidence for the indirect parasitism of forest species, not only by non-photosynthetic heteromycotrophs but also by some green orchid species such as Epipactis microphylla via ectomycorrhizal truffle fungi, describing this as ‘mixotrophy’.

The meeting in general may be remembered as the beginning of the genomics era for weedy parasitic species. In addition to many excellent presentations describing molecular studies, there were announcements that a large amount of gene sequence information would become available soon. In the session on Evolution and Phylogeny of Parasitic Plants the rationale and initial data from the Parasitic Plant Genome Project (Westwood et al. and de Pamphilis et al.) was described. This project is sequencing expressed genes from Triphysaria versicolor, Striga hermonthica and Orobanche aegyptiaca and has already generated 29,000 and 24,000 gene sequences from Striga and Orobanche, respectively. Another project (presented by Yoshida and Shirasu in the Host and Non-host Response to Parasitism session) revealed that 17,000 expressed genes have been sequenced from Striga hermonthica. Public access to these data is expected to greatly facilitate molecular research and add momentum to gene/genome sequencing of other parasitic species. Other papers described the possible role of host specificity towards speciation of Orobanche minor (Thorogood et al.), and phylogenetic clarification within the Orobanchaceae via proteome analysis (Castillejo et al.). Molecular techniques were also used to help clarify the relationships within the Hydnoraceae, leading to the proposed description of a new species previously included in Hydnora africana (Bolin et al.). Posters illustrated the use of molecular techniques in the taxonomic clarification of Orobanchaceae in Bulgaria (Stoyanov and Denev).

Under the heading of Parasite Biochemistry and Physiology, we heard of the relative importance of transpiration and osmotic mechanisms in the creation of sinks in xylem feeders (e.g. Striga) and phloem feeders (e.g. Orobanche) respectively (Peron et al.). Important metabolites in the seeds of Orobanche minor were shown to be allantoin as a substrate for glutamine and gentianose for sugars (Okazawa et al.). A paper on the medicinally important Cynomorium songaricum and Cistanche deserticola in China showed some progress in the understanding of germination requirements (GuiLin and ShangWu) and a poster described preliminary evidence on the structure of a germination stimulant from the host of C. songaricum, Nitararia sibirica (ShangWu and GuiLin). There was also a poster on the possibility of tissue culture of C. songaricum as an aid to propagation (Yue and Chen). Cynomorium coccineum in Bahrain was shown to depend on its host for carbohydrates but perhaps not for nitrogenous metabolites (Almansoori et al.). The ability of Orobanche aegyptiaca to acquire a range of plant viruses from its hosts tobacco or tomato was confirmed (Aly et al.).

Sessions on Ecology and Population Biology began with a description of pollination in Hydnora species in Namibia, and the interesting changes in the flower controlling the trapping and eventual release of the pollinating beetles involved (Maas et al.). There were welcome papers on the unfamiliar Pilostyles ulei (Apodanthaceae) in Brazil a highly reduced dioecious holoparasite on two spp. of Mimosa, dealing with the ratio between the sexes (Brasil and Cecchanti) and the anatomy of the endophyte and its connections with the host stele (do Amaral and Cecchanti). Studies on endangered populations of Cuscuta epithymym in Belgium showed that mowing or cutting is needed to provide freshly disturbed Calluna vulgaris on which to establish (Meulebrock et al.). The rarity of many Orobanche species in Romania is explained by a combination of specialised germination requirements and insect predation (Hoeniges et al.). It was also suggested that the narrow host range of certain Orobanche species could be attributed to a requirement for specific combinations of stimulant (Hoeniges et al.). Studies on Rhamphicarpa fistulosa in West Africa and in Tanzania report its increasing significance as a weed of rice, causing up to 60% yield loss and confirm that it is facultative and can set seed without a host (Rodenburg et al.). Distribution and severity of O. ramosa and O. aegyptiaca in Greece are shown to be correlated with a range of soil characters including pH and...
organic matter (Economou et al.). A survey of Cuscuta infestations in Malaysia revealed a wide range of hosts. The species was referred to as C. australis but in discussion it was suggested that at least some C. campestris was likely to be present (Bakar et al.). New information was provided on the range of Orobancharaceae in Iran (Mehrvarz) and on a very wide and apparently increasing range of parasitic weed problems, including Plicosepalus acaciae (Loranthaceae), in Jordan (Qasem). Among a range of posters under this heading, there were descriptions of the Striga asiatica problem on sugar cane in Tamilnadu, India (Chinnusamy et al.), of Cuscuta monogyna on fruit tress in Morocco (Baye et al.), the potential for O. ramosa to become an increasing problem on oilseed rape in Bulgaria (Shindrova and Kostov), the potential of populations of Viscum album Thesium humile, Pilostyles olympica oxycedri, Melampyrum arvense, Cytinus hypocistis, Orobanche foetida from a wild host in Tunisia to parasitize faba bean and lentil (Amri et al.) and an increasing problem of the mistletoe Tapinanthes globiferus on fruit trees in Central Sudan (Zaroug et al.). In Turkey, the range of parasites, apart from Orobanche species, includes several Cuscuta species, Viscum album, Loranthus europaeus, Arcutubhium oxycedri, Melampyrum arvense, Cyttinus hypocistis, Thesium humile, Pilostyles olympica and many others (Uludad and Nemli). Posters described the distribution and importance of Orobanche ramosa in tomato (Isik and Kay; Rusen and Yaslik) and in tobacco (Kaya and Isik) in Turkey.

Under the heading of Special Topics – Hemiparasites the interesting diurnal nutation of Viscum album in mid summer is shown to be associated with a remarkable increase in jasmonic acid content, of possible relevance for the time of harvesting for medicinal use (Dorka et al.). Studies on another mistletoe of medicinal interest in India suggested that there may be differences in the potentially active flavanoid, terpenoid and phenolic components in Helicanthes elastica according to the host it is parasitizing (Girija et al.). Dendrophythoe falcatia is the commonest of a wide range of other mistletoes occurring in India (Girija et al.). Another mistletoe, Struthanthus vulgaris, is shown to cause serious damage to the quality of timber from the host tree Tipuana tipu in Brazil by competing for moisture in the dry season (Domeignos and Ceccatini).

The topic of Host-Parasite Communication was introduced with a review on strigolactones by Harro Bouwmeester, who discussed new information on the biosynthetic pathway for strigolactones, their new-found role in suppressing branching, and the reduction of their synthesis in rice by higher levels of phosphate. Some more detailed results involving mutant rice and varying levels of N and P were also presented (Jamil et al.). The higher susceptibility of a standard Pioneer variety of maize is shown to be due to its greater exudation of the relatively stable 5-deoxystrigol while the tolerant KST94 exudes mainly the less stable sorgomol (Yoneyama et al.). A poster showed that abamine, an inhibitor of strigolactone biosynthesis, can reduce germination by reducing levels of 5-deoxystrigol (Ito et al.). The isoflavone formononetin, used commercially to promote colonization by AM fungi is shown to be highly active in stimulating germination of O. ramosa, O. aegyptiaca and Striga hermonthica (but not O. cumana or O. crenata) and has potential as a control measure? (Kohlachmd et al.). Germination of Orobanche species has for the first time been shown to be stimulated by a number of actinomycetes in the soil (Naumova et al.). The need for the conditioning phase before seeds of Orobanche will respond to stimulant was challenged, it being shown that, for O. aegyptiaca and O. cumana there is merely a need to allow adequate time for germination (Plakhine et al.).

Under Parasitic Weed Management, the first paper described the sophisticated decision support system PICKIT, that has been developed for highly successful control of O. aegyptiaca in tomatoes in Israel, depending on monitoring growing degree days (GDD) using an inexpensive soil probe, to predict the growth stage of the parasite and applying sulfosulfuron at 200, 400 and 600 GDD followed by imazapic between 45 and 24 days before harvest (Eizenberg et al.). The status and control of Orobanche in Turkey was the subject of a multi-author paper presented by Eda Aksoy and a number of other papers and posters. Among a range of herbicide and other treatments for control of Orobanche spp. in tomato in Turkey, encouraging results were reported for catch-cropping with vetch and the use of chicken manure (Nemli et al.); use of metham sodium, trifluralin and maleic hydrazide (Toshkova et al.); and soil solarization for greenhouse crops (Bulbul and Uygur).

Herbicides (glyphosate and iamzetapyr) also show potential for control of O. ramosa in potato, in combination with Fusarium isolates. Imazapic has potential in lentil (Haddad et al.). For O. crenata waste water from olive processing showed promise in Morocco (Saffour et al.) while in Tunisia, O. crenata emergence was well reduced by inter-cropping with fenugreek (Amri et al.). Control of O. cernua in tobacco in India is achieved with iamzetapyr post-emergence and also by applying neem cake in the planting hole (Prabhakaran et al.).

A comparable success story to that for Orobanche in tomato in Israel involves the control of Striga hermonthica and S. asiatica in maize in East Africa, using seed treatment with imazapir on (non-GM) imidazolinone-tolerant maize, leading to 3-fold increases in crop yield (Kanampiu et al.). Equivalent studies with imidazolinone-tolerant sorghum
The success of another means of suppressing *S. hermonthica* in maize, inter-cropping with *Desmodium* species, is shown to be attributable to inhibition of *Striga* radicle elongation and haustorial initiation by flavone compounds including isoschaftoside, exuded by the *Desmodium* (Tittcomb et al.). Less dramatic but some benefit from intercropping with soyabean in maize is reported from Nigeria (Ahom et al.), and from leguminous trap crops, cowpea and *Dolichos lablab* in Sudan (Abbasher et al.).

In India pendimethalin proves effective for control of *Cuscuta ‘chinensis’* (perhaps *C. campestris*) in lucerne (Chinnusamy et al.), while trifluralin proved the best of a range of treatments for control of *C. europaea* in lucerne in Serbia (Konstantinovic and Meseldzija).

There was encouraging news of progress in the development of techniques for the culture and application of mycoherbicides based on *Fusarium* for control of *Striga* in Africa. DNA techniques suggest that the strains Foxy2 from Ghana and PSM 197 from Nigeria are genetically identical (Elzein et al.; Ndambi et al.). Recognition of the *F. oxysporum* strain FT2 by AFLP markers represents a valuable tool for the identification and monitoring of the strains used as mycoherbicides (Cipriani et al.). Use of *Fusarium* for control of *Orobanche cumana* was described but results are influenced by a range of climatic and agronomic factors (Mueller-Stover et al.).

Among a range of insects identified on *Orobanche* in Turkey, *Phytomyza orobanchia* occurred commonly in lentil fields, less commonly in tomato and tobacco, perhaps because of insecticide use? (Uygur et al.). In Slovakia, *P. orobanchia* shows host preference for *O. flava*, *O. alba* and *O. reticulata* (Toth and Bouwmeester). In neither country is *P. orobanchia* seen as a practical means of control.

**Host and Non-host Responses to Parasitism.** Study of gene expression in cowpea shows up-regulation of a range of genes relating to chitinase, cyt 450 and protein synthesis in varieties showing resistance to *Striga gesnerioides* (Lis et al.). In a cowpea line resistant to *S. gesnerioides* race 3, a gene was identified which, when ‘knocked down’ eliminated the resistant response (Li and Timko). The failure of *Striga hermonthica* to parasitize the non-host *Lotus japonicus* could be attributed to the induction of the synthesis of the phytooalexin vestitol (Sugimoto and Ueda) while its failure on *Phtheirospermum japonicum* is attributed to incompatibility at an earlier stage (Yoshida and Shirasu). The failure of *Orobanche crenata* on resistant varieties of *Medicago trunculata* appears due to elicitation of phytoalexins including medicarpin, maackiain and scopoletin (Lozano-Baena et al.). The resistance of *Phaseolus* bean to *Cuscuta campestris* could also be due to chemical defence mechanisms (Farah). It was also suggested that resistance of crops to *Cuscuta reflexa* might be induced by application of a propeptide interfering with up-regulation of a cysteine protease (Bleischwitz et al.).

**Breeding for Parasitic Plant Control.** A valuable appraisal of the sources of resistance to *Orobanche crenata* in faba bean have shown those based on Giza 429 to have some of the widest stability and many large-seeded lines are now available (Maalouf et al.). In discussion it was pointed out that 4 further lines had been developed in Spain and should be exploited. A technique for regeneration and transformation of faba bean explants should prove valuable for future genetic modification of the crop (Abdelwahed et al.). In the absence of useful natural resistance in tomato, the possibilities for chemical mutagenesis are being explored in Bulgaria (Kostov et al.). In Nigeria the area planted to maize had increased 20-fold over the past 20 years and it was being planted in areas severely infested with *Striga hermonthica*. One way of minimising the risk of loss, and build-up of infestation was to use short-season varieties and these had now been developed with some resistance and made available to farmers (Adesosun et al.). Useful resistance to *Cuscuta campestris* had been identified in 3 out of 52 lines of chickpea; these were not successfully penetrated by the parasite (Goldwasser et al.).

**Special Topic – Orobanche cumana.** In sunflower, resistance to *Orobanche cumana* has been linked to elicitation of the HaDEF1 defensin gene. In an elegant study its activity in *O. cumana* is shown to involve a rapid increase in cellular calcium levels, causing cell death. Some link is also suggested to the up-regulation of this defensin by ABA (Thoiron et al.). In European Turkey infestations have peaked at 20 year intervals (1960, 1980, 2000) followed by successful introduction of resistant varieties. Now some 80% of crops are infested with new races. Imazapic is being widely used in conjunction with imidazolinone-resistant varieties (Kaya and Evci) and some encouraging results are being obtained from mutation breeding (Evci et al.). A useful appraisal of the races of *O. cumana* in Romania show that there are sources of resistance to virtually all races and there is emphasis on combining genes for horizontal and vertical resistance, together with resistance to imidazolinone herbicide (Pacuraenu-Joita et al.). A comparable study in Spain has compared a wide range of races from across Europe (Pineda-Martos et al.).

**Field trips** On a full day field trip we enjoyed a brief stop in the old town of Birgi, a relaxing lake-side picnic lunch and a visit to the site of potato field trials on *Orobanche* control.
No parasite was to be seen here but nearby and elsewhere at least four *Orobanche* species were collected. *Loranthus europaeus* was seen in sweet chestnut trees and *Cuscuta campestris* frequently on roadsides. No *Arceuthobium oxycedi* was seen this day but your intrepid editors (LJM and CP) tracked it down on Mt Sypilos on an unofficial post-conference excursion. Many delegates also took the opportunity to visit the ancient site of Ephesus.

**Closing ceremony.** In closing the meeting, Jim Westwood was pleased to announce that Maurizio Vurro had agreed to host the next, 11th Congress in Puglia, Italy in June 2011. See below for detail.

**Thanks and congratulations** are due to Ahmet Uludag and all others in the local organising committee for arranging and hosting a memorably relaxed and enjoyable meeting.

There will be no printed Proceedings but abstracts are available on the IPPS website (http://www.ppws.vt.edu/IPPS/). Titles of all papers and posters presented are listed below. NB The web-site lists some papers and posters which were not presented. These were numbers 9, 34, 35, 37, 47, 509, 69, 70, 77, 93, 94, 110, 112, 114, 116, 124, 125.

Chris Parker
Jim Westwood

**Oral presentations:**

R. Zimdahl - The role of ethics in science.
D.M. Joel - Taxonomic and evolutionary justifications for considering *Phelipanche* as a separate genus.
M.A. Selosse - One way of forest plants to make their living in deep shade: eating mycorrhizal fungi.
Westwood et al. - The Parasitic Plant Genome Project: A massive gene discovery project for the Orobanchaceae.
dePamphilis et al. - The Parasitic Plant Genome Project II: Large-scale EST sequencing of *Triphysaria*, *Striga*, and *Phelipanche*.
Bolin et al. - Molecular phylogenetic relationships and a revised taxonomy of the holoparasitic family Hydnoraceae.
Thorogood et al. - Host specificity and speciation in *Orobanche minor*.
Péron et al. - Molecular, biochemical and histological characterization of the sucrose-degrading enzymes involved in the sink-strength of *Phelipanche ramosa*.
Okazawa et al. - Metabolome analysis of *Orobanche minor* seed germination for selective control of parasitic weeds.
Aly et al. - Could plant viruses move from a host plant to the parasitic weed *Phelipanche*?

Gui-Lin and Shang-Wu - Research progresses of *Cistanche deserticola* and *Cynomorium songaricum* in western China.
Almansoori et al. - Stable isotope ratios and mineral nutrient composition of *Cynomorium coccineum* and its halophytic host *Zygophyllum qatarense* in Bahrain.
Maass et al. - Pollination biology in the genus *Hydnora*.
Brasil et al. - Distribution and sex ratio of the holoparasite *Pilostyles ulei* Solms-Laubach (Apodanthaceae) in Serra do Cipo, Minas Gerais, Brazil.
Hristova et al. - Application of ISSR methods in studying broomrape (*Orobanchaceae*) biodiversity in South/South-Western Balkans.
Meulebrouck et al. - Putting things on their heads: host age thwarts establishment of the holoparasite *Cuscuta epithymum*.
Hoeniges et al. - Why are rare *Orobanche* species rare?
Dorka et al. - Rhythms of nutational movement and seasonal changes in jasmonate levels during the course of the year and under constant conditions in mistletoe (*Viscum album*).
Girija et al. - Effect of host interaction on the phytochemical composition of *Helicanthus elastica*.
Domeignoz and Ceccantini - Modifications in wood anatomy caused by the mistletoe *Struthanthus vulgaris* in the host *Tipuana tipu* in Sao Paulo, Brazil.
Rodenburg et al. - Invasion, impact and possible integrated management of the facultative hemi-parasitic weed *Rhamphicarpa fistulosa* in rain-fed lowland rice.
Economou et al. - Assessing the role of abiotic factors on *Orobanche* infestation in Solanaceous crops using GIS.
Bakar et al. - Population spread, host status and damage of crop plants and weed species by *Cuscuta australis* R.Br. in Johore, Malaysia.
Mehrvarz - Taxonomic revision of Orobanchaceae in Iran.
Qasem - Parasitic weeds, a possible threat to fruit and forest trees in Jordan.
Boumeester - Strigolactones: signaling molecules with surprising activities.
Jamil et al. - Quantifying the relationship between strigolactones and *Striga hermonthica* under varying levels of nitrogen and phosphorus in rice (*Oryza sativa*).
Plakhine et al. - Broomrape seed conditioning and response to germination stimulants in soil.
Yoneyama et al. - Qualitative and quantitative differences in strigolactone exudation between *Striga* tolerant and susceptible maize cultivars.
Kohlschmid et al. - Can formononetin induce germination of parasitic weeds?
Eizenberg et al. - PICKIT- a decision support system for rational control of *Phelipanche aegyptiaca* in tomato.
Kanampiu et al. - Empowering smallholder farmers for integrated *Striga* control in Africa.
Tittcomb et al. - How does *Desmodium uncinatum* control the parasitic plant *Striga*?
Aksoy et al. - National broomrape project in Turkey.
Elzein et al. - Innovations for scaling-up of Striga mycoherbicides application in Africa.
Ndambi et al. - Colonisation of Striga hermonthica and its host sorghum by the mycoherbicide Fusarium oxysporum f.sp. strigae.
Muller-Stoever et al. - Mycoherbicial management of Orobanche cumana: observations from three years of field experiments.
Toth and Bouwmeester - Is Phytomyza orobanchia fastidious?
Lis et al. - Global gene expression profiling during resistant and susceptible interactions of cowpea with Striga gesnerioides.
Hoeniges et al. - The secret of broomrape host-specificity.
Sugimoto and Ueda - Induction of phytoalexin biosynthesis in Lotus japonicus roots in response to Striga hermonthica attachment.
Yoshida and Shirasu - Multiple layers of non-host incompatibility to Striga hermonthica.
Farah - The response of two legume crops (hyacinth bean and kidney bean) to the parasitism of field dodder (Cuscuta campestris).
Lozano-Baena et al. - Resistance mechanism to Orobanche crenata in the model legume Medicago truncatula: The isoflavonoid response.
Thoiron et al. - Implication of HaDEF1 defensin in sunflower resistance to Orobanche cumana.
Evci et al. - The mutation breeding for broomrape resistance in sunflower.
Pacureanu-Joita et al. - Resistance and sensitivity in the parasitic system Helianthus annuus - Orobanche crenata.
Pineda-Martos et al. - Genetic diversity of Orobanche crenata populations from Spain and Eastern Europe.
Nemli et al. - Research on broomrape control in tomato fields in western Turkey.
Sinha and De - Management of parasitic weeds in Eastern India.
Haddad et al. - Integrated control of Helipanche ramosa on potato in Syria.
Chinnusamy et al. - Integrated management of Chinese dodder (Cuscuta chinensis) in lucerne (Medicago sativa) and in Amaranthus viridis - a leafy vegetable.
Ahom et al. - Suppressing Striga hermonthisca parasitism in Zea mays with Sesamum indicum and Glycine max and nitrogen fertilization in Benue State, Nigeria.
Maalouf et al. - Stability of Orobanche resistance of faba bean lines in various environments.
Adeosun et al. - Evaluation of early and extra-early maize cultivars for their reaction to Striga hermonthisca in the North-Western Nigeria.
Slavov and Batchvarova - Chemical mutagenesis and haploidy - combined approach for breeding broomrape resistant tobacco.
Goldwasser et al. - Screening of chickpea (Cicer arietinum) genotypes for field dodder (Cuscuta campestris) resistance.

Posters:
Castillejo et al. - Proteome analysis for phylogenetic clarification in the Orobanchaceae.
Stoyanov and Denev - Taxonomic evaluation of five Phelipanche species (Orobanchaceae) in Bulgaria using ISSR markers.
Abbes et al. - Effect of Orobanche foetida parasitism on carbohydrates and organic acid composition in faba bean.
do Amaral and Ceccantini - The structure of the endoparasite Pilostyles ullei (Apodantheaceae) in Mimosa hosts: vegetative body and vascular connection.
Rahmani et al. - Evolution of the osmolality, proline and certain polyols contents in Orobanche crenata and its host Vicia faba subjected to water stress.
Bouya et al. - Contents of certain heavy metals and toxic elements in crenate broomrape (Orobanche crenata) and in its host (Vicia faba) collected from soils irrigated with wastewater.
Yue and Chen - Callus induction of Cynomorium songaricum.
Mukhtar - Antifungal activity of Cuscuta reflexa.
Prabakaran - Eco-biological characterisation of Orobanche cernua and its management in tobacco (Nicotiana tabacum) planted in alfisols of Southern India.
Chinnusamy - Ecobiological quantification and integrated management of parasitic weed Striga asiatica in sugarcane (Saccharum officinarum) planted in alfisols of southern peninsular India.
Rusen and Yazlik - Density and frequency of Phelipanche ramosa in tomato fields in Marmara Region.
Baye et al. - Current status of Tadla region (Morocco) infestation by parasitic weeds.
Lyra et al. - In vivo exploration of Phelipanche’s populations differential parasitism.
Tsveva and Stoyanov - The trophic plasticity of Phelipanche in Bulgaria.
Uludag and Nemli - Parasitic flowering plants in Turkey.
Isik and Kaya - Broomrape survey in tomato fields in Samsun Turkey.
Macukanovic-Jocic and Acic - Distribution and ecology of two Cuscuta species in Belgrade urban environment.
Kaya and Isik - A survey on broomrape in tobacco fields in Samsun, Turkey.
Shindrov and Kostov - Broomrape as a future problem for oilseed rape production in Bulgaria.
Amri et al. - Pathogenicity of different broomrape populations on five host plant species.
Zaroug et al. - Occurrence of mistletoe (Tapinanthus globefeious) on orchards in central Sudan.
Babiker et al. - Orobanche crenata: A genuine threat to agricultural productivity of the Nile Valley in Sudan.
Shang Wu and Gui Lin - Simultaneous isolation and purification of three compounds from the root extracts of Nitraria sibirica by HSCCC.
Saric et al. - Effect of plant growth-promoting rhizobacteria on the germination of Cuscuta campestris Yunck.
Fernandez-Aparicio et al. - Stimulation of Orobanche seed germination by Pisum sativum root exudates.
Ueno et al. - Preparation of multideuterium-labeled 5-deoxystrigol as an internal standard for quantitative analyses by LC/MS.
Naumova et al. - Actinomycetal stimulation of in vitro broomrape seed germination.
Ahom et al. - Suppressing Striga hermonthica parasitism in Zea mays with Sesamum indicum and Glycine max and nitrogen fertilization in Benue State, Nigeria.
Al-Khatin et al. - Managing Striga infestation with herbicide seed treatment in acetolactate synthase-resistant grain sorghum.
Bulbul and Uygur - Effect of soil solarization on broomrape in greenhouse tomato.
Cipriani et al. - Identification of molecular markers by f- AFLP technique for the detection of Fusarium oxysporum strain FT2, a potential mycoherbicide of Phelipanche ramosa.
Ozdemir et al. - Detection of tomato spotted wilt virus and cucumber mosaic virus on Cuscuta sp. in Denizli province of Turkey.
Konstantinovic and Meseldzija - Control possibilities of parasitic flowering plant Cuscuta europaea and some perennial weeds in lucerne.
Demirkan et al. - Research on broomrape control in potato in Bozdag (Odemis), Turkey.
Toshkova et al. - Possibilities for broomrape control in tomato fields.
Dehaghi et al. - Evaluation of cover crops for decreasing the infestation of Egyptian broomrape (Pelypanche aegyptiaca).
Ghotbi et al. - Environmental factors on disease incitement of Fusarium oxysporum attacking Egyptian broomrape (Phelipanche aegyptiaca).
Er and Nemli - Effect of plant residues and exudates on broomrape germination on tomatoes.
Baye - Eastern dodder (Cuscuta monogyna) control by glyphanosate in citrus and olive orchards.
Sarpe - Chemical control of dodder in alfalfa in conditions of Romania.
Saffour et al. - Effect of olive wastewater on germination and early growth stages of Orobanche crenata.
Amri et al. - Intercropping with fenugreek reduce Orobanche foetida infection of two faba bean cultivars.

PARASITIC PLANT SEQUENCES NOW AVAILABLE

The Parasitic Plant Genome Project (PPGP) has unveiled a project website that provides access to tens of thousands of partial or complete cDNA sequences from parasitic Orobanchaceae: Triphysaria versicolor, Striga hermonthica, and Orobanche aegyptiaca. The website is http://ppgp.huck.psu.edu/ and contains functions for BLAST, search (by key word or Gene Ontogeny classification), and data downloading. Currently, most of the sequences available are from above-ground tissues of each species, but the number of sequences will increase over the next several months.

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CONGRATULATIONS TO PROFESSOR GEBISA EJETA - 23RD WORLD FOOD PRIZE LAUREATE

Our heartiest congratulations are extended to Prof. Gebisa Ejeta following the announcement, June 11th, at a ceremony in Washington DC, that he is to be awarded the highly prestigious 2009 World Food Prize. The formal presentation is to take place on the 15th of October in the Iowa State Capitol.
Dr. Ejeta, a distinguished leader in global sorghum research and in promoting technical solutions in the fight against hunger and poverty, is an Ethiopian born in 1950 in rural Shewa in Ethiopia. He obtained his B. Sc. (1973) from Alemaya University in Ethiopia and his Ph.D (1978) from Purdue University in USA. His first employment was with the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) where he was dispatched to Sudan (1979) to serve with dedication and devotion for 5 years as a sorghum breeder. Dr. Ejeta returned to Purdue as a faculty member in 1984. Since then Gebisa has been involved in international agricultural research and development. He focused his efforts and devoted his time to sorghum, the crop of choice and the main staff of life for millions of African subsistence farmers and poor families. Dr. Ejeta, among others, realized that low soil fertility, drought and *Striga* are the major constraints that besiege sorghum production in Africa. However, his approach is unique in being holistic. Dr. Ejeta realized that for development, technology generation is a means and not an end and its dissemination and tuning to farmers needs and capabilities are of equal importance. To him illiteracy among farmers, lack of systems for seed propagation, and their negative impact on technology transfer, adoption and sustainability have been targets of importance and needed to be addressed.

Over a period of 30 years since graduation from Purdue University Dr. Ejeta has conducted, coordinated and lead multidisciplinary research programmes in Africa and the US on sorghum targeting biotic and abiotic stresses and their impact on yield, quality and utilization. His focus has always been to develop a technology simple and easy to implement by end users. He strived to attain his objectives through genetic manipulation and management based on simple agronomy.

In Sudan Dr. Ejeta released Hageen Dura-1, which was the first sorghum hybrid to be released in Sub-Saharan Africa. Hageen Dura-1 outyielded traditional varieties and local land races by 50 to 100% under irrigation and gives 2-to-3-fold more yield under rain fed conditions. More important than the unique and historical release of the hybrid was the ability to anticipate, predict and address problems associated with hybrid production. Dr. Ejeta’s assiduous efforts led to formation of a National Advisory Committee to monitor production of hybrid seed. Farmers’ and policy-makers’ awareness of the importance of improved seeds were raised. A seed industry was born and both governments and private sectors were enticed to get involved in the business. The seed industry has extended beyond sorghum to include other crops.

Upon joining Purdue University another hybrid, NAD-1, was released in Niger. The experience in Sudan was repeated and a seed industry has been established. In the US Dr. Ejeta released more than 50 parental inbred lines that have been taken up by the US industry and sorghum breeders for use in synthesis of sorghum hybrids for domestic and international markets.

Dr. Ejeta’s remarkable and distinguished research and achievements on *Striga* have been based on knowledge of the parasite, the host, and their interactions. To eliminate or minimize damage by the parasite Dr. Ejeta’s zealous efforts have been directed at perturbation of the early developmental stages through genetic manipulation of the host with the objective of developing cultivars with multiple mechanisms for more stable and durable resistance. Efficient laboratory methods for rapid screening for resistance and resistance mechanisms were developed at Purdue. Genetic basis of the interactions of *Striga* and its hosts have been elucidated using conventional and molecular approaches. Genes for *Striga* resistance in various germplasms were identified. Based on the methods and knowledge developed, intensive field work was launched at Purdue University. Varieties with multiple resistance to the parasite were synthesized and released for field testing in Africa through a network of collaborators including National Agricultural Research (NARS) and NGOS. Dr. Ejeta managed to have the eight lines he developed at Purdue tested for resistance, and adaptability to agro-ecological zones, in 12 African countries namely, Senegal, Mali, Niger, Sudan, Ethiopia,
Eritrea, Somalia, Rwanda, Tanzania, Zimbabwe, Botswana and Mozambique. Three cultivars were released in Ethiopia, two in Tanzania, one in Eritrea and one is very promising in Sudan.

Dr. Ejeta’s work on *Striga* has focused on integration of resistance with agronomic practices. The *Striga* control package in Ethiopia includes a resistant variety, a fertilizer and water harvest using tied ridges. Under these conditions the yield attained was 3 to 4 times that of local land races planted by neighbouring farmers. In Ethiopia adoption of the package of practice released by Dr. Ejeta for *Striga* control is phenomenal. Arrangements for community-based seed multiplication have already been made and plans are underway to find and organize markets for the surplus. In 2008 cropping season it was estimated that over 500,000 rural families had received seeds of *Striga* resistant cultivars in parts of Tigray, Oromoia, Amhara and the southern parts of Ethiopia. Parallel progress is expected in other African countries.

Apart from his direct personal contribution to progress in *Striga* management and control we have to thank Gebisa for raising the profile of *Striga* to a whole new audience, including the US Secretary of State Hillary Clinton who was among those speaking at the announcement ceremony (see http://www.worldfoodprize.org/about/about.htm)

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### AATF PROJECT ON *STRIGA* CONTROL IN SMALLHOLDER MAIZE FIELDS IN SUB-SAHARAN AFRICA

In 2005, AATF (African Agricultural Technology Foundation) initiated a project with the objective of controlling *Striga* species which curtail maize production, resulting even in total grain loss in severely infested fields. The project embodies the public-private partnership approach, in which AATF, CIMMYT and BASF are key partners, collaborating with several other stakeholders in target countries. Currently, the project is in the deployment phase, which aims to facilitate ‘Strigaway’ (IR) maize technology, product awareness, uptake and sustainable utilization. The IR maize technology comprises maize seed that is resistant to imazapyr herbicide; the seed is coated with the herbicide without affecting its viability. To achieve this deployment, the project supports product demonstration, information dissemination amongst stakeholders, product commercialization, and stewardship for long term benefit to farmers. Potential benefits from the implementation of the project include:

- Improvement of food security in sub-Saharan Africa through increased grain harvests
- Grain surplus that can earn farmers income
- Significant reduction of *Striga* seed bank in the soil
- Opening up of abandoned land for cultivation and Encouraging farming as a business.

In the AATF experience, delivery and uptake of *Striga* management technologies require value chain management and institutional partnerships that enable smallholder farmers to control the weed, produce surplus maize and access efficient and equitable markets. This has led to greater income generation and motivation of farmers to invest in the uptake of new technologies.

Against this background, AATF’s objective is to enable smallholder farmers in sub-Saharan Africa to access appropriate *Striga* management technologies such as ‘Strigaway’ maize (IR-Maize) seed, *Striga* tolerant maize varieties and suppression and trap cropping management systems.

**Progress to date:** reduction of *Striga* damage and improved maize grain yield: field work with the ‘Strigaway’ (IR) maize technology has shown marked reduction in emerged *Striga* with fields being almost clear of the weed. Maize yield has been driven from the paltry average of about 500 to 3,000 kg/ha. This significant yield increase is a stimulus to sale of the surplus grain, after household food security is achieved by some project farmers.

**Product demonstration and Stakeholder Outreach:** since 2005, a total of 60,000 demonstrations have taken place in Kenya; and, since 2007, 2,000 in Uganda and 6,000 in Tanzania. These have illustrated the product performance, and particularly given farmers a chance to learn how to use the ‘Strigaway’ (IR) maize within their farming systems, thus promoting uptake of the technology. The demonstrations have built demand for the technology, sensitized seed producers, regulators and policy makers, who as a result have facilitated subsequent commercialization and delivery of this technology to farmers in target countries.

**Information dissemination:** various publications have been developed and circulated amongst stakeholders. These include baseline studies from Kenya, Uganda, Malawi, and Tanzania and a farmer perception study report from Kenya.

**Product commercialization:** IR maize varieties have been registered and released for certified seed production in Kenya since 2006; and in Tanzania in December 2008.

**Technology Stewardship:** stewardship has assessed performance of the ‘Strigaway’ technology, and farmer
adherence to user instruction, thus ensuring optimal benefits from the technology. Superior performance of IR maize under Striga infestation is easily evident and indeed farmland that had been abandoned is now being opened for cultivation once again.

**Future Activities:**

**Wide-scale expansion:** AATF and its partners will work jointly to cover all key Striga infested maize growing fields in Eastern, Southern and Western Africa. The target countries are Kenya, Malawi, Tanzania, Uganda, Zambia, Ethiopia, Ghana, Mozambique, Nigeria and Zimbabwe. These countries account for 85% of the Striga weed occurring within Africa’s maize fields. Both S. hermonthica and S. asiatica are equally controlled. Project activities within each country will focus on severely Striga-infested areas identified by national cooperators.

**Product Stewardship:** work will continue to ensure that the product is used appropriately for optimal performance. This will encompass monitoring and evaluation missions, field workshops, training meetings for various stakeholders, including farmers, extension officers, agro-dealers and seed companies.

**Commercialization:** AATF will facilitate national performance trials and distinctiveness, uniformity and stability tests to ensure variety registration and release, so that the improved seeds are available to agro-dealers and further acquisition by farmers in Striga infested areas. As the project rolls out and intensifies work in Sub-Saharan Africa, AATF will also plan impact studies to assess and document adoption of the technology and lessons that can be used to continually improve the deployment strategy.

Partners and stakeholders include CIMMYT (International Maize and Wheat Improvement Centre), BASF, Weizmann Institute of Science, Israel, TSBF-CIAT – (Tropical Soil Biology and Fertility Program of the International Centre for Tropical Agriculture) IITA (International Institute of Tropical Agriculture Kenya) and a wide range of government institutions and NGOs in Kenya, Tanzania, Uganda and Malawi.

Further detail of partners, etc can be found on the web-site: [www.aatf-africa.org](http://www.aatf-africa.org)

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### UNLOCKING THE CEREAL PRODUCTION POTENTIAL IN EAST AFRICA BY ELIMINATING THE STRIGA THREAT

**THE KILIMO TRUST PROJECT**

The parasitic weed *Striga* has infested more than 1.5 million hectares (ha) of land across East Africa, causing economic losses of up to $335 million per year for maize alone.

A team of experts formed a Consortium in 2008 to build synergies in eliminating the *Striga* threat in East Africa using the available proven technologies which include the ‘push-pull’ technology involving use of the legume fodder crop, *Desmodium*, a herbicide-based approach using impazyr with herbicide-resistant mutant (IR) maize varieties, crop varieties resistant to *Striga*, especially for sorghum and maize, and cultural control methods like crop rotation.

The Consortium comprised Kilimo Trust, AGRA (Alliance for a Green Revolution in Africa), IFAD (International Fund for Agricultural Development), CIMMYT, AATF (African Agricultural Technology Foundation), ICIPE (International Centre for Insect Physiology and Ecology), Seed and Cereal Traders, Seed Certification Institutions, National Research Systems, Public Extension and Universities and the Ministries of Agriculture in Kenya, Tanzania and Uganda. With funding from Kilimo Trust, a consultancy was commissioned to assess the ex-ante impact of the threat and benefits of *Striga* with the broad strategic objectives of quantifying and documenting the magnitude of the *Striga* problem in East Africa, conducting a critical evaluation of the efficacy of the available solutions to control *Striga* and estimating the social, economic, and environmental impacts of introducing improved *Striga* control measures in East Africa. This provided information to guide the development of a regional *Striga* control program in East Africa.

Using a modeling framework developed to predict the economic benefits of introducing *Striga* control measures in the three East Africa countries, the model was constructed using the results of field trial data from sixteen independent studies conducted over the past eight years in East and Central Africa. The field trial results were extrapolated to other *Striga* infested locations.

**Key findings:** (see p. 12)

a) There are four major *Striga* zones in East Africa: the Lake Victoria Zone, the Inland Semi Arid Zone in Tanzania, the Inland Moist Zone in Uganda and South Highlands of Tanzania and Kenya, and the Coastal zone in Kenya and Tanzania. The Lake Victoria Zone in Kenya, Tanzania and Uganda has the largest extent of infestation of over 850,000 hectares with the heaviest *Striga* infestations (over
50% of the cropland) being medium to severely infested. This area also experienced crop losses ranging between 50% and 80% due to Striga.

b) On average, Tanzania loses 961,000 tons of maize per year due to Striga or about 28% of the annual crop, Kenya 226,565 tonnes (10% of annual crop) and Uganda 725,000 tons per year (about 57% of annual crop).

c) In the heavily infested Striga zones rural poverty rates often exceed 70% and where Striga infestation is lighter, poverty rates are often 20% or less.

d) It is feasible to design a special program to accelerate elimination of the Striga threat in cereal production systems based on the existing technologies.

e) Cereal cropping systems have a considerable and proven potential (improved varieties, agronomic practices and farmers’ skills) of improving food security and reducing poverty, but this potential has not been realized in areas infested by Striga. None of the methods can solve the problem on their own in the entire region and an integrated approach is required. Removal of the Striga threat will therefore contribute to the unlocking of such potential to enable smallholders to i) contribute to regional supply of cereals, and, if market access is improved, to ii) increase their incomes.

f) An investment of $US 40 million would be required over a 20 year period with the most benefits obtainable from Striga control with an investment of $US 20 million, one half of the $US 40 million required to reach the full adoption.

The Project:

Considering the opportunities and the challenges, the regional program entitled: ‘Unlocking Cereal Production Potential in East Africa through Elimination of Striga Threat’ is being designed to address the current challenges of putting the existing technologies into use, such that by 2020, yields of maize, sorghum, rice and millet in 60% of cropped lands currently infested by Striga in East Africa, will have been substantially increased (for instance in maize to an average of 3 t/ha per season) as a result of reduction by at least 50% of Striga infestation and seed bank in the soil of the target areas.

Jointly facilitated by Kilimo Trust and AGRA, the regional program has six key pillars addressing the cereal value chain that will be implemented in country sub-level projects with each project covering about 50,000 households. In this case the Consortium invests jointly in key geographic regions where the problem is severe, targets a large number of households, and scales up Striga control technologies and practices as part of a package that will include work on the entire value chain.

The six key pillars:

a) Establish baseline information for monitoring and evaluation of the work that needs to be done.

b) Ensure sufficient technology dissemination through guaranteeing a dedicated extension service and other capacities to support the fight against Striga on a continuous basis.

c) Facilitate regulatory services, especially seed certification and phyto-sanitary services to approve the various

d) Involve a motivated private sector in the inputs’ supply for the push-pull and IR-maize technologies

e) Further Technological Innovation that includes identification of the necessary research required to adapt the technologies and practices to different situations, especially the recent spread of Striga to upland rice.

f) An advocacy thrust to leverage infrastructure and market access investments.

The Goal:

To enhance sustained contribution of cereals production systems to incomes and food security in the East Africa region with the purpose focused on substantially reducing and finally eliminating the threat of Striga in cereal production systems in East Africa.

Implementation:

It was resolved that implementation of the proposed program while targeting the entire East Africa region, should be through country level sub-programmes, supported by special regional-wide sub-program to deal with cross-cutting issues. It was thus agreed that each country (Uganda, Tanzania and Kenya) should take the initiative to develop the necessary sub-programmes to deal with the Striga problem in the infested areas of the country. The purpose of each sub-program will be ‘to scale-up the most appropriate technologies and practices to control Striga in the Target Area, in an integrated package that addresses the entire value chain from resource management to marketing in cereal production systems affected by Striga’.

Further information can be found at www.thekilimotrust.org

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Summary of key findings by country

<table>
<thead>
<tr>
<th>Country</th>
<th>Total area infested by <em>Striga</em> (ha)</th>
<th>Annual cereal losses (MT) caused by <em>Striga</em></th>
<th>Annual economic losses ($US) with no control measure in place</th>
<th>Potential annual production gains (MT)</th>
<th>Potential annual economic gains ($US) if control program is implemented successfully</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>340,978</td>
<td>Maize: 184,237</td>
<td>45,144,780 *(54,000,000)</td>
<td>Maize: 695,963</td>
<td>166,523,880</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sorghum: 27,646</td>
<td>Sorghum: 90,821</td>
<td>Millet: 1,855</td>
<td>Millet: 6,338</td>
</tr>
<tr>
<td>Tanzania</td>
<td>963,532</td>
<td>Maize: 464,599</td>
<td>333,283,200 *(356,000,000)</td>
<td>Maize: 1,442,502</td>
<td>1,122,250,240</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sorghum: 192,975</td>
<td>Sorghum: 584,538</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rice: 232,913</td>
<td></td>
<td>Rice: 837,599</td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td>107,799</td>
<td>Maize: 76,568</td>
<td>23,557,120 *(27,000,000)</td>
<td>Maize: 220,303</td>
<td>287,193,640</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sorghum: 4,944</td>
<td>Sorghum: 14,301</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rice: 8,574</td>
<td></td>
<td>Rice: 2,460</td>
<td></td>
</tr>
</tbody>
</table>

Notes: *Rice is currently being promoted in Kenya as well but no immediate data was available being a new initiative*

*Overall Economic losses inclusive of other cereals in the respective countries

(FORTHCOMING) MEETINGS

**Novel and sustainable weed management in arid and semi-arid agro-ecosystems** 7-10 September 2009, Santorini, Greece.

The 2nd International Conference on ‘Novel and sustainable weed management in arid and semi-arid agro-ecosystems’ will take place in Santorini, Greece from 7 to 10 September 2009 and is organised by the EWRS Working Group Weed Management in Arid and Semi-Arid Climate. The aim of the conference is to establish a forum of weed scientists involved in research in weed biology, distribution and management in arid and semi-arid agriculture.

A wide variety of topics will include Parasitic weeds.

Further information can be found at [www.ewrs.org/arid/default.asp](http://www.ewrs.org/arid/default.asp) or from Dr. Garifalia Economou [economou@aua.gr](mailto:economou@aua.gr) or Dr. Ilias Travlos [h travlos@yahoo.gr](mailto:h travlos@yahoo.gr)

(Apologies that due to the delay in publication, this meeting is no longer ‘forthcoming’ – Ed.)

BOOK – ERRATA


The author has listed a large number of corrections to this volume. Please contact Chris Parker for a copy of this list.

THESIS

**Ana Höninger,** (PhD, Eberhard-Karls University Tübingen, Germany, December 2009)

**Ecological and Physiological Studies on Orobanche Species in Natural Ecosystems**

The main objective of this thesis was to find out why rare broomrakes (*Orobanche* spp.) in the spontaneous flora are rare and endangered, while weedy broomrakes threat crops in agriculture.

During extensive field work 13 of 22 listed *Orobanche* spp. were found in Romania, namely *Orobanche alba, O. arenaria, O. caryophyllacea, O. coerulescens, O. elatior, O. gracilis, O. lucorum, O. lutea, O. minor, O. purpurea, O. reticulata, O. salviae* and *O. teucrii.* In Baden-Württemberg, Southwest Germany, 11 of 21 listed *Orobanche* spp. were
found, namely *Orobanche alsatica*, *O. arenaria*, *O. caryophyllacea*, *O. elatior*, *O. hederae*, *O. lutea*, *O. mayeri*, *O. minor*, *O. picridis*, *O. purpurea* and *O. teurcii*. The studies result in the statement, that the number of sites, where *Orobanche* occurs, and the number of individuals, where they are found, is generally declining.

Climate warming plays a minor role, although it would favour *Orobanche*. Collected local weather data over the past 3-4 years showed a distinct tendency towards dryer spring months (April-June). The precipitation over the days and months is irregularly distributed and changes from year to year. Dry spring months are unsuitable for conditioning and germination of *Orobanche* seeds. This explains, why some *Orobanche* spp. were not found in every year.

Rare *Orobanche* spp. compared with the noxious *Orobanche* spp. in agriculture are biologically handicapped. Their seed production is lower, since their flower stands are much smaller than that of noxious species. Due to insect attack the stems dry off early, so that the seed development leads to immature or empty seeds. This was shown by germination tests under standardised conditions and was confirmed by electron microscopy. Some *Orobanche* spp. develop only short germination tubes (radicles), which have a very limited chance to come in contact with a host plant root and to form a haustorium.

Due to these biological disadvantages the rare *Orobanche* spp. are not expected to become noxious species endangering crop plants. The transition to crop damaging pathotypes in rare cases may happen by mutative adaptation (*Orobanche foetida*) or by hybridisation (*Orobanche lavandulacea* x *O. ramosa*).

Series of germination tests were carried out with *Orobanche* seeds, stimulating them with root exudates of their host plants or with the synthetic germination stimulant GR 24, without or with the addition of potential germination inhibitors, and/or gibberellic acid, which could increase elongation growth of the germ tubes. With GR 24 the germination rates of *O. elatior* and *O. lutea* were zero, that of *O. hederae* extremely low. This deserves attention, because GR 24 generally serves as a standard in germination tests. In all the germination test series in this thesis *Orobanche ramosa*, a noxious species in agriculture, was used for comparison.

In order to study allelopathic interactions with the associated flora analyses of root exudates by HPLC with UV/VIS diode array detector, and GC-MS were carried out. Benzoic acid was a significant component in half of the investigated root exudates, including that of the associated flora. Its identity was verified by the retention time in the HPLC chromatograms and by the absorption spectrum. Germination inhibitors of the cinnamic acid family were not found. Germination inhibition, shown by standardised germination tests, resulted in significant differences in sensitivity among the *Orobanche* spp.

Suicidal germination is considered a significant factor in the limitation of rare *Orobanche* spp. Almost all plant roots exude strigolactones, the natural germination stimulants, because these are required for mycorrhiza development. Hence, the exudates of the associated flora stimulates germination, without being parasitised afterwards. Under these circumstances no seed potential is built up in the soil, which during a favourable year could lead to a mass appearance of *Orobanche*.

After the observation during the germination tests that fungi grow out of the seed, these were investigated by transmission electron microscopy. When the presence of endophytic Ascomycetes was discovered, their molecular-genetic identification was carried out. Two fungi have been positively identified as *Alternaria tenuissima* strain IA 285 and *Cladosporium* sp.

For the first time strigolactones have been isolated from the root exudates of host plants of rare *Orobanche* spp. and identified by HPLC-Tandem-MS. Known structures have been found, but there are also indications for related compound, whose structures are not yet revealed. The results show host plant specific qualitative differences in the composition of strigolactones. This supports the hypothesis that host specificity may depend on specific mixtures of strigolactones exuded by the host plant.

The surface of seed coats of *Orobanche* spp. has been investigated by scanning electron microscopy, in order to prove the suitability for the identification of *Orobanche* spp. According to the obtained results *Orobanche* and *Phelipanche* (*Trionychon*) sections can be distinguished, but scarcely the species within these sections.

**PRESS RELEASES**

‘Chemical genetics’ approach used to regulate the activity of plant hormones.’

‘Plant researcher Tobias Sieberer of the Max F. Perutz Laboratories of the University of Vienna works on signal transduction of hormones called strigolactones. Within his search for chemical substances to influence the activity of this pathway, he is establishing a high-throughput approach to test thousands of different chemical compounds. The project is funded by the Vienna Science and Technology Fund (WWTF).

The project allows the establishment of the first academic compound screening facility in Austria. In pharmaceutical
companies such libraries are routinely used for drug discovery. For scientists from public research institutes the use of such libraries is cost-intensive and results are subjected to complicate patent laws. ‘Our library will be open for collaboration with interested scientists from the Viennese area’, Sieberer illustrates the possibility to use this library for research on additional model organisms. Results of this chemical genetics technique will support basic and applied research. For the strigolactone project this means that discovered inhibitors might be used to enlighten the basic mechanisms of biosynthesis and signalling of the hormone. But also in applied research this might lead to the development of directed shoot branching regulation or impact on the infection rate of plant parasites.’


‘Development and promotion of Alectra resistant cowpea cultivars’

‘Improved regional collaboration cowpea research will result from implementation of this project. Recent donor funded legume improvement projects in E. and S. Africa have focused on beans and groundnuts and have neglected cowpea. Up-scaling of outputs beyond the lifetime of the project can lead to improved nutrition and income in semi-arid areas of E. and S. Africa. This will be achieved by improved reliability of cowpea production through use of early maturing, Alectra, pest and disease resistant cultivars.

New knowledge will be generated about farmer preferences in cowpea and the current cowpea market structure. Alectra resistant cowpea lines that are acceptable to farmers and the market will be identified. Best bet lines identified through a PVS approach from existing collections can be progressed to begin registration by national authorities by the fourth year of the project. From literature reviewed it is expected that a range of resistant lines with different traits will be needed by farmers. Breeding will produce stable lines of high yielding, early maturing, pest, disease and Alectra resistant lines by the end of the project. These will need further on-farm evaluation prior to registration. A further output will be knowledge on variability of A. vogelli in E. Africa, necessary for confident deployment of resistance over wide geographic areas. Involvement of agricultural service providers and farmers in the project will increase their understanding of cowpea production constraints and opportunities to increase productivity. Lessons learnt with experienced farmer groups will provide foci for up-scaling multiplication use of high-yielding cultivars in the future.’


‘Cowpea growers see 55 per cent jump in profits from improved varieties’

‘Resource-poor cowpea farmers in sub-Saharan Africa have seen their profits jump by 55 per cent thanks to improved dual-purpose cowpea varieties developed and introduced by IITA and its national partners in Nigeria. Paul Amaza, IITA Agricultural Economist, says that farmers who use traditional varieties earn about US$ 251 per hectare, while those who are growing the improved cowpea are getting US$390, or US$139 more, per hectare with proper crop management.

The improved varieties -- IT89KD-288, IT89KD-391, IT97K-499-35, and IT93K-452-1 -- produce high-quality grains for use as food and fodder and are also resistant to Striga, a parasitic weed that reduces yields of susceptible local cowpeas by as much as 80 per cent.

Alpha Yaya Kamara, IITA’s Savannah Systems Agronomist, says over 100,000 farmers in Borno and Kano states in northern Nigeria and in the Niger Republic are currently using the improved varieties, where their adoption rate is conservatively estimated at 65 per cent. He explains that farmers in the savannah region view cowpea as both food and cash crop. Therefore, when the varieties were introduced, farmers took to them quickly since they serve both ends well. "Those who cultivate it are basically better off than those who do not”, Kamara adds.

The improved cowpea varieties were developed and deployed in partnership with the Borno State Agricultural Development Project, Kano State Agricultural and Rural Development Authority, Kaduna State Agricultural Development Project, the Institute of Agricultural Research - Zaria and the University of Maiduuguri. Other local development partners are also promoting the improved varieties by organizing farmers’ field days, exchange visits, training and farmer-to-farmer diffusion.’

‘US$27 million annually to dangerous weed’

‘Uganda loses 27 million dollars annually due to Striga weeds which affect cereal crops. The Senior Agricultural Inspector in the ministry of Agriculture Mary Asio says Striga has reduced production of cereals to about 90,000 tonnes. Asio says Striga weeds are mostly affecting the West Nile, Eastern and the northern part of the country. She calls upon scientists to design a strategy that will help reduce the seed bank of Striga in the soil.’

From New Vision, Thursday, 28th May, 2009: http://www.newvision.co.ug/D/1/10/682783

‘Expert tasks African countries on agricultural biotechnology’

‘Two centers supported by the Consultative Group on International Agricultural Research, CGIAR – the International Maize and Wheat Improvement Center (CIMMYT) and the International Institute of Tropical Agriculture (IITA) have jointly initiated the Drought-Tolerant Maize for Africa Initiative aimed to protect Africa’s maize crop from drought and other threats. Their combined efforts are vital for improving and stabilizing Africa’s maize production in an era of food price volatility and emerging climate change.

Drought, which is expected to become more frequent and severe with climate change, already reduces maize yields by an average of 15% annually, amounting to about US$200 million worth of lost grain. Recent droughts in eastern and southern Africa have been particularly disastrous.

For many years, CIMMYT and IITA tended to divide their responsibilities for maize research in Africa geographically, with CIMMYT working in eastern and southern Africa and IITA focusing on West Africa, explains Paula Bramel, IITA’s deputy director general in charge of research for development. The big advantage of the DTMA Initiative, she says, is that bringing together the complementary strengths and research products of the two centers, in an effort that spans the continent, enables national public and private partners to tap into and benefit from a much broader base of improved germ-plasm, knowledge and expertise.

More recently, IITA researchers have registered important gains against parasitic weeds of the genus Striga, also called witchweed. The single most important biotic constraint of cereal crops in Africa, Striga causes especially severe damage to maize yields in the savannas of coastal and central sub-Saharan Africa.

By significantly scaling up current efforts through more intensive collaboration, the DTMA Initiative expects to provide over the next decade 30-40 million farmers with improved maize varieties that will help to boost maize productivity on small farms by 20-30%. It is working in 13 African countries where maize is particularly important, with support from Germany’s Federal Ministry for Economic Cooperation and Development (BMZ, its acronym in German), Howard G. Buffett Foundation, Hermann Eiselen, Bill & Melinda Gates Foundation, International Fund for Agricultural Development (IFAD), Rockefeller Foundation, Swiss Agency for Development and Cooperation (SDC), and US Agency for International Development (USAID).

Two newly released varieties - Sammaz 15 and 16, developed in collaboration with Nigeria’s Institute for Agricultural Research (IAR) show high yields, with only minor losses to the weeds, even under extreme infestation.’


‘Nigeria: ABU introduces three maize varieties’

‘In its efforts of boosting agricultural advancement and food production in the country, the Ahmadu Bello University's (ABU) Institute for Agricultural Research (IAR), Zaria, has released three new maize varieties capable of fully maturing within 70-120 days with a yield potential of 6.9 tonnes per hectare. Unveiling the new seeds christened SAMMAZ 15, 16, and IAR-07-1050 in Zaria, its Director, Professor Balarabe Tanimu, said the three new seeds are resistant to Striga and tolerant to streak virus and suitable for cultivation in the Nigerian savannas.

Another new variety of cowpea called SAMPEA 10 was also released by IAR, with full maturity within 60 - 70 days. The new cowpea is also resistant to Striga and Alectra. Its yield potential is 2.5 tonnes per hectare and it can be grown in savanna ecological zones.’

GENERAL WEB SITES

For individual web-site papers and reports see
LITERATURE

For information on the International Parasitic Plant
Society, current issues of Haustorium, etc. see:
http://www.ppws.vt.edu/IPPS/

For past and current issues of Haustorium see also:
http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the announcement of Gebisa Ejeta’s World Food
Prize, including video of Hillary Clinton’s address see:
http://www.worldfoodprize.org/about/about.htm

For abstracts from the 10th World Congress on Parasitic
Plants in Kusadasi, Turkey, June 8-12, 2009, see:
http://www.ippsturkey.com

For abstracts from the 9th World Congress on Parasitic
Plants see: http://www.cpe.vt.edu/wcopp/index.html

For the ODU parasite site see:
http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see:
http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see:
http://ppgp.huck.psu.edu/

For The Mistletoe Center (including a comprehensive
Annotated Bibliography on mistletoes, up to 2005) see:
http://www.rmrs.nau.edu/mistletoe/

For information on the EU COST 849 Project (now
completed) and reports of its meetings see:
http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic
weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the
Desmodium technique for Striga suppression, see:
http://www.push-pull.net/

For the work of Forest Products Commission (FPC) on
sandalwood, see: http://www.fpc.wa.gov.au (Search
Santalum)

For past and future issues of the Sandalwood Research
Newsletter, see:

For information on the Kilimo Trust Striga project see:
www.thekilimotrust.org

For information on the work of the African Agricultural
Technology Foundation (AATF) on Striga control in
Kenya, including periodical ‘Strides in Striga
management’ newsletters, see: http://www.aatf-
africa.org/

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6.3.5.4) in the N metabolism of the parasite.)

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Nutrition and Development 7(3): unpaginated.
(Concluding that nitrogen application has little influence
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Journal of Medicinal Plant 2(2): 86-91. (Leaves, stem
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96. (Three testcross hybrids had consistently positive
SCA effects in two environments and are potentially
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ecologies.)

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Agronomie Africaine 18(1): 13-21. (Intercrops of
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Encheva, J., Christov, M. and Shindrova, P. 2008. Developing mutant sunflower line (Helianthus annuus L.) by combined use of classical method with induced mutagenesis and embryo culture method. Bulgarian Journal of Agricultural Science 14(4): 397-404. (Describing the development of line 35 RM with improved characteristics including resistance to Orobanche cumana and its use to form Hybrid No 61, tested successfully in the field.)

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related genes and systemic gene expression as compared to *Striga*.)

Hooper, A.M., Hassanali, A., Chamberlain, K., Khan, Z., and Pickett, J.A. 2009. New genetic opportunities from legume intercrops for controlling *Striga* spp. parasitic weeds. In: Balázs, E., Vurro, M. and Gressel, J. (eds.) Pest Management Science 65(5): 546-552. (Suggesting that the biosynthesis of isoschaftoside, the di-C-glycosylflavone responsible for the effectiveness of *Desmodium* as a suppressant of *Striga*, might be introduced by bio-engineering to other legume or cereal crops to make them equally effective.)

Hosseini, S.M., Kartoolinejad, D., Mirnia, S.K., Tabibzadeh, Z., Akbarinia, M. and Shayamnahr, F. 2008. The European mistletoe effects on leaves and nutritional elements of two host species in Hyrcanian forests. Silva Lusitana 16(2): 229-237. (Results suggest that *Viscum album* L. can damage leaf structure, physiological and nutritional status of host trees (*Carpinus betulus* and *Parrotia persica*) at high levels of infection.)


Jackson, M.B. 2008. Douglas-fir dwarf mistletoe spread, intensification, and tree growth impact: thirty-eight year re-measurement. Forest Health Protection Report - Northern Region, USDA Forest Service No.08-09: 12 pp. (In a long-term study of *Arceuthobium douglasii* infection of Douglas fir, a trend towards reduced height growth after 38 years was apparent as dwarf mistletoe rating increased above 3 or 4.)

James, D.B., Owolabi, A.O., Ibiyeye, H., Magaji, J. and Ikugiyi, Y.A. 2008. Assessment of the hepatic effects, haematological effect and some phytochemical constituents of *Ximenia americana* (Leaves, stem and root) extracts. *African Journal of Biotechnology* 7(23): 4274-4278. (Roots have higher content of potentially active compounds than leaf or stem.)


campaign resulting in wide-scale adoption of Striga control practices, and trebling of cereal yields.)


Kawai, Y. and Kudo, G. 2009. Effectiveness of buzz pollination in Pedicularis chamissonis: significance of multiple visits by bumblebees. Ecological Research 24(1): 215-223. (Concluding that buzz pollination (vibrating the anthers) in P. chamissonis improves the chance of cross-pollination upon multiple visits if pollinator visitation is frequent.)


Kloooster, M.R. and Culley, T.M. 2009. Comparative analysis of the reproductive ecology of Monotropa and Monotropis: two mycoheterotrophic genera in the Monotropeoideae (Ericaceae). American Journal of Botany 96(7):137-1347. (Monotropa uniflora, M. hypopitys and Monotropis odorata all show mainly outcross pollination, but differ in many other aspects of their breeding systems.)

Kloooster, M.R., Hoenle, A.W. and Culley, T.M. 2009. Characterization of microsatellite loci in the myco-heterotrophic plant Monotropa hypopitys (Ericaceae) and amplification in related taxa. Molecular Ecology Resources 9(1): 219-221. (The method is cost-effective and applicable to M. uniflora and five other closely related genera.)

Kolo, M.G.M. and Mamudu, A.Y. 2008. Water treatment of Parkia biglobosa pulp dressed maize (Zea mays L.) seeds for Striga hermonthica control at Minna, Nigeria. Agriculture Tropica et Subtropica 41(3): 96-105. (Trials in 2004/2005 showed that soaking maize seeds for 18 hours with 164 g P. biglobosa pulp and 50 ml water per kg seed, reduced emergence of S. hermonthica by 60-70% and increased maize yield by 80%. Any follow-up to these interesting results? The pulp is high in N.)

Konieczka, C.M., Colquhoun, J.B., Rittmeyer, R.A. 2009. Swamp dodder (Cuscuta gronovii) applied ecology in carrot production. Weed Technology 23(1): 175-178. (Five varieties of carrot were found to be relatively tolerant of infestation by C. gronovii.)

Kovacs, E., Link, S. and Toffol-Schmidt, U. 2008. Comparison of Viscum album QuFrF extract with vincristine in an in vitro model of human B cell lymphoma WSU-1. Arzneimittel Forschung 58(11): 592-597. (The effects of the V. album extract on the B cell lymphoma cell line WSU-1 were comparable to those of vincristine.)

Kubo, M., Ueda, H., Park PyoYun, Kawaguchi, M. and Sugimoto, Y. 2009. Reactions of Lotus japonicus ecotypes and mutants to root parasitic plants. Journal of Plant Physiology 166(4): 353-362. (The model legume L. japonicus is susceptible to Orobanche aegyptiaca but not to O. minor, Striga hermonthica or S. gesnerioides. The reaction of selected mutants of L. japonicus suggests there are interactions with nodulation and, mycorrhizal colonization.)


Kwon-Ndung, E.H. and Ismaila, A. 2009. Prospects of host resistance in improved and domesticated species of Parkia biglobosa to African mistletoes (Tapinanthus spp.) in Central Nigeria. Electronic Journal of Environmental, Agricultural and Food Chemistry 8(5): 382-388. (Noting that P. globosa is host to three (unspecified) Tapinanthus species, and discussing the potential for selecting resistant lines of the tree.)

Lendzemo, V., Kuyper, T.W., Urban, A., Vegvari, G., Puschenreiter, M., Schickmann, S., Langer, I.,
Steinkellner, S. and Vierheilig, H. 2009. The arbuscular mycorrhizal host status of plants cannot be linked with the *Striga* seed-germination-activity of plant root exudates. Journal of Plant Diseases and Protection 116(2): 86-89. (Confirming that plants which do not host AM fungi do not exude strigolactones, but that some AM host plants also fail to stimulate germination of *Striga hermonthica*.)

Li, J. and Timko, M.P. 2009. Gene-for-gene resistance in *Striga-cowpea* associations. Science 325: 1094. (This article is notable for being the first documentation of a coiled coil nucleotide binding site leucine-rich repeat domain protein being involved in response to a parasitic plant; these “R” genes are well known from other plant pathogen interactions. The RSG3-301 describe here is responsible for race-specific resistance in cowpea.)

Li, J.X., Lis, K.E. and Timko, M.P. 2009. Molecular genetics of race-specific resistance of cowpea to *Striga gesnerioides* (Willd.). In: Balázs, E., Vurro, M. and Gressel, J. (eds.) Pest Management Science 65(5): 520-527. (Reporting valuable progress in understanding the resistance pattern in cowpea. Several race-specific resistance genes have been identified and located to linkage groups LG1 or LG6. Expression of *PR5* (pathogen-resistance gene 5) may be a useful marker of *Striga* infection, suggesting that salicylic acid signalling may play a role in the cowpea-*Striga* interaction.)

Li JunMin and Dong Ming 2009. Fine-scale clonal structure and diversity of invasive plant *Mikania micrantha* H.B.K. and its plant parasite *Cuscuta campestris* Yuncker. Biological Invasions 11(3): 687-695. (Clonal diversity of *M. micrantha* (14 genets of 20 ramets) was significantly greater than that of *C. campestris* (4 genets of 20 ramets).)

Llugany, M., Lombini, A., Dinelli, E., Poschenrieder, C. and Barceló, J. 2009. Transfer of selected mineral nutrients and trace elements in the host-hemiparasite association, *Cistus-Odontites lutea*, growing on and off metal-polluted sites. Plant Biology 11(2): 170-178. (Results indicate that the flower of *S. album* is dichogamous where the pollen matures before the embryo sac. Following fertilization, 1-3 embryos and endosperms are formed in the same fruit. Seeds mostly produce only a single seedling, but sometimes 2 or 3.)

Lu Yi, Wang QingGuo, Melzig, M.F. and Jenett-Siems, K. 2009. Extracts of *Cynomorium songaricum* protect SK-N-SH human neuroblastoma cells against staurosporine-induced apoptosis potentially through their radical scavenging activity. Phytotherapy Research 23(2): 257-261. (Results confirm the neuroprotective activity of *C. songaricum* extracts *in vitro*, thus supporting their traditional use.)


Ma ChaoMei, Wei Ying, Wang ZhiGang and Hattori, M. 2009. Triterpenes from *Cynomorium songaricum* - analysis of HCV protease inhibitory activity, quantification, and content change under the influence of heating. Journal of Natural Medicines 63(1): 9-14. (Malonyl ursolic acid hemiester the most potent element, but also the most affected by heating.)

Ma, G-H. and Bunn, E. 2007. Embryology and pollination trials support dichogamy in *Santalum album* L. Sandalwood Research Newsletter 22: 1-4. [http://www.jcu.edu.au/mbil/srn/Papers/063%20Ma%202007.pdf](http://www.jcu.edu.au/mbil/srn/Papers/063%20Ma%202007.pdf) (Results indicate that the flower of *S. album* is dichogamous where the pollen matures before the embryo sac. Following fertilization, 1-3 embryos and endosperms are formed in the same fruit. Seeds mostly produce only a single seedling, but sometimes 2 or 3.)

Ma JingJing, Zhao Fan and Sun Yun 2009. The effects of acteoside on nourishing kidney and strengthening Yang in Yang deficient mice. Source: Journal of Yangzhou University, Agricultural and Life Sciences Edition 30(1): 22-25. (Acteoside, distilled from *Cistanche tubulosa* decreased the latent period of penis erection, increased the number of germ cells, increased the coefficient of sexual organs and improved pathology changes of testes. Good news for the Yang-deficient?)


Ma ZhiGuo, Yang ZhongLin, Li Ping and Li ChengHua. 2008. Simultaneous determination of eight phenylethanoid glycosides in different species of the genus *Cistanche* by high performance liquid


Mathiasen, R.L. 2009. Comparative susceptibility of conifers to knoebone pine dwarf mistletoe. Western North American Naturalist 69(1): 42-48. (Concluding that Jeffrey pine (Pinus jeffreyi) should be regarded as a principal host of Arceuthobium siskiyouense, and shore pine (Pinus contorta var. contorta) as an occasional host. White pine, Douglas fir and incense-cedar are immune.)

Mathiasen, R.L. and Daugherty, C. 2009. First report of mountain hemlock dwarf mistletoe (Arceuthobium tsugense subsp. mertensianae) on sugar pine (Pinus lambertiana) from Oregon. Plant Disease 93(3): 321. (Just a few infections observed.)

Matsushima, K., Minami, M. and Nemoto, K. 2009. Usage of edible wild plants in Bhutan. Journal of the Faculty of Agriculture, Shinshu University 45(1/2): 49-54. (Tea is purported to cure bone fracture and body pain.)


Mazzio, E.A. and Soliman, K.F.A. 2009. In vitro screening for the tumoricidal properties of international medicinal herbs. Phytotherapy Research 23(3): 385-398. (In a wide study of 374 natural products on ‘immortal neuroblastoma of spontaneous malignant origin’, ‘mistletoe’ (Viscum album) was among the vast majority showing ‘no pattern of tumoricidal effects.’)

Mbagwu, F.N., Unamba, C.I.N., Onuoha, C.I. and Ezeibeke, I.O. 2009. Histochemical studies on five variants of Viscum L. (Loranthaceae). Research Journal of Biological Sciences 4(3): 254-257. (Reporting different-shaped oxalate crystals in different variants of ‘Viscum’ in Nigeria, but completely unclear what species was/were involved.)

Meir, S., Amsellem, Z., Al-Ahmad, H., Safran, E. and Gressel, J. 2009. Transforming a NEP1 toxin gene into two Fusarium spp. to enhance mycoherbicide activity on Orobanche - failure and success. In: Baláz, E., Vurro, M. and Gressel, J. (eds.) Pest Management Science 65(5): 588-595. (Introduction of the transformed NEP1 toxin gene enhanced virulence on Orobanche of Fusarium CNCM I-1621, an unidentified type previously identified as F. arthrosporioides which lacks any form of this gene; but it failed to do so on other Fusarium types which already have a form of the gene.)


Montenegro, A.L. and Vargas, O. 2008. (Vital traits of woody species in High Andean forest edges of the Cogua Forest Reserve (Colombia).) (in Spanish) Revista de Biología Tropical 56(2): 705-720. (Including observations on Gaiadendron punctatum (Loranthaceae).)

**HAUSTORIUM 55 July 2009**

Muniappan, R., Reddy, G.V.P. and Raman, A. 2009. *Struthanthus haenkeanus* had strong antimicrobial activity against *Shigella flexneri*.


Müller-Stöver, D., Kohlschmid, E. and Sauerborn, J. 2009. A novel strain of *Fusarium oxysporum* from Germany and its potential for biocontrol of *Orobanche ramosa*. Weed Research (Oxford) 49(2): 175-182. (Reporting good host-specific results from lab and pot experiments with a German strain of *F. oxysporum* on *O. ramosa*.)


Nickrent, D.L. and García, M.A. 2009. On the brink of holoparasitism: plastome evolution in dwarf mistletoes (*Arceuthobium*, Viscaceae). Journal of Molecular Evolution 68(6): 603-615. (Chloroplast DNA sequences from the inverted repeat of *Arceuthobium campylopodum* and *A. pendens* were generated and compared to other plants. Changes paralleling those seen in the holoparasite *Epifagus* (Orobanchaceae) were seen. The 16S–23S rDNA intergenic spacer was shown to have phylogenetic information at the species level in dwarf mistletoes.)


Ouattara, K., Coulibaly, A., N’Guessen, J. D., Gueda-Guina, F. and Djaman, A.J. 2007. (Effects of *Thonningia sanguinea* (Thos) on the quality of the eggs and egg-laying rate of hens during an experimental salmonellosis induced by the ingestion of *Salmonella enterica* serotype Enteritidis lysotype 6.) (In French) Agronomie Africaine 19(1): 21-28. (Extracts of *T. sanguinea* eradicated *S. enteritidis* from the eggs and can therefore be recommended as an efficient treatment to improve laying ability and egg quality in the case of chicken salmonellosis.)


Okazawa, A. 2007. Study on parasite plants regarding loss of photosynthesis ability and mutant phytochrome. Kagaku to Seibutsu 45(10): 674-676. (Involving genetic analysis of phytochrome A in *Orobanche minor*.) (Apologies - this was listed in the last issue under the incorrect name of Okazaki.)


strigolactones in the stimulation of Striga germination by sorghum.

Parker, C. 2009. Observations on the current status of Orobanche and Striga problems worldwide. In: Balázs, E., Vurro, M. and Gressel, J. (eds.) Pest Management Science 65(5): 453-459. (Noting the lack of reliable statistics on the exact areas affected and the damage caused by the main parasitic weed species, but confirming that they continue to cause massive losses. Control measures are having some impact on a localised basis, but the scale of Striga problems may still be increasing.)

Pattanayak, S.P. and Mazumder, P.M. 2009. Assessment of neurobehavioral toxicity of Dendrophthoe falcata (L.f) Ettingsh in rats by functional observational battery after a subacute exposure. Pharmacognosy Magazine 5(18): 98-105. (Results suggest that hydroalcoholic extracts of D. falcata have no serious neurobehavioral toxicity and are safe to use. The many traditional uses in India include treating ulcers, asthma, impotence, paralysis, skin diseases, and wounds.)


Pest Management Science. 2009. OECD Special Issue: Managing Parasitic Weeds, Integrating Science and Practice. Pest Management Science 65(5): 451-614. (This issue is devoted to the 23 papers presented at the meeting in Ostuni, Italy, in September, 2008. The individual papers are all reviewed in this issue. A copy of this single issue is available to Haustorium readers for US$ 85.00 + p&p – a 50% discount on the standard issue price. To order, email cs-journals@wiley.co.uk or phone +44 1243-843335.)


Qasem, J.R. 2009. Parasitic weeds of the Orobanchaceae family and their natural hosts in Jordan. Weed Biology and Management 9(2): 112-122. (Results of a survey over several years, recording 10 spp. of Orobanche and 3 spp. of Cistanche and a wide range of host species, a number of these not previously reported.)


Radenkovic, M., Ivetic, V., Popovic, M., Brankovic, S. and Gvozdenovic, L. 2009. Effects of mistletoe (Viscum album L., Loranthaceae) extracts on arterial blood pressure in rats treated with atropine sulfate and hexocycline. Clinical and Experimental Hypertension 31(1): 11-19. (The total ethanol extract of V. album exhibited the best effect and significantly decreased the blood pressure after applied concentration 1.00 x 10⁻³ mg kg⁻¹.)

fruit production of *A. americanum* by over 50% and has potential as a biocontrol agent.


Rodríguez-Pontes, M. 2009. Seed formation and pollination system in *Cuscuta obutsiflora*: first record of preanthesis cleistogamy in parasitic plants and some functional inferences. Flora (Jena) 204(3): 228-237. (Results suggest that in predominantly cleistogamous populations of *C. obutsiflora*, gene flow occurs through hydrochoric seed dispersal. Pre-anthesis cleistogamy, likely to increase reproductive performance, is recorded for the first time in a parasitic plant.)


Shamoun, S.F. 2009. Special issue on stem and shoot fungal pathogens and parasitic plants: the values of biological diversity. In Shamoun, S.F. (ed.) Botany 87(1):1-63. (Containing a number of papers on mistletoes in N. America, reviewed elsewhere in this list.)

Landbauforschung Völkenrode 59(1): 11-18. (No clear correlations demonstrated.)


http://www.jcu.edu.au/mbil/srn/Papers/067%20Shepherd%202008.pdf (Exploring a technique involving excised flowers kept moist on ‘Oasis’ floral foam.)

Sherman, T.D., Bowling, A.J., Barger, T.W. and Vaughn, K.C. 2008. The vestigial root of dodder (Cuscuta pentagona) seedlings. International Journal of Plant Sciences 169(8): 998-1012. (Concluding from detailed anatomical analysis that the swollen appearance of the dodder root (perhaps more properly described as the base of the shoot) is due to a low level of microtubules, so that neither mitotic divisions nor cell elongation can occur.)

Shi HaiMing, Wang Jing, Wang MengYue, Tu PengFei and Li XiaoBo. 2009. Identification of Cistanche species by chemical and inter-simple sequence repeat fingerprinting. Biological & Pharmaceutical Bulletin 32(1): 142-146. (Eight ISSR found to be sufficient to distinguish four Cistanche species, serving as markers for quality control of Herba Cistanches (cf. Jiang. Y. et al.).)


Stein, C., Rissmann, C., Hempel, S., Renker, C., Buscot, F., Prati, D. and Auge, H. 2009. Interactive effects of mycorrhizae and a root hemiparasite on plant community productivity and diversity. Oecologia 159(1): 191-205. (AM fungi increased diversity, but at the expense of Holcus lanatus and Plantago lanceolata, thus decreasing productivity. Rhinanthus minor benefited from AM fungi and contributed to the reduced productivity but not to increased diversity.)


Swarbrick, P.J., Scholes, J.D., Press, M.C. and Slate, J. 2009. A major QTL for resistance of rice to the parasitic plant Striga hermon thica is not dependent on genetic background. In: Balázs, E., Murro, M. and Gressel, J. (eds.) Pest Management Science 65(5): 528-532. (The study verified and narrowed down the position of a Striga resistance QTL of major effect in rice, and demonstrated that it may be a tractable target for marker-assisted selection.)


Takagi, K., Okazawa, A., Wada, Y., Mongkolchaitayphruex, A., Fukusaki, E., Yoneyama, K., Takeuchi, Y. and Kobayashi, A. 2009. Unique phytochrome responses of the holoparasitic plant Orobanche minor. New Phytologist 182(4): 965-974. (Confirming that phytochrome-mediated responses are retained in O. minor, but show some unique characteristics. Shoot elongation was inhibited by FR but not by R. This pattern is unique among known patterns of plant photoresponses.)

proposed structure of solanacol, stimulant from tobacco, was incorrect.)


Thorogood, C.J., Rumsey, F.J. and Hiscock, S.J. 2009. Host-specific races in the holoparasitic angiosperm Orobanche minor: implications for speciation in parasitic plants. Annals of Botany 103(7): 1005-1014. (Confirming the existence of distinct physiological races within O. minor, with a strong degree of host-specificity, and suggesting such host specificity as the basis for gradual evolution of new species.)

Tripathy, N.K. and Behera, N. 2008. Traditional methods of crop protection used in Bolangir district of Orissa. Ethnobotany 20(1/2): 147-149. (Noting that Olax scandens is used for insect control.)


Venne, J., Beed, F., Avocanh, A. and Watson, A. 2009. Integrating Fusarium oxysporum f. sp. strigae into cereal cropping systems in Africa. In: Balázs, E., Virro, M. and Gressel, J. (eds.) Pest Management Science 65(5): 566-571. (Discussing the potential of fungal phytopoxins for control of parasitic weeds, including macrocyclic trichotheccenes (inhibitory to O. ramosa germination at 0.1 micro M); phyllistine A, highly active on both O. ramosa and Cuscuta campestris; also methionine and arginine, active below 1 mM.)

Vurro, M., Boari, A., Evidente, A., Andolfi, A. and Zermane, N. 2009. Natural metabolites for parasitic weed management. In: Balázs, E., Virro, M. and Gressel, J. (eds.) Pest Management Science 65(5): 566-571. (Discussing the potential of fungal phytopoxins for control of parasitic weeds, including macrocyclic trichotheccenes (inhibitory to O. ramosa germination at 0.1 micro M); phyllistine A, highly active on both O. ramosa and Cuscuta campestris; also methionine and arginine, active below 1 mM.)


of its carbon from its hosts (as well as N), depending on host species.)

Wanntorp, L. and de Craene, L.P.R. 2009. Perianth evolution in the sandalwood order Santalales. American Journal of Botany 96(7):1361-1371. (This SEM developmental study of several members of Santalales presents data supporting a bracteolar origin of the calyculus. For taxa without a calyx or calyculus, the single perianth whorl is interpreted as petals.)

Watson, D.M. 2009. Determinants of parasitic plant distribution: the role of host quality. In: Shamoun, S.F. (ed.) Botany 87(1): 16-21. (Hypothesising that the non-random distribution of many parasitic plants (especially mistletoes?) is dictated by the ‘quality’ of their hosts, in terms of access to water, nutrients, etc.)


Xu Rong, Chen Jun, Chen ShiLin, Liu TongNing, Zhu WeiCheng and Xu Jiang. 2009. Cistanche deserticola Ma cultivated as a new crop in China. Genetic Resources and Crop Evolution 56(1): 137-142. (Giving information on the taxonomy, distribution, cultivation and genetic diversity of C. deserticola, now being grown as a crop for use as a tonic.)


Yang GuanE, Chen BaiNian, Zhang ZhaoMing, Gong Jun, Bai HongJun, Li JianKuan, Wang YuFen and Li BaoZhen. 2009. Cytotoxic activities of extracts and compounds from Viscum coloratum and its transformation products by Rhodobacter sphaeroides. Applied Biochemistry and Biotechnology 152(3): 353-365. (Concluding that transformation of V. coloratum extracts converted by R. sphaeroides have lower toxicity and higher anti-tumour activity compared to standard treatments.)

Yang HongXin, Yang Yong and Yan XiaoHong. 2008. Experimental study of anti-sports fatigue effect mechanisms of cistanche deserticola. Chinese Journal of Information on Traditional Chinese Medicine 15(4): 24-25, 28. (C. deserticola decreased LDH5, protected the liver of mice subjected to a strenuous swimming test and accelerated glycogen accumulation by increasing the expression of NOS3 to protect the liver and improve physical recovery.)

Yang HyunMo, Shin HyunKyung, Kang YoungHee and Kim JinKyung. 2009. Cuscuta chinensis extract promotes osteoblast differentiation and mineralization in human osteoblast-like MG-63 cells. Journal of Medicinal Food 12(1): 85-92. (This study, in Korea, suggest that C. chinensis can play an important role in osteoblastic bone formation and may possibly lead to the development of bone-forming drugs.)


review of the strigolactones, their functions and the structural features required for potent germination stimulation.)


Yu Hua, He WeiMing, Liu Jian, Miao ShiLi and Dong Ming 2009. Native Cuscuta campestris restrains exotic Mikania micrantha and enhances soil resources beneficial to natives in the invaded communities. Biological Invasions 11(4): 835-844. (Suppression of M. micrantha by C. campestris significantly enhanced soil water, pH and nutrient content and greatly increased the cover and species richness of native plants.)

Yu QiWen, Zhang JiYing, Gong Fang, Ma YanHui, Cheng WeiZhi, Chen XueHua, Ma AnLun and Zhang DongQing. 2009. Preparation and immune modulation of Mistletoe lectin. Chinese Journal of Immunology 25(1): 59-62. (Concluding that a 55 kD lectin purified from Chinese mistletoe, Viscum album, is a potent immunomodulator to human T cell cytoxicity, cytokine production and apoptosis of tumour cells.)


Zhang RuMin, Bai Jing, LüChunLing, Chen HongWei and Gao Yan. 2008. Fluctuating-temperature stratification induced seed germination of Cistanche deserticola. Scientia Silvae Sinicae 44(9): 170-173. (Best germination was achieved with two repeated stratification treatments and exogenous plant hormone treatment, especially with GA3.)

Zhou YuBi, Ye RunRong, Lu XueFeng, Lin PengCheng, Yang ShiBing, Yue PengPeng, Zhang ChangXian and Peng Min 2009. GC-MS analysis of liposoluble constituents from the stems of Cynomorium songaricum. Journal of Pharmaceutical and Biomedical Analysis 49(4): 1097-1100. (Noting differences in the oil components of samples of C. songaricum growing on Nitaria spp. (N. sibirica and N. tanguticum) and those growing on Zygoxyllum xanthoxylum or Peganum harmala.)

Ziegler, H., Weber, J. and Lüttge, U.E. 2009. Thermal dissipation probe measurements of sap flow in the xylem of trees documenting dynamic relations to variable transpiration given by instantaneous weather changes and the activities of a mistletoe xylem parasite. Trees: Structure and Function 23(3): 441-450. (Suggesting that the flow of water through roots and stems of the host Tilia mandschurica into Viscum album results from larger sap flow rates in the xylem as well as stronger transpiration.)

Zuber, D. and Widmer, A. 2009. Phylogeography and host race differentiation in the European mistletoe (Viscum album L.). Molecular Ecology 18(9): 1946-1962. (Molecular analysis of chloroplast DNA variation supported the distinction of the four main taxa within V. album, three widespread and one endemic to Crete. Haplotypes from Turkey were distinct and may represent new taxa.)


HAUSTORIUM 55 has been edited by Chris Parker, 5 Royal York Crescent, Bristol BS8 4JZ, UK (Email chrisparker5@compuserve.com), Lytton Musselman, Parasitic Plant Laboratory, Department of Biological Sciences, Old Dominion University, Norfolk Virginia 23529-0266, USA (fax 757 683 5283; Email lamusselm@odu.edu), Jim Westwood, Dept. of Plant Pathology, Physiology and Weed Science, Virginia Tech, Blacksburg, VA 24061-0331, USA (Email westwood@vt.edu) and Diego Rubiales, Dep. Mejora y Agronomía, Instituto Agricultura Sostenible, CSIC, Apdo 4084, E-14080 Cordoba, Spain (Email: ge2ruozd@uco.es); with valued assistance from Dan Nickrent, Southern Illinois University, Carbondale, USA. It is produced and distributed by Chris Parker and published by Old Dominion University (ISSN 1944-6969). Send material for publication to any of the editors.

NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be down-loaded from the IPPS web-site (see above).
MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

2010 is here, with promise of a new year and a new decade. The IPPS officers have been working hard to realize some longstanding goals that will strengthen our society to form a solid foundation for the future.

The most noticeable change for this year is the unveiling of our new IPPS website ([http://www.parasiticplants.org](http://www.parasiticplants.org)). We obtained this permanent URL and now have a professional web manager who is able to give it high quality features and timely upgrades. I can safely say that the old webmaster (yours truly) was not up to the job in terms of skill or time commitment. He was rightfully sacked (and is glad to be relieved of the burden!).

A nice feature of the new website is an emphasis on parasitic plant photos. We all know that these organisms are both beautiful and intriguing; photos are a great way to attract interest in the site and provide information to visitors. Each time the page reloads you will see new photos in the banner and the main part of the page. To find full images, plant names and photo credits, click on the “Photos” button of the menu. We are happy to add more, so I invite all of you to send me a few of your favorite parasite photos.

Another move forward for our society is the development of an improved dues system. Although perhaps less thrilling than parasitic plant photos, this matter is critical to our functioning as a society. In the past, dues were primarily collected along with conference registration, so everyone who attended a conference automatically became a member. However, payment of dues outside of a conference registration was inconvenient and expensive, especially in the large percentage of cases involving an international money transfer, so anyone who missed a conference would end up in a limbo of lapsed membership. The result was confused members and a society with no fair way of determining who its active members were. The new website will solve this by providing a secure system for payment based on the PayPal tool, which is simple, inexpensive, and familiar to most people. By improving the ease of paying and establishing a predictable cycle, we can stabilize our active membership and reach out to potential members who are not regular attendees of our conferences.

Discussing dues is probably next to discussing taxes in terms of dampening people’s interest, but it’s important nevertheless. The new standard membership rate of 30 Euros for two years is still a modest price, and will enable IPPS to provide better services to members. Members will receive discounts on meeting registration that will more than offset the cost of dues, and will enjoy benefits of a stronger society. IPPS will use dues in many ways: to keep the website evolving to meet new needs, to provide grants that help students and other deserving members attend our conferences, to expand the prizes for best posters at conferences, and to continue our practice of honoring our outstanding members.

I will end with a reminder that this is your society. Input is always valued, so if you have ideas on what features we should have on the website or how we should collect and allocate our resources, please don’t hesitate to write.

Sincerely,

Jim Westwood, IPPS President

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LORANTHUS EUROPAEUS, NEW TO BRITAIN, AND NOTES ON VISCUM ALBUM, BOTH NEW TO KEW GARDENS

There has been a flurry of short reports recently on the curious appearance of the central-southern European mistletoe *Loranthus europaeus* at the Royal Botanic Gardens, Kew. These include Spooner (2009), Clement (2008), Cope (2008) and Nelson (2008), though the original report was by Vines (2006). In summary *L. europaeus*, previously unknown in Britain, was discovered, as a mature plant, growing on a young *Quercus velutina* (black oak) at Kew in May 2005. Its origin is a mystery; the oak, an American species, was grown from seed at Kew and the mistletoe was probably deliberately introduced, albeit unofficially.

Vines (2006), and Clement (2008) quoting Vines, mention a previous occurrence of *L. europaeus* at Kew in the 1870s. Nelson (2008) and Cope (2008) correct this assertion, quoting original correspondence that shows the 1870s *Loranthus* records were actually from the Glasnevin Botanic Gardens in Dublin. Clements adds, however, that there are other records for *Loranthus* at Kew for the late 19th/early 20th century period. All these *L. europaeus* plants were, apparently, very short-lived.

Fig 1. *Loranthus europaeus*

The recent discovery of the Kew *Loranthus* coincided with, and may even have been prompted by, an initiative I'm involved in to establish *Viscum album* at Kew and other London sites. Before this initiative *V. album* had been entirely absent from the Kew Gardens inventory. This was a curious omission, partly because *V. album* is a regular feature of Botanic Gardens across the British Isles, even those well outside its natural British range (well-known examples include Edinburgh BG, Cambridge BG and Glasnevin BG at Dublin) but largely because *V. album*'s biggest London population, established at least 200 years, is around Bushy and Home Parks at Hampton Court and so very close to Kew. The 2004/5 initiative to establish *Viscum* at Kew was part of the original London Biodiversity Plan (London Biodiversity Partnership 2007), which had designated mistletoe as a Priority Species within Greater London on the basis of its rarity and popularity. New, managed, *Viscum* populations have been established as part of this initiative at Chelsea Physic Garden, Lambeth Palace Garden, Buckingham Palace Garden, Down House and several other London sites as well as Kew. All these new *Viscum* colonies are very young, and will not be apparent to visitors for a few years yet.

So Kew Gardens has recently acquired two species of mistletoe, one each from the two main mistletoe families - and has the distinction of being the only site (any other records out there?) for *L. europaeus* in Britain. If the *Loranthus* thrives (unlikely on historic precedent) Kew could become a site of 'pilgrimage' for...
those wishing to compare these two mistletoes in Britain as they are, in many ways, very similar. The Loranthus has a similar branching pattern to Viscum but has brown, not green, stems. Leaf shape for the Loranthus is broader and leaves are not so obviously paired as in Viscum. Flowers in both species are small and green, so this Loranthus is very different to the tropical Loranthaceae with their more showy flowers. And then there are the fruits; similar-sized single-seeded berries, yellow in the Loranthus and creamy-white, of course, in the Viscum. They are often known as the yellow-berried and white-berried mistletoes respectively. Host preferences are very different - but the biggest difference has to be the fact that the Loranthus is deciduous, not evergreen.

Similarities and differences are not just botanical - they have an oddly overlapping role in legend too. Mistletoe on oak was, according to Pliny, sacred to the Druids, the priest caste of the Celts in Britain and Brittany; and James Frazer (1922) in The Golden Bough quotes ‘Thus among the Celts of Gaul the Druids esteemed nothing more sacred than the mistletoe and the oak on which it grew’. They are generally assumed to have worshipped it at the winter solstice (though it is uncertain that Pliny actually states this). Loranthus is frequent on oak; Viscum is very rare on oak. And Loranthus is native to the areas of Europe where the Celtic tribes originated, so it is possible that they would be familiar with this species on their oaks. But Loranthus isn’t evergreen, so it would have relatively little significance, compared to the evergreen Viscum, at midwinter. So which is the true mistletoe of the druids? Perhaps the druidic tradition is based on a combined folk memory of both these European species - but we only have Pliny’s writings to draw on, and those are not necessarily accurate!

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References


BIOCONTROL OF STRIGA

Mycobactericides have for many years been identified as possible agents for controlling Striga. Jurgen Kroschel and colleagues (Kroschel et al, 1996) identified what became known as Fusarium oxysporum f. sp. strigae isolate Foxy 2 and have undertaken intensive development work on this organism as a potential mycoherbicide for Striga hermonthica and S. asiatica. The Real IPM Company (K) Ltd (www.realipm.com) is a biocontrol company based in Kenya, which has developed various potential bio-pesticides as well as producing predatory mites such as Phytoseiulus persimilis for use by the horticultural industry in Kenya.

In 2009, in collaboration with the University of Hohenheim, The Real IPM Company (K) Ltd was awarded a match-funded grant from the African Enterprise Challenge Fund (http://www.aecfafrica.org/) to commercialise Foxy 2 as a mycoherbicide. All ‘pest controlling products’ which include all bio-pesticides require registration with the Kenyan authorities (Pest Control Products Board) (www.pcpb.or.ke) which includes compiling a full toxicology package on the fungi as well as undertaking independent efficacy trials. This process has begun and hopefully will lead to full registration in 2010 of what we think will be the first commercially available mycoherbicide in Africa!

Late in 2009 UK Department for International Development (DFID)’s Research into Use programme (www.researchintouse.com) launched a Best Bets competition with the objective of fast-tracking ‘best bet’ research findings and getting them into use in developing countries. A multi-partner bid (Real IPM, Greendown House Ltd, Bangor University, University of Hohenheim and KARI) were successful in proposing a strategy whereby farmers will undertake “on farm” seed priming with an enriched phosphate solution of their own farmer saved seed (e.g. maize, sorghum, millet), a technique developed by David Harris at Bangor (Harris, 2006) and then treat the seed immediately prior to planting with the Foxy 2 isolate to combat Striga. The product will be sold to farmers in an easy to use, low-cost pack, designed for the small scale subsistence grower.

References:


Henry Wainwright, PO Box 4001, Madaraka, Thika 01002, KENYA.

**GEBISA EJETA – WORLD FOOD PRIZE**

To see a CNN clip covering Gebisa’s award see: http://awarnessblog.com/2009/11/draft-world-food-prize-award-w.php

And for a tribute and other coverage from the Purdue Agricultural Newspaper ‘Connections’ see: http://www.agriculture.purdue.edu/connections/fall2009/01_world_food_prize_winner_01.shtml

**COST 849 - PARASITIC PLANT MANAGEMENT IN SUSTAINABLE AGRICULTURE**

This programme, funded by the European Union via European Science Foundation, and concerned with the problems from *Orobanche* and *Phelipanche* in Europe was wound up in 2006. However, programmes, abstracts and reports of meetings are still available on the COST849 web-site (http://cost849.ba.cnr.it/) and a further final output has just been published in the form of a special issue of Weed Research, Volume 49, Supplement 1. The papers included in this supplement, each of which is reviewed under Literature below, are:


Pérez-de-Luque, A. *et al.* Understanding *Orobanche* and *Phelipanche*--host plant interactions and developing resistance. pp. 8-22.


Rubiales, D. *et al.* Revisiting strategies for reducing the seedbank of *Orobanche* and *Phelipanche* spp. pp. 23-33.

Hershenhorn, J. *et al.* *Phelipanche aegyiaca* management in tomato. pp. 34-47.


Castillejo, M.A. *et al.* Comparative proteomic analysis of *Orobanche* and *Phelipanche* species inferred from seed proteins. pp. 81-87.

**PRESS RELEASE**

‘Save Share Nigeria: SS TF KKM project - Changing lives in the savannah’ 8th January 2010.

(Extract)

Despite the plethora of challenges facing the savannah region of West Africa, agricultural research is helping in transforming the lives of millions of resource poor farmers in those areas. The deployment of improved seeds backed by the dissemination of innovative agricultural practices is helping in changing the fortunes of farmers in northern Nigeria—a savannah region where agriculture is the main source of livelihood—thanks to the International Institute of Tropical Agriculture and partners working on the Sudan Savannah Task Force of the Kano- Katsina-Maradi (SS TF KKM) Pilot Learning Site (PLS) of the Sub-Saharan Challenge Program. Local farmers say the improved seeds have raised their incomes, improved health and agricultural productivity. ”My family is happy I am now a successful farmer. I can easily feed my family and send my children to school,” says Mohammed Mustapha, a farmer in Kunamawa village in Safana Local Government of Katsina State. As a participant in the SS TF KKM PLS project, Mustapha has seen his yield double using the same plot of land but with improved varieties and agronomic practices. ”This was possible due to the training and also the improved seeds I acquired from the Sudan Savannah Task Force team that are working on the KKM project. Before I used to get two bags of cowpea from this field but in 2009, I harvested five bags which were more than double the initial amount,” he explains. For Hajia Binta Garba, who heads a women farmer group in Bunkure Local Government Area of Kano State, the drought- and *Striga*-tolerant varieties are helping farmers in her farm group to overcome the negative effects of climatic change in the region. She says the varieties which are either early-maturing or drought-tolerant have raised yield by more than 100 percent. ”I used to get one and half bags of cowpea but now I harvest nothing less than four bags on this field,” Garba says. Like Mustapha and Garba, several farmers in northern Nigeria are tapping the opportunities presented by improved seeds and agronomic practices to better their livelihoods.
The SS TF KKM project, which is funded by the Forum for Agricultural Research in Africa (FARA) is seeking to mitigate these constraints and also to enhance marketing opportunities for farmers in the region. Partners in the project include the Katsina State Agricultural Development Programme (ADP), Institute of Agricultural Research, Zaria; National Agricultural Extension Research and Liaison Services, National Animal Production Research Institute, Bayero University Kano, Local Government Councils and input and output dealers. Alpha Kamara, IITA-Savanna System Agronomist who is the Sudan Savannah Taskforce Leader, says the dissemination of the solutions is helping in boosting crops' productivity and generating wealth in the drought-prone regions of the savannas. According to him, the team is tackling the limitations via innovation platforms in a holistic manner. For instance, the deployment of drought-tolerant cowpea and maize varieties is helping in mitigating the effect of drought, offering farmers improved harvest and incomes.

Consultative Group on International Agricultural Research (CGIAR)

BOOK


This volume is based on the meeting held in 2007 and reported in Haustorium 53. The 48 chapters on mistletoe (Viscum album) and its potential applications in cancer therapy (all in German but with English summaries) are listed here by their English titles:

Kreis, W. - Advances in structure elucidation of mistletoe constituents. pp. 17-29
Ramm, H. - Influence of soil chemical factors on the cultivation of oak mistletoe (Viscum album on Quercus robur and petraea) and host specific mineral concentrations of mistletoe extracts. pp. 31-40.
Pfüller, U. et al. - Glycan motives of mistletoe lectins of the RIP II type and their biological relevance. pp. 79-90.
Herbst, B. et al. - Characterization of arabinogalactan-proteins from Viscum album L. berries and herb. pp. 121-132
Jäger, S. et al. - Characterisation and quantification of polysaccharides in extracts from Viscum album L. with CE-UV. pp. 133-139.
Orange, M. et al. - The importance of the primary dosage in mistletoe therapy. pp. 385-400.
Huber, R. et al. - Pharmacokinetics of mistletoe lectins - a phase I study. pp. 405-406.
Hagens, C. V. et al. - Treatment with mistletoe extract in patients with breast cancer, a feasibility study to identify surrogate parameters for further studies - design and first results on recruitment, compatibility and safety. pp. 407-416
Stumpf, C. et al. - Comparison of survival time of patients with different tumor entities - results of retrospective investigations for efficacy of mistletoe therapy vs. data from a tumor registry. pp. 441-453.

Holzhauer, P. - Significance of lectin-standardized mistletoe therapy in oncology - a tool for the management of adverse effects. pp. 275-284.


Grah, C. - Efficacy and safety of pulmonary sarcoidosis treatment with Viscum album L. - a case control series. pp. 335-351.


Kovacs, E. et al. - The effect of Viscum album extract and vincristine on the proliferation in several multiple myeloma cell lines - function of IL-6 and IL-10 in the proliferation. pp. 203-204.


Büssing, A. et al. - Decreased in vitro susceptibility of patients' B-CLL cells towards the applied Viscum album extract. pp. 467-475.


Schad, F. et al. - Epidemiological data from the Network Oncology, a research association for anthroposophically oriented medicine. pp. 613-624.

FORTHCOMING MEETINGS

2nd Workshop on Invasive Alien Plants In Mediterranean Type Regions of the World, to be held in Samsun, Turkey, 2-6 August 2010. The organizers EPPO (European and Mediterranean Plant Protection Organization) in partnership with the Council of Europe and the Igdır University will welcome contributions on parasitic plants as invasive aliens. For further information see:

http://archives.eppo.org/MEETINGS/2010_conferences/mediterranean_ias.htm

11th World Congress on Parasitic Plants, to be held in Martina Franca, Puglia, Italy, 7-12 June 2011. For further detail, see the official web-site:

http://ipps2011.ba.cnr.it

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see:

http://www.parasiticplants.org/
LITERATURE

* indicates web-site reference only


Aly, R., Cholakh, H., Joel, D.M., Leibman, D., Steinitz, B., Zelcer, A., Naglis, A., Yarden, O. and Gal-On, A. 2009. Gene silencing of mannose 6-phosphate reductase in the parasitic weed Orobanche aegyptiaca through the production of homologous dsRNA sequences in the host plant. Plant Biotechnology Journal 7: 487-498. ((Entry repeated from Haustorium 55, but with comment attached this time!) A hairpin silencing construct of the parasite M6PR expressed under control of the 35S promoter in tomato caused attached parasites to have lower levels of M6PR transcript, mannitol, and parasite growth.)


using chloroplast DNA sequence variation. American Journal of Botany 96(8): 1571-1580. (T. aphyllus is well known to botanists as a specialized parasite bursting out of cacti stems bearing brilliant red flowers. This study confirms that T. aphyllus shows uniform population structure while T. corymbosus is more variable, the authors suggesting that T. corymbosus arose from T. aphyllus.)


Anon. 2009. EU-ECE Forest health inventory in Spain. European Network monitoring of forest health. Level 1. Results of the 2008 survey. Ecología (Madrid) 22: 265-301. (Mistletoe (presumably both Viscum album and Arceuthobium oxycedri) not among the main factors in forest damage but noting that infestations in pines and junipers ‘keep increasing’.)

Anon. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. Botanical Journal of the Linnean Society 161(2): 105-121. (Revised and updated classification of a range of families including Balanophoraceae, Rafflesiaceae and Schoepfiaceae.) (The taxonomy of angiosperms continues to be revised reflecting the plethora of new information from molecular studies. Students of parasitic plants will be especially interested in placement of parasitic families including the alignment of Balanophoraceae in the Santalales.)


Lucrările Sesuini Stiintifce Bienale cu Participare Internaionala’ Pădurea sj Dezvoltarea Durabilă’ Brâşov, Romania, 27-28 Octombrie, 2006: 183-188. (Reviewing the damaging effects of *V. album* and noting *Turds viscivorus* and *Sylvia atricapilla* as the two main bird dispersers of the seeds.)


Borodin, A.A., Chmeleva, L.E. and Chetin, A.D. 2009. (Herbicide Dual Gold as treatment against field dodder.) (in Russian) Sakharnaya Svekla 2009(3): 30-31. (Combinations of herbicide involving EPTC, metolachlor and others gave over 90% control of *C. arvensis* (= *C. campestris*) in sugar beet.)

Cabezas, N.J., Urzúa, A.M. and Niemeyer, H.M. 2009. Translocation of isoquinoline alkaloids to the hemiparasite, *Tristerix verticillatus* from its host, *Berberis montana*. Systematics and Ecology 37(3): 225-227. (Four compounds were isolated from *B. montana*, *Schinus montanus* and *T. verticillatus*; their chemotaxonomic and ecological significance are briefly discussed.)

Caires, C.S., Uchôa-Fernandes, M.A., Nicácio, J. and Strikis, P.C. 2009. (Larval frugivory of *Neosilba* McAlpine (Diptera, Lonchaeidae) on *Psittacanthus plagiophyllus* Eichler (Santalales, Loranthaceae) in southwestern Mato Grosso do Sul State, Brazil.) (in Portuguese) Revista Brasileira de Entomologia 53(2): 272-277. (Among 6 genera of Loranthaceae in Brazil, *Phthiriusa*, *Psittacanthus* and *Struthanthus* parasite a wide range of host plants. Studies on *Ps. plagiophyllus* found several species of *Neosilba* living on the fruits, including *N. bifida*, *N. certa*, *N. pendula* and *N. zadolicha*, and two unidentified.)

Calvin, C.L. and Wilson, C.A. 2009. Epiparasitism in *Phoradendron durangense* and *P. falcatum* (Viscaceae). Aliso, 2009(27): 1-12. (Concluding that pattern of growth and development of the epiparasites *P. durangense* and *P. falcatum* on their *Phoradendron* host(s) (not identified in the abstract) resembling that of the primary parasite on its non-parasitic host.)

Cameron, D.D., Preiss, K., Gebauer, G. and Read, D.J. 2009. The chlorophyll-containing orchid *Corallorhiza trifida* derives little carbon through photosynthesis. New Phytologist 183(2): 358-364. (Comparing *C. trifida* with *Neottia nidus-avis* and *Cephalanthera damasonium* and finding it closer to the fully mycoheterotrophic *Neottia* than had previously been assumed.)


to investigate responses and resistance to *Orobanche crenata* in *Medicago truncatula*. BMC Genomics 10(294). (http://www.biomedcentral.com/1471-2164/10/294) (Presenting proteomic-based data examining the molecular basis of resistance to *O. crenata* infection in the model legume *M. truncatula*, identifying defence and stress-related proteins, and discussing the existence of a generic defence mechanism operating during the early stages of infection.)

Chaitali Bhattacharya, Bonfante, P., Deagostino, A., Kapulnik, Y., Larini, P., Occhiato, E.G., Prandi, C. and Venturello, P. 2009. A new class of conjugated strigolactone analogues with fluorescent properties: synthesis and biological activity. Organic & Biomolecular Chemistry 7(17): 3413-3420. (The new analogues have a conjugated system which extends from the enol ether bridge to the A ring, the B ring is a heterocycle while the C ring is a cyclic ketone instead of a γ-lactone. They show high activity on *Orobanche aegyptiaca*.)


Chen Huai, Wu Ning, Gao YongHeng, Yao ShouPing, Cipriani, M.G., Stea, G., Moretti, A., Altomare, C., Mulè, G. and Vuro, M. 2009. Development of a PCR-based assay for the detection of *Fusarium oxysporum* strain FT2, a potential mycoherbicide of *Orobanche ramosa*. Biological Control 50(1): 78-84. (Using AFLPs to develop a molecular marker to detect the FT2 strain of *F. oxysporum*, which is specific to *O. ramosa*, and has been proposed as a mycoherbicide for its biological control.)


Cook, J.C., Charudattan, R., Zimmerman, T.W., Rosskopf, E.N., Stall, W.M. and MacDonald, G.E. 2009. Effects of *Alternaria destruens*, glyphosate, and ammonium sulfate individually and integrated for control of dodder (*Cuscuta pentagona*). Weed Technology 23((4): 550-555. (A commercial formulation of *A. destruens* (‘Smolder’) provided partial control of *C. pentagona (= C. campestris*) on citrus plants in the glasshouse. Mixture with glyphosate and ammonium sulphate did not damage the fungus and greatly increased control of the *Cuscuta*.)

Costea, M. and Stefanovic, S. 2009. *Cuscuta jepsonii* (Convolvulaceae): an invasive weed or an extinct endemic? American Journal of Botany 96(9): 1744-1750. (Using molecular data from newly found collections of the very rare *C. jepsonii* in California, it is inferred that it belongs to the *C. californica* complex, not the *C. indecora* clade. Its conservation is also discussed.)


Dita, M.A., Die, J.V., Román, B., Krajinski, F., Küster, H., Moreno, M.T., Cubero, J.I. and Rubiales, D. 2009. Gene expression profiling of Medicago truncatula roots in response to the parasitic plant Orobanche crenata. Weed Research 49(Supplement1): 66-80. (Concluding from the profiling of two lines of M. trunculata, one completely resistant, the other partially resistant, that ‘gene expression patterns suggest that resistance mechanisms activated in both genotypes are temporally and spatially different and resemble those associated with plant resistance to microbial pathogens.)

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Engdal, S. and Nilsen, O.G. 2009. In vitro inhibition of CYP3A4 by herbal remedies frequently used by cancer patients. Phytotherapy Research 23(7): 906-912. (Extract of V. album as ‘Iscador’ showed some activity in vitro but much less than green tea and thought unlikely to be effective in a clinical situation.)


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Kang ShinHo, Kim MinKi, Noh DooJin, Yoon
ChangMann and Kim GilHah. 2009. Spray

Khan, Z.R., Midega, C.A.O., Wanyama, J.M., Amudavi, D.M., Hassanali, A., Pittchar, J. and Pickett, J.A. 2009. Integration of edible beans (Phaseolus vulgaris L.) into the push-pull technology developed for stemborer and Striga control in maize-based cropping systems. Crop Protection 28(11): 997-1006. (Confirming that beans could be sown into the maize row without reducing the benefits of the push-pull technology on Striga, or stem-borer control. Planting in separate holes needed more labour than planting in the maize hill.)

Kitin, P., Beeckman, H., Fujii, T., Funada, R., Noshiro, S. and Abe, H. 2009. What is disjunctive xylem parenchyma? A case study of the African tropical hardwood Okoubaka aubrevillei (Santalaceae). American Journal of Botany 96(8): 1399-1408. (The xylem parenchyma of this parasite is unusual having disjunctive walls that are connected with the axial and ray parenchyma. The pattern suggests this occurs because of the intrusive growth of the wood fibers.)

Kiwia, A, Imo, M. Jama, B., Okalebo, J.R. and Jose, S. 2009. Coppicing improved fallows are profitable for maize production in striga infested soils of western Kenya. Agroforestry Systems 76(2): 455-465. (Gliricidia sepium, Leucaena leucocephala, Cassia scutata, Sesbania sesban, Macuna pruriens and Tephrosia vogelii with and without added N were compared as fallow species for suppression of Striga hermonthica. Best results were achieved with T. vogelii.)


Kohlschmid, E., Sauerborn, J. and Müller-Stöver, D. 2009. Impact of Fusarium oxysporum on the holoparasitic weed Phelipanche ramosa: biocontrol efficacy under field-grown conditions. Weed Research 49(Supplement): 56-65. (Reporting moderately successful results from the use of F. oxysporum isolate ‘FOG’ but suggesting further studies to refine the optimum carrier and mode of application.)

Konieczka, C.M. and Colquhoun, J.B. 2009. Swamp dodder (Cuscuta gronovii) management in carrot production. Weed Technology 23(3): 408-411. (Reporting pendimethalin suitable for early-season control of C. gronovii in carrots, with mowing at 100 days reducing infestation in subsequent crops.)


Kumar-Roiné, S., Matsui, M., Reybier, K., Darius, H.T., Chinain, M., Pauillac, S. and Laurent, D. 2009. Ability of certain plant extracts traditionally used to treat ciguatera fish poisoning to inhibit nitric oxide production in RAW 264.7 macrophage. Journal of Ethnopharmacology 123(3): 369-377. (Ximenia americana (Olacaceae), among a number of plants used to treat ciguatera fish poisoning in New Caledonia, is confirmed as suppressing excess NO production and deserving of further study.)


Lara, C., Pérez, G. and Ornelas, J.F. 2009. Provenance, guts, and fate: field and experimental evidence in a host-mistletoe-bird system. Écoscience 16(3): 399-407. (Studies in Mexico with seeds of Psittacanthus calycaltus, hosts Crataegus pubescens, Prunus serotina and Salix bonplandian, and the grey silky-flycatcher (Ptilogonys cinereus), successful seedling establishment depended on passage through the gut of the bird but not retention time, and to some extent on the source of the seed and the host to which it was transferred.)

authors identified significantly increased levels for 13 transcripts in response to *C. campestris* infection.)

Li, J. X. and Timko, M.P. 2009. Gene-for-gene resistance in *Striga-cowpea* associations. Science (Washington) 325(5944): 1094. (Using SSR segregation analysis to isolate a gene for resistance to *S. gesnerioides* in cowpea with a possible role in the production of a guard molecule against *Striga* attachment and penetration. Resistance was characterised by necrosis of the host root at the point of attachment.)

Li WenWen, Xie LiQiong, Wang Chen, Tian Cong and Li Guan. 2009. (Polyploid induction and identification of *Cistanche deserticola* Y.C. Ma.) (in Chinese) Xinjiang Agricultural Sciences 45(2): 337-341. (Using colchicine to produce autotetraploid and 12% increase in the active ingredient echinocoside.)

Lin Hao, Wang RenXiao, Qian Qian, Yan MeiXian, Li, J. X. and Timko, M.P. 2009. Gene-for-gene from treatment with an extract of *calcium super-phosphate.*)

burnt soil, peat and coconut dust (1:1:1) plus 2%

the growth of Indian sandalwood (*Santalum album*).) No abstract available.)

Ma ChaoMei, Sato, N., Li XiaoYu, Nakamura, N. and Hattori, M. 2010. Flavan-3-ol contents, anti-oxidative and α-glucosidase inhibitory activities of *Cynomorium songaricum.* Food Chemistry 118(1): 116-119. (Results support the use of *C. songaricum* by diabetics in Japan.)

McComb, J.A. 2009. Clonal *Santalum album* growth, oil content and composition on different hosts and at different locations. Journal of the Royal Society of Western Australia 921 15-25. (Comparing growth of *S. album* at 3 locations on *Melaleuca, Azadirachta indica, Acacia mangium, Cassia simaea and Dalbergia saasso.* Growth was best on *D. saasso,* but oil concentration was highest on *A. mangium.*)


Magani, I.E., Ibrahim, A. and Avav, T. 2009. Effect of nitrogen and phosphorus application on the reaction of cowpea to the parasitic plant Alectra vogelii (Benth) and its control. Journal of Applied Biosciences 14: 775-781. (Confirming the resistance to A. vogelii of cowpea line B301 and derivatives of its crosses with IT84S-2246-4 (IT90K-59 and IT90K-76) and reporting useful suppression by metazachlor and imazaquin herbicides.)

Magani, I.E., Lagoke, S.T.O. 2009. Mechanism of reaction of cowpea varieties to Alectra vogelii (Benth) and its control. Journal of Applied Biosciences 10(2): 500-506. (Claiming some benefit from application of both N and P to cowpea variety VITA, but results not clear-cut.)


Marchese, M., Restuccia, A., Tuttobene R., Litrico, A., Russo, A., Mauromicale, G. and Restuccia, G. 2010. (Effects of intercropping on attack by Orobanche crenata Forsk.) (in Italian) XXXVIII Convegno della Società Italiana di Agronomia, Florence, Italy, 21-23 September, 2009: 187-189. (In a pot experiment using soil naturally infested by O. crenata, 1:1 mixtures of faba bean with 14 other species were compared with faba bean only. Significant reductions in attack were recorded with Lolium perenne, L. multiflorum, Avena sativa, Hordeum vulgare, Vicia narbonensis and Sinapis arvensis. Linum usitatissimum caused a significant increase.)


Nadler-Hassar, T., Shaner, D.L., Nissen, S., Westra, P and Rubin, B. 2009. Are herbicide-resistant crops the answer to controlling *Cuscuta*? Pest Management Science 65(7): 811-816. (Imazamox applied to imidazolinone-resistant oil-seed rape gave excellent selective control of *C. campestris*. Corresponding results with glyphosate on glyphosate-resistant crop were good for a while but the parasite recovered. Corresponding results with glufosinate were poor.)


Okpuzor, J., Ogbonugadro, H. and Kareem, G.K. 2009. Antioxidative properties of ethyl acetate fraction of *Globimetula braunii* in normal albino rats. Journal of Biological Sciences 9(5): 470-475. (Concluding that endogenous naringin from *G. braunii* (Loranthaceae), used medicinally in Nigeria may be acting *in vivo* both as an antioxidant and a pro-oxidant.)

Olaya, C.A. and Eilu, G. 2009. Host-parasite relations of an angiospermous root parasite (*Thonningia sanguinea* Vahl) in logged and unlogged sites of Budongo forest reserve, western Uganda. African Journal of Ecology 473 328-334. (*T. sanguinea* is favoured by a complete canopy and was less common in logged sites (420/ha) than in non-logged sites, (870/ha). The parasite is not host specific but *Alchornea laxiflora*, *Celtis mildbraedii* and *Lasiococcus mildbraedii* appeared to be favoured hosts.)


Orel-Aksoy, E., Uygur, F.N., Uygur, S. and Kolören, O. 2003. Distribution of *Orobanche* spp. in the East Mediterranean region of Turkey. Proceedings of the 7th EWRS (European Weed Research Society) Mediterranean Symposium, Çukurova University, Adana, Turkey, 6-9 May 2003: 131-132. (No abstract readily available but this is one of several papers in this volume (not all listed here) with potentially useful information on *Orobanche* in Turkey.)


Owuor, B., Musyimi, D., Ocaido, M. and Asimwe, J. 2009. Vegetative propagation of the large sour plum (*Ximenia caffra* Sond) by rooting of plagiotropic stem cuttings. Journal of Agricultural and Biological Science 4(1): 19-25. (Rooting of single-node stem cuttings of *X. caffra* (Olacaceae) was successful in
sand, sawdust or a sand/sawdust mix, without need for NAA. Work relevant to farmers in W. Kenya.)


Pan Biao, Zhai ShengCheng and Qi HaiNing. 2009. (Wood identification of the wooden parts from the gilded-pagoda excavated at Dabaoen Temple site in Nanjing.) (in Chinese) Journal of Nanjing Forestry University (Natural Sciences Edition) 33(3): 83-86. (Confirming that timber used in construction 1000 years ago was from Santalum album from India.)

Pattanayak, S.P. and Mazumder, P.M. 2009. Effect of Dendrophthoe falcata (L.f.) Ettingsh on female reproductive plant interactions and developing resistance. Weed Research 49(Supplement1): 8-22. (An in-depth review, emphasising the need for an inter-disciplinary approach, including biotechnological approaches.)


Qasem, J.R. 2009. An updated inventory of mistletoe (Plicosepalus acaciae and Viscum cruciatum) distribution in Jordan, hosts, and severity of infestation. Weed Technology 23(3): 465-469. (Detailed surveys recorded P. acaciae on 26 hosts in 12 families, causing serious damage to Zizyphus spp., Casuarina equisetifolia, Melia azedarach and several others. V. cruciatum occurred on 14 species in 8 families, being particularly damaging on almond, olive, pomegranate and others.)


Ramirez, M.M. and Ornelas, J.F. 2009. Germination of Psittacanthus schiedeanus (mistletoe) seeds after passage through the gut of cedar waxwings and grey silky-flycatchers. Journal of the Torrey Botanical Society 136(3): 322-331. (P. schiedeanus seeds collected from plants on the host tree, Liquidambar styraciflua, germinated better than those from Acacia pennatula, and Rapanee myricoides. More seeds defecated by the waxwing germinated, than those defecated by the flycatcher, apparently due to longer retention time in the latter.)


Ren, Y.Q. and Guan, K.Y. 2008. Effects of moist-chilling and GA3 applications on seed germination of three Pedicularis species from Yunnan, China. Seed Science and Technology 361 225-229. (Germination of Pedicularis rex, P. rhinanthoides, and P. longiflora var. tubifloris was favoured by GA3 and by 15-30 days stratification.)

Roat, B.L., Jeewa Ram and Choudhary, S.L. 2009. Fruit rot of chilli incited by Colletotrichum capsici and management through plant products. Annals of Plant Protection Sciences 17(2): 398-401. (Treating seed with a product from Santalum album did not protect against Colletotrichum.)


Rodríguez, R., Grau, J., Baeza, C. and Davies, A. 2008. (Commented checklist of vascular plants of Nevados de Chillan, Chile.) (in Spanish) Gayana Botanica 65(2): 153-197. (Pilostyles berteroii (Rafflesiaceae) listed among ‘characteristic’ species of the area.)

Roman, G.P., Neagu, E. and Radu, G.L. 2009. Antiradical activities of Salvia officinalis and Viscum album L. extracts concentrated by...


Rubiales, D., Fernández-Aparicio, M., Wegmann, K. and Joel, D.M. 2009. Revisiting strategies for reducing the seedbank of Orobanche and Phelipanche spp. Weed Research 49(Supplement1): 23-33. (Discussing the need for techniques to reduce the long-term seed bank and reviewing the various options using soil solarization, inter-cropping, rotation, and other cultural methods.)


Rüther, C.and Klotz, J. 2009. Distribution, phytosociology and ecology of Lathraea squamaria in southern Germany, with a survey of the situation in Central Europe) (in German) Tuexenia 2009(29): 25-62. (Detailed ecological study of L. squamaria over many sites in southern Germany describing the common companion species and noting that it is associated with moderately acidic to weakly basic soils with a high base supply in combination with a moderate to high moisture content. No comment on host(s) in the abstract.)


Sadia Bibi, Husain, S.Z. and Malik, R.N. 2008. Pollen analysis and heavy metals detection in honey samples from seven selected countries. Pakistan Journal of Botany 40(2): 507-516. (Loranthaceae identified as the source of some honeys.)


Sareedenchai, V. and Zidorn, C. 2008. Sequestration of polyacetylenes by the parasite Orobanche hederae (Orobanchaceae) from its host Hedera helix (Araliaceae). Systematics and Ecology 36(10): 772-776. (Concentrations of polyacetylene were much lower in O. hederae than in H. helix. More polar polyacetylenes were relatively higher.)


Seymour, C.L. 2009. Protégé Ziziphus mucronata (Rhamnaceae) show no negative effects of competition with the nurse tree Acacia (Leguminaceae), even as adults. Journal of Vegetation Science 20(5): 926-934. (Z. mucronata growing under A. eriophora was less infested by Viscum rotundifolium than when growing in the open.)
Seymour, R.S., Maass, E. and Bolin, J.F. 2009. Floral thermogenesis of three species of Hydnora (Hydnoraceae) in Africa. Annals of Botany 104(5): 823-832. (There was no elevation of temperature in the flowers of H. africana, but up to 2.8°C elevation in H. abyssinica and up to 3.8°C in H. esculenta.)

Sharawy, S.M. 2008. Polymorphism in seed protein electrophoretic pattern and species relationships in the genus Orobanche. Australian Journal of Basic and Applied Sciences 2(4): 1298-1306. (Results support previous taxonomic grouping in the genus Orobanche (sensa lato) and suggest the technique could be used for identification purposes.)

She GaiMei, Zhang YingJun and Yang ChongRen. 2009. Phenolic constituents from Balanophora laxiflora with DPPH radical-scavenging activity. Chemistry & Biodiversity 6(6): 875-880. (Chasing the essential ingredient responsible for curing hangovers in Yunnan, China.)

Shin HyeYoung, Chang InAe, Zhang WenJi, Kim YounChul, Yuun YongGab and Park Hyun. 2009. Immune stimulatory effects of Loranthi ramulus on macrophages through the increase of NO and TNF-α. Immunopharmacology and Immunotoxicology 31(3): 370-376. (Demonstrating that extracts of ‘Loranthi ramulus’ (= Viscum coloratum), used as a medicinal herb in Korea, can activate macrophages, suggesting they may have potential to regulate immune responses.)

Sohn SungHwa, Lee HyoJung, Nam JiYoung, Kim SungHoon, Jung HeeJae, Kim YangSeok, Shin MinKyu, Hong MooChang and Bae HyunSu. 2009. Screening of herbal medicines for the recovery of cisplatin-induced nephrotoxicity. Environmental Toxicology and Pharmacology 28(2): 206-212. (Observing some beneficial effects from extracts of ‘Loranthus parasiticus’ (= Scurrula parasitica).)


Stanton, S. 2009. Western dwarf mistletoe and prescribed fire behavior - a case study from Crater Lake National Park. Northwest Science 83(3): 189-199. (Ponderosa pine burned faster when infested by Arceuthobium campylopodium but there was no wider influence on response to fire.)

Stanton, S., Honnay, O., Jacquemyn, H. and Roldán-Ruiz, I. 2009 A comparison of the population genetic structure of parasitic Viscum album from two landscapes differing in degree of fragmentation. Plant Systematics and Evolution 281(1/4): 161-169. (Studies in Austria indicate that habitat fragmentation negatively affects population genetic structure and levels of inbreeding in V. album, with the degree of isolation among populations exerting a stronger influence than forest patch size.)


Tao RongYa, Ye Fei, He Yibo, Tian JinYing, Liu GengTao, Ji TengFei and Su YaLun. 2009. Improvement of high-fat-diet-induced metabolic syndrome by a compound from Balanophora polyandra Griff in mice. European Journal of Pharmacology 616(1/3): 328-333. (Results suggest that an extract of B. polyandra improves the metabolic syndrome perhaps by the enhancement of insulin sensitivity and fatty acid oxidation.)

Theu, M.P.K.J. 2008. Biological control of witch weed (Striga) in maize (Zea mays) in Malawi. In: Theu, M.P.K.J. (ed.) Plant protection progress report for the 2007/2008 season, presented at the Department of Agricultural Research Services Planning and Review Meeting, Andrews Hotel, Mangochi, 14-20 September, 2008: 90-103. (The only fungus highly pathogenic on S. asiatica was Fusarium oxysporum. Bacteria Rawlstonia and Agrobacterium were also pathogenic but caused only minor infection.)


Vaz Patto, M.C., Fernández-Aparicio, Satovic, Z. and Rubiales, D. 2009. Extent and pattern of genetic differentiation within and between European populations of Phelipanche ramosa revealed by amplified fragment length polymorphism analysis. Weed Research 49(Supplement1): 48-55. (Collections of P. ramosa from across Europe showed much genetic diversity between populations, while within-population diversity was less but variable. The significance of the results is discussed in relation to breeding parasite resistance in tobacco.)


‘monofloral’ honeys (at least 45% purity?) included one from *Phoradendron quadranquale*.)


Wang KuoHsiung, Wu MingJou, Chiang TzenYuh and Chou ChangHung. 2009. Isolation and characterization of polymorphic microsatellite DNA makers (markers?) for *Euphrasia nankotaizanensis* (Orobanchaceae) and cross amplification in another *Euphrasia* L. Conservation Genetics 10(4): 1163-1165. (Describing nine new microsatellite primer pairs for *E. nankotaizanensis*, with the aim of providing a molecular tool for understanding population genetic structure, and informing the conservation practice of *Euphrasia* species in Taiwan.


Wanntorp, L. and de Craene, L.P.R. 2009. Constraints to on-farm maize (*Zea mays*) seed production in Western Kenya: seed vigor and viability. Journal of New Seeds, 2009, 10, 3, pp 149-159. (Concluding that harvesting of seeds at harvest (not physiological) maturity and application of nitrogen could lead to an improved on-farm production system of maize affected by *Striga hermonthica*.)

Westbury, D.B. and Dunnett, N.P. 2007. The impact of *Rhinanthus minor* in newly established meadows on a productive site. Applied Vegetation Science 10(1): 121-129. (Over a period of 3 years, the presence of *R. minor* favoured the growth of forbs over that of grasses but did not affect species number or diversity.)


Wurdack, K.J. and Davis, C.C. 2009. Malpighiales phylogenetics: gaining ground on one of the most recalcitrant clades in the angiosperm tree of life. American Journal of Botany 96(8): 1551-1570. (The order Malpighiales is one of the lesser known angiosperm clades in terms of relationships among families. One finding of this broad molecular survey is the placement of the Rafflesiaceae and its relationship to the Euphorbiaceae.)

Yuan Yan, Dai XiaoChang, Wang DeBin and Zeng XiangHui. 2009. Purification, characterization and cytotoxicity of malanin, a novel plant toxin from the seeds of Malania oleifera. Toxicon 54(2): 121-127. (Concluding that melanin, from M. oleifera (Olacaceae) ‘is amongst the most potent toxins of plant origin’.)

Yang ZengJiang, Xu DaPing, Zeng Jie, Guo JunYu, Lin QingJin and Yao QingDuan. 2008. A survey of freezing harm of precious trees in South China. Scientia Silvae Sinicae 44(11): 123-127 (Studies following an ice storm in S. China confirmed that Santalum album could tolerate a temperature of as low as 1°C.)


Zhang XiaoYan, Hu YuKun, Ji ChengDong, Guo ZhengGang and Gong YanMing. 2009. (Studies of chemical control of Pedicularis verticilata with 2,4-D butyl ester and the effect on grassland vegetation.) (in Chinese) Acta Prataculture Sinica 18(4): 168-174. (P. verticillata was controlled by 2,4-D, improving the growth of the grass Elymus multicaulis.)

Zharasov, Sh.U. 2009. (Field dodder in the south-east of Kazakhstan.) (in Russian) Zashchita i Karantin Rastenii, 2009(1): 30-32. (A survey records 19 species of Cuscuta in Kazahkstan, 6 being serious weeds, especially C. campestris. Control methods include herbicides phennedipham and clopyralid in sugar beet, and bentazon, bromacil and others in lucerne.)

HAUSTORIUM 56 has been edited by Chris Parker, 5 Royal York Crescent, Bristol BS8 4JZ, UK (Email chrisparker5@compuserve.com), Lytton Musselman, Parasitic Plant Laboratory, Department of Biological Sciences, Old Dominion University, Norfolk Virginia 23529-0266, USA (fax 757 683 5283; Email lmusselm@odu.edu), Jim Westwood, Dept. of Plant Pathology, Physiology and Weed Science, Virginia Tech, Blacksburg, VA 24061-0331, USA (Email westwood@vt.edu) and Diego Rubiales, Dep. Mejora y Agronomía, Instituto Agricultura Sostenible, CSIC, Apdo 4084, E-14080 Cordoba, Spain (Email: ge2ruozd@uco.es); with valued assistance from Chris Thorogood, Dept. of Biological Sciences, University of Bristol, UK. It is produced and distributed by Chris Parker and published by Old Dominion University (ISSN 1944-6969). Send material for publication to any of the editors.

NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be down-loaded from the IPPS web-site (see above).
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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

Grab a bright marker and color in the days of June 7-12, 2011 on your calendars. These are the dates of our next grand meeting, the 11th World Congress on Parasitic Plants. The venue is set in the beautiful small town of Martina Franca, Italy. Although next summer may seem like the distant future, it will be here before we know it, and it’s not too early to start planning. Certainly the lead organizers, Maurizio Vurro (Local Arrangements) and Hanan Eisenberg (Program Chair), have already been busy and preparations will continue over the next several months. Participants can start their planning by visiting the congress website (http://ipps2011.ba.cnr.it/) to get more information and pre-register to ensure that you receive timely notices about registration and abstract submission deadlines. Although the congress program is still taking shape, it promises to be exciting. Just a quick glance at the contents of this newsletter reflects the rapid progress in the world of parasitic plant science. From the busy and preparations will continue over the next several months. Participants can start their planning by visiting the congress website (http://ipps2011.ba.cnr.it/) to get more information and pre-register to ensure that you receive timely notices about registration and abstract submission deadlines. Although the congress program is still taking shape, it promises to be exciting. Just a quick glance at the contents of this newsletter reflects the rapid progress in the world of parasitic plant science. From the news briefs to the literature section you can see evidence of breakthroughs in applied and basic research on parasitic plants. All this and more will be showcased in Italy next year.

The new IPPS website (http://www.parasiticplants.org/) has now been active for six months. The site has had over 3,500 visitors from countries around the world. I know from the comments I’ve received that the site is reaching far beyond the membership of our society and we should continue efforts to reach out to the rest of the world to further the society’s mission of educating the public about parasitic plants. We should also consider how the website can be used to enhance research collaboration and productivity. I welcome your comments and suggestions (and parasite photos!) on ways to further improve the site’s effectiveness.

Sincerely,
Jim Westwood, IPPS President
westwood@vt.edu

RAFFLESIA IN THE PHILIPPINES: AN ERA OF DISCOVERY

I wish to report here some amazing cases of discovery in the ‘Queen of the Parasites’, Rafflesia, particularly with regard to the Philippines. This genus boasts the largest flower in the world and is perhaps equally infamous for its foul smell. This reputation was derived from R. arnoldii of Sumatra whose flower is over one meter in diameter. The discovery of this species in 1818 by Sir Stamford Raffles and Dr. Joseph Arnold was reported by Robert Brown in 1822. Actually, Rafflesia was first discovered by Louis Deschamps in Java between 1791 and 1794 but his notes and illustrations, seized by the British in 1803, were not available to western science until 1861. By the turn of the 20th century, six more species were described (three from Sumatra, two from the Philippines, one from Borneo). Between 1910 and 1918, five new species accounts were published for Rafflesia from Borneo and peninsular Malaysia. A long hiatus then ensued until Dr. Willem Meijer described five species in 1984. Finally, in 1989 another Rafflesia enthusiast, Dr. Kamarudin Mat Salleh, described R. tengku-adlinii from Borneo. The beautifully illustrated book ‘Rafflesia of the World’ by J. Nais (2001) lists 18 species for the genus: in Borneo (7), Sumatra (6), Philippines (2), Peninsular Malaysia and Thailand (2), and Java (1).

One would think that a plant genus as conspicuous as Rafflesia, known for over 200 years and wonderfully documented in a book published in 2001, would be ‘well-covered.’ But in the year following the book’s publication, the “world order” for Rafflesia changed abruptly. A flower of a previously undescribed species of Rafflesia was seen by members of a conservation group (The Antique Outdoors) in Sibalom Natural Park, Antique Province, on the island of Panay. They informed Dr. Julie Barcelona, then of the National Museum of the Philippines, who, along with Dr. Edwino Fernando of the University of the Philippines at Los Baños, named it R. speciosa. This sparked a flurry of media attention and generally raised the awareness of many Filipinos about this botanical wonder specifically, as well as their biological heritage in general.

Up until 2002, the Philippines were thought to harbor just two species of Rafflesia: R. manillana of Luzon and Samar Islands and R. schadenbergiana of Mindanao which has flowers reaching 80 cm in diameter. Within three years, another large-flowered species was discovered in Mindanao, but it was clearly different than R. schadenbergiana. This species, which occurred in Compostella Valley Province, was named R. mira by Dr. Edwino Fernando and Perry Ong in 2005. Dr. Domingo Madulid published the name R. magnifica for the same taxon: however, it appeared later that year and thus it should be considered a synonym. Also in 2005, Renee Galang discovered a second Rafflesia on Panay and together with Dr. Madulid named it R. lobata for the lobed, open diaphragm of the flower. At this point, the Philippines boasted five Rafflesia species.

A mammalogist named Danny Balete collected a small-flowered Rafflesia in the Bicol Region of southern Luzon but at the time (1991) he thought it was R. manillana. When shown living specimens of that species in 2002, he
knew the Bicol *Rafflesia* was different. In 2006 Dr. Barcelona and colleagues published this new species in his honor, *R. baletei*. This species also demonstrates how ‘*Rafflesia* fever’ can sometimes go head to head against taxonomic nomenclatural rules. Unaware of a paper already in press describing *R. baletei* from the adjacent Mt. Isarog, a group of researchers from the Camarines Sur State Agricultural College (now Central Bicol State University of Agriculture) proposed the name ‘*R. irigaense*’ for a population of *Rafflesia* discovered by a mountaineer, Mr. Dominico Bagacina, on the nearby Mt. Asog. In an attempt to commemorate Mt. Iriga (= Mt. Asog), and likely to promote regional pride and ecotourism, this name was proposed at a meeting at the National Museum of the Philippines. This was subsequently reported in the *Philippine Daily Inquirer* newspaper. But alas, reporting plant names in newspapers does not constitute valid publication, so the name *R. baletei* stands.

More nomenclatural funny business ensued in 2007. Mount Banahaw in Luzon, a popular destination for mountaineering and religious groups, seemed an unlikely spot to find a new species of *Rafflesia*. But this is exactly what occurred – in fact three times! In 2007, Drs. Barcelona and Madulid and their colleagues independently published names for this *Rafflesia* (R. *banahaw* and *R. banahawensis*, respectively). Further investigation by Dr. Barcelona showed, however, that this species was the same as the one already named by Blanco in his Flora de Filipinas (1845) – *R. philippensis* found in Monte de Majaijai (an old name for Mt. Banahaw). Yes, botanists must, at times sink names they themselves proposed! The year 2007 was also exciting because *R. schadenbergiana*, not seen since 1882 and presumed extinct, was seen flowering in Bukidnon Province of Mindanao. Only a few infected *Tetrastigma* vines are known, so this large-flowered species is critically endangered.

In 2005, a *Rafflesia* was discovered by a villager named Sumper Aresta from the Cagayan Province of northern Luzon. Julie Barcelona and collaborators collected the type of the eighth Philippine *Rafflesia* species, naming it *R. leonardi* in 2008 in honor of Leonardo Co, an expert on the flora of the Sierra Madre of Luzon where this species occurs. It differed from *R. manillana*, which grows sympatrically with it, by its larger size, a relatively smooth disk (processes absent or reduced), and the lack of windows in the floral tube.

A biodiversity survey of the Sierra Madre mountain range in northeastern Luzon in 2004 resulted in a collection of specimens of *Rafflesia* that did not fit any previously described species from the Philippines. It most resembled *R. tengku-adlinii* of northern Borneo, but differed in ramenta morphology, disk processes and anther number. In 2009, Dr. Barcelona and coauthors named this species *R. auranta* for its orange colored flower. The species is known only from only one population in Quirino Protected Landscape – a bit of a misnomer given that portions of this region are being impacted by gold and copper mining.

One could end this incredible story of discovery here and be impressed that the Philippines has now surpassed Borneo in *Rafflesia* species diversity (nine total). But the saga continues. Just this year, during a small-mammal survey conducted by staff of the Philippine Eagle Foundation and the Field Museum in Chicago, another small-flowered species of *Rafflesia* was discovered in Mindanao by Danny Balete – a fellow who has now found three new species of this parasite! The scientific name cannot be mentioned in this account because the paper describing it is not yet published. Suffice it to say that this species is one of the most remarkable yet seen, not by its size (for indeed it is the smallest in the genus) but by other unusual morphological features.

Figure: Although *Rafflesia* is famous for having the largest flower in the world, some species, such as this *R. baletei* from Mt. Iriga (Mt. Asog), Camarines Sur Province in the Philippines, has a flower measuring only 12 cm in diameter. Photo by Dan Nickrent.

Since 2003, only two other *Rafflesia* species have been described from regions outside the Philippines: *R. bengkulensis* (Sumatra) and *R. azlanii* (Peninsular Malaysia). Could this flurry of discovery in the Philippines simply be a function of the number of people looking for this plant or to greater intrusion into forested areas? Are there more species yet to be discovered in Indonesia and Malaysia? As amazing as it may seem, there is anecdotal evidence that even more species of *Rafflesia* exist in the Philippines. So the lesson to learn from this is that many...
tropical regions of the world remain woefully under-explored. We should also appreciate the power of many eyes trained to a particular search image. The indigenous people often already know about Rafflesia, but their knowledge has simply not been transferred to western scientists. If we value biodiversity, or at least concede the possibility that future generations will, we must continue to support efforts that document and preserve it in areas rich with such botanical treasures.

References:


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LITERATURE HIGHLIGHTS

EVIDENCE FOR NUCLEAR THEFT

Parasitic plants are known thieves; they rob water, nutrients, and even genes from host plants. However the origin of the stolen genes is typically mitochondria, so it may have been assumed that the security surrounding the nucleus is much tighter, until now. A recent paper in Science by Yoshida et al. reported clear evidence that Striga hermonthica obtained a nuclear gene from its sorghum host or closely related species (Yoshida et al., 2010a).

S. hermonthica is a devastating parasitic plant which infects Poaceae species including major crops such as sorghum, maize and rice. As S. hermonthica belongs to the eudicot Orobanchaceae family and only infects monocot plants, the authors reasoned that it may be possible to detect nuclear horizontal gene transfer (HGT) if it occurs by identifying monocot specific genes in the S. hermonthica genome. From a large scale expressed sequence tag (EST) analysis of S. hermontica about 17,000 non-redundant sequences were examined (Yoshida et al., 2010b). Remarkably, one gene, designated ShContig9483, shows high similarity to genes in sorghum but has no homologs in eudicots. Genomic analysis of ShContig9483 shows that the high similarity (more than 80%) extends outside of the open reading frame, indicating its relatively recent translocation.
What could be the mechanism of nuclear HGT by S. hermonthica? Parasitic plants are able to connect their own vasculature to that of their hosts to obtain nutrients and water. It is also known that mRNA can be transferred from hosts to parasites, probably through their connected phloem (Roney, et al., 2007). Thus one possibility is that ShContig9483 was originally captured by S. hermonthica as mRNA. Interestingly, Yoshida et al. found 13 consecutive adenine (A) nucleotides immediately after the 3’ end of the ShContig9483 genomic region that is homologous to the sorghum genes. This sequence may indicate that a poly-A tail was added to a transcriptional unit of the originally transferred monocot gene. Consistent with this hypothesis, a sorghum EST clone was found to contain a poly-A tail attached 30bp downstream of the homologous region.

The comparative genomics analysis of a eudicot parasite and its monocot hosts detected clear evidence for nuclear HGT of a monocot specific gene. As this method is not able to detect nuclear HGT of genes that are common to both eudicot and monocot plants, the frequency of nuclear HGT in S. hermonthica is not clear. The percentage of monocot specific genes in a monocot genome is around 20% and as S. hermonthica is unlikely to discriminate the origin of genes, we suspect that more nuclear HGT will be found if other genes are investigated in detail.


Ken Shirasu and Satoko Yoshida, RIKEN, Plant Science Center, 1-7-22 Suehiro-cho, Tsurumi-ku, Yokohama, 230-0045, Japan.

CELLULAR INTERACTIONS AT THE HOST-PARASITE AND POLLEN-PISTIL INTERFACES IN FLOWERING PLANTS

Research into the host-parasite interface from the cellular to the molecular level has proliferated in recent decades; however host plant resistance mechanisms are multifaceted, complex, and vary between host species (Serghini et al., 2001; Rubiales, 2003; Labrousse et al., 2004). This has impeded the identification of durable resistance traits in the battle against infestation by parasitic weeds. Characterising host resistance pathways using natural host-parasite systems is one relatively unexplored avenue of research that may yield untapped sources of resistance (Thorogood and Hiscock, 2010). Similarly, comparing host-parasite interactions with well characterised processes such as the pollen-pistil interaction in flowering plants may draw interesting new parallels.

To address the knowledge gap between natural and agricultural host-parasite systems, Thorogood and Hiscock (2010) recently examined the compatibility of natural Orobanche-host plant interactions, and identified discrete early-acting and late-acting incompatibility responses. This complemented recent research which underscored the importance of layers of incompatibility in the resistance of various non-host eudicots to Striga hermonthica (Yoshida and Shirasu, 2009). Interestingly, self-incompatible pollen-pistil interactions are also categorised by early-acting and late-acting mechanisms of pollen tube rejection (Hiscock and Allen 2009), leading the authors to speculate that further parallels may be drawn between host-parasite and pollen-pistil interactions in flowering plants.

Pollen-pistil interactions in flowering plants comprise a series of complex cellular interactions involving a continuous exchange of signals between the haploid pollen and the diploid maternal tissue of the pistil (Hiscock and Allen, 2009). Significant progress has been made in elucidating the molecular identity of these signals and the cellular interactions they regulate. These events have been particularly well studied at the cellular and molecular level in species with self-incompatibility (SI) systems, which trigger the arrest in development of incompatible pollen on the stigma. The possibility of a consensus in cellular programmes among these SI systems, and incompatible host-parasite interactions in flowering plants remains to be explored.

Technological advances have greatly facilitated the identification of components involved in complex cellular interactions such as the pollen-pistil interaction. For example advances in microarray technology, such as the availability of genome-wide Affymetrix arrays for Arabidopsis and rice, coupled with the development of reliable cDNA subtraction techniques, such as suppression-subtractive hybridization (SSH), have facilitated the transcriptomic profiling of genes with expression specific to, or up-regulated in, pollen and pistil tissues (Hiscock and Allen, 2009). This has opened up new avenues for pollen-pistil interaction research, particularly the opportunity to identify candidate genes involved in pollen-stigma interactions, and potentially shared components of pollen-stigma signalling pathways among different species. Furthermore, Next Generation Sequencing using the Illumina approach will facilitate sequencing the entire transcriptome of multiple samples simultaneously to
produce quantitative data without prior knowledge of the genome, in theory making it suitable for any species.

Genomic and sequencing technologies such as these offer great hope for unraveling cell signalling networks involved in pollen-stigma interactions. Assuming parallels exist among complex cellular interactions in flowering plants, drawing upon new directions in pollen-pistil interaction research may be fertile new ground for generating hypotheses and new avenues of research into host resistance to parasitic plants.

References:


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OBITUARY

ALFRED M. MAYER (1926-2010)

Professor Alfred Mayer was an Emeritus Professor of Plant Sciences at the Hebrew University of Jerusalem in Israel, who dedicated his last twenty years to the study of parasitic plants.

Alfred Mayer was born in Germany in 1926, and as a son to a Jewish family found a safe haven in Holland after the rise of the Hitler regime in Germany. Later his family managed to escape from Holland prior to its occupation, so he finished school in London, where he lived during the rest of the war. He obtained his Ph.D. from the University of London, and became a member of the department of Botany of the Hebrew University of Jerusalem in 1952. In 1997 he officially retired after a fruitful academic and administrative career, but his scientific career continued until very recently, combining pioneering and productive research in phytochemistry, plant biochemistry and physiology, with a significant contribution also to the understanding of parasitic plants.

Outstanding are two research topics in which Mayer was deeply involved and became internationally acknowledged: One is the biochemistry of seed germination, which peaked when he published the now ‘classic’ book ‘The Physiology of Seed Germination’, and the other is polyphenol oxidases, which peaked when he was awarded an Honorary Doctorate from the University of Bordeaux for his contribution to the wine industry.

After his formal retirement, Professor Mayer put many efforts into parasitic plant research. His research included a detailed analysis of the changes in broomrape seeds during conditioning and germination. He then moved on to the study of enzymatic activities during haustorium penetration, comparing it with the invasion mechanisms of pathogenic fungi.

He passed away at the age of 83 while some research projects on Orobanche are still in progress, including studies of the involvement of jasmonate in host resistance to Orobanche infection, and the possible use of various chemical agents to control broomrape germination and infection.
Mayer initiated and laid the foundations of many of the physical and academic aspects of the Institute of Life Sciences of The Hebrew University of Jerusalem, and at the same time devoted much of his time to education and teaching. In fact he has been teaching at the university for more than fifty years, always updated with cutting edge knowledge, and creative in challenging complicated biological systems.

His scientific enthusiasm, pioneer ideas, and gentle personality will be missed.

Danny Joel, Newe-Ya’ar Research Center, ARO, Haifa 31900, Israel.

CONGRATULATIONS

‘Bristol botanist wins Linnean Society prize’

Dr Christopher Thorogood has been awarded the 2010 Irene Manton Prize by The Linnean Society of London for his thesis on parasitic plants. (Abstract below)

The Irene Manton Prize is awarded for the best thesis in botany examined for a doctorate of philosophy during a single academic year (September to August). Dr Thorogood was named the winner by the President of The Linnean Society, Dr Vaughan Southgate, at the 222nd Anniversary Meeting of the Society this week.

Dr Christopher Thorogood conducted his doctoral research under the supervision of Professor Simon Hiscock at the University of Bristol's School of Biological Sciences. His thesis entitled ‘Host Specificity and speciation in the holoparasitic angiosperm *Orobanche minor* Sm. (Orobanchaceae)’ was largely based on his own ideas and his passionate interest in parasitic plants, particularly broomrapes

In addition to his scientific achievements, Chris is also a botanical illustrator and has exhibited botanical watercolour and oil paintings at the University of Bristol Botanic Garden. He used these skills to illustrate parts of his thesis with pen and ink drawings of floral anatomy, and other features of parasite morphology

University of Bristol, 26 May 2010.


NEWS

**STRIGA QUARANTINE LIFTED IN SOUTH CAROLINA AFTER A HALF CENTURY**

A milestone event will be marked this year in the effort to eradicate *Striga asiatica* from the US. After finding no new plants in 2009, federal and state plant protection officials have initiated a process to lift the quarantine restrictions on the last of the infested area in South Carolina, signaling the final phase of a 53-year eradication effort. This is subject to continued survey. If new finds of witchweed occur in 2010 or later, infested acres may have to remain under restriction or be re-restricted. This event is noteworthy because it reflects the persistence of *Striga* and the time commitment needed for eradication of a parasitic weed.

An infestation of *S. asiatica* was first reported in North Carolina in 1956 and subsequent surveys revealed that a total of 175,000 ha were infested at the peak of the outbreak, spanning parts of both North and South Carolina (Eplee, 1992). The US implemented an eradication program that has relied on a combination of monitoring, public awareness, containment and devitalization of seeds in the soil by ethylene gas to trigger suicidal germination. Surveys in 2010 revealed no new *Striga* plants in South Carolina, although 728 ha in North Carolina continue to be infested and will require continued eradication efforts for
several more years. Even in South Carolina, the plan calls for another 10 years of monitoring to ensure that no *Striga* appears undetected to reestablish the infestation.

It is interesting that in 1992, after substantial success in reducing the area of *Striga* infestation, it was predicted that lifting of quarantine restrictions for the entire Carolinas infestation would be possible by 1995 (Eplee, 1992). The elimination of all plants in a *Striga* population is clearly a significant challenge. Officials are anticipating that escalating demand for biofuel ethanol from corn will entice farmers to rotate back to corn after several years of planting non-host crops, and could result in reappearance of *Striga*.

Reference:


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**PRESS RELEASES**

‘Affordable solution to costly pests’

Extract:

LAKE VICTORIA, Kenya, Apr 16 (IPS) - The International Centre for Plant Physiology and Ecology (ICIPE), based at Mbita, on the Kenyan shores of the world’s second-largest freshwater body, is advocating ‘push-pull cultivation’ as the answer to feeding future generations in Africa.

Up to 30,000 small farmers in East Africa, mostly in Kenya, have adopted this natural method of controlling pests and weeds in maize, the staple crop. Push-pull cultivation intersperses the desmodium plant with maize in a plot, and plants napier grass as a border on all sides. The desmodium repels, or pushes, the stem borer from the maize, and controls the dominant weed, *Striga*; the napier grass attracts, or pulls, the borer towards it.

Approximately 25,375,000 hectares in sub-Saharan Africa are under maize cultivation, of which 6,122,000 ha are affected by the parasitic *Striga* weed which strangles the maize plant. East Africa loses US$7 billion worth of maize worth of maize due to *Striga* and around $5-6 billion from the cereal parasite stem-borer insect, according to ICIPE.

The chemical-free system against them was developed by ICIPE scientists in collaboration with Rothamsted Research in the United Kingdom, the Kenya Agricultural Research Institute and various national partners, with funding from Kilimo Trust (East Africa), Gatsby Foundation (UK) and Biovision (Switzerland).

While farmers may opt to use fertiliser on a push-pull field, desmodium both retains moisture in the soil and fixes its nitrogen content at the rate of 110 kilogrammes per hectare per year. The plant remains in the field after the maize is harvested, and is simply trimmed back to allow new maize to be planted. ‘This is the answer to Africa’s food security,’ says Dr. Zeyaur Khan, principal scientist developing the push-pull project at ICIPE. ‘This will provide the magic number of $2 and over in Africa.’ Khan says farmers in Africa will stop migrating to cities in search of incomes if they can earn more than $2 a day in their fields. Khan says the production of maize by farmers using the method has gone up from less than one tonne per hectare previously to 3.5 tonnes per ha, an increase that ensures year-long food for smallholder family. Both desmodium and napier are fodder grasses that also help cattle and milk production, besides giving extra income through the sale of its seeds.

At Ebukanga village near Mbita, 45 year old Agnes Mbuvi says her production of maize on her 50 by 40 metre plot has gone up from half a bag (45 kilos) to a remarkable 6 bags (540 kilos) of maize per harvest. ‘I have enough milk throughout the year, enough food, the soil is easy. I am happy,’ she says. Mbuvi, a widow, also adds that the extra income from the sale of surplus maize and milk has helped her educate her children. Not far away, 50 year-old Elfas Ameyo, a part-time plumber, says his even smaller ‘push-pull’ plot now gives him 2 bags (180 kg) of maize, instead of the one ‘debe’ (16 kg tin) he would get previously. ‘School education helps in changing the minds of people,’ he says, explaining why his neighbor has not yet adopted the system in spite of seeing Ameyo’s huge increase in yield. ‘We don’t need much money, we need appropriate technology,’ says Khan, who is critical of multinational seed and fertiliser agencies and international donors supporting the giving of seed and chemical fertilizers to farmers in Africa.

ICIPE is now testing the efficacy of the push-pull method in rice cultivation, and against the cotton bollworm, both features that bode good news for millions of Asia’s small farmers. In the context of climate change, ICIPE is encouraging farmers to plant cotton as a second crop in addition to a food crop. The roots of the cotton plant also produce chemical flavinoids and isoflavinoids, similar to the desmodium root, that help kill the *Striga* weed.

‘Drought tolerant and Striga-resistant maize for Ghana’

Four drought tolerant and Striga-resistant corn varieties developed by the International Institute of Tropical Agriculture (IITA) and the National Maize Program of Ghana were released to Ghanaian farmers recently. Three early maturing lines EVDT-W 99 STR QPM Co; TZ-E-W Pop STR QPM C0; and TZEE-W Pop STR QPM C0 and one intermediate maturing, drought tolerant QPM hybrid were released by the Ghanaian Crops Research Institute in collaboration with the Savannah Agricultural Research Institute and Industrial Research of Ghana.

‘With the release of these varieties, farmers in Ghana now have options not only in terms of maturity, grain color and type but also varieties which can tolerate the two major stresses which prevent increased maize production and productivity in the sub-region,’ IITA Maize Breeder, Dr. Baffour Badu-Apraku, said. In addition, Ghana Grains and Legumes Development Board of the Food and Agriculture Ministry, Dr. Robert Asuboah is optimistic that these ‘insurance’ crops will enable farmers to produce crops and profit during periods of drought.


From Crop Biotech, April 8, 2010.

‘New varieties to boost maize output in West and Central Africa’

Maize production in West and Central Africa is set to get a much-needed boost with the release of improved varieties by the Nigeria National Variety Release Committee. The varieties address many of the major constraints to maize production such as drought, low soil fertility, pests, diseases, and parasitic weeds. Researchers developed the varieties through conventional plant breeding by tapping naturally-available traits. The varieties were developed by the International Institute of Tropical Agriculture (IITA) in partnership with the Institute for Agricultural Research (IAR) of the Ahmadu Bello University in Zaria and Institute of Agricultural Research and Training (IARandT) of Obafemi Awolowo University in Ile Ife, Nigeria.

The released maize include 13 open-pollinated varieties of extra-early-, early-, intermediate-, and late-maturity with resistance to the parasitic weed Striga hermonthica and stem borers, tolerance to drought, and with good adaptation to sub-optimal soil nitrogen. Four hybrids with drought-tolerance have also been released.

The committee also approved two Striga-resistant and two white and two yellow productive hybrids developed at IITA in partnership with Premier Seeds Nigeria Limited. The company will commercially produce and market these hybrids.

Abebe Menkir, IITA maize breeder, says that the release of these varieties will hasten the adoption of improved maize cultivars by farmers in Nigeria, consequently increasing yields, raising farm incomes, and improving food security. The release of the improved varieties has sparked renewed optimism for maize farming in the region. ‘These varieties have the potential to provide farmers with opportunities to overcome the challenges to maize production in West and Central Africa,’ he added. Maize farmers often suffer from infestation of parasitic weeds and prolonged droughts, rendering their fields harvestless and farming households with little food and insufficient income for most of the year. Low soil fertility is often as devastating as droughts, while stem borers in the forest regions also hurt productivity.

Every year, IITA distributes improved open-pollinated varieties and hybrids to national partners and the private sector within and outside of WCA through regional trials. These trials have been used as vehicles for selecting promising varieties and hybrids adapted to specific conditions in the different countries for extensive testing and later release.

IITA

‘Striga resistant varieties to boost sorghum yields’

Extract:
In April, scientists in eastern and central Africa embarked on identifying sources of resistance to Striga, a parasitic weed. Supported by the Association for Strengthening Agricultural Research in Eastern and Central Africa (Asareca), the researchers from Sudan, Kenya, Eritrea and the International Crop Research Institute (ICRISAT) are using biotechnological tools in locating and identifying Quantitative Trait Loci (QTL) that gives resistance to Striga. QTL is a statistical method that links two types of information phenotypic data (trait measurements) and genotypic data (usually molecular markers) - in an attempt to explain the genetic basis of variation in complex traits.

According to Dr Charles Mugoya, the programme manager of the Agro biodiversity and biotechnology programme of Asareca, knowing the location and identification of QTLs for Striga resistance is a useful tool in aiding marker assisted breeding/selection (MAB or MAS) of sorghum for...
Striga resistance. MAS is an indirect selection process where a trait of interest is chosen not based on the trait itself but on a marker (morphological, biochemical or one based on DNA/RNA variation) linked to it. So far, QTLs underlying different resistance phenotypes have been identified and the scientists are now backcrossing populations to generate Striga resistance QTLs into farmer preferred sorghum varieties.

Mugoya said Striga hermonthica, also locally known as the witchweed, is a major constraint to sorghum production in particular and cereal production in general, especially in more marginal areas like semi-arid regions, where continuous cropping as a result of population pressure, has led to widespread soil infertility. The weed is genetically diverse and several factors contribute to its diversity. These include a high turnover of several generations of witch weed populations leading to high genetic diversity; hybridisation; broad geographic distributions; long distance dispersal and locally adapted host races.

‘Owing to its great potential genetic diversity, efforts to control it, through conventional breeding to generate Striga resistant varieties or agronomic practices to reduce the Striga seed bank in the soil, have been ineffective and Striga continues to be a menace, with reported cases of up to 100 per cent sorghum yield loss in the region,’ he noted.

The project promises to increase sorghum productivity in order to address food insecurity and poverty in East and Central African semi-arid zones and boost yields by at least by 20 per cent.

Steven Tendo,
Saturday Monitor, 9 June, 2010.
For full version see: http://www.monitor.co.ug/Magazines/Farming/-/689860/934808/-/xc1k6t/-/

‘Nigerian scientists introduce two new cowpea varieties’

Extract:
Nigerians scientists have released two new and improved cowpea varieties to farmers as part of efforts to raise production and improve farmer incomes in Nigeria’s savannah region, an official of the International Institute of Tropical Agriculture (IITA), Ibadan has said.

The varieties - IT89KD-288 and IT89KD-391 - were developed by scientists working at the Institute, in collaboration with the Institute for Agricultural Research of Ahmadu Bello University, Zaria; the University of Maiduguri, Borno and the Agricultural Development Programmes of Borno, Kaduna, Kano, and Katsina States.

Godwin Atser, the West African corporate communications officer of the IITA, said both varieties have proven superiority over the current lines being cultivated and aim to overcome the challenges faced by cowpea farmers in the country. ‘For instance, IT89KD-288 (now SAMPEA-11) is a dual-purpose cowpea variety with large white seeds and a rough seed coat.’ Mr. Atser said. ‘It has combined resistance to major diseases including Septoria leaf spot, scab, and bacterial blight, as well as to nematodes, and tolerance to Nigeria’s strain of Striga gesnerioides - a parasitic weed that severely lowers yield.’

Alpha Kamara, an IITA agronomist who is leading efforts to rapidly disseminate the varieties to farmers, added: ‘It also has a yield advantage of at least 80% over the local varieties.’

Emmanuel Ogala, April 19, 2010
For full version see: http://234next.com/csp/cms/sites/Next/News/5556524-147/nigerian_scientists_introduce_two_new_cowpea.csp#

‘Africa: scientists to develop drought-resistant cowpea’

Scientists conducting research have discovered a means of developing a variety of cowpea that is resistant to drought. The improved variety when introduced to farmers would help overcome constraints of disease, parasitic weeds, insect pest and drought especially in Sub-Saharan Africa.

The researchers from the International Institute for Tropical Agriculture (IITA), University of California, Riverside separately discovered that a portion of the cowpea known as the genome is responsible for disease and drought resistance among other. This discovery has led to the researchers' working on improving the resistance of the plant to drought.

Known for its rich protein content, 70 per cent of world cowpea is grown in the savannah region of Africa and is a source of incomes to its consumers. However, cowpea faces several production constraints among which are diseases, insect pests, parasitic weeds such as Striga, and drought which is becoming increasingly important in the cowpea producing zones of sub-Saharan Africa.

Tina A. Hassan
Daily Trust, 30 March 2010.
‘Wetlands organization says rival group’s planting of parasite akin to a ‘restoration train wreck’.

A lengthy article in ‘The Argonaut’ by Gary Walker describes the disagreement between the Ballona Institute, and the Friends of the Ballona Wetlands over the introduction by the Institute, of Cuscuta salina to state-owned Ballona Wetlands in California, USA. The Friends complain that it is tending to eradicate Jaumea carnosa (Asteraceae) and Salicornia virginica (Chenopodiaceae). With additional posted comments.


THESIS

Host specificity and speciation in the holoparasitic angiosperm Orobanche minor Sm. (Orobanchaceae). Christopher John Thorogood, PhD. School of Biological Sciences, University of Bristol (supervised by Simon Hiscock and Fred Rumsey) April 2009.

Abstract: The holoparasitic angiosperm Orobanche minor sensu lato parasitizes a taxonomically diverse range of angiosperms, and has therefore been considered to be a host-generalist. However even host-generalist parasites may show host specificity on a local or regional scale. This study examines the host specificity of O. minor, and its potential to drive population divergence and speciation in this parasitic plant. Divergent host ecology appears to have genetically isolated intra-specific taxa O. minor var. minor and O. minor ssp. maritima on their local hosts, red clover (Trifolium pratense) and sea carrot (Daucus carota ssp. gymnifer) respectively. Inter-simple sequence repeat (ISSR) marker-based data provided strong evidence for genetic divergence of morphologically cryptic populations. Patterns of genetic divergence were reinforced by phylogenetic analyses based on sequence-characterised amplified region (SCAR) markers derived from ISSR loci, which clearly differentiated host-specific clades. To explore the possibility of a physiological basis for population divergence, host-parasite interactions were then examined by cultivating clovers and carrots in Petri dish bioassays (‘rhizotrons’), and inoculating them with Orobanche. A series of histological studies were carried out, and compatible and incompatible pathways of parasite development were characterised, which suggested that host-resistance responses may determine early patterns of host specificity. Reciprocal infection studies identified increased fitness of populations when cultivated on their local hosts, indicating that cryptic taxa in fact comprise adaptive host-specific races. Microscopic techniques, coupled with controlled pollinations, identified a high potential for self-fertility in O. minor, indicating that selfing and inbreeding may reinforce these patterns of adaptive population divergence by isolating host-specific populations from gene flow. Finally, this analysis was extended by sampling populations from multiple hosts, across a broad geographic range. Sequence data identified an exotic host-generalist lineage and a native host-specialist lineage of O. minor, suggesting genetic structure in this species is defined by both host specificity and geography. These lineages may have hybridised following anthropogenic activity and host-shifts. Using the host-generalist holoparasite O. minor as a model, this study clearly demonstrates that host-driven divergence may be an important catalyst for speciation in parasitic plants.

BOOK REVIEW


Having reached the age when many botanists would have willingly (or unwillingly!) slowed their rate of publication, Job Kuijt has again demonstrated his unparalleled knowledge and unbounded energy by producing this monograph of Psittacanthus. As with his monograph of Phoradendron (Kuijt 2003), this work summarizes and synthesizes information on a taxonomically difficult mistletoe genus. Psittacanthus is the most speciose New World Loranthaceae genus. It is also widespread (Mexico to Paraguay) and conspicuous with its often large and colorful bird-pollinated flowers. It (plus the related Aetanthus) is distinguished from other members of the family by seeds lacking endosperm. Although previous contributions to the taxonomy of the genus have been made, no modern monograph existed. Thus, all students of parasitic plants should be delighted that the author’s 50+ years of experience with this group has culminated in this landmark publication. It is difficult to imagine anyone else accomplishing this goal. Previous estimates of the number of Psittacanthus species were gross underestimates. This monograph describes and provides illustrations for 119 species. Most remarkably, 51 of these are new. When new species named previously by the author are included, the total is 62, i.e. over half the species in the genus.

As with all the author’s previous work, his strength is in the meticulous documentation of the morphology of the organisms. Most of the illustrations were prepared by the author and these are both scientifically and artistically superb. Two keys to species are provided: for Mexico / Central America and South America / Caribbean (justified because species distributions do not overlap between these regions). The keys are generally workable, usually requiring both vegetative and floral features for
identification. In terms of production, the work was very well edited, being essentially free of typographical and other errors. The text is engaging and provides a cornucopia of ideas for further testing using ecological and biosystematic methods. For example, *P. ramiflorus* occurs in two geographically disjunct regions where the plants show morphological differences. A population genetics study might help determine whether these are best represented by one or two species.

Inflorescence of *Psittacanthus ramiflorus* (as *P. kramerii*). Costa Rica. Photo by Mauricio Bonaficino.

Forty three species occur in Brazil (some exclusively so), thus this country represents the region where further work is needed. A recent compilation of *Psittacanthus* photographs for the Parasitic Plant Connection web site resulted in 35 species but also demonstrated that mysteries still exist (e.g., compare the photographs of *P. bitemnatus* from Goiás and Pará in Brazil). The author states ‘I regret not having seen more species in the field and hope my presentation does not suffer unduly in consequence.’ Indeed, most of the descriptions were prepared from herbarium material, but this would be inevitable for any monographer given that 23 species are extremely rare and known only from the type specimen. On a brighter conservation note, some of these species (e.g. *P. nudus* and *P. pascoensis*) may actually be more common, as documented by recent additional collections.

The species are arranged alphabetically as the author did not attempt a subgeneric classification of the genus. As properly indicated on p. 7, there is currently no species-level phylogeny of *Psittacanthus*. The author correctly acknowledges that an evolutionary interpretation of morphological character trends (e.g. dyads evolving from triads) requires a robust molecular phylogeny of the genus. This paragraph also states ‘the phylogenetic affinities within the family have not been adequately resolved…’, a concept which apparently predates the appearance of Vidal-Russell and Nickrent (2008). Had this work been read and cited, the statement on p. 31 regarding a possible relationship between *Psittacanthus* and *Desmaria*, *Ligaria*, and *Tristerix* would have been removed or revised. The x = 8 chromosome group of small-flowered Loranthaceae (e.g. *Struthanthus*, *Cladocolea*, *Oryctanthus*, etc.) form a well-supported clade along with *Psittacanthus*, not including the above three genera.

Despite any such minor shortcomings, this work is a remarkable achievement. Where would we be without the monographs produced by the author, such as for *Cladocolea* (Kuijt, 1975), *Oryctanthus* (Kuijt, 1976), and *Tristerix* (Kuijt, 1988) (and soon *Dendropemon!*). These works provide the taxonomic framework upon which depends further studies on the ecology, physiology, morphology, anatomy, development and phylogeny of these fascinating organisms called mistletoes.

References:


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FORTHCOMING MEETINGS

A Summer School on ‘Rhizosphere Signalling’ is to be held 23-25 August 2010 at Wageningen, The Netherlands. Twelve keynote speakers are arranged. Additionally, there will be 20 slots for participants to present their work. For more information and registration (deadline July 26th, 2010) see: http://www.graduateschool-eps.info, check Summer School ‘Rhizosphere Signaling’
The 5th World Cowpea Research Conference will be held on September 27 to October 2010 in Dakar, Senegal. The theme of the conference is ‘Improving livelihoods in the cowpea value chain through advancement in science’. Topics of discussion include cowpea genetic improvement and use of molecular tools, human nutrition and processing, and enterprise development. Details of the conference are available at: http://cowpea2010.iita.org/ or email Christian Fatokun at c.fatokun@cgiar.org or Katherine Lopez at k.lopez@cgiar.org for direct inquiries.

The 11th World Congress on Parasitic Plants will be held at the Park Hotel San Michele in Martina Franca, Puglia, Italy, 7-12 June 2011.

The Congress continues a long tradition of regularly assembling the world’s experts on parasitic plants for professional and scientific meetings, which started in 1973 with the first international meeting in Malta.

The Congress will bring together scientists representing a wide spectrum of disciplines, research approaches, and geographical representation of parasitic plant research. Assembling specialists with different perspectives, all focused around the common theme of plant parasitism, provides a stimulating environment for learning, exchanging ideas, and connecting with old and new colleagues.

Parasitic plants - both the weedy species that severely constrain agriculture and the many other non-weedy species - present unanswered questions with regard to their origin and evolution from non parasitic plants, population structures and dynamics, evolutionary pathways towards crop parasitism, ecology, physiology, molecular biology, and the structure, function and development of their haustoria.

The Congress will include presentations at the cutting edge of parasitic plant research and management of parasitic weeds. A major emphasis in the Congress will be the fostering of interaction among participants.

For further detail, see the official web-site: http://ipps2011.ba.cnr.it

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see: http://www.parasiticplants.org/

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For information on the 11th World Congress on Parasitic Plants in Martina Franca, Italy, June 2011, see: http://ipps2011.ba.cnr.it

For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/ (Including large numbers of sequences from Triphysaria versicolor, Striga hermonthica, and Orobanche aegyptiaca, with BLAST capability and searchable by keyword and gene ontology terms)

For the Striga hermonthica EST Database see: http://striga.psc.riken.jp/strigaDB/index.php
(A searchable database with BLAST, SSR and SNP searching, and gene ontology functions)

For the announcement of Gebisa Ejeta’s World Food Prize, including video of Hillary Clinton’s address see: http://www.worldfoodprize.org/about/about.htm

For abstracts from the 9th World Congress on Parasitic Plants see: http://www.cpe.vt.edu/wcopp/index.html

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes, up to 2005) see: http://www.rmrs.nau.edu/mistletoe/

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au  (Search Santalum)

For information on the Kilimo Trust Striga project see: www.thekilimotrust.org

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga management’ newsletters, see: http://www.aatf-africa.org/

LITERATURE

STRIGOLACTONES

A special issue of Plant and Cell Physiology (Vol 51 No. 7) has just been published on strigolactones. All papers can be downloaded free. See: http://pcp.oxfordjournals.org/current.dtl A selection of the more relevant papers will be included in the Literature section of our next issue.

MYCO-HETEROTROPHY

New Phytologist has just published a ‘Special Virtual Issue’ (Volume 185 No. 3) on the topic of myco-heterotrophy, containing 25 articles. See: http://www3.interscience.wiley.com/cgi-bin/fulltext/123242499/PDFSTART These will be reviewed in some way in our next issue.

CURTIS’S BOTANICAL MAGAZINE

Volume 26 No 4 of this magazine is devoted to parasitic plants and their potential cultivation. Single copies are available from the publishers for £14.50 each via: http://www.wiley.com/bw/cservices/single.asp?site=1 The individual papers are noted below.

CORRECTION

Rodenburg, J. and Johnson, D.E. 2009. Weed management in rice-based cropping systems in Africa. Advances in Agronomy 103: 149-218. - It was wrongly suggested in the last issue of Haustorium that this paper reported Striga spp. as weeds in lowland rice. This should have read ‘upland rice’. Our apologies - and see the new more detailed paper by Rodenburg et al. on this subject under Literature below.

NEW ITEMS

* indicates web-site reference only


Albert, M., van der Krol, S. and Kaldenhoff, R. 2010. Cuscuta reflexa invasion induces Ca\textsuperscript{2+} release in its host. Plant Biology 12(3) 554-557. (Calcium release in tomato was closely associated with the Cuscuta haustorium.)


Alvarado-Rosales, D., Saavedra-Romero, L.de L. and Cárdenas-Soriano, E. 2009. (Anatomy of the interaction Cladocolea loniceroides (Van Tieghem) Kuijrt-Salix bonplandiana Kunth.) (in Spanish) Ciencia Forestal en Mexico 34(106): 191-203. (C. loniceroides (Loranthaceae) affects at least 15 ornamental trees in Mexico City, especially S. bonplandiana. The haustorium is a simple wedge without necrosis.)


families. *T. belvisii* was mainly coastal. Most farmers practice cutting off the infested branch.)


Bandaranayake, P.C.G., Filappova, T., Tomilov, A., Tomilova, N.B., Jamison-McClung, D., Ngo, Q., Inoue, K. and Yoder, J.I. 2010. A single-electron reducing quinone oxidoreductase is necessary to induce haustorium development in the root parasitic plant *Triphysaria*. Plant Cell (22) 1404-1419. (This substantial paper provides a large leap forward in understanding the mechanisms that mediate haustorium formation. The enzymes characterized regulate the production of phenolic-derived reactive oxygen species involved in haustorium signaling.)


Barcelona, J.F., Co, L.L., Balete, D.S. and Bartolome, N.A. 2009. *Rafflesia aurantia* (Rafflesieae): a new species from northern Luzon, Philippines. Gardens’ Bulletin (Singapore) 61(1): 17-27. (This new species, related to *R. tengku-adlinii* is considered to be highly threatened by the disappearing dipterocarp forest. See also article in text above.)


Barnoaiea, I. and Iacobescu, O. 2009. Using pixel and object based IKONOS image analysis for studying decay in silver fir stands. Annals of Forest Research 52: 151-162. (Exploring the potential for satellite imagery to survey *Abies alba* for damage from mistletoe (presumably *V. album*) and other problems. Results not convincing?)


insect imprisonment. International Journal of Plant Sciences 170(2): 157-163. (A detailed study confirming the hide beetle *Dermentes maculatus* as the commonest insect visitor, which may be trapped in the flower for 3 days before escaping, carrying viable pollen.)


Bowen, M.E., McAlpine, C.A., Seabrook, L.M., House, A.P.N. and Smith, G.C. 2009. The age and amount of regrowth forest in fragmented brigalow landscapes are both important for woodland dependent birds. Biological Conservation 142(12): 3051-3059. (Mistletoes (unspecified) cited as an important factor in bird populations.)

Brand, J.E. 2009. Effect of different *Acacia acuminata* variants as hosts on performance of sandalwood (*Santalum spicatum*) in the northern and eastern Wheatbelt, Western Australia. Australian Forestry 72(4): 149-156. (*S. spicatum* developed better on *A. acuminata* narrow-phyllode variant and *A. acuminata* small-seed variant than on the typical form or on *A. burkittii* or *A. oldfieldii.*)

Breteler, F.J. 2007. A reconsideration of the species delimitation in *Diogoa* (afrotropical Olacaceae). Systematics and Geography of Plants 77(2): 239-245. (*Strombosia retivenia* previously treated in Nigeria as synonymous with *Diogoa zenkeri* is newly described and illustrated as a separate species, *D. retivenia.*)


Brown, R.H., Nickrent, D.L. and Gasser, C.S. 2010. Expression of ovule and integument-associated genes in reduced ovules of Santalales. Evolution and Development 12(2): 231-240. (Plant morphologists have long been fascinated with embryo sac reduction in parasitic plants. This is one of the first papers to elicit information on the genetic basis of this phenomenon and should stimulate similar studies in other groups of parasites.)

Bülbiü, F., Aksoy, E., Uygur, S. and Uygur, N. 2009. Broomrape (*Orobanche* spp.) problem in the eastern Mediterranean region of Turkey. Helia 32(51): 141-152. (Reporting that in this region, *O. aegyptiaca*/O. *ramosa* were present in 28% of the tomato greenhouses and 80% of tomato fields, *O. crenata* and *O. aegyptiaca*/O. *ramosa* were present in 58% of faba bean and 75% of lentil fields. *O. cumana* does not affect sunflower in this region but does occur elsewhere in the country.)

Cai RunLan, Yang MeiHua, Shi Yue, Chen Jun, Li YongChao and Qi Yun. 2010. Antifatigue activity of phenylethanoid-rich extract from *Cistanche deserticola*. Phytotherapy Research 24(2): 313-315. (Confirming alleviation of fatigue in mice, supporting traditional use.)


Chivandi, E., Davidson, B.C. and Erlwanger, K.H. 2008. A comparison of the lipid and fatty acid profiles from the kernels of the fruit (nuts) of *Ximenia caffra* and *Ricinodendron rautanenii* from Zimbabwe. Industrial Crops and Products 271 29-32. (Concluding that X. *caffra* is potentially an important source of essential fatty acids.)


Codrea, N. 2008. (Crop potential of some sunflower hybrids at Cogealac Varieties Testing Center during 2002-2004.) (in Romanian) Lucrări Științifice - Universitatea de Științe Agronomice București. Seria A, Agronomie 51: 617-623. (Among 4 hybrids tested, Select was susceptible to *Orobanche cumana* while Favorit, Jupiter and Neptun were apparently immune.)


Costea, M., García Ruiz, I. and Welsh, M. 2008. A new species of Cuscuta (Convolvulaceae) from Michoacán, Mexico. Brittonia 60(3): 235-239. (C. cotijana is described from NW Mexico, related to C. jalapensis and occurring on a wide range of hosts including maize and avocado.)

Cullen, J. 2009. Phelypaea boissieri: Orobanchaceae. Curtis’s Botanical Magazine 26(4): 379-388. (P. boissieri is described and illustrated. The history of the genus is described and a key to the species is provided; also instructions for its cultivation.)


Díaz-Ruiz, R., Torres, A.M., Satovic, Z., Gutierrez, M.V., Cubero, J.I. and Román, B. 2010. Validation of QTLs for Orobanche crenata resistance in faba bean (Vicia faba L.) across environments and generations. TAG Theoretical and Applied Genetics 120(5): 909-919. (Two QTLs contribute to O. crenata resistance in all three locations tested, with other QTLs associated with resistance in only one or two of the locations.)

Ducarme, V. and Wesselingh, R.A. 2010. Performance of two Rhinanthus species under different hydric conditions. Plant Ecology 206(2): 263-277. (Confirming that Rhinanthus angustifolius performs better than R. minor in all moisture conditions but especially when wet.)


Journal of Medicinal Plants Research 3(8): 592-595. (In a survey of 150 traditional healers, 82% recommended Phragmanthera capitata for a range of at least 22 diseases.)

Domínguez, L.S., Melville, L., Sérsic, A., Faccio, A. and Peterson, R.L. 2009. The mycoheterotroph Arachnitis uniflora has a unique association with arbuscular mycorrhizal fungi. Botany 87(12): 1198-1208. (Showing that the Glomus fungus associated with A. uniflora (Corsiaceae) has a unique intra-cellular structure in the root cortex.)


Dong ShuQi, Ma YongQing, Shui JunFeng and Sun YaJun. 2009. Germination of Orobanche minor seeds as induced by rhizosphere soil extracts from winter wheat of different historical periods. Journal of China Agricultural University 14(2): 59-63. (Referring to ‘allelopathic’ effects of wheat stimulating germination of O. minor. But abstract also refers to inhibition. Not clear.)


Dor, E., Hershenhorn, J., Andolfi, A., Cinamino, A. and Evidente, A. 2009. Fusarium verticiliioides as a new pathogen of the parasitic weed Orobanche spp. Phytoparasitica 37(4): 361-370. (F. verticiliioides, isolated from O. cumana was highly pathogenic to O. aegyptiaca, O. ramosa and O. cumana but did not affect O. crenata. A toxic metabolite was isolated and identified as fusaric acid.)


Ducarme, V. and Wesselingh, R.A. 2010. Performance of two Rhinanthus species under different hydric conditions. Plant Ecology 206(2): 263-277. (Confirming that Rhinanthus angustifolius performs better than R. minor in all moisture conditions but especially when wet.)


Encheva, J., Shindrova, P. and Penchev, E. 2008. Developing mutant sunflower lines (Helianthus annuus L.) through induced mutagenesis. Helia 31(48): 61-72. (Sunflower mutants generated by ultrasound included a number with high resistance to Orobanche cumana.)


Ertürk, Ö. 2010. Antibacterial and antifungal effects of alcoholic extracts of 41 medicinal plants growing in Turkey. Czech Journal of Food Sciences 28(1): 53-60. (Viscum album among the most active species tested.)

Fadini, R.F., Gonçalves, D.C.M. and Reis, R.P.F. 2009. Consistency in seed-deposition patterns and the distribution of mistletoes among its host trees in an Amazonian savanna. Australian Journal of Botany 57(8): 640-646. (Dispersal of seeds of Psittacanthus plagiophyllus by the bird Elaenia cristata was predominantly onto larger and previously infected cashew (Anacardium occidentale).)


Fallahpour, F., Koocheki, A., Mahalati, M.N. and Rastegar, M.F. 2010. Tolerance of sugarbeet varieties to dodder (Cuscuta campestris). Proceedings of 3rd Iranian Weed Science Congress, Volume 1: Weed biology and ecophysiology, Babolsar, Iran, 17-18 February 2010: 137-142. (Among 5 commercial varieties, Flores was the most tolerant and Castille the most susceptible.)


Fernández-Escobar, J., Rodríguez-Ojeda, M.I., Fernández-Martínez, J.M. and Alonso, L.C. 2009. Sunflower broomrape (Orobanche cumaniana Wallr.) in Castilla-León, a traditionally non-broomrape infested area in northern Spain. Helia 32(51): 57-64. (This province has previously been free of O. cumana but has become infected in recent years by race F.)

horizontal resistance, use of herbicide on imidazolinone-resistant varieties and detailed monitoring of race development in the weed.)

Fondevilla, S., Fernández-Aparicio, M., Satovic, Z., Emeran, A.A., Torres, A.M., Moreno, M.T. and Rubiales, D. 2010. Identification of quantitative trait loci for specific mechanisms of resistance to Orobanche crenata Forsk. in pea (Pisum sativum L.). Molecular Breeding 25(2): 259-272. (Four QTLs were each found to explain from 10 to 17% of the variation in field resistance to parasitism. QTLs involved in specific mechanisms of resistance, such as low induction of parasite seed germination, reduced tubercle establishment, and slower tubercle development were also identified.)


Gal-On, A., Naglis, A., Leibman, D., Ziadna, H., Kathiravan, K., Papayiannis, L., Holdengreber, V., Guenoune-Gelbert, D., Lapidot, M. and Aly, R. 2009. Broomrape can acquire viruses from its hosts. Phytopathology 99(11): 1321-1329. (Showing that cucumber mosaic virus could be transmitted from tomato to Phelipanche aegyptiaca and could replicate in the latter. Tomato mosaic virus, potato virus Y, and tomato yellow leaf curl virus were also transmitted but there was less clear evidence of replication.)


Gontcharov, S.V. 2009. Sunflower breeding for resistance to the new broomrape race in the Krasnodar Region of Russia. Helia 32(51): 75-80. (Line VK 623 has been used in the development of varieties resistant to O. cumana races E and F but the recessive nature is a drawback.)


general review, including reference to mistletoe, presumably mainly Viscum album."

Han JianPing, Song, Jing Yuan, Liu Chang, Chen Jun, Qian Jun, Zhu YingJie, Shi LinChun, Yao Hui and Chen ShiLin. 2010. Identification of Cistanche deserticola and Cistanche tubulosa species (Orobanchaceae) based on sequences of the plastid psbA-trnH intergenic region. Acta Pharmaceutica Sinica 45(1): 126-130. (Suggesting that the psbA-trnH intergenic spacer region represents a barcode that can be used to distinguish C. deserticola and Cistanche tubulosa, the preferred medicinal species, from C. sinensis, C. salsa, Orobanche pycnostachya and Boschmiakia rossica.)


Hldadi, N., Jocic´, S., Mikli´c, V., Saftic´-Pankovic´, D. and Škoric´, D. 2009. Using new Rf inbred lines originating from an interspecific population with H. deserticola for development of sunflower hybrids resistant to broomrape. Helia 32(51): 81-90. (Hybrids derived from inbreds RHA-D-2, RHA-D-5, RHA-D-6, RHA-D-7 and RHA-D-8, which had been developed from H. deserticola, showed resistance to Orobanche cumana races E and F.)

Ho ShangTse, Tung YuTangm, Cheng KaiChung and Wu JyhHorng. 2010. Screening, determination and quantification of major antioxidants from Balanophora laxiflora flowers. Food Chemistry 122(3): 584-588. (Identifying several components of flower extracts from B. laxiflora with excellent antioxidant activities.)

Hopper, S.D. 2009. Nyuetsia floribunda: Loranthaceae. Curtis's Botanical Magazine 26(4): 333-368. (N. floribunda is described and illustrated, its mythological and practical use by Australian aborigines, its phylogeny, biology, ecology and systematics are described; also its possible cultivation and propagation.)


*Ibrahim, H.I. and Omotesho, O.A. 2010. Economic analysis of alternative Striga hermonthica control methods in the Northern guinea Savanna of Nigeria. Electronic Journal of Environmental, Agricultural and Food Chemistry 9(1): 138-144. (http://ejeafche.uvigo.es/index.php?option=com_docman&task=doc_download&gid=587&Itemid=33) (Over a two-season period, best economic return was obtained from successive crops of Striga-tolerant maize variety Acr 97 TZL COMP.1-W, compared with local varieties with or without extra N fertilizer.)


Ilic’, N. 2009. (Decline of sessile oak [Quercus petraea (Mattuschka) Lieblein] and occurrence of the mistletoe Loranthus europaeus Jacq. on mountain Motajica.) (in Serbo-Croatian) Radovi Šumarskog Fakulteta Univerziteta u Sarajevu 39(1): 21-33. (Attributing the decline in oak forest at least partly, if not mainly, to L. europaeus, which infests up to 80% of older trees in the study area.)


and herbicides, Babolsar, Iran, 17-18 February 2010: 115-118. (Best results obtained with rimsulfuron 90 g/ha 30, 40 and 50 days after planting.)


Jinga, V., Iliescu, H., Stefan, S. and Manole, D. 2009. Response of some sunflower cultivars to broomrape attack in Romania. Helia 32(51): 127-134. (Hybrids HS 1900, Turbo, Justin and Favorit showed absolute resistance to O. cumana. Good control was also achieved with herbicides trifuralin and imazamethabenz.)


Kelly, S.K., Friedman, C.M.R. and Smith, R.G. 2009. Vesicular cells of the lodgepole pine dwarf mistletoe (Arcteuthobium americanum) fruit: development, cytochemistry, and lipid analysis. Botany 87(12): 1177-1185. (The explosive fruits of Arcteuthobium species are frequently mentioned in introductory texts though the mechanism has received little study. Using histological methods and chemical analyses, the authors elucidate the origin of the vesicular cells and suggest that their accumulation of lipid functions in the discharge of the seed.)


Krishna, A.R. and Valli, P.K.D. 2009. Studies on biological control of Cuscuta chinensis Lamk - a parasitic weed by Euphorbia hirta L. Indian Journal of Weed Science 41(1): 101-102. (Showing that 'C. chinensis' (probably C. campestris?) fails to develop normally on E. hirta and when the latter is inter-planted with green gram (Phaseolus aureus), it also reduces the attack on the crop and increases crop yield.)


Lashkari, A., Meibodi, M.A.B., Moeini, M.M. and Mirhadi, S.M.J. 2010. Survey the possibility chemical and cultural control of tomato weed field with concern on broomrape (*Orobanche aegyptiaca*). Proceedings of 3rd Iranian Weed Science Congress, Volume 2: Key papers, weed management and herbicides, Babolsar, Iran, 17-18 February 2010: 278-281. (Some control with glyphosate, and with sulfosulfuron + metsulfuron but not with sulfosulfuron alone, rimsulfuron, ammonium sulphate or urea.)

Laszczyk, M.N. 2009. Pentacyclic triterpenes of the lupane, oleane and ursane group as tools in cancer therapy. Planta Medica 75(15): 1549-1560. (Noting that mistletoe (presumably *Viscum album*) could be a source of active triterpenes.)

Lee ChanHo, Kim JoonKi, Kim HyoYeon, Park SungMin and Lee SunMee. 2009. Immunomodulating effects of Korean mistletoe lectin *in vitro* and *in vivo*. International Immunopharmacology 9(13/14): 1555-1556. (Results suggest that extracts of *Viscum album* var. *coloratum* enhance the immune system through modulation of lymphocytes, NK cells, and macrophages.)

Leimu, R. 2010. Habitat quality and population size as determinants of performance of two endangered hemiparasites. Annales Botanici Fennici 47(1): 1-13. (Performance of *Melampyrum arvense* was influenced only by habitat quality, while that of *M. cristatum* depended also on population size.)


Lewis, K.C., Alers-Garcia, J. and Wright, L.J. 2010. Green tea catechins applied to susceptible hosts inhibit parasitic plant attachment success. Crop Science 50(1): pp 253-264. (Catechins, known to inhibit pectin methylesterase, reduced parasitism of *Lupinus texensis* by *Castilleja indivisa* and of *Arabidopsis thaliana* by *Cuscuta pentagona* at 5-10 g/l, perhaps corroborating evidence for the inhibition of cell-wall degrading enzymes in resistance to parasitism.)

Li DongXiao, Wang, L.J., Yang XiaoPo, Zhang GuoGuang and Chen LiAng. 2010. Proteomic analysis of blue light-induced twining response in *Cuscuta australis*. Plant Molecular Biology 72(1/2): 205-213. (Results suggest the blue light-induced twining in *C. australis* seedlings may be mediated by proteins involved in light signal transduction, cell wall degradation, cell structure, and metabolism.)

Li DongXiao, Zhang HuiHuang, Zhang GuoGuang and Chen Liang. 2009. The effects of different lights and gibberellin on establishment of parasitism between dodder and its hosts. Journal of Tropical and Subtropical Botany 17(5): 458-464. (Demonstrating that there was not only HER (high energy reaction) in dodders, but also dark conversion from Pr to Pr, and there were mutual interactions of phytochromes and cryptochromes in twining.)

López-Bellido, R.J., Benítez-Vega, J. and López-Bellido, L. 2009. No-tillage improves broomrape control with glyphosate in faba-bean. Agronomy Journal 101(6): 1394-1399. (Abstract suggests control of *Orobanche crenata* in faba bean was better with glyphosate (113 g/ha) plus conventional tillage but yields better with glyphosate plus no-tillage. Not clear.)

Ma LiJie, Chen GuiLin, Nie LiSha and Ai Min. 2009. Effect of *Cynomorium songaricum* polysaccharide on telomere length in blood and brain of D-galactose-induced senescence mice. China Journal of Chinese Materia Medica 34(10): 1257-1260. (Concluding that extract of *C. songaricum* can exert an anti-aging effect by increasing telomere length in senescent mice.)

MacRaidl, L.M., Radford, J.Q. and Bennett, A.F. 2010. Non-linear effects of landscape properties on mistletoe parasitism in fragmented agricultural landscapes. Landscape Ecology 25(3): 395-406. (Moderate landscape fragmentation may increase abundance of *Amyema miquelii* but more extreme fragmentation results in a reduction associated with loss of the associated seed-dispersing bird *Dicaeum hirundinaceum*.)


Martin, M., Gavazov, K., Körner, C., Hättenschwiler, S. and Rixen, C. 2010. Reduced early growing season freezing resistance in alpine treeline plants under elevated atmospheric CO₂. Global Change Biology...
16(3): 1057-1070. (Higher CO₂ levels did not increase the susceptibility of *Melampyrum pratense* to frost.)

Maširević, S. and Medic´-Pap, S. 2009. Broomrape in Serbia from its occurrence till today. Helia 32(51): 91-100. (Describing the spread of *Orobanche cumana* race E in Serbia, believed to have been introduced with confectionary sunflower in the 1990s.)


Mathiasen, R.L. and Daugherty, C.M. 2009. *Arceuthobium abietinum* subspecies *wiensis*, a new subspecies of fir dwarf mistletoe (*Viscaceae*) from Northern California and Southern Oregon. Madroño 56(2): 118-126. (Distinguishing this new subspecies, attacking red fir and Brewers spruce, from *A. abietinum* ssp. *concolor* (on white fir) and ssp. *magnificae* (on red fir) on morphological and host-range differences.)

Mathiasen, R.L. Daugherty, C.M. and Reif, B.P. 2009. *Arceuthobium rubrum* (Viscaceae) in Mexico. Madroño 56(2): 99-103. (Establishing that the disjunct population in S. Mexico previously given specific status as *A. oaxacanum* is not morphologically or genetically distinguishable from *A. rubrum*.)


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Meulebrouck, K., Verheyen, K., Hermy, M. and Baskin, C. 2010. Will the sleeping beauties wake up? Seasonal dormancy cycles in seeds of the holoparasite *Cuscuta epithymum*. Seed Science Research 20(1): 23-30. (Dormancy in seeds of *C. epithymum* declined over the winter but was re-imposed with higher spring temperatures. Most seeds had germinated after 31 months.)


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medications for eye diseases. Journal of Applied Sciences 9(22): 4076-4080. (Extracts of C. australis exhibited some anti-microbial activity, supporting its medicinal use in Nigeria.)


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Smith-Ramirez, C., Celis-Diez, J.L., von Jenstechy, E., Jimenez, J.E. and Armesto, J.J. 2010. Habitat use of remnant forest habitats by the threatened arboreal marsupial *Dromiciops gliroides* (Microbiotheria) in a rural landscape of southern Chile. *Wildlife Research* 37(3): 249-254. (Concluding that the abundance of *D. gliroides* was correlated with inter-connectedness of remnant forest patches but not clearly with the occurrence of *Tristerix corymbosus* whose fruits are a favoured food source.)


Sundararaj, R., Karibasavaraja, L.R., Gaurav Sharma and Raja Muthukrishnan. 2008. Hemipteran fauna (Insecta) infesting sandal *Santalum album* Linn. in southern

Tafokou, R.B.J., Dondjang, J.P., Nkongmeneck, B.A., Smith, M. and Kemeuze, V. 2010. (Diversity and sustainable management of Loranthaceae in the uplands of West Cameroon.) (in French) Bois et Forêts des Tropiques 303: 41-52. (Noting that 6 species of Loranthaceae (unspecified in abstract) occur on fruit trees in Cameroon: all are used in traditional medicine and need to be protected.)


Tewodros Mesfin, Tesahunegn, G.B., Wortmann, C.S., Mamo, M. and Olani Nikus 2010. Skip-row planting and tie-riding for sorghum production in semi-arid areas of Ethiopia. Agronomy Journal 102(2): 745-750. (Under dry conditions, skip-row planting and tied ridges are shown to be beneficial in the presence of both Striga hermonthica and S.asiatica.)

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Torretta, J.P. and Basilio, A.M. 2009. (Pollen dispersion and reproductive success of four tree species of a xerophytic forest from Argentina.) (in Spanish) Revista de Biología Tropical 57(1/2): 283-292. (Jodina rhombifolia (Santalaceae) is entomophylous, although spontaneous autogamy could favor reproduction in the absence of pollinators.)

Troncoso, A.J., Cabezás, N.J., Fuández, E.H., Urzáa, A. and Niemeyer, H.M. 2010. Host-mediated volatile polymorphism in a parasitic plant influences its attractiveness to pollinators. Oecologia 162(2): 413-425. (Showing that insects as well as birds are involved in pollination of Tristerix verticillatus and that they are attracted by volatiles, differing according to the host tree species.)


Vachev, T., Ivanova, D., Minkov, I., Tsagris, M. and Gozmanova, M. 2010. Trafficking of the potato spindle tuber viroid between tomato and Orobanche ramosa. Virology 399(2): 187-193. (Confirming that PSTV was transferred from the host tomato to O. ramosa and replicates in the latter, but does not move from parasite to host.)


Welsh, M., Stefanovic ’S. and Costea, M. 2010. Pollen evolution and its taxonomic significance in *Cuscuta* (dodders, Convolvulaceae). Plant Systematics and Evolution 285(1/2) 83-101. (Continuing intensive study of the genus *Cuscuta*, the Stefanovic lab present extensive data on pollen morphology which supports their large data sets of molecular information. This works shows the genus to fit meaningfully into the family Convolvulaceae.)

Westwood, J.H., Yoder, J.I., Timko, M.P. and de Pamphilis, C.W. 2010. The evolution of parasitism in plants. Trends in Plant Science 15(4): 227-235. (This is a succinct, cogent update on research into the evolution of parasitism in angiosperms by leading experts on the subject. Using powerful molecular techniques, the authors suggest that one key factor was the ability to recognize host plants as well as regulate movement between host and parasite via the haustorium. Like other studies, the presence and function of starchy cambial cells in the haustorium is not mentioned.)

Wu Yan, Shi HaiMing, Bao Zhong, Wang MengYue, Tu PengFei and Li XiaoBo 2010. Application of molecular markers in predicting production quality of cultivated *Cistanche deserticola*. Biological and Pharmaceutical Bulletin 33(2): 334-339. (Showing that combined ISSR and RAPD data could categorize *C. deserticola* individuals into three groups according to their respective echinacoside content.)


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Xie Hong, Zhu Hui, Cheng Cong, Liang Yu and Wang Zhao. 2009. Echinacoside retards cellular senescence of human fibroblastic cells MRC-5. Pharmazie 64(11): 752-754. (Suggesting echinacoside, a phenylethanoid from *Cistanches salsa*, has potential anti-senescence activity.)

Yahya, A.F., Hyun, J.O., Lee, J.H., Choi, T.B., Sun, B.Y. and Lapitan, P.G. 2010. Distribution pattern, reproductive biology, cytotaxonomic study and conservation of *Rafflesia manillana* in Mt. Makiling, Laguna, Philippines. Journal of Tropical Forest Science 22(2): 118-126. (Concluding that the main threats to *R. manillana* (2n=22) on its host *Tetrastigma harmandii* are from sex ratio imbalance, unsuccessful pollination and seed dispersal; and habitat disturbances caused by tropical typhoons.)

database of *S. hermonthica* expressed gene sequences: 17,317 unigenes with 10,319 contigs and 6,818 singletons. Includes initial characterization of *Striga* genes to those of other crops and *Triphysara*. A set of SSRs was developed from the database and used to characterize genetic diversity in *Striga* populations.)

Yoshida, S., Maruyama, S., Nozaki, H. and Shirasu, K. 2010. Horizontal gene transfer by the parasitic plant *Striga hermonthica*. Science 328: 1128. (Presenting evidence for the presence in *S. hermonthica* of a nuclear gene normally found in monocots, probably from sorghum.)


Zhang RuMin, Chen HongWei, Zhang Dan, Bai Jing and Gao Yan. 2009. Chemical induction on the seed germination and haustorium formation of *Cistanche deserticola*. Scientia Silvae Sinicae 45(6): 39-44. (Low levels of germination were induced by GA$_3$, and haustorial initiation by DMBQ, resorcin and ferulic acid.)


Zhao Gang, Wang Jie, Qin GuoWei and Guo LiHe. 2010. *Cynomorium songaricum* extracts functionally modulate transporters of γ-aminobutyric acid and monoamine. Neurochemical Research 35(4): 666-676. (Concluding that components of *C. songaricum* are novel neurotransmitter-transporter modulators functioning as DAT/NET activators and/or GAT-1/SERT inhibitors.)


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**HAUSTORIUM 57**

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**NB.** Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be down-loaded from the IPPS web-site (see above).
MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

Best wishes for 2011 to all of you! This will be another big year for IPPS as this summer we will again gather together to share science and meet friends old and new. The 11th World Congress on Parasitic Plants will take place on June 7-12, 2011 in Martina-Franca, Italy. See the Meetings section of this issue to find important information on the Congress such as registration and abstract submission dates. Information is also available at the congress website (http://ipps2011.ba.cnr.it/). I encourage all of you to attend. The congress venue and program will be outstanding.

Although we have not even held the 11th Congress yet, now is the time to think about where to meet for the 12th Congress in 2013. We are entertaining all options, so please send me your ideas for (and better still, your willingness to help host!) the next congress. We aim to announce the 2013 venue at the end of the congress in Italy.

IPPS is approaching an anniversary. When we meet in Italy it will be ten years since the formal inception of the society, which occurred at the 7th International Parasitic Weed Symposium in Nantes, France. On one hand, ten years seems like a long time ago and it feels like much has changed in science and our understanding of parasite biology since the turn of the century (Sounds...
even longer ago when put that way!). On the other hand, less has changed when considering that parasitic weeds continue to spread and devastate crops and effective control measures continue to elude us. Likewise with our society, we have had ten years of IPPS and the society has definitely matured over that time. We have established a comfortable rhythm of meeting schedules and an unprecedented level of organizational and financial stability. Yet as a society whose members are scattered around the globe and only meet every two years, we are young and still finding the best ways to operate. Although we are well beyond infancy, we still have some growing to do.

On that note I want to announce that it is time to elect new IPPS officers. You may recall that we created a staggered election cycle to avoid complete turnover of the Executive Committee at one time, and two years ago we elected vice president, secretary, and member at large. We now need to elect an editor and treasurer, with Diego Rubiales and Philippe Delavault having filled these positions, respectively, for four years. One wrinkle in this plan is that for much of his time as Treasurer, Philippe had no access to the IPPS bank account, which had been established in The Netherlands. Having gone to much work to transfer the bank account and reregister IPPS in France, my fellow IPPS officers and I think it is sensible to keep it in France for a while. Philippe has agreed to serve a second term as Treasurer and I hope all will agree with us that it is prudent to keep him in that position. Thus, we will be electing just the Editor position this time. We will solicit nominations and hold the election within the next few months.

See you in Italy!

Jim Westwood, IPPS President westwood@vt.edu

RECENT ADVANCES IN THE BIOLOGY OF HYDNORA (HYDNORACEAE):

The holoparasitic Hydnoraceae have long been considered botanical oddities even in the bizarre world of parasitic plants. Despite often being discussed in relation to the Rafflesiaceae due to gross similarities including habit and mode of nutrition, DNA sequence data have confirmed the prescient taxonomic judgment of Solms-Laubach and Baillon and placed the Hydnoraceae among the Piperales (Nickrent et al. 2002; Barkman et al. 2007). Often compared to their quite unrelated and rightfully admired brethren Rafflesia ‘queen of parasites’, Hydnora and Prosopancha, the two small genera of Hydnoraceae are somewhat more enigmatic and are not experiencing a contemporary explosion in taxonomic interest as noted for Rafflesia (Nickrent 2010), however significant recent progress has been made. Our aim here is to briefly summarize our recent research on the genus Hydnora in southern Africa.

The strange Hydnora africana chamber flower, emitting putrid odors of rotting meat have piqued the interest of botanists and scavenging jackals for many years. Our field studies have summarized the complex pollination biology of Hydnora. Year round, H. africana remains underground except when in flower. Large fleshy flower buds of Hydnora africana emerge from the soil and after opening, immediately emit fetid odors from recessed osmophores located in each tepal. Despite their awful odor, South African botanist Robert Marloth (1907) remarked that Hydnora osmophores were ‘like a spongy pudding, not only in appearance but also in taste’. Although overall thermogenesis is low in Hydnora relative to other thermogenic plants, the osmophores have the highest mass-specific respiration rate of any Hydnora floral part, thus thermogenesis in Hydnora is assumed to be associated with scent production (Seymour et al. 2010). The fetid odors produced by the thermogenic osmophores predictably attract carrion feeders and ovipositors, mainly hide beetles (Deremestes maculatus), which soon after alighting on the flower inevitably tumble into the chamber and are trapped by the smooth chamber walls. A marked beetle addition experiment demonstrated that hide beetles are trapped for several days until pollen is shed, after which structural changes to the chamber wall allow beetles, heavy with pollen, to escape (Bolin et al. 2009a). A University of Namibia undergraduate capstone thesis project conducted by Victor Libuku using pollinator exclosures has shown convincingly that Hydnora is an obligate outcrosser in a severely pollinator limited environment (Maass, Libuku, and Bolin; unpublished data). Thus the specialized pollination ecology of Hydnora flowers: brood site mimicry with insect imprisonment and thermogenesis appears to have evolved in the context of its breeding system and pressure from pollinator limitation.

In regard to the germination ecology of Hydnora, Job Kuijt predicted, ‘a fascinating story awaits the botanist who is fortunate to have access to viable seeds’ (Kuijt 1969). We found Job Kuijt’s assertion warranted in a germination study of Hydnora triceps. This plant is unusual in several ways; it flowers completely underground, is an obligate parasite of Euphorbia dregeana, and is restricted to a small area of Namibia and South Africa near the mouth of the Orange River. The study applied whole root extracts of host and non-host Euphorbia spp. to seeds of H. triceps (Bolin et al. 2009b). We found that germination of H. triceps only
occurs when whole root extracts of its obligate host *E. dregeana* were applied to seeds and not when extracts of other co-occurring *Euphorbia* spp. were applied, even those that are parasitized by *H. africana* and occur sympatrically. Importantly these results suggest that partitioning of the host resource (*Euphorbia* spp.) between *Hydnora* spp. occurs at the host recognition stage of seed germination. The germination strategies of other *Hydnora* spp. are unknown.

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The hypogeous flower of *Hydnora triceps*. Photographed at Farm Namuskluft, Rosh Pinah, Namibia. Photo by Jay Bolin.

In contrast to the well-known strategy of water and nutrient uptake used by mistletoes (high transpiration rates to maintain favorable water potential gradients), in *Hydnora*, the mode of transport is markedly different since it lacks leaves and other transpirative surfaces. We report extremely low transdermal water loss (Bolin *et al*. 2010) from subsurface *Hydnora* rhizomes (Tennakoon *et al*. 2007), comparable to the transpiration of xerophytes. Interestingly the stable carbon isotopic signature of *Hydnora* mirrors that of its hosts, thus *H. abyssinica* on *Acacia* hosts show a range of carbon isotopic values typical of C3 plants while *H. africana* on *Euphorbia* hosts show a CAM signature, confirming complete heterotrophy in *Hydnora* (Bolin *et al*. 2010).

Stable isotopic signatures of host roots from herbarium sheets coupled with DNA sequencing of barcoding loci from the same roots have proven useful in the identification of *Hydnora* host plants. These data are critical for our ongoing studies of host-parasite co-speciation using molecular markers because host information reported from herbarium sheets is notoriously unreliable. We are currently preparing a multi-locus phylogeny of the Hydnoraceae for publication, which we hope will inform future taxonomic work and highlight areas of incongruity in the family. Our studies of the Hydnoraceae have revealed much, however surely much is left to be written and discovered about these, strangest of parasites, if one doesn’t mind digging.


HAUSTORIUM 58

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PERSPECTIVES ON THE SANDALWOOD ORDER

Among the twelve orders of flowering plants in which
haustorial parasitism evolved, only two have more than
three genera: Lamiales and Santalales. Of these,
Lamiales contains a single family of hemi- and
holoparasitic plants: Orobancheaceae (ca. 93 genera/
1725 species). Santalales is the largest order of parasitic
plants composed of 18 families, 160 genera, and ca.
2280 species. Its size increases if one includes the
1725 species). Santalales is the largest order of parasitic
families in ‘core’ Santalales. Balanophoraceae were not
inclosed by quotation marks because they were found to
be para- or polyphylectic. ‘Olacaceae’ has traditionally
been a very heterogeneous group. Three of the families
segregated from it (Erythrophalaeae, Strombosiaese,
and Coutaceae) and are apparently not parasitic. These
families occur at the base of the Santalales tree; all the
remaining families are parasites, which indicates this
nutritional mode evolved just once in the order.

Members of ‘Olacaceae’ are now found in eight
families. One of these segregates (Schoepliaceae) is
actually sister to the South American mistletoes in
Misodendraceae. In addition to Schoepfia, the family
includes two genera formerly placed in Santalaceae:
Arjona and Quinchamalium. Finally, these two families
are sister to Loranthaceae – the most speciose family in
the order (990 species).

The former ‘Santalaceae’ was split into seven families.
These families are monophyletic and diagnosable via a
combination of morphological characters. A key to all
families in the order is given in Nickrent et al. (2010).
If one were to recognize all of these as one family, the
seven genera of Viscaceae would also have to be
included to retain monophyly. Indeed, this is what was
done in the various Angiosperm Phylogeny Group
‘lumping’ vs. ‘splitting’ is often a matter of taste (see 6
below), we preferred to retain the name Viscaceae for
this clade of mistletoes. To do so, however, required
splitting ‘Santalaceae’.

4. ‘Are Loranthaceae and Viscaceae distinct?’ Older
classifications frequently classified the genera of
Viscaceae in Loranthaceae (sic. Santalaceae). I recently
received an email from a student in Iran whose project
was to show, via molecular methods, that Viscaceae
were different from Loranthaceae! The morphological,
embryological, and cytological differences between
these two families are numerous (see Barlow 1964,
Barlow and Wiens 1971, Johri and Bhatnagar 1960) and
this has been strongly substantiated with molecular
phylogenetic methods (see Vidal-Russell and Nickrent
2008a,b). Thus, whether the two groups are distinct or
not is no longer an issue. It is important to recognize
Viscaceae, a name well-established in the literature, as
distinct from Santalaceae and Loranthaceae, if only to
avoid misinterpretations that are residuals of history.

5. ‘What happened to Eremolepidaceae?’ Three genera
of neotropical mistletoes, Antidiapithe, Eubrachion and
Lepidoceras were considered by Kuijt (1988) to
constitute a family, Eremolepidaceae. Kuijt (1969)
believed this family evolved from Olacaceae via Opilia

Recently, my collaborators and I published a revision of
Santalales (Nickrent et al. 2010) that synthesized results
from many sources of evidence to arrive at our
classification. I present below answers to some
frequently asked questions – hopefully this will clear up
some of the confusion that persists concerning various
concepts.

1. ‘How many families in the order?’ We recognized 18
families in ‘core’ Santalales. Balanophoraceae were not
discussed as we do not know its exact relationship to
photosynthetic Santalales.

1. ‘How were the families determined in your new
classification?’ The principle of monophyly was
followed based on results from various molecular
phylogenetic analyses (particularly Malécot and
Nickrent 2008 and Der and Nickrent 2008, and Vidal-
Russell and Nickrent 2008a). Indeed, there are other
perspectives about how to generate a classification, (e.g.
the recognition of paraphyletic taxa – see Hörandl
2010), but we adhered to the monophyly philosophy
following Backlund and Bremer (1998).

3. ‘I thought I knew Olacaceae and Santalaceae, but
now everything has changed!’ Indeed the most change,
compared to traditional classifications, involved
‘Olacaceae’ and ‘Santalaceae’. These names are
enclosed by quotation marks because they were found to
be para- or polyphyletic. ‘Olacaceae’ has traditionally

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Godwin Building, Norfolk VA 23529, USA.
Our phylogenetic studies have shown that indeed these mistletoes do form a clade, but that clade is deeply embedded within Santalaceae sensu stricto. Our early work using rbcL and 18S rDNA sequences (Nickrent and Duff 1996) first indicated this, and additional sequencing and analyses confirmed and strengthened the result (e.g. Der and Nickrent 2008). Thus, it is unfortunate that this ‘family’ is still being used in recent floristic treatments such as Flora of the Guianas (Kuijt 2007) and Flora Mesoamericana (Kuijt 2009). To accept Eremolepidaceae would require also accepting a paraphyletic Santalaceae s.s. Eremolepidaceae was sunk into Santalaceae (in the broad sense) by APG I, II and III. No matter whether a broad or narrow family concept is used, these three mistletoe genera should reside in Santalaceae.

6. ‘Why does your Santalales classification differ from that in APG III?’ A common misconception is that the APG classifications represent one agreed upon by the majority of the systematics community. Although APG represents itself as presenting the authoritative angiosperm classification, it has not been demonstrated that their family concepts are the majority opinion. APG III contains 415 rather than the 457 families recognized in APG II. This was achieved by ‘lumping’, thereby resulting in more inclusive families. Could the decrease in the number of collaborators from APG I to III (22 to 9) possibly reflect dissatisfaction with such decisions?

As stated on Wikipedia, ‘Independent researchers, including members of the APG, continue to publish their own views on areas of angiosperm taxonomy.’ Indeed this is exactly what the Nickrent et al. (2010) classification represents – a different view than APG. In the case of ‘Santalaceae’ and Viscaceae, one can employ a broad concept and recognize one family (Santalaceae sensu lato.), but one must also then ask ‘why stop here?’ Why not also include Opiliaceae? The specific criteria used by APG to define Santalaceae s.l.. and exclude Opiliaceae are not specified. So, if one chooses to recognize Santalaceae s.l., there still exist seven clades that could be recognized and named (as subfamilies?). This opens up the topic of trying to define what taxonomic rank is most appropriate for a particular assemblage of biological diversity – a topic well beyond the scope of this contribution!

7. ‘How many mistletoe families and species?’ Of course, the answer to this question depends upon whose family concept one follows. According to Nickrent et al. (2010), mistletoes evolved on five separate occasions (clades) and are in the following families: Misodendraceae, Loranthaceae*, Santalaceae*, Amphorogynaceae* and Viscaceae. The three families marked with an asterisk contain root parasitic plants as well as mistletoes. Only Misodendraceae and Viscaceae contain only mistletoes. Aerial parasitism was apparently very successful, for mistletoes constitute ca. 1600 of the 2280 species in Santalales. For more information about the evolution of the mistletoe habit, see Vidal-Russell and Nickrent (2008a). General reviews of mistletoes include Mathiasen et al. (2008) and Nickrent (2010).

Literature Cited


REUVEN JACOBSOHN

We are sad to report that Reuven Jacobsohn died suddenly at the end of December 2010. An obituary will be included in the next issue.

PRESS RELEASES

‘Discovery offers hope of saving sub-Saharan crops from devastating parasites.’

Each year, thousands of acres of crops are planted throughout Africa, Asia and Australia only to be laid to waste by a parasitic plant called Striga, also known as witchweed. It is one of the largest challenges to food security in Africa, and a team of scientists led by researchers from the University of Toronto have discovered chemicals and genes that may break Striga's stranglehold. When crops grow, their roots release a plant hormone called strigolactone. If the soil contains Striga seed, it will use the released strigolactone as a cue to germinate and infect the crop plants. Once connected to the crop, the Striga plant kills the crop by sucking out its nutrients. ‘In sub-Saharan Africa alone, Striga has infected up to two-thirds of the arable land,’ says U of T cell and systems biologist Peter McCourt, principle investigator of a study published this week in Nature Chemical Biology (see Yuichiro Tsuchiya et al. below). With chemicals and genes in hand that influence strigolactone production in plants, we should be able to manipulate the level of this compound by chemical application or plant breeding which would break the Striga-crop interaction.

The scientists used a model genetic plant system called Arabidopsis to screen 10,000 compounds and identify a set of five chemicals, designated cotylimides, which increase the accumulation of strigolactone in plants. They also found related chemicals that decrease strigolactone levels. From there, they screened for mutants of Arabidopsis that were resistant to cotylimides and identified mutants that made less strigolactone. These mutants identified genes that regulate strigolactone levels in plants.

Provided by University of Toronto
September 10th, 2010.

‘Witchweed: 50-year war may be nearing its final skirmish.’

For the past 50 years, areas near the border between North and South Carolina have been ground zero for a fierce battle in the war against a devastating weed. Federal and state officials and local farmers have been fighting the only known U.S. infestations of witchweed (Striga asiatica), an invasive plant that has crippled key segments of the agricultural industry in countries around the globe. The parasitic weed is a danger to some of our nation's most important crops, including corn, sorghum, sugarcane, rice and other plants belonging to the grass family. It taps directly into a plant's root system to rob it of nutrients and moisture - dramatically reducing yields. Unfortunately witchweed also is very prolific. A single plant can produce as many as 50,000 dust-like seeds that can live in the soil for a decade or more, making eradication a tough and time-consuming process.

But for farmers battling the weed in North and South Carolina, the end seems tantalizingly close. ‘We're 99 percent of the way there,’ says Alan Tasker, national noxious weed program manager with the USDA's Animal and Plant Health Inspection Service. ‘Not only have we halted the spread of witchweed over the past five decades, but we've dramatically reduced the number of infested acres as well - down from 450,000 in the 1950s to about 2,000 today. Our goal is to eradicate it once and for all.’
Witchweed is native to Africa, India, the Middle East and China. So how did it make its way to the Carolinas? No one is sure. A graduate student from India first spotted the slender, red-blossomed pest in 1955. He knew it well because of its devastating impact on his own country’s sorghum crops. To avert a similar disaster for U.S. growers, Congress created an eradication program in 1957 led by a USDA program that later became the Animal and Plant Health Inspection Service. The agency established a research station and farm where it developed the science-based control methods that have produced outstanding results. The successful program is built around three critical phases - each involving close collaboration among federal and state officials and farmers in the Carolinas:

1. Locate and map all infestations. Since witchweed is so prolific, finding each and every specimen of the foot-tall plant is vital. In addition to farmers checking their own land, scouts are sent out to locate infested sites - traveling on foot and on horseback early in the program and later in all-terrain vehicles. There are penalties for failing to report the weed ... and bounties paid for sightings by eligible parties. ‘We typically have great cooperation from local farmers, who know the danger witchweed poses to their crops,’ Tasker said.

2. Quarantine. Though tiny witchweed seeds can be spread by wind or by water, human activity is often the most common culprit. For that reason, the areas where witchweed is found are quickly quarantined. Machinery used at the site and any crops harvested with soil attached must be cleaned thoroughly to remove witchweed seeds. Growing the grass crops favored by witchweed is strictly prohibited until the pest is totally eradicated in the quarantined segment of a field. Instead, farmers must leave the land fallow or convert to crops that are harvested well above the soil line.

3. Control. Officials remove witchweed plants when they are found and use both foliar-applied and soil-applied herbicides for deterrence. Destroying the tens of thousands of microscopic seeds that may already be in the soil, though, is tougher and more time-consuming. Some seeds sprout right away and are killed by the herbicide. But others can lurk for years. ‘Allowing grassy weeds to grow in the area or planting a crop that is susceptible to witchweed can actually trigger dormant seeds to germinate, even if they are deep underground, Tasker says. ‘We have examples of parasitic weed seeds remaining dormant in a fallow field for 50 years and then sprouting as soon as the preferred host crop is planted.’ One effective technique for controlling dormant seed is ‘suicidal germination.’ Ethylene gas - a natural ripening agent produced by fruits, vegetables and flowers - is injected into the soil and causes the seeds to sprout. Without a host plant to attach to, the new seedlings wither and die. Another approach is to fumigate the soil with chemicals to destroy any seeds that remain. ‘Regardless of the technique used, we spot-check the fields for years afterwards to make certain the weed is truly eradicated,’ Tasker says.

Tasker and Dr. Jim Westwood of Virginia Tech have organized a special day-long symposium on the witchweed program and other parasitic weeds that will be featured during the 51st annual meeting of the Weed Science Society of America. The event is scheduled for Feb 7-10 2011 in Portland, Oregon. To register or to find out more, visit www.wssa.net. (These presentations will be reviewed in the next issue of Haustorium – Ed.)


‘World Food Prize Laureate Dr. Gebisa Ejeta named Science Envoy’

Dr. Gebisa Ejeta is one of three eminent Americans who are selected to represent the U.S. as scientist-diplomats. Dr. Gebisa Ejeta, a distinguished Professor of Agronomy at Purdue University and an acclaimed plant breeder and geneticist, has been named an envoy in the U.S. Science Envoy Program, established to nurture science and technology collaborations between the United States and nations throughout the Middle East, North Africa, and South and Southeast Asia. Senator Richard Lugar (R-Ind.) made the announcement on September 17 at an event hosted by the U.S. Civilian Research and Development Foundation. ‘The Science Envoy program, announced by President Obama in Cairo in June 2009, is a centerpiece program to implement U.S. global engagement in science and technology’, the State Department said in a press release. ‘These pre-eminent scientists will seek to deepen existing ties and foster new relationships with foreign counterparts and gain insights from other nations about potential areas of collaboration that will help address global challenges and realize shared goals.’

The Ethiopian-born scientist, who was also winner of the 2009 World Food Prize, is one of three Americans who are selected to represent the U.S. as scientist-diplomats, including Dr. Rita Colwell, a Professor at both the University of Maryland College Park and Johns Hopkins University, and Dr. Alice Gast, President of Lehigh University.

Professor Gebisa, whom along with a Purdue colleague, discovered the chemical basis of the relationship
between the deadly parasitic weed *Striga* and sorghum and was able to produce sorghum varieties resistant to both drought and *Striga*, won the 2009 World Food Prize for his major contributions in the production of sorghum, one of the world’s five principal grains. His work has dramatically enhanced the food supply for millions of people in sub-Saharan Africa.

The science envoys travel in their capacity as private citizens, and they advise the White House, the Department of State, and the U.S. scientific community about the knowledge and insights they gain from their travels and interactions.

Published by *Tadias*, October 4th, 2010.

‘**Japanese Dodder found in Clarksburg area**’

Yolo County Agriculture Department officials have confirmed the presence of an infestation of Japanese dodder (*Cuscuta japonica*) in Yolo County, found in the riparian area adjacent to the Sacramento River in the Clarksburg area. A vibrant yellow-orange to yellow-green vine, Japanese dodder is an exotic, potentially invasive parasitic vine introduced into California in recent years. Japanese dodder has robust twining stems that are leafless and stout, comparable in size to cooked spaghetti. It can grow up to six inches per day and reproduces vegetatively (through stem fragments) and seeds. Japanese dodder is likely to be found near roads and freeways and hosts include fruit trees and ornamental shrubs.

‘This parasitic vine is a significant threat to our native ecosystems and to agriculture,’ said Yolo County Agricultural Commissioner John Young. ‘We are working with the California Department of Food and Agriculture to come up with an eradication plan.’

The Daily Democrat, Woodland, California
November 9, 2010

‘**New mistletoe species discovered**’

A new species of tropical mistletoe has been described by scientists at the Royal Botanic Gardens, Kew in London. The research team found the plant on an expedition to Mount Mabu in northern Mozambique in 2008. Now, just in time for Christmas, they have confirmed that *Helixanthera schizocalyx* is new to science. The plant tops a list of Kew’s botanical discoveries of 2010, which includes a Vietnamese orchid and an exceptionally rare tree from Cameroon.

Butterfly specialist, Colin Congdon, spotted the mistletoe in the dense foliage near the summit of Mount Mabu. He realised that it was different from anything he had seen on the mountains in neighbouring Malawi and Tanzania. Closer inspection back at Kew confirmed it as a new species. Mistletoes are ‘hemi-parasitic’, meaning they take some of the nutrients they need from other plants. When birds eat the small fleshy white sweet fruits, the seeds are wiped onto branches of trees, where they stick. Once germinated, the root grows into the living tissue of the tree to ‘suck out’ its nutrients.

By Victoria Gill
Science and nature reporter, BBC News
Story from BBC NEWS: 20 December 2010.

‘**Could mistletoe help to halt skin cancer?**’

Mistletoe can halt the growth of malignant melanoma, the most lethal type of skin cancer. Mistletoe holds the secret to beating skin cancer, new research suggests. A study by German scientists shows the plant can halt the growth of malignant melanoma — the most lethal type of skin cancer — when combined with the diabetes drug rosiglitazone. Scientists at the University Hospital of Hamburg combined mistletoe with rosiglitazone because, although the diabetes drug has recently been dogged by fears that it may raise the risk of heart attacks, some studies suggest it may be able to tackle cancer. When the combination was applied to melanoma cells in the laboratory, the rate of cancer growth was slashed by up to 79 per cent. It’s thought mistletoe helps the body’s immune system fight tumours and speeds up the disposal of toxic ‘debris’ left behind from chemotherapy. Previous German research using mistletoe extract found patients had fewer side-effects from toxic chemotherapy and radiotherapy and - survived longer.


FROM GOOGLE ALERTS – STRIGA – NEW SPECIES?

‘The Striga, former dragon owl from the Middle Kingdom beyond the Unnamed Sea, has come to stay at the great tree. He has earned the trust of all by saving Bell, Soren's owlet, from Nyra, and he grows daily closer to the young king Coryn, with whom he seems to share a strange bond. As The Striga's power waxes, he accuses the Band of treason and produces flimsy evidence to support his abominable claim. And so the Band is exiled, strengthening the Striga's hold over Coryn’………..What happens next? – more research needed!'
A SEARCHABLE COMPOSITE FILE OF OLD HAUSTORIUM ISSUES

I have been routinely using a composite Word file (about 3.7 Mb) comprising all the Haustorium issues I have available electronically on my computer (issues 33 onwards). This has been useful for searching particular species, authors or topics, back to 1998. I had hoped to add all the earlier issues, using the scanned versions on Lytton Musselman’s website (http://www.odu.edu/~lmusselm/haustorium/index.shtml) but this is not proving easy with many serious formatting problems. We shall continue to work on this but meanwhile, please find my composite file via the above site (also automatically available via the IPPS web-site (http://www.parasiticplants.org/). This has many formatting imperfections and apologies are particularly due to authors whose names include accented or other diacritical letters. These are often corrupted and will make searches for those names unreliable. We hope, however, that readers will find this a useful resource.

Chris Parker.

REFERENCES FROM HAUSTORIUM IN ENDNOTE FORMAT

As many of you may appreciate, Chris Parker painstakingly assembles a literature list for every issue of Haustorium. These lists are extremely useful for me because they encompass some of the less "mainstream” journals, i.e. the ones that I don’t usually browse. I use EndNote (commercial software from Thompson Reuters, see www.EndNote.com) as a means to keep track of my bibliographic information. A free demo version of the software can be downloaded from the above web site and used for 30 days. For Haustorium 51 to 58, I have imported the citations into EndNote. The references are not perfectly formatted, but the basic information (names, dates, titles, journals, etc.) are in the proper fields and all of these can be sorted and searched. The file contains over 1700 references on parasitic plants. I plan to continue formatting Haustorium references in this manner for future issues. These EndNote files will be made available to download from the International Parasitic Plant Society web page: http://www.parasiticplants.org/

Dan Nickrent (Southern Illinois University, Carbondale, IL USA).

PHD OPPORTUNITY

Parasitic plants ‘hijack’ host signalling pathways to successfully invade their hosts

Parasitic plants are common in both natural and agro-ecosystems accounting for 1% of angiosperm species; they are taxonomically diverse and they rob the host plant of carbon, water and inorganic nutrients. Parasitism results in alterations in host growth and performance. In natural plant communities this leads to changes in competitive interactions between host and non host species and to changes in community diversity and in agro-ecosystems to severe losses in yield threatening the food security of millions of poor farmers worldwide. Parasitic plants attach to either the roots or shoots of their hosts by a specialised organ, the haustorium. Haustorial cells penetrate into the root or stem of the host and link to the host xylem e.g. the root parasite Striga (witchweed) and/or phloem vessels e.g. the shoot parasite Cuscuta (dodder). Recent work at the University of Sheffield, using Arabidopsis as a model host, suggests that parasite-induced reprogramming of host plant hormone biosynthetic and signalling pathways are critical for successful infection. A PhD studentship is available for a bright, enthusiastic individual to use a range of, genetic (Arabidopsis or Medicago mutants) molecular (transcriptomics, quantitative RT-PCR) and bioimaging techniques (promoter-reporter fusions, confocal and light microscopy) to elucidate the changes in host gene expression and signalling pathways that allow Striga and Cuscuta to successfully parasitise the host plant.

Starting date 1 October 2011

How to apply: Complete an on-line application form via University of Sheffield web site at http://www.shef.ac.uk/postgraduate/research/apply/index.html.

NB funding will be available for UK applicants only
Closing date for applications: 31 January 2011.

THESIS

Emily Suzanne Marquardt (Ph.D., University of Houston, 2009) ‘Foraging and host use of the parasitic plant Cuscuta indecora’ 122 pages; AAT 3371162

Parasitic plants provide a unique opportunity to test the generality of ecological models intended for herbivores. Both types of consumers display preferences for hosts, reduce host biomass and allocation patterns, interact
directly and indirectly with other organisms, and can alter community dynamics. My goal was to understand how abiotic stress, host constraints, diet mixing, and interactions with below-ground symbionts affected foraging by the parasitic plant *Cuscuta indecora* in the salt marsh. First, I examined how abiotic stress affecting host plants mediated *Cuscuta* performance on a variety of hosts (*Batis maritima*, *Salicornia virginica*, *Suaeda linearis*, and *Borrichia frutescens*). Salinity had a severely negative affected host and *Cuscuta* performance, while flooding was better tolerated by both host and *Cuscuta*. In the salt marsh, plants that tolerate high salinities may avoid *Cuscuta* parasitism. Second, I looked at three possible constraints (phenology, height, and sexual reproduction) that could make some hosts (*Batis maritima*, *Salicornia virginica*, *Salicornia bigloveii*, and *Suaeda linearis*) less susceptible to parasitism, thereby affecting *Cuscuta*’s host range in the field. All three constraints influenced *Cuscuta*. *Cuscuta* only parasitized plants that shared the same phenological schedule. *Cuscuta* attacked taller host plants and the upper canopy portions of hosts. Instead of reproducing sexually by seeds, *Cuscuta* reproduced asexually by vegetatively overwintering in hosts. Constraints on host use eliminated half of *Cuscuta*’s potential hosts. Third, because *Cuscuta* can parasitize many hosts simultaneously, I examined if *Cuscuta* selectively foraged to obtain a mixed diet. *Cuscuta* did not prefer or perform better on a mixed diet comprised of *Iva frutescens* and *Borrichia frutescens* than a diet of either host alone. Host preference for *Iva* or *Borrichia* was not significant but trends showed that *Cuscuta* preferred hosts that were more abundant. Diet mixing is a result of lack of mobility of *Cuscuta*. Finally, I examined the relationship between *Cuscuta* and arbuscular mycorrhizal (AM) fungi that share the same host plant *Iva frutescens*. *Cuscuta* did not have a strong effect on AM fungi. It is possible that pathogenic fungi decreased host and *Cuscuta* biomass, perhaps by disrupting the plant-mycorrhizal symbiosis. Interactions between *Cuscuta* and AM fungi seem to be weak. Overall, my results show that a variety of factors influence the foraging of *Cuscuta indecora*. Although there are fundamental differences between plants and herbivores such as mobility, foraging by holoparasitic plants can be understood within the framework of existing plant-herbivore theory.

**FORTHCOMING MEETINGS**

**11th World Congress on Parasitic Plants 7 - 12 June 2011, Martina Franca, Italy**

The Congress continues a long tradition of regularly assembling the world’s experts on parasitic plants for professional and scientific meetings, which started in 1973 with the first international meeting in Malta.

The Congress will bring together scientists representing a wide spectrum of disciplines, research approaches, and geographical representation of parasitic plant research. Assembling specialists with different perspectives, all focused around the common theme of plant parasitism, provides a stimulating environment for learning, exchanging ideas, and connecting with old and new colleagues.

**Palazzo Ducale, Martina Franca**

Parasitic plants - both the weedy species that severely constrain agriculture and the many other non-weedy species - present unanswered questions with regard to their origin and evolution from non parasitic plants, population structures and dynamics, evolutionary pathways towards crop parasitism, ecology, physiology, molecular biology, and the structure, function and development of their haustoria.

The Congress will include presentations at the cutting edge of parasitic plant research and management of parasitic weeds. A major emphasis in the Congress will be the fostering of interaction among participants.

Information can be found at the official Website of the Congress at: http://ipps2011.ba.cnr.it
Please visit it regularly, or pre-register to receive updates on all the news about the Congress.

**Deadlines:**

- March 1st 2011 - Abstract titles submission
- April 1st 2011 - Early registration
- April 15th 2011 - Abstracts to be considered for oral presentation
- May 1st 2011 - Abstract submission
- May 27th 2011 - Registration
Contacts:

Any information about accommodation, tours, location, etc. can be requested from the following email address: ipps2011@ispa.ba.cnr.it


The Near East Weed Science Society (NEWSS) will hold its second conference with cooperation of the local and international supporting parties during the period 16-19 November 2011 at the University of Jordan, Amman, Jordan. The conference will include sessions for presenting research papers and posters. Keynote speakers will be invited to address recent issues in weed science including parasitic weed management.

N.B. Last date for registration is 1 May 2011

Further information from:
Prof. B E Abu Irmaileh
Faculty of agriculture – University of Jordan
Amman 11942 Jordan
Barakat@ju.edu.jo

Or via the NEWSS website
http://www.ju.edu.jo/sites/newss

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see: http://www.parasiticplants.org/

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes, up to 2005) see: http://www.rmrs.nau.edu/mistletoe/

For information on the 11th World Congress on Parasitic Plants in Martina Franca, Italy, June 2011, see: http://ipps2011.ba.cnr.it

For the announcement of Gebisa Ejeta’s World Food Prize, including video of Hillary Clinton’s address see: http://www.worldfoodprize.org/about/about.htm

For abstracts from the 9th World Congress on Parasitic Plants see: http://www.cpe.vt.edu/wcopp/index.html

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)


For information on the Kilimo Trust Striga project see: www.thekilimotrust.org

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Steps in Striga management’ newsletters, see: http://www.aatf-africa.org/

LITERATURE

*indicates web-site reference only

maize in Tanzania and extension of AATF *Striga* project activities to Uganda and Southern and Western Africa.)


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Suggesting emphasis should be shifted to enhancing soil fertility rather than on Striga itself.)


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cysteine protease from *Cuscuta reflexa*, in host-parasite interactions. BMC Plant Biology 10: 227. (Application of a cuscutain inhibitor during parasitism decreased success rate, indicating that cuscutain may be important in parasitism.)

Bougoure, J., Ludwig, M., Brundrett, M. and Grierson, P. 2009. Identity and specificity of the fungi forming mycorrhizas with the rare mycoheterotrophic orchid *Rhizanthella gardneri*. Fungal Biology 113(10): 1097-1106. (Confirming that the sub-terranean orchid *R. gardneri* participates in a tripartite relationship where its mycorrhizal fungus (of uncertain identity) forms ectomycorrhizas with *Melaleuca uncinata* s.l.)

Bomanowska, A. 2010. Threat to arable weeds in Poland in the light of national and regional red lists. Plant Breeding and Seed Science 61: 55-74. (Noting *Cuscuta epilinum* among species now considered extinct in Poland.)

Braby, M.F. and Nishida, K. 2010. The immature stages, larval food plants and biology of Neotropical mistletoe butterflies (Lepidoptera: Pieridae). II. The Catasticta group (Pierini: Aporini). Journal of Natural History 44(29/32): 1831-1928. (A review of the 8 genera in the Catasticta group, with special attention to the 6 neotropical genera, supported by field observations in Costa Rica. Mistletoe hosts include *Struthanthus*, *Tripodanthus* (Loranthaceae), *Antidaphne* (Santalaceae) and *Dendrophthora* and *Phoradendron* (Viscaceae). Their evolution is discussed in relation to the presence of toxic alkaloids.)


Cazzonelli, C.I. and Pogson, B.J. 2010. Source to sink: regulation of carotenoid biosynthesis in plants. Trends in Plant Science 15(5): 266-274. (Reviewing the mechanisms regulating carotenoid biosynthesis, including evidence for metabolite feedback, transcription and epigenetic control as well as their accumulation, storage and degradation.)


Condrat, D., Harja, F. and Lupea, A.X. 2008. Determination of ascorbic acid through the 2,6-dichlorophenol-indophenol method from the angiospermophyta species. Annales of the University of Craiova, Craiova, Romania, Analele Universitati din Craiova - Biologie, Horticultura, Tehnologia Prelucrarii Produselor Agricole, Ingineria Mediului 13: 357-359. (Confirming *Viscum album* in Romania contains 25 mg ascorbic acid per 100 g.)

Connop, S., Hill, T., Steer, J. and Shaw, P. 2010. The role of dietary breadth in national bumblebee (*Bombus*) declines: simple correlation? Biological Conservation 143(11): 2739-2746. (Noting that the nationally rare *Bombus sylvarum* collected the majority of its pollen from flowers of *Odontites verna*.)


Cullings, K. and Hanely, J. 2010. Dwarf mistletoe effects on soil basidiomycete community structure, soil fungal functional diversity, and soil enzyme function: implications for climate change. Soil Biology & Biochemistry 42(11): 1976-1981. (Severe infection of *Pinus contorta* by *Arceuthobium* (presumably *A. americanum*) not only significantly affected soil fungal species composition and
increased species diversity, but also impacted on
carbon-related function and functional diversity.)


de Abreu, L.M., Almeida, A.R., Salgado, M. and Pfenning, L.H. 2010. Fungal endophytes associated with the mistletoe Phoradendron perrottetii and its host tree Tapirira guianensis. Mycological Progress 9(4): 559-566. (A total of 99 species isolated from P. perrottetii and its host. The mistletoe was less intensely colonised but had the greater species richness., the dominant species being Paraconiothyrium brasiliense, P. sporulosum and Verticillium leptobac.)

de Groote, H., Rutto, E., Odhiambo, G., Kanampiu, F., Khan, Z., Coe, R. and Vanlauwe, B. 2010. Participatory evaluation of integrated pest and soil fertility management options using ordered categorical data analysis. Agricultural Systems 103(5): 233-244. (Twelve demonstration trials in Western Kenya included a range of treatments for control of Striga and pests, and improvement of soil fertility. These were evaluated by over 500 farmers and detailed analysis showed keen interest in all the technologies, especially push-pull, but there were substantial differences between years, sites and farmers. Farmers looked especially for increased yield followed by soil fertility and Striga control.)

de Groote, H., Vanlauwe, B., Rutto, E., Odhiambo, G.D., Kanampiu, F. and Khan, Z.R. 2010. Economic analysis of different options in integrated pest and soil fertility management in maize systems of Western Kenya. Agricultural Economics 41(5): 471-482. (A valuable analysis of the economics of a range of management options for Striga hermonthica in maize, based on 6 seasons’ work, concluding that rotation with ‘promiscuous soybean’ gave good returns. ‘Push-pull’, using Desmodium, was even more profitable but required high initial investment. Green manure rotation, herbicide-resistant-maize, and fertilizer all increased yields, but were not generally justified by their increased revenue.)

de Vega, C., Arista, M., Ortiz, P.L. and Talavera, S. 2010. Anatomical relations among endophytic holoparasitic angiosperms, autotrophic host plants and mycorrhizal fungi: a novel tripartite interaction. American Journal of Botany 97(5): 730-737. (Showing that mycorrhizae were associated with the host Halimium and the parasite Cytinus hypocistis, reaching high frequencies of colonization in both parasite and host root tissues.)

Didier, D.S., Zenabou, N., Ruth, M., Joseph, B.I. and Akoa, A. 2010. A parasitic study of Phragmanthera capitata (Sprengel) S. Balle (Loranthaceae) in the anthropic environments: the case of the Ndobong chieftain's compound orchard (Douala, Cameroon). African Journal of Agricultural Research 5(15): 2051-2055. (Among 11 species surveyed, the indigenous Spondias mangifera was the most infested by P. capitata, 7 exotics were susceptible including citrus, cocoa, guava and avocado, while mango, Dacryodes edulis and Manniophyton fulvum were apparently resistant.)

Dindi, M., Ireland, C., Harper, M.K., Bugni, T. and Matainaho, T. 2009. TB-active metabolite from Exocarpus latifolius. Science in New Guinea 29: 93-104. (Describing several compounds isolated from E. latifolius, which is used traditionally in PNG to cure coughs.)

Dube, M.P. and Belzile, F.J. 2010. Low genetic variability of Striga gesnerioides populations parasitic on cowpea might be explained by a recent origin. Weed Research (Oxford) 50(5): 493-502. (AFLP studies on 43 populations across the 5 recognised biotypes of S. gesnerioides attacking cowpea showed remarkably low variability, both within and between biotypes, suggesting a recent origin.)


This activity varied to some degree according to the host on which it was growing.)


Elzein, A., Heller, A., Ndambi, B., de Mol, M., Kroschel, J. and Cadisch, G. 2010. Cytological investigations on colonization of sorghum roots by the mycoherbicide Fusarium oxysporum f. sp. strigae and its implications for Striga control using a seed treatment delivery system. Biological Control 53(3): 249-257. (Hyphae of F. oxysporum penetrate rhizodermal cells including root hairs of sorghum, and colonize the intercellular space and the cells of the cortical parenchyma but generally fail to penetrate the endoderm, confirming its non-pathogenicity to the crop.)

Evidente, A., Cimmino, A., Fernández-Aparicio, M., Andolfi, A., Rubiales, D. and Motta, A. 2010. Polyphenols, including the new peapolyphenols A-C, from pea root exudates stimulate Orobanche foetida seed germination. Journal of Agricultural and Food Chemistry 58(5): 2902-2907. (Polyphenols from pea were found to stimulate germination of a range of Orobanche/Phelipanche spp. Two of these stimulated only O. foetida, which does not respond to GR24.)


Fernández-Aparicio, M., Emeran, A.A. and Rubiales, D. 2010. Inter-cropping with berseem clover (Trifolium alexandrinum) reduces infection by Orobanche crenata in legumes. Crop Protection 29(8): 867-871. (Indicating a reduction in O. crenata infestation but without any indication of benefit to pea or faba bean.)


Filipowicz, N. and Renner, S.S. 2010. The worldwide holoparasitic Apodanthaceae confidently placed in the Cucurbitales by nuclear and mitochondrial gene trees. BMC Evolutionary Biology 10(219): 48. (Mitochondrial matR and nuclear small-subunit ribosomal DNA sequences were used to address the placement of Apodanthaceae (Apodanthes, Berlinianche, and Pilostyles) among photosynthetic angiosperms. Molecular phylogenetic results support earlier work which placed this family in Cucurbitales.)

Frederick, E.O., Kayode, A.M. and Slyvester, U. 2010. Evaluation of the methanolic extract of mistletoe (Tapianthus bangwensis) leaves grown on orange trees for the phytochemical properties and its physiological effects on streptozotocin induced Diabetes mellitus in laboratory animals. World Applied Sciences Journal 9(9): 975-979. (Concluding that a crude methanolic extract from T. bangwensis leaves have significant anti-diabetic activity, confirming its traditional use for this purpose in Nigeria.)


Furukawa, R. 2010. Potential power of Australian essential oils as an alternative to antibiotics. Aroma Research 11(2): 113-118. (Noting that oil from Australian Santalum spicatum is used as an antibiotic in hospitals. Also noting a difference between this and Indian S. album.)

Galdames, R. and Diaz, J. 2010. Stem rot of branched broomrape (Orobanche ramosa) caused by
Sclerotium rolfsii in Chile. Plant Disease 94(10): 1266. (Recording S. rolfsii on O. ramosa in Chile for the first time, but also noting that it may also damage tomato and is not suitable for biocontrol.)

Galiano, L., Martínez-Vilalta, J. and Lloret, F. 2010. Drought-induced multifactor decline of Scots pine in the Pyrenees and potential vegetation change by the expansion of co-occurring oak species. Ecosystems 13(7): 978-991. (Noting an association between drought damage to pine and occurrence of mistletoe (presumably Viscum album), together with a tendency for increased dominance of Quercus spp.)

Gonzalez, A.M. and Mauseth, J.D. 2010. Morphogenesis is highly aberrant in the vegetative body of the holoparasite Lophophytum leandrii (Balanophoraceae): all typical vegetative organs are absent and many tissues are highly modified. International Journal of Plant Sciences 171(5): 499-508. (Detailed descriptions of the structure (or lack of it) in the tuber of L. leandrii and of the interface with the host Parapiptadenia rigida (Leguminosae).)


Green, E., Samie, A., Obi, C.L., Bessong, P.O. and Ndip, R.N. 2010. Inhibitory properties of selected South African medicinal plants against Mycobacterium tuberculosis. Journal of Ethnopharmacology 130(1): 151-157. (Ximenia caffra was not among the effective species.)

Guo Hui, Mazer, S.J. and Du GuoZhen. 2010. Geographic variation in primary sex allocation per flower within and among 12 species of Pedicularis (Orobanchaceae): proportional male investment increases with elevation. American Journal of Botany 97(8): 1334-1341. (Study across 12 species of Pedicularis in Tibet, suggested that high elevation favoured greater allocation to male parts, possibly associated with decreased plant size)

Guo Hui, Mazer, S.J. and Du GuoZhen. 2010. Geographic variation in seed mass within and among nine species of Pedicularis (Orobanchaceae): effects of elevation, plant size and seed number per fruit. Journal of Ecology (Oxford) 98(5): 1232-1242. (Failing to confirm the previous presumption that seed mass declines at higher elevations on the Tibetan Plateau.)

Haidar, M.A., Gharib, C. and Sleiman, F.T. 2010. Survival of weed seeds subjected to sheep rumen digestion. Weed Research (Oxford) 50(5): 467-471. (Viability of seeds of Cuscuta campestris was very little affected by 4 days in the rumen.)

Hanumantha, M., Gunaga, R.P., Doddabasawa, Biradar, S.S. and Roopa, S.P. 2010. Infestation status of loranthus among teak plantations of Dandeli province of Karnataka, India. Environment and Ecology 28(2B): 1345-1347. (About 20% of trees were infested by unspecified mistletoe. Intensity level tended to increase with greater tree density.)

Hartung, J.S., Paul, C., Achor, D. and Bransky, R.H. 2010. Colonization of dodder, Cuscuta indecora, by ‘Candidatus Liberibacter asiaticus’ and ‘Ca. L. americanus’. Pytopathology 100(8): 756-762. (Studying the colonisation of the dodder itself when C. indecora, was being used to transfer the citrus greening pathogens to other hosts.)


Hosseini, A. 2009. (Investigation the affect rate of oak trees to mistletoe, Loranthus europaeus, in forests of Zagross area: (a case study of southern slope of Manesht mountain in Ilam province.) (in Persian) Iranian Journal of Forest and Range Protection Research 7(1): 26-35. (L. europaeus infested 25% of oak trees and apparently contributed to die back of branches.)

Hsiao ShuChuan, Huang WeiTing and Lin MawSun. 2010. Genetic diversity of Balanophora fengosa and its conservation in Taiwan. Botanical Studies 51(2): 217-222. (Inter-simple sequence repeats (ISSR) were used to address levels of genetic diversity.
among populations of this species from the Hengchum peninsula and Orchid Island in Taiwan. All populations showed a Dice similarity value above 0.78, however, populations from the two regions clustered separately, indicating some genetic diversification that correlates with inflorescence colour.

Huang PanHui, Yu WenBin, Yang JunBo, Wang Hong and Lu Lu. 2010. Isolation and characterization of 13 microsatellite loci from Pedicularis rex (lousewort). HortScience 45(7): 1129-1131. (P. rex is endemic to the Himalayas and of horticultural interest. The study contributes to further investigation of the population genetics, introduction, and acclimatization of P. rex and its congeners.)


Karadžić, D. and Lazarev, V. 2005. (The most significant parasite and saprophyte fungi on mistletoe (Viscum album L.) and possibilities of their usage in bio-control.) (in Serbian) Glasnik Šumarskog Fakulteta, Univerziteta u Banjoj Luci 3: 35-49. (Referring to the ‘large damage’ caused to fir by V. album in Serbia and the possibilities for Botryosphaeria dothidea, Gibberidina visci, Necctria cinnabarina and Sphaeropsis visci as components of integrated control.)

the presence of terminal sclereids in *V. cruciata* and brachysclereids in *K. opuntia*.)

Kim BohKyung, Choi MiJin, Park KunYoung and Cho EunJu 2010. Protective effects of Korean mistletoe lectin on radical-induced oxidative stress. Biological & Pharmaceutical Bulletin 33(7): 1152-1158. (Confirming that extracts from *Viscum album* ssp. coloratum have protective effects against oxidative damage induced by free radicals.)

Kienle, G.S. and Kiene, H. 2010. Influence of *Viscum album* L. (European mistletoe) extracts on quality of life in cancer patients: a systematic review of controlled clinical studies. Integrative Cancer Therapies 99(2): 142-157. (Reviewing 26 published studies and noting 22 of these reported benefits to quality of life from *V. album* preparations (often applied in conjunction with chemotherapy, radiotherapy, or surgery) including improvements in coping, fatigue, sleep, exhaustion, energy, nausea, vomiting, appetite, depression, anxiety, ability to work, and emotional and functional well-being in general. Recommending further exploration of benefits re fatigue.)


Kirmizi, S., Güleryüz, G., Arslan, H. and Sakar, F.S. 2010. Effects of moist chilling, gibberellic acid, and scarification on seed dormancy in the rare endemic *Pedicularis olympica* (Scrophulariaceae). Turkish Journal of Botany 34(3): 225-232. (Germination of *P. olympica*, a rare endemic in Turkey was stimulated by GA and by scarification but not by moist chilling.)


Kuo Yufen, Yang YuChing, Zhang LiJie, Wu MingDer, Kuo, L.M.Y., Kuo YuhChi, Hwang SyhYuan, Chou ChengJen, Lee KuoHsiung, Ho HsiuO and Kuo YaoHaur. 2010. Flavanone and diphenylpropane glycosides and glycosidic acyl esters from *Viscum articulatum*. Journal of Natural Products 73(2): 109-114. (Seven new compounds identified from *V. articulatum*, several with either anti-oxidant or other potentially useful properties.)


Kwaga, Y.M., Olufajo, O.O., Tanimu, B., Shebayan, J.A.Y. and Lagoke, S.T.O. 2010. Effect of herbicide seed treatment on the reaction of groundnut (*Arachis hypogaea* L.) to *Alectra vogelii* (Benth). American-Eurasian Journal of Agricultural and Environmental Science 7(6): 623-627. (Soaking seeds of groundnut in iamzaquin at 0.27 g a.i./l allowed full emergence of *A. vogelii* but increased crop yield, perhaps by delaying attack? Cinosulfuran was not selective.)

Kwaga, Y.M., Olufajo, O.O., Tanimu, B., Shebayan, J.A.Y. and Lagoke, S.T.O. 2010. The reaction of groundnut (*Arachis hypogaea* L.) to *Alectra parasitism*, as influenced by nitrogen and phosphorus fertilization at Samaru, Nigeria. American-Eurasian Journal of Agricultural and Environmental Science 7(6): 628-633. (Emergence of *A. vogelii* was reduced by 25 and 50 kg N/ha but only 50 kg/ha increased crop yield. Yield was also increased by 44 kg P/ha.)

Landrum, J.T., Wang, X.D. and Wurtzel, E.T. (eds). 2010. Special Issue: Carotenoids. Archives of Biochemistry and Biophysics 504(1): 1-168. (This issue of 21 papers discusses the dietary effects, contents and functions of carotenoids in animals and plants. Relevant papers are noted elsewhere in this section.)


Liira, J. and Kohv, K. 2010. Stand characteristics and biodiversity indicators along the productivity gradient in boreal forests: defining a critical set of indicators for the monitoring of habitat nature quality. Plant Biosystems 144(1): 211-220. (Melampyrum pratensis noted as an indicator of disturbance in Estonian forests of Scots pine and Norway spruce.)


Lushaj, B.M., Tabaku, V., Bounous, G. and Beccaro, G.L. 2010. Conversion of old, abandoned chestnut forest into simple coppice and from simple coppice forest into orchards in Tropoja, Albania. Acta Horticulturae 866: 251-258. (Conversion helped to restore the health of chestnut trees suffering from a range of problems including ‘yellow mistletoe’, presumably Loranthus europaeus.)

Lyu SuYun and Park WonBong. 2010. Mistletoe lectin transport by M-cells in follicle-associated epithelium (FAE) and IL-12 secretion in dendritic cells situated below FAE in vitro. Archives of Pharmacal Research 33(9): 1433-1441 (Showing faster transport of lectin isolated from Viscum album var.coloratum across FAE than across Caco-2 monolayer cells - of interest in improving absorption of lectins orally.)


March, W.A. and Watson, D.M. 2010. The contribution of mistletoes to nutrient returns: evidence for a critical role in nutrient cycling. Austral Ecology 35(7): 713-721. (The return of all elements increased with infection of Eucalyptus blakelyi, E. dwyeri, and E. dealbata by Amyema miquelii. because of the combined effect of enrichment in mistletoe tissues and high rates of mistletoe litterfall. Annual returns of N and P in leaf litter increased by a factor of 1.65 and 3 respectively, with the greatest increase being for K by a factor of 43 in spring.)


March, W.A. and Watson, D.M. 2010. The contribution of mistletoes to nutrient returns: evidence for a critical role in nutrient cycling. Austral Ecology 35(7): 713-721. (The return of all elements increased with infection of Eucalyptus blakelyi, E. dwyeri, and E. dealbata by Amyema miquelii. because of the combined effect of enrichment in mistletoe tissues and high rates of mistletoe litterfall. Annual returns of N and P in leaf litter increased by a factor of 1.65 and 3 respectively, with the greatest increase being for K by a factor of 43 in spring.)


Marquardt, E.S. and Pennings, S.C. 2010. Constraints on host use by a parasitic plant. Oecologia 164(1): 177-184. (Discussing the reasons why Cuscuta indecera parasitizes certain species in the glasshouse, but rarely in the wild, due to mismatches in phenology, or plant height (C. indecera prefers tall plants), or because they over-winter on certain perennials and preferentially continue to grow on those.)

Marques, O.M., Sakakibara, A.M., Santana, M.J.S., Carvalho, A.J.de A. and Coutinho, M.L. 2009. (Species of Membracoidea (Insecta: Hemiptera) associated with the mistletoe Struthanthus marginatus (Desr.) Blume (Loranthaceae) in Cruz das Almas, Bahia.) (in Portuguese) Magistra 21(3):
219-221. (12 spp. of Membracoidea identified, 6 being new to Bahia State.)

Mayzlish-Gati, E., LekKala, S.P., Resnick, N., Wingen, S., Chaitali Bhattacharya, Lemcoff, J.H., Kapulnik, Y. and Hinanit Koltai. 2010. Strigolactones are positive regulators of light-harvesting genes in tomato. Journal of Experimental Botany 61(11): 3129-3136. (Results suggest that GR24 treatment interferes with the root’s response to IAA treatment and that strigolactones are potentially positive regulators of light harvesting in plants.)


Menkir, A., Chikoye, D. and Lum, F. 2010. Incorporating an herbicide resistance gene into tropical maize with inherent polygenic resistance to control Striga hermonthica (Del.) Benth. Plant Breeding 129(4): 385-392. (Reporting the incorporation of imidazolinone-resistance genes into maize lines with known Striga resistance. In addition to their use with herbicide seed dressings (with excellent results), they could be used periodically without herbicide to reduce the risk of build-up of herbicide resistance in the Striga.)

Merckx, V., Stöckel, M., Fleischmann, A., Bruns, T.D. and Gebauer, G. 2010. 15N and 13C natural abundance of two mycoheterotrophic and a putative partially mycoheterotrophic species associated with arbuscular mycorrhizal fungi. New Phytopathologist 188(2): 590-596. (Studies involved Dicystega orobanchoides, Burmannia capitata (Burmanniaceae) and Voryia aphylla (Gentianaceae).)


Mohamed, A.H., Housley, T.L. and Ejeta, G. 2010. An in vitro technique for studying specific Striga resistance mechanisms in sorghum. African Journal of Agricultural Research 5(14): 1868-1875. (Describing an ‘Extended Agar Gel Assay (EAGA) by which different mechanisms of Striga resistance can be identified, including reduced germination stimulant, germination inhibitors, reduced haustorial initiation factor, and hypersensitive reaction.)


Morel, A. 2010. (Dieback and the presence of mistletoe in the fir Livradois.) (in French) Forêt-Entreprise 193: 61-64. (Dieback of Abies alba was correlated with altitude and age. Not clear if presence of Viscum album was contributing, but recommendations made for its management.)

Moscatelli, R., Squartini, A., Mariani, P. and Navazio, L. 2010. Flavonoid-induced calcium signalling in Rhizobium leguminosarum bv. viciae. Phytopathologist 188(3): 814-823. (Strigolactones, were not perceived by rhizobia through Ca2+ variations.)


Munodawafa, T., Chagonda, L.S., Viol, I., Muchuweti, M. and Moyo, S.R. 2010. Total phenolic content and antioxidant activity of some Zimbabwean traditional medicinal plants. In: Govil, J.N. and Singh, V.K. (eds) Drug plants III: 363-373. (Phenolic content was relatively high in Ximenia caffra (Olacaceae) but there was poor correlation between phenolic content and antioxidant activity.)

Mwang’ing’o, P.L., Kibodya, G. and Mng’ong’o, A.R. 2010. Oil yield and quality variation between sexes in Osyris lanceolata (African sandalwood) and its value as a fodder plant in Tanzania. Southern Forests: a Journal of Forest Science 72(2): 69-74. (Concluding that the supposed superiority of female trees in oil yield is not true, but there is large variability between trees. Fodder value of the foliage is adequate.)


and Technology 3(1): 021-025. (Including data on *Strombosia pustulata* (Olacaceae).)


Obati, G.O., Karachi, M. and Nyagah, D.M. 2009. The prevalence of epiphytic parasites (mistletoes) on trees in Egerton University. In: Muchiri, M.N., Kamondo, B., Ochieng, D., Tuwei, P. and Wanjiku, J. Recent advances in forestry research for environmental conservation, improved livelihood and economic development. Proceedings of the 4th KEFRI Scientific Conference, KEFRI Headquarters, Muguga, Kenya, 6 to 9 October 2008: 92-98. (*Schinus molle*, *Fraxinus pennsylvanica* and *Acacia mearnsii* were the most infested by mistletoes, and *Polyscias fulva*, Croton megalocarpus and *Spaethoea campanulata* the least. Not clear if individual parasites were identified.)

Ofori, J., Brentuo, B., Mensah, M., Mohammed, A.I. and Boamah-Tawiah, R. 2009. Properties of 10 Ghanaian high density lesser-used-species of importance to bridge construction - Part 1: green moisture content, basic density and shrinkage characteristics. Ghana Journal of Forestry 25: 67-77. (Timber from *Strombosia glaucescens* (Olacaceae) showed moderate shrinkage during drying and would not be ideal for bridge construction.)


Ogbonnanya, A.E., Mounmbegna, E.P. and Monago, C.C. 2010. Effect of ethanolic extract of mistletoe (*Viscum album* L.) leaves on paracetamol-induced hepatotoxicity in rats. Journal of Pharmacy Research 3(8): 1888-1891. (Confirming that an ethanolic extract of *V. album* leaves has an ameliorating effect on paracetamol-induced hepatotoxicity.)


Osadebe, P.O., Omeje, E.O., Nworu, S.C., Esimone, C.O., Uzor, P.F., David, E.K. and Uzoma, J.U. 2010. Antidiabetic principles of *Loranthus micranthus* Linn. parasitic on *Persea americana*. Asian Pacific Journal of Tropical Medicine,3(8): 619-623. (Concluding that the weakly acidic fraction of an extract from the Nigerian mistletoe *L. micranthus* (=?*Tapinanthus globiferus*) has potent antidiabetic activity.) (NB *Loranthus. micranthus* does NOT equate to *Oleostylis micranthus* as previously suggested in this newsletter – your editor failed to check that the latter is a strictly temperate sp. from Australasia. The authors are seeking to clarify its proper nomenclature.)


Öztürk, L. and Demirkan, H. 2010. (The effects of some plants and their leaves in soil on *Phelipanche* ssp. (syn: *Orobanche* ssp.) in potato field.) (in Turkish) Ege Üniversitesi Ziraat Fakültesi Dergisi 47(2): 105-112. (A pot experiment (not field) showing that large additions of fresh faba bean, vetch or oleander leaves reduced infestation of potato by *Phelipanche/Orobanche* sp.)

programme for increasing the cultivation of Santalum austrocaledonicum for heartwood in Vanuatu, using new selected material.)

Page, T., Southwell, I., Russell, M., Tate, H., Tungon, J., Sam, C., Dickinson, G., Robson, K. and Leakey, R.R.B. 2010. Geographic and phenotypic variation in heartwood and essential-oil characters in natural populations of Santalum austrocaledonicum in Vanuatu. Chemistry & Biodiversity 7(8): 1990-2006. (Showing no correlation between heartwood colour and oil quality. See also item by same authors in Haustorium 49.)


Park HongJai, Hong JuHo, Kwon HyungJoon, Kim YoungChan, Lee KwanHee, Kim JongBae and Song, S.K. 2010. TLR4-mediated activation of HAUSTORIUM. Biochemical and Biophysical Research Communications 396(3): 721-725. (Exploring the mechanism by which Viscum album lectin (KML-C) activates systemic and mucosal immune cells to release cytokines including TNF-α, which induces immunity against viruses and cancer cells.)


Peršoh, D., Melcher, M., Flessa, F. and Rambold, G. 2010. First fungal community analyses of endophytic ascomycetes associated with Viscum album ssp. austriacum and its host Pinus sylvestris. Fungal Biology 114(7): 585-596. (Discussing the relative abundance of 208 endophytic fungi in V. album and in P. sylvestris. Similarities were greatest in older tissues, suggesting a decline in defence mechanisms.)


Plakhine, D. and Joel, D.M. 2010. Ecophysiological consideration of Orobanche cumana germination. Helia 33(52): 13-18. (Showing that a conditioning phase is not essential for stimulation of O. cumana germination by GR24 or Nijmegen-1, germination levels being similar after 14 days, regardless of conditioning period.)

Qasem, J.R. 2010. Parasitic flowering plants on cultivated plants in Jordan - the present status and management. Pakistan Journal of Weed Science Research 16(2): 227-239. (Reviewing the occurrence, importance, and local control methods of Orobanche, Cistanche, Cuscuta, Osyris, Thesium, Cynomorium, Viscum and Loranthus spp. in Jordan.)


Rigling, A., Eilmann, B., Koechli, R. and Dobbertin, M. 2010. Geographic and phenotypic variation in heartwood and essential-oil characters in natural populations of Santalum austriacum P. sylvestris and P. sylvestris ssp. for control of Orobanche cumana. Helia 33(52): 13-18. (Showing that a conditioning phase is not essential for stimulation of O. cumana germination by GR24 or Nijmegen-1, germination levels being similar after 14 days, regardless of conditioning period.)


Shavvon, R.S. and Mehrvarz, S.S. 2010. Pollen and seed morphology of the genus Cistanche (Orobanchaceae) in Iran. Biologia (Bratislava) 65(4): 615-620. (Detailed morphological descriptions of pollen and seed are given for each of six Cistanche species.)


Siu HoIing and Ko KamMing 2010. Herba Cistanche extract enhances mitochondrial glutathione status and respiration in rat hearts, with possible induction of uncoupling proteins. Pharmaceutical Biology 48(5): 512-517. (Confirming the effects of extracts of Cistanche deserticola in enhancing mitochondrial ATP generation and protecting against myocardial ischemia/reperfusion (I/R) injury ex vivo in rats.)


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Zhang ZhiHong, Li ChunQi and Li JianHua. 2009. Phylogenetic placement of Cynomorium in Rosales inferred from sequences of the inverted repeat region of the chloroplast genome. Journal of Systematics and Evolution 47(4): 297-304. (Previous molecular phylogenetic work placed Cynomorium sanguinea either in Sapindales (mitochondrial matR and nuclear 18S rDNA) or Saxifragales (mitochondrial atp1 and cox1). This study obtained sequences of the plastid inverted repeat from C. songaricum and parsimony and Bayesian analyses placed the holoparasite in Rosales. Further study is needed to determine the phylogenetic position of this parasite and elucidate the influence of horizontal gene transfer and contamination.)


HAUSTORIUM
Parasitic Plants Newsletter
ISSN 1944-6969
Official Organ of the International Parasitic Plant Society
(http://www.parasiticplants.org/)

July 2011 Number 59

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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

It has been a good summer for IPPS. We had a very successful meeting in the 11th World Congress on Parasitic Plants that took place June 7-12, 2011 in Martina-Franca, Italy. I think all those in attendance would agree that it was an outstanding conference and I’d like to again thank Maurizio Vurro for arranging such an enchanting venue, with great facilities, entertainment, and of course memorable food and wine. Also thanks to Hanan Eizenberg for an engaging program that had both diversity and depth of scientific coverage. Finally, thanks to all attendees (especially the many students) who through their passion for parasites made the conference feel like a big family reunion. If you did not attend, you can find a detailed report of the meeting in this issue, as well as abstracts on the IPPS website (http://www.parasiticplants.org/).

Even with memories of Italy fresh in our minds, it is not too soon to start thinking about our next congress. In summer of 2013 the 12th International Congress on Parasitic Plants will take place in Sheffield, UK. Details will be provided in due time, but add this to your long-range planning. We have absolute confidence in Julie Scholes (Local Organizer) and Koichi Yoneyama (Program Chair) to produce another outstanding IPPS event. For those of you who can’t wait two more years for another occasion to gather to discuss parasitic plants, IPPS is planning a joint symposium with the International Weed Science Society Congress to be held from June 17-22, 2012 in Hangzhou, China. This is a good opportunity for parasitic plant researchers from Asia and the Pacific region to engage with our society without having to travel half way around the world. Look for more details on this on our website in the coming weeks.

The result of the recent IPPS election was reported at the congress in Italy. The new Editor for IPPS is Harro Bouwmeester, and we welcome him to the team. Harro replaces Diego Rubiales who has now completed his term, and we are very grateful to Diego for his years of service and contributions to the society (including Program Chair of the Kusadai, Turkey congress). Any contributions or other ideas you have for Haustorium can now be sent to Harro as well as to Chris Parker (who continues his yeoman’s work on this newsletter).

Those of you who attended the Congress in Italy may have noticed a strange image (shown here) printed on your souvenir bag and materials. This is my humble proposal for an IPPS logo. I have long thought our society needed a logo, but the subject never made it to the top of the priority list. I had occasionally made doodles of various parasitic plants bent into the shapes of IPPS letters, but always ended with a convoluted mess. Then last spring Maurizio asked me about an IPPS logo for the congress materials during a time when I was reading many articles about haustorial anatomy, and I was inspired to create this image. I’m sure it’s based on an actual picture of a cross-section of a haustorium embedded in a host, but I can’t seem to find the right paper again, so perhaps I exaggerated it past the point of recognition. Anyway, I’m still satisfied with it and an informal survey of some IPPS members was positive, so I’m putting it forth as our new logo. I welcome your comments and ideas.

Sincerely,

Jim Westwood, IPPS President
westwood@vt.edu

MEETINGS

The US Witchweed Eradication Effort Turns 50 - A Symposium within the 51st Annual Meeting of the Weed Science Society of America, Portland, Oregon, 7-10 February, 2011.

This one day symposium celebrated the 50-year-long programme devoted to the eradication of Striga asiatica from N. and S. Carolina. Several presentations were retrospective in nature, while others took the opportunity to review new developments in control of this and other parasite groups.

Chris Parker (Bristol, UK) opened with a review of the major parasite groups, emphasising the extent and seriousness of the Striga problem and the wide-scale losses still occurring. Other groups covered were Orobanche spp., Cuscuta spp. and mistletoes, especially Arceuthobium spp.

Al Tasker (USDA/APHIS, Washington DC), Symposium Chairman, then presented the paper by Randy Westbrooks et al. of USDA, describing the history of the witchweed eradication programme since its inception in 1960, and referring to the great contributions this programme has made to the understanding and control of Striga problems elsewhere. Now that the infestation has been reduced to just 5 counties, with the combined use of herbicides, ethylene gas and fumigants, there is emphasis on
continued vigilant monitoring and techniques for eradicating small patches, now made more difficult by the impending total withdrawal of methyl bromide. The following paper by Rick Iverson, representing the N. Carolina Dept. of Agriculture, now responsible for the continuing witchweed programme, described how the programme over 50 years had cost about $250 million, involving up to 250 staff at times, but now down to 6 full-time and 20-25 temporary survey workers. Although only a few hundred acres now show infestation and remain in quarantine, several thousand acres continue to be monitored every 3 weeks for re-infestation and are put back under quarantine when any specimen is found. Surveyors are rewarded $25 for any emerged plant found.

Craig Ramsey (USDA/APHIS, Fort Collins, Colorado) then described the Methods Development Programme for Parasitic Weeds which covers Orobanche spp. and Cuscuta japonica as well as Striga and is looking at a range of herbicide and fumigant options for all groups.

The next paper, presented by Carol Mallory-Smith (Oregon State University, Corvallis) described the occurrence of Orobanche minor in clover crops in Oregon. It was recognised in 15 fields in 2000 and 22 fields in 2001. It was quarantined in 2003 but since then had been down-classified to a class B noxious weed and is no longer subject to survey. It is controlled well by imazamox but in the absence of strict regulation, it has persisted and there is no prospect of eradication. Seed sold for local consumption requires special testing and cleaning.

Hanan Eizenberg (Newe Yaar Research Center, Israel) then described high-tech procedures for the monitoring and control of Orobanche/Phelipanche aegyptiaca in tomato. These involve sophisticated probes placed in the field with below-soil thermometers and video, recording the stage of development of the parasite in order to optimise the timing of herbicide (sulfosulfuron and imazapic) applications, resulting in savings up to 50% in herbicide use. He emphasised how the costs of such technology are falling rapidly as other costs rise.

The afternoon session began with an overview paper presented by Jim Westwood (Virginia Tech, Blacksburg) describing the progress being made in sequencing expressed genes of parasitic species under the collaborative Parasitic Plant Genome Project the results from which are publicly available (go to http://ppgp.huck.psu.edu/). Species included so far are the facultative hemi-parasite Triphysaria versicolor, the obligate hemiparasite Striga hermonthica and the holoparasite Orobanche aegyptiaca. 96% of genes are already accounted for, including the unexpected finding of a full range of chlorophyll synthesis genes in O. aegyptiaca, and also evidence that obligate parasites may produce their own strigolactones. Examples such as this suggest that alterations in gene expression have been more important in the evolution of parasitism than gene gain or loss.

Mike Timko (University of Virginia, Charlottesville) reported on the latest results from studies on the race-specific resistance of cowpea to Striga gesnerioides. The dominant resistance genes for each of the 7 known races of S. gesnerioides have been located, not all on the same chromosome, together with useful molecular markers. The anomalous behaviour of the Zakota race of S. gesnerioides in Benin, which is virulent on cowpea B301 suggests a very recent genetic adaptation of the parasite. The results were discussed in relation to their value in understanding the resistance processes in other Striga and Orobanche species.

Radi Aly (Newe Yaar Research Center, Israel) described a biotechnological approach to control of Orobanche aegyptiaca via the generation of transgenic tobacco plants expressing a cecropin peptide (sarcotoxin IA), under the control of the inducible HMG2 promoter. Transgenic lines showed enhanced host resistance (causing abortion of parasite attachments) and increased host biomass. Sarcotoxin IA had no obvious effect on the host plants. Another approach involves the silencing of genes in the parasite responsible for regulating the generation of mannose, resulting in abortion of many parasite nodules.

Joel Ransom (North Dakota State University, Fargo) reported on the latest experiences with imazapic and pyrithiobac applied to seed of imidazolinone-resistant maize for control of Striga spp. in East Africa. There have been widespread trials with farmers, but some instances of poor results due to wet (or dry) conditions. A build-up of herbicide-resistance in the Striga is estimated to be unlikely but precautions are suggested.

Discussing Cuscuta spp. and their control, Tom Lanini (University of California, Davis) referred to the recent occurrences of the exotic C. japonica apparently being imported as an herbal remedy and escaping or being deliberately planted at a number of sites in California. Fortunately, to date no flowering or seeding has been observed. He then reviewed the range of approaches needed for control of Cuscuta species in a wide range of crops, including the use of biocontrol with Alternaria destruens on C. gronovii in cranberry, and the use of glyphosate on C. campestris in ‘Round-up Ready’ alfalfa.
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Papers presented (with abstract number):

Chris Parker - Parasitic weeds - a world challenge. (218)
Randy Webstrosks et al. - Overview of methods development support for the USDA-Carolinas witchweed eradication program - 1959-1995. (219)
Rick Iverson - Current eradication program for the witchweed infestation in the US. (220)
Craig Ramsey - Current parasitic weed control methods development efforts in the US. (221)
Carol Mallory-Smith - Orobanche minor and the 3 R's: regulation, research, and reality. (222)
Hanan Eizenberg - Technologies for precision control of Orobanche. (223)
Jim Westwood - The Parasitic Plant Genome Project: new tools for understanding the biology of Orobanche and Striga. (256)
Mike Timko - Race-specific host resistance to Striga - New insights into an old foe. (257)
Rudi Aly - Biotechnological approaches to parasitic weed control. (258)
Joel Ransom et al. - Control of Striga using IR-maize: a success story – how long will it last? (259)
Tom Lanini - Current approaches to control of Cuscuta. (260)

Relevant posters were:

Andersen, L.C., et al. – The significance of sorghum root exudates on the germination of the parasitic weed, Striga hermonthica. (91)
Sandler, H.A. and Ghantous, K.M. – Economics of using hand-held flame cultivators for weed management in cranberry. (142)

Most of these oral presentations are being prepared for publication in Weed Science. Meanwhile full abstracts of the meeting are available on the WSSA website - http://wssaabstracts.com/public/4/proceedings.html

Chris Parker and Jim Westwood.

ELEVENTH WORLD CONGRESS ON PARASITIC PLANTS, MARTINA FRANCA, ITALY, 7-12 JUNE 2011

Strigolactones and genomics were the key words at this exceptional meeting held in the understated elegance of the Park Hotel San Michele in Martina Franca in the scenic Puglia region of Italy.

After welcomes from Dr Angelo Visconti, the head of the Institute of Sciences of Food Production and Jim Westwood, President of IPPS, the opening plenary lecture was given by Koichi Yoneyama with a helpful overview of strigolactone research reporting that all angiosperms studied produce strigolactones as well as a moss and liverwort indicating how ancient and widespread this plant hormone is. Fungal rhizoid recognition and elongation are among the effects of strigolactones. High phosphorus inhibits strigolactone production, as mentioned by several speakers.

Parasitic plant genomic research completed the remainder of the first morning of the meeting with a report on lateral gene transfer to Striga hermonthica from its sorghum host by Satoko Yoshida and plans to complete a full genomic sequence of S. asiatica. Also dealing with lateral gene transfer was the paper by Leblanc and others on movement of host mRNA to Cuscuta. One of three Hydnora papers at the congress, Julia Naumann’s is the first to deal with the genome of that bizarre plant showing once again transfer of genetic material from host to parasite. Several papers from the Parasitic Plant Genome Project were reported including that by Jim Westwood who gave an overview of the project and Loren Honaas who described their work on haustorial microdissection and the transcriptome of Triphysaria. Claude DePamphilis continued this theme with data from the same project on studies in Phelipanche aegyptiaca showing that no genes for light harvesting were found while, inexplicably, genes for some aspects of chlorophyll synthesis were present. Lateral gene transfer was reported as well as genes for producing strigolactones in the parasite. Both Guangda Liu and Gunjune Kim discussed movement of genetic material between host and parasite. Liu studied Cynomorium songaricum and Nitraria tangutorum the first report of this kind in this genus. Kim reported massive movement of mRNA from tomato and Arabidopsis hosts to Cuscuta pentagona. John Yoder concluded the morning session reporting research on the genetic basis of haustorial development.

The afternoon of the first day dealt with parasitic plant biology and included information on the floral biology of Hydnora abyssinica by Erika Maass and colleagues, a review of the genus Orobanche in turkey using seed micro-morphology by Golshan Zare and colleagues, showing good delineation of sections within the genus but less success in separating species, and germination studies on Orobanche minor and the role of gentianose and GR24 by Atushi Ozakawa. Alastair Murdoch spoke of models of germination for Striga hermonthica that take into account dormancy and mortality. A detailed study of the early stages of haustorial attachment and penetration of Orobanche crenata on garden pea by Alejandro Pérez-de-Luque showed that penetration occurred 4 days after inoculation and that the vascular
tissue was invaded at 12 days. Mustapha Haidar showed that blue light stimulates coiling and haustorial development in *Cuscuta* and is related to the induction of Ca and a decrease in H⁺ flux. A third *Cuscuta* paper, by Furushashi and colleagues, dealt with seedling proteins of *Cuscuta japonica* attached to different hosts but there was little difference between seedlings attached to hosts and unattached. The only paper dealing with the Apodanthaceae reported on the peculiar sex ratios in *Pilostyles ulei* and *P. thurberi* in Brazil. In the same paper Ceccantini presented the first record of diclinous flowers (flowers with both sexes) in the genus. Anatomy of *Phelipanche ramosa* was the emphasis of a paper by A. Stepowska. One of the few mistletoe papers at the Congress, presented by V. Barão showed that wood of *Tipuana tipu* (Fabaceae) had increased embolisms in its vessels when parasitized by *Struthanthus vulgaris*. A second mistletoe paper by Sugwang Lee discussed the host range and host selection of *Loranthus tanakae* in South Korea with 85% of hosts being species of *Quercus*. Dan Nickrent stimulated discussion with his ideas about atavism (reversion) in the largest group of parasites, the Santalales, which he has investigated for many years, suggesting that characters once lost in evolution may reappear. One paper on hemi-parasites was given by James Fisher showing the complex interactions of *Rhinanthus minor* in an English grassland indicating that the nutrient-enriched litter of the parasite benefits the host by providing nutrients.

The first meeting of the second day returned us to the subject of Recent Advances in Strigolactone Research with a helpful plenary lecture by Hananit Koltai. She reviewed the numerous functions of these compounds in plants. In a similar vein but with much more chemistry was the review by Cristina Prandi. In yet another new function of strigolactones, Yoram Kapulnik reported that they have the ability to induce light harvesting complexes in tomato. Continuing to expand our appreciation of these virtually ubiquitous compounds, Evgenya Dor and colleagues studied the impact of strigolactones on phytopathogenic fungi suggesting that these chemicals are ancient and perhaps evolved as a defence to fungal pathogens. Carolien Ruyter-Spira discussed the role of strigolactones in the adaptation of root architecture of plants under low phosphate conditions. Reporting on ongoing research, Hidemitsu Nakamura discussed the interaction of strigolactone signaling mechanisms in parasitic plants. Closing this second session of the symposium was a talk by Kaori Yoneyama on relationships between strigolactones and other plant hormones indicating that P fertilizers inhibit strigolactone production and that auxin is required for its production.

Ecology and Population Biology was the next session with the first paper by Mohamed Kamal suggesting that topography in Ethiopia is responsible for population differentiation in *Striga hermonthica* by isolating cross pollination in this outbreeder. The third and final paper on *Hydnora* was by Lytton Musselman who reviewed recent research on the genus in southern Africa and Madagascar showing that the Malagasy endemic *Hydnora esculentula* is not dioecious but has the basic flower structure of the genus. The native *Orobanche cernua* from Spain was analyzed from several populations by Leonardo Valesco and co-workers who found high genetic diversity between populations. Mat Yunoh Siti-Munirah charmed those in attendance with her beautifully illustrated talk on *Rafflesia* in Malaysia, its diversity and efforts to conserve it. A unique approach to *Orobanche* evolution and relationships was presented by Peter Tóth who examined the volatile compounds produced by cut flowering stems of European broomrapes. Hans-Christian Weber reviewed the parasitic plants of Malta along with consideration of terms used in the descriptive morphology of parasites.

In the session Host-Parasite Communication, Radi Aly showed functional phloem tissue in the haustorium of *Phelipanche aegyptiaca* as well as gene silencing of the parasite gene M6PR by RNAi constructs expressed in the host. *P. ramosa* is a fairly recent but increasing problem on winter oilseed (*Brassica napus*) in France. Zachary Gaudin reported considerable differences between two oilseed cultivars in their responses to the parasite. Further research on the oilseed rape problem was given by Philippe Simier who reported that germination was largely stimulated by isocyothyanates rather than strigolactones. Following on a similar theme Danny Joel showed that the germination stimulant of *Orobanche cumana* is dehydrocostus lactone rather than a strigolactone. Muhammad Jamal confirmed the long standing observation that increased N and P in the soil suppresses *Striga* which can now be attributed, at least in part, to a suppressed strigolactone production.

In a special session dedicated to control of parasitic weeds, arranged by the European Weed Research Society Working Group on Parasitic Weeds, Nadja Zermane presented preliminary results on the possible use of extracts of several Mediterranean plants as natural herbicides to control early growth stages of field dodder and broomrapes; Alistair Murdoch presented and discussed pros and cons of use of the *Desmodium* ‘push-pull’ strategy, developed for *Striga* control in Africa, against *Phelipanche ramosa* and *Orobanche crenata*. Alpha Kamara showed results on the use of nitrogen fertilizers and resistant varieties to reduce *Striga* infestation and damage. Sarah Hearne reviewed the numerous control methods for *Striga* adopted,
proposed and in development, at the International Institute of Tropical Agriculture (IITA), and how their scientists work with international and national scientists, agribusiness, farmers and extension agents to combine strategies in order to provide durable management solutions.

Considering that during the initial stages of parasitism the broomrapes grow underground, predicting their developmental stages is a necessity in order to properly apply control measures. Hanan Eizenberg showed how the modelling approach and suitable mathematical functions, if properly used, could be helpful for such predictions and then be important support tools for designing management strategies.

The last morning began, appropriately, with a final session on strigolactones. Binne Zwanenburg discussed the chemistry of strigolactones and the production of new analogs using ketones and keto enols and emphasized the role of stereochemistry in their activity. Yukihiro Sugimoto presented complementary data showing the importance of stereochemistry of stimulants on the germination of Striga gesnerioides. Shinsaku Ito showed how gibberellins inhibit strigolactone production. Another paper, by Kosuke Fukui, dealt with chemistry of the strigolactones looking for mimics that could be inexpensively produced for control of parasitic weeds. The role of strigolactone in rice plant morphology, including suppression of tillering in rice, was reported by Rodrigo Echegoyen-Nava. Phtheirospermum japonicum is a hemiparasite in the Orobanchaceae and is used as a model organism for parasitism studies; Julia Ishida gave a detailed account of transcriptome events in the development of the haustorium with more than 1500 genes.

Crop Resistance to Parasitic Weeds and Crop Breeding was next, continuing a theme at every parasitic plant meeting with attempts to produce crops that can ameliorate the impact of parasites. Mamadou Cissoko reviewed work in West Africa to find suitable varieties of rice against Striga asiatica and S. hermonthica and reported some encouraging results. Another paper dealing with S. hermonthica, this time in maize in Kenya, by Haron Karaya, discussed breeding experiments. The other papers in this session all dealt with Orobanche or Phelipanche. Joseph Hershenhorn has developed a tomato mutant, HRT-1, with promising resistance to herbicides used to control P. aegyptiaca. The floral biology of Orobanche cumana and its relationship to genetic interchange was presented by Leonardo Velasco with preliminary data suggesting some allogamy. Recently, P. aegyptiaca has become a problem on capsicum peppers grown in greenhouses in Israel. Yaakov Goldwasser discussed this development, reporting a wide range of susceptibility of pepper cultivars. Johann Louarn, in preliminary data, showed that roots of sunflowers with arbuscular mychorrhizal fungi reduce germination of Orobanche cumana compared with non-mychorrhizal roots.

As genomics has revealed so much about parasite biology and evolution, there was a presentation on using the free data available from the various genomic projects.

The final session of a congress packed with informative, well-presented papers ended with the broad topic of Interactions between Parasitic Plants and the Environment—taking us from the strigolactone molecules to the biosphere. Ahmet Uludag reviewed the data known about the potential spread of parasites with global warming and how this might affect their biology and impact. Less global was the talk by Jonne Rodenburg on a new integrated rice project in Africa involving agronomy as well as economic and cultural factors. The role of date of sowing on parasitism of carrot by P. aegyptiaca in Israel was shown by Amnon Cochavi to favor a late summer sowing. This species, as well as P. ramosa, affects tobacco production in Greece and Garafalia Economou studied the interactions of a range of edaphic factors and concluding that humidity, pH, and organic matter had the strongest correlation with broomrape infestation. Lastly, Tuvia Yacooby reported weedy species of Malvaceae as hosts of Phelipanche aegyptiaca in Israel.

In summary, the majority of the papers dealt with Striga and Orobanche/Phelipanche as usual at these meetings. There were some papers on Cuscuta and mistletoes, though limited to two genera, as well as three on Hydnora, and one each on Rafflesiaeaceae, Cynomoriaceae, and Apodanthaceae but nothing on Cassytha or Balanophoraceae During the meeting a plea was made for more research on mistletoes.

The amount of new information presented at this meeting and its impact upon our discipline is staggering. It is difficult to convey the interest and enthusiasm of the participants at these long and intense meetings. Particularly impressive were the presentations by students, many giving papers for the first time in a foreign language to a group of specialists. The country with the most attendees was Japan, followed by Israel. Special arrangements were made at this congress to recognize and encourage these students with the awarding of prizes for best posters and best presentations. There was a three-way tie for first place for oral presentations by Rodrigo Echegoyen-Naya (Univ. of Sheffield), Kosuke Fukui (Univ. of Tokyo)
and Gunjune Kim (Virginia Tech.). First place winner for best poster was Megan LeBlanc (Virginia Tech.) with Hadas Miryamchik (Israel) receiving honorable mention. All winners received cash prizes and a copy of the book, Integrating New Technologies for Striga Control: Towards Ending the Witch-hunt (G. Ejeta and J. Gressel, eds.).

Perhaps the most poignant moment at the meeting was in the final session when Klaus Wegmann asked to address the company telling us that he was terminally ill and that this would be his last parasitic congress but that, despite his obvious frailty, he wanted to attend. The response was a standing ovation from his colleagues. (Klaus Wegmann sadly died on 7th July. See Obituary below.)

The scientific content of the meetings was outstanding and it was especially encouraging to see so many young people giving papers for the first time, including an undergraduate. Program organizer Hanan Eizenberg and his committee did a great job to bring this together. The social program was no less impressive with a baroque music concert Tuesday evening in the city cathedral, an elegant dinner in a nearby town, and a visit to the spectacular Grotti di Castellana, a botanical garden tour at Monopoli, and a visit to the characteristic trulli houses in the town of Alberobello. Exceptional food three times a day punctuated with regular refreshment breaks were provided.

All in attendance would heartily agree that the efforts of Maurizio Vurro were exemplary. Every detail was attended to from meeting at the airport, maintenance of the data projector, hosting excursions, and so much more was handled by Maurizio and his staff with aplomb and alacrity.

A limited number of booklets containing all the abstracts is available on request from Maurizio Vurro (maurizio.vurro@ispa.cnr.it). Otherwise, abstracts are available on the IPPS website (http://www.parasiticplants.org/default.asp)

The presentations were:

- Koichi YONEYAMA - How many strigolactones do plants produce?
- Satoko YOSHIDA - Large-scale sequencing analysis of Striga species.
- Jim WESTWOOD and Claude DEPAMPHILIS - The parasitic plant genome project: a massive EST sequencing project for the Orobancheaceae.
- Julia NAUMANN - The Hydnora transcriptome project - first genomic insights into the ‘strangest plant in the world’.
- Loren HONAAS - Functional genomics of a generalist parasitic plant.
- Guangda LIU - Horizontal gene transfer between the parasitic plant Cynomorium songaricum Rupr. and its host Nitraria tangutorum Bobr.
- Gunjune KIM - Genomics approaches to understanding mRNA movement between hosts and parasites.
- John YODER - Parasitic plant genes necessary for haustorium development.
- Golshan ZARE - Micromorphological studies on seed of Orobanche L. (Orobanchaceae) species from Turkey, and their systematic significance.
- Atsushi OZAKAWA - Sugar metabolism during germination of Orobanche minor as a novel target for selective control.
- Alistair MURDOCH - Comparison of multiplicative and sequential models of dormancy and germination of Striga hermonthica.
- Alejandro PÉREZ DE LUQUE - Creno broomrape invasion of pea root: a histological time lapse study.
- Mustapha HAIDAR - Histological studies on the haustorium of Cuscuta campestris Yuncker.
- Takeshi FURUHASHI - Comparative analysis of seedling proteins of Cuscuta japonica attached to different hosts.
- Gregorio CECCANTINI - Skewed “sex ratios” in the peculiar holoparasite Pilostyles (Apodanthaceae – Cucurbitales).
- Anna STEPOWSKA - Morphological response of the tomato (Lycopersicon esculentum Mill.) to parasitic plants – Phelipanche ramosa L. Pomel and pathogen – Oidium neolycopersici L. Kiss.
- Vitor BARÃO - Modifications in wood hydraulic conductivity and embolism increase in Tipuana tipu parasitized by Struthanthus vulgaris.
- James FISHER - Redistributing the wealth: interactions between plant parasitism and parasite litter in seminatural grassland communities.
- Sugwang LEE - Distribution, characteristics and host specificity of Loranthus tanakae in South Korea.
- Daniel NICKRENT - Santalales phylogeny prompts new insights into morphological character evolution.
- Hinanit KOLTAI - Strigolactones’ multiple roles in plant development.
- Cristina PRANDI - New potent fluorescent analogues of strigolactones: synthesis and biological activity in parasitic weed germination and hyphal branching in AM fungi.
- Yoram KAPULNIK - Strigolactone substances stimulate different gene expression of tomato light
NEW PHYTOLOGIST RECOGNISES RECENT ADVANCES IN MYCOHETEROTROPHY RESEARCH

Mycoheterotrophic plants are defined by their reliance on carbon derived from their fungal symbionts at some point in their lifecycle (Leake 1994); this is usually at the germination life stage (initial mycoheterotrophy) where the plant produces seeds that are so small and lacking in seed reserves that they are unable to germinate in the absence of a fungal partner. Most initial mycoheterotrophs, including the majority of orchids, then form green photosynthetic shoots as adult plants, where their symbiosis with a fungal partner reverts to a mutualistic, mycorrhizal association, characterised by carbon for nutrient exchange between plant and fungal partners. A subset of these green plants however (partial mycoheterotrophs), never engage in a mutualistic association, continuing to parasitise fungi for carbon and nutrients throughout their life (Cameron and Bolin 2010; Julou et al. 2005; Gebauer and Meyer 2003). Finally, some mycoheterotrophs never photosynthesise and so are parasitic on their fungal partners through their life cycle (Leake 1994).

Corallorhiza trifida, Germany, 2008

The source of carbon for fungi parasitised by mycoheterotrophic plants falls into two distinct categories; firstly, mycoheterotrophs that form associations with fungi which gain their carbon saprotrophically from organic matter and secondly, from fungi that obtain their carbon through mutualistic mycorrhizal symbioses with other autotrophic plants and are thus in tripartite symbiosis with the mycoheterotroph connected to an autotrophic plant through a shared fungal network (Bidartondo et al. 2004). These plants are referred to as epiparasites in recognition of their indirect parasitism of other plants.

Since initial research into plants that parasitise fungi (see Kujit 1969) and the first use of the term ‘mycoheterotrophy’ nearly 18 years ago (Leake 1994), research into this form of plant parasitism has lagged behind allied research into the ecology and physiology of haustorial parasitical plants. This said, rapid advances have been made over the last few years, substantially expanding our understanding of the ecology, physiology and evolution of the c. 10% of plant species that are mycoheterotrophic at some point during their life.

In recognition of these recent developments, the New Phytologist commissioned a ‘virtual special issue’ (http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291469-8137/homepage/virtual_special_issue_on_mycoheterotrophy.htm) edited by Marc-Andre Selosse (Montpellier, France) and Duncan Cameron (Sheffield, UK) to draw together the advances in mycoheterotrophy research previously published in the journal into an online-only edition which aimed to provide a state-of-the-art in addition to signposting earlier research. This took the form of an editorial and three newly commissioned letters from experts in the field, published in print discussing ‘Fungal hosts for mycoheterotrophic plants: a nonexclusive, but highly selective club’ (Hynson and Bruns 2010), ‘Physiological ecology of mycoheterotrophy’ (Leake and Cameron 2010) and ‘Evolution of mycoheterotrophy in plants: a phylogenetic perspective’ (Merckx and Freudenstein 2010).

The last 20 years of research focusing on the emergent field of mycoheterotrophy has revealed it to be the most common form of plant parasitism (Leake and Cameron 2010) highlighting that full mycoheterotrophy has more than twice the number of evolutionary origins compared with haustoria-forming holoparasitic plants (Watson 2009; Merckx and Freudenstein 2010), and occurs in a much wider phylogenetic range of species, spanning from liverworts and basal ferns through dicotyledons and monocotyledons, culminating in the Orchidaceae, the largest family of flowering plants (Leake 1994). However, other aspects, especially of mycoheterotroph physiology are less well resolved. For example, whilst the metabolite fluxes into plant haustorial parasites and the mechanisms driving these fluxes are increasingly well understood (Shen et al. 2006), the metabolic basis of mycoheterotrophy is yet to be elucidated. While the mechanisms underpinning resource abstraction by haustorial parasitises is distinct from that of mycoheterotrophs, striking, convergent morphological and physiological traits are shared by both groups of plant parasites. Morphological and physiological convergence takes the form of highly reduced root
networks and the reduction of leaves to scales or foliose bracts (e.g. the orchids Neottia and Corallorhiza), the production of minute seeds dependent on host signals for germination (e.g. most orchids and mycoheterotrophic gentians) and the production of little or no chlorophyll. Indeed, as a result of such convergence, the mycoheterotroph Monotropa hypopitys (Monotropaceae) was considered to be an Orobanche before being accurately described by Linnaeus in 1753 (Leake 1994)!

In summary, research into the fundamental biology of mycoheterotrophic plants has rapidly expanded, revealing mycoheterotrophs as powerful models for understanding the evolution of achlorophylly to be paralleled with haustorial parasitic plants that feed directly on the vascular system of other plants (Selsosse and Cameron 2010). Using this comparative approach, many overlooked traits of mycoheterotrophs, including the evolution of plastid genomes or reproductive biology can now be resolved.

**References:**


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**A NEW $9 MILLION STRIGA PROJECT IS SUPPORTED BY A $6.75 MILLION GRANT FROM THE BILL AND MELINDA GATES FOUNDATION TO IITA**

The fight against Striga is being given a great boost as a result of new funding from the Bill and Melinda Gates Foundation. See first two Press Reports below.

**PRESS RELEASES/REPORTS**

Researchers and farmers begin effort to reduce crop loss from parasitic witchweed attacking Africa’s staple crops.

New project to generate an additional US$8.6 million annually, 50% higher yields for farmers across Kenya and Nigeria.

Scientists based in Nigeria and Kenya have begun a major push against parasitic weeds that have spread across much of sub-Saharan Africa, causing up to US$1.2 billion in damage every year to the maize and cowpea crops of tens of millions of small farmers.

The project, coordinated by the Nigeria-based International Institute of Tropical Agriculture (IITA), will introduce proven technologies for fighting Striga, or witchweed, and Alecta. Known by some as the ‘violet vampire’ because of its bright purple color, Striga attaches itself to the roots of plants like maize...
and cowpea and sucks out nutrients, reducing yields and destroying entire harvests. Witchweed primarily affects smallholder farmers who can’t afford costly herbicides for fighting the parasitic plant. The most widespread Striga species is estimated to have infested up to 4 million hectares of land under maize production in sub-Saharan Africa, causing yield losses of up to 80 percent. According to researchers at IITA, this represents up to $1.2 billion in losses for farmers and affects approximately 100 million people in sub-Saharan Africa. The parasitic weeds have spread widely in Africa in recent decades; their prolific seeds germinate in response to substances released by the roots of crop plants. Because crop plants have more difficulty competing with witchweed in poor soils, intensive farming and the expansion of farming into marginal soils have encouraged their spread. Furthermore, witchweed is difficult to control because each plant produces up to half a million seeds that can remain dormant in the soil for decades. ‘Africa is plagued by a plant ‘vampire’ that robs farmers of their harvest,’ said Hartmann, IITA director general. ‘Dedicated pursuit by farmers and researchers is delivering several ways to fight the parasite.’ The $9.0 million Striga project is supported by a $6.75 million grant from the Bill & Melinda Gates Foundation to IITA. Its goal is to help 200,000 maize farmers and 50,000 cowpea farmers who work in areas with high rates of Striga infestation in Kenya and Nigeria. By project’s end in 2014, organizers estimate that over 250,000 individual farmers will potentially see up to 50% higher maize yields and 100% higher cowpea yields.

The four-year project will focus on improving and expanding access to methods of Striga control, while supporting research to identify the most effective means of controlling the parasitic weed under varying conditions. The project will evaluate and implement four approaches: using Striga-resistant crop varieties; using a ‘push-pull’ technology that involves intercropping with specific forage legumes that inhibit the germination of Striga; using herbicide-coated seeds; and deploying biocontrol of Striga. After a two-year evaluation period, the project will scale up the most effective approaches.

Project partners include the International Maize and Wheat Improvement Center (www.cimmyt.org), African Agricultural Technology Foundation (www.aatf-africa.org), International Centre of Insect Physiology and Ecology (www.icipe.org), and BASF Crop Protection. Scientists expect that the integrated witchweed control interventions will generate an estimated $8.6 million worth of additional grain (maize and legumes) annually at the project locations—resulting in increased incomes, better nutrition, and reduced poverty, as well as employment opportunities from grain production to food markets.

The project will work with farmers, seed companies, community-based organizations, extension workers, policymakers, and researchers. In pilot areas, it will supply witchweed-resistant maize and legume seed and chemically treated seed to private seed companies and community-based seed producers for production and distribution. ‘Most farmers in the Striga Project target areas are highly resource-poor. The Project aims to integrate delivery of Striga-resistant maize and legume seeds with best-bet agronomic technologies to fight the weed menace, while raising farmers’ awareness of the technologies, and supporting community-based organizations with technical assistance,’ said Prasanna Boddupalli, director of the Global Maize Program of CIMMYT, based in Nairobi, Kenya.

The project will also research new management techniques such as use of a biological control method. Biocontrol can help maintain the balance of nature, support biodiversity, and sustain complex and beneficial ecological interactions.

In addition, the project will provide lessons and strategies for scaling up in other areas of sub-Saharan Africa, where witchweed is a major problem for maize and cowpea production. The project will also generate scientific data on the biology of witchweed, including the plant’s relationship with different hosts and methods for rapid screening for resistance to the weed in maize and other crops. Each of the approaches to control Striga holds promise, especially when two or more options are employed at the same time. For example, in West Africa, IITA and partners have tested the combined use of Striga-resistant maize varieties in rotation with legumes that cause witchweed seeds to germinate but fail to latch on to the host. This approach increased crop productivity by an average of 88 percent. In East Africa, ICPE and partners have developed a novel cropping system, known as ‘push-pull.’ It is an environmentally-friendly, economical approach that inhibits witchweed, and attracts insect pests to trap plants (pull) while driving them away from the main crop using a repellent intercrop (push).

‘Increased uncertainty about the continent’s vulnerability to climate change and its spin-off effects on parasitic weeds like Striga have created more demand for ‘push-pull.’ Farmers need more weapons in the fight against these threats,’ said Christian Borgemeister, director general of ICPE. ‘Our partnership is a good example of donors and researchers responding to the needs of farmers by enabling their
ability to withstand the increasingly adverse and highly-variable weather and other constraints at the farm level. Approximately 80 percent of the population in sub-Saharan Africa depends on agriculture for food, income, and employment. However, average yields of maize and cowpea are very low. Approximately 300 million people live below the poverty line in the region, and in rural areas, roughly half the population encounters hunger and malnutrition.

IITA, Nairobi, Kenya 31 May 2011.

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Experts in drive to save farmers from weeds
(abbreviated)

Scientists in Nigeria and Kenya have started a major war against parasitic weeds that cost small scale farmers in Sub-Saharan Africa $1.2 billion in harvests every year, aggravating food deficits. An initiative coordinated by the Nigeria-based International Institute of Tropical Agriculture (IITA), will introduce new methods for fighting *Striga*, or witchweed, and *Alectra*.

Kenya is among the countries expected to benefit from the $9 million *Striga* project. The Bill and Melinda Gates Foundation has given IITA $6.75 million as part of a campaign to help 200,000 maize farmers and 50,000 cowpea farmers raise yields by 50 per cent and 100 per cent, respectively. The four-year project aims to improve and expand access to methods of *Striga* control including using a ‘push-pull’ technology that involves intercropping with legumes that inhibit the germination of *Striga*, using herbicide-coated seeds and deploying bio-control of *Striga*.

Scientists expect that the integrated witchweed control interventions will generate an estimated $8.6 million worth of additional grain (maize and legumes) increasing incomes, improving nutrition and reducing poverty. ‘The project aims to raise farmers’ awareness of the technologies, and supporting community-based organisations with technical assistance,’ said Prasanna Boddupalli, director of the Global Maize Programme based in Nairobi. About 80 per cent of the population in sub-Saharan Africa depends on agriculture for food, income, and employment.

Business Daily 01 June 2011. mndurya@ke.nationmedia.com

New approaches to an old technology prepare farmers in readiness to the impacts of climate change.

Extracts from a much longer item by Henry Neondo in Africa Science News 1 April, 2011.

It is a relatively old technology whose usefulness was until recently confined to few farming households in western Kenyan districts around Lake Victoria. Now however, push-pull, a novel farming system developed by ICIPE, Rothamsted Research (UK) and national partners in East Africa, is raising interests from beyond Kenya’s borders and scientists think it holds the key to unravelling challenges climate change portends to farmers in drier parts of sub-Saharan Africa. ICIPE Director General, Prof. Christian Borgemeister says stemborers, parasitic *Striga* weeds and poor soil fertility are the three main constraints to efficient production of cereals in most sub-Saharan Africa.

Since being founded in 1997, the push-pull technology has so far helped close to 40,000 farmers. ‘But time to move it to other ecological zones is now’, said Prof Christian. ‘In the past 17 years, farmers that have adopted the technology have seen maize yields increase between one ton to 3.5 tonnes per hectare with minimal inputs. This action has improved the food security for close to 250,000 people in the region’. ‘Push-pull’ simultaneously addresses the major constraints of cereal-based farming system, which include striga weeds, stemborer pests and poor soil fertility. The technology also provides high quality animal fodder. Because of its ability to expand small-farm incomes, Push-Pull is being promoted by the public sector, private sector and farmer groups across Eastern Africa through what has come to be known as Farmer Field Schools (FFS).

The Farmer Field Schools approach relies on ‘learning by doing’ through participatory ecological field studies that are undertaken by farmers, government extension services, researchers, NGOs and community-based organizations studying together. According to Maurice Emuria, an agricultural officer with Kenya’s Ministry of Agriculture, FFS is one of the extension approaches but with a difference. ‘Unlike conventional extension, FFS aims to make a farmer an expert in his or her own farm,’ he says. First developed by the UN Food and Agriculture Organization in Indonesia, the FFS approach is being used to disseminate Push-Pull training through 51 intensive weekly sessions that cover two growing seasons. ICIPE expanded the Push-Pull curriculum into western Kenya’s Bungoma District in March 2007. There are now 265 farmer field schools in
Bungoma County with about 8,000 farmers being members and 18 FFS in nine other counties in western Kenya.

ICIPE now has a target to extend the benefits of ‘push-pull’ to over one million people by 2020. To help realize this, ICIPE Wednesday launched a project known as ADOPT – the Adaptation and Dissemination of the ‘Push-Pull’ Technology to Climate Change. The initiative will directly benefit 50,000 smallholder cereal-livestock farmers. It will also improve food availability for half a million people living in areas that are dry and vulnerable to climate change in Kenya, Tanzania and Ethiopia.

Uganda: regional scientists develop quick-growing, weed-resistant sorghum

Scientists from the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) through a project ‘Fighting Striga: resistance genes deployed to boost sorghum productivity’ have developed a sorghum which is resistant to the Striga weed and can mature within two months. The breakthrough was a result of research carried out to build upon an earlier project with the aim of utilising modern biotechnology tools to identify traits for Striga-resistant sorghum. Dr. Charles Mugoya, who heads ASARECA’s Agro-Biodiversity and Biotechnology Programme (AGROBIO), says they developed 50 sorghum lines capable of 3.6 tonnes grain yield per hectare. This was done together with partner institutions in Sudan, Kenya and Eritrea and the technical support of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). ‘There is a potential of raising sorghum production to 61.2 million tonnes on 17 million hectares of farmland that are threatened due to Striga infestation. The 300 million people in Africa who depend on sorghum will attain food security and lead better lives,’ he said.

Though the current sorghum varieties have a yield potential of 4.5 tonnes per hectare, they are highly susceptible to attack by Striga, which can cause yield losses of up to 100 per cent. ‘The target was to breed varieties that have similar yield as the current preferred varieties. In just three years, the lines generated are close to the background parent by up to 80 per cent grain yield,’ he adds.

Mr Clet Wandui Masiga, of AGROBIO, revealed that the effort was the first of its kind which has generated techniques that will be used worldwide to breed for resistance against Striga weed in crops. ‘The success will also transform other cereal crops affected by Striga like maize and rice, among others, because they have similar genes,’ he said.

Makere University had been commissioned to carry out research on value addition and nutritional content of the improved sorghum. The grain can be used to produce beer, bread, breakfast cereal products, porridge, among other products.

According to Mr Robert Olupot, a research officer at Serere National Semi-Arid Resources Research Institute, which is under National Agricultural Research Organisation, said the seeds will be tested before being released to farmers. ‘We test for its resistance to Striga, diseases, pests like stock borers, adaptability, drought and yield performance before taking it to the variety release committee,’ he said.

Statistics show that about 17 million hectares of sorghum are infested with Striga in Africa every year with yield losses of between 6 to 7 million tonnes.

ASARECA, headquartered in Entebbe, is an organisation of the national agricultural research systems of ten countries: Burundi, D. R. Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania and Uganda. It aims at boosting agricultural research in eastern and central Africa to facilitate economic growth, food security and export competitiveness through sustainable agriculture.

Martin Ssebuyira The Monitor 22 June 2011.

President Obama appoints Prof. Gebisa Ejeta to food board
(extract)

Gebisa Ejeta, a distinguished professor of agronomy and the 2009 World Food Prize laureate, received an appointment to the Board for International Food and Agricultural Development from President Barack Obama, the university announced Wednesday. Obama made the three-year appointment April 22. Three others were named to the board -- Brady J. Deaton, chancellor of the University of Missouri; Jo Luck, president of Heifer International; and Marty McVey, president of McVey & Co. Investments.

Ethiopian Journal 28 April 2011.

For cancer patients mistletoes have more value than a Christmas kiss

A study conducted at Rambam Medical Center in Haifa, Israel, reveals that mistletoe extract is effective in stabilizing patients suffering from advanced stages of
mistletoe extract can stabilize cancerous tumors and alleviate symptoms suffered by patients, whose chemotherapy no longer works.

The mistletoe plant, also known as *Viscum album*, is best known for its place in ancient mythology and folklore. It has long been the tradition during the Christmas season to hang mistletoes around the house and for men and women who stand under it to give each other a kiss.

Other ancient myths present the mistletoe plant as the fabled healer of all kinds of medical ailments including epilepsy, heart conditions, edema, and diseases of the spleen. However, with the recent research findings in Israel, its fame is growing as the most frequently prescribed alternative treatment for various kinds of cancers, namely in Germany and other European countries, according to the Mesothelomia Support Network. Herbal medicine uses the leaves and twigs of mistletoe, which is a semi-parasitic plant, but the berries are discarded.

While using the plant’s extract to combat cancer is not a new practice, the recent research conducted at Rambam is adding to the mistletoe’s credibility as a valid form of alternative medicine. While the plant has been used for decades to treat cancer patients, until recently there were no reliable, clinical studies supporting its effectiveness. The research conducted at Rambam Medical Center now adds to the growing number of recent studies confirming that mistletoe’s medicinal capabilities may exceed its place in mythology.

‘Mistletoe has unique properties,’ said Dr. Maurice Orange, a United Kingdom General Practitioner who has administered mistletoe extract treatments for the past ten years. ‘It has been shown in labs and with patients to both have anti-cancer properties and a powerful stimulating effect on the immune system.’ According to Dr. Orange, mistletoe can counteract tumor growth, while in other instances stimulating the immune system.

The Rambam study focused on patients suffering from lung and colon cancer. Patients suffering from advanced stages of colon cancer received subcutaneous injections, the most common way of administering mistletoe treatments, of the plant’s extract, three times per week. The treatment was only administered after all other conventional forms of chemotherapy were no longer having an effect on the patient. The extract, though not expected to cause shrinkage in the patients’ cancerous tumors, was successful in stabilizing the disease for a period of four months and lessening symptoms in 40 percent of cases. The plant was also found to improve the quality of life of the cancer patients suffering from advanced stages of the disease and who were not benefiting from regular cancer treatment. Twenty-three patients who were previously regularly required to undergo an intrusive procedure draining fluid from their abdomen through a needle began to receive injections of mistletoe extract. After receiving the mistletoe treatment, the interval between requiring draining procedures significantly increased, therefore increasing the patients’ quality of life.

This study, presented at the annual meeting of the Society for Complementary Medicine held in the London, UK this month, joined other cutting edge studies conducted internationally supporting the mistletoe’s role in the fight against cancer.

Kipper Adler 03 June 2011.

**CYTAVIS’ Aviscumine improves survival of patients with metastatic melanoma in a Phase II trial Hamburg**

CYTAVIS BioPharma GmbH, a biopharmaceutical company developing derivatives of natural compounds for the treatment of oncological and immunological diseases, today announced Phase II data demonstrating that its lead compound Aviscumine (CY503), an immune potentiator, may improve survival of patients with refractory metastatic melanoma (stage IV).

The open-label Phase II multicenter trial (NCT00658437) was designed to test the influence of subcutaneous injections of Aviscumine (CY503) on progression-free survival (PFS) and overall survival (OS) of patients with unresectable metastatic melanoma (stage IV) after antineoplastic treatment failure. The trial included 31 eligible patients and was conducted at four German sites.

The progression-free survival rate after 3 months was 32.3%, while the 1-year-survival rate was 45.0% and median overall survival time (mOS) 11 months in the full analysis set/intention to treat population (FAS/ITT). In case of the standard therapy with Dacarbazine the 1-year-survival rate is usually about 30% and the mOS between 6 and 8 months, respectively. The majority of treatment-related adverse events were not severe application site reactions and pruritus.

‘The results clearly suggest that CY503 is active in patients with metastatic melanoma, and they add to our evidence that the compound has great potential as a
highly active immunotherapeutic,’ said Hans Lentzen, CEO of CYTAVIS. ‘We see activity in all grades of metastatic melanoma, in particular in repeatedly pretreated melanoma patients.’ ‘More than 70% of the patients in this trial were suffering from the most severe stage IV M1c metastatic melanoma,’ said the principle investigator of the trial, Dr. Peter Mohr from the Elbe Klinikum Buxtehude, Germany. ‘These patients already have developed distant metastases, e.g. in the liver, have an elevated lactate dehydrogenase level and have experienced previous treatments. The results of this trial therefore are very encouraging and require confirmation in a large randomized phase III trial. Furthermore, the subcutaneous application of the drug is of advantage for allowing an outpatient treatment and has shown a good compliance.’

Aviscumine (CY503) is a recombinant version of viscumin, a protein found in the mistletoe plant (Viscum album). It influences the immune system via multiple modes of action: activating antigen-presenting cells, evoking strong T-cell response, increasing the cytotoxic activity of killer cells, and inducing the release of key cytokines which mediate the anti-cancer activity of the immune system. The safe administration of Aviscumine has already been shown in three Phase I studies in patients with different solid tumors and in a Phase I/II trial in patients with superficial bladder cancer.

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Hamburg/Germany, July 13, 2011.

**Province invests $260,000 for forest research**

The British Colombia government is providing $260,000 to further research at Thompson Rivers University into parasitic plants that attack coniferous forests in B.C. The funding award is being provided through the B.C. Knowledge Development Fund (BCKDF) and used to acquire an advanced scanning electron microscope for research dedicated to controlling dwarf mistletoes (Arceuthobium spp.), plant parasites that infect trees and in the case of lodgepole pine, make the trees more susceptible to pine beetle infestations. The BCKDF announcement matched funding from the Canadian Foundation for Innovation and is added to other internal and external sources at TRU for a total research infrastructure investment of $666,333 for the purchase of a state-of-the-art Scanning Electron Microscope or SEM.

Nelson Daily, 06 Feb 2011.

Get ready for kissing: National Trust urge people to plant mistletoe.

The evergreen plant, that is traditionally a sign of love, is in decline across the country. During Christmas, when mistletoe is hung up as a decoration to kiss beneath, garden centres are having to import the plant from Eastern Europe because of the shortage. The semiparasitic plant grows on apple trees and other native species and the decline has been linked with the loss of ancient orchards as fruit is also imported from Europe. Conservationists are not only worried about the loss of income for small farmers who harvest mistletoe but a dying ancient tradition and the health of wildlife, including 41 species of birds that rely on the plant. To try and address the problem, the National Trust is encouraging people to plant mistletoe themselves this spring.

Daily Telegraph, UK, 14 Feb 2011.

**OBITUARIES**

**DR REUVEN JACOBSON 1934-2010**

Dr. Reuven Jacobsohn passed away last December when he was 76 years old.

Reuven completed his PhD in weed science at University of Minnesota, USA in 1970, and returned to
Israel as a research scientist at the Volcani Center of the Agricultural Research Organization (ARO). From that time, Reuven was involved with many activities and research worldwide relating to applicative aspects of the biology and control of parasitic weeds. Reuven was a pioneer in developing chemical control approaches using systemic herbicides.

In 1999 Reuven retired from the ARO and went back to his farm in Beit El’aaZari to grow citrus and high quality seeds for seed companies in Israel.

His main scientific achievements included:
- the development of protocols for chemical control of Orobanche crenata and Phelipanche aegyptiaca in faba beans, pea and carrots, with the systemic herbicide glyphosate and imidazolinones applied to host foliage after broomrape attachment, but before shoot emergence;
- development of methodologies for soil disinfection including fumigants and soil solarization;
- studying host parasite relationships and how environmental conditions affect those relations;
- defining the host range of P. aegyptiaca, P. ramosa, O. cumana, O. crenata and O. cernua to dozens of crops under Israeli field conditions; he believed that host range of broomrape to its host should be confirmed under field conditions; therefore he performed at least 60 field studies over about 15 years to examine his hypothesis;
- development of a protocol for extracting broomrape seeds from the soil, in order to predict the potential of the damage as related to infestation level.

In 2009 Reuven was honoured by the Israeli Weed Science Society for his contribution to the Weed Science in Israel.

He was the supervisor for my master thesis, and exposed me to the marvelous world of parasitic plants. Reuven was a great man and researcher, but I think mostly he would like us to remember him as a diligent farmer. We will all remember our noble friend and colleague Dr. Reuven Jacobsohn and always appreciate his activities.

Hanan Eizenberg,
Newe Ya’ar Research Center, P.O.Box 1021, Ramat Yishay, 30095, Israel

Prof. Dr. Dr. KLAUS WEGMANN
1932-2011

He will be missed…

It is with a heavy heart that we learned of the death of Prof. Dr. Dr. h.c. mult. Klaus Wegmann on July 12, 2011.

The parasitic plants research community has lost a long-standing member. Born July 27, 1932 in Germany, Klaus Wegmann married his wife Gertrude in 1957 and they had four children. After studying chemistry and biology at the Technical University Karlsruhe and the University of Tübingen (both Germany), he received a PhD (Dr. rer. nat) in plant physiology in 1967. Since 1980 he was a full professor of Biochemistry at the University of Tübingen.

His research was manifold, covering not only biochemical relations between parasitic plants of the genera Orobanche, Phelipanche and Striga and their host plants, but also a broad range of other themes such as plant adaptation to water stress, tobacco biochemistry, ecological plant biochemistry, plant disease resistance, and heavy metal accumulation in plants. A good portion of the research work was carried out in cooperation with colleagues from various countries, in particular from Romania, Russia, Egypt, and Brazil, and with the International Agricultural Research Centers ICARDA (Aleppo, Syria), ICRISAT (Bamako, Mali), CIMMYT (Nairobi, Kenya) and IITA (Abadan, Nigeria). Klaus Wegmann was a very active member of the COST Action 849, Parasitic Plant Management in Sustainable Agriculture, for which he helped organizing meetings and contributed to different
working groups, especially related to Orobanche research and control.

He was an active person in strengthening the relationship of the University of Tübingen with Universities of Eastern Europe, especially with Romania where he was awarded two honorary doctorate degrees, in 1994 from the Lucian Blaga University of Hermannstadt/Sibiu and in 2002 from the Vasile Goldis Western University of Arad. Even after his retirement from the University of Tübingen, he was still very active, among other things as associate professor and pro-rector (2004-2008) at the Vasile Goldis Western University of Arad (Romania). In June 2011, he still bravely participated in the 11th World Congress on Parasitic Plants in Martina Franca, Italy where he delivered a poignant farewell.

We will keep Klaus Wegmann in mind as a very supportive, open-minded and delightful person. May his soul rest in peace.

Joachim Sauerborn and Bettina Haussmann, University of Hohenheim, 70593, Stuttgart, Germany

BOOK REVIEWS


This is indeed a ‘little’ book, on the one common European mistletoe species - Viscum album. It is aimed primarily at the layman in UK, but is very technically sound, informative and well illustrated, by an author who has been studying it for over 25 years. There are two-page sections on a range of aspects including ‘what exactly is a mistletoe?’, ‘where does it grow?’, ‘ancient traditions’, ‘Christmas and modern customs’, ‘harvesting and trading’, ‘mistletoe events’, ‘mistletoe in decorative art’, ‘mistletoe in medicine’, ‘mistletoe and wildlife’, ‘conserving mistletoe’, ‘controlling mistletoe’, ‘growing your own’ and ‘finding out more’.

Chris Parker.

Mistletoes of Southern Australia by David Watson 2011, CSIRO Publishing, Collingwood, Australia, 188 pp

Aside from scholarly works, there has never been a book treating the mistletoes of Australia, so this work fills that void. Within the 188 pages are over 130 photographs of 46 of the 91 Australian species of Loranthaceae and Viscaceae. This book, aimed at a popular audience, also features paintings of all species prepared by Robyn Hulley. The species coverage is focused upon southern Australia: Victoria, New South Wales, South Australia and the southern part of Western Australia. The species accounts serve the intended use as a field guide, and in addition the book features chapters on mistletoe biology, ecology, cultural significance, and management. I found these later chapters to be most engaging, presenting clear discussions of a number of fascinating biological aspects of mistletoe biology such as host interactions, mimicry, pollination and seed dispersal, herbivorous insect associations, etc. The chapter on cultural significance first reviews European concepts and then segways into how Australians (both European imports and indigenous people) view and utilize mistletoes. The chapter on management attempts to strike a balance between divergent viewpoints, i.e. that mistletoes are harmful weeds vs. ecologically important keystone species.

Overall my impression of the book is positive; however, I believe it would have benefited from editing by a specialist. Although the paintings are artistically pleasing, in many cases they are botanically inaccurate. The species descriptions often differ from the details depicted in the paintings (see for example the vegetative description of Amyema plicatula). The author chose not to include keys to the genera and species, justifying this because the targeted audience is non-specialists. I view this as a shortcoming because most taxa can be identified using macro-morphological features (not anatomical ones as stated). To identify a species using this book requires one to flip through all the pages comparing the specimen at hand with the paintings and descriptions. The terminology was possibly oversimplified, for example, ’stem’ here refers to an actual stem, a petiole or a peduncle. As an ornithologist, the author carried forward the tradition of using common names. I found myself writing the scientific names in the book because nearly all the common names were unfamiliar to me. There was no list of common names alphabetized and cross-referenced to scientific names (the Table on p. 173 is ordered by scientific name). Problems inevitably crop up when common names are used: one species with two common names (Amyema maidenii = pale-leaved mistletoe and green mistletoe) and two species with the same common name (A. maidenii and Ileostylus micranthus both are called green mistletoe). The section on mistletoe origins and relationships (pp. 7-9) did not incorporate data from recent work on phylogenetics that clearly shows five mistletoe clades that have been named as families. Moreover, the same section discusses loranth biogeography, but this was apparently based on the work of Barlow, not the newer concepts (with time-calibrated trees) from Vidal-Russell...
and Nickrent (2008). It is stated that loranths are ‘largely absent from North America’, curious given the diversity of this family in Mexico and Central America. It is likely that many of the above issues would be missed by the average reader, being noticed only by specialists such as myself. Thus, the book should be welcomed by anyone wishing to identify mistletoes in southern Australia.

Daniel Nickrent, Southern Illinois University, Carbondale IL USA

THESIS


Abstract: The problem of the parasitic weed striga (Striga hermonthica (Del.) Benth.) has worsened for African farmers, in conjunction with degrading soil fertility. An analysis of the striga problem showed that scientists, policy makers and farmers conceptualise striga differently. Whether striga is viewed as a weed or a symptom of degraded soils raises two questions: Should farmers control striga, even when the impact on yields would be negligible? Or should fertility enhancement, leading to higher yields, be their focus, even when not accompanied by an immediate reduction in striga? This study seeks to understand how organic matter inputs affect nutrient dynamics, sorghum (Sorghum bicolor [L.] Moench) production and striga abundance.

Surveys in northern Cameroon showed that striga infestation increased over the past two decades. Increased land pressure led to reduced fallow periods and enhanced cereal (mono-) cropping. Reduced access to fertiliser and manure hampered options to improve soil fertility. Yields from farmers’ fields did not correlate with striga incidence, confirming farmers’ prioritisation of soil fertility, weeds, and labour as production constraints, rather than striga. The entry point to tackle low yields and the worsening of the striga situation should follow farmers’ priority of alleviating low soil fertility.

Whether and how soil fertility improvement, through organic matter, enhances agricultural productivity and reduces striga, was investigated in field experiments. Organic matter amendments significantly depressed striga seed survival, with the strongest effect achieved at higher quality; presumably due to higher microbial activity. Organic matter enhanced soil water retention and soil temperature but without effects on striga seed survival. Organic matter did not affect soil ethylene concentrations. The effect of organic matter amendments was directly related to N mineralisation, both for better cereal growth and reduced striga survival. The organic matter amendments and use of fallow, as applied here, however, may not be practicable for the resource-poor farmer.

Increasing N-fertilisation increased sorghum root N mass concentration, which resulted in a lower striga seed germination. That relationship was linear up to a root N mass concentration of 19.5 mg g⁻¹ where seed germination was close to but always still above 0%.

In a broader framework of the research findings, the ultimate solution for farm productivity for Africa is in sustainable farm intensification by investing in soil fertility. However, the prevailing land tenure system and limited access to fertiliser and organic matter need to be overcome. A new conceptual model is proposed, indicating how changes in both cereal yield and striga infestation over time co-vary with changes in soil fertility. The implication of this model is that recovery of soil fertility should be the priority. The challenge to agronomists remains to consider how to make farm intensification rewarding and attainable for resource-poor farmers. In areas where striga is an obstacle, an integrated scheme for the intensification of cereal cropping should start with integrated soil fertility management. Crop rotation and intercropping with selected non-host leguminous crops are essential ingredients.

FORTHCOMING MEETINGS

Joint Workshop of the EWRS Working Groups - Weed management in arid and semi-arid climate and Weed management systems in vegetables, to be held in Huesca, Spain, 4-8 September 2011

The Workshop will take place at the Escuela Politécnica Superior de Huesca, located 7 m from the centre of Huesca. Huesca is an ancient town of 50,000 inhabitants with very interesting architecture, especially from its Romanesque period. It is one of the three capitals of the Aragón region. The city lies on the road to France about 75 km from Zaragoza. The programme will include a session on parasitic weeds.

Local Organizer S. Fernández-Cavada (Centro de Protección Vegetal, Diputación General de Aragón, Zaragoza, Spain) (sfernandez-cavada@aragon.es )
The VIIth International Weed Science Congress (IWSC) will be held on June 17 to 22, 2012 at the New Century Grand Hotel, Hangzhou, China.

Sessions will include one devoted to parasitic weeds. For further information contact Per Kudsk (per.kudsk@agrsci.dk).

**COMPOSITE AND ENDNOTE FILES**

We apologise that there has been lack of progress with the preparation and/or up-loading of the files referred to in Haustorium 58. But we are still working on them.

Chris Parker.

**GENERAL WEB SITES**

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see: http://www.parasiticplants.org/

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the parasitic weeds mentioned in the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for *Striga* suppression, see: http://www.push-pull.net/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes, up to 2005) see: http://www.rmr5.nau.edu/mistletoe/

For information on the 11th World Congress on Parasitic Plants in Martina Franca, Italy, June 2011, see: http://ipps2011.ba.cnr.it

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search *Santalum*)


For information on the work of the African Agricultural Technology Foundation (AATF) on *Striga* control in Kenya, including periodical ‘Strides in *Striga* management’ newsletters, see: http://www.aatf-africa.org/

**LITERATURE**

* indicates web-site reference only


Abbes, Z., Sellami, F., Amri, M. and Kharrat, M. 2010. Effect of sowing date on *Orobanche foetida* infection and seed yield of resistant and susceptible faba bean cultivars. Acta Phytopathologica et Entomologica Hungarica 45(2): 267-275. [Delaying sowing date for faba bean to December reduced attack by *O. foetida* and increased yield of the more resistant variety Najeh, but was less beneficial with the susceptible Badi.]


[Identifying isolates of Fusarium including F. oxysporum, F. equiseti and F. compactum, mainly from Orobanche crenata, with activity against both O. crenata and O. ramosa.]


Ahmed, U.A. and Alamun, T.M. 2010. Evaluation of different plants based products for Striga hermonthica control in sorghum (Sorghum bicolor) under Sudanese field conditions. Journal of Weed Science Research 16(4): 443-449. [2g each of ground dried material of Azadirachta indica, Lawsonia alba and Cissus quadrangularis placed in the planting hole caused significant reduction of S. hermonthica emergence, and later mortality of Striga seedlings. Ocimum basilicum less effective. No data or observation on the health of the crop!]


Albert, M., Kaiser, B., van der Krol, S. and Kaldenhoff, R. 2010. Calcium signaling during the plant-plant interaction of parasitic Cuscuta reflexa with its hosts. Plant Signaling and Behavior 5(9): 1144-1146. [Confirming the importance of Ca\(^{2+}\) signaling between C. reflexa and its host, and that the substance that induces Ca\(^{2+}\) release in the host plant is closely linked to the parasite’s haustoria.]


Amico, G.C., Rodriguez-Cabal, M.A. and Aizen, M.A. 2011. Geographic variation in fruit colour is associated with contrasting seed disperser assemblages in a south-Andean mistletoe. Ecography 34(2): 318-326. [The yellow fruits of Tristerix corymbosus in Chilean matorral are exclusively dispersed by three bird species while green fruits in the temperate forest are exclusively dispersed by a nocturnal marsupial, the mouse opossum (Dromiciops gliroides) which can locate them irrespective of colour.]

Andree, K.(and at least 25 others) 2010. Permanent genetic resources added to Molecular Ecology Resources Database 1 April 2010-31 May 2010. Molecular Ecology Resources 10(6): 1098-1105. [Striga hermonthica among species for which microsatellite marker loci have been identified.]

Anne, A., Peter, M. and Henning, A. 2011. Angiotensin-converting enzyme inhibitory activity of Viscum triflorum is host plant-dependent. Pharmaceutical Biology 49(3): 302-305. [V. triflorum is used to treat hypertension on Réunion Island. Concluding that only V. triflorum growing on Acacia heterophylla or Sophora denudata had relevant inhibitory activity (also shown by those host species themselves); 8 other hosts and associated V. triflorum were inactive.]


Arvind Shukla; Sharma, H.K. 2011. Bio-compost from Jatropha curcas L. leaves and deoiled cake. Indian Forester 137(3): 397-399. [Compost from J. curcas plus Cuscuta reflexa was inferior to J. curcas plus dung.]


inbred lines for hybrid production using multiple traits under Striga-infested and Striga-free environments. Maydica 55(3/4): 261-274. [Identifying inbred TZEI 3 as the best as source of Striga resistance genes for introgression into white-endosperm populations.]


Badu-Apraku, B., Oyekunle, M., Akinwale, R.O. and Lum, A.F. 2011. Combining ability of early-maturing white maize inbreds under stress and nonstress environments. Agronomy Journal 103(2): 544-557. [Concluding that additive gene action played a major role in the inheritance of the S. hermonthisca resistance traits and that the inbreds TZEI 4 and TZEI 5 were the most promising in yield performance and stability across the test environments.]

Balasubramanian, P., Aruna, R., Anbarasu, C. and Santhoshkumar, E. 2011. Avian frugivory and seed dispersal of Indian Sandalwood Santalum album in Tamil Nadu, India. Journal of Threatened Taxa 3(5): 1775-1777. [The most seed dispersers of Santalum album were the red-whiskered bulbul Pycnonotus jocosus, the white-headed babbler and the Asian koel Eudynamys scolopacea.]


Bedlan, G. 2011. (First report of Phelipanche ramosa on tomatoes (Solanum lycopersicum) in Austria.) (in German) Journal für Kulturpflanze 63(4): 111-112. [Orobanche/Phelipanche ramosa found in glasshouses in 2010.]


Bora, H.R., Alok Yadav, Kumud Das and Ranjeet Kumar. 2010. Balanophora dioica R. Br. ex Royle (Balanophoraceae) - a rare total root parasite reported from Karbi-Anglong district, Assam, India. Journal of Economic and Taxonomic Botany 34(2): 298-299. [B. dioica recorded for the first time in semi ever-green forest of the district.]


Breuillin, F. and 14 others. 2010. Phosphate systemically inhibits development of arbuscular mycorrhiza in Petunia hybrida and represses genes involved in mycorrhizal functioning. Plant Journal 64(6): 1002-1017. [Confirming that phosphate systemically inhibits mycorrhizal symbiosis as well as the expression of genes involved in strigolactone biosynthesis.]


Caamal-Fuentes, E., Torres-Tapia, L.W., Simá-Polanco, P., Peraza-Sánchez, S.R. and Moo-Puc, R. 201. Screening of plants used in Mayan traditional medicine to treat cancer-like symptoms. Journal of Ethnopharmacology 135(3): 719-724. [Among the 21 species tested, Phoradendron vernicosum showed moderate cytotoxic activity but Psittacanthus americanus did not. Also noting that an Orbanche sp. is used for treatment of ‘hard swelling’.]

Cardoso, C., Ruyter-Spira, C. and Bouwmeester, H.J. 2011. Strigolactones and root infestation by plant-parasitic Striga, Orobanche and Phelipanche spp. Plant Science 180(3): 414-420. [Reviewing strigolactones and how the increasing knowledge on the variety of their biological roles can be used to design strategies for parasitic plant control.]


Chen PingTing, Chen LongQing and Wen, J. 2011. The first phylogenetic analysis of Tetrastigma (Miq.) Planch., the host of Rafflesiaceae. Taxon 60(2): 499-512. [A phylogeny generated from four plastid markers for 53 of the 95 species of Tetrastigma was compared to one generated for Rafflesiaceae by Barkman et al. (2008), rejected a single origin of the host-parasite relationship using a Templeton test.]


Coría Ávalos, V.M., Vázquez Collazo, I., Muñoz Flores, H.J. and Villa Castillo, J. 2010. (Diatoms ground impact over *Arceuthobium globosum* Hawksworth & Wiens subsp. *grandicale* of *Pinus pseudostrobus* Lindl.) (in Spanish) Ciencia Forestal en Mexico 1(1): 39-46. [A 7.5% solution of the diatom preparation ‘Muérdago Killer’ applied in 200 L of water/ha gave equally good results to those of ethephon 2,500 ppm in causing complete abscission of *A. globosum* after 45 days, without damaging the host.]

Court, P.E., Walder, F., Boller, T., Ineichen, K., Wiemken, A., Rousteau, A. and Selosse, M.A. 2011. Carbon and nitrogen metabolism in mycorrhizal networks and mycoheterotrophic plants of tropical forests: a stable isotope analysis. Plant Physiology 156(2): 952-961. [Isotopic enrichment is a distinguishing feature of mycorrhizal networks and mycoheterotrophic plants associated with higher (basidiomycete) fungi forming ectomycorrhizal networks with autotrophic plants. This study shows that mycoheterotrophs associated with AM fungi do not exhibit the same isotopic enrichment profiles as mycoheterotrophs associated with temperate higher fungi.]

Crampton, L.H. and Sedinger, J.S. 2011. Nest-habitat selection by the Phainopepla: congruence across spatial scales but not habitat types. Condor 113(1): 209-222. [Noting that the nesting of *Phainopepla nitens* was influenced by the occurrence of unspecified mistletoe species in woodland, acacia and mesquite, in the Mojave Desert.]


mistletoe species identified in the region, on *Cola acuminata* and other hosts.]


Dinesh Jadhav. 2010. A note on some ethnomedicinal plants found effective in the treatment of jaundice used by Bhil tribe of Ratlam district (M.P.). Journal of Economic and Taxonomic Botany 34(4): 751-753. [Including reference to *Cuscuta reflexa*.]


Dostálek, T. and Münzbergová, Z. 2010. Habitat requirements and host selectivity of *Thesium* species (Santalaceae). Botanical Journal of the Linnean Society 164(4): 394-408. [*T. linophyllum* showed some degree of host preference but *T. bavarum* and *T. ebracteatum* showed none and all three had extremely wide host range.]


Eisenbraun, J., Scheer, R., Kröz, M., Schad, F. and Huber, R. 2011. Quality of life in breast cancer patients during chemotherapy and concurrent therapy with a mistletoe extract. Phytotherapy 18(2/3): 151-157. [In a study with 270 breast cancer patients, the tolerance of the standardized aqueous *Viscum album* extracts were rated good or very good for 91% of the patients and the efficacy was rated good or very good for 94%. 89% of the patients reported a good or very good benefit.]


Fasil Reda, Dierick, A. and Verkleij, J.A.C. 2010. Virulence study of *Striga hermonthica* populations from Tigray Region (Northern Ethiopia). World Journal of Agricultural Sciences 6(6): 676-682. [Nine of the 19 populations of *S. hermonthica* tested were able to attack the relatively resistant varieties SRN 39 and P-9401.]

Fernández-Aparicio, M., Yoneyama, K. and Rubiales, D. 2011. The role of strigolactones in host specificity of *Orobanche* and *Phelipanche* seed germination. Seed Science Research 21(1): 55-61. [Showing that strigolactones/germination stimulants
play a role in determining host specificity of *Orobanche* and *Phelepanche.*]


Galiano, L., Martínez-Vilalta, J. and Lloret, F. 2011. Carbon reserves and canopy defoliation determine the recovery of Scots pine 4 yr after a drought episode. New Phytologist 190(3): 750-759. [Incidentally assessing the contribution of *Viscum album* to the decline of *Pinus sylvestris* in NE Spain and concluding that infection reduced leaf nitrogen content, negatively affecting growth.]

Gatto, M.A., Ippolito, A., Linsalata, V., Cascarano, N.A., Negro, F., Vanadia, S. and di Venere, D. 2011. Activity of extracts from wild edible herbs postharvest fungal diseases of fruit and vegetables. Postharvest Biology and Technology 61(1): 72-82. [Extracts of *O. crenata* showed high activity against fungi and strongly reduced grey mould, brown rot, and green mould on a range of fruits. The activity was ascribed to the presence of caffeic acid derivatives and/or flavonoids.]

Gaurav Mudgal and Brajesh Mudgal. 2011. Evidence for unusual choice of host and haustoria by *Dendrophthoe falcata* (L.f) Ettingsh, a leafy mistletoe. Archives of Phytopathology and Plant Protection 44(2): 186-190. [Noting simple attachments to *A. squamosa* but a network of epicortical roots on *P. guajava.* Nearby *Mangifera indica* and *Achras sapota,* usual hosts of *D. falcata* not attacked. (Perhaps some other mistletoe species involved?)]


Geetha, K.M., Gopal, P.V.V.S.B. and Murugan, V. 2010. Antiepileptic activity of aerial parts of *Viscum articulatum* (Viscaceae) in rats. Journal of Pharmacy Research 3(12): 2886-2887. [Identifying some compounds which could correlate with the use of *V. articulatum* in traditional medicine.]

González-Medina, R.E., Equihu Martínez, A., Mendoza Briseño, M.A. and Cibrían Tovar, D. 2010. Relationship between bark beetles (Coleóptera: Scolytidae) and vitality in *Pinus hartwegii* Lindl. forests. Ciencia Forestal en Mexico 1(2): 121-133. [Unspecified mistletoes could be a factor in abundance of bark beetles in southern Mexico.]


Harbaugh, D.T., Oppenheimer, H.L., Wood, K.R. and Wagner, W.L. 2010. Taxonomic revision of the endangered Hawaiian red-flowered sandalwoods (*Santalum*) and discovery of an ancient hybrid species. Systematic Botany 35(4): 827-838. [Clarifying the Hawaiian populations into *S. freycinetianum* (only on O'ahu); *S. freycinetianum* var. *lanaiense* re-classified into *S. haleakalae* as *S. haleakalae* var. *lanaiense,* comb nov, and *S. freycinetianum* var. *pyrularium* to be treated at specific rank as *S. pyrularium.* Some populations sympatric with *S. pyrularium* and *S. ellipticum* thought to be an ancient hybrid between them.]


He XiangHui, Yang WenZhi, Meng Ahui, He WenNi, Guo DeAn and Ye Min 2010. Two new lignan glycosides from the seeds of *Cuscuta chinensis.* Journal of Asian Natural Products Research 12(11/12): 934-939.
Hejcman, M., Schellberg, J. and Pavlu, V. 2011. Competitive ability of Rhinanthus minor L. in relation to productivity in the Rengen Grassland Experiment. Plant, Soil and Environment 57(2): 45-51. [Concluding that a viable population of R. minor can only be established if annual aboveground dry matter of vascular plants is below 5 t/ha. The biomass of bryophytes did not matter.]


Hu YanWu and Wang LiLi. 2010. Extraction and research 16(4): 451-457. [Emphasizing an integral part of late Mesolithic ecology.)


Hu YanWu and Wang LiLi. 2010. Extraction and content determination of polysaccharide in Cuscuta japonica Choisy in Changbai mountain area. Medicinal Plant 1(2): 42-44. [Recording high polysaccharide in C. japonica denoting high value as a traditional medicine in this part of China.]


Innes, J., Blackford, J. and Simmons, I. 2010. woodland disturbance and possible land-use regimes during the Late Mesolithic in the English uplands: pollen, charcoal and non-pollen palynomorph evidence from Bluewath Beck, North York Moors, UK. Vegetation History and Archaeobotany 19(5/6): 439-452. [Noting an increase in Melampyrum pollen as evidence for fire as an integral part of late Mesolithic ecology.]


Jäger, S., Beffert, M., Hoppe, K., Nadberezny, D., Frank, B. and Scheffler, A. 2011. Preparation of herbal tea as infusion or by maceration at room temperature using mistletoe tea as an example. Scientia Pharmaceutica 79(1): 145-155. [Maceration of Viscum album extracted 43% of mistletoe lectins, whereas by infusion they are inactivated by thermal degradation.]

Jamil, M., Charmikhova, T., Cardoso, C., Jamil, T., Ueno, K., Verstappen, F., Asami, T. and Bouwmeester, H.J. 2011. Quantification of the relationship between strigolactones and Striga hermonthica infection in rice under varying levels of nitrogen and phosphorus. Weed Research 51(4): 373-385. [Confirming a strong negative correlation between N and particularly P levels and the exudation of strigolactones by rice, the subsequent germination of S. hermonthica, and infection of rice. Rice variety IAC 165 exuded 100 times as much strigolactone as variety TN 1.]


cumana does not germinate in response to strigolactones (though O. cernua does), and identifying the natural stimulant from sunflower, as the guianolide sesquiterpene lactone, dehydrocostus lactone (DCL). In contrast to strigolactones, the production/exudation of DCL is reduced by P starvation and is not inhibited by fluridone.


Khan, Z.R., Midega, C.A.O., Bruce, T.J.A., Hooper, A.M. and Pickett, J.A. 2010. Exploiting phytochemicals for developing a ‘push-pull’ crop protection strategy for cereal farmers in Africa. Journal of Experimental Botany 61(15): 4185-4196. [Reviewing the ‘push-pull’ technique, including the use of Desmodium for control of Striga hermonthica in maize and claiming 30,000 farmers have taken up the technique with yields greatly increased.]


of Applied Biosciences 2011(37): 2453-2459. [S. gesnerioides from tobacco in Zimbabwe was stimulated to germinate by potential trap crops Phaseolus vulgaris, groundnut, pigeon pea and cowpea. Cowpea was not parasitised.]

Koltai, H. 2011. Strigolactones are regulators of root development. New Phytologist 190(3):545-549. [Reviewing the role of strigolactones in root development and as coordinators of shoot and root development and mediators of plant responses to environmental conditions.]

Koltai, H. and Kapulnik, Y. 2011. Strigolactones as mediators of plant growth responses to environmental conditions. Plant Signaling and Behavior 6(1): 37-41. [Reviewing the effects of strigolactones on shoot and root development, and possible feedback loops between strigolactones and light and nutrient status.]


Labrousse, P., Delmail, D., Arnaud, M.C. and Thalouarn, P. 2010. Mineral nutrient concentration influences sunflower infection by broomrape (Orobanche cumana). Botany 88(9): 839-849. [Increased nutrient increased susceptibility of a susceptible sunflower to O. cumana but decreased that of a resistant variety.]


in Environmental Biology 4(2): 258-264. \textit{S. hermonthica} was reduced and maize yields increased by 20 minute soaking of maize seeds in a fruit and seed powder suspension of \textit{P. biglobosa} before planting, with or without post-emergence application of 2,4-D or triclopyr.


Malik, H., Kohlen, W., Jamil, M., Rutjes, F.P.J.T. and Marquardt, E.S. and Pennings, S.C. 2011. Diet mixing of orobanchol, new germination stimulants for seeds of parasitic weeds. Organic & Biomolecular Chemistry 9(7): 2286-2293. [Synthetic aromatic A-ring analogues of orobanchol are active as germination stimulants, with the natural relative configuration being most active. The data also suggest that hydrogen bonding is not important for the binding of the stimulant to the receptor.]


Marquardt, E.S. and Pennings, S.C. 2011. Diet mixing in a parasitic plant: adaptation or constraint? Plant Ecology 212(1): 69-77. \textit{Cuscuta indecora} grew more strongly on \textit{Iva frutescens} than on \textit{Borrichia frutescens}, but was also able to thrive on the latter.

Mathiasen, R. 2011. Susceptibility of conifers to three dwarf mistletoes in the Klamath-Siskiyou Mountains. Western Journal of Applied Forestry 26(1): 13-18. [Western white pine and mountain hemlock were principal hosts of \textit{Arceuthobium monticola} and \textit{A. tsugense} ssp. \textit{mertensiana}], respectively. Brewer spruce and red fir were principal hosts of \textit{A. abietinum} ssp. \textit{wienssi}.]

Mathiasen, R.L. and Daugherty, C.M. 2010. Susceptibility of brewer Spruce (\textit{Picea breweriana}) to dwarf mistletoes (\textit{Arceuthobium} spp., Viscaceae). Northwest Science 8(3): 295-301. [A survey in NW USA concluded that \textit{P. breweriana} acts as a primary host of both \textit{Arceuthobium monticola} and \textit{A. abietinum} ssp. \textit{wienssi}, and a secondary host of \textit{A. tsugense} ssp. \textit{mertensiana}.]


infestation levels and under conditions of drought stress and low soil fertility.]

Mwakaboko, A.S. and Zwanenburg, B. 2011. Strigolactone analogs derived from ketones using a working model for germination stimulants as a blueprint. Plant and Cell Physiology 52(4): 699-715. [Analogs derived from the cyclic ketones, 1-indanone and 1-tetralone have activity comparable with that of GR 24, while those derived from 2-phenyl-cyclohexanone, carvone and pulegone also have good activity.]


Nagata, J.M., Jew, A.R., Kimeu, J.M., Salmen, C.R., leucarpum Phoradendron serotinum Proposal to conserve the name particular focus upon mistletoes.]

but up-to-date review of the sandalwood order, with 10.1002/9780470015902.a0003714.pub2. [A brief

In: Encyclopedia of Life Science John Wiley & 8902. [Both the response of seeds to strigolactones – the induction of germination of root parasitic species – require MAX2, suggesting that a similar biological mechanism was adapted in these two species – require MAX2, suggesting that a similar


Ormeño Núñez, J. 2010. (Dodder (Cuscuta suaveolens Syr.), mistletoe (Tristerix corymbosus L.) and broomrape (Orobancha ramosa L.): parasitic weeds of economic importance in Chile.) (in Spanish) Agro-Ciencia 26(2): 109-119. [Noting the importance of C. suaveolens on lucerne and sugar beet, O. ramosa on Solanaceae, especially tomato, and T. corymbosa on Populus and Salix species.]


Pfiz, M. and Küppers, M. 2010. Dense crowns of the hemiparasitic mistletoe Viscum album L. exhibit shrub-like growth and high dry matter turnover. Flora (Jena) 205(12): 787-796. [Comparing relative growth rates, leaf area densities and leaf longevity in three subspecies of Viscum album on their respective hosts Betula pendula, Abies alba and Pinus sylvestris and questioning whether photoautotrophic carbon gain of the leaves is sufficient to maintain the observed high relative growth rates.]
Pickett, J.A., Hamilton, M.L., Hooper, A.M., Khan, Z.R. and Midega, C.A.O. 2010. Companion cropping to manage parasitic plants. Annual Review of Phytopathology 2010(48): 161-177. (A general review but with emphasis on the use of *Desmodium* spp. in the control of *Striga* spp.) [A general review but with emphasis on the use of *Desmodium* spp. in the control of *Striga* spp. Including a plea for study of the mechanism by which companion crops are effective in order to further optimise this control technique.]


Praj, B. 2010. *Orobanche purpurea* on its newly discovered site near Zaton’ Dolna (NW Poland): the problem of protection of a threatened parasitic plant species. Biodiversity: Research and Conservation 2010(17): 33-38. [Regretting the decline in a population of *O. purpurea*, associated with a decline in its host *Achillea millefolium*.]


Prider, J.N., Facelli, J.M. and Watling, J.R. 2011. Multispecies interactions among a plant parasite, a pollinator and a seed predator affect the reproductive output of an invasive plant, *Cytisus scoparius*. Austral Ecology 36(2): 167-175. [The native *Cassitha pubescens* reduced flowering of the invasive *Cytisus scoparius* in S. Australia by 50%. There were minor interactions with the pollinator *Apis mellifera* and a seed predator, *Bruchidius villosus*.]


Qiu, Y.L., Li, L., Wang, B., Xue, J.Y., Hendry, T.A., Li, R.Q., Brown, J.W., Liu, Y., Hudson, G.T. and Chen ZhiDuan. 2010. Angiosperm phylogeny inferred from sequences of four mitochondrial genes. Journal of Systematics and Evolution 48(6): 391-425. [376 genera in 296 families were analyzed using atp1, matR, nad5 and rps3. Results were largely congruent with previous multigene analyses of angiosperms. Parasites included were: *Krameria*, Santalales.]

Quan JiShu, Yin XueZhe and Xu HuiXian. 2011. *Boschniakia rossica* prevents the carbon tetrachloride-induced hepatotoxicity in rat. Experimental and Toxicologic Pathology 63(1/2): 53-59. [Demonstrating a range of activities from extracts of *B. rossica* (Orobanchaceae).]


Rist, L., Shaanker, R.U. and Ghaouzil, J. 2011. The spatial distribution of mistletoe in a Southern Indian tropical forest at multiple scales. Biotropica 43(1): 50-57. [Relating to *Taxillus tomentotus* in the fruit trees *Phyllanthus emblica* and *P. indofischeri*.]

and nuclear sequences. American Journal of Botany 98(5): 896-908. [Concluding that there are three distinct lineages represented within the two recognised species in N. and Central America, indicating that there could be a minimum of three species within the genus.]

Rodríguez-Ojeda, M.I., Velasco, L., Alonso, L.C., Fernández-Escobar, J. and Pérez-Vich, B. 2011. Inheritance of the unpigmented plant trait in Orobanche cumana. Weed Research (Oxford) 51(2): 151-156. [Concluding that pigmentation in O. cumana is controlled by a partially dominant allele at a single locus and that the lack of pigmentation has no effect on its ability to parasite.]


Rowntree, J.K., Cameron, D.D., Preziosi, R.F., Rowntree, J.K., Shuker, D.M. and Preziosi, R.F. 2011. Genetic variation changes the interactions between the parasitic plant-ecosystem engineer Rhinanthus and its hosts. Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences 366(1569):1380-1388. [In detailed studies the outcome of infection of the host Hordeum vulgare by Rhinanthus minor and R. angustifolius, depended not only on the host species, but also on the underlying genetics of both host and parasite.]

Runyon, J.B., Mescher, M.C. and de Moraes, C.M. 2010. Plant defenses against parasitic plants show similarities to those induced by herbivores and pathogens. Plant Signaling and Behavior 5(8): 929-931. [Discussing the importance of jasmonic acid and salicylic acid in the response of hosts tomato and tobacco to Cuscuta campestris and also the possible importance of trichomes.]


Sawadogo, M., Ouedraogo, J.T., Gowda, B.S. and Timko, M.P. 2010. Genetic diversity of cowpea (Vigna unguiculata L. Walp) cultivars in Burkina Faso resistant to Striga gesnerioides. African Journal of Biotechnology 9(48): 8146-8153. [SSR markers were used to characterize 16 cowpea genotypes. A minor proportion of markers were useful in distinguishing Striga resistant from susceptible genotypes, but overall clustering of genotypes did not fall cleanly into resistant or susceptible groups.]

Schaefer, H. and Renner, S.S. 2011. Phylogenetic relationships in the order Cucurbitales and a new classification of the gourd family (Cucurbitaceae). Taxon 60(1): 122-138. [14 DNA regions were analyzed for 664 species representing all but two of the genera in the order. Unlike their previous study (Filipowicz and Renner 2010, BMC Evol. Biol. 10: 219) where Apodanthaceae was sister to Coriariaceae and Corynocarpaceae, here Apodanthaceae was sister to the remaining families in the order.]

Schmid, R., Calvin, C.L. and Wilson, C.A. 2010. Sinker structure of Phoradendron californicum (Viscaceae) confounds its presumed close relationship to other acataphyllous species. Aliso 2010 (29): 13-23. [Detailed anatomical work helps clarify the systematic position of the species and its relationship to tropical species. Features studied include seedling establishment, stem anatomy, and endophyte structure.]


Selosse, M.A., Martos, F.; Perry, B., Padamsee Maj, Roy, M. and Pailler, T. 2010. Saprotophical fungal symbionts in tropical achlorophyllous orchids: finding treasures among the ‘molecular scraps’? Plant Signaling and Behavior 5(4): 349-353. [Noting that some mycoheterotrophic plants are not fungal-specific, and that some mycoheterotrophic orchids associate with saprophytic fungi; lower specificity may be less than supposed in mycoheterotrophic plants. Association between mycoheterotrophic orchids and saprophytic fungi arose several times in the evolution of the two partners.]


Shao HongXia, Yang Jiuyan and Ju AiHua. 2011. Marked effect of Cuscuta on puerarin accumulation in cell cultures of Pueraria tuberosa grown in shake flasks and a bioreactor. Plant Biotechnology Reports 5(2): 121-126. [An extract of Cuscuta reflexa elicited increased production of isoflavonoids in cell cultures of P. tuberosum, ‘Indian Kudzu’ used in India as a traditional herb to lower cholesterol.]


Shen Hao, Hong Lan, Chen Hua, Ye WanHui, Cao HongLin and Wang ZhangMing. 2011. The response of the invasive weed Mikania micrantha to infection density of the obligate parasite Cuscuta campestris and its implications for biological control of M. micrantha. Botanical Studies 52(1): 89-97. [Concluding that the optimal cost-effective number of C. campestris to control M. micrantha is 4 per host plant in the field (in China).]


Shi GuangJie, Jiang Wei, Cai Li and Sui GuangJie. 2011. Molecular characteristics and antitumor
capacity of glycan extracted from *Cynomorium songaricum*. International Journal of Biological Macromolecules 48(5): 788-792. [Glycan from *C. songaricum* was less active on human liver carcinoma cell line HepG2 than flavone from ginkgo leaf.]

Shin HeonSub, Park SangYong, Yang JungEun, Kim SeYoung, Shin JiYon and Yi TaeHoo. 2010. *Cuscuta japonica* BuOH fraction stimulates hair growth in the cyclophosphamide-induced alopecia model C57BL/6 mouse. Horticulture, Environment and Biotechnology 51(6): 580-587. [Confirming the potential value of a *C. japonica* extract in treatment of hair loss.]


Soltis, D.E. (and 27 coauthors). 2011 Angiosperm phylogeny: 17 genes, 640 taxa. American Journal of Botany 98(4): 704-730. [25,260 bp from 17 chloroplast, mitochondrial and nuclear genes were analyzed. Compared to previous studies using fewer genes, greater resolution was achieved including deep-level clades such as Superrosidae and Superasteridae.]


Soro, K., Gnahoua, G.M. and Traore, D. 2009. (Parasitism in Loranthaceae leguminous tree plantations in the forest zone of Côte d’Ivoire.) (in French) Agronomie Africaine 21: 1 page. [Exotic trees *Acacia mangium, A. auriculaeformis, Albizia guachapele* and *A. lebeck*) more susceptible to mistletoes than the native species *Albizia adianthifolia* and *A. zygia*. Most affected is *A. lebeck* by *Tapinanthus bangensis*.)


Stöckel, M., Meyer, C. and Gebauer, G. 2011. The degree of mycoheterotrophic carbon gain in green, variegated and vegetative albino individuals of *Cephalanthera damasonium* is related to leaf chlorophyll concentrations. New Phytologist 189(3): 790-796. [Studying the isotopic enrichment in 13C and 15N, a distinguishing feature of mycoheterotrophic plants associating with higher (basidiomycete) fungi, and confirming that the extent of chlorophyll production is negatively correlated with the extent of isotopic enrichment and hence mycoheterotrophy.]

Sui ZhiFu, Gu TingMin, Liu Biao, Peng ShaoWen, Zhao ZhiLi, Li Li, Shi DongFang and Yang RongYa. 2011. Water-soluble carbohydrate compound from the bodies of Herba Cistanches: isolation and its scavenging effect on free radical in skin. Carbohydrate Polymers 85(1): 75-79. [Polysaccharides from *Cistanche deserticola* inhibited the oxidative modification of lipids, thus protecting cells from injury in aged rats’ skin.]


Sun YongHui, Ling Yong, Ren MeiRong, Zhou XueGang, Wang JiaYu and Ma YingLi. 2010. (Chemical constituents of *Viscum coloratum f. rubroaurantiacum*.) (in Chinese) Zhongcaoyao = Chinese Traditional and Herbal Drugs 41(9): 1418-1420. [Identifying 10 components, including one new.]


Tahseen Ghous, Kalsoom Akhtar, Faiz-ul-Hassan Nasim and Choudhry, M.A. 2010. Screening of
selected medicinal plants for urease inhibitory activity. Biology and Medicine 2(4): 64-69. [Cuscuta reflexa showed moderate anti-urease activity.]


Thorogood, C. and Hiscock, S. 2010. Specific developmental pathways underlie host specificity in the parasitic plant Orobanche. Plant Signaling and Behavior 5(3): 275-277. [Following up on their work on Orobanche minor and emphasising the importance of host specificity and proposing that identifying host specific races using physiological techniques can provide a framework for delineating evolutionary relationships among cryptic host-specific parasitic plants.]

Thriveni, M.C. and Shivamurthy, G.R. 2010. Distribution, host range and mode of seed dispersal in Dendrophthoe falcata (L.f.) Ettingsh (Loranthaceae). Advances in Plant Sciences 23(2): 605-608. [Listing 10 new hosts of D. falcata and discussing mechanism of host selection, involvement of birds in seed dispersal, and need for better management practices.]


Wang GuoPing, Shi MingHui, Li XiaoJin and Jia XinYue. 2010. Growth suitability analysis of Cynomorium songaricum in Xinjiang origin. Medicinal Plant 1(3): 6-8. [Concluding C. songaricum could be planted in 90% of Xinjiang Province.]


White, B.L.A., Ribeiro, A.de S., White, L.A.S. and do Nascimento Júnior, J.E. 2011. (Analysis of the incidence of mistletoes in the Sertige Federal University, São Cristóvão Campus.) (in Portuguese) Floresta 41(2): 1-8. [Struthanthus vulgaris or S. polyrizus occurred on 8% of all trees; S. polyrizus apparently restricted to the native Anacardium occidentale; four other exotic trees also affected by S. vulgaris.]


Wszelaki, N. and Melzig, M.F. 2011. (Eyebright: Euphrasia officinalis L.) (in German) Zeitschrift für Phytotherapie 32(1): 40-46. [Reviewing the wide range of traditional uses of E. officinalis, especially for treating eyes, but noting the need for more research to validate these uses.]


Xia Bo, Tian ChengMing, Luo YouQing, Zhao FengYu, Ma JianHai, Wang GuoCang and Han FuZhong. 2010. (Flowering characteristics and chemical control of the buds of Arceuthobium sichuanaense.) (in Chinese) Scientia Silvae Sinicae 46(4): 98-102. [A. sichuanaense is a serious parasite of Picea crassifolia, P. purpurea, P. likiangensis var. balfouriana and P. spinulosa in S. China and Tibet. A 1:400 dilution of 40% ethephon killed nearly 100% of flowering buds and was harmless to the hosts.]

Yang LiJuan, Chen QianFeng, Wang Fei and Zhang GuoLin 2011. Antiosteoporotic compounds from seeds of Cuscuta chinensis. Journal of Ethnopharmacology 135(2): 553-560. (Validating the use of C. chinensis in treatment of osteoporosis, the active ingredients being kaempferol and hyperoside.)

Yonli, D., Traoré, H., Sérémé, P. and Sankara, P. 2010. Use of local plant aqueous extracts as potential bioherbicides against Striga hermonthica (Del.) Benth. in Burkina Faso. Asian Journal of Crop Science 2(3): 147-154. [Extracts from a number of local species including Thevecia nerifolia, Azadirachta indica, Jatropha gossypifolia, Parkia biglobosa, Balanites aegyptiaca, Lannaea microcarpa and Acacia gourmaensis greatly reduced germination of]

Yu Hua, Liu Jian, He WeiMing, Miao ShiLi and Dong Ming. 2011. Cuscuta australis restrains three exotic invasive plants and benefits native species. Biological Invasions 13(3): 747-756. [C. australis showed greater virulence on the exotic Ipomoea cairica, Mikania micrantha, and Wedelia trilobata than on native hosts, suggesting value for biocontrol.]


*Zonneveld, B.J.M. 2010. New record holders for maximum genome size in eudicots and monocots. Journal of Botany 2010, Article ID 527357. [Claiming V. album to have the largest genome among eudicots, of 2C = 205.8 pg, supplanting the previous claimant V. cruciatum.]

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NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be down-loaded from the IPPS web-site (see above).

FEETNOTE

Your editor regrets not joining you all at the recent Congress in Italy. He had surgery involving both feet in April and was not quite back on them in time to travel. Plastic surgery was needed to repair damage resulting from the (then) latest up-to-date treatment for verrucas (plantar warts) in the 1940s – x-ray therapy – resulting in radiation burns and eventual ulceration and worse. Glad to report recovery at last and I look forward to seeing you at future meetings.

Chris Parker.
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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

Happy 2012! I hope this year brings you all health, happiness, and new insights into parasitic plants.

Future meetings. The next opportunity for a parasitic plant meeting will be a joint IPPS symposium with the International Weed Science Society Congress, which will take place from June 17-22, 2012 in Hangzhou, China. However, in order to ensure that we have sufficient attendance at this event, please indicate your interest right away by emailing Hanan Eizenberg (eizenber@agri.gov.il). This is a great opportunity for our society to connect with parasitic plant researchers from Asia and the Pacific region who don’t usually have the ability to travel to our typical congress location in Europe.

The next major conference, the 12th International Congress on Parasitic Plants, will take place in Sheffield, UK on July 15-19, 2013. Local arrangements will be handled by Julie Scholes and Duncan Cameron, with Koichi Yoneyama leading planning of the scientific program. The venue will be the Edge Conference facility at the University of Sheffield, and is located just next to the Peak District National Park, one of the most beautiful national parks in the UK. Block out your calendars now!

Upcoming IPPS elections. It is time for another round of IPPS elections. Three positions are open this year: Vice President, Secretary, and Member at Large. You may think that we just recently held elections, and indeed it was about a year ago that we elected a new Editor, but that election had been delayed and should have occurred in 2010. To remind you of recent society history, officers serve staggered four-year terms with about half the Executive Committee elected every two years to maintain continuity on the Committee. The Vice President position is special in that it comes with one major stipulation; The Vice President ascends to the Presidency at the end of the term, so this position actually carries an eight-year commitment. (Koichi Yoneyama with make this transition to President in the next few months.) You will receive a separate announcement this spring to solicit nominations for the election, so please start thinking about who you would nominate (self nominations are welcome) and whether you would agree to serve if nominated.

Final words. My term as IPPS President will soon end, so this is the final column I will write in this capacity. Each time I set out to write the President’s Message (eight times since 2008!) I have struggled with what to say. Of course there is always the business of the society: the forthcoming or completed congresses, elections, and administrative matters of many kinds. These are all important and I have dutifully reported them because that is the job of the President, but it strikes me as too much mundane bureaucracy. I would prefer to use this space to cheer progress in parasitic plant research, although that seems superfluous considering that readers have generally devoted their lives to the subject. Also, there is simply not enough space to adequately capture the energy in this field. Perhaps the best I can do is encourage you to read the rest of this newsletter and appreciate the breadth and depth of progress in just the past six months!

In closing I will say that it has been an honor and a pleasure to work with IPPS. I am grateful to everyone who has contributed to the society in even a small way, and especially to those who have taken on the major jobs of organizing congresses, serving as an officer or contributing to Haustorium. Although I am stepping aside from official duties, I look forward to continuing parasitic plant research and supporting the society for many years to come.

Sincerely,

Jim Westwood, IPPS President
westwood@vt.edu

A NEW SPECIES OF BALANOPHORACEAE FROM BRAZIL

In 1996, Prof. Ruy J. Válka Alves from the National Museum, Rio de Janeiro, was called to the type locality of the plant referred to herein. The person who had found the plant thought it was a strange orchid (it does resemble Australian *Rhizanthella gardneri*). The Itatiaia National Park is a high diversity hotspot of the Atlantic Rainforest of southeastern Brazil. Prof. Alves preserved a sample in alcohol for later studies, but the specimen remained untouched for a decade, when the first author examined the material and became convinced that it belonged to a new species of *Langsdorffia*. We then analyzed all *Langsdorffia* collections in many herbaria, covering the distribution of *L. hypogaea* Mart., thereto the only known American species of the genus. We concluded that none of the variations within *L. hypogaea* were consistent with that of the new taxon. Furthermore, the herbaria yielded further specimens of the new species, all collected in Itatiaia, the oldest collection being from 1957.

In 2006 a new search expedition to the type locality took place. It was successful, thanks to the help of Mr. André Vieira, who had taken Prof. Alves to the site back in
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1996. The type locality is a cloud forest at an altitude of 1940 m a.s.l., a site which harbors many endemic species. The 1996 collection had only female inflorescences, not permitting the observation of the main distinctive characters, present on male inflorescences. Finally, in 2009, fertile male material of the new species was collected near the original site, along with a specimen clearly belonging to *L. hypogaea*, proving both species grew sympatrically in that locality. This finding gave us the confidence to publish *Langsdorffia heterotepala* L.J.T. Cardoso, R.J.V. Aves & J.M.A. Braga. The specific epithet refers to the different shapes of the three tepals in the male flowers, which are identical in *L. hypogaea*. Further distinctive characters of *L. heterotepala* include the conspicuously Y-shaped connective; a flat male inflorescence; scales with a corrugate apex and female flowers with shorter styles.

The ecology of this new species is poorly known. Not even the species of the host plant was determined. The currently known distribution is restricted to cloud forests above 1500m a.s.l., which encompass the Itatiaia massif, an area of less than 30 km$^2$. It seems probable that *L. heterotepala* also occurs at similar altitudes in the Mantiqueira and Serra do Mar massifs, and even in other States. An intensified collection effort might shed further light on the distribution of this species and its conservation status.

HYDNORA VISSEI – A REMARKABLE PLANT TO HONOUR A REMARKABLE MAN

In a memorial lecture at the University of Stellenbosch on 9 March 2011 attended by his widow, Thresia Visser and children, Erika Maass announced the naming of a new species of *Hydnora* in honour of Prof. Johann Visser and paid tribute to a great figure in the world of parasitic plants who sadly died so soon after his retirement, in 1990.

‘My association with the late Prof. Johann Visser started 30 years ago when I, as a young undergraduate student, walked into his Plant Physiology class at the then Department of Botany, at the University of Stellenbosch. As post-graduate student, I was quickly introduced into the world of parasitic plants and soon realized that *Hydnora* was without doubt one of Prof. Visser’s all time favourites – this strange, most un-plant-like of all angiosperms with the beautiful albeit stinking flowers!

Johann Visser spent many hours *Hydnora*-hunting in his little red pickup– an activity that was rewarded when he rediscovered the evasive *Hydnora triceps* in the Springbok area. The previous known collection of this strange plant was 150 years earlier and there was still much to learn from these weird plants when Prof. Visser fell ill and died in 1990.

Before his death, Prof. Visser appointed Prof. Lytton Musselman, a friend and colleague from Old Dominion University in Norfolk, Virginia, as the external examiner of my Ph D thesis which dealt with the germination requirements of *Striga*, another genus of parasitic flowering plants. When, a few years after Visser’s death, Musselman became interested in furthering his work on *Hydnora*, and was looking for a collaborator in Namibia, I was the obvious choice – the only one he knew in Namibia!

This was the beginning of a very successful and fruitful collaboration - building on the foundation laid by Johann Visser, researchers from the University of Namibia and Old Dominion University in Norfolk, Virginia, worked together over the past 10 years to unravel the mysteries of this remarkable genus. Our group was not only the first to successfully germinate *Hydnora* seeds, but we also documented the distribution of *Hydnora triceps* in Namibia, and recently described a new *Hydnora* species from the Karas Region of Namibia and the Northern Cape Province of South Africa. This species is a distinct segregate of *Hydnora africana sensu lato*, and to honour the contribution made by Prof. Visser to our current understanding of parasitic plants, this new species was named *Hydnora visseri* (see Bolin, J., Maas, E. and Musselman, L.J. 2011. A new species of *Hydnora*

For more information see the complete article:

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**HAUSTORIUM 60**

(Hydnoraceae) from Southern Africa. Systematic Botany 36(2): 255-260 in Literature section below.)

*Hydnora visseri* is known from the Karas region of Namibia and the Northern Cape Province of South Africa. This distribution follows that of its obligated hosts *E. gregaria* and *E. gummifera* in winter and transitional rainfall (summer-winter) areas of Namibia and South Africa. The type locality is the sandy valley floor of Namuskluft, an important endemism hotspot in Southern Africa and contains impressive stands of *Euphorbia gummifera* and its parasite *H. visseri*. In South Africa, *H. visseri* has only been observed in the Richtersveld. However, *E. gregaria*-dominated flats are common in the eastern portion of the Northern Cape Province near the Namibian border settlement of Ariamsvlei and its presence there is expected.

*Hydnora visseri*  
*photo Jay Bolin*

Some of my lasting memories include the respect he showed to his students. Despite an extremely busy schedule, and long queues of people in front of his office door waiting for a chance to consult him, he always made time for each and every one – listening attentively and patiently - offering his wisdom. I was very fortunate that I never had to queue at his office door – one of my tasks as his research assistant was to, every evening before I left for home, switch on the percolator to make a fresh pot of coffee that was left throughout the night to brew. And when he then came into my office early the next morning for his first cup of coffee, I had his undivided attention.

He taught me a lot of things – from the intricacies of photosynthesis to the amazing life strategies of *Hydnora*. However, much more important than what he taught me, is what I learned from him – the virtues of hard work, dedication and commitment. For his contribution to the person I am today, and the influence he had on all that crossed his path, I wish to salute Johann Visser – the Southern African father of parasitic plants.

I so wish that tonight, before I go home, I could once more switch on the coffee machine so that tomorrow, over a cup of strong, black coffee as he liked it, we can ponder over the wonders of a plant now known as *Hydnora visseri.*

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**THE MYSTERIOUS STERILE DODDER IN BRUNEI DARUSSALAM (NORTH-EAST BORNEO)**

Along the waterways and ditches of Brunei Darussalam careful observers can spot strange looking tangled masses of spaghetti thrown over the vegetation. Of course we are discussing the genus *Cuscuta* which was once mistaken to be *Cassytha filiformis* among local naturalists and botanists due to its striking resemblance. One of the most convenient methods of differentiating these two species quickly in the field is by scanning the stem under a hand lens. Stems of *Cassytha* tend to be rather woody, coarse and ridged due to the presence of numerous waxy-plates, compared to *Cuscuta* with a smooth and relatively shiny surface.

So far, only *Cuscuta australis* R. Brown has been documented based on flower morphology (Chak et al. 2010) in Brunei Darussalam. Surprisingly, of the 450 odd sites of dodder populations in Brunei Darussalam, only one population has flowered during four years of regular observation. The rest of the populations have remained completely sterile, thus arousing our interest. Molecular identification of these sterile *Cuscuta* populations in Brunei Darussalam using ITS and *trnL-F* DNA sequence data has indicated that all sterile populations of *Cuscuta* sampled are *C. australis*.

Sterile *C. australis* is usually found parasitizing *Mikania micrantha* along the waterways and low-lying areas in Brunei Darussalam and appears to go through cycles of rapid growth and perennation. The periodicity and stimuli for perennation are unclear. Perennation of *Cuscuta* was first reported by Rao (1939), whereby the young perennating *C. reflexa* shoots emerged from the absorbing tissue of the haustoria embedded within the body of the host. However, the perennating mechanism described for *C. reflexa* differs from the perennation of *C. australis* observed in Brunei, whereby the young
perennating shoots originate from the central pith instead of the haustorium tissue of the parental strand (see plate 1a - b). This perennating strategy of *C. australis* suggests that the reproduction is from food reserves. However, this hypothesis remains to be tested. During the perennating stage of *C. australis*, several young shoots of varying lengths were observed to emerge at several points along the parental strands. Further elongation of these young shoots results in the fresh attack of any nearby potential host plants.

Paucity of flowering populations of *C. australis* in Brunei remains an enigma. This species is mainly distributed in less strictly equatorial latitudes; throughout southern Europe, in South–Southeast Asia, in Australia (Liao et al. 2000) and also in the USA (Holm et al. 1997). Suppression of flowering in *C. australis* for several years may be an exclusive adaptation that associates to the ecological conditions in the tropics (i.e. day-length and dark period) or perhaps related to major climatic phenomena (i.e. El Niño and La Niña) (Kelly et al. 2001). Fratianne (1965) claimed that certain *Cuscuta* spp. may express flowering synchronicity with the host however this does not appear to be the case here. The factors that could trigger the initiation of flowering of sterile *C. australis* populations in Brunei Darussalam remain unknown. With only one exception, all dodder populations across Brunei Darussalam have remained sterile over four years. This raises the concern of future simultaneous flowering and seed dispersal in response to some as yet undetermined cue. The sudden outbreak of an introduced parasitic vine *via* simultaneous seed formation may pose a threat to native plants in the riparian zones and to crops commonly cultivated in Brunei such as beans, lettuces and tomatoes. Cultivated crops may be extremely susceptible due to the potential of irrigation water contaminated with *Cuscuta* seeds. Hence, timely precautionary measures should be taken well in advance before any possible future outbreak.

Acknowledgements
Funding for this study was provided by the National Development Plan, Brunei Darussalam University Brunei Darussalam (UBD) Science and Technology Research Grant No. 8. Molecular work at Old Dominion University was supported by the Mary Payne Hogan Endowment.

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WIKIPEDIA
Wikipedia needs well-written treatments of parasitic plants crafted by specialists. If you are interested in participating in this project, please contact Lytton Musselman (lmusselm@odu.edu)

SEASONAL GREETING
For a (late) seasonal greeting check www.youtube.com/watch?v=LUjn3RpkcKY and see why Google Alerts for ‘mistletoe’ have recently been providing an excessive number of hits.

CONGRATULATIONS TO PROF. ZEYAUR KHAN
Prof. Zeyaur Khan, the ICIPE scientist, leader of the widely-reputed push-pull programme, has been named co-winner of the 2011 TWAS Prize for Agriculture. The TWAS Prizes, awarded by The Academy of Sciences for the Developing World, honour individual scientists in developing countries in recognition of an outstanding contribution to knowledge. See item below under Press releases.
PRESS RELEASES

‘ICIPE scientist and leader of the push-pull programme wins TWAS Prize’

Prof. Zeyaur Khan, the leader of the widely-reputed ICIPE push-pull programme, has been named co-winner of the 2011 TWAS Prize for Agriculture. The TWAS Prizes, which are awarded by TWAS, The Academy of Sciences for the Developing World, honour individual scientists in developing countries in recognition of an outstanding contribution to knowledge. Based in Trieste, Italy, TWAS promotes scientific excellence and capacity in the South for science-based sustainable development, through a range of programmes that includes research grants; awards and prizes; fellowships and associate fellowships. The TWAS Prize adds to Prof. Khan’s growing list of accolades for his work as the leader of the push-pull programme, an innovative technology that simultaneously addresses the three key constraints of cereal production in Africa: stemborers, *Striga* weed and poor soil fertility.

The push-pull technology was developed by Prof. Khan at ICIPE in collaboration with Rothamsted Research in the United Kingdom, Kenya Agricultural Research Institute and various national partners, with funding from Gatsby Charitable Foundation (UK). Further research and development of the technology has been funded by the European Union, the Kilimo Trust (East Africa), Biovision Foundation (Switzerland) and McKnight Foundation (USA), among others. The technology involves intercropping cereals with a repellent plant such as *Desmodium*, and planting an attractive trap plant, for instance Napier grass, as a border crop around this intercrop. Stemborers are repelled or deterred from the target crop (push) and at the same time they are attracted (pull) to the trap crop, preventing damage on the cereal crop. In addition, *Desmodium* provides a novel means of *in situ* reduction of the *Striga* seed bank in the soil through efficient suicidal germination: the plant stimulates the germination of *Striga* seeds and inhibits their growth after they germinate.

Today, more than 50,000 farmers in eastern Africa are practicing the push-pull technology on their farms, dramatically improving their cereal yields. Moreover, the technology enables small-scale farmers to venture into dairy cattle and goat keeping, as both *Desmodium* and Napier are excellent fodder crops. Moreover, *Desmodium* fixes nitrogen and helps retain moisture through natural mulching, prevents soil erosion, and is also a perennial crop, which enables it to exert its *Striga* control effect even when the host crop is out of season.

In 2010, Prof. Zeyaur Khan received the designation of Fellow of the Entomological Society of America (ESA), which is accorded to individuals who have made outstanding contributions to the science of entomology – the scientific study of insects – with only 10 such distinction made annually. In addition he was elected to the Council of the International Congress of Entomology, and nominated Distinguished Scientist, International Branch of Entomological Society of America. Prof. Khan also received the designation of Fellow of Royal Entomological Society, London, and was also the 2010 winner of ESA’s Nan-Yao Su Award for Innovation and Creativity in Entomology. In 2009, Prof. Khan was selected the winner of the International Integrated Pest Management (IPM) Achievement awards, which are given to individuals or teams who have made significant contributions to the advancement of IPM, with at least one extraordinary achievement. In 2008 he was a plenary speaker at the 23rd International Congress of Entomology.


‘Green tech reins in noxious pests’

A unique technology that uses a weed and napier grass to keep a close rein on a pest that attacks maize is bringing good tidings to farmers. The ‘push and pull’ intermediate technology can fight the *Striga* weed and control the maize stalk borer instead of using pesticides.

For the technology to work, napier grass is planted around the maize field to attract (pull) moths. Its attractive scent pulls nearly three quarters of the borer insects, which go to lay their eggs in the grass instead of the maize. This reduces the chances of the crop being attacked. On the other hand, *Desmodium’s* unpleasant smell sends away (keeps off) the moths about 30 days after the maize has been planted. The insects go away in search of a suitable place to lay their eggs.

Reduce on use of fertiliser: The protein-rich legume *Desmodium* that is planted after every three rows of maize also fixes nitrogen nutrients in the soil, thus reducing the cost of adding fertiliser. ‘I was reluctant to invest in cattle because I didn’t have enough feeds, but this technology has changed my mind. I now keep cattle because I do not want to continue selling the animal feeds in my farm,’ said Mrs Eunice Simiyu, a farmer from Muyai village in Bungoma County, who first planted maize under the push and pull technology last year. She now rears two dairy cows.

Mr Ben Gitahi, a farmer at Rwaitira village, Gatanga District in Central Kenya who has adopted the technology said he has been able to harvest more from his quarter-acre piece of land and spends less on farm
inputs. ‘I now harvest six bags instead of two after I adopted this agricultural practice two years ago,’ said Mr Gitahi.

The technology is also useful in livestock rearing. To feed animals, napier grass is mixed with Desmodium in a ratio of 3:1. ‘Milk production has increased as a result. Desmodium further suffocates the Striga weed, which has been a threat to crop production. It is also a cover crop that retains water for long and cuts the effects of soil erosion,’ says Mr Patrick Waboya, the patron of Simana Farmer Field School.

The technology is being spearheaded by scientists from the Kenya Agricultural Research Institute (Kari) and the International Centre of Insect Physiology and Ecology (ICIPE). Mr Samuel Njihia, the coordinator of the project, said maize, which is the country’s staple crop, takes a larger space because it is the main focus for the farmers. ‘The rest only come in to safeguard maize from the pest, which weakens stems and eventually leaves the crop withering,’ said the Kari scientist. He added that the biological control method, whose efficacy was rated as high as 70 per cent, had improved maize output and livestock production. ‘In the use of natural agents to increase yields, remaining with a risk of between 10 to 30 per cent, as is the case under conventional maize and failure of other pest control methods. Farmers have been using ash, soil, and chemicals to eliminate the stem borer disease. The scientist said the seeds of the Desmodium legume are available at the Kenya Seed Company and mature vines from the crop can be replanted.

Mr Zakayo Saitoti, a technical assistant at Kari, said some farmers in Central, Nyanza, and Western Kenya had been trained and were assisting in sensitising their colleagues about the economic value of the technology. ‘We have identified demonstration sites and with the help of partners such as officials from the ministry of Agriculture and Icipe, many farmers have been brought on board,’ said Mr Saitoti. Icipe is coordinating the project in Western, Nyanza, Central, and parts of Rift Valley provinces. He said the push and pull technology contributes to environmental protection as no toxic substances are released.

By Dennis Odunga dodunga@ke.nation.co.ke
Daily Nation November 29 2011 at 00:00

‘Kenya: local scientists develop weed-resistant sorghum’

Local farmers will have a new sorghum variety resistant to the feared Striga weed at the end of this year. Striga attacks sorghum by growing into the roots where it sucks out water and nutrients. It slowly kills the plant and three weeks later emerges from the soil having done most of the damage. Director of the Kenya Agricultural Research Institute (Kari) Ephrain Mukisira said the new Striga-resistant variety could be available to farmers in December this year. ‘In some cases Striga has caused more than 100 per cent damage. This has really discouraged farmers,’ he said yesterday. Striga, also known as a witch weed, is difficult to manage and can stay under the ground for more than 15 years waiting for a farmer to plant cereal crops which facilitate their growth.

Yesterday, Dr Mukisira said they are testing preferred varieties in the field before releasing the seeds to farmers. The Kari director was speaking in Nairobi at a meeting organised by the Africa Biodiversity Conservation and Innovations Centre and the Association for Strengthening Agriculture Research in Eastern and Central Africa. The meeting was also attended by scientists from Sudan and Eritrea where more than 50 weed-resistant varieties have also been tested.

Sorghum is highly profitable and has rebounded in Kenya as a key cash and food crop. Dr Mukisira said it offers better returns than maize in the face of unreliable rains because of climate change. The East African Breweries also plans to buy sorghum from farmers for its popular keg beer. The ministry of Agriculture says although sorghum growing had declined since 1976, last year farmers produced more than 130,000 metric tonnes.

‘Uganda: Striga weed, the African farmer’s enemy’

Farmers specialising in growing cereal crops in Uganda and other parts of Africa have of late suffered low yields as a result of the striga weed invading their gardens. In Uganda the weed has mostly hit farmers growing cereal crops in eastern and northern Uganda.
Striga weed according to crop science experts is a parasitic weed that grows in farmers’ fields where cereal crops such as maize, millet, sorghum and rice are grown. It is a weed that attaches its roots to the roots of a cereal crop for purposes of obtaining food thereby causing stunted growth to the plant. According to Dr Michael Otim a crop entomologist at the National Crops Resources Research Institute (Nacrri) in Namulonge, in Uganda, the striga weed tends to attack maize, millet and sorghum crops. The weed has also been reported in western Kenya, Southern Sudan, Tanzania, Nigeria, Rwanda as well as South Africa especially in maize fields.

Dr Otim said there are two types of striga which include *Striga hermonthica* with purplish flowers commonly found in northern Uganda and *Striga asiatica* which has yellow flowers commonly found in eastern Uganda. In as far as the East African regions are concerned, three major striga zones have been identified and these include the Lake Victoria zone, the inland dry zone found in Tanzania, the inland moist zone found in Uganda and a conterminous coastal zone found adjacent to the Indian ocean in both Kenya and Tanzania. The most affected zone is the Lake Victoria zone with the largest extent of slightly over 850,000 hectares. The weed is said to cause 50 per cent to 80 per cent crop loss in the entire region. Tanzania has the largest area of striga infestation totalling over one million hectares. Uganda has 262,000 ha of striga infestation. A large portion of Uganda’s striga plagued areas are located away from Lake Victoria, near the Kenyan border and the country reports that 31.9 per cent of its maize is under infestation. Tanzania has the largest share of its maize acreage under striga attack, with 36.9 per cent of its three million maize acres affected mostly in Terima and Serengeti district. Kenya has 216,000 hectares of striga hit cropland, with most of it found near Lake Victoria. Therefore, across East Africa, the economic impacts are substantial, totalling over $568m a year.

Dr Otim says the weed produces up to 50,000 seeds that can remain dormant in the soil for 10 years and it grows mostly in less fertile soil, the reason why farmers’ fields are being attacked by the weed these days, yet it has been in existence for over 100 years. He adds that when farmers in eastern Uganda expressed concern over the weed, a team of science experts started the push-pull technology where the Napier grass is planted on borders of the cereal crop field and the desmodium used for controlling maize stem borers in between the rows.

Crop scientists in Serere are also working on a sorghum variety that is resistant to the weed. The head of the cereals crops research at Namulonge, Dr Godfrey Asea, said his team is working on a number of maize varieties that are resistant to the weed. This is because previously farmers were advised to uproot the weed once they site it in their gardens but because the weed has attractive flowers, many farmers thought it was not a dangerous weed. The team has acquired a maize variety called Imazobil Resistant (IR) maize from International Maize and Wheat Improvement Centre, which is coated with herbicides to avoid attack on the plant. The herbicide kills the roots of the weed and increases the soil nutrient, thereby making it unfavourable for the weeds to grow. Scientists in Kenya have already come up with resistant varieties against the weed which they have released to farmers in Western Kenya.

The Agricultural inspector at the Ministry of Agriculture, Mr Isaac Wamasembe said as regulated by the ministry, when conducting their routine field work, they advise farmers to guard against the weed by leaving the land fallow for two to three years before planting a cereal crop for the second time on the same land. The ministry also inspects seeds that are brought into the country to avoid incidences of some seeds being imported with mixed invasive weed seeds. Farmers are also advised to practice intercropping where cereals are planted with legumes.

Mr Moses Okello, a farmer hailing from Dabani village in Busia, says, ‘The weed has been wiping off our cereal crops because a garden where farmers could harvest one bag of maize, once infested with the weed, will yield half a bag of maize.’

He said most farmers know about the weed but could not devise a method of controlling until the push-pull technology was introduced. He has however urged scientists to come up with another control method for their cassava crop where the weed is sometimes spotted because the above technology only works with cereal crops.

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‘Maize ‘Green Revolution’ coming soon’

Nigeria will increase its maize production within the next few years by 150 percent to 20 million tons per annum. Current produce output stands at 8 million tons. This move is part of efforts by the federal Ministry of Agriculture and Rural Development to enhance food security, create jobs, and more importantly, cushion the oil-rich nation from the effects of rising food prices. According to the minister, Akin Adesina, the new efforts will transform the maize industry and make farming in general more profitable.
Maize is a staple food for millions of Nigerians, and its productivity has been stymied by low adoption of improved seeds, poor seed quality, little or no use of fertilizers, low investment in research funding, and poor extension services. In the 1980s, Nigeria experienced a silent Maize Revolution in the savannah but the transformation was not sustained. ‘We have begun a journey of transformation—a journey to re-engineer Nigerian agriculture for high impact and success,’ Mr Adesina said during a meeting with a team of maize experts in Abuja. Mr Adesina said on the experts to translate research and innovations into impacts on farmers’ fields, adding that ‘we must do this at a scale that can reduce hunger and poverty.’ According to him, government has resolved to ‘rebuild the broken walls of Nigeria’s agriculture. ‘Our resolve is clear: Grow Nigerian Agriculture.’ he added.

Last Sunday, the maize team submitted a blueprint on how to achieve the new targets. Dr Sam Ajala, a Maize Breeder at the International Institute of Tropical Agriculture (IITA), which is headquartered in Ibadan, said the focus on maize was a step in the right direction. ‘If you look at maize, it has the highest return on investment [ROI] compared with other crops. So if we are able to get it right in maize it will be great,’ he said.

Researchers aim to leverage on earlier successes recorded under the Doubling Maize Project that proved that maize yield could be doubled on farmers’ fields. The new move will also benefit from the plethora of innovations lying dormant in international and national research centres waiting to be adopted by farmers. For instance, high-yielding and disease-resistant varieties that are adaptable to Nigeria’s various agroecological zones, as well as drought- and Striga-resistant varieties that could address on-farm stresses will be deployed to farmers. Early, intermediate, and late-maturing varieties with yields up to thrice as much as traditional varieties will help farmers tackle the negative effects of climate change.

‘We are optimistic that if given the necessary support we will achieve the 20 million tons target,’ Mr Ajala said.

Leke Adeyemi
‘Next’ September 13, 2011.

_Cuscuta japonica_ in California

Comparable to the story of non-flowering _Cuscuta_ in Brunei above, a similar occurrence of numerous non-flowering infestations of _Cuscuta japonica_ in California was reported in Haustorium issue 51. A new infestation has now been reported from Santa Barbara County as in the following and subsequent press releases:

http://www.lompocrecord.com/news/local/article_c359e064-ceedd-11e0-9883-001cc4e002e0.html

‘Mistletoe League Project - A survey about mistletoe, and mistletoe management, on fruit trees (in UK).’

(extract from full text)

A survey about mistletoe (Viscum album) on fruit trees, aiming to gather useful information on management practices and attitudes, its harvest, and on any host varietal preference.

Most mistletoe in the UK (and in other parts of northern Europe) grows on fruit trees, mainly apple, and so it is a particular feature of orchards and gardens. This phenomenon is particularly obvious in orchards in mistletoe’s preferred growing area of the English south-west midlands (Herefordshire, Worcestershire, Gloucestershire and Somerset) and across the Welsh border in lowland Monmouthshire. For gardens the phenomenon is more widespread - as much mistletoe has become established on garden fruit trees well outside its natural geographic area.

Mistletoe will grow on many other host tree species too, but it is only usually harvested from fruit trees, as the ‘crop’ is easily reached in these. Mistletoe is, and probably always will be, fairly common on other hosts (Tilia spp., poplars, willows, hawthorns) in the wider countryside in its natural area, but it is difficult to crop from those hosts.

Several problems seem to be arising for mistletoe because of this fruit tree association. Firstly, the huge, and continuing, loss of traditional orchards in recent decades must be reducing opportunities for cropping mistletoe, and reducing the harvest long-term. But how significant is this problem? We have no figures for mistletoe trading, and no way to tell whether the threat is really becoming critical yet, and if not yet, when it will be. Secondly, the decline in economic value for the remaining traditional orchards means that many are significantly neglected. The fruit crop is often left on the ground in these ‘remnant’ orchards and the trees left unpruned.

A short/medium-term side-effect of this second point, in mistletoe’s core growing areas is (ironically) a glut of mistletoe. Fruit trees, particularly apple, in the neglected orchards of this area often develop huge growths of mistletoe - far too prolific for the tree to support, and leading to premature death of both tree and mistletoe.

At present there might seem to be plenty of mistletoe in these situations, but it is clearly not sustainable. But, as with the first problem, no data exist to measure this
problem. A key unknown is how the owners and managers of these orchards perceive the mistletoe - do they understand the issue, are they acting on it, do they know what to do, if not why not, is it simply to do with economics and manpower, and so on. Not just orchards - garden trees too:

The management issue also arises in gardens with mistletoe, where it is not unusual to see an apple tree festooned with abundant mistletoe, of which many gardeners are very proud. But the amount can quickly become unsustainable and it is not unusual to hear of prized mistletoe trees suddenly dying, or falling in winter storms. But most information is anecdotal - is this a real problem or not?

The League Project is also aiming to gain information on varietal preferences. In some core area orchards it is obvious there is some preference - with mistletoe abundant on some trees but relatively poor on others. Sometimes this can be explained from management history - but sometimes it appears to be related to the fruit variety. Some seem more susceptible, or more resistant, than others. So, could a Mistletoe League Table be drawn up showing which varieties are best and worst for mistletoe? And could this be used to help manage mistletoe where it is overabundant, or encourage it where it is scarce? As above, there are currently no data, and it would clearly be useful to have some. The Mistletoe League Project aims to gather information on all these issues.

The project has been split into two parts: Part 1 is a questionnaire for fruit tree managers who deal with mistletoe (1a is for orchard managers, 1b is for gardeners) Part 2 aims to gather information on varietal preferences. Rapid results are not anticipated! The project is likely to run for several years, building up more information each winter season from 2011/12 onwards.

Mistletoe Matters Consultancy is run by Jonathan Briggs, a national mistletoe expert with over 25 years research experience with this parasitic plant.

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Mistletoe Matters Consultancy
November 2011

MEETING REPORTS

APS/IPPPC Joint Meeting, Honolulu, Hawaii, August 6-10, 2011

The American Phytopathological Society (APS) and the International Association for the Plant Protection Sciences (IAPPS) held a joint meeting in Honolulu, Hawaii on August 6-10, 2011. The occasion brought together a large group of scientists interested in pathology and plant protection, which seemed to be the ideal venue for discussing parasitic plants with students and researchers who don’t often have the opportunity to attend parasitic plant congresses. The session was well organized by Yaakov Goldwasser and featured a solid lineup of speakers.

Unfortunately, because the conference format consisted of a large number of concurrent sessions and this session was relegated to the final afternoon, the audience consisted mostly of familiar faces.

Jim Westwood.

Featured speakers were:

G. Ejeta. Striga – A formidable challenge to Africa’s food security.
B. Rubin. Selective and non-selective management of field dodder (Cuscuta campestris).
K. Yoneyama et al. Role of strigolactones in the host-parasite association.
J. Westwood et al. Genomics approaches to parasitic plant research.

5th Mistletoe Symposium: Mistletoe in Cancer Therapy – Basic Research and Clinical Practice, November 10-12, 2011.

About a hundred scientists and doctors from a variety of scientific disciplines and therapeutic approaches met at the European Academy of Otzenhausen (in Nonnweiler, Saarland) for the 5th International, Interdisciplinary Mistletoe Symposium. At the symposium, the latest results from research and clinical medicine were presented, discussed and compared, so as to put together a multidimensional and comprehensive picture of the current state of scientific knowledge on mistletoe extracts. Bridges were built not only between different therapeutic approaches, pharmaceutics and medicine, and basic research into mistletoe and use of mistletoe, but also between conventional and complementary oncology. The treatment of pancreatic carcinoma was chosen as a topic for special attention and was dealt with
in depth in a podium discussion both from the perspective of conventional oncology and in terms of the contribution which mistletoe preparations can make to the management of this condition. In addition, the participants at the symposium discussed and unanimously approved the wording of the “Second Nonnweiler Declaration” (see box at end of article for details). This declaration calls for the cost of parenteral administration of mistletoe preparations not only in the palliative but also in the adjuvant therapeutic setting to remain reimbursable by the German statutory health insurance (SHI) funds.

The symposium was organised and sponsored by the Karl and Veronica Carstens Foundation and the Society of Anthroposophical Doctors in Germany (GAÄD) in collaboration with the Society for Medicinal Plant and Natural Product Research (GA), the Society for Phytotherapy (GPT), the German Pharmaceutical Society (DPhG) and the Central Association of Doctors in Naturopathic and Regulation Medicine (ZAEN), with the International Association for Pharmaceutical Technology (APV) acting as a cooperation partner. The scientific organising committee was made up of Prof. Dr. Susanne Alban (Kiel), Prof. Dr. Hans Becker (St. Ingbert), Prof. Dr. Wolfgang Blaschek (Kiel), Prof. em. Dr. Dr. h.c. mult. Fritz H. Kemper (Münster), Prof. Dr. Wolfgang Kreis (Erlangen), PD Dr. Harald Matthes (Berlin), Prof. Dr. Dr. h.c. mult. Heinz Schilcher (Immenstadt) and Dr. Rainer Stange (Berlin). The symposium was coordinated by Dr. Rainer Scheer, of the Carl Gustav Carus Institute in Niefern-Oschelbronn.

A particular feature of this mistletoe symposium was the broad range of topics covered, reflecting the breadth of current research on this important medicinal plant. Pharmaceutical, pharmacological and medical topics were presented by means of 8 summary papers, 24 short lectures and 19 posters. The specific areas dealt with included pharmaceutical aspects of the manufacture of mistletoe preparations and the effects of various constituents, in vitro and in-vivo preclinical studies, studies on the immunology and cytotoxicity of presently marketed or developmental mistletoe preparations, clinical results obtained in various applications and tumour entities in both adjuvant and palliative therapeutic settings in both human and veterinary medicine, reports from medical practice, and clinical studies designed to demonstrate specific effects, the efficacy, the safety and tolerability of mistletoe preparations. All the abstracts from the symposium have been published in English in Phytomedicine (Elsevier-Verlag) 18 (2011), Supplement VIII and are freely available in the internet at www.ScienceDirect.com. The abstract booklets which are still in stock are available on request from the author of this article. The following paragraphs provide details of the summary papers and the topic of pancreatic carcinoma.

As might be expected, the focus of the pharmaceutical presentations was on mistletoe lectins, a class of substances present in mistletoe extracts which jointly determine the effects of these extracts. Professor Blaschek (Kiel) used immunohistochemical methods to determine the localisation of these lectins in the mistletoe plant and found differences in this regard between tissues and seasons. He showed that mistletoe lectins are mainly located in the shoots rather than the leaves, especially in the cortical parenchyma and in the outer sclerenchyma caps of the vascular bundles.

Based on the known structures of mistletoe lectins ML-1 and ML-3 (the molecular structure of ML-2 remains unknown), Professor Pfüller (Hamburg) discussed the biochemical and pharmacologically relevant properties of these proteins, which specifically recognise galactosyl/N-acetylaminoxylooligosaccharide target structures. In addition to the ribosome-inactivating (cytotoxic) lectins, a chitin-binding lectin (VisalbCBA) which is specific for glucosamine groups is also known to exist. The biochemical properties, biological availability and stability of the mistletoe lectins are influenced by other components of mistletoe extracts (viscotoxins, oligo- and polysaccharides).

Professor Klein (Tübingen) spoke about chronic and acute inflammation and the dual role of inflammation in the pathogenesis of cancer. A variety of immune and inflammatory cells are to be found inside a tumour. These immunocompetent cells influence the tumour cells in various ways (via cytokines, chemokines, growth factors, prostaglandins and reactive oxygen and nitrogen species). Inflammation influences every single step in tumorigenesis, from tumour initiation and tumour maintenance to tumour progression and metastasis. A rough distinction can be made between tumour-destructive inflammation (TH1 response, M1 macrophages, NK cells) and tumour-promoting inflammation (TH2 response, M2 macrophages). Both pro- and anticarcinogenic and inflammatory mechanisms are present simultaneously in developing tumours, but if the tumour is not eliminated, the procarcinogenic effects come to dominate. Signal transduction pathways which promote the procarcinogenic effects of inflammation often form a vicious circle. Certain immune and inflammatory components can exert positive effects on tumour growth during one stage of tumour development, but negative effects during another stage. Treatment with mistletoe preparations, which have long been reported to stimulate a large number of factors that influence (anticarcinogenic) tumour-associated inflammation via a
variety of mechanisms, can help break down immune
tolerance to tumour antigens and positively influence the
immune response to tumours. Nevertheless, the
mechanism of such processes varies from tumour to
tumour, and only by continuously expanding our
knowledge of the complex interplay between different
components of the anti-tumour response will we be able
to develop better strategies for treating this disease.

In his talk, Professor Efferth (Mainz) reported on
methods of predicting response to cancer therapy and on
the significance of these for the development of
personalised treatment strategies. In this respect he
discussed a range of subjects including relevant
cytotoxicity tests, immunohistochemical detection of
prognostic markers of therapeutic response and patient
survival time, and modern pharmacogenomic techniques
(comparative genomic hybridisation, DNA methylation
assays, mRNA microarrays, etc.). He compared data he
had obtained using these techniques with clinical patient
data, and presented the results of investigations aimed at
predicting sensitivity or resistance both to cytotoxic
agents and to phytochemicals used in complementary
medicine. In doing so he emphasised the relevance of
these methods to herbal medicines such as mistletoe
preparations.

Dr. Breitkreuz (Bad Liebenzell) reported on recent
developments in anthroposophical mistletoe therapy and
on a series of expert conferences hosted by the GAÄD
between 2008 and 2011. By reference to a number of case
reports he discussed the topics considered at those
conferences, namely dosing strategies (initiation of
therapy: escalating dosage regimen or high initial dose),
choice of host tree, choice of preparation, control of
mistletoe therapy and methods of administration
(subcutaneous, intravenous, intratumoral, intrapleural,
intravesical, oral), with reference to differences between
mistletoe preparations depending on their method of
manufacture. He also discussed questions such as how
mistletoe therapy and conventional therapy are
coordinated and what should be done in the event of
critical treatment incidents or side effects. In order to
provide doctors who prescribe mistletoe therapy with
well-founded information, new study concepts (e.g.
qualitative studies) are being developed, data collection is
being intensified (Network of Oncology, Havelhöhe
Research Institute) and plans are underway for a new
handbook (GAÄD, compilation of evidence on
therapeutic use of anthroposophical medicines), the third
edition (2013) of which is to include reference to
mistletoe preparations.

Dr. Kienle (Freiburg) provided an overview of clinical
studies on mistletoe preparations used in
anthroposophical medicine and phytotherapy. More than
140 such studies have been published, of which 60 were
prospective controlled studies. The study objectives were
to improve quality of life, patient survival, tumour
response, and safety and tolerability. Most of the studies
yielded positive results, but due to methodological
differences in quality some received more favourable
reviews than others. One definite finding is that
mistletoe preparations improve quality of life and the
tolerability of conventional cancer therapies. Study data
on safety and tolerability show that after parenteral
administration of mistletoe preparations, side effects are
mostly mild. Most common among these are local
reactions (skin reddening, induration at the injection site
after subcutaneous administration) and a slight rise in
temperature. Both of these types of reaction indicate to
the doctor that the patient is responding to the mistletoe
therapy. There have been occasional reports of
pseudoallergic reactions, but no reports of serious
adverse reactions. Approximately equal numbers of
studies have been conducted in adjuvant and palliative
therapy settings. In recent years, regulatory authority
demands have increasingly led to the performance of (in
most cases randomised) clinical trials (RCTs), although
many medical questions cannot be answered on the basis
of RCTs alone.

The question of studies also received a lot of attention in
the podium discussion on the main topic: “Treatment of
pancreatic carcinoma”. In this discussion it was pointed
out that RCTs investigate the effect or efficacy of drugs
in highly selected patient groups, and do not always
reflect real-world therapeutic situations. For this reason,
greater importance is likely to be attached in the future
to health services research and possibly also to
evaluation of registry data as a means of acquiring
medical and therapeutic knowledge. The Network of
Oncology (NO; Havelhöhe Research Institute, Berlin)
will likewise become more important. At present about
2000 patients per year are documented in the Network of
Oncology.

In his talk on “Options and limitations of ductal
pancreatic cancer treatment”, Professor Seufferlein
(Halle) pointed out that pancreatic carcinoma has a very
poor prognosis. The principal reasons for this, he said,
are firstly the lateness with which the disease is
diagnosed as a result of an absence of symptoms or the
presence of only nonspecific symptoms, and secondly
the resistance of the disease to radiotherapy and
chemotherapy. Only complete resection – which is,
however, rarely possible – offers a possibility of cure. In
his talk, Professor Seufferlein dealt with subjects ranging
from neoadjuvant, adjuvant and palliative therapies to
new therapeutic strategies such as the use of CD40
agonists, which cause breakdown of tumour stroma and lysis of tumour cells by macrophages. He also referred to albumin-bound paclitaxel, which is used in the form of nanoparticles in combination with gemcitabine, and to the acquisition of more detailed knowledge of tumour subgroups, which it is hoped will improve the efficiency of treatment. The following observations apply only to adjuvant and palliative therapy settings. In Europe the standard treatment in the adjuvant therapy setting is chemotherapy alone. With this approach, the 5-year survival rate has been increased from 9 to 20 percent. Because of its lower toxicity, gemcitabine is preferred to bolus administration of 5-FU, although survival rates do not differ significantly between the two drugs. In the palliative setting, gemcitabine prolongs survival and relieves disease-related symptoms and signs such as pain and weight loss. The median survival time of patients with metastatic pancreatic carcinoma receiving this treatment is 6 to 7 months. Combination of gemcitabine with erlotinib, an EGFR receptor tyrosine kinase inhibitor, improves this value (to 10.5 months) only in patients who show an (inflammatory) skin reaction in the first few weeks of treatment. Recently Conroy et al. showed that in patients with metastases, intensified chemotherapy in accordance with the FOLFIRINOX protocol increases median survival time to 11.1 months.

Dr. Matthes (Berlin) discussed the use of mistletoe therapy in adjuvant and palliative therapy settings. In patients with pancreatic carcinoma, mistletoe preparations are used subcutaneously (as an adjuvant to chemotherapy), intravenously and intratumorally in order to exploit the cytotoxic properties of mistletoe extracts. Dr. Matthes reported on a controlled, retrospective, multicentric, pharmacoepidemiological noninterventional cohort study in which 396 postoperative patients received conventional therapy with gemcitabine, while those patients in the mistletoe arm (n=201) also received Iscador Quercus subcutaneously. This led to an improvement in terms of quality of life, symptoms attributable to the disease and its treatment and overall survival in the mistletoe group as compared to the comparator group. In a phase I dose escalation study by Mansky et al. (Bethesda, USA), it was found that use of mistletoe therapy with Helixor A in combination with gemcitabine in patients with advanced solid tumours (n=44; pancreatic carcinoma n=10) was not only well tolerated, but also higher doses of gemcitabine (as recommended) were possible. The neutrophil granulocyte count and its minimum value during chemotherapy showed a mistletoe dose-depending increase. No influence whatsoever on the pharmacokinetics of the cytotoxic drug or on cytokine release was observed. Dr. Matthes also referred to smaller studies (Schad et al., Berlin) in which patients with inoperable pancreatic carcinoma were treated with intratumorally administered mistletoe preparations of a number of different manufacturers simultaneously with gemcitabine therapy. Overall survival time was subsequently found to be 12.2 months in patients in UICC stage III and 11.2 months in patients in UICC stage IV, with a one-year survival rate of 26 percent.

Outcome study data obtained by Dr. Spahn (monocentric integrative therapeutic approach = indication-dependent combination of conventional with anthroposophical therapy including mistletoe extract, in most cases Abnoba viscum hypo/thermia) complemented and confirmed these favourable results. The result was good tolerance of treatment with a median survival time of 15.2 months in all patients (n=95) and 12.4 months in patients with advanced disease (stages III and IV; n=60). It was thus shown that an integrative therapeutic approach involving use of mistletoe therapy leads to results which are at least comparable to those obtained with purely conventional therapy, but with better tolerance.

Last but not least, a randomised phase III study (Tröger, Freiburg; Iscador Qu spezial) in patients with advanced or metastatic pancreatic carcinoma was described in a poster. The initial analysis of the results of this study is to be performed shortly, so the papers to be delivered at the next Mistletoe Symposium (2015) will be eagerly awaited. Another phase III study, in this case in patients with superficial bladder carcinoma (Eisenbraun, Pforzheim; Abnoba viscum Fraxini), is currently in preparation. In addition, two prospective pharmacoepidemiological studies on the use of Iscador Qu spezial in patients with colorectal carcinoma (800 patients) and pancreatic carcinoma (400 patients) are being conducted at present.

As the symposium came to an end, all participants agreed that it had been a great success, and the farewell words were “See you again in four years’ time in November 2015 at the 6th Mistletoe Symposium in Nonnweiler.”

The full texts of all contributions to the symposium are to be made available, presumably by the end of 2012, in the form of a book to be published by KVC Verlag Essen. Further information on this and on previous mistletoe symposia is available at www.mistelsymposium.de.

Dr. Rainer Scheer, Carl Gustav Carus-Institut, Am Eichhof 30, 75223 Niefern-Öschelbronn, Germany.

Presentations:

Thomas Breitkreuz. State of the art and new developments of anthroposophic mistletoe therapy – Results from a series of expert conferences hosted by the German anthroposophic doctor’s association (GAAeD) 2008–2011.

M. Werner et al. Supportive therapy with mistletoe extract in tumor patients – Results of four controlled pharmacoepidemiological cohort studies as basis for prospective studies.

Jürgen Johannes Kuehn. Different routes of application in mistletoe therapy – Effect on bone marrow and blood profile. Clinical significance.

R. Ziegler et al. Mistletoe therapy in anthroposophical hospitals in Switzerland.


P.J. Mansky et al. NCCAM/NCI phase 1 study of mistletoe extract and Gemcitabine in patients with advanced solid tumors.

M. Brandenberger et al. Quality of life during mistletoe therapy of cancer patients – An exploratory study with the additional use of questionnaires.

Wilfried Tröger. Mistletoe therapy for advanced pancreatic cancer. A group-sequential, randomised, open label study phase III ISRCTN 70760582.

K.R. Wiebelitz and A.-M. Beer. High dose intravenous mistletoe treatment – Clinical results, laboratory findings and adverse events in a series of 17 patients with 107 intravenous applications.

Jürgen Eisenbraun. Dose-escalation-study with a mistletoe extract from the ash tree as intravesical instillation in patients with superficial bladder cancer: An ICH/GCP phase Ib/Ila study.

M. Orange et al. Two cases of durable regression of primary B-cell cutaneous lymphoma following mistletoe treatment alone.


J. Burkart et al. The potential of a mistletoe (Viscum album L.) extract to alleviate adverse effects of cancer chemotherapy: An in vitro study.

W. Blaschek et al. Localization of mistletoe lectins ML I-III in Viscum album L. by immunofluorescent and immunogold labeling.

T. Ostermann and A. Büssing. Retrospective studies on the survival of cancer patients treated with mistletoe extracts – A meta analysis.

Y. Klapper et al. Interactions between proteins of mistletoe or human serum and lipid membranes.

M. Krötz et al. Mistletoe and chemotherapy responsiveness of different scales in oncological patients undergoing chemotherapy.

U. Mengs et al. Lectins are the pharmacologically active constituents in the standardized mistletoe extract PS76A2 (Lektinol®).

M. Krötz et al. State version of autonomic regulation (aR): A new scale to distinguish between autonomic constitution and loss of regulation with regards to chemo- and mistletoe sensitivity.

U. Pfüller and U. Schumacher. Mistletoe lectins as biologically active substances in aqueous mistletoe extracts.

W.F. Eisenbeiß et al. Selective quantification of mistletoe lectin I in pressed mistletoe juice after inhibition of mistletoe lectin II and III.


Mira Kohl et al. Comparative investigation of monosaccharides and sugar alcohols in mistletoes (Viscum album L.) from different host trees.

J. Doehmer and J. Eisenbraun. Assessment of extracts from mistletoe (Viscum album) for herb–drug interaction by inhibition and induction of cytochrome P450 activities.

C. Werner et al. of the summary of product characteristic of anthroposophic preparations in parenteral dosage forms containing mistletoe – Result of a compromise between the marketing authorization holders and the German Federal Institute for Drugs and Medical Devices.


G. Spahn et al. Clinical outcome study in pancreatic carcinoma using Viscum album therapy in an integrative approach.

Thomas Efferth. Molecular approaches for individualized tumor therapy with standard drugs, phytochemicals, and medicinal herbs.

T.J. Zuzak et al. Viscum album inhibits cell growth, migration and invasion of pediatric tumor cell lines – But effects are limited at concentrations found in serum.

U. Biegel et al. Orally administered Viscum album Quercus dilutions in the therapy of feline fibrosarcoma in cats.

J. Gutsch et al. Observational study on treatment of lymphocytic Non Hodgkin’s Lymphoma (CLL) with Viscum album products Helixor P or A: Clinical course and safety.


Wolfgang Kreis. Lectins – Potential sources and potential benefits.

Christian Grah et al. Randomised, open phase II study of tolerance, safety and efficacy of *Viscum album* extract in the palliative, additive treatment of advanced non-small cell lung carcinoma (NSCLC).

Catharina I. Delebinski et al. Effects of *Viscum album* L. extracts in neuroblastoma in vitro and in vivo.

Catharina I. Delebinski et al. Therapeutic efficacy of natural compounds from *Viscum album* L. in acute lymphoblastic leukaemia.

M. Kröz et al. State version of autonomic regulation (aR): A new scale to distinguish between autonomic constitution and loss of regulation with regards to chemo- and mistletoe sensitivity.


A. Staudt et al. Diurnal cortisol profile in breast cancer patients before and during treatment with *Viscum album* (Iscador® P) for 3 or 6 months.

A. Longhi et al. *Viscum album* fermentatum Pini versus oral Etoposide as adjuvant treatment in osteosarcoma patients after second relapse.

F. Schad et al. Multimodal *Viscum album* L. treatment in an integrative oncological setting in patients with advanced pancreatic carcinoma.

C. Kunz et al. Treatment of basal cell carcinoma with *Viscum album* lipophilic extract – A case series study.

Gunver S. Kienle et al. Safety of higher dosages of *Viscum album* L. in animals and humans – Systematic review of immune changes and safety parameters.

K. Urech et al. Organ specific and seasonal accumulation of viscotoxin-isofoms in *Viscum album* ssp. *album*.

M. Vranceanu and G. Leneweit. Genuine bilayer formation during glancing impact of drops on liquid surfaces both covered by lipid monolayers.

A.P. Simões-Wüst et al. Sensitivity of primary cultures of breast cancer cells to different Iscador®-preparations.

Reinhild Klein. The role of inflammation in the pathogenesis of cancer.


C.v. Hagens et al. Does a treatment with *Viscum album* (Iscador® P) in patients with breast cancer influence the expression of the T-cell receptor (TCR)-zeta chains of T- and NK-cells?.

Shao Kang Hung et al. Case reports of adverse effects of herbal medicinal products (HMPs): A quality assessment.


FORTHCOMING MEETINGS

The VIth International Weed Science Congress (IWSC) will be held on June 17 to 22, 2012 at the New Century Grand Hotel in Hangzhou, China. The theme of the Congress is ‘Dynamic weeds – diverse solutions’ and will include a session on Parasitic Weeds on June 21st and there will be a further Symposium ‘The State of art in Parasitic Plants Research in the Technological and Biotechnological Era’ on June 22nd. For information on these sessions, contacts are:

H. Eizenberg eizenber@volcani.agri.gov.il
K. Yoneyama yoneyama@cc.utsunomiya-u.ac.jp
Y. Goldwasser gold@agri.huji.ac.il

For the main programme the contact is:

Per Kudsk Tel.: +45 8999 3582 Email: Per.Kudsk@agrsci.dk

For registration and hotel accommodation: contact Mengdi Guan, CICCST, No.86 Xueyuan Nanlu, Beijing 100081, P. R. China Tel: 86 10 6218 0144 86 10 6217 4948 Fax: 86 10 6218 0723 Email: gmd@congress.com.cn. Or register online via http://www.iwss.info/.

Deadline for early registration is March 1. The fee will increase thereafter.

N.B. Active members pay a discounted fee for the Congress, will have voting privileges for the election of officers, and will have members-only access to abstracts for the first two years after the Congress. You are advised to renew your membership to IWSS via http://www.olemiss.edu/orgs/iws/DEFAULT.htm.

BOOKS


This has been out of print for some years and the co-authors regrettably declined invitations to prepare a revised edition (we couldn’t quite face it!). Now CABI have decided to re-issue on a ‘print-on-demand’ basis. The price is not yet available but is expected to be in the
range £75-£95. Sadly it has not been possible to correct any of the embarrassing errors in the original.

Chris Parker.

THESES


Cereal production in Africa is under increasing constraint due to the obligate, out-crossing, hemiparasitic weed Striga hermonthica (Del.) Benth, a member of the Scrophulariaceae family. Striga parasitizes roots of cereals like sorghum, pearl millet, maize and upland rice. It has infested about 40% of the African agricultural land, resulting in severe yield losses or even complete crop failure worth US$7 billion per annum. The subsistence farmers or approximately 300 million African people lose about 20-80% of their crop because of this weed. This considerable damage by Striga is due to the fact that existing control measures are often ineffective. These include cultural and mechanical measures, such as hand pulling, that are mainly adopted after its emergence. Since much of the damage occurs underground during the early stages of parasitism, there is a need to develop control strategies that target the weed prior to attachment and emergence. A crucial step in the lifecycle of Striga is the induction of germination by strigolactones, signalling molecules secreted by the roots of its host. These strigolactones could be an important target to control this weed at the pre-attachment phase. Control methods targeted at the germination and attachment phase, based on low strigolactones, might prove to be more effective and result in reduced infestation of this weed in cereal crops. In my thesis we studied the relationship between strigolactones and Striga infection in cereals and explored opportunities for lowering Striga damage at the germination or attachment phase. To this end different aspects like strigolactone biosynthetic inhibitors, genetic variation for strigolactone production, and the effect of fertilizers on strigolactone production were investigated in laboratory studies and – when possible - in the field in Kenya and Mali.

The first investigation was on the use of carotenoid inhibitors to see the possibilities of strigolactone reduction in the roots of plants by blocking carotenoid biosynthesis. We postulated in this study that the (mild) inhibition of carotenoid biosynthesis by carotenoid inhibitors, could lead to a reduced production of strigolactones and decreased Striga germination and infection. Very low concentrations of four different carotenoid inhibitors (fluridone, norflurazon, clomazone and amitrole) were applied to rice either through irrigation or through foliar spray. Irrigation application of all carotenoid inhibitors and spray application of amitrole significantly decreased strigolactone production. A significant negative relationship between inhibitor concentration and Striga germination and attachment was noted for irrigation application of fluridone, clomazone and norflurazon while amitrole application showed significance only in Striga germination. Application of carotenoid inhibitors caused 61-75% reduction in Striga germination and 65-94% reduction in Striga attachment. The study shows that the reducing effect of carotenoid inhibitors (which, in much higher concentrations are widely used as herbicides) on strigolactone secretion and subsequent Striga germination and attachment may be developed into an attractive Striga control technology.

Another experiment (Chapter 3) was aimed at assessing the pre-attachment Striga resistance based on low strigolactone production. We hypothesized that low strigolactones producing crop cultivars might possess pre-attachment Striga resistance due to less germination. For this purpose a set of 18 upland cultivars of NERICA and their parent were screened for strigolactones production and Striga infection parameters like germination, attachment, emergence and Striga dry biomass. NERICA 1 and CG14 produced significantly less strigolactones and showed less Striga infection while NERICAs 7, 8, 11 and 14 produced the highest amounts of strigolactones and showed the most severe Striga infection. A positive relationship between the amount of strigolactones and Striga infection was seenamong the rice cultivars. This study shows that genetic variation for pre-attachment Striga resistance exists in NERICA rice due to variation in strigolactones. This could be highly relevant for breeding programs aimed at the development of Striga resistant cultivars.

In Chapter 4 we hypothesized that variation in strigolactone production in rice might be interconnected with the tillering phenotype and that this link could affect Striga infection. In this study the genetic variation was tested in a series of rice varieties collected from all over the world for strigolactone production, tillering phenotype and Striga infection. Rice cultivars like IAC 165, IAC 1246, Gangweondo and Kinko produced high amounts of the strigolactones, displayed low amounts of tillers and induced high Striga germination, attachment, emergence as well as Striga biomass. In contrast to this, rice cultivars such as Super Basmati, TN 1, Anakila and Agee showed low production of strigolactones and also low Striga germination and infection but high tillering. Statistical analysis across all the varieties confirmed a strong positive correlation between strigolactone production and Striga infection and a negative
relationship with tillering. These results show that genetic variation in strigolactone production results in variation in tillering and also in *Striga* infection. The tillering phenotype could possibly be used as an easy indicator of the strigolactone production in a breeding programme for *Striga* resistance.

A number of experiments (Chapters 5, 6, 7) were designed with the aim to quantify the relationship between strigolactones and *Striga* germination and attachment and to explore the mechanism responsible for the reported reduction in *Striga* parasitism in the field after fertilizer application. We hypothesized that a better mineral nutrient supply reduces *Striga* infection by reducing strigolactone exudation into the rhizosphere. Different levels of nitrogen and phosphorous were applied under greenhouse conditions using rice, maize and sorghum. For maize and sorghum, a parallel study was carried out under field conditions in Kenya and Mali to study the translation of greenhouse results to the field. Application of N and P effectively suppressed *Striga* infection in the greenhouse in all three crop species and the reduction strongly correlated with reduced secretion of strigolactones into the rhizosphere and the *Striga* germination induced by these exudates. Production of strigolactones also differed strongly between crop cultivars. Rice cv IAC 165 produced about 100-fold higher amounts of 2'-epi-5-deoxystrigol, orobanchol and three new strigolactones than TN 1. Although the field results with maize in Kenya were less consistent than in the greenhouse, especially with respect to P effect, still there was a trend that fertilizer application reduced *Striga* infection. Microdosing of diammonium phosphate fertilizer in sorghum in the field in Mali also showed considerable *Striga* suppression which correlated with the results on strigolactone production and *Striga* infection in the greenhouse. These results show that the positive effect of fertilizer against *Striga* is at least partly due to a reduction in strigolactone production and as a consequence of that lower *Striga* germination and subsequent attachment. However, further research to optimize field application of fertilizers for *Striga* is needed.

Overall it can be concluded that there is a good correlation between strigolactones and *Striga* germination, attachment and biomass. We found this using strigolactone biosynthesis inhibitors, genetic variation and using fertilizer application. These technologies can hence be exploited as an important tool to target *Striga* at a very early phase of its life cycle. The practical field application of these strategies requires further research but could lead to effective *Striga* control components that can be used in Integrated *Striga* Management.


Strigolactones are carotenoid derived signaling molecules initially identified as germination stimulants for root parasites of the Orobanchaceae family and pre-symbiotic signal for arbuscular mycorrhiza (AM). They have been identified in the root extracts and exudates of many plant species. Recently, strigolactones – or their derivatives – were identified to be the branch inhibiting signal. This elusive signal is graft transmissible and originating - partly - from the root system. However, the exact origin of strigolactones in the shoot is unknown. Nevertheless, it is likely that strigolactones are transported to the shoot where they exert their shoot branching inhibiting effect in concert with auxin and cytokinins. However, reports of strigolactones in aerial parts of the plant are scarce.

Strigolactone biosynthesis is not fully elucidated. An unknown carotenoid substrate is sequentially cleaved by CAROTENOID CLEAVAGE DIOXYGENASE 7 (CCD7) and CAROTENOID CLEAVAGE DIOXYGENASE 8 (CCD8). In addition to this, two enzymes MORE AXILLARY GROWTH 1 and DWARF 27 are also involved in strigolactone biosynthesis. However, their precise role in strigolactone biosynthesis remains unknown.

In Chapter 1, the root parasitic plants of the Orobanchaceae family and the problems they cause in agriculture are introduced. Furthermore, the role of strigolactones in the root parasite lifecycle as well as in AM symbiosis are addressed. In addition, the recently discovered strigolactone role in shoot architecture, their biosynthesis, hormonal signaling and the two theories on how strigolactones might be integrated into the apical dominance are described.

The first genuine strigolactone derived form the strigolactone biosynthetic pathway is thought to be 5-deoxystrigol. This strigolactone is postulated to be the precursor for all known strigolactones, which are believed to be derived from this compound through a number of different enzymatic and/or non-enzymatic steps. In Chapter 2, the biosynthesis of solanacol in the roots of tomato (*Solanum lycopersicum*) is described. This strigolactone contains an aromatic A-ring and therefore its biosynthesis from the precursor 5-deoxystrigol is not obvious. On the basis of the presence of other strigolactones in tomato (orobanchol, orobanchyl acetate, two 7-hydroxy-orobanchol isomers, 7-oxo-orobanchol and four didehydro-orobanchol isomers) we postulate how solanacol can be derived.
transcription factors are essential for strigolactone biosynthesis is assessed. In legumes these factors (NSP1 and NSP2) in the regulation of In Chapter 5 the role of two GRAS-type transcription factors induced nodulation. In this chapter we show that NSP1 and NSP2 are required for strigolactone biosynthesis and orobanchol (minor). With this work we identify for the first time transcription factors that are regulating strigolactone biosynthesis. We demonstrate that NSP1 functions in strigolactone biosynthesis by regulating DWF27 expression. Our in vitro binding studies indicate that MtDWF27 is a primary target of MtNSP1. We also demonstrate that MtNSP2 is essential for conversion of orobanchol into didehydro-orobanchol. NSP1 and NSP2 are single copy genes in legumes, implying that the proteins they encode fulfill dual regulatory functions of different downstream targets: symbiotic and non-symbiotic. Since NSP1 and NSP2 are required for strigolactone biosynthesis in rice as well as Medicago and these two species represent distinct phylogenetic lineages that split ~150 million years ago, we postulate that regulation of strigolactone biosynthesis by NSP1 and NSP2 is an ancestral function conserved in higher plants.

In Chapter 6 strigolactone biosynthesis is assessed using Arabidopsis thaliana as a model. Strict control of environmental conditions and optimization of analytical protocols for strigolactone analysis enabled the detection of orobanchol, orobanchyl acetate and 5-deoxystrigol in Arabidopsis. In this chapter we demonstrate that the relation between phosphate starvation and the up-regulation of strigolactone biosynthesis is also present in this non AM species. Most land plants are mycorrhizal, which is believed to be the ancestral condition. Hence lack of AM symbiosis in Arabidopsis is likely to be a derived trait. We postulate that strigolactone exudation into the rhizosphere is a relic of this ancestral trait lost by Arabidopsis. However, our data show that strigolactone up-regulation in Arabidopsis under phosphorus deficient conditions serves to restrict the outgrowth of lateral shoot branches. We postulate that this represents an evolutionary advantage which could be the new driving force for the preservation of low phosphate induced strigolactone biosynthesis, as AM colonization no longer is in Arabidopsis. We demonstrate that orobanchol is transported through the xylem sap and that its concentration is elevated under phosphorus deficient conditions and we provide analytical evidence that MAX1 is required for orobanchol biosynthesis.

Recently, a novel function for strigolactones in the regulation of root system architecture (RSA) of tomato and Arabidopsis has been discovered. In Chapter 7 we show that reduced strigolactone biosynthesis or perception - as displayed by the max1,2,4 mutants - leads to a reduction in the length of the primary root meristem. We demonstrate that application of the synthetic strigolactone analog GR24 is able to rescue this
phenotype in all max mutants except the strigolactone insensitive mutant, max2. Furthermore - when grown under sufficient phosphate conditions - GR24 application reduces the amount of lateral roots (LR) - arresting their development at phase five of lateral root primordia (LRP) initiation. We also show that higher concentrations of GR24 blocked LRP initiation completely and caused the primary root meristem to collapse. However, when GR24 application is accompanied by exogenous application of NAA, it has a stimulatory effect on lateral root development and outgrowth. Similarly, under phosphate-limiting conditions, up-regulation of endogenous strigolactones (chapter 6) present in wild type plants stimulated a more rapid outgrowth of lateral root primordia when compared with strigolactone-deficient mutants. In addition, we demonstrate that – under sufficient phosphate conditions - GR24 application to the root system of Arabidopsis leads to reduced auxin concentrations in the leaves. Combined, these results suggest that strigolactones are modulating local auxin gradients and hence influence changes in root architecture. Therefore, the net result of strigolactone action on root development depends on the auxin status of the plant. We postulate that a tightly balanced auxin-strigolactone interaction is the basis for the mechanism by which plants regulate their root to shoot ratio for example under phosphate limited conditions.

In Chapter 8 we summarize and discuss the most important results obtained from the work presented in this thesis and integrate these into the current knowledge on strigolactones, both as a plant hormone as well as rhizosphere signaling molecule. In this chapter we also consider the future perspectives of strigolactone research, especially related to the root parasitic weed problem.

**GENERAL WEB SITES**

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see: http://www.parasiticplants.org/

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes, up to 2005) see: http://www.rmrs.nau.edu/mistletoe/

For information on the 11th World Congress on Parasitic Plants in Martina Franca, Italy, June 2011, see: http://ipps2011.ba.cnr.it

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)


For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga management’ newsletters, see: http://www.aatf-africa.org/

**LITERATURE**

* indicates web-site reference only


Abdulhamid, M.T., Shokr, M.M. and Bekheta, M.A. 2010. Growth, root characteristics, and leaf nutrients accumulation of four faba bean (Vicia faba L.) cultivars differing in their broomrape tolerance and the soil properties in relation to salinity. Communications in Soil Science and Plant Analysis 41: 2713-2728. [Results from additions of sodium chloride to faba bean growing in pots suggested a positive relationship between salt tolerance and tolerance of Orobanche crenata.]

properties against *C. quinquefasciatus* at levels of 0.1-2%.


Ahom, R.I. and Magani, I.E. 2010. Response of the parasitic plant (*Striga hermonthica*) seeds to different germination stimulants produced by sesame and pigeon pea varieties. Agriculture and Biological Journal of North America 1(6): 1199-1205. [Highest germination of *S. hermonthica* was by sesame varieties 69B-882 and Yandev 55 (48% and 30% respectively). Germination was much lower with most of the other 15 varieties tested. Maximum germination with 13 varieties of pigeon pea was only 4%.]


ANON. 2011. Minor diseases of coffee and their management. Indian Coffee 75(7/8): 23-26. [Including reference to *Cuscuta reflexa*, *Balanophora indica* (occurring above 1000m elevation) and *Santalum album*.]


Askew, S.E., Shamoun, S.F. and van der Kamp, B.J. 2011. Assessment of *Colletotrichum gloeosporioides* as a biological control agent for management of hemlock dwarf mistletoe (*Arceuthobium tsugense*). Forest Pathology 41(6): 444-452. [C. gloeosporioides reduced the fruiting of *A. tsugense* somewhat, but failed to invade and kill the mistletoe endophytic system within the host.]


seed depletion in the soil. Crop Protection 30(12): 1594-1600. [Organic matter reduced seed longevity of S. hermonthica in the soil, apparently through nutrient release following decomposition of the organic matter. Paper based on PhD study reported in Haustorium 59.]
Ayongwa, G.C., Stomph, T.J. and Kuyper, T.W. 2011. Host-parasite dynamics of Sorghum bicolor and Striga hermonthica - the influence of soil organic matter amendments of different C:N ratio. Crop Protection 30(12): 1613-1622. [Showing that the quality of organic matter influences the decline in S. hermonthica over 3 seasons, proportionally to its rate of N-mineralisation. Based on PhD study, as above.]

Basceti, E.A., Jama, B. A., Koech, E.K. and Okalebo, J.R. 2011. Effect of improved falls and phosphorus application on weeds and maize yield in smallholder farming system of Western Kenya. American-Eurasian Journal of Agricultural & Environmental Sciences 10(4): 507-514. [In a comparison of continuous maize cropping, *Crotalaria grahamiana* fallow and natural fallow, the *T. diversifolia* fallow led to higher *Striga hermonthica* infestation than *C. grahamiana*.]
Baumgartner, L., Schwaiger, S. and Stuppner, H. 2011. Quantitative analysis of anti-inflammatory lignan derivatives in *Ratanhiae radix* and its tincture by HPLC-PDA and HPLC-MS. Journal of Pharmaceutical and Biomedical Analysis 56(3): 546-552. [Root preparations of *Krameria lappacea* (Krameriaceae), used traditionally against oropharyngeal inflammation, shown to contain mainly (+)-conocarpan and ratanhiaphenol II.]
Basceti, E.A., Jama, B. A., Koech, E.K. and Okalebo, J.R. 2011. Effect of improved falls and phosphorus application on weeds and maize yield in smallholder farming system of Western Kenya. American-Eurasian Journal of Agricultural & Environmental Sciences 10(4): 507-514. [In a comparison of continuous maize cropping, *Crotalaria grahamiana* fallow and natural fallow, the *T. diversifolia* fallow led to higher *Striga hermonthica* infestation than *C. grahamiana*.]

[Concluding that allelopathy of *P. kansuensis* was one of the factors causing the spread of this poisonous weed in degraded alpine meadow on the Qinghai-Tibet Plateau.]

Birschwill, M., Sauer, N., Scheel, D. and Neumann, S. 2007. *Arabidopsis thaliana* is a susceptible host plant


Bonfante, P., Requena, N., Oldroyd, G.E.D. and Robatzek, S. 2011. First report of Tapinanthus buvumae, T. constrictiflorus and Phragmanthera usuiensis shown to be mainly cyanidin 3-O-β-glucopyranoside, comparable to those from Cynomorium coccineum and Cassytha spp.]

Byamukama, R., Jordheim, M., Kiremire, B.T. and Andersen, Ø.M. 2011. Primitive anthocyanin from flowers of three hemiparasitic African mistletoes. Archives of Applied Science Research 3(3): 1-5. [Anthocyanins from the flowers of Tapinanthus buvumae, T. constrictiflorus and Phragmanthera usuiensis shown to be mainly cyanidin 3-O-β-glucopyranoside, comparable to those from Cynomorium coccineum and Cassytha spp.]

Briggs, J. 2011. Mistletoe – a review of its distribution, conservation and insect associates. British Wildlife 23(1): 23-31. [In an in-depth review of the status of Viscum album in UK and its apparent decline in some areas associated with decline of its favoured host apple, but tendency to increase in others, perhaps related to birds and/or climate. Other main hosts include lime, hawthorn and poplar. Also recording two new associated insects - a weevil Isapion variegatum and a mirid bug, Hypseloecus visci.]

Burns, A.E., Cunningham, S.A. and Watson, D.M. 2011. Arthropod assemblages in tree canopies: a comparison of orders on box mistletoe (Amyema miquelii) and its host eucalypts. Australian Journal of Entomology 50(3): 221-230. [Arthropod populations were higher on 3 Eucalyptus hosts than on A. miquelii perhaps due to higher N content in the host.]

Cardoso, L.J.T., Alves, R.J.V. and Braga, J.M.A.. 2011. A new species and a key for Langsdorffia (Balanophoraceae). Systematic Botany 36(2): 424-427. [L. heteroporata was first collected in 1996 and is now confirmed as distinct from L. hypogaea - see news item above.]


effects shown against EAC breast carcinoma cells in vivo.]


Chen, H., Shen, H., Ye, W., Cao, H. and Wang, Z. 2011. Involvement of ABA in reduced photosynthesis and stomatal conductance in Cuscuta campestris - Mikania micrantha association. Biologia Plantarum 55(3): 545-548. [Results suggest that an increase in ABA concentration caused by C. campestris contributes to reduced stomatal conductance, transpiration rate and net photosynthetic rate in the host M. micrantha.]

Chen QingLiang Jia YaMin, Wang ZhiFen, Shan ChengGang, Zhu JingBin and Guo YuHai. 2011. Postembryonic development of Cistanche tubulosa (Schrenk) Whigt. Pakistan Journal of Botany, 2011, 43, 4, 1823-1830. [The anatomy of seed development in this species is similar to that reported for other members of the family with a very reduced embryo.]


Chhabra, S., Thakral, J., Kamboj, P. and Paliwal, Y. 2010. Comparative evaluation of antimicrobial potential of different extracts of Cuscuta reflexa growing on Acacia arabica and Zizyphus jujuba. Pharmacognosy Journal 2(9): 293-296. [Alcohol extracts of C. reflexa from both tree hosts were active against both gram positive and gram negative bacteria.]

Chirilă, F., Fiță, N., Răpuntean, S., Nadiș, G. and Nistor, A.C. 2011. A study regarding the Penicillium larvae strains sensitivity isolated from some counties in Transylvania to different antibiotics and vegetal essential oils. Cluj Veterinary Journal 19(1): 60-64. [Including the effects of an extract of Rhinanthus sp. on the bee pathogen Paenibacillus larvae.]


Cissoko, M., Boisnard, A., Rodenburg, J., Press, M.C. and Scholes, J.D. 2011. New Rice for Africa (NERICA) cultivars exhibit different levels of post-attachment resistance against the parasitic weeds Striga hermonthica and Striga asiatica. New Phytologist 192(4): 952-963. [Across a range of cultivars of NERICA rices and their parents Oryza sativa and O. glaberrima, there was a positive relationship between the amount of strioglacones in the exudate and the germination of S. hermonthica and its attachment and emergence rates. Varieties NERICA 1 and CG14 showed greatest resistance.]

Colbach, N., Abdennebi-Abdemessed, N. and Gibot-Leclerc, S. 2010. Modelling the effects of cropping systems on the dynamics of a parasitic weed, Phelipanche ramosa, in interaction with the non-parasitic weed flora. 21ème Conférence du COLUMA. Journées Internationales sur la Lutte contre les Mauvaises Herbes, Dijon, France, 8-9 Décembre 2010: 311-320. [Describing the development of a model, PHERASYS, aimed at understanding the influence of different control measures, or lack of them, especially herbicide use, on populations of P. ramosa in oilseed rape.]

Costea, M., Ruiz, I.G. and Stefanovic, S. 2011. Systematics of "horned" dodders: phylogenetic relationships, taxonomy, and two new species within the Cuscuta chapalana complex (Convolvulaceae). Botany 89(10): 715-730. [Presenting a taxonomic revision of the C. chapalana complex in Mexico and northern S. America, based on morphology, scanning electron microscopy, and DNA sequence data from plastids and nucleus, with an identification key, descriptions, and illustrations, including two new species C. bonafortunae and C. carnosa.]

chinesis species complex, it is concluded that C. applanata should be treated as a variety of C. chinesis while C. alata, previously considered synonymous to C. applanata is a distinct species; C. potosina var. globifera is now described as a new species, C. azteca, C. chinesis var. chinensis is exceptional in having an E. Asian distribution.

Cuevas-Reyes, P., Fernandes, G.W., González-Dani, K.G.S., Ravikumar, P., Kumar, R.P. and Kush, A. 2011. Genetic variation within and among small species for Slovenia, recorded in the subalpine belt on oaks. Preslia 82(3): 289-306. [Noting that unfavourable climatic conditions cause attenuated trees to become prone to mistletoe (presumably Viscum album) which predispose oaks to damage or death.]

Domina, G. and Mazzola, P. 2011. Notes on the genus Orobanche in Italy: 3. Taxa described by A. Bertoloni. Plant Biosystems 145(2): 342-346. [Eleven of the ‘new’ species described by Bertoloni are re-ascribed to other species. Only O. australis, included by Beck in O. canescens, is a good species, restricted to Sardinia.]
quantitative PCR method to detect and quantify contaminating seeds of *Phelipanche ramosa* and *Orobanche cumana* in crop seed lots. *Weed Research* 52(1): 34-41. [A novel approach to the specific detection and quantification of parasitic seeds in crop seed (or in soil) with very significant potential uses.]

Dor, E., Joel, D.M., Kapulnik, Y., Koltai, H. and Hershchen, J., 2011. The synthetic strigolactone GR24 influences the growth pattern of phytopathogenic fungi. *Planta* 234(2): 419-427. [The synthetic strigolactone GR24 induced in vitro hyphal branching in a number of plant pathogenic fungi such as *Sclerotinia sclerotiorum*, *Colletotrichum acutatum* and *Fusarium oxysporum* suggesting that strigolactones not only affect arbuscular mycorrhizal fungi and parasitic plants, but also have an effect on other fungi.]


Nigerian Journal of Weed Science 23: 1-11. [Confirming previous indications of tolerance to *S. hermonthica* in sorghum variety KSV 8, and resistance in PSL985061, P9401 and P9402.]


Dwarka, A., Friedman, C.M.R., MacKay, M.E. and Nelson, D., 2011. Polymerase chain reaction identification of a female-specific genetic marker in *Arceuthobium americanum* (lodgepole pine dwarf mistletoe) and its implications for *Arceuthobium* sex determination. *Botany* 89(6): 369-377. [This study has generated an efficient molecular tool to differentiate male and female *A. americanum* while also indicating that *A. americanum* may have homomorphic, possibly protoditeromorphos, sex chromosomes.]


Eriksson, O. and Kainulainen, K. 2011. The evolution of dust seeds. Perspectives in Plant Ecology, Evolution and Systematics 13(2): 73-87. [Discussing the evolution and significance of ‘dust seeds’ in Orobanchaceae and at least 11 other families, most being mycophageterotrophic, but this not being confirmed in Rubiaceae, Buddlejaceae and Gesneriaceae.]


Ewald, N.C., John, E.A. and Hartley, S.E. 2011. Responses of insect herbivores to sharing a host plant with a hemiparasite: impacts on preference and performance differ with feeding guild. Ecological Entomology 36(5): 596-604. [Sap-sucking aphid and spittle bug preferred to feed on Holcus lanatus parasitized by Rhinanthus minor than on un-parasitised plants, and the aphid benefited, but a grasshopper showed no such preference.]


*Fernandez-Aparicio, M., Rubiales, D., Bandaranayake, P.C.G., Yoder, J.I. and Westwood, J.H. 2011. Transformation and regeneration of the holoparasitic plant Phelipanche aegyptiaca. Plant Methods 7:36. (doi:10.1186/1746-4811-7-36) (A system was developed that uses cultured parasite tubercles as the starting material for Agrobacterium rhizogenes-mediated transformation, which also enables transformed tubercles to be clonally propagated prior to regeneration. Infection of hosts by YFP-expressing transgenic haustoria is demonstrated.)

Fite, G.L., Bruce, T., Foyer, C., Halford, N., Keys, A., Kunert, K., Lawlor, D., Parry, M. and Russell, G., 2009. Cowpea landraces of Botswana: a potential resistance source for Alectra vogelii. Aspects of Applied Biology 96: 111-117. [Cowpea line B359 is resistant to A. vogelii but has too few flowers. Screening 86 alternative cowpea lines yielded 14 landraces with immunity and 12 cultivars with useful resistance. There appeared to be a correlation between resistance and thick stem-bases which may be a useful selection criterion if confirmed.]


confirming anti-inflammatory activity in extracts from these endophytes."

Gunaga, R.P., Hanumantha, M., Girish Shahapurmath and Vasudeva, R. 2011. Clonal variation for Loranthus infestation in Teak (Tectona grandis L. F.). Indian Journal of Forestry 34(2): 203-208. [Among 24 clones of teak surveyed for incidence of Dendrophthoe falcata, MySS1 and MySS2 showed least infection (ca. 4%) while others showed up to 48% infection.]


Hanks, E.M., Hooten, M.B. and Baker, F.A. 2011. Reconciling multiple data sources to improve accuracy of large-scale prediction of forest disease incidence. Ecological Applications 21(4): 1173-1188. [An inventory of black spruce stands in northern Minnesota found Arceuthobium pusillum in 11% of surveyed stands, while a small, specific-pest survey found mistletoe in 56% of the surveyed stands. The two surveys were reconciled within a Bayesian hierarchical framework, predicting that 35-59% of black spruce stands in northern Minnesota are infested with dwarf mistletoe.]


Hassan, M.M., Gani, M.E.S.A. and Babiker, A.G.T. 2011. Effects of bacterial strains and isolates on in situ germination, subsequent developmental stage of Striga hermonthica ont sorghum roots. Advances in Environmental Biology 5(1): 3263-3269. [A range of bacterial isolates including Azospirillum brasiliense and Pseudomonas putida showed varying effects on the germination and further development of S. hermonthica, the most active being an undefined isolate ‘GSL’ reducing attachment by 80%.]


Hejcman, M., Stetinova, Z., Hejcmanová, P., Pavlu, V. and Schellberg, J. 2011. Plant density and seed production of Rhinanthus minor under long-term Ca, N, P and K fertiliser application in the Rengen Grassland Experiment (Germany). In: Pötsch, E.M., Krautzer, B. and Hopkins, A. (eds) Grassland farming and land management systems in mountainous regions. Proceedings of the 16th Symposium of the European Grassland Federation, Gunzenstein, Austria, 29th-31st August, 2011: 595-597. [Comparing growth of R. minor in plots of varying fertility. Lowest fertility gave highest number of plants (745 v. 5 per m²) and highest seed production (18142 v. 195) compared with the most fertile.]


Hellström, K., Bullock, J.M. and Pywell, R.F. 2011. Testing the generality of hemiparasitic plant effects on mesotrophic grasslands: a multi-site experiment. Basic and Applied Ecology 12(3): 235-243. [Results confirm that it is possible to establish Rhinanthus minor into different mesotrophic grassland communities representing a variety of soil types and ages, suggesting it is a practical and widely applicable tool for restoration.]

Pharmacognosy 42(3): 246-252. [Discussing the relative merits of the A- and B-chains in extracts from *Viscum album* var. *coloratum* but abstract not clear.]

Hong Lan, Shen Hao, Chen Hua, Li Ling, Hu XiaoYing, Xu XinLan, Ye WanHui and WangZhangMing. 2011. The morphology and anatomy of the haustoria of the holoparasitic angiosperm *Cuscuta campestris*. Pakistan Journal of Botany 43(4): 1853-1859. [Development of the haustorium resembles that of root parasites with initial divisions in the cortex with the suggestion that vascular tissue differentiation is linked with host contact by the searching ‘hyphae’.]


Hu KeFei, Li YongHua, Du YuKai, Su BenWei and Lu Dong. 2011. Analysis of 1-deoxynojirimycin component correlation between medicinal parasitic loranthus from loranthaceae and their mulberry host trees. Journal of Medicinal Plants Research 5(17): 4326-4331. [’Loranthus’ not defined.]


Huang, S., Chen, J.H., Gong, M., Huang, M.Q., Li, J., Wu, A.G. and Lai, X.P. 2010. (Studies on the flavonoids from the herb of *Striga asiatica*.) (in Chinese) Zhong Yao Cai 33(7): 1089-1091. [Eleven compounds were obtained, six of them identified as flavonoids, including 4 not previously recorded in *S. asiatica*.]

#Huber, R., Ludtke, H., Wieber, J. and Beckmann, C. 2011. Safety and effects of two mistletoe preparations on production of interleukin-6 and other immune parameters a placebo controlled clinical trial in healthy subjects. BMC Complementary and Alternative Medicine 11(116): 30 pp. (http://www.biomedcentral.com/content/pdf/1472-6882-11-116.pdf) [In Germany, ’Iscucin® Populi’ (IP), a preparation from *Viscum album* growing on poplar, is used in cancer therapy while ’Viscum Mali e planta tota’ (VM), from apple, is used in patients with osteoarthritis. In a study involving 71 healthy volunteers, treatment with IP results in eosinophilia and an increase of CD4 cells but not in an increase of IL-6 or CRP. No safety concerns regarding the two mistletoe preparations have been raised by this study.]

Ilia, A.O., Odhiambo, G.D. and Dida, M.M. 2010. Increasing imazapyr-resistant maize yield by increasing plant density under natural *Striga hermonthica* infestation. Agriculture and Biology Journal of North America 1(5): 1061-1068. [Increasing the plant density of herbicide-treated IR maize from 44,444 to 88,888 plants per ha did not affect *Striga* incidence but increased maize yield from 1.60 to 3.48 t per ha.]

Illana, A., Garcia-Garrido, J.M., Sampedro, I. and Ocampo, J.A. and Vierheilig, H. 2011. Strigolactones seem not to be involved in the nonsusceptibility of arbuscular mycorrhizal (AM) nonhost plants to AM fungi. Botany 89(4): 285-288. [Strigolactones are important factors in the establishment of mycorrhizal symbiosis. In the strigolactone-deficient *rms1* mutant (ccd8) of pea, colonization of roots is reduced which can be rescued by the application of GR24. However, the authors show that the application of GR24 cannot facilitate colonization of AM non-host plants.]

Imloame, E.O. Joshua, S.D. 2011. Effect of cultural methods on *Striga hermonthica* (Del.) Benth management and yield of cereals in the Savanna Zone of Nigeria: a review. Archives of Phytopathology and Plant Protection 44(17): 1655-1665. [Reporting good suppression of *S. hermonthica* and improved yields with various combinations of resistant maize and rice varieties with cowpea and soybean rotations, intercropping with bambara nuts and/or nitrogen applications. For sorghum, results disappointing due to low yields of resistant varieties.]

Iqbal, M.N. and Suradker, S.S. 2011. Ethnobotanical and ethnomedicinal study of some medicinal plants of Barshitakli Tahsil District Akola (MS) India.
Bioscience Discovery Journ 2(2): 236-239. [Documenting the local uses of 10 species, including *Cascuta reflexa*.


*A Cyclin B1 promoter fused to a reporter gene was used to visualize cell division during haustorium formation.*


*Striga hermonothica* in rice under varying level.

*Striga asiatica* resistance of NERICA cultivars based on low strigolactone production. New Phytologist 192: 964–975. [Across a range of NERICA rice lines and their parents *Oryza sativa* and *O. glaberrima*, there was considerable variation in the exudation of strigolactones. There was a positive relationship between the amount of strigolactones in the exudates and *S. hermonothica* germination and attachment, suggesting that reduction in strigolactone production is at least one of the mechanisms by which fertiliser application reduces damage in cereals by parasitic weeds.]

Jamil, M., Rodenburg, J., Charnikhova, T. and Bouwmeeester, H.J. 2011. Pre-attachment *Striga hermonothica* resistance of NERICA cultivars based on low strigolactone production. New Phytologist 192: 964–975. [Across a range of NERICA rice lines and their parents *Oryza sativa* and *O. glaberrima*, there was considerable variation in the exudation of strigolactones. There was a positive relationship between the amount of strigolactones in the exudate and the germination of *S. hermonothica* and its attachment and emergence rates. Varieties NERICA 1 and CG14 exhibited lowest induction of germination.]

Johnsen, S.D., Burgoyne, P.M., Harder, L.D. and Dötterl, S. 2011. Mammal pollinators lured by the scent of a parasitic plant. Proceedings of the Royal Society of London. Series B, Biological Sciences 278(1716): 2303-2310. [Aliphatic ketones 3-hexanone and 1-hexen-3-one dominate the scent of *Cytinus visseri* (Cytinaceae) which attracts rodents for pollination. Plants attracting insects tend to produce terpenoids, aromatic or non-ketone aliphatic compounds.]


Kamara, A.Y., Ekeleme, F., Omoigui, L., Menkir, A., Chikoye, D. and Dugje, I.Y. 2011. Response of exotic sorghum (*Sorghum bicolor* [L.] Moench) cultivars to planting date under natural infestation of *Striga hermonthica* (Del) Benth. in the Sudan savanna zone of northeast Nigeria. Archives of Agronomy and Soil Science 57(6): 679-692. [Noting that the success of the improved varieties P9402, P9405, and PSL985061, and local KSV8 under infestation by *S. hermonthica* depended on planting date, earlier planting usually being best.]


Khan, Z.R. and 16 others. 2009. Control of stem borers and striga in African cereals: a low input push-pull approach with rapidly expanding impact. Aspects of Applied Biology 96: 71-76. [A review covering the use of *Desmodium* spp. to control *Striga hermonthica* concluding that ‘The push-pull technology raises the farming level above subsistence by improving cereal yields and by providing animal forage, and the evidence also suggests that it does so whilst stabilising a high density rural population.’]


*Kienle, G.S., Grugel, R. and Kiene, H. 2011. Safety of higher dosages of *Viscum album* L. in animals and humans - systematic review of immune changes and safety parameters. BMC Complementary and Alternative Medicine 11: 72.* (http://www.biomedcentral.com/content/pdf/1472-6882-11-72.pdf) [Reviewing 69 clinical studies and 48 animal experiments involving *V. album* extracts or isolated mistletoe lectins and concluding that there were no serious side-effects at relatively high dosages.]


[Reporting that 6 patients with sarcoma, treated with a *Viscum album* lectin preparation, showed remissions of tumour symptoms, apparently due to an improved balance of natural immunological mechanisms.]


Kohlschmid, E., Müller-Stöver, D. and Sauerborn, J. 2011. *Piecing together the puzzle of parasitic Plasmodiophora brassicae (Loranthaceae) on Northern Strandjas Oak Forests-Turkey*. Scientific Research and Essays 6(14): 2970-2975. [Survey showed 2.3% of trees infested overall; highest occurrence was in Quercus petraea; none detected in Quercus cerris.]


Lagoke, S.T.O. and Isah, K.M. 2010. *Reaction of maize varieties to Striga hermonthica as influenced by food legume intercrop, spacing and split application of compound fertilizer*. Nigerian Journal of Weed Science 23: 45-58. [Best results obtained with planting two stands of groundnut or three stands of soyabean between two stands of *Striga*-resistant maize genotypes spaced at 50 cm, given split-application of fertilizer at total rate of 100 kgN/ha, 50 kgP2O5/ha and 50 kgK2O/ha.]


Lewis, K.J. 2011. *Forest health and mortality of advance regeneration following canopy tree mortality caused by the mountain pine beetle*. Mountain Pine Beetle Working Paper - Pacific Forestry Centre, Canadian Forest Service 2010-03. [Incidentally emphasising the continuing threat to Canadian forests from *Arceuthobium* spp.]

Drugs 42(8): 1537-1540. [Optimum preparation involved salt 2%, immersing time 60 min, baking temperature 170°C, and baking time 60 min.]

Li Yang, Zhao YanLi, Yang YongPing and Li XiaoLi. 2011. Chemical constituents of Viscum album var. meridianum. Biochemical Systematics and Ecology 39(4/6): 849-852. [Flavanones, flavanone glycosides and triterpenenes among the major components of V. album var. meridianum.]


Lin MingKuem, Yu YenLing, Chen KaiChieh, Chang WenTe, Lee MengShiou, Yang MengJa, Cheng HsinChung, Liu ChienHeng, Chen DzChi and Chu ChingLiang. 2011. Kaempferol from Semen cuscutae attenuates the immune function of dendritic cells. Immunobiology 216(10): 1103-1109. [Confirming that extracts of Cuscuta spp. exhibit an immunosuppressive effect on dendritic cells and that the active ingredient kaempferol has potential in the treatment of chronic inflammatory and autoimmune disease.]

Liu YeWei, Li HongBing, Wang XiaoFei, Zhang GeXiang, Wang Yu and Duolong. 2011. Evaluation of the free radical scavenging activity of Cynomorium songaricum Rupr. by a novel DPPH-HPLC method. Journal of Medical 76(9): C1245-C1249. [Results showed that the free radical scavenging activity of the samples of C. songaricum from different sites varied significantly.]

Liu MengJiao, Hong Lan, Shen Hao, Wei Xiao, Ye WanHui and Cao HongLing. 2011. Responses of Mikania micrantha to parasitization of Cuscuta campestris in total soluble protein content and activities of antioxidant enzymes. Guangxi Zhiwu / Mikania micrantha 31(4): 520-525. [C. campestris significantly lowered soluble protein content in M. micrantha. Activities of superoxide dismutase and peroxidase significantly increased at a density of 1 parasite per host plant; but both activities decreased up to 8 per host.]


Luan Na, Chang Ping, Zhuang LiYing and Shang XiaoYa 2010. Isolation and determination of catechin from Cynomorium songaricum Rupr. Medicinal Plant 1(8): 87-88.

Luisi, A., Lorenzi, R. and Sorce, C. 2011. Strigolactone may interact with gibberellin to control apical dominance in pea (Pisum sativum). Plant Growth Regulation 65(2): 415-419. [Experiments in which GR24 was applied to decapitated climbing and dwarf (gibberellin biosynthesis mutant) peas suggest that the endogenous level of gibberellin GA3 modulates the response of decapitated pea plants to GR24, by changing bud sensitivity to the applied strigolactone.]


Maikai, V.A. 2010. In vitro and in vivo evaluation of antitrypanosomal activity of stem bark of Ximenia americana. African Journal of Microbiology Research 4(23): 2570-2575. [Results suggest that the mechanisms of induced resistance by Rhizobia against O. crenata involve an elevated induction of the phenylpropanoid pathway, conferring mechanical and chemical barriers against the invading parasite.]
Mitra, P., Chang KyuSeob and Yoo DaeSeok. 2011. Effect of genetic divergence of Striga hermonthica (Delile) Benth.-resistant maize inbred lines on heterosis and hybrid performance under parasite pressure. Crop Science 51(4): 1591-1602. [Concluding that selection for inbreds with greater levels of resistance to S. hermonthica appears to be more effective for developing resistant hybrids than selection of parental pairs based on genetic distance alone.]

Mignonou, D.B., Manyong, V.M., Mutabazi, K.D.S. and Senkondo, E.M. 2011. Determinants of adopting imazapyr-resistant maize for Striga control in Western Kenya: a double-hurdle approach. Journal of Development and Agricultural Economics 3(11): 572-580. [Based on the same survey as the following item, concluding that age of the household head, household size, membership to social group, access to extension services and perception towards IR maize for Striga control were found to influence the decision to adopt the technique.]


Muhammad Altaf Hussain, Muhammad Qayyum Khan, Nazar Hussain and Tariq Habib. 2011. Antibacterial and antifungal potential of leaves and twigs of Viscum album L. Journal of Medicinal Plants Research 5(23): 5545-5549. [Comparing different solvents for the extraction of active materials from V. album.]


Muhammad Saeed, Marwat, K.B. and Bakhtiar Gul. 2011. Occurrence of different weeds in canola: a survey of farmers in District Swat-Pakistan. Pakistan Journal of Weed Science Research 17(1): 25-31. [Orobanche spp. were recorded as serious weeds in canola and tobacco, causing up to 50% yield losses.]


Mulvey, R.L. and Hansen, E.M. 2011. Castilleja and Pedicularis confirmed as telial hosts for Cronartium ribicola in whitebark pine ecosystems of Oregon and Washington. Pathology 41(6): 453-463. [Confirming that Pedicularis racemosa and P. bracteosa and Castilleja applegatei, C. miniata, C. parviflora and C. arachnoidea were, or could be, infected by the rust Cronartium ribicola and that there is sufficient time for C. ribicola to complete its life cycle on these hosts.]


Mwakaboko, A.S. and Zwanenburg, B. 2011. Strigolactone analogs derived from ketones using a working model for germination stimulants as a blueprint. Plant Cell Physiol 52(4): 699-715. [Describing a range of compounds with appreciable germinating activity on Striga hermonthica, Orobanche crenata and O. cernua. Stereosomers having the same configuration at the D-ring as in naturally occurring strigol have a higher stimulatory effect than the corresponding antipodes. The analogs obtained from 1-indanone and 1-tetralone have an activity comparable with that of the well known stimulant GR 24.]


Ndambi, B., Cadisch, G., Elzein, A. and Heller, A. 2011. Colonization and control of Striga hermonthica by Fusarium oxysporum f. sp. strigae, a mycoherbicide component: an anatomical study. Biological Control 58(2): 149-159. [F. oxysporum strigae (Foxy 2) controls S. hermonthica by i) complete digestion of parasite seedlings inside the host and ii) clogging of vessels of emerged plants by hyphae, contributing to wilting and subsequent death.]

Nicáio, J.N., Uchôa, M.A., Faccenda, O., Guimarães, J.A. and Marinho, C.F. 2001. Native larval parasitoids (Hymenoptera) of frugivorous Tephritidae (Diptera) in South Pantanal Region, Brazil. Florida Entomologist 94(3): 407-419. [In Xylena americana (Xylenidae) 14% of the larvae of the tephritid Anastrepha spp. were parasitized by the braconid Dorcystobracus arvelatus which reached more than 96% of total parasitism in this host fruit.]


Nobre, C., E.B. and Schlindwein, C. 2011. New records for species of Theope (Lepidoptera, Riodinidae) for the state of Pernambuco and northeastern Brazil, with notes on their natural history. Revista Brasileira de Entomologia 55(2): 275-278. [Schoepfia guianensis (Schoepfiaceae) noted as the probable host of Theope terambus.]


Nowak, B., Pineault-Molenat, D., Boulet, C. and Leflon, M. 2010. (Impact of catch crops on the evolution of broomrape's seed bank.) (in French) 21ème Conférence du COLUMA. Journées Internationales sur la Lutte contre les Mauvaises Herbes, Dijon, France, 8-9 Décembre, 2010: 247-255. [Noting increasing importance of O. ramosa on oilseed rape in the Poitou-Charentes area, and the lack of good control methods. Suggesting that catch crops of mustard or oilseed rape decrease the seed bank by 30% and can be combined with chemical control.]

O’Connell, J.M., Sandler, H.A., Adler, L.S. and Caruso, F.L. 2011. Controlled studies further the development of practical guidelines to manage dodder (Cuscuta gronovii) in cranberry production with short-term flooding. Renewable Agriculture and Food Systems 26(4): 269-275. [Results suggest flooding does not reduce germination of C. gronovii but delays stem growth and may be best applied some time after germination.]


Ogola, J.B.O. and 10 others. 2009. Effects of green manure legumes on striga infestation in maize. Aspects of Applied Biology 96: 259-262. [In a field trial in South Africa mucuna, lablab, sunhemp and cowpea grown for a season prior to maize did not affect emergence or biomass of S. asiatica but gave increased crop yield comparable to those from nitrogen.]

Nowak, B., Pineault-Molenat, D., Boulet, C. and Leflon, M. 2010. (Impact of catch crops on the evolution of broomrape’s seed bank.) (in French) 21ème Conférence du COLUMA. Journées Internationales sur la Lutte contre les Mauvaises Herbes, Dijon, France, 8-9 Décembre, 2010: 247-255. [Noting increasing importance of O. ramosa on oilseed rape in the Poitou-Charentes area, and the lack of good control methods. Suggesting that catch crops of mustard or oilseed rape decrease the seed bank by 30% and can be combined with chemical control.]

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Okubamichael, D.Y., Griffiths, M.E. and Ward, D. 2011. Host specificity, nutrient and water dynamics of the mistletoe Viscum rotundifolium and its potential host species in the Kalahari of South Africa. Journal of Arid Environments 75(10): 898-902. [V. rotundifolium parasitises only Ehretia rigida and Ziziphus mucronata at this site though these were not the commonest or tallest trees available.]


Peng Liang (and many others). 2011. (Influences of herba cistanche tea on the ability of anti-fatigue and anoxia endurance in mice.) (in Chinese) Modern Preventive Medicine 38(12): 2362-2364. [Extracts of Cistanche prolonged the swimming time of mice, increased their hepatic glycogen reserve and decreased their lactic acid after swimming.]


Pooja Sinoriya, Irenchia, R., Bhawna Sharma, Gayatri Sahu and Santosh Kumar. 2011. Anticonvulsant and muscle relaxant activity of the ethanolic extract of stems of Dendrophthoe falcata (Linn. F.) in mice. Indian Journal of Pharmacology 43(6): 710-713. [Concluding that extracts of D. falcata do have anticonvulsant and muscle relaxant activity.]


Tapinanthus dodoneifolius


Olakojo, S.A. and Olaoye, G. 2011. Correlation and heritability estimates of maize agronomic traits for yield improvement and Striga asiatica (L.) Kutentz tolerance. African Journal of Plant Science 5(6): 365-369. [Confirming that genotypic and phenotypic correlation coefficients as well as heritability estimates were found suitable as models for yield improvement and selection for S. asiatica-tolerant genotypes in Nigeria.]

Okubamichael, D.Y., Griffiths, M.E. and Ward, D. 2011. Host specificity, nutrient and water dynamics of the mistletoe Viscum rotundifolium and its potential host species in the Kalahari of South Africa. Journal of Arid Environments 75(10): 898-902. [V. rotundifolium parasitises only Ehretia rigida and Ziziphus mucronata at this site though these were not the commonest or tallest trees available.]


Riley, K. L. and Chastagner, G.A. 2011. First report of Phoradendron serotinum? infection of mistletoe in California. Plant Health Progress PHP-2011-0209-02-BR. (http://www.plantmanagementnetwork.org/php/elements/sum.aspx?id=9402&photo=5200) [Unspecified mistletoe (Phoradendron serotinum?) infesting black walnut was found to be a host for P. serotinum, the cause of Sudden Oak Death.]


Rodenburg, J. and Bastiaans, L. 2011. Host-plant defence against Striga spp.: reconsidering the role of tolerance. Weed Research (Oxford) 51(5): 438-441. [Emphasising the potential value of combining tolerance with resistance (including as insurance against breakdown of resistance) but noting the difficulty of screening for tolerance in resistant material. Suggesting approaches to the identification and exploitation of genes for tolerance.]


Rösch, M. and Tserendorj, G. 2011. (A natural history study of the flora of the northern Schwarzwald region, southwestern Germany.) (in German) Hercynia 44(1): 53-71. [Pollen studies show that Viscum album occurred in the early Holocene but became less common after the expansion of Abies alba, replacing Taxus baccata.]


Saidou, A.K., Ajeigbe, H.A. and Singh, B.B. 2011. Participatory evaluation of improved cowpea lines and cropping systems for enhancing food security and income generation in Niger Republic, West Africa. American-Eurasian Journal of Agricultural & Environmental Sciences 11(1): 55-61. [Four improved cowpea varieties were inferior to local varieties under traditional cropping practice but gave 2-3 fold higher yields as sole crops or with an improved cropping system (not specified in the abstract). Two, IT97K-499-38 and IT97K-499-35, are resistant to Striga gesnerioides.]

activity and \textit{in-vitro} antioxidant activity of Indian Mistletoe, the hemiparasite \textit{Dendrophthoe falcata} L. F. (Loranthaceae). Iranian Journal of Pharmaceutical Research 10(2): 253-259. [Extracts of \textit{D. falcata} leaves were found to have potent anti-inflammatory and \textit{in-vitro} antioxidant effects.]


Shefferson, R.P., McCormick, M.K., Whigham, D.F. and O’Neill, J.P. 2011. Life history strategy in herbaceous perennials: inferring demographic patterns from the aboveground dynamics of a primarily subterranean, myco-heterotrophic orchid. Oikos 120(9): 1291-1300. [Including exploration of the hypothesis that in the absence of the need to photosynthesise, sprouting of the myco-heterotrophic \textit{Coralorhiza odontorhiza} would be rare and would always lead to flowering.]


Start, A.N. 2011. Fire responses and survival strategies of mistletoes (Loranthaceae) in an arid environment in Western Australia. Australian Journal of Botany 59(6): 533-542. [One species (unspecified!) recovered from fire by resprouting. Twelve others reduced fire risk by varying degrees of host specificity, favouring hosts that grew in fire-sheltered sites while 2 other species grew on fire-vulnerable hosts in fire-prone grasslands but had very low host specificity, increasing the likelihood that imported seed would be deposited on suitable hosts.]


Suchinina, T.V. and Petrichenko, V.M. 2011. Seed oil fatty acid composition of some \textit{Euphrasia} species (Scrophulariaceae). Rastitel’nye Resursy 47(3): 97-102. [Nine fatty acids were identified in oils from 7
Euphrasia spp., mainly unsaturated linolenic, linoleic and oleic acids, in Perm region of Russia.


Tehmina Asmat, Khan, M.A., Mushtaq Ahmed, Muhammad Zafar, Fouzia Manzoor, Mamoon Munir, Kulsoom Akhtar, Shazia Bashir, Tehmeena Mukhtar, Madhi Ambreen and Abbasi, S.N. 2011. Pollen morphology of selected species of Scrophulariaceae of District Dir Upper, Pakistan. Journal of Medicinal Plants Research 5(28): 6423-6428. [In a study of 9 species, pollen grains were usually radially symmetrical, isopolar, oblate-spheroidal or prolate-spheroidal or sub-prolate, triloculate and pislate, except Pedicularis oederi (the only parasitic sp. included) which has bisyncolpate pollen.]

germination induction of *Striga gesnerioides* seeds. Journal of Agricultural and Food Chemistry 59(17) 9226-9231. [Optically active (8R,2′R)-isomers of 4-hydroxy-GR24 and 4-acetoxy-GR24 induced germination of *Striga gesnerioides*, but the racemic diastereomers did not. The stereoisomer of GR24 with the same configuration induced negligible germination. Some of the compounds tested were effective antagonists of induction of seed germination by cowpea root exudate. An oxygenated substituent at C-4 and the configuration of the C-and D-ring are essential structural requirements for induction of germination in *S. gesnerioides* seeds.]

Ueno, K., Nomura, S., Muranaka, S., Mizutani, M., Takikawa, H. and Sugimoto, Y. 2011. *Ent-2′-epi-orobanchol and its acetate, as germination stimulants for Striga gesnerioides* seeds isolated from cowpea and red clover. Journal of Agricultural and Food Chemistry 59(19): 10485-10490. [Confirming the identity of stimulants for *S. gesnerioides* and indicating that the acetate may be the same as that previously described as alectrol.]


van Deenen, N., Prüfer, D. and Gronover, C.S. 2011. *A haustorium 60 41*

van Mourik, T.A., Stomph, T.J. and Murdoch, A.J. 2011. *Pharmacognostical study on the seed of Striga gesnerioides* seeds isolated from cowpea and red clover. Journal of Agricultural and Food Chemistry 59(19): 10485-10490. [Confirming the identity of stimulants for *S. gesnerioides* and indicating that the acetate may be the same as that previously described as alectrol.]


van Hoveln, M.D., Evans, B.A. and Borowicz, V.A. 2011. Hemiparasite - host plant interactions and the impact of herbivory: a field experiment. Botany 89(9): 537-544. [In a study of four clipping treatments (none, early, late, early and late) on *Schizachyrium scoparium*, the impact of *Pedicularis canadensis* (Orobanchaceae) and clipping on host growth were independent, but clipping altered the value of the host to the parasite.]

van Mourik, T.A., Stomph, T.J. and Murdoch, A.J. 2011. *Purple witchweed (Striga hermonthica)* germination and seedbank depletion under different crops, fallow, and bare soil. Weed Biology and Management 11(2): 100-110. [Similar results were obtained by seed bag and soil sampling techniques used to assess seed loss of *S. hermonthica* in the field in Mali and Nigeria. Greatest losses were by germination under susceptible cereal crops. Losses lower under non-host crops, fallow and bare soil.]


(http://www.ewrs.org/doc/EWRS_Invasive_Ascona_Abstracts_2011.pdf) [Reporting culture techniques for use of the fungus *Phaeobotrysphaeria visci* for control of *V. album*.]


Vicas, S.I., Rugină, D. and Socaciu, C. 2011. Comparative study about antioxidant activities of *Viscum album* from different host trees, harvested in different seasons. Journal of Medicinal Plants Research 5(11): 2237-2244. [Noting differences in antioxidant activity of extracts of *V. album* according to the host *Acer campestre*, *Fraxinus excelsior*, *Populus nigra*, *Malus domestica* or *Robinia pseudoacacia*, and season.]


Vurro, E., Ruotolo, R., Ottonello, S., Elviri, L., Maffini, M., Falasca, G., Zanella, L., Altamura, M.M., di Toppi, L.S., di Toppi, L.S. and Meharg, A.A. 2011. Phytochelatins govern zinc/copper homeostasis and cadmium detoxification in *Cuscuta campestris* parasitizing *Daucus carota*. Environmental and Experimental Botany 72(1): 26-33. [*C. campestris* accumulates much higher levels of Zn, Cu and Cd than its hosts, but also produces phytochelatins that may function to protect it from acquired toxic substances.]


Waters, M.T., Smith, S.M. and Nelson, D.C. 2011. Smoke signals and seed dormancy: Where next for MAX2? Plant Signaling and Behaviour 6(9): 1418-1422. [The Arabidopsis thaliana protein MAX2 has roles in leaf senescence, seedling photosensitivity, shoot outgrowth, and seed germination. MAX2 mediates specific responses to both strigolactones and karrikins. Putative Orobanchaceae MAX2 orthologs form a sub-clade distinct from those of other dicots, suggesting that lineage-specific evolution of MAX2 may have given rise to specializations to these signaling molecules.]


Welsh, A.B. and Mohamed, K.I. 2011. Genetic diversity of Striga hermonthica populations in Ethiopia: evaluating the role of geography and host specificity in shaping population structure. International Journal of Plant Sciences 172(6): 773-782. [All 12 populations of S. hermonthica from 4 host crops were distinct when compared using AFLP. Differences were greatest with geographic distance rather than host species.]


Wickett N.J., plus 10 coauthors. 2011. Transcriptomes of the parasitic plant family Orobanchaceae reveal surprising conservation of chlorophyll synthesis. Current Biology 21: 2098–2104. [One would expect the holoparasite Phelipanche aegyptiaca to have lost not only photosynthesis-related gene expression but also its chlorophyll synthesis pathway. But such is not the case in that the latter genes are retained and expressed at low levels.]


Yagi, S., Yagi, A.I., Gadir, E.H.A., Henry, M., Chapleur, Y. and Laurain-Mattar, D. 2011. Toxicity of Cistanche tubulosa extracts in the treatment of eye conditions, their action is not well understood and there is a need for more scientific study.


Yoshida, S. and Shirasu, K. 2011. Discovery of the holoparasite Phelipanche aegyptiaca to have lost not only photosynthesis-related gene expression but also its chlorophyll synthesis pathway. But such is not the case in that the latter genes are retained and expressed at low levels.]


paper (328: 1128) (see Haustorium 57) for a Japanese governmental publication.)

Yu WenBin, Huang PanHui, Lee, R.H., Liu MinLu, Li DeZhu and Wang Hong. 2011. DNA barcoding of Pedicularis L. (Orobanchaceae): evaluating four universal barcode loci in a large and hemiparasitic genus. Journal of Systematics and Evolution 49(5): 425-437. [Applying the bar-coding concept of species identification to members of the genus Pedicularis, it was found that a combination of rbcL and ITS sequences are able to resolve at least 78% of the 88 species.]


Zhao DongPing, Guo YuHai, Zhu YanXia and Cui XuSheng. 2011. (Influence of haustorium inducing factors on haustorium formation of Cistanthe tubulosa,) (in Chinese) Journal of China Agricultural University 16(4): 38-42. [Highest (76-80%) rate of haustorium induction was from 2,6-DMBQ, kinetin and 6-BA with lower rates from quercetin and resorcinol.]

Zhao YunLi, Yu ZhiGuo, Fan RongHua, Gao XiaoXia, Yu Miao, Li HongYan, Wei HongJun and Bi KaiShun. 2011. Simultaneous determination of ten flavonoids from Viscum coloratum grown on different host species and different sources by LC-MS. Chemical & Pharmaceutical Bulletin 59(11): 1322-1328. [The content of flavonoids from V. coloratum varied according to their geographic source (a range of sites across China from temperate to sub-tropical) but not according to their hosts (a range of 8 species).]


Zwienenburg B, and Mwakaboko A.S. 2011. Strigolactone analogues and mimics derived from phthalimidine, saccharine, p-tolylmalondialdehyde, benzoic and salicylic acid as scaffolds. Bioorganic and Medicinal Chemistry 19(24): 7394-7400. [A series of new strigolactone (SL) analogues - a modified Nijmegen-1, one containing saccharin and the third one derived from p-tolylmalondialdehyde - are appreciably to highly active as germination stimulants of seeds of Striga hermonthica and Orobanchace cernua. Two SL mimics obtained from benzoic and salicylic acid are very active germinating agents, representing a new type of germination stimulants for which a mode of action is proposed.]

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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

First of all, I would like to acknowledge the time and great efforts devoted by Jim Westwood during his presidency and finally in the election of IPPS executive members. I also thank all members who took part in this important election process. Now the new IPPS executive members are ready to lead the society with continuing support from you all.

The new elected IPPS executive members are now: Julie Scholes (Vice President), John Yoder (Secretary) and Ahmet Uludag (Treasurer), Harro Bouwmeester (Editor), and myself President.

As the first mission of the new IPPS executive members, we are pleased to invite you to the 12th World Congress on Parasitic Plants (WCPP), which will be held on Monday July 15 to Friday July 19, 2013 in Sheffield, UK. The venue will be the Edge Conference facility at the University of Sheffield. We are currently planning sessions and workshops and any inputs from the IPPS members will be highly appreciated. Please contact me or Julie by email. Details of venue, program, and progress can be followed on a special conference website which will be available from the beginning of September 2012 (to follow shortly).

During the VI International Weed Science Congress (IWSC) held in Hangzhou, China, a session on parasitic weeds was held as a joint IPPS symposium with the IWSC (see the meeting report below). To my knowledge, this was the first international symposium on parasitic weeds held in Asia at least in this century. The papers presented in the symposium were a good mix of basic and applied studies, and I was convinced that contributions to IPPS from Asian scientists would increase in the near future. This is because the number of scientists working on parasitic weeds in Asian countries has been gradually increasing probably due to the spreading parasitic weed problems. Thus, we should raise awareness about parasitic weeds in Southeast and East Asian countries where both root and stem parasitic weeds are becoming serious problems.

Finally, I would like to express my sincere appreciation to Jim for his hard work on behalf of the society. Under his leadership, two IPPS meetings in Kusadasi (Turkey) and Martina Franca (Italy) have been held successfully and infrastructure of IPPS including the constitution and election system has been established. Of course I am sure that Jim will continue to support and encourage us and the society.

Sincerely,

Koichi Yoneyama, IPPS President
yoneyama@cc.utsunomiya-u.ac.jp

STRIGA GESNERIOIDES AND STRIGA ASIATICA IN NAMIBIA

As part of ongoing research collaboration among the University of Namibia, State University of New York-Oswego, and Old Dominion University, we surveyed Namibia for *Striga gesnerioides* and *S. asiatica*. Our field work covered 3500 km from the west coast north to the border with Angola and through the central part of the country. There are six species of the genus in Namibia with *Striga gesnerioides* and *S. asiatica* the most frequent. *Striga hermonthica* and *S. forbesii* have been collected but at present do not seem to be an agricultural problem. The other two, *S. elegans* and *S. bilabiati ssp* bilabiata are confined to natural grasslands.

*Striga gesnerioides* is the most variable of all witchweeds in terms of morphology and host selection. It is a well-known and often serious parasite of cowpea, *Vigna unguiculata* (Fabaceae). Wild hosts that have been documented in Namibia include species of *Euphorbia* (Euphorbiaceae), *Ipomoea*, *Jaquemontia*, and *Merremia* (Convolvulaceae); *Indigofera*, *Alysicarpus* and other wild legumes (Fabaceae), and *Nicotiana* (Solanaceae). Each of these hosts support populations with varying stem color, branching frequency, and flower color. Despite reports that such plants lack chlorophyll (e.g. Fischer *et al.*, 2011, Willdenowia 41: 51-56 – see Literature section below) we have always found chlorophyll, though it is masked by the anthocyanins.

Here we confirm that a member of Bignoniaceae is host to *S. gesnerioides*. Some herbarium labels in Windhoek had suggested *Catophractes* as a possible host but we were able to confirm this now by excavating the parasite and tracing it to the root of the shrub. The flower and stem color of this variant are quite different from other morphotypes. Plants are always a reddish-purple with a purple corolla and a large haustorium (2.5 cm across).

Of the various ‘strains’ of this species that we have studied in Africa, the *Catophractes* parasites most closely resemble those parasitizing *Euphorbia*.
Striga gesnerioides parasitising Catophractes alexandri, Outjo, Namibia. The woolly white leaves of the host are obvious.

The cropping system in the communal farming regions of northern Namibia is mixed cropping with millet (Pennisetum americanum), known locally as mahango, and Zea mays the favoured cereals. Fields also contain bambara nuts (Vigna subterranea) and cowpea (Vigna unguiculata) and less frequently peanuts (Arachis hypogea). We found no S. gesnerioides on cowpea or bambara nut though there is one record in the Windhoek herbarium of S. gesnerioides on cowpea, which could be growing on a different host in a cowpea field. However, within these fields this parasite was frequent on Alysicarpus vaginalis and Indigofera arenophila.

The situation with Striga asiatica is much different. At a new commercial maize cropping scheme near Rundu on the Angolan border, S. asiatica was parasitizing the crop. There was a marked increase in infestation since the first cropping season in 2011 when only a few Striga plants were observed. As a result, we examined about a dozen traditional fields that had mixed crops of mahango and maize. No witchweed was found on mahango or sorghum even when the maize was seriously attacked in the same field. Maize, a New World crop, is particularly susceptible to witchweed.

S. asiatica is native in Namibia and occurs scattered in acacia bush savannas. It is not clear if this is the source of the agronomically important parasites. S. asiatica parasitizing grasses has consistently shorter and round corolla lobes. We plan further research using molecular markers to determine the variability within both species of witchweed.

Striga asiatica on Digitaria in Northern Namibia showing the short corolla lobes.

Witchweed parasitizing maize in a mixed mahango/maize field, Rundu, Northern Namibia

Several of the farmers we interviewed were unaware of the damage that S. asiatica can do to maize so it is important that a program for making them aware of the parasite, its potential, and its control be instituted as soon as possible.

Erika Maass, University of Namibia; Kamal Mohamed, State University of New York-Oswego; Lytton Musselman, Old Dominion University.
NOTE ON THE COMMERCIAL USE OF XIMENIA AMERICANA

Known by the unhelpful common name of hogplum, *Ximenia americana* is a thorny, deciduous shrub in the family Ximeniaceae (formerly placed in the Olacaceae). In colloquial American English, a plant common name with ‘hog’ in it usually refers to something of inferior value to the original. However, the fruit of hogplum is quite tasty - as good as a real plum. It is also known as tallow wood.

This is perhaps the most widely distributed native parasitic plant on the globe. (The most widely distributed parasitic weed is *Cuscuta campestris*, native to the United States but spread around the globe.) I have seen stands of *Ximenia* in southern Florida in the United States where hogplum is common in dwarf oak sand scrub, central Sudan where the green color of the leaves stand out in the dry season, New Caledonia where it forms thickets near the coast, and many places in western and southern Africa. But it is also reported to form dense stands in Australia and elsewhere in tropical and semi-tropical regions in both the Western and Eastern Hemispheres.

I have traced its parasitic attachments to a diversity of hosts, it is a generalist in host selection. Germination of the large seeds is easy and unique. As the epicotyl emerges, the first two formed leaves, cataphylls, bend back into the inter-cotyledon space. Early naturalists noticed this and suggested that these cataphylls were forming parasitic attachments within the seed. Careful examination, however, shows that this is not the case, there is no connection between the cotyledons and cataphylls.

During a recent visit to Namibia, I was surprised to learn of an industry that has arisen around this parasitic shrub. *X. americana* and the more restricted *X. afra* are quite common in the central and northern region of that country and the fruits are collected for the oil expressed from the seeds. In 2011, 16.5 tons of seeds where harvested for a value of approximately US$19,500 according to Indigenous Natural Products in Namibia (INP Market Bulletin. 2011. *Ximenia*. Indigenous Natural Products in Namibia 3: 2.). That does not seem like a lot of money but represents a lot of *Ximenia* plants! And for the 300 or so collectors it is a significant income. Most of the oil is shipped to France for the cosmetics industry.

Lytton John Musselman, Old Dominion University

MEETING REPORT

The VI International Weed Science Congress (IWSC) was held from 17 to 22 June 2012, at the New Century Grand Hotel Hangzhou, Hangzhou, China. The congress attracted 545 weed scientists from 51 countries. During this congress, a symposium on the ‘The state of art of parasitic plants research in the technological and biotechnological era’, organized by the International Parasitic Plant Society (IPPS) and the International Weed Science Society (IWSS), was held on Tuesday 19 June, and the oral presentations were grouped into 4 sessions; ecology and seed-bank, biology, and two management sessions. The number of abstracts submitted to this symposium was 34 and there were 18 oral (including 3 invited talks) and 16 poster presentations. The final programme and the proceedings will soon be available from the IWSC homepage (http://www.congress.com.cn/IWSC2012/)

Oral presentations:

Ecology and seedbank

Yongqing Ma (invited talk, China) - The parasitic weeds problems in China-past and present situation.

A historical view of parasitic weed problems in China was given. *Orobanche*, *Phelipanche* and *Cuscuta* spp. are important weedy parasites in China but most of the attention and publications was focused on the herbal and medicinal traits of these plants and not on their damaging effect as parasitic weeds. In recent years up to 50% crop loss in sunflower production due to *O. cumana* infection was reported. Severe crop loss due to *P. aegyptiaca* in melon and tomato was also reported. *Cuscuta* was described in an old Chinese book (2200 years ago) but mainly as a medicinal herb. Since some water and methanol extracts of medicinal herbs could induce seed germination of *Orobanche* and *Phelipanche* spp., they could be used as trap crops.

Marc Cotter (Germany) - Predicting the potential future geographic distribution of *Striga* under climate and land use change.

Using GIS-based modeling complemented by greenhouse and field studies, the present geographic distribution of *Striga* species mainly in Sub-Saharan
Africa was defined more precisely and its potential future expansion was predicted. *Striga* was found to occur as patches and may spread to areas of similar climate conditions like northern Australia in 2020. To improve reliability of the prediction, detailed data on *Striga* distribution, local climate factors, management practices, soil types, and vegetation need to be included.

Rosemary I. Ahom (Nigeria) - Severity of *Striga hermonthica* (Del.) Benth., parasitism on small-scale maize farms in Benue State, Nigeria. Extensive and intensive surveys were conducted on the extent of *S. hermonthica* infestation on maize in low-input farmers in Benue State Nigeria. The farmers identified *Striga* properly but 20% of them indicated that *Striga* was a useful medicinal herb. *Striga* infested both local and improved varieties and the more severe damage being observed in the former. Although intercropping was adopted widely, most of the farmers in the Northern zone gave up cropping maize due to the pile. The resistance of submersion treatment in cattle slurry and in the compost survive. Similar trends could be observed in the *Striga* problem. Hoe weeding was the only control measure in their farms.

Tuvia Yaacoby (Israel) - Survival of the parasitic weed *Phelipanche aegyptiaca* in compost. Since the source of heavy *P. aegyptiaca* infestations in tomato greenhouses was suspected to be parasite seeds originating from compost used as fertilizer, the ability of *P. aegyptiaca* seeds to survive the composting procedure was investigated. *P. aegyptiaca* seeds lost germinability when they were kept at > 55°C for 4 hours or at 45–50°C for 15 hours. Therefore, proper composting procedure can prevent spreading of *P. aegyptiaca* infestation.

Yaakov Goldwasser (Israel) - Survival of seeds of parasitic weeds in cow manure. Cattle manure may contain weed seeds and thus has a high potential to disseminate them and infest farm fields. Seeds of *P. aegyptiaca* and *C. campestris* were examined for their survival after passing through the cow digestive system, in farm liquid slurry in the reception pits in cattle sheds and in compost piles. *P. aegyptiaca* seeds could not survive the 3 day passage through the cow stomach while up to 36% of *Cuscuta* seeds could survive. Similar trends could be observed in the submersion treatment in cattle slurry and in the compost pile. The resistance of *C. campestris* seeds is probably due to its hard seed coat.

**Biology**

Linjian Jiang (China) - Interspecies protein trafficking endows the parasitic flowering plant dodder (*Cuscuta* spp.) with a host-specific herbicide tolerant phenotype. It was examined how dodder (*C. pentagona = C. campestris*) interacted with transgenic glufosinate tolerant hosts carrying the detoxifying enzyme phosphinotricin acetyl transferase (PAT) gene. The interspecies trafficking of PAT protein from hosts to the parasite was detected by ELISA, but not that of PAT mRNA by RT-PCR. This may provide a basis for novel approaches to parasitic weed control by preventing interspecies trafficking of targeted enzymes.

Airong Li (China) - Nutrient strategies of root hemiparasitic *Pedicularis* (Orobanchaceae). Both of the two sympatric root facultative hemiparasites *Pedicularis rex* and *P. tricolor* have been shown to have wide host ranges but different host preferences. Since they form symbiotic relationship with AM fungi, effects of host plants and AM fungi on growth of these hemiparasites and on phosphorus (P) acquisition were examined. Contribution of AM pathway in P acquisition was negligible in the absence of hosts but AM colonization affects host-derived P acquisition. In addition, AM colonization significantly reduced the number of haustoria (Li et al., 2012. Ann. Bot. 109: 1075-1080 – see Literature below). Inhibition of haustorium induction would be a promising target for both facultative root hemiparasites as well as obligate root parasites.

Kaori Yoneyama (Japan) - Seed germination stimulants for *Phelipanche ramosa* produced by oilseed rape. 2-Phenylethyl isothiocyanate (ITC) was found to be a major germination stimulant for *P. ramosa* produced by oilseed rape (*Brassica napus*). This non-mycotrophic plant also produced orobanchyl acetate and novel strigolactones but the amounts exuded were quite low as compared with mycotrophic plants. Then, 21 ITCs were examined for their germination stimulation activities on *P. ramosa* and *O. minor*. Among them, C_{12}-alkyl-ITCs, and benzyl- and 2-phenylethyl-ITC but not phenyl-ITC were active *P. ramosa* germination stimulants. By contrast, these ITCs were totally inactive on *O. minor* seeds. ITCs are important germination stimulants for *P. ramosa*, and *P. ramosa* has developed a special seed germination strategy to parasitize oilseed rape.

Tal Shilo (Israel) - Glyphosate inhibits the translocation of macromolecules in the parasitic association between Egyptian broomrape (*Phelipanche aegyptiaca*) and tomato (*Solanum lycopersicum*). To examine a hypothesis that glyphosate restricts the translocation of phloem solutes from tomato (host) to *P. aegyptiaca*, a cross-bred transgenic tomato line expressing resistance to glyphosate and green fluorescent protein (GFP) was used. In the control (without glyphosate) treatment, a gradual increase in tubercle fluorescence was observed, indicating accumulation of GFP. By contrast, GFP accumulation in *P. aegyptiaca* tubercles was inhibited following glyphosate application. These results supported the hypothesis.
Zhi Wei Fan (China) - Induced host resistance as a control method for parasitic weeds. The efficacy of acibenzolar-S-methyl (ASM, BTH) an inducer of systemic acquired resistance (SAR), in soybean dodder (Cuscuta australis) control was investigated in western Kenya where the soil was P deficient. Application of P at 46 and 69 kg P ha\(^{-1}\) significantly reduced dodder biomass without affecting growth of soybean. Accordingly induction of SAR by ASM when combined with other control methods would provide effective control strategy for soybean dodder.

### Management

Murizio Vurro (invited talk, Italy) - Renewing the interest in biological control of parasitic weeds: use of strigolactone-degrading microbes. Extensive studies on microorganism-derived compounds which inhibit or stimulate germination of broomrape seeds, and thus could be used as biological agents for managing broomrapes, were summarized. A novel approach to biological control of root parasitic weeds has been proposed – using microorganisms which grow along the root system of the host plant, degrade strigolactones (SLs) rapidly, and thus prevent germination of parasite seeds. Distinct differences were observed among microorganisms, treatments and SLs used.

George D. Odhiambo (Kenya) – Interaction between phosphorus and desmodium on Striga hermonthica (Del.) Benth. incidence and maize yield in western Kenya. The influence of phosphorus (P) on effectiveness of two desmodium species (D. uncinatum and D. intorum) on S. hermonthica infestation and maize grain yield was investigated in western Kenya where the soil was P deficient. Application of P at 46 and 69 kg P ha\(^{-1}\) significantly reduced Striga seedbank after three continuous cropping seasons. P fertilization of desmodium induced early emergence of Striga but later, as desmodium became matured, effectively suppressed Striga emergence. Farmers in P deficient areas are advised to fertilize their field with P to achieve optimum results.

Chinnusamy Chinnagounder (India) - Integrated management of witchweed (Striga asiatica L.) in early planted sugarcane (Saccharum officinarum L.) under red sandy loam soils of Tamil Nadu. Field experiments were carried out to evaluate herbicidal management techniques for controlling S. asiatica in sugarcane. An integrated management system including pre-emergence application of atrazine (1.0 kg ha\(^{-1}\)), subsequent hand-weeding of emerged Striga shoots, and post-emergence application of 2,4-D sodium salt (5g L\(^{-1}\)) + urea (20 g L\(^{-1}\)) was proven to be effective in reducing S. asiatica infection in sugarcane under red sandy loam soils.

Hanan Eizenberg (invited talk, Israel) - The contribution of advanced technologies for broomrape (Orobanchaceae and Phelipanche spp.) management. As broomrapes are highly sensitive to herbicides in the underground stages, information for their spatial distribution and quantification of their developmental stages should contribute to management success. The temporal variation was quantified and broomrape parasitism was predicted by a thermal time model. Spatial variation of broomrape infestation within a field and between fields was estimated by the use of Geographical Information Systems (GIS) and other advanced technologies including in-situ observation using a minirhizotron for parasitic weed mapping, and field history data storage. This allows accurate mapping of the spatial distribution of broomrape in the field and use of these data for Site Specific Weed Management (SSWM). An example of a decision support system for rational management of Egyptian broomrape (P. aegyptiaca) was presented.

Amnon Cochavi (Israel) - A thermal-time model for predicting the parasitism of Phelipanche aegyptiaca in carrot (Daucus carota). A thermal-time model for predicting the initial parasitism of P. aegyptiaca in carrot was studied. Although the initial parasitism of P. aegyptiaca in tomato, O. minor in red clover and O. cumana in sunflower could be predicted by using a linear equation, this was not applicable to P. aegyptiaca in carrot. Instead, a beta function equation could robustly predict the tubercle growth stage (1-2 mm) which is highly sensitive to the herbicide glyphosate.

Evgenia Dor (Israel) - The resistance mechanism to imidazolinones herbicides of a novel tomato mutant HRT1 for broomrape management. A tomato mutant HRT1 resistant to imidazolinone herbicides was screened from an EMS treated tomato line M82. Acetolactate synthase (ALS) of HRT1 was less sensitive to the imidazolinone herbicides imazamox, imazapic and imazapyr, but equally sensitive to sulfonylurea and pyridimilinithiobenzoate herbicides as compared to ALS from M82. HRT1 ALS genes revealed four mutations and one of them resulted in the replacement of Ala194 to Val corresponding to Ala205 in the conserved region of Arabidopsis ALS. This mutation appeared to confer resistance to imidazolinone herbicides.

Satbir Punia (India) - Management of Phelipanche aegyptiaca in mustard and tomato in North-West India. Extensive field trials to establish feasible management of P. aegyptiaca in mustard and tomato in North-West India were conducted. Application of different kinds of organic and inorganic fertilizers and foliar...
treatment with crop oils were not effective. Seed coating with residual herbicides delayed the emergence of *P. aegyptiaca*. Post-emergence application of glyphosate provided promising results. Addition of 1% (NH$_4$)$_2$SO$_4$ to glyphosate spray enhanced its efficacy. Nitrogen fertilization (40 kg ha$^{-1}$, 3 times) could alleviate crop loss caused by the parasite.

**Poster presentations:**

**Ecology and seedbank**
Wentao Yu (China) - Expressed sequence tag (EST) - intron length polymorphism (ILPs) as a molecular tool for the identification of *Cuscuta* species.

**Biology**
Yongqing Ma (China) - Induction of sunflower broomrape (*Orobanche cumana*) seed germination by some hybrid maize (*Zea mays* L.) varieties and their parents.
Wei Zhang (China) - Induction of sunflower broomrape (*Orobanche cumana*) seeds germination by different soybean (*Glycine max*) varieties.
Ana A. Stepowska (Poland) - Light and scanning electron microscopy studies on the *Phelipanche ramosa* L. Pomel development parasitizing tomato plants.
Dragana M. Bozic (Serbia) - Effect of salinity on seed germination of *Cuscuta campestris* Yunck.
Zhaohu Li (China) - Programmed cell death facilitates the dispersion of dodder.

**Management**
Gui-Lin Chen (China) - The resistance of different sunflowers to *Orobanche Cumana* Wallr. in seedling stage.
Hanan Eizenberg (Israel) - A multidisciplinary integrated approach for alleviating broomrape damage in Israeli agriculture - an emergency national project, 2010-2013.
Murali Arthanari Palanisamy (India) - Integrated *Cuscuta* management in legume fodder lucerne *Medicago sativa* and leafy vegetable (*Amaranthus viridis*).
Goran Malidza Serbia) - Broomrape (*Orobanche cumana*) control in tribenuron-tolerant sunflower.
Hanen Eizenberg (Israel) - Modelling approach for the prediction of parasitism dynamics in the root holoparasite broomrapes (*Orobanche* and *Phelipanche* spp.).

**Germination stimulants**
Hyun-il Kim (Korea, Japan) - Germination stimulating activity of strigolactone mixtures.
Takayuki Kishig (Japan) - Germination stimulants for root parasitic weeds produced by faba bean.

Takahito Nomura (Japan) - Analysis of endogenous strigolactones using plant cell cultures.
Xiaonan Xie (Japan) - Characterization of strigolactones produced by tobacco plant.
Pichit Khetkam (Thailand, Japan) - Strigolactones in root exudates from rice plants.

**PRESS RELEASES**

Global Food Security Center Hires Manager, Receives Grants (abridged)
The recently created Center for Global Food Security at Purdue University has hired a managing director and received grants totalling $10 million for work to improve crops in Africa and train the next generation of global food security experts.

Gary Burniske, who had been director of Mercy Corps operations in Bogotá, Colombia, since 2006, will run daily operations of the center at Discovery Park, a complex of organizations leading large-scale collaborative research on campus engaging faculty, students and industry in state, national and global partnerships and entrepreneurial education. Burniske's appointment comes at a time when the center, established in 2011, will begin work on two major projects that have received significant funding and align with two of the center's core mission areas - research and education:

A four-year, multidisciplinary research and development program on the control of the parasitic *Striga* weed, which infests sorghum and other crops in Africa, damaging or destroying them. The center received a $5 million grant from the Bill & Melinda Gates Foundation to further research and establish programs for a sustainable *Striga* control and institutional development effort in the African nations of Tanzania and Ethiopia.

The *Striga* research will build on the work of Gebisa Ejeta, the center's director and Distinguished Professor of Agronomy who received the World Food Prize in 2009 for developing sorghum varieties resistant to drought and *Striga* in his native Africa, where sorghum is a major crop. The new effort will focus on furthering knowledge of biological interactions between *Striga* and sorghum through research in chemistry, molecular genetics and crop improvement.

'In the previous research, we focused on controlling *Striga* through manipulation of resistance genes in the host plant,' Ejeta said. 'Now we will expand the research to explore the role of virulence genes in the pathogen to
avoid catastrophic breakdown of resistance.’ Shorter-term solutions will involve establishing sustainable *Striga* control programs by adapting previously piloted *Striga* management technologies to the variety of environments and livelihoods of small-scale farmers in highly infested regions of Ethiopia and Tanzania.

Ejeta will direct the project, which will include Tesfaye Mengiste, a Purdue professor of botany and plant pathology, and Harro Bouwmeester, who heads the Laboratory of Plant Physiology at Wageningen University in the Netherlands. They will collaborate with the agriculture ministries in Ethiopia and Tanzania.

Purdue University, 20 Feb 2012.

**Mistletoe was controversial choice for Oklahoma flower**

For 114 years, Oklahoma’s state flower was the mistletoe. But it was always a controversial choice. In February 1893, while the 2nd Territorial Legislature met in Guthrie, Rep. John A. Wimberly introduced the bill to designate mistletoe as the official floral emblem. The Women’s Congress of the Columbian World Exposition held in Chicago in 1893 had proposed that the states should consider selecting floral emblems to represent their state at the exposition. While Oklahoma was not a state, the Oklahoma Pavilion at the exposition, also known as the Chicago World’s Fair, promoted the territory to exposition visitors. Wimberly was the youngest member of the House of Representatives and it was he who, according to The Oklahoman on April 19, 1925, suggested ‘one of the most interesting traditions.’

‘One day the question of the state flower was brought up. Everything from daisies to American Beauty roses was suggested. A representative from the southern part of the Territory wanted forget-me-nots. ‘That’s a good name for a state flower, and it’s a pretty flower too,’ he said. ‘Mr. Wimberly remembered how hard the previous winter had been and that when settlers had died and there were no flowers to put on the graves: ‘the only thing in the whole country with a bit of color was mistletoe.’ So it was adopted as the new territory’s floral emblem.

‘Years later when Oklahoma became a state, members of the constitutional convention carried the old territorial flower over into statehood, thus confirming what has since become one of Oklahoma’s oldest traditions.’

Every few years after it seemed someone would propose a change, it would be discussed and mistletoe would remain. The sweet pea, yucca and the cowboy rose (not a rose but a part of the mallow family), were among those proposed, but probably the most unusual was the alfalfa blossom.

Before we were even a state, in 1906, William H. Murray stated his preference for alfalfa in a letter to the editor of The Oklahoman: ‘Who, indeed, would desire to adopt for a state flower, a parasite? Let greater Oklahoma be known as the ‘Alfalfa State.’ In an editorial in The Oklahoman for June 17, 1912, the newspaper came out in support of alfalfa as the state flower: ‘Now that Oklahoma has become known as the marvelous alfalfa state, why not use the alfalfa blossom as the state flower?’ ‘The alfalfa blossoms are pretty; they enrich the scenery, added to the artistic part, alfalfa, is the mortgage lifter of Oklahoma. It is the crop which brings riches to the state; it is a crop which means more to the future than any other crop.’ ‘Alfalfa blossom — the state flower. It should be adopted’

The hardy little mistletoe stood firm from 1890 until 2004 when Gov. Brad Henry signed a bill into law making the Oklahoma Rose our official state flower. The mistletoe remains the state floral emblem.

Mary Philips for The Archivist June 28, 2012

**Global warming may shift the range of invasive weeds in Australia**

Global warming may shift the range of invasive weeds in Australia by hundreds of miles and awaken so-called ‘sleeper weeds,’ according to scientists with the Commonwealth Scientific and Industrial Research Organization (CSIRO). Plant experts warned at the end of March warned that resource managers need to be prepared for big changes in the coming decades.

Invasive weeds already cost Australia more than $4 billion (Australian) per year either in control of lost production, and, like elsewhere, displace native habitat and species.

At a recent conference in Perth, CSIRO scientist Dr. John Scott, said, those cost estimates are only based on the damage caused by weeds known to be active in Australia. ‘Out there, throughout the nation, are many weed species lying low but with the potential to take off and add to the economic and social burden of weed control,’ Dr Scott said. ‘One critical unknown is what these lurking weeds will do under climate change. Will their distributions change? Will they spread north or south, east or west, and will these movements change them into full-blown pest species?’

A recent CSIRO report for the Australian Government’s Land and Water Australia looked at what effects climate changes anticipated for 2030 and 2070 might have on the distribution of 41 weeds that pose a threat to agriculture (‘sleeper’ species) and the natural environment (‘alert’...
We found that climate change will cause most of these weeds to shift south, with wet tropical species making the greatest move—a move of over 1,000 kilometers,' Scott said. 'The regions most at threat from alert and sleeper weeds, both under the current climate and under climate change, are south east Australia, followed by the south west.'

Karroo thorn (Acacia karroo), rosewood (Tipuana tipu) and kochia (Bassia scoparia) were found to pose the greatest threat under climate change while white weeping broom (Retama raetam) and fringed dodder (Cuscuta suaveolens) were predicted to have the highest risk of establishing in new areas.

'The predicted move south by both native and introduced plants would produce a ‘vacuum’ in northern Australia so, to prevent lurking species from invading, a new list of alert and sleeper weeds for this region needs to be developed,' Dr Scott said. The report also found that while the area currently infested by the most widespread weeds will decrease under climate change, the area of high risk would still be large.

Bob Berwyn for Summit County Citizens Voice
12 May 2012

CONGRATULATIONS


Dr Bikash Ray. Congratulations to Dr Bikash Ray on his promotion to the Pulses and Oilseeds Research Station, Berhampore, West Bengal India, where he will be exploring the availability of resistance to Orobanche aegyptiaca in rapeseed and mustard.

FORTHCOMING MEETING

12th World Congress on Parasitic Plants (WCPP) will be held on Monday July 15 to Friday July 19, 2013 in Sheffield, UK. The venue will be the Edge Conference facility at the University of Sheffield. Further details will be provided via the conference website which will be available from mid October 2012. An e-mail will be sent to everyone who receives Haustorium once the website is available.

GENERAL WEB SITES

For individual web-site papers and reports see:

LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see:
http://www.parasiticplants.org/

For past and current issues of Haustorium see also:
http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see:
http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see:
http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see:
http://ppgp.huck.psu.edu/

For information on the EU COST 849 Project (now completed) and reports of its meetings see:
http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see:
http://www.push-pull.net/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes, up to 1995?) see:
http://www.rmrs.nau.edu/mistletoe/

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)

For past and current issues of the Sandalwood Research Newsletter, see:

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ newsletters, see: http://www.aatf-africa.org/

THANKS

As editors of Haustorium, Harro Bouwmeester and Chris Parker wish to thank Jim Westwood for his stalwart help, support and encouragement in the production of this newsletter over the past many years, particularly helping Chris with literature items that were beyond his comprehension. We may yet trouble him further but will try to leave him in peace.
LITERATURE

* indicates web-site reference only


Alder, A., Jamil, M., Marzorati, M., Bruno, M., Vermathen, M., Bigler, P., Ghisla, S., Bouwmeester, H., Beyer, P. and Al-Babili, S. 2012. The path from β-carotene to carlactone, a strigolactone-like plant hormone. Science (Washington) 335(6074): 1348-1351. [A breakthrough paper on the elucidation of the strigolactone biosynthetic pathway. The catalytic function of DWARF7 was determined to be the isomerisation of trans to cis-β-carotene. The latter serves as substrate for CCD7 and the resulting apocarotenoid as substrate for CCD8. This 3-step pathway results in the formation of the highly surprising compound carlactone that already has the D-ring that is so characteristic for strigolactones and stimulates the germination of Striga and Orobanchaceae/Phelipanche.]


Aly, R. 2012. Advanced technologies for parasitic weed control. Weed Science 60(2): 290-294. [Reviewing the need for alternative biotechnology-methods and describing the generation of transgenic tobacco plants expressing a cecropin peptide (sarcotoxin IA), under the control of the inducible HMG2 promoter and showing enhanced resistance to Phelipanche aegyptiaca. (see also Haustorium 59 pp 2-3).]


Amico, G.C., Vidal-Russell, R., García, M.A., and Nickrent D.L. 2012. Evolutionary history of the South American mistletoe Tripodanthus (Loranthaceae) using nuclear and chloroplast markers. Systematic. Botany 37: 218-225. [Results from a combined analysis of ITS and plastid genes showed the Tripodanthus flagellaris clade (including T. belmirensis) as sister to T. acutifolius which was composed of eastern and Andean clades.]


Atera, E.A., Itoh, K., Azuma, T. and Ishii, T. 2012. Farmers’ perspectives on the biotic constraint of Striga hermonthica and its control in western Kenya. Weed Biology and Management, 12: 53–62. [Striga hermonthica is regarded as a major constraint to maize, sorghum, and finger millet production and is increasing in the region. Local control measures include hand-pulling, crop rotation, and intercropping, but are not
widely adopted as there is no guarantee of a direct pay-off in increased crop yield.\footnote{Atera, E.A., Itoh, K., Azuma, T. Ishii, T. 2012. Response of NERICA rice to Striga hermonthica infections in western Kenya. International Journal of Agriculture and Biology 14(2): 271-275. [Confirming rice varieties NERICA 1 and NERICA 10 are resistant to \textit{S. hermonthica}, while NERICA 4 is highly susceptible. Yield loss ranged between 33 and 90%.]}

Atera, E.A., Itoh, K., Azuma, T. Ishii, T. 2012. Farmers' perception and constraints to the adoption of weed control options: the case of \textit{Striga asiatica} in Malawi. Journal of Agricultural Science (Toronto) 4(5): 41-50. [Farmers attribute increasing infestation of maize by \textit{Striga asiatica} in central Malawi to insufficient funds to purchase inputs, low soil fertility and lack of grazing animals. Control options are not implemented because they are not trusted.]


Badu-Apraku, B. and Oyekunle, M. 2012. Genetic analysis of grain yield and other traits of extra-early yellow maize inbreds and hybrid performance under contrasting environments. Field Crops Research 129: 99-110. [The available extra-early maize inbred lines are not only drought escaping but also possess genes for drought tolerance. TZEEI 79 × TZEEI 63 was the best extra-early hybrid under infestation by \textit{Striga hermonthica}.]

Bandaranayake, P.C.G., Tomilov, A., Tomilova, N.B., Ngo, Q.A., Wickett, N., de Pamphilis, C.W. and Yoder, J.I. 2012. The \textit{TvPirin} gene is necessary for haustorium development in the parasitic plant \textit{Triphysaria versicolor}. Plant Physiology 158(2): 1046-1053. [Showing that \textit{TvPirin} homologs are present in most flowering plants, and are not parasite-specific but are associated with the expression of a number of genes, some of which are involved in haustorium development.]


Barea, L.P. 2012. Habitat influences on nest-site selection by the Painted Honeyeater (\textit{Graietiella picta}): do food resources matter? Emu - Austral Ornithology 112(1): 39-45. [Showing that nest-site selection by the Painted Honeyeaters was largely explained by abundance and proximity of (unspecified) mistletoe clumps and discussing the need to conserve mistletoes in the interest of conserving this declining bird species.]

Barrett, T.M., Latta, G., Hennon, P.E., Eskelson, B.N.I. and Temesgen, H. 2012. Host-parasite distributions under changing climate: \textit{Tsuga heterophylla} and \textit{Arceuthobium tsugense} in Alaska. Canadian Journal of Forest Research 42(4): 642-656. [Analysis of 1549 forested plots within a 14.5 million ha region of southeast Alaska suggest that climate currently limits the range of \textit{A. tsugense} on \textit{Tsuga heterophylla} and that certain models for climate change suggest up to 750% increase in distribution over the next century.]

Beavan, S.D. and Heckford, R.J. 2012. Discovery of the larva of \textit{Gynnidomorpha permixtana} ([Denis & Schiffermüller], 1775) (Lepidoptera: Tortricidae) in the British Isles and a consideration of the species' distribution there. Entomologist's Gazette 63(2): 69-83. [Larvae of \textit{G. permixtana} found feeding in seed-capsules of \textit{Odontites vernus} and \textit{Rhinanthus minor}.]


Borokini, T.I. and Omotayo, F.O. 2012. Phytochemical and ethnobotanical study of some selected medicinal plants from Nigeria. Journal of Medicinal Plants Research 6(7): 1106-1118. [Identifying components in a range of plants, including \textit{Tapinanthus globiferus} which tend to support their traditional medicinal uses.]

Brady, M.F. 2012. New larval food plants and biological notes for some butterflies (Lepidoptera: Papilionoidea) from eastern Australia. Australian Entomologist 39(2): 65-68. [\textit{Pieris rapae} recorded for the first time on \textit{Lysiana spathulata} (Loranthaceae).]

Bracci, A., Amat, A.G., Maione, F., Cicala, C., Mascolo, N. and de Feo, V. 2012. Diuretic activity of \textit{Lophophytum leandri}. Natural Product Communications 7(1): 33-34. [Confirming the diuretic activity of extracts of \textit{L. leandri} (Balanophoraceae), used traditionally in Argentina.]

(Krameriaceae), an endangered medicinal plant from the Andean deserts. Journal of Arid Environments 83: 94-100. [K. lappacea is an endangered, hemiparasitic, medicinal plant from the semi-deserts of Andean South America, and is being overexploited. The work in Peru confirms that it has a very wide host range. The need for conservation strategies and adequate management are stressed.]

Brown, A., Eatt, J., Done, C., Raymond, D. and Pattison, M. 2011. Indian sandalwood. Perfumer & Flavorist 36(22): 26-34. [A study of 90 Santalum album trees in Western Australia show good correlations between stem diameter, merchantable mass yield and heartwood yield. Together with observed oil yield from heartwood, the results contribute to the development of a predictive model.]


Chandrakasan, L. and Neelamegam, R. 2011. GC-MS analysis of Loranthus longiflorus Desr. (a hemi-parasite) bark harvested from two host trees. Journal of Pharmacy Research 4(9): 3072-3074. [Extracts from the bark of L. longiflorus (= Dendrophthoe falcata) growing on Casuarina equisetifolia showed anti-microbial and anti-cancer properties, while the same species growing on Ficus religiosa contained different components, without useful activity.]

Chandrakasan, L. and Neelamegam, R. 2011. In vitro studies on antioxidants and free radical scavenging activities in the extracts of Loranthus longiflorus Desr. bark samples obtained from two host trees. Journal of Phytology 3(12): 22-30. [Showing some small differences in the antioxidant constituents and free radical scavenging activities of extracts from L. longiflorus (= Dendrophthoe falcata) growing on the hosts Casuarina equisetifolia and Ficus religiosa.]

Chen C.Q., Han, S., Gao, J. and Yang, L.N. 2012. First report of ginseng (Panax ginseng) as a natural host of dodder (Cuscuta japonica) in China. Plant Disease 96(2): 297. [Reporting poor growth, chlorosis, wilting, and eventual death in a field of ginseng infested by C. japonica in Jilin Province, China.]

Chen JaoShiEn and Hsiao ShuChuan. 2011. Study on seed morphogenesis of Orobanchaceae in Taiwan. Taiwania 56(4): 267-278. [Embryos of Aeginetia indica were of solanoid type, while in Boschniakia himalaica and Orobanche caerulescens they were of onagrod type. All seeds consisted of embryo, endosperm and testa.]


Daryaei, M.G. and Mohgadam, E.S. 2012. Effects of mistletoe (Viscum album L.) on leaves and nutrients content of some host trees in hycranian forests (Iran). International Journal of Agriculture: Research and Review 2(3): 85-90. [Studies on V. album-infested hornbeam (Carpinus betulus) and alder (Alnus glutinosa) showed reduction of area and weight of host leaves, and lowered N, but increased K, Mn and Zn.]


sanguinea (Balanophoraceae) among 33 species used to treat sexually transmitted disease.)

Delaux, P.M., Xie, X., Timme, R.E., Puech-Pages, V., Dunand, C., Lecompte, E., Delwiche, C.F., Yoneyama, K., Bécard, G., Séjalon-Delmas, N. 2012. Origin of strigolactones in the green lineage. New Phytologist 195(4): 857-871. [The authors show that strigolactones and corresponding genes are present in primitive land plants and the Charales, freshwater algae, and control rhizoid elongation in the primitive plants. They suggest that the original biological function of strigolactones is not to facilitate mycorrhizal colonisation but plant development.]

Disadee, W., Mahidol, C., Sahakitpichan, P., Sithimonchais, S., Ruchirawat, S. and Kanchanapoom, T. 2012. Unprecedented furan-2-carboxyl C-glycosides and phenolic diglycosides from Scleropyrum pentandrum. Phytochemistry 74: 115-122. [Five new compounds from S. pentandrum (Santalaceae) identified and evaluated for their radical scavenging activities using both DPPH and ORAC assays.]

Dong LiNa, Li DeZhu and Wang Hong. 2011. (Species delimitation of Pterygiella (Orobanchaceae), a genus endemic to southwestern China on the basis of morphometric and molecular analyses.) (in Chinese) Plant Diversity and Resources 33(6): 581-594. [Revising the genus Pterygiella to include only three species, P. nigrescens, P. dulcoulxii, and P. cylindrica. P. suffruticosa is merged into P. cylindrica as a variety.]

Dong, A., Lefflon, M., Simier, P. and Delaval, P. 2012. Development of a high-throughput real-time quantitative PCR method to detect and quantify contaminating seeds of Phelipanche ramose and Orobanche cumana in crop seed lots. Weed Research (Oxford) 52(1): 34-41. [The PCR (TaqMan) diagnostic method allowed rapid, high-throughput and accurate assessment of contamination of rapeseed and sunflower seeds with P. ramosa or O. cumana respectively, to the level of seeds per kg crop seed.]


Encheva, J. and Shindrova, P. 2011. Developing mutant sunflower lines (Helianthus annuus L.) through induced mutagenesis and study of their combining ability. Helia 34(54): 107-122. [Describing the use of ultrasound as a means of creating mutant lines of potential value in breeding for resistance to Orobanche cumana.]

Ephrath, I.E., Herschenhorn, J., Achardgi, G., Bringer, S. and Eizenberg, H. 2012. Use of logistic equation for detection of the initial parasitism phase of Egyptian broomrape (Phelipanche aegyptiaca) in tomato. Weed Science 60(1): 57-63. [From phytotron and greenhouse experiments at a range of temperatures, it was established that attachment of P. aegyptiaca on tomato began at 200 growing degree days (GDD) and maximum attachment was at 800 GDD.]

Estepe, M.C., Gowda, B.S., Huang, K., Timko, M.P. and Bennetzen, J.L. 2012. Genomic characterization for parasitic weeds of the genus Striga by sample sequence analysis. Plant Genome, 5(1): 30-41. [Genomics analysis of Striga spp. shows that their DNA contains repetitive elements. The genome size varied from 615 Mb in S. asiatica to almost 2460 Mb in S. forbesii, suggesting a ploidy series. Phylogenetic analysis of chloroplast loci suggest that S. gesnerioides is more closely related to the grass-parasitising Striga spp. than expected.]

Fadini, R.F. and Lima, A.P. 2012. Fire and host abundance as determinants of the distribution of three congener and sympatric mistletoes in an Amazonian savanna. Biotropica 44(1): 27-34. [Prevalence of the relatively host-specific P. plagiophyllus was negatively related to fire frequency, while for the more generalist P. biternatus and P. eucalyptiifolius it was not.]

Feldman, T.S., Morsy, M.R. and Roossinck, M.J. 2012. Are communities of microbial symbionts more diverse than communities of macrobiial hosts? Fungal Biology 116(4): 465-477. [Studies on Cuscuta cuspidata and its host Ambrosia psilostachya in grassland in Oklahoma, USA, revealed at least 25 fungal taxa, and 10% of these with detectable viruses. Several mycovirus types were shared among fungal taxa, indicating that mycoviruses may be less specialized than previously thought.]


Fischer, E., Lobin, W. and Mutke, J. 2011. *Striga barthlottii* (Orobanchaceae), a new parasitic species from Morocco. Willdenowia 41(1): 51-56. [Describing *S. barthlottii*, endemic to Morocco and specific to succulent *Euphorbia* species, previously mistaken for *S. gesnerioides*. The corolla lobes of *S. barthlottii* are rounded and about as long as wide while *S. gesnerioides* has long, narrow corolla lobes. The corolla of *S. barthlottii* is pale pink/whitish, while in *S. gesnerioides* it is usually violet. The stem of *Striga barthlottii* is typically unbranched, while typical *S. gesnerioides* is richly branched.]

Furuhashi, T., Fragner, L., Furuhashi, K., Valledor, L., Sun XiaoLiang and Weckwerth, W. 2012. Metabolite changes with induction of *Cuscuta* haustorium and translocation from host plants. Journal of Plant Interactions 7(1): 84-93. [Showing that metabolic components of *Cuscuta japonica* varied according to the host on which it was growing.]


Gaurav Sharma and Sundararaj, R 2011. Association of ants and honeydew producing sucking pests in Bangalore provenance of sandal (*Santalum album* Linn. Biological Forum 3(2): 62-64. [Different ants were found associated with five species of coccids on *S. album*.]

Genni, J., Córtés, M.C., Guimarães Júnior, P.R. and Galetti, M. 2012. Mistletoes play different roles in a modular host-parasite network. Biotropica 44(2): 171-178. [Finding a wider host range for *Psittacanthus* spp. than for *Phoradendron* spp. in the Brazilian Pantanal, apparently associated with a wider range of bird dispersers.]


Goldwasser, Y., Miryamchik, H., Sibony, M. and Rubin, B. 2012. Detection of resistant chickpea (*Cicer arietinum*) genotypes to *Cuscuta campestris* (field dodder). Weed Research 52(2): 122-130. [Among 52 international varieties of chickpea and 11 local varieties tested in pot experiments in Israel, ICV 95333 and Hazera 4 showed very high resistance to primary parasitism from *C. campestris*, and moderate resistance to secondary parasitism (when the *C. campestris* had first established on a susceptible variety).]


Goto, R., Yamakoshi, G. and Matsuawaza, T. 2012. A novel brood-site pollination mutualism?: the root holoparasite *Thonningia sanguinea* (Balanophoraceae) and an
inflorescence-feeding fly in the tropical rainforests of West Africa. Plant Species Biology 27(2): 164-169. [Female flies of the families Muscidae and Calliphoridae as well as Technomyrmex ants are shown to be responsible for pollination of T. sanguinea in Guinea. Morella sp. (Muscidae) lays eggs on T. sanguinea, and the larvae feed only on the tissue of decaying male inflorescences.]


Greuter, W. and van Raab-Straube, E. 2009. Euro+Med Notulae, 4. Willdenowia 39(2): 327-333. [The authors indicate that the molecular data are inconclusive regarding segregating Phelipanche from Orobanche and thus propose two new combinations, O. shultzioides and O. tricholoba.]

Grudnicki, M., Barbu, C. and Curelaru, C. 2010. The influence of mistletoe (Viscum album ssp. abietis) attack on fir tree (Abies alba) in Solca forest arrondissement Suceava District. Lucrări Științifice, Universitatea de Științe Agricole Sj Medicină/ Veterinară”Ion Ionescu de la Brad”. Seria Horticultura” 53(1): 585-590. [In Romania, V. album reduces wood quality of fir and increases vulnerability to strong winds, heavy snow falls, and the attacks of insects and fungi.]

Guo Hui, Weiner, J., Mazer, S.J., Zhao ZhiGang; Du GuoZhen and Li Bo. 2012. Reproductive allometry in Pedicularis species changes with elevation. Journal of Ecology (Oxford) 100(2): 452-458. [Studying 24 Pedicularis ssp. in Tibet and showing that the ratio of reproductive to vegetative growth decreases with increasing elevation.]


Hajtò, T., Fodor, K., Perjési, P. and Németh, P. 2011. Difficulties and perspectives of immunomodulatory therapy with mistletoe lectins and standardized mistletoe extracts in evidence-based medicine. Evidence-based Complementary and Alternative Medicine 2011: Article ID 298972, 6 pp. [A review concluding that research on lectins from Viscum album needs new perspectives The advantages and disadvantages of purified and biologically better defined lectin preparations are also discussed.]


Henderson, R.C., Sultan, A. and Robertson, A.W. 2010. Scale insect fauna (Hemiptera: Sternorrhyncha: Cococcidea) of New Zealand’s pygmy mistletoes (Korthalsella: Viscaceae) with description of three new species: Leucaspis albotecta, L. trilobata (Diaspididae) and Eriococcus korthalsellae (Eriococcidae). Zootaxa 2644: 1-24. [Apart from the new species referred to in the title, 10 other scale insects are listed as occurring on Korthalsella clavata, K. lindsayi and K. salicornioides.]


Hettiarachchi, D.S., Gamage, M. and Subasinghe, U. 2010. Oil content analysis of sandalwood: A novel approach to...
Hossain, M.E., Kim GwiMan, Sun SangSoo, Firman, J.D. and Yang ChulJu. 2012. Evaluation of water plantain (Alisma canaliculatum (Alisma canaliculatum (A. Br. et Bouche) and mistletoe (Viscum album L.) effects on broiler growth performance, meat composition and serum biochemical parameters. Journal of Medicinal Plants Research 6(11): 2160-2169. [The addition of V. album to the diet of chickens (basal diet+0.5% mistletoe powder) in Korea caused some hepatotoxic effect and is not recommended.]
Huang, K., Whitlock, R., Press, M.C. and Scholes, J.D. 2012. Variation for host range within and among populations of the parasitic plant Striga hermonthica. Heredity 108(2): 96-104. [Identifying a small subset of AFLP markers which showed ‘outlier’ genetic differentiation among sub-populations of S. hermonthica attached to different rice cultivars, suggesting a genetic component to host range within populations of S. hermonthica.]
Iwalokun, B.A., Oyenuga, A.O., Saibu, G.M. and Ayorinde, J. 2011. Analyses of cytotoxic and genotoxic potentials of Loranthus micranthus using the Allium cepa test. Current Research Journal of Biological Sciences 3(5): 459-467. [L. micranthus (= Ileostylus micranthus) is used traditionally in Nigeria for the management of immuno-depressive illnesses such as diabetes mellitus, cancer and hypertension. This study showed that it is cytotoxic, mitodepressive and genotoxic to A. cepa roots and recommends caution in its use on humans.]
Jacobo-Salcedo, M. del R. and 13 others. 2011. Antimicrobial and cytotoxic effects of Mexican medicinal plants. Natural Product Communications 6(12): 1925-1928. [Comparisons among a range of rice varieties confirmed a negative correlation between strigolactone production and tillering, and a corresponding tendency for lower infestation of S. hermonthica on high-tillering varieties.]
Jamil, M., Charnikhova, T., Houshyani, B., van Ast, A. and Bouwmeester, H.J. 2012. Genetic variation in strigolactone production and tillering in rice and its effect on Striga hermonthica infection. Planta 235(3) 473-484. [Comparisons among a range of rice varieties confirmed a negative correlation between strigolactone production and tillering, and a corresponding tendency for lower infestation of S. hermonthica on high-tillering varieties.]
Jamil, M., Kanampiu, F., Karaya, H., Tatsiana Charnikhova and Bouwmeester, H., 2012. Striga hermonthica parasitism in maize in response to soil fertility. Field Crops Research 134: 1-10. [In a combination of greenhouse/lab and field experiments the paper shows that in the greenhouse, increasing availability of N and P...
strongly reduce the exudation of strigolactones in maize which results in reduced infection with Striga. In the field the results are less consistent, particularly for P application, although N application did reduce Striga infection, probably because of physiochemical properties of the field soil.)


Jeetendra Sainkhediya and Sudip Ray. 2012. Preliminary study of flowering plant diversity of Nimar region. Bioscience Discovery Journal 3(1) 70-72. [Viscum album ssp. coloratum (KML-C) has the ability to serve as a mucosal adjuvant.]


Karanja, J., Nguluu, S. and G after, M. 2012. Farm yard manure reduces the virulence of A lectra vogelii (Benth) on cowpea (Vigna unguiculata). African Journal of Plant Science 6(3): 130-136. [Field trials in Kenya showed farm yard manure at 5 or 10 t/ha reduced A. vogelii density by >50% and increased crop yield.]


Karpavičius, J. and Kar pavičius, J. 2011. (The features of European mistletoe (Viscum album L.) influence to the radial growth and state of Populus L. genus trees.) (in Lithuanian) Miškininkystė, 2(70): 49-57. [Showing that V. album infestation does not affect breast-height radial growth of P. nigra and P. canadensis but does seriously affect branch growth above points of attachment, resulting in death after 5-10 years and risk of fungal infection.]

Kawo, A.H., Suleiman, Z.A. and Yusha'u, M. 2011. Studies on the antibacterial activity and chemical constituents of Khaya senegalensis and Ximenia americana leaf extracts. African Journal of Microbiology Research 5(26): 4562-4568. [Extracts of X. americana failed to kill a range of wound bacteria, but chemical analysis showed the presence of potentially active compounds and suggested that higher doses could give results justifying their traditional use on wound infections in Nigeria.]

*Kester, M. 2012. Investigation trip to the United States of America to investigate golden dodder control options. Rural Industries Research and Development Corporation. https://rirdc.infoservices.com.au/items/12-009[Describing the control measures used to control Cuscuta campestris on lucerne in USA, including parquat plus burning, flam ing, sulphuric acid spraying, crop rotation into cereals, and the herbicides trifluralin
and pendimethalin. Also the use of glyphosate on a recently released Round-up-resistant lucerne.)

Kgosi, R.L., Zwanenburg, B., Mwakaboko, A.S. and Murdoch, A.J. 2012. Strigolactone analogues induce suicidal seed germination of *Striga* spp. in soil. Weed Research 52(3): 197-203. [Describing 5 new strigolactone analogues which were apparently active in soil of neutral pH. One derived from 1-tetralone was distinctively more active than the standard Nijemegen-1. The abstract refers to ‘no noticeable signs of decomposition’ but experimental evidence for this is not presented.]

Kim SanWoong, Yoo SeungHyeong, Lee HeeJae, Kim, K.D., Kim DoRim, Park SeongKyu and Chang MunSeog. 2012. *Cistanches herba* induces testis cytotoxicity in male mice. Bulletin of Environmental Contamination and Toxicology 88(1): 112-117. [At the doses used, extracts of *Cistanche* (presumably *C. deserticola* and/or *C. tubulosa*) induce cytotoxicity in the male reproductive system of mice, through inhibition of spermatogenesis, testicular damage, and limiting hormonal function.]

Koga, C., Mwenje, E. and Garwe, D. 2011. Response of tobacco cultivars to varying fertilizer levels in *Striga gesnerioides* infested soils in Zimbabwe. Agricultural Journal 6(6): 347-352. [Among 5 tobacco varieties, 2 landraces were severely damaged by *S. gesnerioides* while variety T66 was relatively tolerant. Parasite emergence, and damage to T66, was reduced by increasing N from 25 to 50 kg/ha.]


Kretzschmar, T., Kohlen, W., Sasse, J., Borghi, L., Schlegel, M., Bachelier, J.B., Reinhardt, D., Bours, R., Bouwmeester H.J. and Martínoia, E. 2012. A petunia ABC protein controls strigolactone dependent symbiotic signalling and branching. Nature 483: 341-346 [The authors cloned an ABC transporter from *Petunia* and show it is involved in strigolactone export. A mutant and transgenic knock-down plants secrete negligible amounts of strigolactones and have a (mild) branching phenotype. Intriguingly, the transporter seems to be expressed in specific cell-types in the root particularly, possibly in the hypodermal passage cells where AM fungi enter. Unexpectedly, the transporter is also expressed near the hypodermal passage cells where AM fungi enter.]

Kuijt, J. 2011. Loranthaceae Jussieu. 79. Eremolepidaeae (eds.) Flora de Chile 3(1): 9-24. [This treatment covers *Desmaria* (1 sp.), *Ligaria* (1 sp.), *Notanthera* (1 sp.) and *Tristerix* (3 spp.) for Loranthaceae. The concept of ‘Eremolepidaeae’ as a family is still being followed (modern works place these genera in Santalaceae) including *Antidaphne* (1 sp.) and *Lepidocoeus* (1 sp.).]

Kuijt, Job. 2011. Monograph of the genus *Dendropemon* (Loranthaceae). Syst. Bot. Monogr. 92: 1-110. [The last comprehensive examination of this genus was in the late 1800s. This monograph describes 31 species distributed among the Caribbean islands.]

Kuijt, Job. 2011. A note on isophasic parasitism in *Phoradendron perredactum* (Viscaceae). Acta Bot. Mexicana 96: 7-9. [A short note comparing the isophasic nature of growth in this mistletoe to other parasites where this has also evolved (e.g. *Arceuthobium*, *Pilostyles*, etc.).]


Kuijt, Job. 2012. Reinstatement and expansion of the genus *Peristethium* Tiegh. (Loranthaceae). Annals of the Missouri Bot. Garden 98(4): 542-577. [Generic boundaries in the neotropical small-flowered loranthuses are further redefined. The genus *Peristethium* Tiegh. is resurrected and now includes 15 mistletoe species, ten of which were formerly classified in *Struthanthus* and *Cladocolea*.]


Kutyna, I., Drewniak, E. and Młynkowiak, E. 2012. (A short note comparing the isophasic nature of growth in this mistletoe to other parasites where this has also evolved (e.g. *Arceuthobium*, *Pilostyles*, etc.).]

Kuijt, J. 2011. Thirteen new species of neotropical Viscaceae (*Dendropemon* and *Phoradendron*). Novon 21(4): 444-462. [Describing 2 new *Dendroptheta* spp., from Bolivia and Ecuador, 8 *Phoradendron* spp. from Peru, and 3 *Phoradendron* spp. from Venezuela.]

Kutscha, G. and Pickett, J.A. 2012. Farmers’ knowledge and perceptions of blister beetles, *Hycleus*

ChihHsin. 2012. Wu ChiMing, Chen WenChi, Fong YiChin and Tang. [Describing the process of 'stir-baking' seeds of C. campestris increased levels of quercetin in the seeds and also increased anti-inflammatory and antiproliferative activities.]

Lee MengShiou, Chen ChaoJung, Wan Lei, Koizumi, A., Chang WenTe, Yang MengJa, Lin WenHsin, Tsai FuuJen and Lin MingKuem. 2011. Quercetin is increased in heat-processed Cuscuta campestris seeds, which enhances the seed's anti-inflammatory and anti-proliferative activities. Process Biochemistry 46(12): 2248-2254. [Showing that the process of 'stir-baking' seeds of C. campestris increased levels of quercetin in the seeds and also increased anti-inflammatory and antiproliferative activities.]


Lemaître, A.B., Troncoso, A.J. and Niemeyer, H.M. 2012. Host preference of a temperate mistletoe: disproportional infection on three co-occurring host species influenced by differential success. Austral Ecology 37(3): 339-345. [Discussing differences in the establishment of Tristerix verticillatus on hosts Schinus montanus, Fabiana imbricata and Berberis montana in Chile, depending on the seed source and behaviour of the bird disperser Mimus ictericus.]


Li Jing, Deng ShuYong and Wang JianHong. 2011. (Extracting technology of total flavonoids from China Dodder by uni-form design method.) (in Chinese) Journal of Liaoning University of Traditional Chinese Medicine 13(11): 53-54. [The optimal conditions for extraction from Cuscuta chinensis include extraction time of 60 min, temperature 80°C, ratio between solid and fluid 1:100 and concentration of ethanol 52%.]

Li TeMao, Huang HsinChih, Su ChenMing, Ho TinYun, Wu ChiMing, Chen WenChi, Fong YiChin and Tang ChihHsin. 2012. Cistanche deserticola extract increases bone formation in osteoblasts. Journal of Pharmacy and Pharmacology 64(6): 897-907. [Concluding that C. deserticola extract may be a novel bone formation agent for the treatment of osteoporosis.]

Lin HuiBin, Lu Ning and Lin JianQiang. 2012. (Influence of different hosts on quality in Semen Cuscutae.) (in Chinese) China Journal of Traditional Chinese Medicine and Pharmacy 27(3): 625-627. [Analysing 19 different samples of Semen Cuscutae based on Cuscuta spp, including C. chinensis and concluding that content of flavonoids varies according to the host on which the Cuscuta has grown.]


Liu Wei, and 15 others. 2011. Strigolactone biosynthesis in Medicago truncatula and rice requires the symbiotic GRAS-type transcription factors NSP1 and NSP2., Plant Cell 23(10): 3853-3865. [NODULATION SIGNALING PATHWAY1 (NSP1) and NSP2 are transcription factors that are essential for rhizobium Nod factor-induced nodulation. Using transgenic lines, the authors show that NSP1 and NSP2 are indispensable for strigolactone (SL) biosynthesis in Medicago truncatula and in rice. The disturbed SL biosynthesis in nspl ns2 mutant backgrounds correlates with reduced expression of DWARF27, a gene essential for SL biosynthesis.]

Lo Gullo, M.A., Glatzel, G., Devkota, M., Raimondo, F., Trifilò, P. and Richter, H. 2012. Mistletoes and mutant albino shoots on woody plants as mineral nutrient traps. Annals of Botany 109(6): 1101-1109. [Showing that the higher levels of potassium, sulphur and zinc in Scirrula elata compared with those in the hosts Citrus sinensis and Nerium oleander (as in albino shoots of the latter) is due to the lack of phloem loading (and hence export from the foliage) rather than any selective transport via the haustorium.]

confirms the B-chain fragment as a potential immunomodulator.]


Ma YongQing, Lang Ming, Dong ShuQi, Shui JunFeng and Zhao JunXin. 2012. Screening of some cotton varieties for allelopathic potential on clover broomrape germination. Agronomy Journal 104(3): 569-574. [Describing varied activity (allelopathic apparently meaning stimulatory) of exudates from 6 varieties of cotton (G. hirsutum and G. barbadense) on Orobanche minor germination and confirming that the activity of extracts from the stem correlated with those from roots.] 


Mallory-Smith, C. and Colquhoun, J. 2012. Small broomrape (Orobanche minor) in Oregon and the 3 Rs: regulation, research, and reality. Weed Science 60(2) 277-282. [Infestations of O. minor occurred in 22 fields of red clover in 2001 and quarantine regulations were imposed, but then relaxed in 2003. Control is achieved using false host crops and imazamox but some small populations still occur. (see also Haustorium 59 pp 2-3.]

Mamontova, V.A. 2012. (New species of aphids of the family Lachnidae (Homoptera, Aphidoidea) from Ukraine and Russia.) Vestnik Zoologii 46(1): 37-44. [Describing Trama orobanches presumably occurring on Orobanche spp.] 


Matsuda, Y., Okochi, S., Katayama, T., Yamada, A. and Ito, S. 2011. Mycorrhizal fungi associated with Monotropastrum humile (Ericaceae) in central Japan. Mycorrhiza 21(6): 569-576. [Results indicate that the genetic diversity of mycorrhizal fungi of M. humile was highly specific to the Russulaceae, but diverse within that family, and that the fungi associated with M. humile differ from those associated with Monotropa uniflora.] 

Matsuo, Y. and Mimaki, Y. 2012. α-santalol derivatives from Santalum album and their cytotoxic activities. Phytochemistry 77: 304-311. [Seven derivatives identified including one with tumour-selective cytotoxicity.] 

Mehrvarz, S.S., Shavvon, R.S. and Golmohammadi, N. 2012. Notes on the genus Viscum (Viscaceae) in Iran: A new combination based on morphological evidence. African Journal of Agricultural Research 7(11): 1694-1702. [Describing a new taxon: V. album subsp. golestanicum. The seed and fruit surfaces in V. album subsp. album are smooth while respectively wrinkled and furnished with platelet crystalloid ornamentations in the population from Golestan forest. Also the prophylls are two at the axis of each leaf in the former but four in the latter.] 

Mei QiWen, Zhang XinHua and Ma GuoHua. 2011. (Influence of rhizospheric pH value of host on growth of Indian sandalwood and preference to host.) (in Chinese) Journal of Tropical and Subtropical Botany 19(6): 565-570. [Comparing the rhizospheric pH values of 61 hosts of S. album and concluding that the optimum for S. album is pH 5.5.] 

Menkir, A., Franco, J., Adpoju, A. and Bossey, B. 2012. Evaluating consistency of resistance reactions of open-pollinated maize cultivars to Striga hermonthica (Del.) Bentham under artificial infestation. Crop Science 52(3): 1051-1060. [Performance of 8 maize varieties compared over two sites over 5-6 years. 'The resistant cultivars had low average ranks for grain yield under infestation (i.e. yielded well?), Striga damage rating, and emerged Striga plant count whereas the reverse was true for both the tolerant and susceptible cultivars. Cultivars with stable resistance, which can be used directly for cultivation or as sources of resistance alleles for breeding, were identified in this study. ’] 

and reduce poverty in maize farming households. But noting that uptake continues to be low.]


Ndambi, B., Cadisch, G., Elzein, A. and Heller, A. 2012. Tissue specific reactions of sorghum roots to the mycoherbicide Fusarium oxysporum f. sp. strigae versus the pathogenic F. proliferatum. Biocontrol Science and Technology 22(2): 135-150. [Confirming that the safety of F. oxysporum f. sp. strigae (‘Foxy 2’) as a biocontrol agent against Striga spp. in sorghum is due to its lack of ability to penetrate and/or spread within the central stele, associated with enhanced levels of phenolics in the host tissue, which do not occur with F. proliferatum which freely penetrates and damages the sorghum.]

Nelson, D.C., Flematti, G.R., Ghisalberti, E.L., Dixon, K.W. and Smith, S.M. 2012. Regulation of seed germination and seedling growth by chemical signals from burning vegetation. Annual Review of Plant Biology 63: 107-130. [A general review of karrikins, a family of butenolides that are present in smoke. Karrikins stimulate seed germination and influence seedling growth. They are also active in species not normally associated with fire, and in Arabidopsis they require the F-box protein MAX2, which also controls responses to strigolactone hormones. The authors hypothesize that chemical similarity between karrikins and strigolactones provided the opportunity for plants to employ a common signal transduction pathway to respond to both types of compound.]

deoxyribonucleic acid (DNA) for molecular characterization of cowpea breeding lines for *Striga* resistance. African Journal of Biotechnology 10(85): 19681-19686. [Demonstrating that the application of marker-assisted selection using FTA technology can speed up the breeding process and increase the efficiency of breeding activities.]

Omoigui, L.O., Kamara, A.Y., Ishiyaku, M.F. and Boukar, O. 2012. Comparative responses of cowpea breeding lines to *Striga* and *Alectra* in the dry savanna of northeast Nigeria. African Journal of Agricultural Research 7(5): 747-754. [Confirming resistance of B301, IT03K-338-1 and IT99K-573-2-1 to both *S. gesnerioides* and *A. vogelii* while IT98K-1092-1 and IT97K-205-8 resisted *S. gesnerioides* but allowed some attack by *A. vogelii*.

Osadebe, P.O., Abba, C.C. and Agbo, M.O. 2012. Antimotility effects of extracts and fractions of Eastern Nigeria mistletoe (*Loranthus micranthus* Linn.). Asian Pacific Journal of Tropical Medicine 5(7): 556-560. [Inhibition in gastrointestinal transit was greater in extracts of ‘*L. micranthus*’ (= *Ileostylus micranthus*) growing on *Pentaclethra macrophylla* than on 5 other host trees.]

Padrón Soroa, J.V. 2005. Regional regulated invasive plant species, an approach to the Cuban list. XVII Congreso de la Asociación Latinoamericana de Malezas (ALAM) I Congreso Iberoamericano de Ciencia de las Malezas, IV Congreso Nacional de Ciencia de Malezas, Matanzas, Cuba, 8 al 11 de noviembre del 2005:17-30. [Listing regulated invasive weeds for Mexico, Florida U.S.A., Cuba, Chile, Costa Rica and Brazil. *Striga* listed in all, *Orobanche* and *Cuscuta* in all but Brazil, and, for Cuba, *Cassytha spp.*, *Phoradendron robustissimum* and *Psittacanthus calyculatus*.]

Parada Quintero, M. 2012. (Comparative analysis of seed rain of *Gaiadendron punctatum* (Ruiz & Pavón) G. Don (Loranthaceae) y *Ternstroemia meridionalis* Mutis ex L.f. (Theaceae) at Natural Municipal Park Rancheria (Boyacá), Colombia.) (in Spanish) Acta Biológica Colombiana 17(1): 159-172. [Recording that *G. punctatum* had the higher seed rain of 169/m²]


Parker, C. 2012. Parasitic weeds: a world challenge. Weed Science 60(2): 269-276. [The continuing problems from *Striga*, *Orobanchaceae*, *Cuscuta* and mistletoes species are outlined, including their extent, the degrees of damage caused, and the difficulties in their control. While some are being successfully controlled by a range of techniques, others may even be spreading or intensifying. The challenges they present are emphasised. (see also Haustorium 59 pp 2-3).]

Pattanayak, S.P., Mazumder, P.M. and Sunita, P. 2012. Total phenolic content, flavonoid content and in vitro antioxidant activities of Dendrophthoe falcata (L.f.) Ettingsh. Research Journal of Medicinal Plant 6(2): 136-148. [Results indicate that D. falcata extracts can be a potential source of natural antioxidant with strong anti-radical capacity.]


Piwowarczyk, R. 2012. A revision of distribution and the ecological description of Orobanche picridis (Orobanchaceae) at the NE limit of its geographical range from Poland and Ukraine. Acta Agrobotanica 65(1): 91-106. [Reporting two new localities for O. ramosa in Poland.]

Plakhine, D., Tadmor, Y., Ziadne, H. and Joel, D.M. 2012. Maternal tissue is involved in stimulant reception by seeds of the parasitic plant Orobanche. Annals of Botany 109(5): 979-986. [In an elegant experiment the authors show that the dependence on external chemical stimulation for seed germination in Orobanche seeds is genetically controlled. The genetic control is expressed in a seed tissue with maternal origin (presumably the perisperm that originates from the nucellus) and genetic variation for this trait exists in Orobanche species.]


Pricop, S.M., Cristea, S. and Petcu, E. 2011. Results on the virulence of the *Orobanche cumana* Wallr. populations in Dobrogea, Romania. Romanian Agricultural Research 28: 237-242. [*O. cumana* is serious in sunflower in SE Romania and tending to spread to the west, while virulence is increasing with evidence for races F and G, and hybrid PR64E71 (race G resistant) also showing some limited attack. The susceptible variety Performer shows 37% yield loss.]

Rahmawati, S.I. and Hayashi, N. 2012. The effects of batch reactor extraction on antioxidant activity from *Scurraula atropurpurea*. American Journal of Applied Sciences 9(3): 337-342. [Optimum ‘batch reactor extraction’ from *Scurraula atropurpurea* was with 30% ethanol at 100°C for 10 min. giving better results than a traditional extract (known as ‘benalu teh’ in Indonesia) in terms of yield, radical scavenging activities and total phenolics.]

Rai, I.D., Adhikari, B.S., Rawat, G.S. and Kiran Bargali. 2012. The effects of batch reactor extraction from *Scurraula atropurpurea* on antioxidant activity from *Scurraula atropurpurea*. American Journal of Applied Sciences 9(3): 337-342. [Optimum ‘batch reactor extraction’ from *Scurraula atropurpurea* was with 30% ethanol at 100°C for 10 min. giving better results than a traditional extract (known as ‘benalu teh’ in Indonesia) in terms of yield, radical scavenging activities and total phenolics.]


Ramjasy Harikrishnan, Chellam Balasundaram and Heo MoonSoo. 2012. Korean mistletoe enriched diet enhances innate immune response in kelp grouper, *Epinephalus bruneus* against *Philasterides dicentrarchi*. Veterinary Parasitology 183(1/2) 146-151. [Confirming that a 1 or 2% supplementation of the diet of the fish *E. bruneus* with extract of *Viscum album* positively enhances the innate immune response against infection by the histophagous ciliate *P. dicentrarchi*.]


Ramsfield, T.D., Shamoun, S.F. and van der Kamp, B.J. 2012. Histopathology of the endophytic system and aerial shoots of *Arceuthobium americanum* infected by *Colletotrichum gloeosporioides*. Botany 90(1): 43-49. [Failing to confirm that *C. gloeosporioides* infected the endophytic system of *A. americanum* parasitizing *P. contorta* var. *latifolia*, although xylem continuity between the aerial and endophytic systems was observed.]

Ransom, J., Kanampiu, F., Gressel, J., de Groote, H., Burnet, M. and Odhiambo, G. 2012. Herbicide applied to imidazolinone-resistant-maize seed as a *Striga* control option for small-scale African farmers. Weed Science 60(2): 283-289. [Reporting that imazapyr- and pyrithiobac-coated imidazolinone-resist (IR)-resistant maize seed prior to planting, at rates of 30 to 45 g/ha can provide near season long control of *S. hermonthica* and increase maize yields three- to fourfold under ideal conditions, but may be less successful under excessively wet or dry conditions. Risk of herbicide resistance developing in the parasite is discussed. (see also Haustorium 59 pp 2-3).]


QTLs together with the development of MAS techniques are promising approaches to rapidly improving crop resistance.


Rzedowski, J., & G. Calderón de R. 2011. Dos especies notables de Phoradendron. (Viscaceae) de la Mixteca Oaxacaquen (MeXico), una nueva y una complementada. Acta Bot. Mexicana 96: 3-10. [Phoradendron perredactum is described and is one of the most remarkable members the genus owing to its isophasic development on Bursera. The description of P. olae Kuijt is complemented with data on hosts and male plants.]


Sathish, K., Gutema, Z., Grenier, C., Rich, P.J. and Ejeta, G. 2012. Molecular tagging and validation of microsatellite markers linked to the low germination stimulant gene (lgs) for Striga resistance in sorghum [Sorghum bicolor (L.) Moench], TAG Theoretical and Applied Genetics 124(6): 989-1003. [In a mapping study, the sorghum low germination stimulation locus was fine-mapped. This yields new, more reliable markers for marker-assisted selection of low germination inducing germplasm. With the sorghum genome sequence at hand a list of candidate genes for this trait could also be drafted.]


Scarpa, G.F. and Montani, M.C. 2011. Medical ethnobotany of "ligas" (Loranthaceae sensu lato) among indigenous and criollo people of Argentina. Dominquezia 27(2): 5-19. [Recording traditional medicinal uses of 8 species of Loranthaceae (s.l.), most relating to Struthanthus uraguenensis, Tripodanthus acutifolius, Phoradendron bathoryctum, and Ligaria cuneifolia. Suggesting further studies on S. uraguenensis.]

Euphrasia (unspecified) among species that have proved valuable in treating conjunctivitis,

Schmidt, H.U. 2010. (Might the mistletoe (Viscum album spp. album) be a problem (not only) for the deciduous trees of the city of Berlin?) (in German) Julius-Kühn-Archiv 428: 362-363. [Discussing the possible reasons for increased incidence of V. album on a range of trees in Berlin, the difficulties of mechanical control, and suggesting the planting of trees which would be less susceptible.]


Seegmüller, S. 2012. (Scots pine mistletoe viscosinin 1-PS-regional comparison and ecophysiologcal hints.) (in German) Allgemeine Forst- und Jagdzeitung 183(1/2): 33-43. [The concentration of viscosinin in Viscum album ssp. austriacum on Pinus sylvestris across a range of sites in Germany and Switzerland varied widely with soil and climatic factors, being negatively correlated to host leaf nitrogen and sulfur status and highest under drought or irradiance stress.]


Şekeroglu, Z.A. and Şekeroglu, V. 2012. Effects of Viscum album L. extract and quercetin on methotrexate-induced cyto-genotoxicity in mouse bone-marrow cells. Mutation Research, Genetic Toxicology and Environmental Mutagenesis 746(1): 56-59. [Suggesting that V. album extract may play a role in reducing cyto-genotoxicity induced by anti-neoplastic drugs during cancer chemotherapy.]
Štech, M. 2012. Changes of seasonal characters in populations of Melampyrum sylvaticum along an altitudinal gradient. Verhandlungen der Zoologisch-Botanischen Gesellschaft in Österreich 148/149: 137-144. [A study in Czech Republic concludes that seasonal characters are not sufficiently reliable to be the basis for sub-specific taxa.]


Su HueiJiun, Murata, J. and Hu JerMing. 2012. Morphology and phylogenetics of two holoparasitic plants, Balanophora japonica and Balanophora yakushimensis (Balanophoraceae), and their hosts in Taiwan and Japan. Journal of Plant Research 125(3): 317-326. [Refining the distinctions between B. japonica, B. yakushimensis, and B. laxiflora which form a well-supported clade within Balanophora. Also confirming that B. japonica parasitizes Symlocos spp., while B. yakushimensis parasitizes Distylium racemosum in Japan and Schima superba in Taiwan.]

Sultan, A., Johnston, P.R., Park, D. and Robertson, A.W. 2011. Two new pathogenic ascomycetes in Gaignardia and Rosenscheldiella on New Zealand’s pygmy mistletoes (Korthalsella: Viscaceae). Studies in Mycology 68: 237-247. [G. korthalsellae and R. korthalsellae are described from Korthalsella salicornioides, K. clavata and K. lindsayi. R. korthalsellae is a member of the Mycosphaerellaceae s.s.]

Sun ZhiYing, Song JingYuan, Yao Hui and Han JianPing. 2012. Molecular identification of Cistanches Herba and its adulterants based on nrITS2 sequence. Journal of Medicinal Plants Research 6(6): 1041-1045. [Confirming its adulterants based on nrITS2 sequence. Journal of Medicinal Plants Research 6(6): 1041-1045. [Confirming that ITS2 can be used as a DNA barcode to distinguish ‘genuine’ ‘Cistanches Herba’ (based on Cistanche deserticola and C. tubulosa) from possible adulterants including C. salsa, C. sinensis Orobanchaceae, O. coerulescens, Boschniakia rossica, and Cynomorium songaricum.]

Sundararaj, R. and Gaurav Sharma. 2010. Studies on the floral composition in the six selected provenances of sandal (Santalum album Linnaeus) from south India. Biological Forum 2(2): 73-77. [Recording 76 spp. of various families associated with S. album.]

Sunita Shailajan, Sasikumar Menon and Harshvardhan Joshi. 2011. Microwave-assisted extraction of lupeol from Cuscuta reflexa Roxb. growing on different hosts and its quantitation by high-performance thin layer chromatography. International Journal of Green Pharmacy 5(3): 212-215. [The method is a good alternative to conventional extraction techniques.]


Tan, A.S. 2010. Sunflower (Helianthus annuus L.) researches in the Aegean Region of Turkey. Helia 33(53): 77-84. [Reviewing research in Turkey, including work on resistance to Orobanche cumana.]


Tibe, O., Perrethander, A., Sutherland, I., Lesperance, L. and Harding, D.R.K. 2012. Condensed tannins from Botswana forage plants are effective priming agents of γδ T cells in ruminants. Veterinary Immunology and Immunopathology 146(3/40: 237-244. [Extracts from Tapinanthus oleifolius showed moderate activity while effects of Viscum rotundifolium and V. verrucosum were minimal.]

Timko, M.P., Huang, K. and Lis, K.E. 2012. Host resistance and parasite virulence in Striga-host plant interactions: a shifting balance of power. Weed Science 60(2): 307-315. [‘The recent cloning and functional characterization of a race-specific R gene from cowpea encoding a canonical coiled-coil (CC)-nucleotide binding site (NBS)-leucine-rich repeat (LRR) type R-protein opens the door for further exploration of the mechanism of host resistance to S. gesnerioides in cowpea, and provides a focal point for studies aimed at uncovering the molecular and genetic factors underlying parasite virulence and host selection.’ (see also Haustorium 59 pp 2-3).]


Ukwueze, S.E. and Osadebe, P.O. 2012. Determination of


http://ecos.fws.gov/docs/recovery_plan/TMRP/Chapter%2011%20Species%20Accounts.pdf [Including a section on the endangered Cordylanthus maritimus ssp. maritimus (Orobanchaceae) with detailed information on taxonomy, ecology, distribution etc. and factors threatening its survival. Hosts not identified but it is associated with Sarcocornia pacifica, Distichlis spicata, Frankenia salina, Limonium coronarium and occasionally Cuscuta salina.]

Varga, I., Keresztes, B. and Poczai, P. 2012. (Data to the Hungarian insect fauna of European mistletoe (Viscum album)). (in Hungarian) Növényvédelem 48(4): 153-164. [Identifying 22 insect species on V. album, of which Cacopsylla visci, Carapisviscis, Hyspeloeccus visci, Pinutilus visci, Ixapion variegatum, Liparthrum bartschii, Synanthedon loranthi and Celypha woodiana are restricted to it. Those with some potential for biocontrol are the psyllid (Caco. visci), the mistletoe scale (Caru. visci), the mistletoe bug, H. visci, the clearing moth, S. loranthi and the bark beetle, L. bartschii.]


Wan Jing, Xu Jun, Yang MingYan, Yang ZhenDe, Huang QingHe and Zhao ShuFang, 2012. (Effects of three plant extracts on growth and development of dodder and soybean and on protective enzymes of host.) (in Chinese) Praticultural Science 28(3): 420-425. [One of the grassland types – a ‘sedge group’ - described from Gansu Province, China, includes Pedicularis spp.]


Wang Jing, Pu XiaoPeng, Cao ZhiZhong, Cao WenXia, Feng Xiao, Duan MingXuan and Qiu ZhiHe. 2011. (Study on grassland type and productivity of Tanzian pasture in Danchang County.) (in Chinese) Praticultural Science 28(3): 420-425. [One of the grassland types – a ‘sedge group’ - described from Gansu Province, China, includes Pedicularis spp.]

Waters, M.T., Nelson, D.C., Scaffidi, A., Flematti, G.R., Sun, Y.M.K., Dixon, K.W. and Smith, S.M. 2012. Specialisation within the DWARF14 protein family confers distinct responses to karrikins and strigolactones in Arabidopsis. Development (Cambridge) 139(7): 1285-1295. [The Arabidopsis DWARF14 orthologue, AtD14, is – just as in rice - necessary for strigolactone response while the AtD14 parologue KARRIKIN INSENSITIVE 2 (KAII2) is specifically required for responses to karrikins, and not to strigolactones. The expression patterns of AtD14 and KAII2 are consistent with the capacity to respond to either strigolactones or karrikins at different stages of plant development. They propose that AtD14 and KAII2 are necessary for the separate regulation of karrikin and strigolactone signalling by MAX2.]


Wienis, D. and Calvin, C.L. 2011. Two epiparasitic species of Phoradendron (Viscaceae) from Honduras: one new and for the other a range extension and host determination. Aliso 29(2): 119-123. [Describing the new species, Phoradendron mathiasenii, growing as a hyper-parasite on Psittacanthus angustifolius. Ph. tikalense is also recorded from one site in Honduras, again hyper-parasitic on Ps. angustifolius.]

Wong ZinHua, Habsah Abdul Kadir and Ling SuiKiong. 2012. Bioassay-guided isolation of neuroprotective compounds from Loranthis parasiticus against H2O2-induced oxidative damage in NG108-15 cells. Journal of Ethnopharmacology 139(1): 256-264. [L. parasiticus (= Scarrula parasitica) is used traditionally in China for treatment of schizophrenia, bone, brain, kidney, liver complaints and to treat ‘wind-damp’, and prevent miscarriage. Results of the study support the use of L. parasiticus in the treatment of neurological disorders where oxidative stress is implicated, thanks to the presence of proanthocyanidins.]

Wright, M.A.R., Ianni, M.D. and Costea, M. 2012. Diversity and evolution of pollen-ovule production in Cuscuta (dodders, Convolvulaceae) in relation to floral morphology. Plant Systematics and Evolution 298(2): 369-389. [The authors surveyed 128 species in each of the three subgenera looking at the ratio of pollen to ovules. While four ovules are present in the flowers of each species, the relationship of pollen to ovules varied widely among species. Outcrossing seems to be the rule with no species with established selfing.]


Xu Rong, Chen Jun, Zhou Feng, Yu Jing and Liu TongNing. 2011. (Study on rapid determination technique of Cistanche deserticola seed viability.) (in Chinese) Seed 30(5): 24-28. [Defining the optimum technique for determining seed viability in C. deserticola as pH 6.4 and TTC solution concentration of 0.3-1.0%, at 38°C.]

Yagi, S., Chretien, F., Duval, R.E., Fontanay, S., Maldini, M., Piacente, S., Henry, M., Chapleur, Y. and Laurain-Mattar, D. 2012. Antibacterial activity, cytotoxicity and chemical constituents of Hydnora johannis roots. South African Journal of Botany 78: 228-234. [In Sudan, the roots of H. johannis are traditionally used for the treatment of dysentery, diarrhoea, cholera and swelling tonsillitis, but the work reported here does not fully support these uses and suggests much more study needed.]

Yamato, M., Yagame, T., Shimomura, N., Iwase, K., Takahashi, H., Ogura-Tsujita, Y. and Yukawa, T. 2011. Specific arbuscular mycorrhizal fungi associated with non-photosynthetic Petrocota sakuraii (Petrosaviaceae). Mycorrhiza 21(7): 631-639. [Studies on P. sakuraii associated with Japanese cypress (Chamaecyparis obtusa) in Honshu, Japan, indicate that particular AM fungi are selected by P. sakuraii from diverse indigenous AM fungi. The same AM fungi can colonize both plant species, and photosynthates of C. obtusa may be supplied to P. sakuraii through a shared AM fungal mycelial network.]


Yoneyama, K., Xie XiaoNan, Kim HyunIl, Kisugi, T., Nomura, T., Sekimoto, H., Yokota, T. and Yoneyama, K. 2012. How do nitrogen and phosphorus deficiencies affect strigolactone production and exudation? Planta 235(6): 1197-1207. [A detailed discussion on the varied responses of a range of crops to N and P deficiencies in promoting strigolactone exudation. Confirming that in general, P deficiency promotes strigolactone exudation in all species while N deficiency promotes exudation only in non-legumes (as legumes acquire N without AM fungi). And proposing explanations for the anomalous behaviour of tomato in which only P deficiency promotes exudation. Distinct reductions in shoot P levels were observed in the plants grown under N deficiency, except for tomato, in which shoot P level was increased by N starvation, suggesting that the P status of the shoot regulates SL exudation.]

Zhang XinHua, da Silva, J.A.T., Jia YongXia, Zhao JieTang and Ma GuoHua. 2012. Chemical composition of volatile oils from the pericarps of Indian sandalwood (Santalum album) by different extraction methods. Natural Product Communications 7(1): 93-96. [Identifying palmitic and oleic acids and a range of other compounds in the pericarp oil from S. album.]

Zhang XinHua, da Silva, J.A.T. and Ma GuoHua. 2011. Karyotype analysis of Santalum album L. Caryologia 63(2): 142-148. [Reporting diploid (2n=20) and tetraploid (2n=40) individuals in S. album while some meristems showed 'mixaploid' character.]


Zheng Wei, Tan XingQi, Guo LiangJun, Kong FeiFei, Lu Pin, Ni DongJie and Wang Ping. 2012. Chemical constituents from Monochasma savatieri. Chinese Journal of Natural Medicines 10(2): 102-104. [Identifying eight compounds from M. savatieri (Orobanchaceae).]


Zweifel, R., Bangerter, S., Rigling, A. and Sterck, F.J. 2012. Pine and mistletoes: how to live with a leak in the water flow and storage system? Journal of Experimental Botany 63(7): 2565-2578. [Studies in Switzerland show that stomata of Pinus sylvestris infested by Viscum album close but still suffer water loss and also suffer reduced photosynthesis. A tree with more than 10-20% of its total leaf area attributable to V. album is at the threshold of keeping a positive carbon balance. Increasing mistletoe abundance, due to increasing mean annual temperatures, is accelerating pine decline in many dry inner-Alpine valleys.]

[Confirming that polysaccharide from C. songaricum has anti-ulcer effect in rats.]


Zhang RenBo and Dou QuanLi. 2011. GC-MS analysis on volatile components in mucilage from Christisonia hookeri. Medicinal Plant 2(10): 35-36. [Mucilage from the calyx and corolla of C. hookeri contained potentially useful volatiles 2-(2-butoxyethoxy) ethanol and methyl n-butyl sulfoxide, but mainly polysaccharides.]

Zhang XinHua, da Silva, A.T., Duan Jun, Deng RuFang, Xu XinLan and Ma GuoHua. 2012. Endogenous hormone levels and anatomical characters of haustoria in Santalum album L. seedlings before and after attachment to the host. Journal of Plant Physiology 169(9): 859-866. [Identifying the endogenous hormones involved in the haustorial development of S. album on its host Kutinia rosmarinifolia. A high auxin-to-cytokinin ratio contributed to haustorial development.]

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has been edited by Chris Parker, 5 Royal York Crescent, Bristol BS8 4JZ, UK (Email chrisparker5@compuserve.com), Lytton Musselman, Parasitic Plant Laboratory, Department of Biological Sciences, Old Dominion University, Norfolk Virginia 23529-0266, USA (fax 757 683 5283; Email lmusselm@odu.edu) and Harro Bouwmeester of Laboratory of Plant Physiology, Wageningen University, P.O. Box 658, 6700 AR Wageningen, the Netherlands (Email harro.bouwmeester@wur.nl): with valued assistance from Dan Nickrent, Southern Illinois University, Carbondale, USA. It is produced and distributed by Chris Parker and published by Old Dominion University (ISSN 1944-6969). Send material for publication to any of the editors.

NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be down-loaded from the IPPS web-site (see above).
## HAUSTORIUM

*Parasitic Plants Newsletter*

ISSN 1944-6969

Official Organ of the International Parasitic Plant Society

(https://www.parasiticplants.org/)

December 2012                        Number 62

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PRESIDENT’S MESSAGE

Dear IPPS Members,

May the year 2013 be happy and fruitful.

As mentioned in the last issue of Haustorium, our next World Congress on Parasitic Plants (WCPP) will be held from July 15-19 in Sheffield, UK. We are sorry for the delay in opening of the special conference website which will soon be available. (You will informed directly as soon as it is available – Ed.)

We will have seven sessions (session titles & session organizers), 1. Genomics (John Yoder, Jim Westwood), 2. Biology and Biochemistry (Philippe Delavault, Philippe Simier), 3. Host-Parasite Communication (Koichi Yoneyama, Maurizio Vurro), 4. Ecology and Population Biology (Yaakov Goldwasser, Jonne Rodenburg), 5. Control and Management (Diego Rubiales, Joseph Hershonhorn), 6. Crop Resistance and Tolerance (Julie Scholes, Michael Timko), 7. Environmental factors, modeling and mapping (Ahmed Uludag, Hanan Eizenburg), and an IPPS-COST (STRigolactones Enhanced Agricultural Methodologies, STREAM) symposium (Hinanit Koltai, Cristina Prandy). Please prepare for the Congress to share your recent findings on parasitic plants with many colleagues and friends.

During a year and a half after the 11th WCPP in Italy, we have witnessed breakthroughs in parasitic plant sciences. Among them, for example, practical transgenic techniques of root parasitic plants have been developed, and the major pathways in strigolactone biosynthesis have been unveiled. These have convinced me that our current schedule to have WCPP every other year is appropriate to catch up with this rapid progress.

In addition to these rapid advances in basic sciences, we also need to pay great attention to applied sciences because farmers have been waiting eagerly for innovation in practical control measures for parasitic weeds.

In Japan, clover broomrape (Orobanche minor) was first reported in 1937 in Chiba Prefecture near Tokyo. Since then it has spread rapidly and now it occurs in Kyoto. Ten years ago, we went to Watarase River bank to collect the seeds but now we can find it easily in our city. In addition, dodgers (Cuscuta spp.) are now causing noticeable crop damage in Japan. So we are afraid that in the near future these parasitic weeds may become noxious weeds in Japan.

Of course, parasitic plants are unique and important contributors to biodiversity. We need to evaluate not only negative effects but also positive effects of parasitic plants on natural and agricultural ecosystems.

Looking forward to meeting many IPPS members at the next WCPP in Sheffield in July.

Sincerely,

Koichi Yoneyama, IPPS President
yoneyama@cc.utsunomiya-u.ac.jp

SEASONAL GREETINGS TO ALL

With thanks to Dietmar Fennel for this montage, prepared for the exhibition entitled “The Bird World of the Mistletoe, in the StadtMuseum, Schwabach, Germany
http://www.schwabach.de/stadtmuseum/

ALECTRA VOGELII ON SUNFLOWER IN TANZANIA

Alectra vogelii Benth. is widely distributed as a parasite of legume crops in the dry savannahs of sub-Saharan Africa. The species is found on a number of legume hosts, most commonly in cowpea and locally as a significant problem in groundnut and soyabean. Earlier this year when travelling in Singida Rural District of central Tanzania we noticed plants of an Alectra species in many sunflower fields in Mrinko ward. Sunflower has become an important cash crop in central Tanzania expanding to meet the demands from oil extraction plants built in the area. While at first glance specimens looked typical for A. vogelii we noticed that all plants in the area collected from sunflower, cowpea and occasionally soya have densely hairy or so called “bearded” anther filaments. Current taxonomic treatments of Alectra (see Flora Zambesiaca: vol 8 part 2 (1990) Scrophulariaceae by D. Philcox) place A. vogelii with A. picta (Hiern) Hemsl. as two species with non-apiculate
A. picta was maintained as a separate species by virtue of bearded filaments and plants were described as being ‘floriferous in the upper part of the stem, not generally throughout’. All our specimens from Singida are floriferous throughout but with densely bearded filaments so could be assigned to A. picta. Dr Iain Darbyshire kindly compared these Tanzania plants to other specimens in the Royal Botanic Gardens, Kew Herbarium and confirmed they are broadly similar to those previously identified as A. picta. The first author has previously collected A. picta type plants in Eastern Malawi growing in the same row of groundnuts as typical A. vogelii with glabrous filaments. In view of morphological similarities and similar responses to legume hosts in pot trials, Parker and Riches (1993 – Parasitic Weeds of the World: Biology and Control, Wallingford, UK, CAB International) raised doubt that A. picta and A. vogelii are distinct species. Subsequently Jeffery Morawetz in a revision of Alectra synonymised the two species as A. vogelii (Morawetz, J. 2007. Systematics of Alectra (Orobanchaceae) and phylogenetic relationships among the tropical clade of Orobanchaceae. PhD Thesis Ohio State University). Based on the above it seems likely that the Alectra in Singida is indeed A. vogelii.

As far as we are aware the extent of infestation of sunflower in Tanzania and beyond by A. vogelii is largely unknown. The second author has observed infested fields in Ismani ward of Iringa District where sunflower has also become a cash crop. Johann Visser listed an occurrence of A. vogelii on the crop at Venterdsorp in South Africa many years ago (Visser, J.H. 1978 The Biology of Alectra vogelii Benth., An Angiospermous Root Parasite. Beiträge zur Chemischen Kommunikation in Bio- und Ökosystemen, Witzenhausen pp. 279-294). In Singida farmers plant sunflower in rotation with maize or sorghum and rarely apply fertilizer. They report steadily declining yields. The effect of the parasite on sunflower is, however, uncertain although in Singidawe observed that some infested plants were stunted with small heads compared to non-infested ones.

Charlie Riches (Natural Resources Institute, University of Greenwich UK, charlie@riches27.freeserve.co.uk)
Ambonesigwe Mbwaga (Uyole Agricultural Research Institute, Mbeya, Tanzania, ambwaga@gmail.com)

PRESS RELEASES

Decades old weed seeds trigger new plant parasite outbreak

In the early 1980s, a devastating parasitic weed was found in a tomato field in California. The infestation of branched broomrape (Orobanche ramosa) was treated aggressively and the field was quarantined to prevent further spread. When tomatoes were planted in the same spot more than two decades later, though, the branched broomrape quickly returned. According to Lee Van Wychen, Ph.D., science policy director of the Weed Science Society of America, the recurrence is not a surprise. ‘When weed seeds drop to the soil, some can remain viable for many decades,’ Van Wychen says. ‘Effective control requires a long-term commitment.’

There are a number of alternatives available to manage noxious weed seeds that become part of the soil seed bank. One is to quarantine the area and leave the seeds undisturbed until they are no longer viable. But as the broomrape example shows, the length of time the area will need to be quarantined is an unknown. In some instances, the soil is fumigated in an attempt to destroy noxious weed seeds. In other instances, the soil is lightly tilled and a nitrogen fertilizer applied to promote germination and encourage the seeds to sprout. Once they’ve emerged, the weeds are pulled, tilled or treated with an herbicide to keep them from reseeding. ‘None of these options are a magic bullet that will work overnight or kill 100 percent of the weed seeds each and every time,’ Van Wychen said. 'Persistence is the key.'

Branched broomrape is a prolific seed producer, which significantly compounds efforts to control it. A single plant
can produce 50,000 or more tiny seeds that are easily spread by people, animals, farm machinery, wind and water. When the weed seeds germinate, they attach to the roots of host plants and drain them of water and nutrients – devastating tomatoes, potatoes, peppers, beans and other important crops that branched broomrape prefers.

As a result, California officials quickly sprang into action when the most recent outbreak of branched broomrape was discovered. The San Benito Agricultural Commissioner took the lead in a multifaceted response – quarantining the site again and pulling in state and federal experts and university personnel to lend their expertise. The California Department of Food and Agriculture has been involved, as well as the USDA’s Animal and Plant Health Inspection Service (APHIS). It was a pretty serious infestation,’ said Richard Smith, farm advisor with the University of California Cooperative Extension. ’We collected big garbage bags of branched broomrape from the 70-acre plot where it was discovered. And when we mapped the site, it overlapped almost precisely with the 1980s outbreak.’

Smith says officials are still evaluating soil fumigation and other potential alternatives for dealing with the long-lived seeds still hidden in the soil.

Branched broomrape has earned a well-deserved spot on the federal noxious weed list. It has been found in several U.S. states to date, including California, Illinois, Kentucky, New Jersey, North Carolina and Texas.

Weed Science Society of America | October 3, 2012

How to go about getting rid of mistletoe in Modesto

On Aug. 16, I authored a community column encouraging Modesto residents to take responsibility for pruning mistletoe from city-owned trees that shade their properties and increase their property values. I have since heard from several Modestans who say the city won’t allow private citizens to interfere with the maintenance of city-owned trees. I knew the city had an approved vendor list of companies that homeowners could hire to prune a city-owned tree affecting their property, but I didn’t know the particulars, so I did some more research.

The city does in fact allow homeowners to provide maintenance to city-owned trees at the property owner’s expense, if you don’t want to wait the scheduled seven years for the Modesto Community Forestry Department’s regular maintenance. Homeowners are allowed to contract through approved vendors who have applied for a permit to maintain city-owned trees. The process can differ depending on the service the homeowner wants performed. General tree pruning and removal of mistletoe, deadwood or stumps can be handled by directly hiring a vendor from the list; no prior approval or permits is required. For tree removal, you first must contact the Community Forestry Division and request tree removal. Once approved, you can contact a vendor from the approved provider list. Planting a new tree can be handled by an approved vendor, provided the tree being replanted is of the same species. If the homeowner wishes to replace a tree with an alternate species, the tree must be approved by city staff. Root cutting and pest infestations can only be handled by the Community Forestry Division.

I called several of the approved vendors to find out how much it costs to prune mistletoe from a city-owned tree. The cost can range from $150 to $750, depending on the size of the tree and the degree of mistletoe infestation, but the average seemed to be $200 to $350.

Janie Gatzman

Mistletoe therapy may give cancer sufferers kiss of life

It normally only comes to public attention at Christmas time but mistletoe may have beneficial effects on some cancer patients in terms of life expectancy and quality of life.

Now a pilot study for a clinical trial is being planned at Aberdeen University with the aim of understanding what effect mistletoe has on immune cells in the blood of patients with cancer, and on the tumours themselves, after positive results were experienced by patients of a general practitioner in the city.

Those who say they have benefited from mistletoe treatment include former England international cricketer John Edrich who was diagnosed in 2000 with a rare form of incurable leukaemia. He was given a maximum of seven years, with treatment, to live, and underwent gruelling chemotherapy for five years. Then he learned about the mistletoe treatment, and began receiving twice-weekly injections. Mr Edrich, who lives in Aberdeenshire, said he had been advised to contact Dr Stefan Geider, a GP and qualified anthroposophic doctor, at Camphill Medical Practice in Aberdeen. The retired Test cricketer said: ‘I’ve gradually got better and better and I’ve got to a stage where I’m doing everything. I’m probably better now than I have ever been. I’m 75 and I’m playing golf three times a week. ‘I’m certain it has been down to the mistletoe. Otherwise, I’m sure I wouldn’t be here today.’

Dr Geider said: ‘I’ve had experience with the treatment within the context of a German university hospital and had witnessed a number of patients who showed a marked improvement with the treatment. I’ve used mistletoe therapy with patients here in Aberdeen for 16 years and have had similar successes. ‘Typically you see an increase in energy levels, less pain, improved appetite, better sleep patterns...\"
and improved motivation. From my clinical experience, of seeing patients for mistletoe therapy on a regular basis, it becomes clear mistletoe, with some people – though not with all – has some impact on tumour reduction. ‘Mistletoe has in my experience been helpful to many of my patients, both in terms of quality of life and life expectancy, but it does not work for everybody. It should be stressed it is not a miraculous cure and we need to understand more fully how mistletoe works and why it does so for some people more than for others. Therefore we need the pilot study.’

The Mistletoe for Cancer UK website, which notes the plant has been used in cancer treatment for more than 90 years, says the introduction of the mistletoe extract from the whole plant into the body is designed to kickstart and re-educate the immune system, so it realises something is wrong and starts to fight back against the cancer.

An Aberdeen University study found 70% of breast cancer patients have taken, or are taking, complementary and alternative medicines. One of these is mistletoe which is being taken on the basis of European studies suggesting there might be an anti-cancer effect.

Steve Heys, professor of surgical oncology at the university and a consultant surgeon, said: ‘A very high quality, detailed analysis reviewed all the studies of mistletoe and concluded that because of the methodological problems with these studies there is currently no evidence for an effect on survival. [But] this review also suggested there might be an effect of mistletoe on improving the quality of life in patients with breast cancer undergoing chemotherapy. Further studies are necessary to determine if there is an effect on improving quality of life in this situation. ‘Given the importance of complementary and alternative medicine to patients, there is an urgent need to understand what effects these agents have both in terms of their own effects and possible drug interactions so patients may have this information to facilitate them making an informed decision as to what is important for them.’

Russell Leadbetter
Herald Scotland 26 September 2012

**Varsity researchers win war on *Striga* weed with hybrid maize varieties – Magazines.**

The development of three hybrid maize varieties and one for finger millet by a don at Maseno University (near Kisumu, Kenya) could offer the solution to massive crop infestation. Prof Dida said that tackling the weed and the need to address the perennial food security was the overriding goal of his research that began more than 10 years ago. ‘I was trying to solve some of these problems I see in farming. How can we keep importing food yet we have the some of the best climatic conditions to be able to achieve self-sufficiency in food production?’ he posed. When finally taken up together with other varieties already in supply, he said that the country would be able to feed the rest of the East African community bloc. The researchers also developed Maseno 60D, a code name of the finger millet seed, which they said is not only fast maturing but also suitable for regions that experience low rainfall.

According to the researcher, the agricultural sector suffers close to Sh6.7 billion in losses as a result of *Striga* weed infestation. Prof Dida said that the new maize varieties mature between 20 and 50 days earlier than those already in the market. ‘They flower in 60 days and mature in 80 days. This represents a reduction from 125 to 80 days,’ he observed. Although the seeds may thrive in almost all parts of the country, the don said that during the research, they focused on lowlands and the Lake Victoria region and coastal parts of the country, which receive relatively scarce rainfall. A seed variety with such traits will be the first of a kind in East Africa. However, similar seeds have been developed for farmers in Nigeria and South Africa. It took Prof Dida two years to develop and evaluate the millet seeds before Kephis took over to conduct independent trials. The work on maize took a little longer since the researchers had to cross-pollinate different maize varieties to obtain the superior breeds out of the originals. ‘Developing new seed variety is referred to as plant breeding and demands for a lot of patience if anything good is to come out of it. Like this has taken 10 years to piece together,’ he said.

By Justus Wanga
Kenya Business Daily
July 23 2012.
ICIPE and AATF in new partnership to boost *Striga* control efforts in Kenya

The International Centre for Insect Physiology and Ecology (ICIPE) and AATF in March 2012 signed a Partnership Agreement under the Integrated *Striga* Management in Africa (ISMA) project that is supported by the Bill & Melinda Gates Foundation. The agreement will see AATF and ICIPE undertake a survey on *Striga* weed management technologies in Kenya. The *Striga* weed is a highly invasive parasitic weed that attacks cereal crops. The infestation of *Striga* causes between 20 percent and 100 percent grain yield loss in many fields in Western Kenya, affecting over 250,000 hectares. It is estimated that farmers lose 300,000 tonnes (3.3 million bags or US$ 132 million) of maize grain every year in the region.

For more information visit http://www.aatf-africa.org/news/new_partnership_for_aatf_and_icipe/en/ or contact Gospel Omanya (g.omanya@aatf-africa.org)

From: AATF Partnerships Newsletter 09, Jan-Apr. 2012.

**A New EU COST Action – FA1206. Strigolactones: biological roles and applications**

Strigolactones (SLs) are newly discovered phytohormones that contribute to define plant morphology, also in response to environmental conditions, and to the dialogue with organisms in the rhizosphere. As a consequence, SLs have become a cutting-edge topic in plant biology and agronomy, having a great potential in modern agriculture. However, little is known about how they act, their biosynthesis and signaling pathways. Because of their both endogenous and exogenous role as signalling molecules, SLs are well placed to mediate both adaptive changes in the plant architecture and beneficial rhizosphere interactions. Even though SLs are a prime interest for many laboratories across disciplines, there are no official networks neither in Europe nor in the rest of the world on this subject. An outcome of an EU network on this subject would be sustaining and promoting the EU leadership in SLs-related sciences, the coordination of SLs research activities and a transfer of knowledge which may lead to the development of targeted and sustainable agro-technologies. The aim of this proposal is the creation of such multidisciplinary network of experts, of both basic and applied sciences, who can share expertise through the flexibility of the COST framework.

**PAST MEETING**

**XV International Congress - Molecular Plant-Microbe Interactions, July 29-Aug 2, 2012, Kyoto, Japan.**

Papers presented included:

- Zachary Gaudin *et al.* – Nitrogen fluxes in the *Phelipanche ramosa*/*Brassica napus* interaction.
- Philippe Delavault *et al.* – *Phelipanche ramosa* seed germination in response to the strigolactone analog GR24.
- Thomas Peron *et al.* - The phloem network in the parasitic plant *Phelipanche ramosa*; carboxyfluorescein labelling and characterization of three sucrose transporters.
- Bathilde Auger *et al.* - Germination stimulants of *Phelipanche ramosa* in the rhizosphere of *Brassica napus* are derived from the glucosinolate pathway.

**FORTHCOMING MEETING**

**The 12th World Congress on Parasitic Plants (WCPP)**

will be held on Monday July 15 to Friday July 19, 2013 in Sheffield, UK. The venue will be the Edge Conference facility at the University of Sheffield. Further details will be provided via the conference website which will be available soon. An e-mail will be sent to everyone who receives Haustorium once the website is available, around the end of January.

Some details appear in the President’s Message above.

**VIDEOS ON STRIGA**

A new NGO, Access Agriculture, has been initiated with inputs from three private media companies and financial support from the Swiss Agency for Development and Cooperation. Access Agriculture functions as a global facilitator/broker for the production, translation and dissemination of agricultural training videos in developing countries. People are invited to submit their training videos. Guidelines for this are provided on the site (www.accessagriculture.org).

Along with training videos on many other topics, the series of ten ‘Fighting *Striga*’ videos can be watched and downloaded for free, either as video or audio file (for radio broadcasters) from the Access Agriculture website. The ten video modules focus on sorghum and pearl millet and are developed by Agro-Insight, ICRISAT, NGOs, farmer organisations and national scientists, enriched with key inputs from many African farmers involved in experimentation on integrated *Striga* and fertility.
management. The videos are available in 8 languages – English, French, Bambara, Bomu, Fulani, Hausa, Mossi/Mooré, Zarma/Djarma. DVD’s containing the ten video modules in these eight languages are also available for free and can be ordered from: Dr. T. van Mourik, ICRISAT-Mali, BP 320, Bamako, Mali (Tom.vanmourik@icrisatml.org). By early 2013, Access Agriculture will also make Arabic, Swahili, Portuguese and Chichewa versions of these videos available on its website. These are very high quality films and can be highly recommended to any agricultural service provider.

A range of videos developed by Agro-Insight, ICRISAT, NGOs, farmer organisations and national scientists, enriched with key inputs from many African farmers involved in experimentation on integrated Striga and fertility management, are available on this site. The ten video modules focus on sorghum and pearl millet. They can be watched and downloaded for free, either as video or audio file (for radio broadcasters) from the Access Agriculture website. The videos are available in 8 languages – English, French, Bambara, Bomu, Fulani, Hausa, Mossi/Mooré, Zarma/Djarma. A DVD containing the ten video modules in these eight languages can be ordered from: Dr. T. van Mourik, ICRISAT-Mali, BP 320, Bamako, Mali, or via Tom.vanmourik@icrisatml.org. Individual copies are free. By early 2013, Access Agriculture will also make Arabic, Swahili, Portuguese and Chichewa versions of these videos available on its website. These are very high quality films and can be highly recommended to any agricultural service provider.

For more on the way the films were made see:

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see:
http://www.parasiticplants.org/ (N.B. currently a little out of date)

For past and current issues of Haustorium see also:
http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see:
http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see:
http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see:
http://ppgp.huck.psu.edu/

For information on the EU COST 849 Project (now completed) and reports of its meetings see:
http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see:
http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see:
http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes up to 1995, but apparently incomplete since then) see:
http://www.rmrs.nau.edu/mistletoe/

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see:
http://www.vfk.ch/informationen/ literatursuche (in German but can be searched by inserting author name).

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)

For past and current issues of the Sandalwood Research Newsletter, see:

LITERATURE

* indicates web-site reference only


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Anupama Chembath, Balsundaram, M. and Sujanapal, P. 2012/ Phylogenetic relationships of Santalum album and its adulterants as inferred from nuclear DNA sequences.


Anon. 2012. (EU-ECE inventory of forest damage (IDF) in Spain. European Network Monitoring Forest damage. Level I. Sampling results 2010.) (in Spanish) Ecología (Madrid) 24: 107-149. [Damage due to mistletoe infestations (Viscum album?) continues with their worrying increasing trend, and the impact of the decline process on alder forest stands near the Cantabrian coasts is confirmed.]

Antenhe Belayneh, Zemed Asfaw, Sebsebe Demissew and Bussa, N.F. 2012. Medicinal plants potential and use by pastoral and agro-pastoral communities in Erer valley of Babile Wereeda, eastern Ethiopia. Journal of Ethnobiology and Ethnomedicine 8(42) (http://www.ethnobiomed.com/content/pdf/1746-4269-8-42.pdf) [Root preparations from Hydnora johannis are prescribed as remedies for diarrhoea, haemorrhage, wound and painful body swelling.]

Anter, S.H. and Kassim, T.A. 2011. (Effect of cutting and bronamid herbicide on growth and seed yield of alfalfa Medicago sativa L. and dodder Cuscuta sp.) (in Arabic) Diyala Agricultural Sciences Journal 3(2): Ar241-Ar249. [Cutting to 1 cm was superior to cutting at 5 cm for control of Cuscuta planiflora and C. chinensis (or perhaps C. campestris?) in Iraq. Pronamide (=propyzamide) was ineffective.]

Antonova, T.S., Arasanov, N.M., Strelnikov, E.A., Ramazanova, S.A., Guchetl, S.Z. and Tchelustnikova, T.A. 2012. Some peculiarities of ontogenesis of Orobanche cumana Wallr., parasitizing on sunflower in Rostov region of Russian Federation. Helia 35(56): 99-109. [Noting the relatively recent development of the Orobanche cumana problem in the Rostov region of Russia in the 1990s, and describing some features of the plant’s development including multiple stem apices on the tubercle, development of new plants from secondary infections, development of new plants from root apices without attachment to other roots, regrowth from the tubercle after the main shoot has matured and fruited, etc.]
Arruda, R. and nine others. 2012. Ecology of neotropical mistletoes: an important canopy-dwelling component of Brazilian ecosystems. Acta Botanica Brasilia 26(2): 264-274. [Reviewing studies conducted in the neotropical region in order to provide a framework for current research and new ideas for future investigations of mistletoes, especially in Brazil.]


Barbu, C.O. 2012. Impact of white mistletoe (Viscum album ssp. abietis) infection on needles and crown morphology of silver fir (Abies alba Mill.). Notulae Botanicae, Horti Agrobotanici, Cluj-Napoca 40(2): 152-158. [A careful study confirming that infection by V. album is associated with significantly smaller needles, increased needle fall, and lower photosynthesis, apparently playing an important role in silver fir decline. But lacking discussion on possibility that weaker trees have increased incidence of parasite.]


Borowicz, V.A. and Armstrong, J.E. 2012. Resource limitation and the role of a hemiparasite on a restored prairie. Oecologia 169(3): 783-792. [Three after removal of Pedicularis canadensis the mass of grasses was almost doubled but there were smaller effects on forb species in Illinois grassland. Light levels did not affect the hemiparasite across 4 years of manipulation but fertilizer increased P. canadensis shoot mass.]

Boz, Ö., Doğan, M.N. and Öğüt, D. 2012. The effect of duration of solarization on controlling branched broomrape (Phelipanche ramosa L.) and some weed species. Julius-Kühn-Archiv 2(434): 687-693. [In one season when maximum temperatures under plastic reached 54°C, P. ramosa was completely controlled by 2 weeks solarization. In a second season when temperatures only reached 44.5°C, control was only 20% after 2 weeks and 74% after 6 weeks.]

Braby, M.F. 2012. The taxonomy and ecology of Delias aestiva Butler, 1897 stat. rev. (Lepidoptera: Pieridae), a unique mangrove specialist of Euphorbiaceae from northern Australia. Biological Journal of the Linnean Society 107(3): 697-720. [Delias spp. mostly feed on Snatacaceae, Loranthaceae and Viscaceae. D. aestiva differs in being specialized on mangroves, but was found to be able to also feed on some Loranthaceae, suggesting a recent evolutionary shift.]


Byrne, M. and Hankinson, M. 2012. Testing the variability of chloroplastic sequences for plant phylogeography. Australian Journal of Botany 60(7): 569-574. [Analysis identified a set of seven chloroplastic regions that are a useful basis for informed selection of sequences for assessment of phylogeographic structure in plants in several families including Santalaceae.]

Cafasso, D. and Chinali, G. 2012. Multiple and different genomic rearrangements of the rbcL gene are present in the parasitic orchid Neottia nidus-avis. Genome, 2012,
55, 9, 629-637. [Concluding that N. nidus-avis contains different plastomes, each with a different pseudogene, and these can exist within the same individual plant.]

C’ebovic’, T., Popovic’, M., Rovčanin, B. and Gojkovic’, Z. 2012. Evaluation of the cytotoxic and antioxidiant effects of non-polar Viscum album L. extract (collected from Juniperus communis). Fresenius Environmental Bulletin 21(6): 1454-1460. [The CO2 extract of V. album contained the sesquiterpenes trans-α-bergamotene, trans-β-farnesene and vomifoliol as major extract constituents. The cytotoxic activity of the extract was assayed against EAC breast carcinoma cells and AS30D hepatoma cells in vivo. Vomifoliol was the most active component.]


Chen Rui, Huo LiNi, Liao YanFang, Li PeiYuan, Lu Ru Mei and Zhang HongYi. 2013. Study on the chemical constituents of essential oils from the leaves of Viscum ovalifolium and Loranthus pentapetalus Roxb. parasitizing on Guaiacum spp. Asian Journal of Chemistry 25(3): 1757-1758. [Isolating a wide range of compounds from V. ovalifolium and L. pentapetalus (=Helixanthera parasitica).]


Crichton, R.J., Squirrel, J., Woodin, S.J., Dalrymple, S.E. and Hollingsworth, P.M. 2012. Isolation of microsatellite primers for Melampyrum sylvaticum (Orobanchaceae), an endangered plant in the United Kingdom. American Journal of Botany 99(11): e457-e459. ['The results show the utility of these novel polymorphic microsatellite markers for further conservation genetic analyses. The strong deficit of heterozygosity across all loci in the local sample suggests the species may be inbreeding.]


de Vega, C. and Herrera, C.M. 2012. Relationships among nectar-dwelling yeasts, flowers and ants: patterns and incidence on nectar traits. Oikos 121(11): 1878-1888. [The nectar fungus, Metschnikowia reukaufii, introduced to the flowers of Cytinus hypocitis by ants, is shown to decrease the quality of the nectar and may influence pollinator behaviour.]

Delaux, P.M., Xie, X., Timme, R.E., Puech-Pages, V., Dunand, C., Lecompte, E., Delwiche, C.F., Yoneyama, K., Bécard Origin of strigolactones in the green lineage, G. and Séjalon-Delmas, N. 2012. New Phytologist 195(4): 857-871. [Detecting strigolactones in liverworts and in some other lower green plants but concluding that their function in these is to control rhizoid elongation.]


Ding LiLi, Zhang XueKun, Zhao SiFeng, Yao ZhaoQun and Du Juan. 2012. (Isolation and identification of pathogen of Orobanche cumana stem-rot disease in Xinjiang.) (in Chinese) Xinjiang Agricultural Sciences 49(6): 1096-1102. [Noting that O. cumana is a serious problem in Xinjiang. Isolating 377 samples of pathogen most of which were Fusarium spp, including F. oxysporum, F. solani and F. cerealis, also Rhizoctonia and Pythium.]

Drumeva, M. 2012. Development and testing of experimental sunflower hybrids obtained by using doubled haploid lines. Agricultural Science and Technology 4(3): 196-200. [Testing 17 new hybrids, 12 of which showed full resistance to both downy mildew and Orobanche cumana (races E-F) and moderate resistance to phoma and phomopsis.]


Eaton, D.A.R., Fenster, C.B., Hereford, J., Huang, S.Q. and Ree, R.H. 2012. Floral diversity and community structure in Pedicularis (Orobanchaceae). Ecology 93(88): S182-S194. [Results suggest that a dynamic mosaic of pollinator-mediated interactions among Pedicularis spp. in the Hengduan region of China promotes ecological sorting through recurrent selection against reproductive interference, causing rapid species turnover, and accelerating the rate of floral divergence, together contributing to the florally diverse species of Pedicularis endemic to this biodiversity hotspot.]

Encheva, J., Shindrova, P., Encheva, V. and Penchev, E. 2012. Sunflower commercial hybrid Yana, developed with mutant restorer line R 12003. Helia 35(56): 47-59. [Hybrid Yana developed from line 12003 (see next) X Bulgarian line cms2607 retains immunity to Orobanche cumana races A-F.]


Feyssa, D.H., Njoka, J.T., Zemed Asfaw and Nyangito, M.M. 2012. Uses and management of Ximenia americana, Olacaceae in semi-arid east Shewa, Ethiopia. Pakistan Journal of Botany 44(4): 1177-1184. [X. americana is not domesticated but is a valuable wild resource, mainly for its edible fruit but roots and other parts are used for medicine.]


Physiologiae Plantarum 34(5): 1801-1809. [Nutrients seemed to be transferred passively through the xylem sap between *Loranthus* and *Quercus* as there was a strong correlation between the calcium and potassium concentrations within the species and between the species, Nitrogen appeared to be the limiting nutrient for the parasite.]


Ghantous, K.M. and Sandler, H.A. 2012. Mechanical scarification of dodder seeds with a handheld rotary tool. Weed Technology 26(3): 485-489. [Good germination of small seed lots of *Cuscuta gronovii* (probably but some doubt) was obtained using a handheld rotary tool at the 10,000 rpm setting with a conical grinding-stone bit attached.]


Gulnur, Halik, U., Matruzi, A. and Welp, M. 2012. Study on the high and stable yield cultivation techniques of *Cistanche tubulosa* (Schenk) Wight. Medicinal Plant 3(8): 16-18. [The success rate of *C. tubulosa* inoculation on *Tamarix* sp. was influenced by inoculation method, inoculation distance, inoculation time and planting mode, also by inoculation depth and irrigation time.]


Hamiaux, C., Drummond, R.S.M., Janssen, B.J. 2012. *DAD2* is an α/β hydrolase likely to be involved in the perception of the plant branching hormone, strigolactone. Current Biology 22(21): 2032-2036. [A crystal structure of DAD2 (ortholog of D14) and biochemical evidence showing that DAD2 can post-emergence at 50 or 100 g/ha for control of *C. campestris*. Rimsulfuron, halosulfuron, and flazasulfuron were less effective.]


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hydrolyse GR24 provide compelling evidence that DAD2/D14 is involved in the recognition/perception of strigolactones.

Han LiFeng, Boakye-Yiadom, M., Liu ErWei, Zhang Yi, Li Wei, Song XinBo, Fu FengHua and Gao XiuMei. 2012. Structural characterisation and identification of phenylethyleneglycosides from Cistanches deserticola Y.C. Ma by UHPLC/ESI-QTOF-MS/MS. Phytoc hemical Analysis 23(6): 668-676. [Describing a rapid method for the identification of phenylethyleneglycosides in the crude extract of Cistanch e deserticola which can be used for rapid prediction of the chemical constituents and qualities of the plant.]

Han LiFeng, Ji LiNa, Boakye-Yiadom, M., Li Wei, Song XinBo and Gao XiuMei. 2012. Preparative isolation and purification of four compounds from Cistanches deserticola Y.C. Ma by high-speed counter-current chromatography. Molecules 17(7): 8276-8284. [Four phenyl-ethanoid glycosides identified.]


Hassan, M.M., Yagoub, S.O. and Gabouch, N.A. 2010. Effect of different levels of organic manure on Striga hermonthica (Del.) Benth. and sorghum growth. Bioscience Research 7(1): 32-38. [In a pot experiment, a combination of chicken manure and nitrogen at 95 kg/ha reduced S. hermonthica infestation by 60%. Nitrogen alone reduced it by 83%.


Hladni, N., Dedic´, B., Jociˇc´, S., Mikliˇc, V. and Dušanic´, N. 2012. Evaluation of resistance of new sunflower hybrids to broomrape in the breeding programs in Novi Sad. Helia 35(56): 89-98. [Nine out of 15 hybrids tested showed complete immunity to Orobanche cumana race E in Serbia. Of these NS-H-6385 and NS-H-6396 were the most high-yielding.]

Hobbie, E.A. and Högberg, P. 2012. Nitrogen isotopes link mycorrhizal fungi and plants to nitrogen dynamics. New Phytologist 196(2): 367-382. [A review noting that parasitic plants and autotrophic hosts are similar in δ15N, mycoheterotrophic plants are higher in δ15N than their fungal hosts, presumably with preferential assimilation of fungal protein, and autotrophic, mycorrhizal plants are lower in δ15N than their fungal symbionts, with saprotrophic fungi intermediate, because mycorrhizal fungi transfer 15N-depleted ammonia or amino acids to plants.]

Huang, K., Mellor, K.E., Paul, S.N., Lawson, M.J., Mackey, A.J. and Timko, M.P. 2012. Global changes in gene expression during compatible and incompatible interactions of cowpea (Vigna unguiculata L.) with the root parasitic angiosperm Striga gesnerioides. BMC Genomics 13(402) (http://www.biomedcentral.com/content/pdf/1471-2164-13-402.pdf) [Studying the difference in response of cowpea variety B.301 to non-virulent and virulent (Benin/Zakpota) races of S. gesnerioides and tracking the distinct changes in global gene expression profiles following successful and unsuccessful attempted parasitism.]

Huang, K., Whitlock, R., Press, M.C. and Scholes, J.D. 2012. Variation for host range within and among populations of the parasitic plant Striga hermonthica. Heredity (Edinb) 108(2): 96-104. [The developmental success of S. hermonthica on different rice-host cultivars depended significantly on a parasite population by host-genotype interaction. Genetic analysis using AFLP markers revealed that a small subset of markers showed ‘outlier’ genetic differentiation among sub-populations of S. hermonthica attached to different host cultivars.]


Isah, K.M. and Niranjan Kumar. 2012. Influence of non-host crop rotation on the reaction of cereal host crop genotypes to *Striga hermonthica* of different ecotypes. Indian Journal of Scientific Research (JSR) 3(1): 179-190. [In a pot experiment, groundnut var. SAMNUT 11, soybean var. TGs 1448-2E, cowpea var. SAMPEA 7 and cotton var. SAMCOT 10 reduced *Striga* parasitism and increased growth vigour and productivity more than other varietis of the tested trap-crops.]

Ismaila, M.S. and Adamu, S.A. 2012. The impact of genotypes to host crop rotation on the reaction of cereal host crop *Striga hermonthica* and increased growth vigour and productivity more than other varietis of the tested trap-crops.]


Jung HoeYune and eleven others. 2012. Korean mistletoe (*Viscum album coloratum*) extract improves endurance capacity in mice by stimulating mitochondrial activity. Journal of Medicinal Food 15(7): 621-628. [Confirming antioxidant activity in *V. album coloratum* induces mitochondrial activity, possibly by activating *PGC-1a* and *SIRT1*.]


Kaitera, J., Hiltunen, R. 2012. New alternate hosts for *Alectra parasitica* A. Rich - a rare medicinal parasitic plant. Advance Research in Pharmaceuticals and Biologicals 2(1): 103-111. [Analyzing a range of potentially interesting components, flavonoids etc. in extracts from *A. parasitica*.]


Kang Jing, Li XuWen, Geng JiaYang, Han Lu, Tang Jie Li, Kakpure, M.R. and Rothe, S.P. 2012. Qualitative


Koua, F.H.M. 2011. Striga hermonthica (Del.) Benth: phytochemistry and pharmacological properties outline. Journal of Applied Pharmaceutical Science 1(7): 1-5. [Noting a wide range of traditional uses for S. hermonthica; for abortion, dermatosis, diabetes, leprosy ulcer, pneumonia and jaundice remedy, trypanocidal effects; also antibacterial and anti-plasmoidal activities have been recorded.]


Lee KeyongHo, Kim ByeongSoo and Rhee KiHyeong. 2012. Two sympatric root hemiparasitic Pedicularis species differ in host dependency and selectivity under phosphorus limitation. CSIRO, Collingwood, Australia, Functional Plant Biology 39(9): 784-794. [Pedicularis rex and P. tricolor showed different host specificity. Overall, P. rex showed much weaker host dependency and less damage to hosts than P. tricolor. Concluding that different Pedicularis-host pairs showed different interaction patterns and hence differential influence on plant community structure and productivity.]


Li AiRong, Smith, F.A., Smith, S.E. and Guan KaiYun. Lee KeyongHo, Kim ByeongSoo and Rhee KiHyeong. 2012. Antioxidant, anti-inflammatory, and protectant, defence and growth stimulants in legume medicinal plants of a Herba Sunscreen Formulations. American Journal of Chinese Medicine 40(2): 335-348. [Confirming that the response in root architecture of plants to low Pi (inorganic phosphate) is regulated by strigolactones. This regulation requires MAX2 and correlates with the induction of TIR1, the auxin receptor.]

Matata, P.Z., Gama, B.M., Mbwaga, A., Mpanda, M. and Byamungu, D.A. 2011. Effect of Sesbania sesban fallows on Striga infestation and maize yield in Tabora Region of Western Tanzania. Journal of Soil Science and Environmental Management 2(10): 311-317. [Growing Sesbania sesban for 2 years resulted in 88% less Striga asiatica in maize in the third year than in plots in which maize had been grown for the first 2 years without fertilizer. With fertilizer Striga numbers in the third year were halved. Yields in third year were ca. 1400 kg/ha after S. sesban, 1200 kg/ha with fertilizer and 400 kg/ha without. Economics not discussed.]

Matiwa, P.S., Kajjidoni, S.T. and Hundekar, A.R. 2010. Orobanche management in bidi tobacco through trap crops in Northern Karnataka, India. Plant Archives 10(1): 479-481. [Maize and sorghum were the most effective of a range of trap crops for control of O. cernua tested over a 3 year period in the field.]

Mayljish-Gati, E. and 14 others. 2012. Strigolactones are involved in root response to low phosphate conditions in Arabidopsis. Plant Physiology, 2012, 160, 3, 1329-1341. [Confirming that the response in root architecture of plants to low Pi (inorganic phosphate) is regulated by strigolactones. This regulation requires MAX2 and correlates with the induction of TIR1, the auxin receptor.]


[Describing an optimized protocol for the rapid generation of transformed hairy roots on ex vitro composite plants of cowpea using Agrobacterium rhizogenes, offering a rapid alternative to methods requiring stable transformation and whole plant regeneration for studying gene expression in resistance or susceptibility responses to S. gesnerioides.]


Min Shen, Chang-Qin Zhang, Yong-Peng Ma, Welti, S., Moreau, P.A. and Selosse, M.A. 2012. Mycorrhizal features and fungal partners of four mycohererotrophic Monotropoideae (Ericaceae) species from Yunnan, China. Symphysis 57(1): 1-13. [Identifying the fungal associates of Monotropa uniflora, Hypopitys mononotropa, Monotropastrum humile and Monotropastrum scaphilum, and challenging the idea that these are host-specific.]


Morawetz, J.J. 2007. Systematics of Alectra (Orobanchaceae) and phylogenetic relationships among the tropical clade of Orobanchaceae. Doctor of Philosophy, Ohio State University, Evolution, Ecology, and Organismal Biology. 312 pp. (http://etd.ohiolink.edu/send-pdf.cgi/Morawetz%Jeffery%20J.pdf?osu1195069917) [This molecular phylogenetic study of Alectra using nuclear and chloroplast DNA sequences showed the genus is mostly monophyletic, with the apparent exceptions of A. alba and A. fruticosus. A key is provided that recognises 11 species. A. picta is treated as a synonym for A. vogeli.]


Morawetz, J.J., Randle, C.P. and Wolfe, A.D. 2010. Phylogenetic relationships among the tropical clade of Orobanchaceae. Taxon 59(2): 416-426. [The tropical clade was strongly supported as monophyletic in all analyses, and four main clades were recovered. The genus Nesogenes is included within the tropical clade of Orobanchaceae rather than in the separate family Nesogenaceae.]

Morawetz, J.J. and Wolfe., A.D. 2011. Taxonomic revision of the Alectra sessiliflora complex (Orobanchaceae). Systematic Botany 36(1): 141-152. [Concluding that the variously recognized varieties of A. sessiliflora are part of a continuum and recommending that the species be recognized without infraspecific taxa.]


Morgan, J. K., Zhou, L. J.; Li, W. B.; Shatters, R. G.; Keremane, M.; Duan, Y. P.; Improved real-time PCR detection of Candidatus Liberibacter asiaticus' from citrus and psyllid hosts by targeting the intragenic tandem-repeats of its prophase genes. Elsevier, Amsterdam, Netherlands, Molecular and Cellular Probes, 2012, 26, 2, 90-98. [Describing an optimized protocol for the rapid generation of transformed hairy roots on ex vitro composite plants of cowpea using Agrobacterium rhizogenes, offering a rapid alternative to methods requiring stable transformation and whole plant regeneration for studying gene expression in resistance or susceptibility responses to S. gesnerioides.]


Muhammad Remy Othman, Leong SowTein, Baki Bakar, Khalijah Awang and Mohamad Suffian, M.A. 2012. Allelopathic potentials of *Cuscuta campestris* Yuncker extracts on germination and growth of radish (*Raphanus sativus* L.) and lettuce (*Lactuca sativa* L.). Journal of Agricultural Science (Toronto) 4(9): 57-63. [Confirming some toxic effects from extracts of *C. campestris*.]


Natalis, L.C. and Wesselingh, R.A. 2012. Post-pollination barriers and their role in asymmetric hybridization in *Rhinanthus* (Orobanchaceae). American Journal of Botany 99(11): 1847-1856. [In a *R. angustifolius* background, bumblebees preferred *R. angustifolius*, but visited hybrids more often than *R. minor*. In contrast, visitation rates were similar on a *R. minor* background. Results suggest that hybridization rates in *Rhinanthus* remain low because of several leaky barriers that make *R. minor* the maternal parent of most *F1* offspring.]

Natalis, L.C. and Wesselingh, R.A. 2012. Shared pollinators and pollen transfer dynamics in two hybridizing species, *Rhinanthus minor* and *R. angustifolius*. Oecologia 170(3): 709. [Discussing the degree to which bumble bees visit both these species and successfully cause cross pollination.]

Ndagurwa, H.G.T., Mundy, P.J., Dube, J.S. and Mlambo, D. 2012. Patterns of mistletoe infection in four *Acacia* species in a semi-arid southern African savanna. Journal of Tropical Ecology 28(5): 523-526. [*Acacia gerrardii*, *A. karroo*, *A. nilotica* and *A. robusta* were variously infested by *Erianthemum ngamicum*, *Plicosepalus kalachariensi* and *Viscum verrucosum*.]


Nibletti, C.L. and Bailey, A.M. 2012. Potential applications of gene silencing or RNA interference (RNAi) to control disease and insect pests of date palm. In: Al-Khayri, J.M., Johnson, D.V., Al-Khalifah, N.S. and Jain, S.M. (eds) Emirates Journal of Food and Agriculture 24(5): 462-469. [Reviewing the topic of gene silencing or RNA interference (RNAi), and its potential uses including the control of *Orobanche* and *Striga* spp.]

Noubissié, J.B.T., Fokhou, F.N.T. and Tchako, S.L.T. 2012. Role of Lepidoptera as pollinators on the breeding systems of *Striga hermonthica* (Del.) Benth under the Guinea savannah zone conditions. Annals of Biological Research 3(6): 2821-2828. [In Cameroon, insect visitors to *S. hermonthica* included 4 Lepidoptera, 1 Hymenoptera, 1 Hemiptera and 1 Coleoptera. The Lepidoptera, a Hesperid, *Papilio demodocus* and a *Heterocera* were the main foragers with 64%, 28 % and 3% of visits (impact of each pollinator on fruit set) respectively.]


Ogbonnia, S.O., Anyika, E.N., Mbaka, G.O., Utah, P., Ugwu, D., Nwakakwa, N. and Ota, D.A. 2012. Antihyperglycaemic and antihyperlipidaemic effects of aqueous ethanol extract of *Tapinanthus globiferus* leaves and *Treculia africana* root bark and their mixture on alloxan diabetic rats. Agriculture and Biology Journal of North America 3(6): 237-246. [Results did not support the use of mixture of a mixture of *T. globiferus* *Treculia africana* in the management of diabetes and heart diseases in Nigeria.]

O-rhamnosides from the Eastern Nigeria mistletoe with potent immunostimulatory and antioxidant activities. Biomolecules Journal of Biomolecular Research and Therapeutics 1(102) (http://omicsgroup.org/journals/BOM/BOM-1-102.php?aid=5016) [Demonstrating high anti-oxidative activity in three compounds: (-) catechin- 7-O- rhamnoside (1), (-) catechin-3-O- rhamnoside (2) and a 4‘-methoxy-7-O-rhamnoside (3) isolated from L. micranthus (= Ileostylus micranthus) parasitising Kola acuminate.]

Olufajo, O.O. 2012. Agronomic performance of improved cowpea varieties under natural infestation with Alecra vogelii (Benth.) in the northern Guinea savannah of Nigeria. Agricultura Tropica et Subtropica 45(2): 66-71. [Among 20 varieties IT95K-1072-57 and IT97K-499-35 supported little A. vogelii and were high yielding in grain and fodder. IT95K-1090-12 and IT97K-818-35 were immune but very low yielding.]


Othira, J.O., Omolo, J.O., Wachira, F.N. and Onek, L.A. 2012. Effectiveness of arbuscular mycorrhizal fungi in protection of maize (Zea mays L.) against witchweed (Striga hermonthica Del Benth) infestation. Journal of Agricultural Biotechnology and Sustainable Development 4(3): 37-44. [A greenhouse experiment showed that AMF inhibited germination and reduced growth of Striga hermonthica while enhancing maize host growth and development. Glomus etunicatum, was more effective than Scutellospora fulgida and Gigaspora margarita.]


Page, T., Tate, H., Bunt, C., Potrawiak, A. and Berry, A. 2012. Opportunities for the smallholder sandalwood industry in Vanuatu. ACIAR Technical Reports Series No. 79: 67 pp. [This report discusses the current rate and location of new plantings of sandalwood (Santalum sp.) in Vanuatu, and the silvicultural requirements for growing sandalwood.]


Peregryn, O.M. 2012. Morphological features of the leaves of Euphrasia taurica Ganesch. (Orobanchaceae). Modern Phytomorphology 2: 63-65. [Showing that tooth pattern, type of ultrastructure and type of indumentum of the leaves are diagnostic for E. taurica.]


Prider, J., Correll, R. and Warren, P. 2012. A model for risk-based assessment of Phelipanche matulii (branched broomrape) eradication in fields. Weed Research 52(6): 526-534. [A new model predicts that the current infestation of P. matulii (= Orobanche ramosa ssp. matulii) is unlikely to be eradicated in less than 38 years and may take 62 years.]


Ramirez, M.M., Ornelas, J.F. 2012. Cross-infection experiments of Psittacanthus schiedeanus: effects of host provenance, gut passage, and host fate on mistletoe seedling survival. Plant Disease 96(6): 780-787. [The success rate of P. schiedeanus establishment on 4 hosts Acacia pennatula, Liquidambar styraciflua, Platanus mexicana, and Quercus germa, depended largely (but not simply!) on the host from which the seed came.]


Rehker, J., Lachnit, M. and Kaldenhoff, R. 2012. Molecular convergence of the parasitic plant species Cuscuta reflexa and Phelipanche aegyptiacus. Planta 236(2): 557-566. [Showing by validation of transcriptome sequencing data that the Phelipanche orthologue of a haustorium-specific Cuscuta gene, which codes for a cysteine proteinase, was activated in the early stages of Phelipanche invasion.]

Rios, M.Y. and nine others. 2012. Vasorelaxant activity of some structurally related triterpenic acids from Phoradendron reichenbachianum (Viscaceae) mainly by NO production: ex vivo and in silico studies. Fitoterapia 83(6): 1023-1029. [All compounds showed significant relaxant effect on endothelium-intact vessels in a concentration-dependent manner. Ursolic, moronic and betulinic acids were the most potent.]

Robson, K. 2012. Variation in Sandalwood (Santalum album L.) seed diameter and its effect on nursery and field growth. Sandalwood Research Newsletter 27: 6-8. [Showing a non-significant but consistent advantage of larger seeds in germination and growth rate.]


Rosa, A., Rescigno, A., Piras, A., Atzeri, A., Scano, P., Porcedda, S., Zucca, P. and Dessì, M.A. 2012. Chemical composition and effect on intestinal Caco-2 cell viability and lipid profile of fixed oil from Cynomorium coccineum L. Food and Chemical Toxicology 50(10): 3799-3807. ['The results showed remarkable biological activity of Maltese mushroom oil, and qualify it as a potential resource for food/pharmaceutical applications.]

Roura-Pascual, N., Brotons, L., García, D., Zamora, R. and de Cáceres, M. 2012. Local and landscape-scale biotic correlates of mistletoe distribution in Mediterranean pine forests. Forest Systems 21(2): 179-188. [The presence of Viscum album in stands of Pinus halepensis is determined by multiple factors operating at different spatial scales, with the availability of orchards of Olea europaea in the surroundings playing a relevant role.]

Rusinamhodzi, L., Corbeels, M., Nyamangara, J. and Giller, K.E. 2012. Maize-grain legume intercropping is an attractive option for ecological intensification that reduces climatic risk for smallholder farmers in central Mozambique. Field Crops Research 136:12-22. [Within-row pigeon pea was more effective than N and P in increasing yield and suppressing Striga asiatica in maize.]

Rzedowski, J. and Calderón de Rzedowski, G. 2010. (Main hosts and some other ecological data Viscaceae species in the state of Queretaro.) (in Spanish) Flora del Bajío y de Regiones Adyacentes: Fasc compl 26, 5 pp. [A study in Mexico. No detail in abstract but author’s email address available.]

reporter gene construct, Green Fluorescent Protein (GFP), was used to generate transgenic composite maize plants that were parasitised normally by *Striga hermonthica*. The technique will help to advance understanding of gene function in parasitic plant-host interactions.]

Ruyter-Spira, C. and Bouwmeester, H. 2012. Strigolactones affect development in primitive plants. The missing link between plants and arbuscular mycorrhizal fungi? New Phytologist 195(4): 730-733. [A commentary to the paper by Delaux et al, mentioned above, that showed that freshwater green algae belonging to the Charales already produce and exude strigolactones. The commentary concludes that if strigolactone signaling evolved first when plants started to colonize drier habitats, strigolactone signaling in AM fungi must have evolved independently. It will be of interest to see if this is indeed the case and what then the differences and/or similarities are between plants and AM fungi in strigolactone downstream signalling.]


invasive parasite Parentucellia viscosa on floodplain vegetative communities in Japan. Botanical Journal of the Linnean Society 170(1): 69-78. [P. viscosa has recently become established in Japan and threatens to become invasive. It favours Poaceae and Fabaceae and reduces their vigour relative to other vegetation, hence changing native flora.]


Ticktin, T., Rengai Ganesan, Mallegowda Paramesh and Siddappa Setty. 2012. Disentangling the effects of multiple anthropogenic drivers on the decline of two tropical dry forest trees. Journal of Applied Ecology 49(4): 774-784. [Phyllanthus emblica and P. indofischeri are important wild trees which have declined by 84% in the past 10 years, it is thought largely due to infestation by Lantana camara and the mistletoe Taxillus tomentosus.]


Uchôa, M.A., Caires, C.S., Nicácio, J.N. and Duarte, M. 2012. Frugivory of Neosilba species (Diptera: Lonchaeidae) and Theypus echelata (Lepidoptera: Lycaenidae) on Psittacanthus (Santalales: Loranthaceae) in ecoinonal Cerrado-South Pantanal, Brazil. Florida Entomologist 95(3): 630-640. [A study aimed at finding potential biocontrol agents for Psittacanthus spp. mainly P. acinarius. The lepidopteran Theypus echelata was identified as having some potential.]

Urban, J., Gebauer, R., Nadezhdina, N. and Čermák, J. 2012. Transpiration and stomatal conductance of mistletoe (Loranthus europaeus) and its host plant, downy oak (Quercus pubescens). Biologia (Bratislava) 67(5): 917-926. [The seasonal sum of transpired water expressed per leaf area unit was five times higher in the mistletoe than in the oak.]


Wahab, O.M., Ayodele, A.E. and Moody, J.O. 2010. TL C phytochemical screening in some Nigerian Loranthaceae. Journal of Pharmacognosy and Phytotherapy 2(5): 64-70. [A valuable paper endeavouring to clarify the taxonomy of Nigerian mistletoe species used in traditional medicine and usefully confirming that ‘Viscum album’ repeatedly referred to in Nigerian publications does NOT occur in Nigeria and that in most cases Tapinanthus spp. are involved.]


Watson, D.M. and Herring, M. 2012. Mistletoe as a keystone resource: an experimental test. Series B, Biological Sciences 279(1743): 3853-3860. [Complete removal of all mistletoes (mainly Amyema miquelii but with occasional Muellerina eucalyptoides, A. pendula and A. miraculosa) from Dry Foothill Forest or Grassy Box Woodland in NSW, Australia, resulted over 3 years in losses of more than a quarter of the woodland-dependent bird species, with the number of resident species decreasing by more than a third. Birds nesting in mistletoe were more affected than those feeding on them.]


Wong ZiHua, Habshah Abdul Kadir, Lee ChoyLong and Goh BeyHing 2012. Neuprotective properties of Loranthus parasiticus aqueous fraction against oxidative stress-induced damage in NG108-15 cells. Journal of Natural Medicines 66(3): 544-551. [Confirming that L. parasiticus (=Scurrula parasitica) exerts marked neuroprotective activity, with potential therapeutic application for managing oxidative stress-related neurological disorders and supporting the traditional use of L. parasiticus in treating brain-related diseases in SW China.]


*Xi, Z.X., Bradley, R.K., Wurdack, K.J., Wong, K.M., Sugumaran, M., Bombilies, K., Rest, J.S. and Davis, C.C. 2012. Horizontal transfer of expressed genes in a parasitic flowering plant. BMC Genomics 13(227) (http://www.biomedcentral.com/content/pdf/1471-2164-13-227.pdf) [A study of Rafflesia cantleyi and its obligate host Tetrasigma rafflesiae showed that several dozen actively transcribed genes in the parasite, mostly in the nuclear genome, are likely of host origin, perhaps providing a fitness benefit.]


Xia Jing and Guo YouHao 2012. Effects of flowering date and co-flowering species on pollination and reproduction in Pedicularis gruina. Biodiversity Science 20(3): 330-336. [Pollination by bumble bees, and reproduction in P. gruina was not affected by flowering date but in the presence of co-flowering P. densisipica and P. siphonantha there was enhanced pollination and reproduction through increased floral resource diversity and larger floral displays.]


Yang YueQin, Yi XianFeng, Peng Min and Zhou YuBi 2012. Stable carbon and nitrogen isotope signatures of root-holoparasitic Cynomorium songaricum and its hosts at the Tibetan plateau and the surrounding Gobi desert in China. Isotopes in Environmental and Health Studies 48(4): 483-493. [δ13C and δ15N values of C. songaricum closely mirrored the values of its hosts, Nitraria tangutorum and N. sibirica. Isotopic difference also depend on the different altitudes and habitats of the hosts on the Tibetan plateau and in the Gobi desert.]


Yonli, D., Traoré, H., Sérémé, P., Sankara, P. and Hess, D.E. 2012. Integrated management of Striga hermonthica (Del.) Benth. in sorghum using Fusarium inoculum, host plant resistance and intercropping. Journal of Applied Biosciences 53: 3734-3741. [Studying combinations of Striga-resistant sorghum (F2-20), inoculation with F. oxyssporum (’Finoculum’,34-FO) and intercropping with alternate rows of cowpea (IT-89-KD-245). Various combinations were effective, reducing S. hermonthica infestation by 74-89% and increasing sorghum yield up to 72%.]

Yoshida, S., Kameoka, H., Tempo, M., Akiyama, K., Umehara, M., Yamaguchi, S., Hayashi, H., Kyozuka, J. and Shirasu, K. 2012. The D3 F-box protein is a key component in host strigolactone responses essential for arbuscular mycorrhizal symbiosis. New Phytologist 196(4): 1208-1216. [This study provides evidence that strigolactones also play a role in facilitating the symbiosis after root colonization. However, only D3 (ortholog of MAX2) is crucial for establishing AM symbiosis in rice, whereas D14 and D14-LIKE are not.]

Zhu YanXia and Guo YuHai. 2012. (Monitor of tamarisk root growth and Cistanche tubulosa infection in soil arable layer by WINRHIZO.) (in Chinese) Journal of China Agricultural University 17(3): 43-48. [Using the WINRHIZO method to follow the development of C. tubulosa on three roots of the host tamarisk. Attachment began at 60 days after planting. Also following the content of echinacoside, verbascoside and soluble sugar in the parasite.]

HAUSTORIUM 62

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NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be downloaded from the IPPS web-site (see above).
HAUSTORIUM
Parasitic Plants Newsletter
ISSN 1944-6969
Official Organ of the International Parasitic Plant Society
(http://www.parasiticplants.org/)

December 2012                         Number 62

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Dear IPPS Members,

May the year 2013 be happy and fruitful.

As mentioned in the last issue of Haustorium, our next World Congress on Parasitic Plants (WCPP) will be held from July 15-19 in Sheffield, UK. We are sorry for the delay in opening of the special conference website which will soon be available. (You will informed directly as soon as it is available – Ed.)

We will have seven sessions (session titles & session organizers), 1. Genomics (John Yoder, Jim Westwood), 2. Biology and Biochemistry (Philippe Delavault, Philippe Simier), 3. Host-Parasite Communication (Koichi Yoneyama, Maurizio Vurro), 4. Ecology and Population Biology (Yaakov Goldwasser, Jonne Rodenburg), 5. Control and Management (Diego Rubiales, Joseph Hershenhorn), 6. Crop Resistance and Tolerance (Julie Scholes, Michael Timko), 7. Environmental factors, modeling and mapping (Ahmed Uludag, Hanan Eizenburg), and an IPPS-COST (STReGlactones Enhanced Agricultural Methodologies, STREAM) symposium (Hinanit Koltai, Cristina Prandy). Please prepare for the Congress to share your recent findings on parasitic plants with many colleagues and friends.

During a year and a half after the 11th WCPP in Italy, we have witnessed breakthroughs in parasitic plant sciences. Among them, for example, practical transgenic techniques of root parasitic plants have been developed, and the major pathways in strigolactone biosynthesis have been unveiled. These have convinced me that our current schedule to have WCPP every other year is appropriate to catch up with this rapid progress.

In addition to these rapid advances in basic sciences, we also need to pay great attention to applied sciences because farmers have been waiting eagerly for innovation in practical control measures for parasitic weeds.

In Japan, clover broomrape (Orobanche minor) was first reported in 1937 in Chiba Prefecture near Tokyo. Since then it has spread rapidly and now it occurs in Kyoto. Ten years ago, we went to Watarase River bank to collect the seeds but now we can find it easily in our city. In addition, dodders (Cuscuta spp.) are now causing noticeable crop damage in Japan. So we are afraid that in the near future these parasitic weeds may become noxious weeds in Japan.

Of course, parasitic plants are unique and important contributors to biodiversity. We need to evaluate not only negative effects but also positive effects of parasitic plants on natural and agricultural ecosystems.

Looking forward to meeting many IPPS members at the next WCPP in Sheffield in July.

Sincerely,
Koichi Yoneyama, IPPS President
yoneyama@cc.utsunomiya-u.ac.jp

SEASONAL GREETINGS TO ALL

With thanks to Dietmar Fennel for this montage, prepared for the exhibition entitled “The Bird World of the Mistletoe, in the Stadtmuseum, Schwabach, Germany

http://www.schwabach.de/stadtmuseum/

ALECTRA VOGELII ON SUNFLOWER IN TANZANIA

Alectra vogelii Benth. is widely distributed as a parasite of legume crops in the dry savannahs of sub-Saharan Africa. The species is found on a number of legume hosts, most commonly in cowpea and locally as a significant problem in groundnut and soyabean. Earlier this year when travelling in Singida Rural District of central Tanzania we noticed plants of an Alectra species in many sunflower fields in Mitinko ward. Sunflower has become an important cash crop in central Tanzania expanding to meet the demands from oil extraction plants built in the area. While at first glance specimens looked typical for A. vogelii we noticed that all plants in the area collected from sunflower, cowpea and occasionally soya have densely hairy or so called “bearded” anther filaments. Current taxonomic treatments of Alectra (see Flora Zambesiaca: vol 8 part 2 (1990) Scrophulariaceae by D. Philcox) place A. vogelii with A. picta (Hiern) Hemsl. as two species with non-apicalulate
A. picta was maintained as a separate species by virtue of bearded filaments and plants were described as being ‘floriferous in the upper part of the stem, not generally throughout’. All our specimens from Singida are floriferous throughout but with densely bearded filaments so could be assigned to A. picta. Dr Iain Darbyshire kindly compared these Tanzania plants to other specimens in the Royal Botanic Gardens, Kew Herbarium and confirmed they are broadly similar to those previously identified as A. picta. The first author has previously collected A. picta type plants in Eastern Malawi growing in the same row of groundnuts as typical A. vogelii with glabrous filaments. In view of morphological similarities and similar responses to legume hosts in pot trials, Parker and Riches (1993 – Parasitic Weeds of the World: Biology and Control, Wallingford, UK, CAB International) raised doubt that A. picta and A. vogelii are distinct species. Subsequently Jeffery Morawetz in a revision of Alectra synonymised the two species as A. vogelii (Morawetz, J. 2007. Systematics of Alectra (Orobanchaceae) and phylogenetic relationships among the tropical clade of Orobanchaceae. PhD Thesis Ohio State University). Based on the above it seems likely that the Alectra in Singida is indeed A. vogelii.

As far as we are aware the extent of infestation of sunflower in Tanzania and beyond by A. vogelii is largely unknown. The second author has observed infested fields in Ismani ward of Iringa District where sunflower has also become a cash crop. Johann Visser listed an occurrence of A. vogelii on the crop at Venterdorp in South Africa many years ago (Visser, J.H. 1978 The Biology of Alectra vogelii Benth., An Angiospermous Root Parasite. Beiträge zur Chemischen Kommunikation in Bio- und Ökosystemen, Witzenhausen pp. 279-294). In Singida farmers plant sunflower in rotation with maize or sorghum and rarely apply fertilizer. They report steadily declining yields. The effect of the parasite on sunflower is, however, uncertain although in Singidawe observed that some infested plants were stunted with small heads compared to non-infested ones.

Charlie Riches (Natural Resources Institute, University of Greenwich UK, charlie@riches27.freeserve.co.uk)
Ambonesigwe Mbwaga (Uyole Agricultural Research Institute, Mbeya, Tanzania, ambwaga@gmail.com)

PRESS RELEASES

Decades old weed seeds trigger new plant parasite outbreak

In the early 1980s, a devastating parasitic weed was found in a tomato field in California. The infestation of branched broomrape (Orobanche ramosa) was treated aggressively and the field was quarantined to prevent further spread. When tomatoes were planted in the same spot more than two decades later, though, the branched broomrape quickly returned. According to Lee Van Wychen, Ph.D., science policy director of the Weed Science Society of America, the recurrence is not a surprise. ‘When weed seeds drop to the soil, some can remain viable for many decades,’ Van Wychen says. ‘Effective control requires a long-term commitment.’

There are a number of alternatives available to manage noxious weed seeds that become part of the soil seed bank. One is to quarantine the area and leave the seeds undisturbed until they are no longer viable. But as the broomrape example shows, the length of time the area will need to be quarantined is an unknown. In some instances, the soil is fumigated in an attempt to destroy noxious weed seeds. In other instances, the soil is lightly tilled and a nitrogen fertilizer applied to promote germination and encourage the seeds to sprout. Once they’ve emerged, the weeds are pulled, tilled or treated with an herbicide to keep them from reseeding. ‘None of these options are a magic bullet that will work overnight or kill 100 percent of the weed seeds each and every time,’ Van Wychen said. ‘Persistence is the key.’

Branched broomrape is a prolific seed producer, which significantly compounds efforts to control it. A single plant
can produce 50,000 or more tiny seeds that are easily spread by people, animals, farm machinery, wind and water. When the weed seeds germinate, they attach to the roots of host plants and drain them of water and nutrients – devastating tomatoes, potatoes, peppers, beans and other important crops that branched broomrape prefers.

As a result, California officials quickly sprang into action when the most recent outbreak of branched broomrape was discovered. The San Benito Agricultural Commissioner took the lead in a multifaceted response – quarantining the site again and pulling in state and federal experts and university personnel to lend their expertise. The California Department of Food and Agriculture has been involved, as well as the USDA’s Animal and Plant Health Inspection Service (APHIS). It was a pretty serious infestation,’ said Richard Smith, farm advisor with the University of California Cooperative Extension. ‘We collected big garbage bags of branched broomrape from the 70-acre plot where it was discovered. And when we mapped the site, it overlapped almost precisely with the 1980s outbreak.’ Smith says officials are still evaluating soil fumigation and other potential alternatives for dealing with the long-lived seeds still hidden in the soil.

Branched broomrape has earned a well-deserved spot on the federal noxious weed list. It has been found in several U.S. states to date, including California, Illinois, Kentucky, New Jersey, North Carolina and Texas.

Weed Science Society of America | October 3, 2012

How to go about getting rid of mistletoe in Modesto

On Aug. 16, I authored a community column encouraging Modesto residents to take responsibility for pruning mistletoe from city-owned trees that shade their properties and increase their property values. I have since heard from several Modestans who say the city won’t allow private citizens to interfere with the maintenance of city-owned trees.

I knew the city had an approved vendor list of companies that homeowners could hire to prune a city-owned tree affecting their property, but I didn’t know the particulars, so I did some more research.

The city does in fact allow homeowners to provide maintenance to city-owned trees at the property owner’s expense, if you don’t want to wait the scheduled seven years for the Modesto Community Forestry Department’s regular maintenance. Homeowners are allowed to contract through approved vendors who have applied for a permit to maintain city-owned trees. The process can differ depending on the service the homeowner wants performed. General tree pruning and removal of mistletoe, deadwood or stumps can be handled by directly hiring a vendor from the list; no prior approval or permits is required. For tree removal, you first must contact the Community Forestry Division and request tree removal. Once approved, you can contact a vendor from the approved provider list. Planting a new tree can be handled by an approved vendor, provided the tree being replanted is of the same species. If the homeowner wishes to replace a tree with an alternate species, the tree must be approved by city staff. Root cutting and pest infestations can only be handled by the Community Forestry Division.

I called several of the approved vendors to find out how much it costs to prune mistletoe from a city-owned tree. The cost can range from $150 to $750, depending on the size of the tree and the degree of mistletoe infestation, but the average seemed to be $200 to $350.

Janie Gatzman
columns@modbee.com Wednesday, Aug. 29, 2012

Mistletoe therapy may give cancer sufferers kiss of life

It normally only comes to public attention at Christmas time but mistletoe may have beneficial effects on some cancer patients in terms of life expectancy and quality of life.

Now a pilot study for a clinical trial is being planned at Aberdeen University with the aim of understanding what effect mistletoe has on immune cells in the blood of patients with cancer, and on the tumours themselves, after positive results were experienced by patients of a general practitioner in the city.

Those who say they have benefited from mistletoe treatment include former England international cricketer John Edrich who was diagnosed in 2000 with a rare form of incurable leukaemia. He was given a maximum of seven years, with treatment, to live, and underwent gruelling chemotherapy for five years. Then he learned about the mistletoe treatment, and began receiving twice-weekly injections. Mr Edrich, who lives in Aberdeenshire, said he had been advised to contact Dr Stefan Geider, a GP and qualified anthroposophic doctor, at Camphill Medical Practice in Aberdeen. The retired Test cricketer said: ‘I’ve gradually got better and better and I’ve got to a stage where I’m doing everything. I’m probably better now than I have ever been. I’m 75 and I’m playing golf three times a week. ‘I’m certain it has been down to the mistletoe. Otherwise, I’m sure I wouldn’t be here today.’

Dr Geider said: ‘I’ve had experience with the treatment within the context of a German university hospital and had witnessed a number of patients who showed a marked improvement with the treatment. I’ve used mistletoe therapy with patients here in Aberdeen for 16 years and have had similar successes. ‘Typically you see an increase in energy levels, less pain, improved appetite, better sleep patterns...
and improved motivation. From my clinical experience, of seeing patients for mistletoe therapy on a regular basis, it becomes clear mistletoe, with some people – though not with all – has some impact on tumour reduction. ‘Mistletoe has in my experience been helpful to many of my patients, both in terms of quality of life and life expectancy, but it does not work for everybody. It should be stressed it is not a miraculous cure and we need to understand more fully how mistletoe works and why it does so for some people more than for others. Therefore we need the pilot study.’

The Mistletoe for Cancer UK website, which notes the plant has been used in cancer treatment for more than 90 years, says the introduction of the mistletoe extract from the whole plant into the body is designed to kickstart and re-educate the immune system, so it realises something is wrong and starts to fight back against the cancer.

An Aberdeen University study found 70% of breast cancer patients have taken, or are taking, complementary and alternative medicines. One of these is mistletoe which is being taken on the basis of European studies suggesting there might be an anti-cancer effect.

Steve Heys, professor of surgical oncology at the university and a consultant surgeon, said: ‘A very high quality, detailed analysis reviewed all the studies of mistletoe and concluded that because of the methodological problems with these studies there is currently no evidence for an effect on survival. [But] this review also suggested there might be an effect of mistletoe on improving the quality of life in patients with breast cancer undergoing chemotherapy. Further studies are necessary to determine if there is an effect on improving quality of life in this situation. ‘Given the importance of complementary and alternative medicine to patients, there is an urgent need to understand what effects these agents have both in terms of their own effects and possible drug interactions so patients may have this information to facilitate them making an informed decision as to what is important for them.’

Russell Leadbetter
Herald Scotland 26 September 2012

**Varsity researchers win war on Striga weed with hybrid maize varieties – Magazines.**

The development of three hybrid maize varieties and one for finger millet by a don at Maseno University (near Kisumu, Kenya) could offer the solution to massive crop failure as a result of Striga weed. Led by Prof Mathews Dida, lecturers from the university have developed Maseno EH10, EH11 and EH14 maize varieties, which emit a natural chemical component that suppresses growth of Striga weed in a maize farm. ‘I know that my colleagues have developed sterling seeds before and I must admit that it is on some of these initiatives that I have improved mine, but what makes these particular seeds stand out is their ability to eliminate Striga weed in our shambas (farms),’ Prof Dida said.

According to the researcher, the agricultural sector suffers close to Sh6.7 billion in losses as a result of Striga weed infestation. Prof Dida said that tackling the weed and the need to address the perennial food security was the overriding goal of his research that began more than 10 years ago. ‘I was trying to solve some of these problems I see in farming. How can we keep importing food yet we have the some of the best climatic conditions to be able to achieve self-sufficiency in food production?’ he posed. When finally taken up together with other varieties already in supply, he said that the country would be able to feed the rest of the East African community bloc. The researchers also developed Maseno 60D, a code name of the finger millet seed, which they said is not only fast maturing but also suitable for regions that experience low rainfall. The initiative was partly funded by the National Council for Science and Technology that promotes research and innovation to the tune of Sh1.7 million. Prof Dida said that in terms of output, a farmer should expect at least 12 tonnes of produce per acre compared to the current situation where some farmers harvest as low as a tonne or less from same size of farm. He said that all requisite assessment by the Kenya Plant Health Inspectorate (Kephis), which ascertains effectiveness of newly developed seeds, points to their success.

Agriculture minister Sally Kosgei will launch the new seeds soon to pave the way for commercial exploitation. They are also on display at the Kisumu agricultural show, which opened on Wednesday. Prof Dida said that the new maize varieties mature between 20 and 50 days earlier than those already in the market. ‘They flower in 60 days and mature in 80 days. This represents a reduction from 125 to 80 days,’ he observed. Although the seeds may thrive in almost all parts of the country, the don said that during the research, they focused on lowlands and the Lake Victoria region and coastal parts of the country, which receive relatively scarce rainfall. A seed variety with such traits will be the first of a kind in East Africa. However, similar seeds have been developed for farmers in Nigeria and South Africa. It took Prof Dida two years to develop and evaluate the millet seeds before Kephis took over to conduct independent trials. The work on maize took a little longer since the researchers had to cross-pollinate different maize seeds to obtain the superior breeds out of the originals. ‘Developing new seed variety is referred to as plant breeding and demands for a lot of patience if anything good is to come out of it. Like this has taken 10 years to piece together,’ he said.

By Justus Wanga
Kenya Business Daily
July 23 2012.
ICIPE and AATF in new partnership to boost *Striga* control efforts in Kenya

The International Centre for Insect Physiology and Ecology (ICIPE) and AATF in March 2012 signed a Partnership Agreement under the Integrated *Striga* Management in Africa (ISMA) project that is supported by the Bill & Melinda Gates Foundation. The agreement will see AATF and ICIPE undertake a survey on *Striga* weed management technologies in Kenya. The *Striga* weed is a highly invasive parasitic weed that attacks cereal crops. The infestation of *Striga* causes between 20 percent and 100 percent grain yield loss in many fields in Western Kenya, affecting over 250,000 hectares. It is estimated that farmers lose 300,000 tonnes (3.3 million bags or US$ 132 million) of maize grain every year in the region.

For more information visit http://www.aatf-africa.org/news/new_partnership_for_aatf_and_icipe/en/ or contact Gospel Omanya (g.omanya@aatf-africa.org)

From: AATF Partnerships Newsletter 09, Jan-Apr. 2012.

A New EU COST Action – FA1206. Strigolactones: biological roles and applications

Strigolactones (SLs) are newly discovered phytohormones that contribute to define plant morphology, also in response to environmental conditions, and to the dialogue with organisms in the rhizosphere. As a consequence, SLs have become a cutting-edge topic in plant biology and agronomy, having a great potential in modern agriculture. However, little is known about how they act, their biosynthesis and signaling pathways. Because of their both endogenous and exogenous role as signalling molecules, SLs are well placed to mediate both adaptive changes in the plant architecture and beneficial rhizosphere interactions. Even though SLs are a prime interest for many laboratories across disciplines, there are no official networks neither in Europe nor in the rest of the world on this subject. An outcome of an EU network on this subject would be sustaining and promoting the EU leadership in SLs-related sciences, the coordination of SLs research activities and a transfer of knowledge which may lead to the development of targeted and sustainable agro-technologies. The aim of this proposal is the creation of such multidisciplinary network of experts, of both basic and applied sciences, who can share expertise through the flexibility of the COST framework.

PAST MEETING


Papers presented included:

- Zachary Gaudin et al. – Nitrogen fluxes in the *Phelipanche ramosa*/*Brassica napus* interaction.
- Philippe Delavault et al. – *Phelipanche ramosa* seed germination in response to the strigolactone analog GR24.
- Thomas Peron et al. - The phloem network in the parasitic plant *Phelipanche ramosa*; carboxyfluorescein labelling and characterization of three sucrose transporters.
- Bathilde Auger et al. - Germination stimulants of *Phelipanche ramosa* in the rhizosphere of *Brassica napus* are derived from the glucosinolate pathway.

FORTHCOMING MEETING

The 12th World Congress on Parasitic Plants (WCPP) will be held on Monday July 15 to Friday July 19, 2013 in Sheffield, UK. The venue will be the Edge Conference facility at the University of Sheffield. Further details will be provided via the conference website which will be available soon. An e-mail will be sent to everyone who receives Haustorium once the website is available, around the end of January.

Some details appear in the President’s Message above.

VIDEOS ON STRIGA

A new NGO, Access Agriculture, has been initiated with inputs from three private media companies and financial support from the Swiss Agency for Development and Cooperation Access Agriculture functions as a global facilitator/broker for the production, translation and dissemination of agricultural training videos in developing countries. People are invited to submit their training videos. Guidelines for this are provided on the site (www.accessagriculture.org).

Along with training videos on many other topics, the series of ten ‘Fighting Striga’ videos can be watched and downloaded for free, either as video or audio file (for radio broadcasters) from the Access Agriculture website. The ten video modules focus on sorghum and pearl millet and are developed by Agro-Insight, ICRISAT, NGOs, farmer organisations and national scientists, enriched with key inputs from many African farmers involved in experimentation on integrated *Striga* and fertility.
management. The videos are available in 8 languages – English, French, Bambara, Bomu, Fulani, Hausa, Mossi/Mooré, Zarma/Djarma. DVD’s containing the ten video modules in these eight languages are also available for free and can be ordered from: Dr. T. van Mourik, ICRISAT-Mali, BP 320, Bamako, Mali (Tom.vanmourik@icrisatml.org). By early 2013, Access Agriculture will also make Arabic, Swahili, Portuguese and Chichewa versions of these videos available on its website. These are very high quality films and can be highly recommended to any agricultural service provider.

A range of videos developed by Agro-Insight, ICRISAT, NGOs, farmer organisations and national scientists, enriched with key inputs from many African farmers involved in experimentation on integrated Striga and fertility management, are available on this site. The ten video modules focus on sorghum and pearl millet. They can be watched and downloaded for free, either as video or audio file (for radio broadcasters) from the Access Agriculture website. The videos are available in 8 languages – English, French, Bambara, Bomu, Fulani, Hausa, Mossi/Mooré, Zarma/Djarma. A DVD containing the ten video modules in these eight languages can be ordered from: Dr. T. van Mourik, ICRISAT-Mali, BP 320, Bamako, Mali, or via Tom.vanmourik@icrisatml.org. Individual copies are free. By early 2013, Access Agriculture will also make Arabic, Swahili, Portuguese and Chichewa versions of these videos available on its website. These are very high quality films and can be highly recommended to any agricultural service provider.

For more on the way the films were made see: http://www.new-ag.info/en/research/innovationItem.php?a=2513

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see: http://www.parasiticplants.org/ (N.B. currently a little out of date)

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.si.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmosium technique for Striga suppression, see: http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodic ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes up to 1995, but apparently incomplete since then) see: http://www.rmers.nau.edu/mistletoe/

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/ informationsen/literaturersuche (in German but can be searched by inserting author name).

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)

For past and current issues of the Sandalwood Research Newsletter, see: http://www.jcu.edu.au/mbil/srn/index.html

LITERATURE

* indicates web-site reference only


Alishahi, M. and Mesbah, M. 2012. (Effects of *European Journal of Plant Pathology* 133(3): 523-526.) [Demonstrating that a gene upregulated in C. *pentagona* (= C. *campestris*) on attachment to tobacco is silenced when attaching to a transgenic host, resulting in weaker growth of the parasite and stronger host.]


Antonova, T.S., Araslanova, N.M., Strelnikov, E.A., Ramazanova, S.A., Guchetl, S.Z. and Tchelustnikova, T.A. 2012. Some peculiarities of ontogenesis of *Orobanche cumana* Wallr., parasitizing on sunflower in Rostov region of Russian Federation. Helia 35(56): 99-109. [Noting the relatively recent development of the *Orobanche cumana* problem in the Rostov region of Russia in the 1990s, and describing some features of the plant’s development including multiple stem apices on the tubercle, development of new plants from secondary infections, development of new plants from root apices without attachment to other roots, regrowth from the tubercle after the main shoot has matured and fruited, etc.]

Antonova, T.S., Asrslanova, N.M., Strelnikov, E.A., Ramazanova, S.A., Guchetl, S.Z. and Tchelustnikova, T.A. 2012. Some peculiarities of ontogenesis of *Orobanche cumana* Wallr., parasitizing on sunflower in Rostov region of Russian Federation. Helia 35(56): 99-109. [Noting the relatively recent development of the *Orobanche cumana* problem in the Rostov region of Russia in the 1990s, and describing some features of the plant’s development including multiple stem apices on the tubercle, development of new plants from secondary infections, development of new plants from root apices without attachment to other roots, regrowth from the tubercle after the main shoot has matured and fruited, etc.]


International Journal of Agriculture and Forestry 2(2): 150-156. [Presenting molecular data for the separation of *S. album* from several potential adulterant species including *Osyris wightiana*, *O. lanceolata* and *Ximenia americana.*]


Arruda, R. and nine others. 2012. Ecology of neotropical mistletoes: an important canopy-dwelling component of Brazilian ecosystems. Acta Botanica Brasilica 26(2): 264-274. [Reviewing studies conducted in the neotropical region in order to provide a framework for current research and new ideas for future investigations of mistletoes, especially in Brazil.]


Auger, B., Poureveau, J.B., Pouponneau, K., Yoneyama, K., Montiel, G., le Bizec, B., Yoneyama, K., Delavalut, P., Delourme, R. and Simier, P. 2012. Germination stimulants of *Phelipanche ramosa* in the rhizosphere of *Brassica napus* are derived from the glucosinolate pathway. Molecular Plant-Microbe Interactions 25(7): 993-1004. [Making the interesting discovery that *P. ramosa* germination is triggered particularly by isothiocyanate products derived from the breakdown of glucosinolates in the rhizosphere of *B. napus* and other *Brassicaceae* such as *Arabidopsis* rather than by strigolactones. Raises the interesting question how the rapeseed parasite *P. ramosa* has acquired sensitivity to isothiocyanates while other races of the same species parasitise non-*Brassicaceae* so are apparently sensitive to other compounds (strigolactones).]


Bachhav, S.S., Bhutada, M.S., Patil, S.D., Bhavana Baser and Chaudhari, K.B. 2012. Effect of *Viscum articulatum* Burm. (Loranthaceae) in *N*-nitro-l-arginine methyl ester induced hypertension and renal dysfunction. Journal of Ethnopharmacology 142(2): 467-473. [Concluding that *V. articulatum* may have an anti-hypertensive effect in the NO deficient type of hypertension, attributable to its diuretic, nephroprotective and hypolipidemic actions, supporting its traditional use for hypertension in China.]


54(3/4): 219-234. [‘Method’ not clear but establishing that most plants could be host to C. europaea if there was contact, but grasses and species in nitrogen-poor habitats were less likely to be parasitized.]

Baráth, K. and Csiky, J. 2012. Host range and host choice of Cuscuta species in Hungary. Acta Botanica Croatica 7(1): 215-227. [An excellent detailed study of the host ranges of 7 Cuscuta spp. Numbers of hosts ranged from 183 to 341 for C. ephitynum, C. campestris and C. europaea; 77-99 for C. lupuliformis and C. australis; and 15-16 for C. approximata and C. epilimum. Concluding that these species are not host specific and are able to parasitise most plants they come into contact with. Hence host range is mostly determined by habitat differences and host availability.]

Barbu, C.O. 2012. Impact of white mistletoe (Viscum album ssp. abietis) infection on needles and crown morphology of silver fir (Abies alba Mill.). Notulae Botanicae, Horti Agrobotanici, Cluj-Napoca 40(2): 152-158. [A careful study confirming that infection by V. album is associated with significantly smaller needles, increased needle fall, and lower photosynthesis, apparently playing an important role in silver fir decline. But lacking discussion on possibility that weaker trees have increased incidence of parasite.]


Borowicz, V.A. and Armstrong, J.E. 2012. Resource limitation and the role of a hemiparasite on a restored prairie. Oecologia 169(3): 783-792. [Three after removal of Pedicularis canadensis the mass of grasses was almost doubled but there were smaller effects on forb species in Illinois grassland. Light levels did not affect the hemiparasite across 4 years of manipulation but fertilizer increased P. canadensis shoot mass.]

Boz, Ö., Doğan, M.N. and Öğüt, D. 2012. The effect of duration of solarization on controlling branched broomrape (Phelipanche ramosa L.) and some weed species. Julius-Kühn-Archiv 2(434): 687-693. [In one season when maximum temperatures under plastic reached 54°C, P. ramosa was completely controlled by 2 weeks solarization. In a second season when temperatures only reached 44.5°C, control was only 20% after 2 weeks and 74% after 6 weeks.]

Braby, M.F. 2012. The taxonomy and ecology of Delias aestiva Butler, 1897 stat. rev. (Lepidoptera: Pieridae), a unique mangrove specialist of Euphorbiaceae from northern Australia. Biological Journal of the Linnean Society 107(3): 697-720. [Delias spp. mostly feed on Snatalaceae, Loranthaceae and Viscaceae. D. aestiva differs in being specialized on mangroves, but was found to be able to also feed on some Loranthaceae, suggesting a recent evolutionary shift.]


Byrne, M. and Hankinson, M. 2012. Testing the variability of chloroplast sequences for plant phylogeography. Australian Journal of Botany 60(7): 569-574. [Analysis identified a set of seven chloroplast regions that are a useful basis for informed selection of sequences for assessment of phylogeographic structure in plants in several families including Santalaceae.]

Cafasso, D. and Chinali, G. 2012. Multiple and different genomic rearrangements of the rbcL gene are present in the parasitic orchid Neottia nidus-avis. Genome, 2012,
55, 9, 629-637. [Concluding that N. nidus-avis contains different plastomes, each with a different pseudogene, and these can exist within the same individual plant.]

C’ebovic’, T., Popovic’, M., Rovcanin, B. and Gojkovic’, Z. 2012. Evaluation of the cytotoxic and antioxidiant effects of non-polar Viscum album L. extract (collected from Juniperus communis). Fresenius Environmental Bulletin 21(6): 1454-1460. [The CO2 extract of V. album contained the sesquiterpenes trans-α-bergamotene, trans-β-farnesene and vomifoliol as major extract constituents. The cytotoxic activity of the extract was assayed against EAC breast carcinoma cells and AS30D hepatoma cells in vivo. Volmifoliol was the most active component.]


Chen Rui, Huo LiNi, Liao YanFang, Li PeiYuan, Lu RuMei and Zhang HongYi. 2013. Study on the chemical constituents of essential oils from the leaves of Viscum ovalifolium and Loranthus pentapetalus Roxb. parasitizing on Guaiacum spp. Asian Journal of Chemistry 25(3): 1757-1758. [Isolating a wide range of compounds from V. ovalifolium and L. pentapetalus (=Helixanthera parasitica).]


Crichton, R.J., Squirrell, J., Woodin, S.J., Dalrymple, S.E. and Hollingsworth, P.M. 2012. Isolation of microsatellite primers for Melampyrum sylvaticum (Orobanchaceae), an endangered plant in the United Kingdom. American Journal of Botany 99(11): e457-e459. [The results show the utility of these novel polymorphic microsatellite markers for further conservation genetic analyses. The strong deficit of heterozygosity across all loci in the local sample suggests the species may be inbreeding.]


de Vega, C. and Herrera, C.M. 2012. Relationships among nectar-dwelling yeasts, flowers and ants: patterns and incidence on nectar traits. Oikos 121(11): 1878-1888. [The nectar fungus, Metschnikowia reukaufii, introduced to the flowers of Cytinus hypocisits by ants, is shown to decrease the quality of the nectar and may influence pollinator behaviour.]

Delaux, P.M., Xie, X., Timme, R.E., Puech-Pages, V., Dunand, C., Lecompte, E., Delwiche, C.F., Yoneyama, K., Bécard Origin of strigolactones in the green lineage, G. and Séjalon-Delmas, N. 2012.. New Phytologist 195(4): 857-871. [Detecting strigolactones in liverworts and in some other lower green plants but concluding that their function in these is to control rhizoid elongation.]


Ding LiLi, Zhang XueKun, Zhao SiFeng, Yao ZhaoQun and Du Juan. 2012. (Isolation and identification of Orobanchaceae, stem-rot disease in Xinjiang.) (in Chinese) Xinjiang Agricultural Sciences 45(4): 1096-1102. [Noting that O. cumana is a serious problem in Xinjiang. Isolating 377 samples of pathogen most of which were Fusarium spp, including F. oxysporum, F.solanii and F. cerealis, also Rhizoctonia and Pythium.]

Dixon, E. 2012. Vancouver Ground cone (Boschniakia hookeri), Douglasia Journal of the Washington Native Plant Society 36(4):1. (A brief, illustrated note on the presence of this parasite in Washington State where it is not rare but always fascinating to find.)
Drumeva, M. 2012. Development and testing of experimental sunflower hybrids obtained by using doubled haploid lines. Agricultural Science and Technology 4(3): 196-200. [Testing 17 new hybrids, 12 of which showed full resistance to both downy mildew and Orobanche cumana (races E-F) and moderate resistance to phoma and phomopsis.]


Encheva, J., Shindrova, P., Encheva, V. and Valkova, D. 2012. Mutant sunflower line R 12003, produced through ultrasound treatment sunflower line 12003 (races E-F) based in low induction of broomrape seed germination. Euphytica 186(3): 897-905. [Confirming that the resistance of two breeding lines (Navio and Quijote – based on material resistant to O. foetida in Tunisia – this in turn developed from crosses INIA06 × F402 selected for resistance to O. crenata by ICARDA) is based largely on low stimulation of germination of O. crenata, O. foetida and O. aegyptiaca.]

Feyssa, D.H., Njoka, J.T., Zemed Asfaw and Nyangit o, M.M. 2012. Uses and management of Ximenia americana, Olacaceae in semi-arid east Shewa, Ethiopia. Pakistan Journal of Botany 44(4): 1177-1184. [X. americana is not domesticated but is a valuable wild resource, mainly for its edible fruit but roots and other parts are used for medicine.]


Gao MeiLi, Li YongFei, Yang JianXiong and Wang YiLi. 2012. Effects of n-butanol and water fractions from Pedicularis decorata Franch on oxidative stress in mice induced by a single bout of swimming exercise. Journal of Medicinal Plants Research 6(39): 5186-5195. [P. decorata fractions protected mice from oxidative stress induced by a single bout swimming exercise through a decrease in LPO levels, SOD, GPx, LDH.]

Physiologiae Plantarum 34(5): 1801-1809. [Nutrients seemed to be transferred passively through the xylem sap between Loranthus and Quercus as there was a strong correlation between the calcium and potassium concentrations within the species and between the species, Nitrogen appeared to be the limiting nutrient for the parasite.]


Ghantous, K.M. and Sandler, H.A. 2012. Mechanical scarification of dodder seeds with a handheld rotary tool. Weed Technology 26(3): 485-489. [Good germination of small seed lots of Cuscuta gronovii (probably but some doubt) was obtained using a handheld rotary tool at the 10,000 rpm setting with a conical grinding-stone bit attached.]


Gibot-Declerc, S., Sallé, G., Reboud, X. and Moreau, D. 2012. What are the traits of Phelipanche ramosa (L.) Pomel that contribute to the success of its biological cycle on its host Brassica napus L.? Flora (Jena) 207(7): 512-521. [A detailed analysis of the germination, attachment and development of P. ramosa on oilseed rape and noting up to 90% yield losses recorded in France.]


Goldwasser, Y., Miranda Sazo, M.R. and Lanini, W.T. 2012. Control of field dodder (Cuscuta campestris) parasitizing tomato with ALS-inhibiting herbicides. Weed Technology 26(4): 740-746. [Pot and field studies confirmed the selectivity of sulfosulfuron early post-emergence at 50 or 100 g/ha for control of C. campestris. Rimsulfuron, halosulfuron, and flazasulfuron were less effective.]


Gulur; Halik, U., Matruzzi, A. and Welp, M. 2012. Study on the high and stable yield cultivation techniques of Cistanche tubulosa (Schenk) Wight. Medicinal Plant 3(8): 16-18. [The success rate of C. tubulosa inoculation on Tamarrus sp. was influenced by inoculation method, inoculation distance, inoculation time and planting mode, also by inoculation depth and irrigation time.]


Hamiaux, C., Drummond, R.S.M., Janssen, B.J. 2012. DAD2 is an α/β hydrolase likely to be involved in the perception of the plant branching hormone, strigolactone. Current Biology 22(21): 2032-2036. [A crystal structure of DAD2 (orthology of D14) and biochemical evidence showing that DAD2 can
hydrolyse GR24 provide compelling evidence that DAD2/D14 is involved in the recognition/perception of strigolactones.

Han LiFeng, Boakye-Yiadom, M., Liu ErWei, Zhang Yi, Li Wei, Song XinBo, Fu FengHua and Gao XiuMei. 2012. Structural characterisation and identification of phenylethanolglycosides from Cistanches deserticola Y.C. Ma by UHPLC/ESI-QTOF-MS/MS. Phytochemical Analysis 23(6): 668-676. [Describing a rapid method for the identification of phenylethanol-glycosides in the crude extract of Cistanches deserticola which can be used for rapid prediction of the chemical constituents and qualities of the plant.]

Han LiFeng, Ji LiNa, Boakye-Yiadom, M., Li Wei, Song XinBo and Gao XiuMei. 2012. Preparative isolation and purification of four compounds from Cistanches deserticola Y.C. Ma by high-speed counter-current chromatography. Molecules 17(7): 8276-8284. [Four phenyl-ethanoid glycosides identified.]


Hladni, N., Dedíč, B., Jocić, S., Miklić, V. and Dušančič, N. 2012. Evaluation of resistance of new sunflower hybrids to broomrape in the breeding programs in Novi Sad. Helia 35(56): 89-98. [Nine out of 15 hybrids tested showed complete immunity to Orobanche cumana race E in Serbia. Of these NS-H-6385 and NS-H-6396 were the most high-yielding.]

Hobbie, E.A. and Högborg, P. 2012. Nitrogen isotopes link mycorrhizal fungi and plants to nitrogen dynamics. New Phytologist 196(2): 367-382. [A review noting that parasitic plants and autotrophic hosts are similar in δ15N, mycoheterotrophic plants are higher in δ15N than their fungal hosts, presumably with preferential assimilation of fungal protein, and autotrophic, mycorrhizal plants are lower in 15N than their fungal symbionts, with saprotrophic fungi intermediate, because mycorrhizal fungi transfer 15N-depleted ammonia or amino acids to plants.]

*Huang, K., Mellor, K.E., Paul, S.N., Lawson, M.J., Mackey, A.J. and Timko, M.P. 2012. Global changes in gene expression during compatible and incompatible interactions of cowpea (Vigna unguiculata L.) with the root parasitic angiosperm Striga gesnerioides. BMC Genomics 13(402) (http://www.biomedcentral.com/content/pdf/1471-2164-13-402.pdf) [Studying the difference in response of cowpea variety B.301 to non-virulent and virulent (Benin/Zakpota) races of S. gesnerioides and tracking the distinct changes in global gene expression profiles following successful and unsuccessful attempted parasitism.]

Huang, K., Whitlock, R., Press, M.C. and Scholes, J.D. 2012. Variation for host range within and among populations of the parasitic plant Striga hermonthica. Hereditas (Edinb) 108(2): 96-104. [The developmental success of S. hermonthica on different rice-host cultivars depended significantly on a parasite population by host-genotype interaction. Genetic analysis using AFLP markers revealed that a small subset of markers showed ‘outlier’ genetic differentiation among subpopulations of S. hermonthica attached to different host cultivars.]


Isah, K.M. and Niranjan Kumar. 2012. Influence of non-host crop rotation on the reaction of cereal host crop genotypes to Striga hermonthica of different ecotypes. Indian Journal of Scientific Research (JSR) 3(1): 179-190. [In a pot experiment, groundnut var. SAMNUT 11, soybean var. TGs 1448-2E, cowpea var. SAMPEA 7 and cotton var. SAMCOT 10 reduced Striga parasitism and increased growth vigour and productivity more than other varietis of the tested trap-crops.]


Jamil, M., Van Mourik, T.A., Charnikhova, T. and Ismaila, M.S. and Adamu, S.A. 2012. The impact of genotypes to host crop rotation on the reaction of cereal host crop parasitism by Striga hermonthica in maize in response to N and P fertilisers. Field Crops Research 134: 1-10. [In pot experiments S. hermonthica parasitism by maize was suppressed by both N and P and this strongly correlated to the reduced exudation of strigolactones under high levels of N and P. In the field in Kenya, there was also a Striga suppressive effect of N application but the effect of P was less pronounced than in the greenhouse, likely due to unpredictable P availability in Kenyan field soil.]

*Jamil, M., Van Mourik, T.A., Charnikhova, T. and Bouwmeester, H.J. 2012. Striga hermonthica parasitism in maize. Field Crops Research 134: 1-10. [In pot experiments S. hermonthica parasitism in maize was suppressed by both N and P and this strongly correlated to the reduced exudation of strigolactones under high levels of N and P. In the field in Kenya, there was also a Striga suppressive effect of N application but the effect of P was less pronounced than in the greenhouse, likely due to unpredictable P availability in Kenyan field soil.]]

Jamil, M., Kanampiu, F.K., Karaya, H., Charnikhova, T. and Bouwmeester, H.J. 2012. Striga hermonthica parasitism in maize. Field Crops Research 134: 1-10. [In pot experiments S. hermonthica parasitism in maize was suppressed by both N and P and this strongly correlated to the reduced exudation of strigolactones under high levels of N and P. In the field in Kenya, there was also a Striga suppressive effect of N application but the effect of P was less pronounced than in the greenhouse, likely due to unpredictable P availability in Kenyan field soil.]

Jawani, R. 2012. Efficacy of Thomningia sanguinea (Balanophoraceae) root extract against Plasmodium berghei, Plasmodium chabaudi, inflammation and nociception in mice. Journal of Applied Pharmaceutical Science 2(1): 47-51. [Results moderate only but T. sanguinea could be worth further investigation against P. berghei.]


Jung HoeYune and eleven others. 2012. Korean mistletoe (Viscum album coloratum) extract improves endurance capacity in mice by stimulating mitochondrial activity. Journal of Medicinal Food 15(7): 621-628. [Demonstrating that V. album coloratum induces mitochondrial activity, possibly by activating PGC-1α and SIRT1.]


Kaitera, J., Hiltunen, R. and Samils, B. 2012. Alternate host ranges of Cronartium flaccidum and Cronartium ribicola in northern Europe. Botany 90(8): 694-703. [C. ribicola formed uredinia or telia on 10 species including Pedicularis palustris subsp. palustris and Bartisia alpina.]

Kaitera, J. and Hiltunen, R. 2012. New alternate hosts for the rusts Cronartium ribicola and Cronartium flaccidum in Finland. Canadian Journal of Forest Research 42(9): 1661-1668. [Establishing that the pine rusts C. ribicola and C. flaccidum could infect a range of wild hosts including Bartisia albina and Euphorbia stricta.]


Kang Jing, Li XuWen, Geng JiaYang, Han Lu, Tang Jie Li, Kakpure, M.R. and Rothe, S.P. 2012. Qualitative

Kavanagh, P.H. and Burns, K.C. 2012. Mistletoe macroecology: spatial patterns in species diversity and host use across Australia. Biological Journal of the Linnean Society 106(3): 459-468. [Data collected on the distribution and host use of 65 species of Loranthaceae mistletoes across Australia. Generally supporting the prediction that greater host generality is likely to evolve in regions with greater host diversity while regions with fewer potential hosts lead to the evolution of host specialization.]

Kohlen, W., López Ráez, J.A., Pollina, T., Lammers, M., Toth, P., Charnikhova, T., de Maagd, R., Pozo, M.J., Bouwmeester, H.J. and Ruyter-Spira, C. 2012. The tomato CAROTENOID CLEAVAGE DIOXYGENASE8 (*SICCD8*) is regulating rhizosphere signaling, plant architecture and reproductive development through strigolactone biosynthesis. New Phytologist 196: 535–547. [Transgenic *SICCD8* RNAi tomato lines exhibited strongly reduced strigolactone production. They displayed a.o. increased shoot branching, and infestation by *Phelipanche ramosa* was reduced by 90% while arbuscular mycorrhizal symbiosis was only mildly affected. This demonstrates that reduction of strigolactone biosynthesis could be a suitable tool in parasitic weed management.]

Kokubugata, G., Nakamura, K., Forster, P.J., Wilson, G.W., Holland, A.E, Hirayama, Y. and Yokota, M. 2012. *Cassytha pubescens* and *C. glabella* (Lauraceae) are not disjunctly distributed between Australia and the Ryukyu Archipelago of Japan - evidence from morphological and molecular data. Australian Systematic Botany 25(5): 364-373. [Concluding that that plants considered as *C. pubescens* and *C. glabella* in the Ryukyus are to be respectively treated as *C. filliformis* and the Ryukyu endemic species *C. pergracilis*.]


Kowa, F.H.M. 2011. *Striga hermonthica* (Del.) Benth: phytochemistry and pharmacological properties outline. Journal of Applied Pharmaceutical Science 1(7): 1-5. [Noting a wide range of traditional uses for *S. hermonthica*; for abortion, dermatosis, diabetes, leprosy ulcer, pneumonia and jaundice remedy, trypanocidal effects; also antibacterial and anti-plasmodial activities have been recorded.]


Lee KeyongHo, Kim ByeongSoo and Rhee KiHyeong. 2012. Two sympatric root hemiparasitic species differ in host dependency and selectivity under phosphorus limitation.

CSIRO, Collingwood, Australia, Functional Plant Biology 39(9): 784-794. [Pedicularis rex and P. tricolor showed different host specificity. Overall, P. rex showed much weaker host dependency and less damage to hosts than P. tricolor. Concluding that different Pedicularis-host pairs showed different interaction patterns and hence differential influence on plant community structure and productivity.]


Matata, P.Z., Gama, B.M., Mbwaga, A., Mpanda, M. and Byamungu, D.A. 2011. Effect of Sesbania sesban fallows on Striga infestation and maize yield in Tabora Region of Western Tanzania. Journal of Soil Science and Environmental Management 2(10): 311-317. [Growing S. sesban for 2 years resulted in 88% less Striga asiatica in maize in the third year than in plots in which maize had been grown for the first 2 years without fertilizer. With fertilizer Striga numbers in the third year were halved. Yields in third year were ca. 1400 kg/ha after S. sesban, 1200 kg/ha with fertilizer and 400 kg/ha without. Economics not discussed.]

Matiwade, P.S., Kajjidoni, S.T. and Hundekar, A.R. 2010. Orobanche management in bidi tobacco through trap crops in Northern Karnataka, India. Plant Archives 10(1): 479-481. [Maize and sorghum were the most effective of a range of trap crops for control of O. cernua tested over a 3 year period in the field.]

Mayzlish-Gati, E. and 14 others. 2012. Strigolactones are involved in root response to low phosphate conditions in Arabidopsis. Plant Physiology, 2012, 160, 3, 1329-1341. [Confirming that the response in root architecture of plants to low Pi (inorganic phosphate) is regulated by strigolactones. This regulation requires MAX2 and correlates with the induction of TIR1, the auxin receptor.]

Medak, J. 2011. (Forests of sweet chestnut with odorous pig-salad (Aposerii foetidae-Castanetum sativae ass. nova) in Croatia.) (in Croatian) Šumarski List 135(Special Issue): 5-24. [Listing many associated species including Melampyrum pratense.]

Morawetz, J.J. 2007. Systematics of *Alectra* (Orobanchaceae) and phylogenetic relationships among the tropical clade of Orobanchaceae. Doctor of Philosophy, Ohio State University, Evolution, Ecology, and Organismal Biology. 312 pp. (http://etd.ohiolink.edu/send-pdf.cgi/Morawetz%20Jeffery%20J.pdf?osu1195069917) [This molecular phylogenetic study of *Alectra* using nuclear and chloroplast DNA sequences showed the genus is mostly monophyletic, with the apparent exceptions of *A. alba* and *A. fruticosa*. A key is provided that recognizes 11 species. *A. picta* is treated as a synonym for *A. vogelii*.]


Morawetz, J.J., Wolfe., A.D. 2011. Taxonomic revision of the *Alectra sessiliflora* complex (Orobanchaceae). Systematic Botany 36(1): 141-152. [Concluding that the variously recognized varieties of *A. sessiliflora* are part of a continuum and recommending that the species be recognized without infraspecific taxa.]


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Muhammad Remy Othman, Leong SowTein, Baki Bakar, Khalijah Awang and Mohamad Suffian, M.A. 2012. Allelopathic potentials of Cuscuta campestris Yuncker extracts on germination and growth of radish (Raphanus sativus L.) and lettuce (Lactuca sativa L.). Journal of Agricultural Science (Toronto) 4(9): 57-63. [Confirming some toxic effects from extracts of C. campestris.]


Natalis, L.C. and Wesselingh, R.A. 2012. Post-pollination barriers and their role in asymmetric hybridization in Rhinanthus (Orobanchaceae). American Journal of Botany 99(11): 1847-1856. [In a R. angustifolius background, bumblebees preferred R. angustifolius, but visited hybrids more often than R. minor. In contrast, visitation rates were similar on a R. minor background. Results suggest that hybridization rates in Rhinanthus remain low because of several leaky barriers that make R. minor the maternal parent of most F1 offspring.]

Natalis, L.C. and Wesselingh, R.A. 2012. Shared pollinators and pollen transfer dynamics in two hybridizing species, Rhinanthus minor and R. angustifolius. Oecologia 170(3): 709. [Discussing the degree to which bumble bees visit both these species and successfully cause cross pollination.]


Noubissié, J.B.T., Fohouo, F.N.T. and Tchako, S.L.T. 2012. Role of Lepidoptera as pollinators on the breeding systems of Striga hermonthica (Del.) Benth under the Guinea savannah zone conditions. Annals of Biological Research 3(6): 2821-2828. [In Cameroon, insect visitors to S. hermonthica included 4 Lepidoptera, 1 Hymenoptera, 1 Hemiptera and 1 Coleoptera. The Lepidoptera, a Hesperidae, Papilio demedocus and a Heterocera were the main foragers with 64%, 28% and 3% of visits (impact of each pollinator on fruit set) respectively.]


O-rhamnosides from the Eastern Nigeria mistletoe with potent immunostimulatory and antioxidant activities. Biomolecules Journal of Biomolecular Research and Therapeutics 1(102) (http://omicsgroup.org/journals/BOM/BOM-1-102.php?id=5016) [Demonstrating high anti-oxidant activity in three compounds: (-) catechin-7-O-rhamnoside (1), (-) catechin-3-O-rhamnoside (2) and a 4′-methoxy-7-O-rhamnoside (3) isolated from L. micranthus (= Ileostylus micranthus) parasitising Kola acuminata.]

Othira, J.O. 2012. Agronomic performance of improved cowpea varieties under natural infestation with Alestra vogelii (Benth.) in the northern Guinea savannah of Nigeria. Agricultura Tropica et Subtropica 45(2): 66-71. [Among 20 varieties IT95K-1072-57 and IT97K-499-35 supported little A. vogelii and were high yielding in grain and fodder. IT95K-1090-12 and IT97K-818-35 were immune but very low yielding.]


Othira, J.O., Omolo, J.O., Wachira, F.N. and Onak, L.A. 2012. Effectiveness of arbuscular mycorrhizal fungi in protection of maize (Zeas mays L.) against witchweed (Striga hermonthica Del Benth.) infestation. Journal of Agricultural Biotechnology and Sustainable Development 4(3): 37-44. [A greenhouse experiment showed that AMF inhibited germination and reduced growth of Striga hermonthica while enhancing maize host growth and development. Glomus etunicatum, was more effective than Scutellospora fulgida and Gigaspora margarita.]


Page, T., Tate, H., Bunt, C., Potrawiak, A. and Berry, A. 2012. Opportunities for the smallholder sandalwood industry in Vanuatu. ACIAR Technical Reports Series No. 79: 67 pp. [This report discusses the current rate and location of new plantings of sandalwood (Santalum sp.) in Vanuatu, and the silvicultural requirements for growing sandalwood.]


Prider, J., Correll, R. and Warren, P. 2012. A model for risk-based assessment of *Phelipanche mutellii* (branched broomrape) eradication in fields. Weed Research 52(6): 526-534. [A new model predicts that the current infestation of *P. mutellii* (= *Orobanche ramosa* ssp. *mutellii*) is unlikely to be eradicated in less than 38 years and may take 62 years.]


Ramirez, M.M., Ornelas, J.F. 2012. Cross-infection experiments of *Psittacanthus schiedeanus* schiedeanus: effects of host provenance, gut passage, and host fate on mistletoe seedling survival. Plant Disease 96(6): 780-787. [The success rate of *P. schiedeanus* establishment on 4 hosts *Acacia pennatula*, *Liquidambar styaciflua*, *Platanus mexicana*, and *Quercus germa*, depended largely (but not simply!) on the host from which the seed came.]


Rehker, J., Lachnit, M. and Kaldenhoff, R. 2012. Molecular convergence of the parasitic plant species *Cuscuta reflexa* and *Phelipanche aegyptiaca*. Planta 236(2): 557-566. [Showing by validation of transcriptome sequencing data that the *Phelipanche* orthologue of a haustorium-specific *Cuscuta* gene, which codes for a cysteine proteinase, was activated in the early stages of *Phelipanche* invasion.]

Rios, M.Y. and nine others. 2012. Vasorelaxant activity of some structurally related triterpenic acids from *Phoradendron reichenbachianum* (Viscaceae) mainly by NO production: *ex vivo* and *in silico* studies. Fitoterapia 83(6): 1023-1029. [All compounds showed significant relaxant effect on endothelium-intact vessels in a concentration-dependent manner. Ursolic, moronic and betulinic acids were the most potent.]

Robson, K. 2012. Variation in Sandalwood (*Santalum album* L.) seed diameter and its effect on nursery and field growth. Sandalwood Research Newsletter 27: 6-8. [Showing a non-significant but consistent advantage of larger seeds in germination and growth rate.]


Rosa, A., Rescigno, A., Piras, A., Atzeri, A., Scano, P., Porcedda, S., Zucca, P. and Dessì, M.A. 2012. Chemical composition and effect on intestinal Caco-2 cell viability and lipid profile of fixed oil from *Cynomorium coccineum* L. Food and Chemical Toxicology 50(10): 3799-3807. [The results showed remarkable biological activity of Maltese mushroom oil, and qualify it as a potential resource for food/pharmaceutical applications.]

Roura-Pascual, N., Brotons, L., García, D., Zamora, R. and de Cáceres, M. 2012. Local and landscape-scale biotic correlates of mistletoe distribution in Mediterranean pine forests. Forest Systems 21(2): 179-188. [The presence of *Viscum album* in stands of *Pinus halepensis* is determined by multiple factors operating at different spatial scales, with the availability of orchards of *Olea europaea* in the surroundings playing a relevant role.]

Rusinamhodzi, L., Corbeels, M., Nyamangara, J. and Giller, K.E. 2012. Maize-grain legume intercropping is an attractive option for ecological intensification that reduces climatic risk for smallholder farmers in central Mozambique. Field Crops Research 136:12-22. [Within-row pigeon pea was more effective than N and P in increasing yield and suppressing *Striga asiatica* in maize.]

Rzedowski, J. and Calderón de Rzedowski, G. 2010. (Main hosts and some other ecological data Viscaceae species in the state of Queretaro.) (in Spanish) Flora del Bajío y de Regiones Adyacentes: Fasc compil 26, 5 pp. [A study in Mexico. No detail in abstract but author’s email address available.]

Semerci Sarangzai, A.M., Moinuddin Ahmed, Alia Ahmed, Lubna Saji Kuriakose and Joe, H. 2012. Qualitative and
Ruyter-Spira, C. and Bouwmeester, H. 2012. Strigolactones
Saji Kuriakose and Joe, H. 2012. Qualitative and
Semerci, A., Kaya, Y., Sahin, I. and Cıtak, N. 2010. Determination of the performances and adoption levels of sunflower cultivars based on resistance to broomrape in farm conditions in Thrace region. Helia 33(53): 69-76. [Comparing the performance of sunflower varieties resistant to Orobanche cumana and those resistant to imidazolinone herbicide in Thrace, Turkey and concluding that highest and most economical yields are obtained with genetic resistance to the parasite.] [NB Entry repeated from Haustorium 61 with inclusion of full title and source – Ed.]
Seto, Y., Kameoka, H., Yamaguchi, S. and Kyozuka, J. 2012. Recent advances in strigolactone research:
chemical and biological aspects. Plant and Cell Physiology 53(11): 1843-1853. [Another review on the strigolactones, providing an overview of recent topics and new knowledge on their biosynthetic pathway and hormonal roles in plant development and adaptation.]
Su HueiJin and Hu JerMing. 2012. Rate heterogeneity in six protein-coding genes from the holoparasite Balanophora (Balanophoraceae) and other taxa of Santalales. Annals of Botany 110(6): 1137-1147. [Concluding that the mechanism or mechanisms responsible for rapid sequence evolution and concomitant rate acceleration for 18 S rDNA and matR are currently not well understood and require further study in Balanophora and other holoparasites.]
Suetogu, K., Takeuchi, Y., Futai, K. and Kato, M. 2012. Host selectivity, haustorial anatomy and impact of the
invasive parasite *Parentucellia viscosa* on floodplain vegetative communities in Japan. Botanical Journal of the Linnean Society 170(1): 69-78. [P. viscosa has recently become established in Japan and threatens to become invasive. It favours Poaceae and Fabaceae and reduces their vigour relative to other vegetation, hence changing native flora.]


Ticktin, T., Rengai Ganesan, Mallegowda Paramesh and Siddappa Setty. 2012. Disentangling the effects of multiple anthropogenic drivers on the decline of two tropical dry forest trees. Journal of Applied Ecology 49(4): 774-784. [*Phyllanthus emblica* and *P. indofischeri* are important wild trees which have declined by 84% in the past 10 years, it is thought largely due to infestation by *Lantana camara* and the mistletoe *Taxillus tomentosus*.]


Uchôa, M.A., Caires, C.S., Nicácio, J.N. and Duarte, M. 2012. Frugivory of *Neosilba* species (Diptera: Lonchaeidae) and *Theypus echelta* (Lepidoptera: Lycaenidae) on *Psittacanthus santalales* (Santalales: Loranthaceae) in ecotonal Cerrado-South Pantanal, Brazil. Florida Entomologist 95(3): 630-640. [A study aimed at finding potential biocontrol agents for *Psittacanthus* spp. mainly *P. acinarus*. The lepidopteran *Theypus echelta* was identified as having some potential.]

Urban, J., Gebauer, R., Nadezhdina, N. and Čermák, J. 2012. Transpiration and stomatal conductance of mistletoe (*Loranthus europaeus*) and its host plant, downy oak (*Quercus pubescens*). Biologia (Bratislava) 67(5): 917-926. [The seasonal sum of transpired water expressed per leaf area unit was five times higher in the mistletoe than in the oak.]


Vít, P.; Lepší, M. and Lepší, P. 2012. There is no diploid apomict among Czech *Sorbus* species: a biosystematic revision of *S. eximia* and discovery of *S. barrandienica*. Preslia 84(1): 71-96. [Incidentally noting association of *Sorbus* spp. with *Melampyrum nemorum*,]  
Wahab, O.M., Ayodele, A.E. and Moody, J.O. 2010. TLC phytochemical screening in some Nigerian Loranthaceae. Journal of Pharmacognosy and Phytotherapy 2(5): 64-70. [A valuable paper endeavouring to clarify the taxonomy of Nigerian mistletoe species used in traditional medicine and usefully confirming that ‘Viscum album’ repeatedly referred to in Nigerian publications does NOT occur in Nigeria and that in most cases *Tapinanthus* spp. are involved.]  
Watson, D.M. and Herring, M. 2012. Mistletoe as a keystone resource: an experimental test. Series B, Biological Sciences 279(1743): 3853-3860. [Complete removal of all mistletoes (mainly *Amyema miquelii* but with occasional *Muellerina eucalyptoides*, *A. pendula* and *A. miraculosa*) from Dry Foothill Forest or Grassy Box Woodland in NSW, Australia, resulted over 3 years in losses of more than a quarter of the woodland-dependent bird species, with the number of resident species decreasing by more than a third. Birds nesting in mistletoe were more affected than those feeding on them.]  
Wong ZinHua, Habsah Abdul Kadir, Lee ChoyLong and Goh BeyHing 2012. Neuroprotective properties of *Loranthus parasiticus* aqueous fraction against oxidative stress-induced damage in NG108-15 cells. Journal of Natural Medicines 66(3): 544-551. [Confirming that *L. parasiticus* (=*Scardula parasitica*) exerts marked neuroprotective activity, with potential therapeutic application for managing oxidative stress-related neurological disorders and supporting the traditional use of *L. parasiticus* in treating brain-related diseases in SW China.]  
Xi, Z.X., Bradley, R.K., Wurdack, K.J., Wong, K.M., Sugumaran, M., Bombilis, K., Rest, J.S. and Davis, C.C. 2012. Horizontal transfer of expressed genes in a parasitic flowering plant. BMC Genomics 13(227) (http://www.biomedcentral.com/content/pdf/1471-2164-13-227.pdf) [A study of *Rafflesiopsis cantleyi* and its obligate host *Tetrastigma rafflesiae* showed that several dozen actively transcribed genes in the parasite, mostly in the nuclear genome, are likely of host origin, perhaps providing a fitness benefit.]  
Xia Jing and Guo YouHao. 2012. Effects of flowering date and co-flowering species on pollination and reproduction in *Pedicularis gruina*. Biodiversity Science 20(3): 330-336. [Pollination by bumble bees, and reproduction in *P. gruina* was not affected by flowering date but in the presence of co-flowering *P. densisipica* and *P. siphonantha* there was enhanced pollination and reproduction through increased floral resource diversity and larger floral displays.]  

Yang YueQin, Yi XianFeng, Peng Min and Zhou YuBi 2012. Stable carbon and nitrogen isotope signatures of root-holoparasitic *Cynomorium songaricum* and its hosts at the Tibetan plateau and the surrounding Gobi desert in China. Isotopes in Environmental and Health Studies 48(4): 483-493. \[\delta^{13}C\text{ and }\delta^{15}N \text{ values of } C. \text{ songaricum }\text{ closely mirrored the values of its hosts, } Nitraria \text{ tangutorum and } N. \text{ sibirica.} \text{ Isotopic difference also depend on the different altitudes and habitats of the hosts on the Tibetan plateau and in the Gobi desert.}\]


Yigezu, A.Y. and Sanders, J.H. 2012. Introducing new agricultural technologies and marketing strategies: a means for increasing income and nutrition of farm households in Ethiopia. African Journal of Food, Agriculture, Nutrition and Development 12(5): 6365-6384. \[\text{[A study in the Qobo Valley in Central Ethiopia confirmed that an integrated approach, involving the combined technologies of water harvesting, fertilization and } \text{Striga hermonthica}-\text{resistant sorghum varieties, along with inventory credit increases farm household income by 31% and eliminates under-nutrition except in extreme drought years during which public assistance may be still needed.]}\]

Yonli, D., Traoré, H., Sérémé, P., Sankara, P. and Hess, D.E. 2012. Integrated management of *Striga hermonthica* (Del.) Benth. in sorghum using *Fusarium* inoculum, host plant resistance and intercropping. Journal of Applied Biosciences 53: 3734-3741. \[\text{[Studying combinations of } \text{Striga}-\text{resistant sorghum (F2-20, inoculation with } F. \text{ oxysporum} \text{ (‘Finoculum’,34-FO) and intercropping with alternate rows of cowpea (IT-89-KD-245). Various combinations were effective, reducing } S. \text{ hermonthica infestation by 74-89% and increasing sorghum yield up to 72%.]}\]

Yoshida, S., Kameoka, H., Tempo, M., Akiyama, K., Umehara, M., Yamaguchi, S., Hayashi, H., Kyozuka, J. and Shirasu, K. 2012. The D3 F-box protein is a key component in host strigolactone responses essential for arbuscular mycorrhizal symbiosis. New Phytologist 196(4): 1208-1216. \[\text{[This study provides evidence that strigolactones also play a role in facilitating the symbiosis after root colonization. However, only D3 (ortholog of MAX2) is crucial for establishing AM symbiosis in rice, whereas D14 and D14-LIKE are not.]}\]

Zhu YanXia and Guo YuHai. 2012. (Monitor of tamarisk root growth and *Cistanche tubulosa* infection in soil arable layer by WINRHIZO.) (in Chinese) Journal of China Agricultural University 17(3): 43-48. \[\text{[Using the WINRHIZO method to follow the development of } C. \text{ tubulosa on three roots of the host tamarisk. Attachment began at 60 days after planting. Also following the content of echinacoside, verbascoside and soluble sugar in the parasite.]}\]

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NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be down-loaded from the IPPS web-site (see above).
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Dear IPPS members,

We had another excellent meeting at the 12th World Congress on Parasitic Plants that was held from July 15 to 19 in Sheffield, UK. More than 100 participants from around the world really enjoyed the science, social activities, food and drink, in magnificent green surroundings. I would like to thank Julie Scholes and Duncan Cameron for their perfect preparation, arrangements, and warm hospitality; they even provided good weather for the meeting! Also thanks to session organizers for their efforts in preparation and management of sessions. All of the keynote lectures were very informative and helped us to understand recent advances in various research areas related to parasitic plants. In addition, oral and poster presentations were all of good quality and, in particular, those selected for student awards were excellent. Each student awardee received a copy of ‘Parasitic Orobancheaceae – Parasitic Mechanisms and Control Strategies’ edited by Danny Joel, Jonathan Gressel and Lytton Musselman, just published and its first copy arrived on the second day of the meeting. I am confident that these young scientists will offer breakthroughs in parasitic plant research in the future.

Finally, I would like to thank all attendees for their active participations and discussions. Details of the meeting will be found below.

The IPPS executive committee proposed Jim Westwood unanimously as an IPPS Honorary Fellow awardee, and Jim received this award, a silver plate and a bottle of Scotch whisky, at the conference dinner. We all acknowledge his great contributions to both parasitic plant science, in particular genomics area, and to IPPS.

Although it is only one month after the 12th WCPP in Sheffield, it is time to start thinking about our next Congress. So far, I have already received three official offers for the next venue; Ouro Preto in Brazil, Kunming in China, and Asilomar in USA. If you would like to invite our next congress to your country, please send me an e-mail notice. In addition, I welcome any suggestions and comments for possible congress venues as we would like to select a venue that is most convenient to many IPPS members.

Sincerely,

Koichi Yoneyama, IPPS President
yoneyama@cc.utsunomiya-u.ac.jp

THE 12TH WORLD CONGRESS ON PARASITIC PLANTS

The Congress, held in Sheffield University UK, was attended by just over 100 delegates from at least 26 countries. There were 54 oral presentations and 25 posters arranged under 8 subject-headings, as below. A striking feature of many of the contributions was the degree of cooperation exhibited. There was regular acknowledgement of collaboration between institutions and across countries and continents. This degree of involvement surely contributes to the warm atmosphere of the meeting and to more rapid progress in mutual objectives.

Strigolactones – structure and function. Binne Zwanenburg gave a masterly summary of the chemistry of the strigolactones (SLs) (based on his recent review – see Literature), pointing out the difficulties that have occurred in defining some of the structures, emphasising the importance of stereochemistry, describing some of the available synthetic pathways, re-visiting the question of stability in relation to soil pH and their uses for control. He and others especially Yoram Kapulnik provided insight into the structure of SLs in relation to their three main functions noting that the structures required for parasite germination were not always the same as those needed for stimulating branching in AM fungi or suppressing tillering. Salim Al Babili and others clarified what is now known of the biosynthetic pathways for the SLs and the activity of the intermediate carlactone; also the role of N and P in reducing synthesis if SLs. Others referred to the families of stimulant derived respectively from 5-deoxystrigol and ent-2’-epi-5-deoxyxstrigol; to the activity of debranones as SL mimics; and the
relationship between SLs and karrikins. Evgenia Dor described the successful use of ethyl methane sulphonate mutagenesis to create tomato varieties which fail to synthesise SLs and hence are free of *Phelipanche aegyptiaca* infestation. These show additional branching and greater numbers of inflorescences and smaller fruit but several lines are proving successful commercially for juice production.

**Genomics.** Important progress was reported on the genomes of a range of parasitic species including *Striga asiatica* (Ken Shirasu), *Triphysaria versicolor*, *Striga hermonthica* and *Phelipanche aegyptiaca* (Claude dePamphilis and Loren Honaaas). Steven Runo described the Agrobacterium rhizogenes transformation of maize, a further useful step in the study of gene function in that host. John Yoder described steps towards the use of RNAi as means of control, using transformed *Medicago truncatula* loaded with constructs designed to inhibit ACCase genes in *Triphysaria versicolor* and demonstrating substantial reduction in parasite growth. It is hoped the technique may be transferable to other parasite species. Jim Westwood reported on the ready transfer of mRNAs from hosts tomato and *Arabidopsis* into *Cuscuta pentagona* (this transfer does not generally occur into other classes of parasite) and concluding that there are at least two major routes involved in the transfer. Posters included one reporting successful Agrobacterium rhizogenes-mediated transformation of *Phelipanche ramosa* and another adding further information on the transcriptomics in parasite development of *Striga hermonthica*.

**Biology and biochemistry.** Marc-Marie Lechat presented a novel finding that there is an ‘ABA lock’ in parasitic seeds and it is only after the germination stimulant triggers the up-regulation of genes involved in the destruction of ABA that seeds can then respond to stimulant, first demonstrated with GR24 in *Phelipanche ramosa* but then confirmed with 2-phenylethyl isothiocyanate in *P. ramosa*. GR 24 in *Striga hermonthica* and dehydrocostus lactone in *Orobanche cumana*. It did not occur with compounds which did not stimulate germination. Takatoshi Wakabayashi reported on the importance of the metabolism of trisaccharide to monosaccharide in the course of germination of *Orobanche minor* in response to stimulant. This conversion, and hence germination, is inhibited by nojirimycin bisulfite, while the inhibition can be overcome by addition of suitable monosaccharide. Anna Wiese provided further observations on the importance of carbon metabolism in parasitic and in mycoheterotrophic plants. Tal Shilo reported on exploration of the reason that *Phelipanche aegyptiaca* is damaged by glyphosate. It should be getting its amino acids from the host and should thus not be affected, but experiment showed that the enzyme responsible for shikimate synthesis is active in the parasite and the resultant accumulation of shikimate apparently causes general disruption in carbon metabolism and a fatal reduction in sink strength in the parasite. Luiza Teixera-Costa reported on detailed studies of the detrimental influence of *Phoradendron crassifolius* on wood structure of the host tree *Tapira guianensis*. Juan Lopez-Raez showed that the response of tomato to infection by *Phelipanche ramosa* involved an increase in jasmonate-related genes but a reduced expression of salicylate marker genes. Jason Smith broadened our view somewhat to show a three-way interaction of host, parasite and insect herbivore. *Cuscuta* spp. growing on turnip are less attacked by most aphid species but one that tolerates glucosinolate toxins can thrive on it. Further tests with *C. gronovii* on *Arabidopsis* mutants varying in glucosinolate content confirmed that this type of toxin is readily transported from host to parasite in *Cuscuta* and can influence susceptibility to insect attack. Ai-Rong Li showed that two *Pedicularis* spp., *P. rex* and *P. tricolor* grown without hosts responded differently to N, P and K fertilization. *P. tricolor* shows a greater dependency on P than *P. rex*, corresponding apparently to its greater need for a host for optimum growth. *P. rex* was more dependent on N, less dependent on hosts, and may obtain P more successfully via mycorrhiza. Posters included a study of the role of a β-mannosidase in the early stages of germination of *Orobanche minor*; another studied the genes involved in sucrose metabolism in *Phelipanche ramosa*; another also on *P. ramosa*, looked at the three distinct types of the weed occurring in France, with varying host range and susceptibility to germination by strigolactones; one on metabolomic analysis of *P. aegyptiaca*; and finally a comparison of two species of *Struthanthus, S. vulgaris* and *S. flexicaulis*, overlapping in distribution but parasitising different hosts and with distinctly different phenology. Flowering and fruiting times are distinct reducing the risk of competition for seed-dispersing birds.

**Ecology and population biology.** Gui-Lin Chen described the distribution, host range and evolution of
the 2 closely related species of *Cynomorium*, *C. coccineum* mainly in W. Asia and *C. songaricum* mainly in E. Asia, differing in stamen colour and tepal length; noting particularly the horizontal transfer of genes from their hosts and the role this may have played in their divergence. Peter Toth had studied the volatiles emitted by a range of 11 *Orobanche* and *Phelipanche* spp., and the range of insect pollinators on each, concluding that at least 150 compounds may be involved and that ‘weedy’ parasite species, mainly parasitizing annual hosts, apparently have a smaller range of emitted volatiles than ‘non-weedy’ species attacking mainly perennial hosts. As described and illustrated by Nina Hobbhahn, the pollination of *Cytinus* spp. involves a wider range of agents including ants, rodents, elephant shrews and birds. Mechanisms vary between the several populations of *Cytinus* spp. in S. Africa, Madagascar and the Mediterranean. A careful genomic study of *Phelipanche* spp. in Bulgaria tended to confirm that, while *P. purpurea* and *P. arenaria* are not well distinguished from each other, *P. nana*, *P. oxyloba* and *P. mutelii* are each quite distinct from *P. ramosa*. However, the ‘*O. mutelii*’ occurring in Bulgaria does not clearly match material from elsewhere. Jane Prider reported on studies of the rate of decline of viable seeds of *P. ramosa* (possibly to be re-defined now as *O. mutelii*) in the soil. After 10 years, the decline in viability had varied from 35% to 98% depending on soil depth, moisture and organic matter. New sites had been established and tend to confirm that total loss of viability cannot be expected in less than at least 17 years and may be 30 years or more. A survey of *Striga hermonthica* problems in N. Nigeria showed correlations with low P, N and organic matter; noting particularly the horizontal transfer of genes involved in the resistance to different races of the *Striga* and providing valuable new detail on the up- and down-regulation of genes in cowpea B.301 in response to the non-virulent race SG3 and to the virulent Benin race SG4z. Boubacon Koutche gave a welcome presentation reporting useful progress from 5 cycles of recurrent selection of pearl millet (now known as *Cenchrus americanus*) for combined resistance to *Striga hermonthica* and downy mildew, though high genotype by environment interaction suggests work will need to continue on multiple sites before progress is fully assured. Xi Cheng studied 349 *Arabidopsis* ecotypes and looked for reaction to *Phelipanche ramosa* (germination, attachment, vigour) and, via

**Crop resistance and tolerance.** Michael Timko described the latest findings from studies of the genes controlling susceptibility and resistance of cowpea to *Striga gesnerioides*, confirming that there are distinct genes involved in the resistance to different races of the *Striga* and providing valuable new detail on the up- and down-regulation of genes in cowpea B.301 in response to the non-virulent race SG3 and to the virulent Benin race SG4z. Boubacon Koutche gave a welcome presentation reporting useful progress from 5 cycles of recurrent selection of pearl millet (now known as *Cenchrus americanus*) for combined resistance to *Striga hermonthica* and downy mildew, though high genotype by environment interaction suggests work will need to continue on multiple sites before progress is fully assured. Xi Cheng studied 349 *Arabidopsis* ecotypes and looked for reaction to *Phelipanche ramosa* (germination, attachment, vigour) and, via
genome-wide mapping, identifying association in the form of significant variation in SNPs. Oz Ben David looked for cross resistance in confectionary sunflower, to Orobanche cumana (races B and C) and Phelipanche aegyptiaca. A resistant sunflower ‘Emeq 3’ proved highly resistant to O. cumana but not to P. aegyptiaca though another sunflower variety ‘Ambar’ had shown resistance to both. Anne-Laure Hepp looked in more detail at the metabolic reactions in roots of resistant and susceptible sunflower and identified a range of up-regulated metabolic processes in resistant roots, especially involving flavonoid and isoflavonoid biosynthetic pathways. Posters relating to this section included one from IITA on detail of the breeding programme for Striga-resistant maize, another on selection of a number of rice varieties highly resistant to Striga hermonthica, especially NERICA 5 and NERICA 13 and SATREP S1. Performance was confirmed in the field and SATREPS1 selected for use in Sudan. An apparently new source of resistance to Striga gesnerioides was reported in cowpea from Nigeria but its relationship to other sources of resistance has not been clarified. A marker-assisted breeding programme for Striga-resistant sorghum in Kenya, based on 5 QTLs from the resistant variety N-13 had yielded 21 promising selections and 4 varieties had been released in Sudan. These and others are being further tested across eastern Africa.

Environmental factors: modelling and mapping. Hanan Eisenberg discussed the valuable contribution to be made by modelling in the prediction of below-ground parasite development and hence the optimum timing of herbicide treatments, which are routinely used in Israel for control of Orobanche/Phelipanche spp. in tomato, carrot and sunflower. The use of drones for mapping distribution of emerged parasite was also illustrated. Ammon Cochavi followed with description of a Decision Support System that had been developed for multiple applications of glyphosate for the control of P. aegyptiaca in carrot (see Thesis abstract below). Abebe Menkir described how the efforts of IITA had, over the past 5 years, focused on ensuring that both drought and Striga-resistance were selected for simultaneously in the maize breeding programme and reporting on very encouraging results in terms of new inbred lines and hybrids. Simon N’Cho presented an analysis of factors affecting the intensity of Rhamphicarpa fistulosa in rice in Benin, using a double-hurdle modelling approach and concluding that low soil fertility and farmer ignorance contribute most and that improved farming practices and herbicide use can greatly reduce the problem.

Host-parasite communication. An introductory paper by Harro Bouwmeesterr reviewed the biosynthesis of the strigolactones, the genes involved and the influence of P. The multiple functions of SLs suggest possibilities for selection of e.g. more branched varieties associated with lower SL exudation. However, the specificity of different SL structures to different functions may complicate this approach while also providing some reassurance that reduced parasite germination may be achievable without interfering with the other benefits of SL biosynthesis. He also referred to the unrelated dehydrocostuslactone and 2-phenylethyl isothiocyanate, important stimulants exuded by sunflower and rapeseed (and Arabidopsis) respectively. In a following paper Kaori Yoneyama confirmed that the relative resistance of maize variety KST 94 was associated with lower exudation of 5-deoxystroigol but that other SLs were presumably involved in the branching of AM fungi as there was little difference in mycorrhizal colonisation between this and the susceptible variety Pioneer 3253. Johann Louarn then confirmed that the dehydrocostuslactone (DHCL) that stimulates germination of Orobanche cumana is not involved in mycorrhizal branching and that normal mycorrhizal development could further reduce the germination of O. cumana by direct inhibition rather than by reducing DHCL exudation. Danny Joel presented a detailed appraisal of haustorium structure in Orobancheae (based on his chapter in Joel et al., 2013) and emphasised that the terms terminal and lateral haustorium should be used in place of ‘primary’ and ‘secondary’. Jeff Morawetz expanded further on variation in haustorial structure in relation to the main taxonomic groups within the Orobancheae. Takanori Wakatake then described detailed studies of the pattern of cell division and development in the haustorium in the hemi-parasitic Phtheirospernum japonicum. The final (prize-winning) presentation was by Juliane Ishida describing studies of gene expression during haustorial development in P. japonicum and demonstrating the importance of genes related to the YUCCA genes in Arabidopsis. A relevant paper in another section, by Gregorio Ceccantini described the use of microtomography in studies of the anatomical interface between host and parasite. In related posters, one by Yukihiro Sugimoto demonstrated that the SLs needed for germination of Striga gesnerioides—lectrol and ent-2'-epi-
orobanchol—were quite distinct from those stimulating *S. hermonthica*—sorgolactone, sorgomol and 5-deoxystrogl — which were actually inhibitory on *S. gesnerioides* (thus reducing the risk of cereal crops causing suicidal germination). Other posters referred to the stimulants exuded by tobacco (13 SLs identified including 5 not yet fully defined); by *Houttynia cordata* (5 identified including the new ‘strigone’); and by black oat (*Avena strigosa*) (6 apparently new structures). Finally a poster on *Cistanche deserticola* described effects of norflurazon in promoting seed germination and attachment to the host *Haloxylon ammodendron*.

Julie Scholes and Duncan Cameron are to be thanked and congratulated on all the excellent arrangements for this meeting. Thanks are also due to Sheffield University, Syngenta Corp and IITA for generous financial support which contributed to the attendance of many student newcomers to the field, as well as to an extremely enjoyable social programme, including a half day visit to the Chatsworth stately home and good opportunities each evening to meet and socialise. The exceptionally warm un-British weather also contributed to what must be regarded as an unqualified success. The next Congress will have something to live up to!

Abstracts will be available on the Congress website [http://ipps13.group.shef.ac.uk/](http://ipps13.group.shef.ac.uk/) and/or the IPPS website quite soon.

Chris Parker

**Papers presented:**

NB Only the presenter’s name is included below. He/she may not always be the senior author.

Binne Zwanenburg - Advances and challenges in strigolactone research.
Salim AI-Babili - Strigolactone biosynthesis: few enzymes for a complex backbone.
Kotomi Ueno - The bioconversion of 5-deoxystrogl to mono- hydroxylatedstrigolactone by plants.
Carolien Ruyter-Spira - Natural variation in strigolactone biosynthesis in rice is associated with structural variation and deletion of two *MAX1* orthologs.
Yoram Kapulnik - Biological and functional activity of different strigolactone analogues.

Evgenia Dor - Characterization of new tomato varieties lacking strigolactones.
Takahito Nomura - The effects of phosphate and nitrogen nutrients on the production of strigolactones in *Arabidopsis*.
Kosuke Fukui - Debranones partially and selectively mimic strigolactone function.
Ken Shirasu - Genome and transcriptome analyses of *Striga* spp.
Claude W. dePamphilis - Tissue specific *de novo* transcriptomics in the parasitic Orobanchaceae.
Loren A. Honaa - Genome scale analysis of laser micro-dissected tissues sheds light on parasitic plant-host plant interactions.
Steven Runo - *Agrobacterium rhizogenes* transformation of *Zeas mays*: a functional genomics tool for host-parasite interaction.
John Yoder - Trans-specific gene silencing: a biological strategy to control parasitic weeds?
Gunjune Kim - *De novo* transcriptome assembly of *Cuscuta pentagona* and bidirectional movement of mRNA between hosts and parasite using high-throughput sequencing.
Jim Westwood - Characterization of mobile RNA from hosts to *Cuscuta pentagona*.
Marc-Marie Lechat - *CYPIOLAl*, an ABA catabolic gene, is a ubiquitous component of parasitic plant seed germination in response to various germination stimulants.
Takatoshi Wakabayashi - Inhibitory effect of nojirimycin on germination and sugar metabolism of a broomrape.
Tal Shilo - Aspects of glyphosate mechanism in *Phoradendron crassifolium* (Viscaceae).
Juan A. Lopez-Raez - Plant defence responses against root parasitic plants.
Anna J. Wiese - The chemical nature of parasitic and mycoheterotrophic metabolism involves the reconfiguration of substrate usage in order to sustain the tricarboxylic acid cycle.
Jason D. Smith - Parasitic plants imbibe host plant toxins that influence insect herbivores.
Ai-Rong Li - Nutrient requirements differ in two *Pedicularis* species in the absence of a host plant:
implication for driving forces in the evolution of host preference of root hemiparasitic plants.

Gui-Lin Chen - The distribution and evolution of the genus *Cynomorium*.

Peter T6th - Broomrape pollinators in the light of floral volatiles.

Nina Hobbhahn - Pollination systems in *Cynus*: ants, rodents, elephant shrews, and more.

Iliya Denev - A molecular taxonomy study on *Phelipanche* species (Orobanchaceae) in Bulgaria.

Jane Prider - Natural seed bank decline of *Phelipanche mutelii* in South Australia.

Emmanuel Aigbokhan - Host range and preference of *Cuscuta campestris* (Yunck.) among common weeds in Benin City.

Jonne Rodenburg - The potential of timing as a parasitic weed management strategy for smallholder rice farmers.

Meva Tahiry Randrianafiananka - The role of resistant rice varieties in a locally adapted integrated *Striga* management approach.

Yaakov Goldwasser - *Phelipanche aegyptiaca* control in tomato by application of imazapic through drip irrigation.

Alistair J. Murdoch - Effects of *Desmodium* root exudates on *Phelipanche ramosa* and *Orobanche crenata* and other associated hosts.

Gregório Ceccantini - Shoot the mistletoe - a new method for controlling mistletoes in trees.

Djibril Yonli - Use of potential non-host crop genotypes and allelopathy properties of local plants for controlling *Striga hermonthica* in Burkina Faso.

Michael M. Timko - Identification of genes controlling compatible and incompatible interactions of cowpea with *Striga. gesnerioides*.

Boubacar A. Kountche - Breeding for *Striga* resistance in pearl millet: response to five cycles of recurrent selection.

Xi Cheng - Natural variation in resistance against parasitic plants

Oz Ben David - Variation in response of a resistant sunflower cultivar to *Phelipanche aegyptiaca* and *Orobanche crenata*.


Hanan Eizenberg - Tempo-spatial modeling of broomrapes (*Orobanche* and *Phelipanche* spp.) parasitism - a key for their sustainable management.

Abebe Menkir - Combining resistance to *Striga hermonthica* with tolerance to drought in maize.

Amnon Cochavi - Development of a decision support system based on modeling approach for Egyptian broomrape (*Phelipanche aegyptiaca*) control in carrot.

Gregório Ceccantini - Using microtomography techniques to better understand the anatomical interface between host and parasite.


Harro Bouwmeester - Regulation of parasitic plant germination.

Kaori Yoneyama - Difference in *Striga*-susceptibility correlates with 5-deoxystrigol exudation but not with compatibility/selectivity to AM fungi in maize.

Johann Louam - Can we use arbuscular mycorrhizal fungi to improve resistance to *Orobanche cumana* in sunflower?

Daniel M. Joel - The haustorium of the Orobanchaceae - a review.

Jeffery J. Morawetz - Comparative haustorial morphology and structure in parasitic Orobanchaceae.

Takanori Wakatake - Dynamic changes in cell morphology during haustorium development in *Phtheirospermum japonicum*.

Juliane K. Ishida - Functional identification of the genes involved in haustorium development in the facultative parasitic plant *Phtheirospermum japonicum*.

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Juliane K. Ishida - Functional identification of the genes involved in haustorium development in the facultative parasitic plant *Phtheirospermum japonicum*.

Posters:

Radoslava Matusova - *Agrobacterium*-mediated transformation of *Phelipanche ramosa*.

Yasunori Ichihashi – Tnscriptomics in parasite development of *Striga hermonthica*.

Gregory Guiromand - Functional characterization of a 13-mannosidase involved in the early germination process of *Orobanche minor*.

Philippe Simier - Genetic and phenotypic diversities in the parasitic species *Phelipanche ramosa*.
Luiza Teixeira-Costa - Comparative phenology of two parasitic plants of the genus Struthanthus (Loranthaceae) infesting two different hosts.

Kristen Clermont - Metabolomic analysis of early stages of Phelipanche aegyptiaca development.

Maria Paz-Ponce - Report on Ceroplastes sp in mistletoe (Phoradendron bolleanum) Sierra de Arteaga in Coahuila, Mexico.

Alpha Y. Kamara - Assessment of the level and extent of Striga infestation of cereal and cow pea fields in a dry savanna ecology of northern Nigeria.

Stella Kabiri - Ecological niche differences between Rhamphicarpa fistulosa and Striga asiatica in rain-fed rice.

Nina Hobbhahn - Limitation of current reproduction by resource availability and mating costs in two South African Harveya species - An experimental field study.

Lum A. Fontem - Combating purple witchweed (Striga hermonthica (Del.) Benth.) with acetolactate synthase-modified maize seeds in the West African savannas.

Emmanuel Aigbokhan - Screening effects of crude aqueous sawdust extracts on germination of Striga hermonthica seeds.

Musa G. M. Kolo - Management of Striga hermonthica with Aeschynomene histrix in maize (Zea mays L.).

Daniel T. Gungula - Reactions of different genotypes of maize treated with varying rates of imazapyr in Vola Nigeria.

Rosemary Ahom - Studies on the potential of neem tree products as bioagents for management of Striga hermonthica in maize.

Maria Paz-Ponce - Isolation of fungi infecting mistletoe, Phoradendron macrophyllum, at Saltillo, Mexico.

Baffour Badu-Apraku - Combining ability and heterotic patterns of quality protein maize inbreds under Striga-infested environments.

Hiroaki Samejima - Striga asiatica Evaluation of resistance of upland rice varieties to Striga hermonthica through laboratory, pot and field experiments.

Dan Kiambi - Evaluation of marker assisted Breeding Striga resistant sorghum varieties in Eastern and Central Africa.

Yukihiro Sugimoto - Structural requirements of strigolactones for germination induction and inhibition of Striga gesnerioides seeds.

Xiaonan Xie - Novel germination stimulants for root parasitic plants produced by Nicotiana tabacum L.

Takaya Kisugi - Identification of strigolactones produced by a Chinese medicinal plant Houttuynia cordata.

Hyun II Kim - Novel strigolactones produced by black oat.

Yu-xia Song - Effects of exogenous substances on parasitism of Cistanche deserticola.

BRAZILIAN PARASITIC PLANTS RESEARCH GROUP

Created in 2012, the Parasitic Plants Research Group - PPRG - was chartered by the National Council for Scientific and Technological Development - CNPq, aiming to bring together scientists and students, especially Brazilians, who develop research on different biological aspects of plant-plant parasitism in the Neotropical region. Devoting itself to the study of Anatomy, Ecology, Phylogeny, Physiology, Plant Geography, Morphology, Taxonomy and Floristics, the PPRG is currently formed by 12 researchers* from different institutions plus three undergraduate and postgraduate students. Since its creation six scientific papers were published about parasitism by its participants in Brazilian and foreign magazines. We intend that this production grows as a result of the inclusion of new members and facilitation of partnerships between its participants with external researchers, as well as by the publication of manuscripts from recently qualified doctoral and masters graduates who are group participants.

The first meeting of PPRG took place at the 63rd National Botanical Congress, held in November 2012 at the city of Joinville-SC. There, goals were drawn up to promote the development and integration of research conducted in different regions of Brazil. Thus, in 2013 we intend to further consolidate PPRG through further publications, conducting new scientific meetings and formalizing the group with the Botanical Society of Brazil, which will bring greater visibility and integration between the Brazilian and international botanic communities. In this way, we would like to invite potential stakeholders to meet and participate in PPRG. Soon we will launch a web page in English to facilitate the release of the group's actions, as well as facilitating contact with affiliate members.

More information about this group, researchers or research lines, can be viewed at:
http://dgp.cnpq.br/buscaoperacional/ or by typing the group name in the search field. To contact the coordinators of PPRG email Dr. Claudenir S. Caires (cscaires@hotmail.com) or Dr. Rafael S. Arruda (rafael.arruda@pq.cnpq.br).

*Members of the Parasitic Plants Research Group are:
Claudenir Simões Caires, Leandro Jorge Telles Cardoso, Greta Aline Dettke, Jesiani Rigon, João Marcelo A. Braga, Grazielle Sales Teodoro, Eduardo van den Berg, Fabiana Alves Mourão, Claudia Maria Jacobi, Rodrigo Ferreira Fadini, Lucélia Nobre Carvalho, Kleber Del-Claro and Rafael Soares Arruda.

Articles published by PPRG members since its inauguration:

Arruda, R. et al. 2012. (see Literature below)
Dettke, G.A. and Waechter, J.L. 2012. (see Literature below)
Dettke, G.A. and Waechter, J.L. 2012. (see Literature below)
Caires, C.S. et al. 2012. (see Literature below)
Arruda, R. et al. 2013. (see Literature below)

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Strigolactones (SLs) are a class of structurally related carotenoid-derived compounds with multiple functions in plant physiology and plant-biotic interactions. They are produced in all plants examined so far, including eudicot, monocot and primitive plants. SLs are produced mainly in plant roots and are secreted to the soil, thus present in the rhizosphere. Their benefit to agriculture may be derived from their association both with beneficial and detrimental plant biotic interactions, and their function as plant hormones that regulate both shoot and root development. The consortium will form a network of collaborations that will facilitate finding SLs-related alternatives for field use. SLs were first identified as root-exuded host factors that stimulate the germination of the seeds of parasitic plants (e.g.: Orobanche, Phelipanche and spp.).

Parasitic ‘witchweeds’ and ‘broomrapes’ are causing massive damage to cereal, legumes, solanaceous crops, sunflower and many other crop production in the Mediterranean area and in the developing world; overall they are among the most destructive weeds in agriculture around the world. They represent a serious risk for food security, because they substantially reduce yield, and may lead in some of the regions to increase poverty and hunger. This threat led the UN to state that Striga infection alone is the largest impediment to poverty alleviation in Africa and the Gates Foundation to support a Striga control project in 2011. Moreover, weed management of parasitic plants is extremely difficult. This is because almost all the traditional methods of control were proven to be scarcely effective. A better knowledge on their mode of action may lead to development of ways to block the SLs-related seed germination signal, and thus to prevent parasitic weed seed germination. SLs act also in the rhizosphere as signalling molecules in the interaction with beneficial arbuscular-mycorrhizal fungi (AMF) and nitrogen-fixing bacteria of the genus Rhizobium, facilitating the establishment of these symbioses.

In agricultural systems, SLs may be used for promoting these beneficial associations. For that purpose, a structure-activity relationship allowing to reduce the molecular complexity to minimum structures while maintaining the essential functionalities and bioproperties is desired. The design and synthesis of analogues of SLs that are more potent or have longer sustainability in the soil is strongly needed. These may be used to specifically promote these beneficial symbioses in agricultural systems. An additional agriculturally relevant aspect of SLs is related to nutrition balance. Since SLs are promoted under nutrient limiting conditions (mainly phosphorus and nitrogen), they are proposed to play a key role in the regulatory network for adaptation of shoot and root architecture to poor mineral nutrient supply, including the fostering of rhizosphere associations for added nutrient acquisition. An example for the usage of SLs in this regard is development of biotechnological means for treating plants in the field with SLs, with the
aim of regulation of their shoot and root development. This will reduce the need for development of genetically modified crops, and may promote sustainable solutions to nutrient poor environments.

To conclude, a more comprehensive and coordinated knowledge on SLs will facilitate the possibilities of implementing SL usage in sustainable agriculture. In this sense a coordinated research on SLs, termed STRigolactones Enhanced Agricultural Methodologies (STREAM) consortium, in the frame of the COST program will provide a unique opportunity to create a forum for meetings and discussions on the concepts and understanding of SLs, as well as their potential use in agriculture for a variety of plant species and crops in Europe, but also in developing countries. Thanks to the flexibility of the COST Action tool, other scientists from non-EU countries could be involved in the scientific advances. Also, the network might be joined by people that have never worked directly on SLs, but their expertise could be very useful for opening new research frontiers: e.g. experts in parasitic weed management and parasite biology, plant-microbe interactions, chemistry, bioinformatics, etc. Likewise, scientists from the industry may join the action: their integration will promote further collaborations financed by EU Framework Program and other European organizations, both as basic and applied research as well as the opportunity to jointly develop new means for efficient and specific application of SLs for agricultural usage. As this is a coordinating network, it will foster collaboration rather than internal competition, avoid redundancies in research effort, and allow the emergence of synergies in this highly competitive field of research. In later stages this network might lead to discovery of innovative research areas and to the ability to submit joint proposals for EU research funds (e.g., the EU Framework Program). The Network is chaired by Prof. Cristina Prandi (Department of Chemistry, University of Turin, Torino, Italy) and vice-chaired by Dr. Hinanit Koltai (Volcani Center, Faculty of Plant Sciences, Bet Dagan, Israel), and currently counts 20 signatory Countries. It was officially approved in November 2012 and had the kickoff meeting in Bruxelles on April 12, 2013. Further information can be found on the COST website at http://www.cost.eu/domains_actions/fa/Actions/FA1206 and on the website of the Action when available.

Good possibilities of collaboration of participants are foreseen between the Action and the EWRS Working Group ‘Parasitic Weeds’, also considering that one of the Working Group to be established within the Action regards parasitic plants.

Maurizio Vurro, Coordinator EWRS Working Group Parasitic Weeds; maurizio.vurro@ispa.cnr.it

From EWRS Newsletter April 2013

N.B. See also the notice below of the 1st meeting of the COST Action to be held in Israel, November 3-7.

OBITUARIES

Robert Eugene Eplee - 1933-2013

Anyone who works with witchweeds, parasitic species of the genus *Striga* (Orobanchaceae), is familiar with the work of Bob Eplee who passed away January 30th 2013. He is best remembered for his research on the biology and control of *Striga asiatica*, a weed native to Africa, first recognised in southeastern North Carolina in July 1956.

Thanks in large part to his 30 year research program to develop methods and equipment for the US Department of Agriculture (USDA) Carolinas Witchweed
Eradication Program, the infestation has been reduced from 432,000 acres in the Carolina Coastal Plain in 1970 to 1,542 acres by the end of 2012. This is unquestionably the most successful suppression of a parasitic weed in history.

Of particular note is the ethylene injection equipment he designed and developed making it practical to induce suicidal germination of 99% of viable witchweed seeds in infested fields. Another achievement was the development of safe and effective application methods for 2,4-D and dicamba for witchweed control. Over the years, hundreds of thousands of acres in the witchweed infested area have been treated by contract applicators around susceptible crops without any damage.

Bob’s accomplishments in the USDA witchweed eradication program led to his involvement with the development of parasitic weed control strategies that were adopted in several countries. His work resonated with scientists trying to control witchweed in Africa. When recalling his visit to laboratories in West Africa, local witchweed workers always spoke of Bob Eplee in superlatives. His name is attached to such practical technology for witchweed research as the Underflow Elutriator for separation of microscopic parasitic plant seeds from soil. Those of us who worked with Bob recall with a fond smile when he explained how the elutriator worked by separating out everything ‘… bigger than, smaller than, heavier than, and lighter than witchweed seeds’ which he delivered in his pleasant growl with an Appalachian mountain accent. He also developed fine mesh bags affectionately referred to as ‘Eplee bags’ for testing the long term viability of witchweed seeds in the soil, and numerous greenhouse and field techniques for growing witchweed for research, and much more.

Eplee received his BS degree in Agronomy from Berea College, Kentucky (1955) and his MS Degree in Agronomy from the University of Kentucky, Lexington (1963). His PhD in Crop Science (Weed Science) was from North Carolina State University (NCSU) in December, 1965.

After serving in the U.S. Army in France from 1955-1957, Bob worked as an extension agent with the USDA Cooperative Extension Service in Morehead County, Kentucky, from 1957-1961. Upon completing his doctoral studies, he accepted the position as director of the Witchweed Laboratory in the Crop Pest Division of the USDA Agricultural Research Service in Whiteville, North Carolina. He held that position until the Whiteville Plant Methods Center was closed by USDA Animal Plant Health Inspection Service (APHIS) in August, 1995. From 1995 until his retirement in 2000, Bob served as the Director of the APHIS Oxford Plant Methods Center (Oxford, North Carolina), and the APHIS Center for Plant Health Science and Technology in Raleigh, North Carolina.

He has been recognized on national and international levels for his professional accomplishments including Fellow of the Weed Science Society of America (1993) and two parasitic plant awards - the Otto Heinreich Award, International Parasitic Plant Society, 6th International Congress, Cordoba, Spain (1996), and the Legacy Award, International Parasitic Plant Society, 9th International Congress, Charlottesville, Virginia (2007) in recognition of extraordinary contributions to understanding the biology, control, and quarantine of witchweed over 30 years in the Carolinas not only possible, but practical, and economically feasible.

His influence on parasitic plant research was immense. Although his emphasis was always the applied aspect, he garnered so much information on witchweed that has been used worldwide by basic researchers. Perhaps just as important is how Bob and his work heightened awareness of these pathogens on a worldwide basis. One way he so effectively did this was through graduate students, American and foreign, working in his Whiteville lab. There they saw first-hand how lab science translates into field programs, and experienced first hand the warm hospitality of the Eplees - and such local cuisine as chicken bog and barbecue. He is survived by his wife Mary and a son, Eugene. He was preceded in death by one son, David.

His quick wit, ready smile, innovation, and generous spirit will be missed by all who were privileged to know him.

Lytton Musselman, based on an article by Randy Westbrooks, Doug Worsham and Lytton Musselman.

F. Nigel Hepper 1929-2013.

Nigel Hepper (never known by his first name Frank) has died at the age of 84. He was a plant scientist with
an international reputation. He was an authority on the plants of West and East Africa, where he took part in many scientific expeditions. He was the managing editor of the authoritative *Flora of West Tropical Africa* (1972). Independently his regular observations of the changes over time of the first flowering of plants at Kew led him to give warning in the early 1970s of the effects of climate change. He studied the incense trade at first hand in the Yemen and East Africa and wrote about it. Always interested in Egyptology, he studied the plants from Tutankhamun’s tomb when they first arrived at Kew and wrote *Pharaoh's Flowers: the Botanical Treasures of Tutankhamun* (1990).

Nigel was always a specialist in the Orobanchaceae and presented the very first paper at the very first parasitic weed meeting in Malta in 1973, describing the ‘Problems in naming *Orobanche* and *Striga*’. He continued to help many of us with the identification of difficult specimens over many years. His expertise and friendly helpful character will be greatly missed.

Chris Parker

**PRESS RELEASES**

**Red witchweed found near Mackay**

BIOSECURITY Queensland has confirmed that a serious exotic weed, red witchweed (*Striga asiatica*), which can affect the production of sugarcane and cereal crops has been found near Mackay. Biosecurity Queensland’s Director Invasive Plants and Animals John Robertson said samples were collected and have been identified by the Queensland Herbarium.

‘While the weed has been confirmed on one property, information to date suggests that the infestation may be on a small number of other properties in the immediate area,’ Dr Robertson said. ‘The affected property is being placed under movement restrictions which means no equipment, soil or plant material is allowed to be moved on or off the property without approval. While our priority is to minimise the biosecurity risks, we will continue to work with the owner to ensure some business continuity. Biosecurity Queensland has established a response program including a local control centre in Mackay. Potentially affected plant industries have been notified and Biosecurity Queensland is working with industry representatives to provide information to producers. We are urging producers to check their crops and report anything they suspect could be red witchweed.’

Red witchweed is a root parasite that is exotic to Australia and affects the production of sugarcane and cereal crops by depriving them of water and nutrients. Dr Robertson said this was the first confirmed detection of red witchweed in Australia. Red witchweed is a prescribed pest under the Plant Protection Act 1989 and all exotic *Striga* species are declared Class 1 pests under the Land Protection (Pest and Stock Route Management) Act 2002. Producers are urged to report any suspect weeds to Biosecurity Queensland on 132 523.

The Observer, Queensland, 25 July 2013

**Medicinal attributes of mistletoe**

Mistletoe, the same plant you kiss under at holiday time, may be an effective aid against certain types of cancer. A semi-parasitic plant, mistletoe grows on a variety of common trees including apple, oak, elm and pine. As a traditional medicine, mistletoe (*Viscum album*) was used by the Druids and the ancient Greeks, and was widely regarded as something of a cure-all. The plant has been used for centuries in European herbalism for treating epilepsy, hypertension, headaches, menopausal symptoms, infertility, arthritis and rheumatism. Since the 1920s, mistletoe has also been studied for its applications in treating various forms of cancer, especially solid tumors.

For people undergoing cancer treatments, the widely studied plant is often used as a complementary-based therapy. In Europe, mistletoe preparations are regularly prescribed for various types of cancers as its extract demonstrates anti-cancer activity when used against cancerous cells in the lab. It’s been said that mistletoe extract enhances immune function, which increases the production of the immune cells. When administered as a form of therapy for cancer, the extracts are given by injection under the skin, into a vein or directly into a tumor. The anti-cancer activity of mistletoe may be influenced by the host plant. Mistletoe growing on an apple tree, for example, may have a somewhat different chemical composition than mistletoe growing on an elm. However, there does not seem to be any definitive research on which type of extract is preferable for which types of cancer.

Human clinical studies on mistletoe and cancer have been conducted in Europe, primarily in Germany. In a number of studies, mistletoe has demonstrated efficacy
against cancer. However, critics in the United States regard these studies as either too small or improperly designed. In one study conducted between 1993 and 2000, researchers examined the use of a mistletoe extract by the brand name Iscador in 800 patients with colorectal cancer. They were all treated with chemotherapy and/or radiation therapy. Researchers found the patients treated with Iscador had fewer adverse events, better symptom relief and improved disease-free survival compared to patients who did not receive the mistletoe extract as adjuvant therapy. This finding concurs with other research, that mistletoe therapy reduces the discomfort and undesirable symptoms of other traditional therapies, such as chemotherapy.

In 2002, the National Center for Complementary and Alternative Medicine (NCCAM), and the National Cancer Institute (NCI), initiated a clinical study of a mistletoe extract (Helixor A) in conjunction with the chemotherapeutic drug gemcitabine in patients with advanced solid tumors. In the study, the combination of the two showed low toxicity and health benefits in almost half the patients. In this case, mistletoe demonstrated its value as an adjuvant, helping to modify the chemotherapy.

At present time, two research groups have "investigational new drug" approval to conduct studies on the use of mistletoe extract for cancer. Their studies may further the cause of this treatment in the U.S. However, at this time, the FDA does not recognize the use of mistletoe to treat any form of cancer, and injectable mistletoe extracts cannot be sold in the U.S.

Chris Kilham
Medicine Hunter
December 24, 2012

(A video associated with this story at:http://www.foxnews.com/health/2012/12/24/medicinal-attributes-mistletoe/ shows Chris Kilham discussing the medical uses of Viscum album.)

Bird spreads mistletoe towards East Lancashire
Romantics are getting excited as mistletoe is spreading towards East Lancashire thanks to a tiny bird. The blackcap, which usually flies south for the winter, but has more recently been staying in Britain, is helping to spread the plant to wooded areas. The distinctive grey warbler, which has the nickname ‘northern nightingale’, carefully pick the berries on mistletoe (Viscum album) apart and leave the seeds embedded in trees, like apple, lime, hawthorn, poplar, maple and willow.

Lancashire Wildlife Trust projects manager Mark Champion said mistletoe had now been found in Wigan and that it would not be long before it spread to other parts of Lancashire. He said: ‘Mistletoe has been increasing its range. It used to be quite localised on the orchards of Herefordshire and Worcestershire where the climate is warm and moist but both here and on the continent the range has expanded. Most birds don’t like the berries of mistletoe because they don’t taste nice for starters and, quite frankly, the berries are full of sticky goo which puts birds right off their lunch.’ Mark added that the mistle thrush, which is normally associated with spreading the parasitic plant, is much less reliable as when the seeds pass through their guts, they rarely land in ideal places for growth.

But since the 1980s, the blackcap has been wintering in the UK and is causing a resurgence of the festive plant. Mark said: ‘This small bird should migrate south for the winter but a small population from central Germany got lost and confused and they now fly west to winter in Britain. It is these birds which carefully take the berry apart, thus avoiding the sticky bits and leaving the seed nicely embedded in the trees where it can sprout to continue its semi-parasitical lifestyle.’

Why do people kiss under the mistletoe?
The mistletoe was part of the mystical Celtic druids’ rites and was considered to be sacred. It is probable that this is the last vestige of a winter fertility rite. In cultures across pre-Christian Europe, mistletoe was seen as a representation of divine male essence as well as romance, fertility and vitality. According to Pliny the Elder, the Celts considered it a remedy for barrenness in animals and an antidote to poison. The earliest documented case of kissing under the mistletoe dates from 16th century England.

Jessica Cree
Lancashire Telegraph, 21st December 2012

Project makes significant progress to save maize from the ‘violet vampire' in western Kenya

Thousands of farmers in western Kenya are successfully battling the invasion in their farms by a deadly parasitic weed called Striga, dubbed the violet vampire because of its beautiful violet flowers. As a
consequence, they are enjoying higher yields of their number one staple, maize. This is thanks to the efforts of the Integrated *Striga* Management in Africa (ISMA) project that has introduced a combination of sustainable multiple-pronged management options to sustainably eliminate the weed from their fields. *Striga* attacks and greatly reduces the production of staple foods and commercial crops such as maize, sorghum, millet, rice, sugarcane, and cowpea. The weed attaches itself to the roots of plants and extracts its water and nutrients adversely affecting its growth. It can cause farmers up to 100% crop loss. Furthermore, a single flower of the weed can produce up to 50,000 seeds that can lie dormant in the soil for up to 20 years. Studies have shown that this parasitic weed is the number one maize production constraint in Western Kenya with most farmers’ fields being infested. The four-year ISMA project is demonstrating the effectiveness of using a combination of existing and new technologies developed by various national and international research organizations and private companies, to sustainably control the beautiful but lethal *Striga* weed.

The technologies range from simple cultural practices such as intercropping maize with legumes, such as groundnuts, rotating maize with soybean (soybean stimulates the *Striga* to germinate but it later dies in the absence of a maize host to latch onto) to deploying a "push-pull" technology that involves intercropping cereals with specific *Striga*-suppressing desmodium forage legume. Other technologies include using *Striga*-resistant maize varieties and maize seeds coated with and resistant to imazapyr, a BASF herbicide (*Strigaway*) developed by the International Maize and Wheat Improvement Center (CIMMYT) which kills the *Striga* seed as it germinates and before it can cause any damage. The project is also testing the effectiveness of biocontrol technologies which use a naturally occurring host-specific fungal pathogen that kills the *Striga* at all stages without affecting other crops. ‘*Striga* is very difficult to control and all the various methods have their challenges. Therefore the key to sustainably manage this weed is to combine various technologies,’ says Dr Fred Kanampiu, a CIMMYT agronomist leading the project activities in Kenya. ‘ISMA is providing farmers with options and they can choose the combination that works best for them.’ According to Dr Mel Oluoch, the project manager based at the International Institute of Tropical Agriculture (IITA) which is coordinating the project, over 6,000 farmers in the western region of Kenya now have access to the imazapyr-resistant (IR) maize variety and maize-legume intercrop and rotation technologies. Furthermore, Dr Oluoch says, on-farm studies have shown that imazapyr resistant-maize and *Striga*-resistant maize hybrids reduce *Striga* emergence by more than 60% and increase maize yields by two to three times compared with the current commercial open-pollinated varieties and hybrids commonly grown by farmers. ‘Partner seed companies have produced 98 tons of IR maize seed, with over 44 tons disseminated through commercial channels consisting of agro-dealer networks. Another 6.5 tons have been disseminated to at least 29,000 smallholder farmers in the *Striga* hot spots of western Kenya,’ Dr Oluoch said. George Martin Mitende,56, from Bonda village in Migori County is one of the farmers who donated land on his farm to the project for demonstration of the technologies. He said the project researchers requested for that part of his land that was the most affected by *Striga* to the project to set up a the trials in 2011. With the application of a combination of the new technologies, Mitende now gets more maize from this parcel of land than from the rest of his farm. He says that *Striga* has been dramatically decreasing on this piece of land. He notes that although the piece of land is about a quarter of an acre only, he has been able to repeatedly harvest four 90-kg bags of maize for the last two growing seasons. He usually harvests only one to two bags per acre from the rest of his farm. ‘My favorite *Striga* control technology is intercropping *Desmodium* with WS303. I will extend this technology to the rest of my farm,’ he says. WS303 is an IR maize variety being marketed by the Western Seed Company. *Desmodium*, a legume that is also fed to livestock, is intercropped with the maize to suppress the growth of *Striga* as part of the push-pull *Striga* management technology developed by the International Centre of Insect Physiology and Ecology (icipe) and partners. To ensure availability of *Desmodium* seeds, Mr Jimmy Pittchar, a Research Scientist with icipe, says the project has been working with community seed producers and partner seed companies who have produced and disseminated 3 tons of the seeds to farmers. More than 14,000 farmers have been trained on the push-pull technology, with 6,800 of them using it on their farms. Farmers who have adopted the push-pull technology have reported almost 100% reduction in *Striga* infestation and up to three-fold maize grain yield increases. ‘The *Striga* menace is expanding in the Lake Victoria basin of Western Kenya.
largely due to declining soil fertility and climate change, which has created a conducive environment for increased infestation. This has made the need for a sustainable solution very urgent,’ says Mr Pittchar. The Striga problem in the region is exacerbated by the new Maize Lethal Necrosis (MLN) virus disease, a combination of two virus diseases which is fast spreading in the area and has wiped out up to 100% of maize fields in Western Kenya, including many Striga technology demonstration and testing fields. ‘We need to develop integrated solutions to tackle both problems. CIMMYT and the Kenya Agricultural Research Institute (KARI) are currently screening hundreds of maize inbred lines from the genebank and other sources to help identify MLN-resistant sources to be used for resistant hybrid development. Some of these inbred lines could be used for Striga control work,’ says Ms Edna Mageto, a researcher with CIMMYT. Researchers from the Real IPM Company Ltd., a biopesticide company working in collaboration with IITA, the University of Hohenheim, and Kenya Agricultural Research Institute (KARI) in the ISMA project are also conducting field validation of the effectiveness of biocontrol technology against Striga in maize farms of western Kenya.

The successful Striga control technology models in Kenya will be scaled out to other countries in sub-Saharan Africa with similar ecologies and where Striga is also a major concern to maize, cowpea, sorghum, and millet production systems. ISMA is funded by the Bill & Melinda Gates Foundation and is being implemented in partnership with icipe, CIMMYT, African Agricultural Technology Foundation (AATF), BASF Crop Protection, and other national agricultural research and extension services and private sector players in Kenya and Nigeria.

For more information, please contact: Catherine Njuguna (c.njuguna@cgiar.org)

STOP PRESS!

**OROBANCHE CRENATA DESTROYING FABA BEAN IN UK**

Orobanche crenata has been previously recorded in UK but only at one site whose whereabouts has been kept secret because of its rarity! But it has now, very recently been reported by the Processors and Growers Organisation (PGRO), causing severe damage to faba bean at two sites, in Kent and in Norfolk. The source of the infestations has not been explained but is not thought to have involved recently imported seed. Perhaps *O. crenata* has been a little more widespread in UK than realised, having been confused with *O. minor*? More anon.

**THESIS**

**Distribution, Identification and Diversity of Orobanche spp. populations in Greece**

Dionyssia Lyra; PhD, Agricultural University of Athens, Faculty of Crop Science.

*Orobanche* spp. parasitize a considerable number of economically important crops such as tobacco, tomato, sunflower, legumes etc. in Greece. All *Orobanche* spp. are characterized as holoparasites, since they totally depend on their plant hosts for their survival and development.

Sixty five broomrape populations were collected throughout Greece parasitizing tobacco, tomato, faba bean, carrot and pea crops, with the aim to study the extent of morphological, genetic, physiological variability. Spatial heterogeneity was also studied for the sampling regions. 17 morphological characteristics were studied for the identification of collected broomrape samples, according to Flora Europaea and Flora d’ Italia taxonomic keys. The identified species were: *O. aegyptiaca*, *O. ramosa* and *O. crenata*.
However, some broomrape samples were characterized as intermediate forms of *O. aegyptiaca* and *O. ramosa* and named as ‘*O. ?*’ biotypes. Analysis of variance for morphological characteristics showed that *Orobanche* spp. differentiated even among and within surveyed areas. In all multivariate analyses conducted, broomrape populations were clearly distinct on the basis of flower morphological characteristics, while ‘*O. ?*’ biotypes were grouped between *O. aegyptiaca* and *O. ramosa* samples.

RAPD molecular markers were used for the study of genetic variability of *Orobanche* samples. Molecular analyses showed that *O. aegyptiaca* populations were characterized by higher differentiation compared to *O. ramosa* ones. In addition, high within-population variability was observed for *O. crenata* samples. It seems for ‘*O. ?*’ biotypes that they are interspecific hybrids between *O. aegyptiaca* and *O. ramosa* species and they are possibly products of continuous back-crosses. Host-plant seems to influence more the genetic variability for *O. crenata*, whereas geographical distance seems to have more impact on the other species. Physiological variability for *Orobanche* populations was investigated with germination and parasitism studies. Algit Super®, an aqueous solution of the alga *Ascophyllum nodosum*, and GR24, a stimulant-control, were evaluated for their efficacy to induce *O. aegyptiaca*, *O. ramosa* and *O. crenata* seeds’ germination at 18, 20 and 23°C. In most cases, *Orobanche* seeds responded in a greater extent to GR24 compared to Algit Super®. However, *O. aegyptiaca* and *O. ramosa* seeds responded much better to Algit Super® compared to *O. crenata* whose germination was very low. On the contrary, the radical of all broomrape species was longer after Algit Super® application compared to GR24. In addition, high variability was observed between and within *Orobanche* species. Moreover, *Orobanche* populations were studied for their efficacy to germinate and parasitize host-plant seedlings in vivo with plastic bag assays. Tomato and tobacco were the host-plants used for *O. aegyptiaca* and *O. ramosa* and faba bean was used for *O. crenata*. *O. ramosa* seeds germinated more compared to *O. aegyptiaca* seeds. The number of tubercles developed on the root system of tobacco and tomato was approximately the same for *O. aegyptiaca*, but *O. ramosa* formed more tubercles on tomato roots. *O. crenata* seeds did not develop any tubercle on faba bean roots. High interspecific variability was observed among all *Orobanche* populations.

The distribution and the infestation level of all *Orobanche* species for all infested crops in all surveyed regions were also studied. Global Position System (GPS) and Geographical Information System (GIS) were utilized in order to map these two parameters. Mapping gave a clear image of the variation in the infestation level among species and sampling areas. Furthermore, several soil and bioclimatic parameters of spatial heterogeneity were taken into account for the regions under study: soil structure, pH, organic matter, annual humidity index and degree days for the whole biological cycle of cultivated crops. Statistical analyses, which were conducted to trace any correlation between the aforementioned parameters and the level of infestation provoked by *O. aegyptiaca* and *O. ramosa*, showed that it was negatively correlated with pH, annual humidity index and positively with organic matter. As far as *O. crenata* is concerned, no correlation was observed.

From EWRS Newsletter April 2013

**Development of a decision support system (DSS) for Egyptian broomrape (*Phelipanche aegyptiaca*) management in carrot (*Daucus carota L.*)**

Amnon Cochavi, MSc, Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot 76100, Israel. Aplil, 2013. Supervisors: Hanan Eizenberg and Baruch Rubin.

Egyptian broomrape (*P. aegyptiaca*) and crenate broomrape (*Orobanche crenata*) are severe threats to agriculture in the Mediterranean area in many crops and vegetables. Carrot is sown in mid-July, and harvested in the late spring of the next year. Depending on the level of infestation, the potential damage of broomrapes in heavily infested fields may reduce carrot quality and yields, sometimes up to total yield loss. As a root parasite that can be effectively controlled only in the soil subsurface, the prediction of the parasitism dynamics in this phase is a key factor in the development of a smart decision support system (DSS) for a rational chemical control of *P. aegyptiaca* in carrot.

The main objective of this study was to develop a DSS for a rational broomrape management in carrot. The sub-objectives are: a) to develop a robust predicting model for the parasitism dynamics in the soil subsurface growth stages; b) to optimize a broomrape
control program based on the parasitism dynamics model; c) to integrate parasitism dynamics models and chemical control approaches into a robust DSS for a rational broomrape management. Fifteen field experiments were conducted in commercial carrot fields throughout Israel between 2010 and 2012, under various geographical and climatic conditions. The experiments employed a minirhizotron camera, which allows non-destructive in-situ subsurface observations of parasite development. At each location, four transparent tubes artificially inoculated with P. aegyptiaca seeds, were buried in soil. Observations for carrot root growth and P. aegyptiaca development were conducted once a week throughout the growing season. Soil surface temperature (top 10 cm) was recorded, and the measured temperature units were converted to thermal-time using several mathematical equations that included among other linear equation, parabolic equation or β-function. The latter function takes into consideration that parasitism dynamics in supra-optimal temperature ranges which in our case is completely inhibited and therefore the computed contribution of temperature to the parasitism dynamics is zero. Several models were tested for best predicting the parasitism dynamics and the specific parasitism stage of 1-2 mm size of broomrape attachments using appropriated statistical analysis. Fit of equations was evaluated by ANOVA of the regressions and root mean-square error (RMSE). Another set of experiments that were conducted under field and controlled conditions examined the broomrape control efficacy and the selectivity of carrots to glyphosate (‘Roundup’, 0.36 kg ae glyphosate L\(^{-1}\)), imazapic (‘Cadre’, 240 g ai imazapic L\(^{-1}\)) and imazamox (‘Pulsar’, 40 g ai imazamox L\(^{-1}\)) applied post-emergence.

The results indicate that temperature has the major effect on broomrape parasitism in carrot. The greatest parasitism rate was observed when carrot was grown under 28-22°C (D/N) temperature regime. The fact that temperature has a great impact on host-parasite relationship was used to develop a predicting model for the parasitism dynamics. The model was developed based on minirhizotron observations under field conditions and was supported by experiments that were conducted under controlled conditions.

For model development, data of temperature and calendar days were converted to growing degree days (GDD) using the β-function model and parasitism dynamics was obtained by the Weibull Equation. This equation allows predicting and analyzing the significance of the initial parasitism stage, (attachment size 1-2 mm) and the optimal stage for herbicide application. A first attachment was observed at 500 GDD while 63% from total attachments (a parameter that was extracted from Weibull Equation) appeared at 600 GDD and the maximum number of attachments appeared at 800 GDD. Glyphosate was found to be the safest and the most selective herbicide to carrot. Herbicide control efficacy over time revealed that glyphosate (0.072 kg ha\(^{-1}\)) effectively controlled Egyptian broomrape when applied at 600 to 800 GDD and excellent control was achieved 150-300 GDD after herbicide application. A protocol for a rational management strategy for broomrape control based on parasitism dynamics was developed. The protocol proposed the commercial application of three sequential treatments of glyphosate at 650, 800 and 950 GDD based on the β-function model. This protocol was evaluated under field conditions and found to be robust and effective for broomrape control in carrot.

From: EWRS Newsletter April 2013

NEW BOOKS


**Die Mistel in der Tumortherapie 3 – Aktueller Stand der Forschung und klinische Anwendung, 2013.** Edited by Rainer Scheer, Susanne Alban, Hans Becker, Wolfgang Blaschek, Fritz H. Kemper, Wolfgang Kreis, Harald Matthes, Heinz Schilcher, Rainer Stange. 502 Seiten mit zahlreichen farbigen Abbildungen ISBN 978-3-86864-032-8, Essen 2013, 39,00 Euro. The book’s main language is German. All abstracts and some contributions are in English. This meeting was reviewed in Haustorium 61 and the abstracts are available at http://www.sciencedirect.com/science/journal/09447113/18/supp/S1
OLD BOOK

Parasitic Weeds of the World; Biology and Control 1993 by Chris Parker and Charlie Riches. As there is some lingering demand for this volume, CAB International are planning to make it available on a ‘print-on-demand basis, from SeptemberOctober. This will be complete and unexpurgated – i.e. with all its original errors and misprints! We have been given no opportunity for any correction but we hope a sheet of ‘ERRATA’ might be available. The price is not yet fixed but will be of the order of £85.

MEETING REPORT


Contributions on parasitic weeds included the following:

Demirbas, S. et al. - Suicidal germination of some broomrape species under the influence of polymeric particles.

Yergin-Özkan and Tepe, I. - Germination physiology of Cuscuta approximate Bab. (alfalfa dodder).

Miryamchik, H. et al. – Studying the resistance mechanism of chickpea (Cicer arietinum) and tomato (Solanum esculentum) to field dodder (Cuscuta campestris).


Aly, R. – translocation of molecules and macromolecules from host plants to parasitic weed Phelipanche aegyptiaca.

Dikilitas, M. et al. – Effect of Fusarium oxysporum f. sp. menogena and its interaction with Orobanche ramosa on the disease development and growth parameters of eggplant.

Stępowska, A. et al. – The search for resistance to Phelipanche ramosa (L.) Pomel among different tomato cultivars.

Nemli, Y. et al. – Problem and management of broomrape (Phelipanche ramosa (L.) Pomel/P. aegyptiaca (Pers.) Pomel) in tomato greenhouses of Turkey.

Bastiaans, L. et al. – PARASITE – an integrated research programme on parasitic weeds of rice in sub-Saharan Africa.


Farhangfar, M. et al. – Possibility of Phelipanche aegyptiaca control in tomato by strains of Pseudomonas fluorescens.

Varga, I. et al. – Effective control methods against European mistletoe (Viscum album): biological control or herbicide treatment.

Aksoy, E. et al. – Significant outputs of national Orobanche project/Turkey.

(Availability of full set of abstracts uncertain, but I have copies of the above. Chris Parker)

FORTHCOMING MEETINGS

The Third Symposium on the Biology of Non-weedy Parasitic Plants will take place in Namur, Belgium on September 12-15 2013. The meeting will be hosted by the Université Catholique de Louvain. There could still be space for further participants. For further information see: http://botanika.prf.jcu.cz/hemiparasites/

Joint Workshop of the EWRS Working Groups ‘Novel and Sustainable Weed Management in Arid and Semi-arid Agroecosystems’ and ‘Weed Mapping’. 29 September – 03 October 2013 Mediterranean Agronomic Institute of Chania, Crete, Greece. Including session on parasitic weeds. For further information go to: http://confer.maich.gr/

Building a new research alliance to reclaim Faba bean production area abandoned to Orobanche. Rabat, Morocco, 7-9th October, 2013. Registration closed on 15th August, but for further information contact: orobanche2013rabat@gmail.com

COST meeting 2013: Strigolactones: biological roles and applications. Jerusalem, Dan Hotel, November 3-7, 2013. N.B. Deadline for registration is August 15 and for abstract submission September 15. For more information, please contact Dr. Einav Mayzlish Gati at: streamisrael2013@gmail.com
The XVI Congress on Molecular Plant-Microbe Interactions will be held July 6–10, 2014 in Rhodes Island, Greece at the Rodos Palace Hotel. No detailed programme as yet, but parasitic plants likely to be covered. To keep track, see:

XIV Congresso de la Sociedad Española de la Malherbologia (SEMH) 5-7 November 2013, Valencia, Spain. Coordinator: Dr. Dr.José Mª Osca (josca@prv.upv.es) Technical Secretariat Dr. Diego Gómez de Barreda, Dr. Nuria Pascual Technical University of Valencia, amino de Vera s / n 46022-Valencia, Spain. Email: 14congresosemh@upv.es Inernet: http://14congresosemh.webs.upv.es/

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see: http://www.parasiticplants.org/ (N.B. currently a little out of date)

For past and current issues of Haustorium see also:
http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see:
http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see:
http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see:
http://ppgp.huck.psu.edu/

For information on the EU COST 849 Project (now completed) and reports of its meetings see:
http://cost849.ba.cnr.it/

For information on the EWRS Working Group ‘Parasitic weeds’ see:
http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see:
http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes up to 1995, but apparently incomplete since then) see:
http://www.rmrs.nau.edu/mistletoe/

For information on future Mistel in derTumortherapie Symposia see:
http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see:
http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).

For the work of the Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)

For past and current issues of the Sandalwood Research Newsletter, see:

LITERATURE

• indicates web-site reference only

Abdul, K., Chemining’wa, G.N. and Onwonga, R.N. 2012. Relationships between agronomic practices, soil chemical characteristics and Striga reproduction in dryland areas of Tanzania. Journal of Agricultural Science and Technology A 2(10): 1134-1141. [A survey of Striga asiatica (not specified in paper) in relation to soil properties in the Morogoro and Dodoma districts indicated a strong positive correlation between K and Striga seed production, and a reduction of Striga with intercropping compared to sole cropping.]

Adam, I.Y.S. and Asma, E.A., 2012. Assessment of antihepatotoxic effect of Cuscuta californica against carbon tetrachloride induced liver damage in Wistar rats. Journal of Pharmacology and Toxicology 7(7): 322-329. [Although C. californica is traditionally regarded as having hepatoprotective effects, these were not confirmed in this study, while there were hepatotoxic effects.]


Agbo, M.O., Lai DaoWan, Okoye, F.B.C., Osadebe, P.O. and Proksch, P. 2013. Antioxidative polyphenols from Nigerian mistletoe Loranthus micranthus (Linn.) parasitizing on Hevea brasiliensis. Fitoterapia 86: 78-83. [Compounds isolated from L. micranthus (= Ileostylus micranthus).]


Adegboyega, A.M. and Odunola, O.O. 2012. The antihepatotoxic effect of Micranthus polyphenols from Nigerian mistletoe P.O. and Proksch, P. 2013. Antioxidative arthritis, pain, cancer, etc. treatment of diabetes mellitus, hypertension, presenting new results to support potential for use in Tapinanthus garlic or [Results suggest that pretreatment of rats with either garlic or V. album extracts reduced the elevated plasma levels of liver enzymes and clastogenicity induced by sodium arsenite in rats.]

**Cuscuta reflexa** acted as attractants to *B. brevicornis*, of potential to attract the parasitoid to the host plant.

Arruda, R., Lunardelli, C., Kitagawa, C., Caires, C.S., Teodor, G.S. and Mourão, F.A. 2013. Two mistletoes are too many? Interspecific occurrence of mistletoes on the same host tree. *Acta Botanica Brasica* 27(3): 226-230. [Recording various combinations of 2 or 3 of the following on a range of hosts - *Passovia ovata*, *P. stelis*, *Dendrophthora warmingii*, *Phoradendron mucronatum*, *Ph. tunaeforme*, *Ph. andersonii*, *Ph. apiciflorum*, *Ph. crassifolium*, *Ph. strongylloclados*, *Ph. affine*, *Ph. bathyoryctum*, *Psittacanthus acinarius* and *Ps. cordatus* and discussing the possible interactions.]

Arslan, Z.F., Aksoy, E. and Uygur, F.N. 2012. (Effect of solarization on weeds in greenhouse tomatoes and tomato yield in East Mediterranean region of Turkey.) (in Turkish) *Bitki Koruma Bülteni* 52(4): 349-366. [Solarization with clear plastic raised soil temperatures to 50°C daily over 8 weeks in a greenhouse and reduced *Phelipanche ramosa* by 97%.


Atewolara-Odule, O.C. and Aiyelaagbe, O.O. 2013. Antimicrobial properties and phytochemical studies of extracts of *Phragmanthera incana* (Schum) Balle [Loranthaceae] grown in Nigeria. *International Journal of Research in Chemistry and Environment (IJRCE)* 3(1): 203-207. [Confirming good activity from extracts of *P. incana* against a range of bacteria and fungi, supporting the traditional use of these locally in traditional medicine.]


Badu-Apraku, B., Yallou, C.G. and Oyekunle, M. 2013. Genetic gains from selection for high grain yield and *Striga* resistance in early maturing maize cultivars of three breeding periods under *Striga*-infested and *Striga*-free environments. *Field Crops Research* 147: 54-67. [Reviewing progress in breeding maize for resistance to *Striga hermonthica* over the past 3 decades.]

Baker, F., Hansen, M., Shaw, J.D., Mielke, M. and Shelstad, D. 2012. The incidence of dwarf mistletoe in Minnesota black spruce stands detected by operational inventories. *Northern Journal of Applied Forestry* 29(3): 109-112. [Unspecified dwarf mistletoe, presumably *Arceuthobium pusillum*, occurred in about 50% of the stands of *Picea mariana* surveyed, with about 20% of trees infested, estimated to be reducing timber yield by 14%.]


Bar-Sela, G., Wollner, M., Hammer, L., Agbarya, A., Dudnik, E. and Haim, N. 2013. Mistletoe as complementary treatment in patients with advanced non-small-cell lung cancer treated with carboplatin-based combinations: a randomised phase II study. *European Journal of Cancer* 49(5): 1058-1064. [The *Viscum album* product Iscador had no significant effect on quality of life or total adverse events but chemotherapy dose reductions, severe non-haematological side-effects and hospitalisations were less frequent in patients, warranting further...
invasion as a modifier of chemotherapy-related toxicity.]


Barbasz, A., Kreczmer, B., Rudolphi-Skórska, E., Sieprawaska, A. and Woźniac, D. 2012. Content of antioxidants in extracts of mistletoe (*Viscum album* L.), yew (*Taxus baccata* L.), pine (*Pinus sylvestris* L.) and fir (*Abies alba* Mill.). Herba Polonica 58(1): 27-36. [Noting a much higher content of non-enzymatic antioxidants such as ascorbic acid, glutathione or beta-carotene in the tissues of *V. album* compared to other plants analyzed.]

Barea, L P, and Watson, D.M. 2013. Trapped between popular fruit and preferred nest location - cafeterias are poor places to raise a family. Functional Ecology 27(3): 766-774. [Suggesting that the habit of the painted honeyeater *Grantiella picta* to nest near its main source of food, *Amyema quandang*, may be counter-productive due to interference by other species attracted to the mistletoe fruits.]


Bellot, S. and Renner, S.S. 2013. Pollination and mating systems of Apodanthaceae and the distribution of reproductive traits in parasitic angiosperms. American Journal of Botany 100(6): 1083-1094. [A report on fly floral visitors of *Pilostyles hausknetchitii* in Iran and *P. berthiananche* *aethiopica* in Zimbabwe. Also a review of parasitic plant reproductive systems showing that most are animal-pollinated and ca. 10% are dioecious.]


Bonabana-Wabbi, J. and Taylor, D.B.A 2012. A limited dependent variable analysis of Integrated Pest Management adoption in Uganda. Journal of Agricultural Science and Technology A 2(10): 1162-1174. [Studying the factors influencing uptake by farmers of IPM practices in sorghum, cowpea and groundnut, including (for *Striga hermonthica* in sorghum) intercropping with *Celosia argentea*, or *Desmodium sp.*, crop rotation, improved varieties, and fertilizer use. Concluding that economic factors, including labor availability, technology resource requirements, technology complexity, and the level of expected benefits are more important than social factors.]

Boublik, K. 2012. (Flora and vegetation of the Fabian Nature Reserve in the southwestern edge of the Českomoravská vřesovina hills.) (in Czech) Sborník Jihočeského Muzea v Českých Budejovicích,
Přírodní Vědy 52: 26-33. [Noting that Viscum album ssp. abietis is listed in the Red List for the Czech Republic.]

Boussim, I.J., Yonli, D., Guinko, S. and Salle, G. 2012. (State infestation, endogenous knowledge and systematic approach to the genus Striga in Burkina Faso.) (in French) International Journal of Biological and Chemical Sciences 5(4): 1374-1386. [Reporting on a survey indicating the occurrence of at least 13 species of Striga in Burkina Faso, including S. forbesii not previously reported. The most important agriculturally are S. hermonthica, S. gesnerioides and S. aspera. Only S. hermonthica is utilised in traditional medicine, and as a dye.]

Boussim, I.J., Yonli, D., Guinko, S. and Salle, G. 2011. (Prospects for an integrated control of Loranthaceae species parasitizing Vitellaria paradoxa C. F. Gaertn in Burkina Faso.) (in French) International Journal of Biological and Chemical Sciences 6(1): 355-364. [Describing useful control of Loranthaceae (probably Tapinanthus spp.) from a range of treatments including pruning and herbicide (glyphosate or 2,4-D). Also noting possible resistance in some accessions of V. paradoxa and the potential for biocontrol by some insects or birds.]

Braukmann, T., Kuzmina, M. and Stefanovic, S. 2013. Plastid genome evolution across the genus Cuscuta (Convolvulaceae): two clades within subgenus Grammica exhibit extensive gene loss. Journal of Experimental Botany 64(4): 977-989. [All major plastome genes were examined using hybridization methods in 56% of the 200 species of Cuscuta. Clades ‘O’ and ‘K’ within subgenus Grammica exhibit more plastid gene loss relative to other members of Cuscuta making these good candidates for whole plastome sequencing.]

Builders, M.I., Uguru, M.O. and Aguiyi, C. 2012. Antiplasmodial potential of the African mistletoe: Agelanthus dodoneifolius Pohl and Wiens. Indian Journal of Pharmaceutical Sciences 74(3): 223-229. [Results suggest that extracts of A. dodoneifolius (= Tapinanthus dodoneifolius) may be active in the treatment of malaria, supporting further studies of its active components.]


Christov, M. 2012. Contribution of interspecific hybridization to sunflower breeding. Helia 35(57): 37-45. [Reviewing the use of hybridisation with wild Helianthus spp. in the course of developing varieties for a range of purposes including resistance to Orobanche cumana.]


Cui ZhanHu, Guo ZhiQin, Miao JianHua, Wang ZhenWang, Li QianQuan, Chai XingYun and Li MinHui. 2013. The genus Cynomorium in China: an ethnopharmacological and phytochemical review. Journal of Ethnopharmacology 147(1): 1-15. [A, comprehensive review of C. songaricum and C. coccineum and their widespread uses in traditional medicine for e.g. impotence, premature ejaculation, kidney-yang deficiency, spermatorrhea, colic, and stomach ulcers, also as health foods, tea, and cosmetics. The active ingredients and potential for further uses as anti-fatigue, anti-hypoxia, anti-oxidationanti-diabetic, immune system modulating, and antiviral agents are also discussed.]

*Christov, M. 2012. Contribution of interspecific hybridization to sunflower breeding. Helia 35(57): 37-45. [Reviewing the use of hybridisation with wild Helianthus spp. in the course of developing varieties for a range of purposes including resistance to Orobanche cumana.]


Cui ZhanHu, Guo ZhiQin, Miao JianHua, Wang ZhenWang, Li QianQuan, Chai XingYun and Li MinHui. 2013. The genus Cynomorium in China: an ethnopharmacological and phytochemical review. Journal of Ethnopharmacology 147(1): 1-15. [A, comprehensive review of C. songaricum and C. coccineum and their widespread uses in traditional medicine for e.g. impotence, premature ejaculation, kidney-yang deficiency, spermatorrhea, colic, and stomach ulcers, also as health foods, tea, and cosmetics. The active ingredients and potential for further uses as anti-fatigue, anti-hypoxia, anti-oxidationanti-diabetic, immune system modulating, and antiviral agents are also discussed.]

*Christov, M. 2012. Contribution of interspecific hybridization to sunflower breeding. Helia 35(57): 37-45. [Reviewing the use of hybridisation with wild Helianthus spp. in the course of developing varieties for a range of purposes including resistance to Orobanche cumana.]


de Vega, C. and Herrera, C.M. 2013. Microorganisms transported by ants induce changes in floral nectar composition of an ant-pollinated plant. American Journal of Botany 100(4): 792-800. [Ants pollinating Cyttinus hypocistus carry yeast fungi which modify the balance of sugars in the plant’s nectar, increasing fructose and glucose and reducing sucrose. Not clear if this favours the ants or not.]


Depe Mathew and Habeeburrahman, P.V. 2013. Base banding technique for the management of mistletoes (Loranthus falcatus L. f. and L. utui Molina) from perennial fruit trees. Archives of Phytopathology and Plant Protection 46(1): 29-38. [Proposing control of L. falcatus (= Dendrophthoe falcata and L. utui (= Tristerix corymbosus) by the use of 2,4-D soaked bands around the trunk after removing outer bark. Sprays with 1% ethephon or 60% diesel are also effective, but costly.]

Deforce, K., Bastiaens, J., van Neer, W., Ervynck, A., Lentacker, A., Sergant, J. and Crombé, P. 2013. Wood charcoal and seeds as indicators for animal husbandry in a wetland site during the late mesolithic-early neolithic transition period (Swifterbant culture, ca. 4600-4000 B.C.) in NW Belgium. Vegetation History and Archaeobotany 22(1): 51-60. [Finding high numbers of Viscum album charcoal fragments, suggesting use as leaf fodder and evidence for animal husbandry.]


Dettke, G.A. and Waechter, J.L.. 2012. Struthanthus martianus, a replacement name for the illegitimate Struthanthus vulgaris Mart. ex Eichler (Loranthaceae). Phytotaxa 57: 6-9. [A herbarium specimen represents only the third new record for Argentina. Darwiniana 50: 148-153. (http://www.redalyc.org/articulo.oa?id=66923967010) [A herbarium specimen represents only the third example of P. rusbyi to be seen (the others from Peru and Bolivia) and the first with staminate...
flowers which confirm its inclusion in *Phoradendron*. It is a leafless hyperparasite on *P. bathoryctrum.*

Dibong, S.D. and 10 others. 2010. (Should eradicate Loranthaceae on woody fruits marketed in the coastal region of Cameroon?) (in French) International Journal of Biological and Chemical Sciences 4: 3pp. [Noting the occurrence of *Phragmanthera capitata* (‘generalist’) and *Tapinanthus ogowensis* (‘specialist’) in Cameroon and questioning the desirability of their eradication, given their importance in traditional medicine.]


Dibong, S.D., Obiang, N.L.E., Din, N., Taffouo, V., Fankem, H., Salle, G. and Ako, A. 2009. (Level of infestation on plant fruit trees by *Phragmanthera capitata* (Loranthaceae) in the coastal region of Cameroon.) (in French) International Journal of Biological and Chemical Sciences 3: 2 pp. [Survey confirms *P. capitata* as the commonest and most damaging mistletoe in the region, occurring on 16 species in 10 families, including rubber and *Cola acuminata.*]

Dibong, S., Taffouo, D.V., Boussim, J.I. and Akoa, A. 2012. Effects of host specificity in parasitic Loranthaceae for sodium and potassium distribution in coastal region of Cameroon. International Journal of Botany 8(3): 159-164. [Recording differences in distribution of Na and K in generalist Loranthaceae *Phragmanthera capitata,* and its hosts *Citrus maxima* *Psidium guajava* and *Theobroma cacao,* compared to that in the specialist *Tapinanthus ogowensis* and its host *Dacryodes edulis.* And suggesting potential for the use of these differences in predicting host range of other mistletoes.]

Ding Bo, Dai Yi, Hou YunLong, Wu XiaoMeng, Chen Xue and Yao Xinguang. 2013. Four new heme-trepeneoid derivatives from *Taxillus chinensis*. Fitoterapia 86: 1-5.

Dong LiNa, Wang Hong, Wortley AH, Lu Lu and Li DeZhu. 2013. Phylogenetic relationships in the *Pterygiella* complex (Orobanchaceae) inferred from molecular and morphological evidence. Botanical Journal of the Linnean Society 171(3): 491-507. [This molecular phylogenetic study of the *Pterygiella* complex (*Pterygiella*, *Phtheirospermum*, *Pseudobartsia* and *Xizangia*) used ITS and plastid regions. See McNeal et al. (2013) who suggest placing some *Phtheirospermum* in *Pterygiella.*]


Eizenberg, H., Herschenhorn, J., Achdari, G. and Ephrath, J.E. 2012. A thermal time model for predicting parasitism of *Orobanche cumana* in irrigated sunflower-field validation. Field Crops Research 137: 49-55. [Reporting on a 5-year field study to refine the model previously described, by inclusion of allowance for a ‘lag phase.’]

El-Metwally, I.M., El-Shahawy, T.A. and Ahmed, M.A. 2013. Effect of sowing dates and some broomrape control treatments on faba bean growth and yield. Journal of Applied Sciences Research 9(1): 197-204. [Delayed sowing reduced infestation of faba bean by *O. crenata* but yields were higher with November planting than October or December. These yields were further significantly enhanced by 3 applications of glyphosate or imazapic.]


three ‘house-keeping’ genes, *UBQ1, PP2A* and *TUB1* which provide the best normalization for gene expression throughout the life cycle of *S. hermonthica*. These should facilitate descriptions of parasite gene expression patterns.

*Fernández-Aparicio, M., Rubiales, D., Bandaranayake, P.C.G., Yoder, J.I. and Westwood, J.H. 2011. Transformation and regeneration of the holoparasitic plant *Phelipanche aegyptiaca*. Plant Methods 7: 36 pp. [Using transformed calli of *P. aegyptiaca*, tomato plants were infected and after eight months the parasite formed haustoria. This is the first report of the transformation and subsequent regeneration of a holoparasite]  


Flematti, G.R., Waters, M.T., Scaffidi, A., Merritt, D.J., Ghisalberti, E.L., Dixon, K.W. and Smith, S.M. 2013. Karrikin and cyanohydrin smoke signals provide clues to new endogenous plant signalling molecules. Molecular Plant 6(1): 29-37. [Discussing karrikins and the ways in which they differ from strigolactones. Also noting the existence of cyanohydrins which release germination-stimulating cyanide upon hydrolysis, though no indication that these would be active on *Striga* etc.]  

Friedman, C.R., Ross, B.N. and Martens, G.D. 2013. An antibody against a conserved C-terminal consensus motif from plant alternative oxidase (AOX) isoforms 1 and 2 label plastids in the explosive dwarf mistletoe (*Arceuthobium americanum*, Santalaceae) fruit exocarp. Protoplasma 250(1): 317-323. [Concluding that plastid terminal oxidases (PTOX) in plastids may be involved in fruit ripening in *A. americanum*, although a role for PTOX in thermogenesis cannot be eliminated.]  


Gao Lei, Xie YuQi, Wang XingHua and Li Yin 2010. Extraction technology of eight botanical pesticides and their antifungal activities on fungus. Plant Diseases and Pests 1(6): 54-57. [Extracts of cinnamon and clove proved active against the ‘pathogens’ *Fusarium oxysporum* and *Cistanche deserticola*.]  


Ghazanfari, T. Naseri, M., Shams, J. and Rahmati, B. 2013. Cytotoxic effects of *Cuscuta* extract on human cancer cell lines. Food and Agricultural Immunology 24(1): 87-94. [Presenting preliminary evidence for cytotoxic effects of an extract of (unspecified) *Cuscuta* sp. on SK-MEL-3 and Raji cell lines.]

González, M., López, S., Mullens, B.A., Baldet, T. and Goldarazena, A. 2013. A survey of *Culicoides* developmental sites on a farm in northern Spain, with a brief review of immature habitats of European species. Veterinary Parasitology 191(1/2): 81-93. [A survey of *Culicoides* spp. vectors of the blue-tongue virus showed an association of larvae with soil litter that included *Lathraea clandestina* and *C. lupicaris* with soil litter that included *Lathraea clandestina*.]

Goulson, D., Park, K.J., Tinsley, M.C., Bussière, L.F. and Vallejo-Marin, M. 2013. Social learning drives handedness in nectar-robbing bumblebees. Behavioral Ecology and Sociobiology 67(7): 1141-1150. [*Rhinanthis minor* may be robbed of nectar by bumblebees cutting holes in either right or left of the corolla tube. This study shows that patches of *R. minor* tended to be raided all from one side, whether by *Bomus wurflenii* or by *B. lucorum*, suggesting a tendency for learning and copying among the local bee community.]

Grewell, B.J., Espeland, E.K. and Fiedler, P.L. 2013. Sea change under climate change: case studies in rare plant conservation from the dynamic San Francisco Estuary. Botany 91(5): 309-318. [Describing efforts to conserve and increase the population of the facultative hemiparasite *Chloropyron molle* (= *Cordylanthus mollis*). Concluding that assisted colonization may sustain populations threatened by sea level rise, but only if a strong commitment to effective stewardship is realized.]


Guimarães, A.C., Siani, A.C., Bezerra, J.L., de Souza, A.Q.L. and Sarquis, M.I.M. 2103. Endophytic mycobiota characterization of the amazonian mistletoe *Cladocolea micrantha* hosted in cashew tree. American Journal of Plant Sciences 4(4): 917-921. [Eight fungal endophytes isolated from *C. micrantha* growing on cashew, including *Guignardia mangiferae* and strains of *Myelia sterilia*.]

Habak, H. Ahmad, M., and El-Rahban, B. 2012. (Distribution and effectiveness of *Phytomyza orobanchia* Kalt. in tomato fields infested with *Orobanche ramosa* L. along the coastal region of Syria.) (in Arabic) Arab Journal of Plant Protection 30(2): 255-260. [Recording extensive occurrence of *P. orobanchia* and significant reductions in seed production in *P. phelipanche*.]


Hassannejad, S. and Ghafarbi, S.P. 2013. Allelopathic effects of some Lamiaceae on seed germination and seedling growth of dodder (*Cuscuta campestris* Yunck.). International Journal of Biosciences (IJB) 3(3): 9-14. [Lavender the most inhibitory of a range of herbal plants in inhibiting germination of *C. campestris* but dosages probably unrealistic.]


Hemissi, I., Mabrouk, Y., Abdi, N., Bouraoui, M., Saidi, M. and Sifi, B. 2013. Growth promotion and derived phytochemicals could be potential candidates as new hypouricemic agents. S. album


Höniges, A., Ardelean, A., Xi XiaoNan, Yoneyama, K., Yoneyama, K. and Wegmann, K. 2012. Towards understanding Orobanche host-specificity. Romanian Agricultural Research 29: 313-322. [Comparing the strigolactone complex in the root exudates of Cirsium vulgaris and Carduus personata (host of O. reticulate), Centaurea scabiosa (host of O. elatior), Hedera helix (host of O. hederae and Galium verum (host of O. caryophyllacea). and finding orobanchol in all, but other components, epi-orobanchol, orobanchyl-acetate, fabacyl acetate and didehydro-orobanchol isomers varying in each case. Discussing the likelihood that these variations may contribute to host specificity.]


Houston, K. and Wolff, K. 2012. Rhinanthus minor population genetic structure and subspecies:
potential seed sources of a keystone species in grassland restoration projects. Perspectives in Plant Ecology, Evolution and Systematics 14(6): 423-433. [Identifying moderate levels of genetic differentiation between R. minor populations within the UK. In addition, R. minor individuals from the UK appear to be distinct from R. minor and Rhinanthus angustifolius individuals from other European countries based on microsatellite genotyping and DNA sequencing of cpDNA and rDNA ITS.]

Hrytsyna, M.R. 2013. (Position of the family Scrophulariaceae from Ukrainian flora in APG system.) (in Russian) Modern Phytomorphology 4: 363-365. [This paper apparently converts the Ukrainian flora familial classification of genera from the old concept of Scrophulariaceae to the modern concept composed now of Scrophulariaceae, Veronicaceae, Orobanchaceae.]

Huang Wen, Wu ShiBiao, Wang YeLing, Guo ZhiYong and Kennedy, E.J. 2013. Chemical constituents from Striga asiatica and its chemotaxonomic study. Biochemical Systematics and Ecology 48: 100-106. [Six flavonoids, diosmetin, apigenin, luteolin, chrysoeriol, apigenin-7-O-glucuronide and acacetin, two caffeic acid sugar esters, verbascoside and isoverbascoside, as well as one norsesquiterpene, blumenol A were isolated or detected in extracts of S. asiatica.]


Isah, K.M., Niranjan Kumar, Lagoke, S.T.O. and Atayese, M.O. 2013. Management of Striga hermonthica on sorghum (Sorghum bicolor) using arbuscular mycorrhizal fungi (Glomus mosae) and NPK fertilizer levels. Pakistan Journal of Biological Sciences 16(22): 1563-1568. [Pot experiments confirmed that the mycorrhizal fungus reduced the impact of S. hermonthica on the crop, but NPK had an even greater benefit.]

Ishiaku, M F and Aliyu, H. 2013. Field evaluation of cowpea genotypes for drought tolerance and Striga resistance in the dry savanna of the North-West Nigeria. Journal of Plant Breeding and Genetics 7(1): 47-56. [Among 22 local cowpea varieties tested only IAR-07-1050 proved resistant to Striga gesnerioides and this was susceptible to drought.]

Jamil, M., van Mourik, T.A., Charnikhova, T. and Bouwmeester, H.J. 2013. Effect of diammonium phosphate application on strigolactone production and Striga hermonthica infection in three sorghum cultivars. Weed Research (Oxford) 53(2): 121-130. [Confirming the effectiveness of P in the form of diammonium phosphate, in pots and in the field, successfully reducing exudation of sorgomol and 5-deoxystrigol and hence infestation by S. hermonthica and increasing sorghum yield. Promoting the use of ‘microdosing’ with DAP as part of an integrated control programme.]

*Janssen, B.J. and Snowden, K.C. 2012. Strigolactone and karrikin signal perception: receptors, enzymes, or both? Frontiers in Plant Science 28 December 2012 (doi: 10.3389/fpls.2012.00296) [The signal transduction pathways for both SLs and karrikins require the same F-box protein (MAX2) but a different but closely related α/β hydrolase fold protein: DAD2 and KAI2, respectively. The crystal structure of DAD2 has been solved revealing an α/β hydrolase fold protein with an internal cavity capable of accommodating SLs. Results suggest a model for binding that requires nucleophilic attack by the active site serine of the hydrolase at the carbonyl atom of the butenolide ring.]


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Jiang, L.J. Qu, F., Li ZhaoHu and Doohan, D. 2013. Inter-species protein trafficking endows dodder (*Cuscuta pentagona*) with a host-specific herbicide-tolerant trait. New Phytologist 198(4): 1017-1022. [Confirming that *C. pentagona* parasitizing a soybean variety with resistance to the herbicide glufosinate acquired the same resistance.]


Kabambe, V.H., Tembo, Y.L.B. and Kazira, E. 2013. Awareness of the parasitic weed *Alectra vogelii* (Benth.) amongst extension officers in three districts in Malawi. American Journal of Experimental Agriculture 3(2): 432-442. [*A. vogelii* has been reported in Lilongwe and Kasungu plains and parts of the southern region. This survey found that less than 40% of extension personnel were aware of *A. vogelii*, as against 91% familiar with *Striga asiatica*. Suggesting the need for dissemination of information via meetings.]

Kacan, K. and Tursun, N. 2012. Effect of planting time and tomato varieties on broomrape (*Phelipanche aegyptiaca*) emergence and tomato yield in western Turkey. Research on Crops 13(3): 1070-1077. [Trials over 3 years showed increasing infestation by *P. ramosa* with repeated cropping in successive years. Best yields and least *P. ramosa* was obtained with early planting and with certain varieties, not specified in the abstract.]

Kamara, A.Y., Ewansiha, S.U., Menkir, A. and Tofa, A.I. 2012. Agronomic response of drought-tolerant and *Striga*-resistant maize cultivars to nitrogen fertilization in the Nigerian Guinea savannas. Maydica 57(2): 114-120. [Results support the idea that maize bred for tolerance to drought and resistance to *Striga hermonthica* does well under conditions of low N. Two cultivars (DT STR SYN-W/IWD C3 SYN and IWD C3 SYN/DT-SYN-1-W) performed particularly well and deserve further demonstration and release.]

Karamoko, O., Tiegbe, K., Dodehe, Y. and Adama, C. 2013. Antifungal activity of the aqueous and ethanolic extracts of *Thomningia sanguinea* Vahl (Balanophoraceae). Journal of Drug Delivery and Therapeutics 3(1): 29-32. [Extracts of *T. sanguinea* are used in West Africa to treat dermatitis, diarrhea and asthma. These traditional uses are supported by evidence for antifungal activity on *Candida albicans* and *C. neoformans*.


Katsarou, A., Rhizopoulou, S. and Kefalas, P. 2012. Antioxidant potential of the aerial tissues of the mistletoe *Loranthus europaeus* Jacq. Records of Natural Products 6(4): 394-397. [Extracts of twigs and stems of *L. europaeus* growing on *Quercus* spp. in Greece exhibited higher antioxidant activity than those of fruits, leaves and flowers.]

Kavita Salkar, Ashish Suthar, VijaySingh Chauhan and Vinayak Naik 2013, Anti-MRSA activity of few Indian medicinal plants. Asian Journal of Biological and Life Sciences 2(1): 73-78. [*Fiscum articulatum* not among species found to have activity.]


Identifying some components of *P. sibthorpii*, used medicinally in Iran.

Khwaja Salahuddin, Gor Suresh, Visavadia Manish, Soni Virendra and Tatmia Nalin. 2013. Ethnobotanical survey of some parasitic plants growing in Girnar forest of Junagadh district of Gujarat, India. International Research Journal of Biological Sciences 2(4): 59-62. [Covering *Dendrophthoe falcata* (commonly on Mangifera indica), *Diospyros melanoxylon* and *Ziziphus jujube*]. Cistanche tubulosa (on *Salvadora oleoides*, *Argemone mexicana*), *Viscum articulatum* (on *S. oleoides*, *A. mexicana*). Cuscuta reflexa (on *Cassia fistula*, *Caesalpinia pulcherima* and *Acacia nilotica*) and ‘C. chinesis’ (on *Ziziphus nummularia*, *A. nilotica* and *C. fistula*). But doubts on identity of ‘*C. chinesis*’ described as having ‘thick, green leaves’, ‘large flowers’ ‘thick style’ - suggesting *?Cassytha?*.]

Kifuko-Koech, M., Pypers, P., Okalebo, J.R, Othieno, C.O., Khan, Z.R., Pickett, J.A., Kipkoech, A.K. and Vanlauwe, B. 2012. The impact of *Desmodium* spp. and cutting regimes on the agronomic and economic performance of *Desmodium*-maize intercropping system in western Kenya. Field Crops Research 137(9): 97-107. [Demonstrating that, with adequate P fertilization, intercropping with *Desmodium* spp. supplied N to substitute for urea, but only after several seasons. In spite of higher labour costs this would be economic in the long run, in addition to the reduction of *Striga hermonthica*. *D. intortum* provided higher fodder yield than *D. uncinatum* but slightly lower maize yield. Times of cutting for forage did not have significant influence.]

Kisugi, T., Xie XiaoNan, Kim Hyunn, Yoneyama, K., Sado, A., Akiyama, K., Hayashi, H., Uchida, K., Yokota, T., Nomura, T. and Yoneyama, K. 2013. Strigone, isolation and identification as a natural strigolactone from *Houttuynia cordata*. Phytochemistry 87: 60-64. [Confirming the structure of strigone and its 4 isomers, differing in their activity as germination stimulants. (+)-strigone was highly active on *Striga hermonthica* and on *Phelipanche ramosa* but less so on *Orobanche minor*. *H. cordata* also exuded strigol, sorgomol and 5-deoxystroigol.]

Kokubugata, G. and Yokota, M. 2012. Host specificity of *Cassytha filiformis* and *C. pergracilis* (Lauraceae) in the Ryukyu Archipelago. Bulletin of the National Museum of Nature and Science. Series B, Botany 38(2): 47-53. [*C. filiformis* has at least 24 host species in this area. But the endemic *C. pergracilis* has only two - *Aristida takeoi* (Poaceae) and *Rhynchospora rubra* (Cyperaceae) - helping to explain its relative rarity.]

Kołodziejek, J., Patykowski, J. and Kołodziejek, R. 2013. Distribution, frequency and host patterns of European mistletoe (*Viscum album* subsp. *album*) in the major city of Lodz, Poland. Biologia (Bratislava) 68(1): 55-64. [*V. album* ssp. *album* recorded on 28 tree species, but mainly on *Acer saccharum*, *Populus x canadensis* and *Robinia pseudoacacia*. Also recording observations on the abundance on *A. saccharum* in relation to tree size and nitrogen level.]

Kotan, R., Okutucu, A., Gómez, A.A., Karagöz, K., Dadasoglu, F., Karaman, İ., Hasanekoglu, İ. and Kordali, S. 2013. Parasitic bacteria and fungi on common mistletoe (*Viscum album* L.), and their potential application in biocontrol. Journal of Phytopathology 161(3): 165-171. [Assessing a wide range of bacteria and fungi collected from *V. album* in Turkey. Several bacteria showed activity when injected but not when sprayed on *V. album*. A number of fungi were active when sprayed on among which *Alternaria alternata* and *Acremonium kiliense* had highest activity.]

Koutakou, S.K., Toure, A., Ouattara, K. and N’Guessan, J.D. 2010. (Anticoccidial activity in vivo aqueous extracts of *Thonningia sanguinea* (Balanophoraceae) in laying hens.) (in French) International Journal of Biological and Chemical Sciences 4(4). [Recording beneficial results from *T. sanguinea* extracts in the treatment of coccidiosis caused by *Eimeria* spp.] Koutecký, P., Tuleu, G., Bad'urová, T., Košnar, J., Štech, M. and Tešitel, J. 2012. Distribution of cytotypes and seasonal variation in the *Odontites vernus* group in central Europe. Preslia 84(4): 887-904. [Confirming the existence of a widespread diploid (2n=2x=18) with a high but variable number of internodes and an early-flowering tetraploid (2n=4x=40) with a low number of internodes occurring on fallows or as an agricultural weed. Also a distinctly late-flowering tetraploid (2n=4x=40) that has the highest number of internodes of all the three types.]

Kuijt, J. 2013. Prophylly, calyculus, and perianth in *Santalales*. Blumea 57: 248–252. [The concept put forward by Wannitopr & Ronse De Craene (2009) (see Haustorium 57) that the calyculus is a fusion of prophylls was challenged whereas the traditional
concept that it is a reduced calyx was supported. The view that the corolla in Loranthaceae is biseriate was also rejected.


Lati, R., Aly, R., Eizenberg, H. and Lande, T. 2013. The view that the corolla in Loranthaceae is concept that it is a reduced calyx was supported. The view that the corolla in Loranthaceae is biseriate was also rejected.


Lee KeunPyo and Lee DaeWon. 2013. Defense response of resistant host Impatiens balsamina to the parasitic angiosperm Cuscuta japonica. Journal of Plant Biology (New York) 56(3): 138-144. [Results suggested that in the tissues of I. balsamina penetrated by the C. japonica, the formation of secondary tissue and swellings caused by active cell division of ground tissue and host vessel occlusion by tyloses constitute the host structural defense against the parasite.]


Lee RuiJuan, Yang GuanE, Bai HongJuan, Zhang Qiong, Li JianKuan, Li QingShan and Zhang ZhaoMing. 2012. A new flavonoid glycoside from mistletoe Micrantha micrantha, the remaining residue – including seeds of other tree, shrub and grass species.]

Li Fei, Yang Xiaolin, Yang YaNan, Guo ChangRun, Zhang ChunFeng, Yang ZhongLin and Li Ping. 2013. Antiosteoporotic activity of echinacoside in ovarietomized rats. Phytomedicine 20(6): 549-557. [Reporting a ‘remarkable antiosteoporotic activity’ and suggesting that this extract from Cistnache tubulosa may be a promising candidate for treatment of postmenopausal osteoporosis induced by oestrogen deficiency.]

Li Fei, Yang YaNan, Zhu PanPan, Chen WeiNa, Qi DongLi, Shi Xiupu, Zhang ChunFeng, Yang ZhongLin and Li Ping. 2012. Echinacoside promotes bone regeneration by increasing OP/G/RANKL ratio in MC3T3-E1 cells. Fitoterapia 83(8): 1443-1450. [Presenting strong evidence for the potential of echinacoside, derived from Cistnache tubulosa in treatment of osteoporosis.]

Li FengLan, Li MingGuang, Zan QiJie, Guo Qiang, Li Fei, Yang XiaoLin, Yang YaNan, Yang YaNan, Guo ChangRun, Zhang ChunFeng, Yang ZhongLin and Li Ping. 2012. A new flavonoid glycoside from mistletoe Micrantha micrantha (Loranthaceae). Biochemical Systematics and Ecology 48: 215-218. [S. marginatus was growing on a Vernonia sp. and S. concinnus was on Morus alba.]
Chemistry of Natural Compounds 48(5): 761-764. [From Viscum album.]

Li Xi, Zhang TiCao, Qiao Qin, Ren ZhuMei, Zhao JiaYuan, Yonezawa, T., Hasegawa, M., Crabbe, M.J.C., Li JianQiang and Zhong Yang. 2013. Complete chloroplast genome sequence of holoparasite Cistanche deserticola (Orobanchaceae) reveals gene loss and horizontal gene transfer from its host Haloxylon ammodendron (Chenopodiaceae). PLoS ONE 8: 3pp. e58747. (http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0058747) [C. deserticola retains almost a full set of tRNA genes, and has lower dN/dS for most genes than e.g. Epipagus virginiana, suggesting that C. deserticola has undergone fewer losses, either due to a reduced level of holoparasitism, or to a recent switch to this life history. Also noting that the rpoC2 gene was present in two copies, one being a homolog of the host plant, H. ammodendron.]

Li Xi, Zhu Ming, Sun YanXia, Zhong Yang and Li JianQiang. 2012. (Systematic position of Cistanche (Orobanchaceae) based on cpDNA rps16 and ncDNA ITS sequences.) (in Chinese) Plant Science Journal 30(5): 431-436. [This phylogenetic analysis of ITS and chloroplast regions showed that Cistanche is in a clade with Orobanche and Boschniakia.]

Liang HaiDong, Yu Fang, Tong ZhiHong, Zhang HongQuan and Liang Wu. 2013. Cistanches Herba aqueous extract affecting serum BGP and TRAP and bone marrow Smad1 mRNA, Smad5 mRNA, TGF-β1 mRNA and TIEG1 mRNA expression levels in osteoporosis disease. Molecular Biology Reports 40(2): 757-763.

Liu GuangDa, Chen GuiLin, Li Wei and Li ChunXing. 2013. Genetic and phytochemical diversities of Cynomorium songaricum Rupr. in Northwest China indicated by ISSR markers and HPLC-fingerprinting. Biochemical Systematics and Ecology 48: 34-41. [The main host of C. songaricum is noted to be the desert species Nitraria tangutorum.]

Liu HsinPing, Chang RongFu, Wu YihShyuan, Lin WeiYong and Tsai FuuJen. 2012. The Yang-Tonifying herbal medicine Cynomorium songaricum extends lifespan and delays aging in Drosophila. Evidence-based Complementary and Alternative Medicine 2012: Article ID 735481. (http://www.hindawi.com/journals/ecam/2012/735481/) [C. songaricum is traditionally used to improve sexual function and treat kidney dysfunction in traditional Chinese medicine. Here it was shown to have anti-ageing effects on Drosophila flies as well as improving mating readiness and fecundity, and suppressing age-related learning impairment in aged flies.]
substitute for *Viscum album*. Morolic acid the major component.

López-Ortega, M., Pérez-Rodríguez, P., Rojas, J.C., Hernández, R.M.S., López-Mata, L. and Rico-Gray, V. 2013. Host use and resource sharing by fruit/seed-infesting insects on *Schoepfia schreberi* (Olacaceae). Environmental Entomology 42(2): 231-239. [Discussing the interactions between the dipteran fruit fly *Anastrepha spatulata* and two moths, the gelechiid *Coleotechnites* sp. and an unidentified tortricid on the substantial reduction in seed production in fruits of *S. schreberi*. *A. spatulata* was the more important.]


*Louarn, J., Carbonne, F., Delavault, P., Bécard, G. and Rochange, S. 2012. Reduced germination of *Orobanche cumana* seeds in the presence of arbuscular mycorrhizal fungi or their exudates. PLoS ONE 7(11): e49273. (http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0049273) [Reduction of germination of *O. cumana* is apparently not only due to reduced stimulant exudation, but also perhaps to some more direct influence of the fungus, *Rhizophagus irregularis* (= *Glomus intraradices*).]

Lu, J.K., Kang, L.H., Sprent, J.I., Xu, D.P. and He, X.H. 2013. Two-way transfer of nitrogen between *Dalbergia odorifera* and its hemiparasite *Santalum album* is enhanced when the host is effectively nodulated and fixing nitrogen. Tree Physiology 33(5): 464-474. [Investigating the transfer of N from *D. odorifera* to *S. album* in the presence and absence of nodulation. Not clear what is meant by ‘two-way transfer’.]

*Luo YaHuang and Zhang Ling 2013. Germination characteristics of *Dendrophthoe pentandra* seeds. Plant Diversity and Resources 35(1): 73-80. [Germination of *D. pentandra* was optimal at 20°C and required light. Germination percentage was increased by passage through the main bird disperser, *Dicaeum concolor*.]


McNeal, J.R., Bennett, J.R., Wolfe, A.D. and Mathews, S. 2013. Phylogeny and origins of holoparasitism in Orobanchaceae. American Journal of Botany 100(5): 971-983. [The most complete molecular phylogeny of Orobanchaceae to date in terms of sampling taxa and genes. Strong support was obtained for relationships for six major clades: *Lindenbergia*, *Cymbarieae*, *Orobanchaeae*, *Pediculariaeae*, *Rhinantheae*, and *Buchneraeae*. In contrast to previous studies, the genus *Orobanche* appears to be monophyletic.]


Magrach, A., Santamaria, L. and Larrinaga, A.R. 2013. Forest edges show contrasting effects on an austral mistletoe due to differences in pollination and seed dispersal. Journal of Ecology (Oxford) 101(3): 713-721. [Concluding that preserving relatively large patches of old-growth forest with low perimeter/area ratios would be key to the habitat requirements of the main disperser and humming bird pollinator and thus for reproductive performance of *Tristerix corymbosus*.]


Martin, L.L., Friedman, C.M.R. and Phillips, L.A. 2012. Fungal endophytes of the obligate parasitic dwarf mistletoe *Arceuthobium americanum* (Santalaceae) act antagonistically in vitro against the native fungal pathogen *Cladosporium* (Davidiellaceae) of their host. American Journal of Botany 99(12): 2027-2034. [Study of *A. americanum* tissues showed the presence of endophytic fungi matching *Phoma*, *Sydowiola*, and *Phacidiopycnis*, which apparently help to suppress infection by pathogenic fungi including *Cladosporium* spp.]

Maruyama, P.K., Mendes-Rodrigues, C., Alves-Silva, E. and Cunha, A.F. 2012. Parasites in the neighbourhood: interactions of the mistletoe *Phoradendron affine* (Viscaceae) with its dispersers and hosts in urban areas of Brazil. Flora (Jena) 207(10): 768-773. [Describing the occurrence of *P. affine* on *Handroanthus chrysotrichus*, *Tabebuia rosea*ba, *Spathodea campanulata*, *Ligustrum lucidum* and *Melia azedarach*, consumption of the fruits by the bird *Euphonia chlorotica*, which was crucial for seed germination, failure of the germinated seeds to penetrate the bark of non-hosts, and its prevalence in large isolated trees.]

Maširević, S., Medic’-Pap, S. and Terzic’, A. 2012. Broomrape seed germination on nutritive media and possibility of its biological control. Helia 35(57): 79-86. [Recording germination rates for *Orobanche cumana* in the presence of sunflower roots and either gibberelin or of ‘Trifender’ a preparation including the fungus *Trichoderma asperellum*. Germination rates and length of seedlings was lower in the presence of ‘Trifender’ interpreted as suggesting some suppresson. But curiously no control with sunflower roots only.]

Mathiasen, R.L. 2013. Morphological comparisons of white fir and red fir dwarf mistletoes in the Sierra Nevada and southern Cascade Mountains. Madroño 58(2): 101-105. [Detailed morphological study of the two forms of *Arceuthobium abietinum* specific respectively to *Abies iowana* and *A. magnifica* failed to show differences, supporting the retention of these two forms as a single species.]

Mauseth, J.D. and Rezaei, K. 2013. Morphogenesis in the parasitic plant *Viscum minimum* (Viscaceae) is highly altered, having apical meristems but lacking roots, stems, and leaves. International Journal of Plant Sciences 174(5): 791-801. [Describing the fascinating morphology of *Viscum minimum* which has no roots or stems; no epidermis or endodermis but exists totally within the tissues of its succulent host *Euphorbia polygonia*. It grows by multicellular apical meristems that produce axes of pure parenchyma, lacking the patterns of tissues typical of stems or roots. Suggesting that molecular genetic studies of morphogenesis in *V. minimum* would greatly expand our understanding of morphogenesis in all plants.]

Melo, A. and Alves, M. 2013. (Synopsis of acolorophyllus herbs in north of the Atlantic Forest of Brazil.) (in Portuguese) Revista Brasileira de Biociências 11(1): 29-38. (Recording *Langsdorffia hypogaea* (Balanophoraceae) for the first time in this region.)

Menkir, A., Makumbi, D. and Franco, J. 2012. Assessment of reaction patterns of hybrids to *Striga hermonthica* (Del.) Benth. under artificial infestation in Kenya and Nigeria. Crop Science 52(6): 2528-2537. [Confirming that *S. hermonthica*-resistant hybrids developed in Nigeria were also resistant in Kenya and identifying a number of hybrids for eventual release.]


Midega, C.A.O., Pittchar, J., Salifu, D., Pickett, J.A. and Khan, Z.R. 2013. Effects of mulching, N-fertilization and intercropping with *Desmodium uncinatum* on *Striga hermonthica* infestation in maize. Crop Protection 44: 44-49. [In a field trial repeated over 12 cropping seasons, intercropping maize with *D. uncinatum* suppressed *S. hermonthica* almost completely from the first season and gave consistently high yields, approximately 3X those of the sole crop maize over the full period. Treatments with N with or without straw mulch gave modest *Striga* control and yield increases but were far less effective than the inter-cropping. They also had a relatively small effect in increasing performance when combined with the inter-crop.]

Mirtchev, S. Zafirov, N. and Rasheed, R. 2012. Dendrochronology as a tool for the investigation of forest decline. Forestry Ideas 18(2): 117-124. [Noting drought as the most important factor in forest decline in Bulgaria, but also mentioning damage from (unspecified) mistletoes.]


Misra, B.B. and Satyahari Dey. 2013. TLC-bioautographic evaluation of in vitro anti-tyrosinase and anti-cholinesterase potentials of α-santalol and sandalwood oil. Natural Product Communications 8(2): 253-256. [Results suggest that α-santalol, the major component of oil from Santalum album, is a strong inhibitor of both tyrosinase and cholinesterase indicating a potential for use in the treatment of Alzheimer's disease, as well as in skin-care.]


Montaño-Centellas, F.A. 2013. Effectiveness of mistletoe seed dispersal by tyrant flycatchers in a mixed Andean landscape. Biotropica 45(2): 209-216. [A study of the effectiveness of the bird dispersers, Mionectes striaticollis and Zimmerius bolivianus in the dispersal of seeds of Struthanthus acuminatus and Pthiriusa retroflexa, and concluding that there were differences in the quantity and quality of dispersal according to the mistletoe species.]

Mony, R., Ondoua, J., Dibong, S., Issaka, J. and Akoa, A. 2009. (Myrmecofauna associated with Phragmanthera capitata (Sprengel) S. Ball/host in an orchard in Ndogbong (Douala, Cameroon.)) (in French) International Journal of Biological and Chemical Sciences 3(6). [Four species of ant, 2 Crematogaster spp., Phidole megacephala and a Camponotus sp., associated with P. capitata appeared to be associated with premature fall of buds and flowers and hence of potential interest for biocontrol.]


Zimbabwe. Livestock Science 151(2/3): 163-170. [Concluding that *Erianthemum ngamicum*, *Plicosepalus kalachariensis* and *Viscum verrucosum* compared favourably with *Acacia* spp. as browse for goats.]

Ndagurwa, H.G.T., Dube, J.S. and Mlambo, D. 2013. The influence of mistletoes on nitrogen cycling in a semi-arid savanna, south-west Zimbabwe. Journal of Tropical Ecology 29(2): 147-159. [Recording varying but generally higher litterfall and N concentrations under *Acacia karoo* infested with *Erianthemum ngamicum*, *Plicosepalus kalachariensis* and *Viscum verrucosum* than under uninfested trees, with potential consequent effects on the understory biota.]


Oga, E.F., Sekine, S., Shitara, Y. and Horie, T. 2012. P-glycoprotein mediated efflux in Caco-2 cell monolayers: the influence of herals on digoxin transport. Journal of Ethnopharmacology 144(3): 612-617. [Results suggest that the traditional use of *Tapinanthes sessilifolius* for cancer and diabetes should not interfere with conventional drugs used against malaria.]


extracts protects HeLa cells against nuclear and mitochondrial DNA damage. Evidence-based Complementary and Alternative Medicine, 2012: Article ID 958740. (http://www.hindawi.com/journals/ecam/2012/958740/) [Confirming the potential for V. album extracts to prevent oxidative DNA damage but activity is affected by the host tree – Robinia pseudoacacia and Tilia argentea being more effective than Acer campestre.]


Parks, N. 2013. Tangled trends for temperate rain forests as temperatures tick up. Science Findings - Pacific Northwest Research Station, USDA Forest Service 149, 5 pp. [Among potential influences of global warming, suggesting that Arceuthobium tsugense could become more prevalent on Tsuga heterophylla in Alaska.]

Penney, D., Notcutt, B. and Rowntree, J.K. 2013. Seed predation of yellow rattle Rhinanthus minor by Phytomyza varipes (Diptera: Agromyzidae), with new British records. British Journal of Entomology and Natural History 26(1): 1-7. [The seed predator, Phytomyza varipes was found on Rhinanthus minor at all 10 sites studied in England and Wales. It was associated with reduced seed viability.]


Piwowarczyk, R. 2012. Revised distribution and plant communities of *Orobanche alsatica* and notes on the Orobanchaceae series *Alsaticae* in Poland. Biodiversity: Research and Conservation 26: 39-51. [Describing the distribution of *O. alsatica* (mostly on *Peucedanum cervaria* and sporadically on *P. alsaticum* and *Seseli* sp.) also of *O. bartlingii* and *O. mayeri*, their taxonomy, biology, ecology, and habitat preferences.]

Piwowarczyk, R. 2012. *Orobanche bohemica* Čelak. (Orobanchaceae) at the eastern limit of its geographical range: new data on its distribution in Poland. Biodiversity: Research and Conservation 26: 53-59. [Recording a new occurrence of *O. bohemica* in Poland, on *Artemisia campestris*, and discussing its relationship to the closely related *O. purpurea* (on *Achillea* sp.) and *O. arenaria* (also on *A. campestris*).]


Piwowarczyk, R. 2012. *Orobanche purpurea* (Orobanchaceae) in Poland: current distribution, taxonomy, plant communities, and preferred hosts. Biodiversity: Research and Conservation 26: 73-81. [*O. purpurea* now known from only 4 sites in Poland, on *Achillea* sp.]

Piwowarczyk, R. 2012. The genus *Orobanche* L. (Orobanchaceae) in the Malopolska Upland (S Poland): distribution, habitat, host preferences, and taxonomic problems. Biodiversity: Research and Conservation 26: 3-22. [Maps show the distribution of 12 species of *Orobanche* in southern Poland. With particular notes on the differences between *O. elatior* s.s. and *O. kochii*.]


Posadzki, P., Watson, L., Ernst, E., Schmitt, J. and Ferro A, 2013. Herb-drug interactions: an overview of systematic reviews. British Journal of Clinical Pharmacology 75(3): 603-618. [While most herbal medicinal products did not show interaction with conventional drugs, there were some serious interactions with *Viscum album*.]


Quan JiShu, Li Tian, Zhao WenXi, Xu HuiXian, Qiu DeLai and Yin XueZhe. 2013. Hepatoprotective effect of polysaccharides from *Boschniakia rossica* on carbon tetrachloride-induced toxicity in mice. Journal of Clinical Biochemistry and Nutrition 52(3): 244-252. [Confirming some hepatoprotective activity in extracts of *B. rossica*.]


Ramires-Espinosa, J.J. and 9 other. 2013. Antihyperglycemic and sub-chronic antidiabetic actions of morilic and moronic acids, *in vitro* and *in silico* inhibition of 11β-HSD 1. Phytomedicine 20(7): 571-576. [Morilic and moronic acids in extracts of *Phoradendron reichenbachianum*, a medicinal plant used in Mexico for the treatment of...
diabetes, have shown sustained antidiabetic and antihyperglycemic action.


Rapparini, G., Campagna, G. and Geminiani, E. 2012. HAUSTORIUM 63 July 2013 41


Rasmussen, A., Heugebaert, T., Matthys, C., Deun, Rvan, Boyer, F.D., Goormachtig, S., Stevens, C. and Geelen, D. 2013. A fluorescent alternative to the synthetic strigolactone GR24. Molecular Plant 6(1): 100-112. [Reporting the synthesis of a fluorescent strigolactone molecule CISA-1 via a novel high-yielding method using simple starting materials, and its activity comparable to that of GR24 on *Orobanche aegyptiaca*.]

Ray, B.R. and Dasgupta, M.K. 2010. Management of root holoparasite *Aeginetia pedunculata* of (Orobanchaceae), causing wilt of sugarcane by trap and catch crops. The Journal of Plant Protection Sciences 2(2): 27-34. [Rice, maize, pearl millet, *Setaria italica*, *Phaseolus mungo*, *Sesbania aculeata*, sesame, jute, pigeon pea and groundnut all showed potential as trap crops, stimulating germination of *A. pedunculata*. Sorghum was identified as a catch crop supporting growth and development of *A. pedunculata* up to flowering.]

Rebeka, G., Shimelis, H., Laing, M.D., Tongoona, P. and Mandefro, N. 2013. Evaluation of sorghum genotypes compatibility with *Fusarium oxysporum* under striga infestation. Crop Science 53(2): 385-393. [From 50 sorghum lines tested, 12 selected for farmer-preferred agronomic traits and with *F. oxysporum* compatibility. Treatment with *F. oxysporum* resulted in significantly delayed emergence and weaker growth of *Striga hermonthica*.]


Riviere, S., Clayson, C., Dockstader, K., Wright, M.A.R. and Costea, M. 2013. To attract or to repel? Diversity, evolution and role of the "most peculiar organ" in the *Cuscuta* flower (dodder, Convolvulaceae) - the infrastaminal scales. Plant Systematics and Evolution 299(3): 529-552. [Results suggest that scales in *Cuscuta* evolved in connection with a modification of their function in the flower: from nectar protection and holding in the first diverged subgenus *Monogynella*, to ovary/ovule protection against herbivorous insects in the derived subgenera *Cuscuta* and *Grammica*. The study also elaborates on the development and ultrastructure of scales in *C. gronovii*, and provides details on their anatomy in other species.]


Rommelaars, L. and Dam, N. 2013. (First records of *Phaeobotryosphaeria visci* from The Netherlands. Coolia 56(1): 35-39. [Describing the leaf spot disease *P. visci* occurring commonly on *Viscum album* in the Limburg Province.]}

mycorrhiza initially but soon relies very largely on its own photosynthesis. Albino individuals fail to grow well and produce few seeds. Discussing possible reasons for failure of these individuals to proceed to full mycoheterotrophy.


Sabra, A.H. and Haidar, M.A. 2012. Invasive weed mapping of Lebanon. Journal of Agricultural Science and Technology, B 2(9): 1010-1015. [Reporting on the mapping of native and non-native invasive species, including Orobanche ramosa and Cuscuta spp. (species not determined) and 6 others, and noting that the most serious are these two plus Sorghum halepense.]


Sandler, H.A. 2013. Response of four cranberry varieties to delayed applications of diclobenil. Weed Technology 27(1): 108-112. [Confirming that mid-season applications of diclobenil are safe for cranberry and improve control of unspecified ‘dodder’ – presumably Cuscuta gronovii.]


Sangüesa-Barreda, G., Linares, J.C. and Camarero, J.J. 2013. Drought and mistletoe reduce growth and water-use efficiency of Scots pine. Forest Ecology and Management 296: 64-73. [Recording damaging combined effects from drought and Viscum album on Pinus sylvestris in Spain, and concluding that these effects are unlikely to be compensated for by higher levels of CO$_2$.]


Saric-Krsmanovic, M. and Dobrikovic, D. 2012. (Dodder and its control in sugar beet.) (in Serbian) Biljni Lekar (Plant Doctor) 40(5): 400-406. [Describing increasing infestation of lucerne, clovers and sugar beet by unspecified Cuscuta spp. Also describing damage effects and methods of control used in sugar beet.]


Sawyer, B. 2013. Sandalwood (Santalum spicatum) establishment in the semi-arid and arid regions of Western Australia. Rangeland Journal 35(1): 109-115. [Studies aimed at encouraging the growth of S. spicatum concluded that a minimum of 264 mm rainfall per year, and breaking soil crusts were needed.]


Scheunert, A., Fleischmann, A., Olano-Marín, C., Brüchler, C. and Heubl, G. 2012. Phylogeny of tribe Rhinantheae (Orobanchaceae) with a focus on biogeography, cytology and re-examination of generic concepts. Taxon 61(6): 1269-1285. [This phylogenetic analysis of ITS and chloroplast regions of tribe Rhinantheae helped untangle several issues regarding generic boundaries. From this study, several new nomenclatural combinations were made.]


Seyyedi, M., Moghaddam, P.R., Shahriari, R., Azad, M. and Rezaei, E.E. 2013. Allelopathic potential of residues of sunflower and castor bean reduced germination of *C. compestris* in Petri dishes, but usual problems of interpreting practical significance.]

Shang Z. H. and Xu, S.G. 2012. Allelopathic testing of *Pedicularis kansuensis* (Scrophulariaceae) on seed germination and seedling growth of two native grasses in the Tibetan plateau. Phyton (Buenos Aires) 81: 75-79. [Suggesting that *P. kansuensis* may have allelopathic effects but high concentrations needed.]


Shavvon, R.S., Mehrvarz, S.S. and Golmohammadi, N. 2012. Evidence from micromorphology and gross morphology of the genus *Loranthus* (Loranthaceae) in Iran. Turkish Journal of Botany 36(6): 655-666. [A comparative study of *L. europaeus* and *L. growingkii*, a species known only from Iran, both growing on host trees including *Quercus infectoria*, *Acer monspessulanum*, and *Armeniaca vulgaris*. Describing a range of characters distinguishing the two including differences in wax crystalloid structures, seed surface structure and other morphological features.]

Shaw, D.C. and Mathiasen, R.L., 2013. Forest diseases caused by higher parasitic plants: mistletoes. In: Gonthier, P. and Nicolotti, G. (eds) Infectious forest diseases, Wallingford, UK: CAB International pp. 97-114. [A useful chapter reviewing mistletoe problems in forestry, providing information on symptom detection, infection biology, dispersal and pollination, management strategies and tactics, which include exclusion, eradication, protection (using a physical barrier, herbicides, shading and fertilizer application), genetic resistance, cultural, biological and integrated methods of control. Mistletoe genera are tabulated, indicating host groups seriously affected and the regions where economic losses occur.]


Silveira, L.H.C., Rezende, A.V. do Vale, A.T. 2013. Moisture content and basic wood density of nine commercial Amazonian tree species. Acta Amazonica 139(9): 858-859. [Describing a range of media in which rooting and growth from leaf explants of mature sandalwood (*Santalum album*) from 139 in 16
host trees in 1952 to 4561 in 887 trees in 2009, mainly in *Malus, Tilia, Populus* and *Sorbus*, attributed to higher temperatures, favourable urban conditions and suitable host trees.}


Doklady Biochemistry and Biophysics 447(1): 300-303. [Treatment with *C. deserticola* helped slow down development of cataract.]


Sowa, I., Wójciak-Kosior, M. and Koćjan, R. 2012. The content of some trace elements in selected medicinal plants collected in the province of Lublin. Acta Scientiarum Polonorum - Hortorum Cultus 30(3): 2714-2719. [Reviewing the economic impact of *Cuscuta* spp. including discussion of *C. trifolii, C. campestris* and *C. cernua* in Romania on *Trifolium, Lotus* and *Medicago* spp. and discussing the germination of (unspecified) seed to concentrated sulphuric acid after 15-25 minutes exposure only.]

Stoyanov, K. and Hristeva, T. 2013. (The trophic plasticity of genus phelipanche pome (orobanchaceae) in Bulgaria.) (in Bulgarian) Journal of Central European Agriculture 14(1): 203-213. [Surveying the non-crop hosts of 5 *Phelipanche* spp. in Bulgaria, noting that *P. ramosa, P. mutelii*, and *P. oxyloba* in Section Phelipanche have wide host ranges, while *P. arenaria* and *P. purpurea* in Section Arenariae have narrow host ranges.]


Sun ShiGuo, Huang ShuangQuan and Guo YouHao. 2013. Pollinator shift to managed honeybees enhances reproductive output in a bumblebee-pollinated plant. Plant Systematics and Evolution 299(1): 139-150. [Confirming that honey bees were at least as successful as the native bumble bees for pollination of *Pedicularis densisepica* where they have been introduced to areas of China.]


Tańase, M. and Moise, C. 2012. Dodders (*Cuscuta* spp.): skin repose, seed germination and pre-parasitic life. Journal of Horticulture, Forestry and Biotechnology 16(3): 89-92. [Reviewing the increased occurrence of *Cuscuta* spp. (*C. trifolii, C. epithymum* and *C. campestris*) in Romania on *Trifolium, Lotus* and *Medicago* spp. and discussing the germination of (unspecified) seed to concentrated sulphuric acid after 15-25 minutes exposure only.]

of the significance of wild hosts; also their medicinal and other uses.]

Tărnase, M., Stanciu, M., Moise, C. and Gheorghe, M. 2012. Ecological and economic impact of dodder species (Cuscuta spp. Convolvulaceae) on pratical ecosystems. Journal of Horticulture, Forestry and Biotechnology 16(3): 93-97. [Further comment on the importance of Cuscuta spp. on a very wide range of crops in Romania but especially affecting 20% of lucerne and red clover crops with losses estimated to be at least 20 M. RON (5 M Euro).]


Tarfa, F.D., Amos, S., Temple, V.J., Ocheke, N.A. and Gamaniel, K.S. 2012. Hypoglycemic effects of the aqueous extract of African Mistletoe, Tapinanthus sesselifolius (P. Beauv) van Tiegh (Loranthaceae). International Journal of Biological and Chemical Sciences 6(1) 408-414. [Confirming that T. sesselifolius contains substances that may be useful in treatment of diabetes giving a scientific basis for its use in herbal traditional medicine as an antidiabetic agent.]


Urso, V., Signorini, M.A., Bruschi, P. 2013. Survey of the ethnobotanical uses of Ximenia americana L.
(mumpeke) among rural communities in South Angola. Journal of Medicinal Plants Research 7(1): 7-18. [A survey suggested that the main uses of X. americana were as oil extracted from seeds as a cosmetic for body and hair care and as a medicinal remedy to prevent varicose veins.]

Varga, I., Nagy, V., Baltazár, T., Mátýás, K.K., Poczai, P. and Molnár, I. 2012. (Study of the efficiency of different systemic herbicides against European mistletoe (Viscum album) and their antifungal activity against hyperparasitic mistletoe fungus.) (in Hungarian) Növényvédelem 48(11): 507-517. [Testing 2,4-D, glyphosate and metsulfuron-methyl on V. album infecting Acer campestre. 2,4-D was effective but damaged the host. The fungus Phaeobotriosphearia visci is of interest as a biocontrol agent.]

Vipan Guleria. 2013. Analysis of plant, host and management relationships for sandalwood (Santalum album) cultivation in new subtropical locality of hill region of Indian Himalayas. Indian Forester 139(1): 53-57. [Best growth of S. album, achieved with Dalbergia sissoo as host. Two other leguminous hosts, Acacia catechu and Leucaena leucocephala were superior to the non-legume Morus alba.]


Wagner, M., Peyton, J., Heard, M.S., Bullock, J.M. and Pywell, R.F. 2011. Effects of Yellow-rattle (Rhinanthus minor) establishment on the vegetation of species-poor grassland. Aspects of Applied Biology 108: 59-66. [Although R. minor has been promoted as a means of increasing species richness in grassland, this study suggests this may not always be so.]

*Wambugu, P.W., Mathenge, P.W., Auma, E.O. and van Rheenen, H.A. 2012. Constraints to on-farm maize (Zea mays L.) seed production in Western Kenya: plant growth and yield. ISRN Agronomy, 2012: Article ID 153412. (http://www.hindawi.com/isrn/agronomy/2012/153412) [A factorial study with 2 maize varieties, 2 times of harvest and 2 levels of nitrogen, on a range of farms, concluded that nitrogen contributed most to increased yield and seed quality under Striga hermonthica-infested conditions.]


Wang Zhong, Ma YongQing, Jia JinNan, Dong ShuQi, and Ye XiaoXin. 2013. Allelopathic effect of potato on Orobanche aegyptiaca Pers. seed germination. Zhongguo Shengtai Nongye Xuebao / Chinese Journal of Eco-Agriculture 21(3) 333-339. [Noting that O. aegyptiaca is a national-class quarantine species in China, seriously harmful to melons and other economic crops, and confirming that potato stimulates germination of O. aegyptiaca and could be useful a trap crop. Some varieties better than others.]

Waters, M.T. and Smith, S.M. 2013. KA12- and MAX2-mediated responses to karrikins and strigolactones are largely independent of HY5 in Arabidopsis seedlings. Molecular Plant 6(1): 63-75. [Further discussion of the modes of action of strigolactones, karrikins and butenolides (cf. Flematti et al., above).]

Watson, D.M. 2013. The relative contribution of specialists and generalists to mistletoe dispersal: insights from a neotropical rain forest. Biotropica 45(2): 195-202. [Observation of 23 different bird species feeding on fruits of Oryctanthus occidentalis suggested that while ‘mistletoe specialists’ were important in intensifying infestations, generalist and opportunistic feeders may be more important in long-distance dispersal.]


Yagume, T. and Yamato, M. 2013. Mycoheterotrophic growth of *Cephalanthera falcata* (Orchidaceae) in tripartite symbioses with Thelephoraceae fungi and *Quercus serrata* (Fagaceae) in pot culture condition. Journal of Plant Research 126(2): 215-222. [Confirming that, although green, the orchid *Cephalanthera falcata* benefits from tripartite symbioses with Thelephoraceae fungi and *Quercus serrata.*]


Yonli, D., Traore, H., van Mourik, T.A., Hess, D.E., Sereme, P. and Sankara, P. 2011. Integrated control of the potential role of coprolites in conservation paleobiology. Conservation Biology 26(6): 1091-1099. [In New Zealand the only known pollinator for the cryptic root-parasite *Dactylanthus towerii* (Balanophoraceae) is the lesser short-tailed bat (*Mystacina tuberculata*) but fossil faeces show that it was almost certainly previously visited by kakapo (*Strigops habroptilus*) a large, nocturnal, flightless parrot, with which it no longer overlaps. Suggesting that the two should be brought together on a predator-free offshore island to the benefit of both.]


*Yonli*, D., Traore, H., van Mourik, T.A., Hess, D.E., Sereme, P. and Sankara, P. 2011. Integrated control of the potential role of coprolites in conservation paleobiology. Conservation Biology 26(6): 1091-1099. [In New Zealand the only known pollinator for the cryptic root-parasite *Dactylanthus towerii* (Balanophoraceae) is the lesser short-tailed bat (*Mystacina tuberculata*) but fossil faeces show that it was almost certainly previously visited by kakapo (*Strigops habroptilus*) a large, nocturnal, flightless parrot, with which it no longer overlaps. Suggesting that the two should be brought together on a predator-free offshore island to the benefit of both.]


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of Striga hermonthica (Del.) Benth. in Burkina Faso through host plant resistance, biocontrol and fertilizers. International Journal of Biological and Chemical Sciences 5(5): 1860-1870. [Indicating modest economic benefits from a combination of improved sorghum variety, a Fusarium-based biocontrol, and urea fertilization for control of S. hermonthica in sorghum in Burkina Faso.]

Yoo JiYoung, An HyoSun, Kim InBo, Kim KyuDae, Kim YoungHoon, Song TaeJun and Kim JongBae. 2013. Isolation and partial characterization of heparin-binding protein from Korean mistletoe (Viscum album coloratum). Journal of Medicinal Plants Research 7(6): 234-242. [Suggesting that heparin-binding protein fractions from V. album coloratum may have anti-cancer activity as well as the lectins.]


*Zhang Wei, Ma YongQing, Wang Zhong, Ye XiaoXin and Shui JunFeng 2013. Some soybean cultivars have ability to induce germination of sunflower broomrape. PLoS ONE 8: 3pp. e59715. (http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0059715) [Confirming soybeans could be used as a trap crop for Orobanche cumana.]


Zheng Lei, Cui XuSheng, Wu Yan, Zhai ZhiXi and Guo YuHai. 2013. (Relationship between the seed yield of Cistanche deserticola and the age of Haloxylon ammodendron.) (in Chinese) Journal of China Agricultural University 18(2): 100-104. [Confirming that the seed yield of C. deserticola increased as the age of the host tree H. ammodendron increased from 3 to 6 years old.]

Zheng Lei, Wu Yan, Cui XuSheng, Zhai ZhiXi and Guo YuHai. 2013. (Study on the capsule and seed development of Cistanche deserticola.) (in Chinese) Journal of China Agricultural University 18(3): 68-72. [A detailed recording of the progress of capsule and seed development, concluding that seeds gave optimum germination when harvested 35 days from onset of flowering.]


germination stimulation, branching of AM fungi, and branching in higher plants, each of these involving different perception systems. Also emphasising the importance of stereochemistry.

HAUSTORIUM 63

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Send material for publication to any of the editors.

NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be
# HAUSTORIUM

**Parasitic Plants Newsletter**  
ISSN 1944-6969  
Official Organ of the International Parasitic Plant Society  

December 2013  
Number 64

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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

Best wishes for a happy new year of 2014. I hope this year brings you all health and happiness.

I am pleased to announce that our next major conference, the 13th World Congress on Parasitic Plants, will take place in Kunming, China, for the first time in Asia. Dr. Airong Li at Kunming Institute of Botany, Chinese Academy of Sciences and her colleagues with other Chinese scientists will organize the congress. We are looking forward to welcoming participants in particular from Asian countries which are rich sources of parasitic plants/weeds. The proposed date will be in June or July 2015, exact timing yet to be decided. Details will soon be available on the conference website.

As you will find in this issue, the first COST-STREAM meeting organized by Cristina Prandi and Hinanit Koltai was held in Jerusalem, Israel, in November. This meeting dealt with strigolactone-related topics and therefore strigolactones were discussed as host recognition signals for root parasitic plants and microorganisms including AM fungi and rhizobia in the rhizosphere, and as hormones regulating growth and developments of plants. Furthermore, their potential application in cancer prevention was also discussed. It was indeed a good mix of sciences on strigolactones and provided an excellent platform on which parasitic plant scientists can work together with colleagues from other research areas. Since many IPPS members are involved in this COST project, they were able to catch up on important progress in strigolactone research.

I hope this year brings further new insights into parasitic plants.

Sincerely,
Koichi Yoneyama, IPPS President
yoneyama@cc.utsunomiya-u.ac.jp

MEETING REPORTS

The Third Symposium on the Biology of Non-Weedy Parasitic Plants, Namur, Belgium, 12-15 September 2013.

This meeting took place in the beautiful town of Namur, Belgium, in the Youth Hostel along the river Meuse. After the first two symposia on the biology of non-weedy hemiparasitic Orobanchaceae (at Wageningen in 2004, and České Budějovice in 2008), we decided to broaden the thematic range to all haustorial parasites, due to similar methodologies used in research and many parallels in the biology across unrelated groups of parasitic plants. The first full day of lectures focused on ecology and ecophysiology, while the talks on the second day dealt with the evolutionary aspects.

The meeting had two invited speakers. Of these, David Watson (Charles Sturt University, Australia) gave an amazing talk about parasitic plants as important components of terrestrial ecosystems supported by many examples of his own work on the ecological interactions of Australian mistletoes. Vincent Merckx provided a fascinating outlook on the biology of mycoheterotrophic plants, which was followed by a discussion comparing their ecological behaviour with haustorial parasites.

Several of the 26 participants gave talks or presented posters on the ecophysiology of hemiparasites. Andras Demey (Ghent University, Belgium) summarized his PhD work on the effects of hemiparasites on nutrient cycling in grasslands. Jakub Těšitel (University of South Bohemia, Czech Republic) gave a talk on the effects of abiotic resources, namely water and mineral nutrients, on the parasitic and competitive components of the root hemiparasitic interaction. Gerhard Glatzel (Austrian Academy of Sciences) presented an ecophysiology-based hypothesis on the evolution of deciduousness in mistletoes. Petra Světlíková (University of South Bohemia, Czech Republic) presented a poster on his MSc project detailing the effects of application of various fertilizers on the population density and seed production of Rhinanthus minor in the long-term Rengen Grassland Experiment. Adrien Saulnier (Louvain University, Belgium) presented a poster on his MSc project detailing the patterns of seed formation in Rhinanthus angustifolius.

Population and community ecology of root parasites was another important topic of the conference. Jitka Kocková (University of South Bohemia, Czech Republic) gave a talk on a DNA barcoding-based approach to identification of host spectra of root hemiparasites. Petr Blažek (University of South Bohemia, Czech Republic) gave a talk on the effects of different mowing treatments on the populations of Rhinanthus. Pavel Bíbcík (University of South Bohemia, Czech Republic) introduced a project on modelling of ecological niches of Central European hemiparasites based on the data from Czech National Phytosociological Database and a functional trait approach. Vojtěch Adamec (University of South Bohemia, Czech Republic) gave a talk on various aspects of ecology of the endangered early ecotype of Melampyrum nemorosum. Vítězslav Zalewski (University of South Bohemia, Czech Republic) presented results of an experiment investigating the effects of climatic
conditions on germination and growth of *Rhinanthus* and its effect on the host. Markéta Tahadlová (University of South Bohemia, Czech Republic) presented a poster on her project dealing with the interactions between root hemiparasites and herbivorous insects. Jakub Těšitel’s poster introduced a restoration ecology project aiming to suppress the aggressive grass species *Calamagrostis epigejos* by *Rhinanthus* hemiparasites.

The evolutionary contributions mostly focused on individual species or species groups. Sidonie Bellot (University of Munich, Germany) gave a talk on the retention of the plastid genome in holoparasitic plant lineages exemplified by her study on the endophytic holoparasites in the Apodanthaceae. Milan Štech (University of South Bohemia, Czech Republic) presented results of his long-term investigation on the evolution and phylogeography of the *Melampyrum nemorosum* group, and the last lecture of the conference was given by Laurent Natalis (Louvain University, Belgium) on the role of bumblebees in shaping asymmetric hybridization between *Rhinanthus minor* and *R. angustifolius*. Šárka Svobodová (University of South Bohemia, Czech Republic) presented a poster on evolution and hybridization patterns in Central European *Euphrasia* species. Daniel Pinto Carrasco (University of Salamanca, Spain) had a poster on taxonomy and phylogeography of the *Odontites recordonii* group, an endemic of the Iberian Peninsula. Olena Peregrym presented her study on seed morphology and ornamentation of East European *Pedicularis* species, and Vinciane Mossip’s poster outlined the plans for her PhD project on the taxonomy and phylogeography of the genus *Rhinanthus*.

The conference programme ended with a field excursion to calcareous grasslands in the hills surrounding the river Meuse close to Namur. We enjoyed this remarkably species-rich vegetation in its late summer shape. Although it was rather late for most annual hemiparasitic species, possibly occurring locally, we managed to find some fruiting plants of *Melampyrum pratense* at a forest edge. The social part of the conference included evening sessions filled with various discussions and supported by a supply of outstanding Belgian beer, and the last evening of the conference happily coincided with splendid fireworks at the Namur Festival.

The abstract book of the conference can be downloaded at http://botanika.prf.jcu.cz/hemiparasites/ and a special issue of Plant Ecology and Evolution at http://www.pleecevo.eu/ with contributions from speakers at the conference is in the making, which will be published in early 2015.

**Papers presented:**

David Watson - Parasitic plants as drivers of ecological communities > predictions > processes.

Andreas Demey - Impacts of hemiparasitic plants on the vegetation and biogeochemical cycling in two contrasting semi-natural grassland types.

Jakub Těšitel - Fighting for resources—parasitism, competition and virulence in a hemiparasitic association.

Petr Blažek - Response of grassland *Rhinanthus Orobanchaceae* to different mowing dates.

Vojtěch Adamec - Ecology of early ecotype of *Melampyrum nemorosum*.

Jitka Kockova - Using DNA-barcoding and anatomical methods to reveal host spectra of hemiparasitic plants under natural conditions.

Pavel Fibich - Modelling of niches of Central European root-hemiparasitic species.

Vincent Mercx - Mycoheterotrophy: plants living on fungi.

Sidonie Bellot - The evolutionary retention of plastid genomes in nonphotosynthetic plants: A comparative approach centred on the endoparasitic Apodanthaceae.

Gerhard Glatzel - The evolution of deciduous mistletoes – a hypothesis.

Milan Štech - Why is the *Melampyrum nemorosum* group taxonomically difficult?

Laurent Natalis - The role of bumblebee pollinators in hybridization between two *Rhinanthus* species.

Jakub Těšitel and Renate Wesselingh


**Contributions presented included:**

Cohen, Y. *et al.* - Parasitic weed mapping to improve management: the case of broomrape in tomato crops.

Eizenberg, H. - Advanced technologies for tempo-spatial modeling of broomrapes (*Orobanche* and *Phelipanche* spp.) and herbicides application.

Shilo, T. *et al.* - Aspects of glyphosate mechanism in Egyptian broomrape control.

Sen, B. *et al.* - Effects of salt stress (NaCl) and broomrape (*Phelipanche aegyptiaca*) on superoxide dismutase and peroxidase activities of two tomatoes varieties.

Ben David, O. *et al.* - Variation in response of a resistant sunflower cultivar to *Phelipanche aegyptiaca* and *Orobanche cumana*.

Aly, R. *et al.* - Development of molecular markers based on ITS and rbcL genes to identify and distinguish between broomrape species in a soil sample.
Rabinovitz, O. et al. - Modeling imazapic movement applied by drip irrigation to maximize broomrape control.
Bab, R. et al. - Breaking dormancy at seeds of Cuscuta approximata
Boz, Ö. et al. - Determination of the frequencies and densities of broomrape and other weed species occurring in field tomato, sunflower and tobacco fields in Denizli Province of Turkey.


Building a new research alliance to reclaim faba bean production area abandoned to Orobanche. Rabat, Morocco, 6-9 October, 2013.

This meeting brought together workers from 12 countries to discuss the current problems from Orobanche crenata and O. foetida in the Mediterranean zone and NE Africa which have resulted in a serious decline in the area of faba bean and other legumes grown in the region. Objectives included gaining a better understanding of the variation within both these species, identification of new sources of resistance within faba bean, and the exploitation of new technology in the understanding of Orobanche biology, and the development of resistance in the crop to the parasites and to herbicides.

The meeting was funded by a range of institutions including the UK BBSRC (Biotechnology and Biological Sciences Research Council), ICARDA (still fully active on a range of sites outside Syria) and INRA, Morocco (Institut National de la Recherche Agronomique).

The first session, hosted by the Institut Agronomique et Vétérinaire Hassan II, entitled ‘Control of Orobanche crenata in legumes’ heard 4 review papers. John Pickett described the successful technique for control of Striga species by intercropping with Desmodium spp. and the possibilities of transferring the essential genes from Desmodium to other species including cowpea initially and conceivably faba bean in the future. Fouad Maalouf described the history of discovery and exploitation of Orobanche resistance in faba bean in Egypt and recent work with herbicides. Diego Rubiales covered the corresponding history of resistance breeding and other techniques for the control of Orobanche species in Spain, commenting incidentally on the fact that there was uncertainty whether there was any source of resistance available in faba bean other than that discovered in Giza 402. Finally Jim Westwood described the Parasitic Plant Genome Project in USA which involves 4 main species including O. aegyptiaca and how results from this project might be applied to O. crenata.

In the session on Taxonomy and Distribution, Mariem Bouhadida first described the dual problems of O. crenata and O. foetida in Tunisia, the latter attacking faba bean in Tunisia only, though other biotypes attack other legumes elsewhere. She also described her exploration of molecular markers as a means of distinguishing populations with different host ranges. Chris Parker then described the serious infestation of faba beans in Kent UK which had only been discovered a few weeks previously. Although not completely new to the UK, this is only the second significant infestation to be recorded in the country, or indeed anywhere in northern Europe. He discussed the need for better understanding of the germination behaviour of the weed in these more temperate conditions and whether this infestation was just a freak occurrence or represented a result of global warming or of a shift in the behaviour of the weed. Gianniantonio Domina reported on the distribution of O. crenata in Italy, mainly confined to Sicily and the extreme south of the mainland, and on some screening of faba bean varieties for resistance. Dense planting of faba bean has shown benefit. Tadessa Sefera Gela then painted an alarming picture of the dramatic spread of O. crenata in faba bean which has occurred in northern and western Ethiopia since it was first recognised in the 1980s. Faba bean is a major crop in Ethiopia grown on almost 500,000 ha and quantities have been exported in the past but domestic shortages have curtailed export activity. Many farmers are having to give up growing the crop and the area of production may be shrinking.

In the session on Breeding for Tolerance and Resistance, Ana Maria Torres described the search for and identification of QTLs for resistance to O. crenata and to O. foetida in faba bean, contributing to the eventual mapping of resistance genes in the crop. The following papers, presented by Mahmoud Abdelmohsen, and Sabah Attia covered various aspects of faba bean breeding and other work on O. crenata in Egypt where the problem of O. crenata has resulted in widespread replacement of the crop by wheat and clover, and a corresponding drastic fall in self-sufficiency in the crop from 99% down to below 50%. Current hopes are pinned on the variety Misr 3, released in 2012, which gives reasonably good yields in heavily infested sites. Walid El-Rodeny described the creation of an EST-SSR based linkage map of faba bean genome which should in time help map genes for resistance. Mahmoud Zeid’s paper made a critical examination of the correlation between the most widely used measure of resistance/tolerance – spikes/plant - and various detailed measures of attachment frequency and parasitic biomass obtained when root systems are carefully washed and evaluated, and this led to a stimulating discussion on what constitutes ‘resistance’. Progress was reported on the identification of relevant QTLs and molecular markers. It was also noted that infestation of faba bean is much less following irrigated crops of rice and cotton and is reduced
somewhat by intercropping with sugar beet or fenugreek. Moez Amri gave further detail of the situation in N.E. Tunisia, where O. foetida, since 1990, has been attacking chickpea, vetch, Vicia narbonensis, medics, Lathyrus sativus, lentil and fenugreek, as well as faba bean and other crop and wild species. Pea is apparently unaffected and may be suitable as a trap crop. Comparison with Spanish and Moroccan ecotypes had confirmed the extra virulence of the Tunisian material. Screening had revealed at least partial resistance in two varieties, ‘Chourouk’ and ‘Najeh’. Finally in this session, Nasr Eldin Abdalla confirmed that the problem was continuing to spread in Sudan and referred to work with a range of introduced lines which showed some promise of partial resistance. However, an integrated approach was still needed, involving hygienic measures, trap crops and hand-pulling.

The third session, on Molecular Understanding of Interactions between Parasitic Weeds and their Hosts and Prospects for Engineering Orobanche Resistance and/or Herbicide Tolerance in Faba bean, began with Rachid Mentag describing the successful in vitro culture of O. crenata callus from which normal shoots could be regenerated, providing a valuable system for studying the molecular steps in the infection process. Donal O’Sullivan described progress in the creation of a dense SNP-based map of the faba bean genome and initiation in the UK of a mutagenesis programme aimed initially at selecting mutants with resistance to herbicides. Khalil Khamil described related genetic diversity and gene mapping work carried out in a UK-Tunisia collaboration, while Abdelwahed Rabha reported on studies aimed at the possible parasite-induced expression of a selective sarcotoxin polypeptide and confirmed the successful integration of the sarcotoxin 1A gene construct in transgenic faba bean plants. Also in this session, Nadia Zermane reported on the situation of gene construct in transgenic faba bean plants. As well as this session, Nasr Eldin Abdalla confirmed that the problem was continuing to spread in Sudan and referred to work with a range of introduced lines which showed some promise of partial resistance. However, an integrated approach was still needed, involving hygienic measures, trap crops and hand-pulling.

The workshop included a number of discussion sessions where ideas were exchanged on future research and collaboration. These included ‘resolutions’ to co-operate more effectively in the areas of collecting and characterising Orobanche populations across its entire range, genetic transformation of faba bean, large-scale mutagenesis programmes to find and deploy herbicide resistance and to highlight the ongoing need for novel solutions based on deeper understanding of the cellular and molecular biology of the interaction between Orobanche and faba bean.

Papers presented (names of presenters only – not full authorship):

Mini-symposium: Control of Orobanche crenata in legumes
- John Pickett (Rothamsted Research, UK) - Can the highly successful control and eradication of Striga in cereals by intercropping with Desmodium offer opportunities for reclaiming faba bean production from Orobanche?
- Fouad Maalouf (ICARDA) - Breeding faba bean for resistance to Orobanche crenata: past problems and future horizons.

Diego Rubiales (CSIC, Spain) - Resistance breeding and complementary control strategies for alleviation of Orobanche problem on legumes in the Mediterranean Basin
- Jim Westwood (Virginia Tech, US) - Genomic insights into parasitism and opportunities for Orobanche control.

Taxonomy, host range and distribution of Orobanche spp.
- Mariem Bouhadida (INRAT, Tunisia) - Distribution and genetic diversity of Orobanche in Tunisia.
- Chris Parker (UK) - The status of Orobanche crenata in UK.
- Gianniantonio Domina (University of Palermo, Italy) - The status of Orobanche crenata in Sicily and preliminary observations on Orobanche crenata susceptibility in Vicia faba.
- Tadesse Sefera Gela (EIAR, Ethiopia) - Status and distribution of Orobanche in faba bean production areas of Northern Ethiopia.

Characterization and exploitation of sources of tolerance of faba bean to Orobanche.
- Mahmoud Ibrahim Abdel Mohsen (ARC, Giza, Egypt) - Current status of faba bean production in Egypt.
- Sabah Attia (ARC, Giza, Egypt) - Misr 3 - a new Egyptian Orobanche-tolerant faba bean variety.
- Ana Maria Torres (IFAPA, Spain) - Molecular approaches for the identification and validation of QTLs for Orobanche spp. resistance in faba bean.
- Walid El-Rodeny (ARC, Sakha, Egypt) - Development of EST-SSR markers and construction of a linkage map in faba bean (Vicia faba).
- Moez Amri (INRA, Tunisia) - The problem of Orobanche in Tunisia: current state, specificity and main results of the national faba bean breeding program to improve tolerance/resistance to Orobanche foetida and Orobanche crenata.
Mahmoud Zeid (University of Alexandria, Egypt) - Development and evaluation of faba bean breeding materials suitable for mapping resistance/tolerance to Orobanche crenata using molecular markers.

Nasr Eldin Khairi Abdalla (Agricultural Research Corporation, Sudan) - Reaction of faba bean genotypes to Orobanche crenata in Sudan.

Molecular understanding of interactions between parasitic weeds and their hosts and prospects for engineering Orobanche resistance and/or herbicide tolerance in Faba bean

Rachid Mentag (INRA-Rabat, Morocco).- In vitro culture of Orobanche crenata.

Nadjia Zermane (ENSA, Algeria) - Beneficial use of plant growth promoting Rhizobacteria for faba bean growth performance and broomrape control.

Khalid Daoui (INRA-Meknès, Morocco) - Faba bean and wheat productivity in an alley cropping system based on olive tree.

Donal O’Sullivan (University of Reading, UK) - A genomic toolkit for genetic improvement of faba bean.

Khalil Khamassi (INAT, Tunisia) - Analysis of genetic diversity and molecular mapping of SNP markers for Vicia faba L. var minor.

Chris Parker
Donal O’Sullivan

The 1st meeting of STREAM - COST Action FA1206, Jerusalem, Israel 3rd-7th November, 2013

STREAM (STRigolactones Enhanced Agricultural Methodologies) is the first official network in Europe focused on strigolactones (SLs) and is open to the rest of the world on this subject. Within this network the aims are: the creation of a multidisciplinary network of experts, of both basic and applied sciences, and the support and promotion of the coordination of SLs research activities and a transfer of knowledge which may lead to the development of targeted and sustainable agro-technologies. To implement the network aims, STREAM is structured into 4 Working Groups: WG1- SLs as plant hormones; WG2 - SLs and parasitic plants; WG3 - SLs and soil biota; and WG4 - SLs chemistry and biochemistry.

The 1st STREAM meeting in Jerusalem was our first stage for creating a multidisciplinary network of experts for all 4 working groups. The organizing committee of the meeting consisted of Chair of the Action: Prof Cristina Prandi (Italy), Vice Chair of the Action: Dr Hinanit Koltau (Israel) and the Local Organizers Dr Einav Mayzlish Gati and Smadar Weininger.

Papers presented included:

Opening lecture:
Koichi Yoneyama - Turning points in strigolactone research.

WG1- SLs as plant hormones;
Ottoline Leyser - Strigolactone signalling in plants - knowns, unknowns.
Catherine Rameau - Strigolactones and other long range signals regulating shoot branching in pea.
Lorenzo Borghi - The strigolactone exporter PhPDR1 is asymmetrical localized in root tips and hypodermal passage cells: first insights into strigolactone polar transport.
Sofie Goormachtig - A proteomic approach to reveal insights into strigolactone signalling.
Hidemitsu Nakamura - Molecular mechanism of strigolactone perception by DWARF14.

WG2 - SLs and parasitic plants;
Alejandro Pérez de Luque - Nanotechnology for strigolactone management in parasitic weeds.
Radoslava Matusova - Response of the Slovak wild and weedy broomrapes to GR24.
Philippe Delavault - CYP707A1, an ABA catabolic gene, is a ubiquitous component of parasitic plant seed germination in response to various germination stimulants.
Maurizio Vurro - Possible use of strigolactone-degrading microbes for managing parasitic weeds.
Diego Rubiales - Identification of broomrape resistance in faba bean based in low strigolactone exudation: applications for faba bean breeding.
Radi Aly - Cucumber mosaic virus as carotenoid inhibitor reduce Phelipanche aegyptiaca infection in tobacco plants.

WG3: SLs and soil biota:
Paola Bonfante - Plant fungal communication in arbuscular mycorrhizas: do you speak plantish or fungish?
Didier Reinhardt - The search for metabolites involved in the regulation of arbuscular mycorrhiza.
Juan A. Lopez-Raez - Strigolactones contribute to plant defence against necrotrophic fungi.
Michael Walter - Integration of SL biosynthesis in greater carotenoid metabolism of mycorrhizal roots.
Pioter Rozpadek - A novel model for phytoremediation-strigolactone research based on Arabidopsis thaliana mutants.

WG4 - SLs chemistry and biochemistry:
B. Zwanenburg - Strigolactone research, quo vadis?
François-Didier Boyer - New strigolactone analogues with specific activities.
Further Developments Related to Strigolactones:
Ronit Yarden - Innovative application of strigolactones to inhibit cancer cells and cancer stem cells growth.

Each session was concluded by 4 flash presentations about relevant posters, and discussions. Posters for each session were displayed throughout the meeting and are listed on the conference website:

22nd COLUMA Conference, International Meeting on Weed Control, Dijon, France, Dec 10-12, 2013.

Contributions included:

Duroueix, F. et al. - Lutte chimique contre l’orobanche rameuse en culture de colza. (oral)
Houngbedji, T. et al. - Étude de l’infection de la plante parasite Rhamphicarpa fistulosa en riziculture au Togo. (poster)
Boulet, C. et al. - Étude de la sensibilité des adventices vis-à-vis de l’orobanche rameuse (Phelipanche ramosa (L.) Pomel) en vue d’une lutte intégrée. (poster)

**THONNINGIA SANGUINEA**

Dr Ernst Specks, a floriculturist in Germany, has recently sent us pictures of this colourful parasitic plant, found in miombo (*Brachystegia*) forest in Zambia. Lyttton Musselman has identified it as *Thonningea sanguinea*.

It is reported to cause serious damage to rubber trees in West Africa, and may also attack oil-palm and cacao. A single plant can spread to attack 20 or more trees over an area of 0.5 ha. The species is dioecious with male and female flowers on separate plants. Hepper and Gasson (1986) in *Haustorium* 16 described and illustrated tubers growing to 6 cm in diameter.

Burkill in *The useful plants of west tropical Africa* (1968) (http://plants.jstor.org/upwta/1_523) provides useful information on distribution (mainly in West Africa but across tropical Africa too) local names, and a very wide range of traditional medicinal and other uses including e.g. in Ivory Coast the flower-heads are tied to the ankles of young infants to hasten their learning to walk. The pointed scales prevent sitting down in comfort! A number of more recent papers have confirmed the activity of extracts against a range of bacteria and fungi.

If any reader has new observations on this fascinating plant do please let us know.

Chris Parker.

**BIOCONTROL OF STRIGA – A PROGRESS REPORT**

The Integrated *Striga* Management in Africa (ISMA project) is taking a multi-pronged approach to *Striga* control and this was described in the July 2013 edition of *Haustorium*, issue 63. A component of this project involves developing the field application of a biological control for *Striga hermonthica*. The main remit of the project in terms of field application is - does the biological control agent, *Fusarium oxysporum* f. sp. *strigae* offer the potential as a realistic method of control? In order to demonstrate this, field trials were conducted in Nigeria and Kenya from 2011 to 2013.

In Nigeria several multi-location trials were conducted under natural and artificial *Striga* infestation across major *Striga*-infested agro-ecological zones and maize based farming systems in northern Nigeria to validate the efficacy of *Striga* bioherbicide *F. oxysporum* f. sp. *strigae* (Fos). Inocula of Fos produced by our project partner University of Hohenheim in Germany, was delivered as a film-coat on maize seeds using gum Arabic and professional seed coating technology. The application of biocontrol in combination with both *Striga* resistant and susceptible maize varieties supported significantly fewer emerged parasites than the susceptible control. In combination with the resistant maize, biocontrol caused a marked reduction in
Striga emergence compared to the resistant control. Results showed that the efficacy of the biocontrol technology in combination with the Striga susceptible maize variety (the farmers’ preferred, and therefore in practice, used variety) on Striga control and enhancement of maize grain yield was more pronounced in comparison to its combination with the resistant variety. This inconsistency in grain yield increase especially in the combination of Fos and resistant variety is due to poor Striga pressure i.e., the levels of Striga emergence were too low to reflect the real impact of Fos on grain yield. Therefore, to confirm the positive results obtained from the combination of biocontrol with the susceptible maize variety, and to verify the inconsistency in the results of its combination with the resistant maize variety, a series of extensive field validation trials were established in 2013 to comprehensively evaluate the control efficacy of isolate Foxy2 against Striga and its impact on grain yield across different environments where Striga populations are sufficiently high. The efficacy of biocontrol seed treatment technology is being evaluated in combination with Striga-resistant and susceptible maize varieties, and with farmer saved seeds included as controls. In addition, socio-economic benefit (cost-benefit) and impact of biocontrol technology is being assessed.

Typical disease symptoms on Striga shoots caused by Fusarium oxysporum f.sp. strigae isolate Foxy2

In Kenya, trials were proposed using the Ghanaian isolate Foxy 2 which was shown to be effective in West Africa. The use of a non-indigenous isolate of Fusarium oxysporum f.sp. strigae isolate Foxy 2 was required to be field tested under quarantine conditions under the supervision of KARI and KEPHIS. However results using the Ghanaian isolate were disappointing in the control of Kenyan Striga. Foxy2 showed poor performance and did not provide effective biocontrol of Striga under East African conditions in Kenya. The low activity of Foxy 2 in East Africa may be due to ecological adaptations, in spite of Foxy2 being able to survive following seed treatment application and planting and proliferate in Kenyan soil in rhizosphere studies carried out by our project partner University of Hohenheim in Germany. As a consequence of this, an indigenous strain FK3 was isolated locally and tested for control of Striga across 2 seasons. This gave promising results over two seasons. Trial work is continuing for the next two growing seasons in Western Kenya.

Project partners: IITA (Dr. F. Beed and Dr. A. Elzein), The Real-IPM Company Ltd (Dr. H. Wainwright), Kenya; University of Hohenheim (Prof. G. Cadisch, Dr. F. Rasche and Prof. J. Kroschel), Germany; Institute for Agricultural Research – Ahmadu Bello University (Dr. A. Zarafi), Nigeria; University of Stellenbosch (Prof. A. Viljoen), South Africa; and McGill University (Prof. A. Watson), Canada.

Fen Beed
Abuelgasim Elzein
Henry Wainwright

CONGRATULATIONS

Our congratulations to Dr G. Nanjappa Dhanapal at University of Agricultural Science, Hebbal, Bangalore, on his recognition as ‘Scientist of the year-2013’ by the National Environmental Science Academy, New Delhi. He has also recently been promoted to the post of Principal Investigator and Scheme Head of the All India Coordinated Research Project on Weed Control in Bangalore.

PRESS REPORTS

Witchweed a serious threat: McVeigh

Red witchweed (Striga asiatica) could cost the grains and cane industries millions if it takes hold in Queensland, says State Agriculture Minister John McVeigh. Mr McVeigh today visited producers near Mackay whose properties have been affected by the recent detection of the exotic pest in mid-July. He said it had been a good opportunity to meet face-to-face with affected landholders to discuss their individual circumstances. ‘We know in the United States it’s a very significant problem, they spend in the order of $250 million to address the issue,’ Mr McVeigh said.

Up to 60 farming properties in the Mackay region could be affected by the serious pest. Biosecurity Queensland’s Director Invasive Plants and Animals John Robertson said
this was the first confirmed detection of red witchweed in Australia. The weed is native to parts of Africa, the Middle East and Asia and causes around $7 billion of damage to grain crops in Africa each year. ‘While our priority is to minimise any biosecurity risks, an integral part of this response is to ensure there is some business continuity for individual producers,’ Mr McVeigh said. ‘We are working closely with both industry and local producers to find ways of allowing harvesting of crops to continue this year.’

Red witchweed has not been detected outside the five properties that originally reported the pest. Movement restrictions have been placed on four of these properties. ‘The fifth property is being surveyed and will continue to be monitored but the weed hasn’t been found on that property to date,’ he said. ‘Our surveillance teams have identified potential high risk pathways for the weed to spread, such as the movement of machinery.’

Canegrowers Queensland chair Paul Schembri said the weed is impacting on the livelihoods of affected farmers and the possibility of compensation had been discussed with the State government. ‘Those four farmers are bearing an enormous bureaucratic burden and on behalf of the greater public good here,’ Mr Schembri said.

Mr McVeigh also met with Biosecurity Queensland staff at the Local Control Centre in Mackay. ‘The team is doing a great job in conducting surveillance for red witchweed and providing support and advice to the property owners,’ he said. Landholders are urged to follow good biosecurity practices to reduce any potential spread of this weed, including appropriate clean down of machinery and equipment. If anyone suspects they have red witchweed, they must report the plant to Biosecurity Queensland immediately.

Farm Weekly, 8 August 2013.

**Hunger looms as deadly weed destroys 450,000 tonnes of maize**

Western Kenya and parts of Nyanza are at risk of losing an estimated 450,000 tonnes of maize. This is as striga — a parasitic weed continues to decimate over 300,000 hectares of the crop. More than 300,000 farmers in the counties of Bungoma, Siaya, Busia, Vihiga, Kisumu, Kakamega, Migori, and Homa Bay, are the most affected by the weed. This leaves about 1.5 million people at risk of starvation. The destructive weed is also showing traces in other food basket regions including areas in Rift Valley and Central.

Across East Africa, the weed infests up to 40 million hectares of smallholder farmland in the region — occasioning yield losses ranging from 20-80 per cent and even total crop failure in severe infestation.

In its wake more than a million farmers are counting massive losses. Marking the 10th Anniversary celebrations of the African Agricultural Technology Foundation (AATF) in Nairobi last week, scientists, agro-dealers, farmers, and local seed companies warned that unless more was done, the weed will severely dent the country’s efforts at ensuring food security. ‘Over one million growers in Kenya, Tanzania, and Uganda have been counting losses as the weed destroys their crops,’ AATF Seed System Manager Gospel Omanya said. ‘We have engaged the growers through new technology but the weed is yet to be fully contained,’ he said, adding that seeds of the dangerous weed remain in the soil for up to 20 years. ‘Due to its characteristics and longevity in the soil, it is able to infest new crops in each season, frustrating efforts to enhance food security.

Striga is a parasitic weed that seriously constrains the productivity of staples such as maize, sorghum, millet and upland rice in sub-Saharan Africa. The weed survives by siphoning off water and nutrients from the crops for its own growth. Yet, according to the forum, this is just one of the challenges of food production on the continent.

Prof Gordon Conway from the Imperial College, London, blamed low commodity prices and poor technology as central to the problems that afflict African farmers. ‘Government’s must draft policies that encourage farmers to adopt modern technology,’ Prof Conway said, noting that while farmers in developed countries produce up to 11 tonnes per hectare, local farmers hardly post a tonne. ‘The beginning point could be adoption of drought-resistant seeds and use of appropriate technology to fight pests and diseases that threaten crop production,’ he said.

The most incapacitating aspect to food production, however, is farmers’ limited market access and its inevitable twin of poor commodity prices. Dr Denis Kyetere, the AATF executive director said governments should invest in structures and policies that link farmers to appropriate markets. ‘This way, agriculture becomes a business and farmers are guaranteed where to sell their produce and at how much,’ he said. He observed that the State should also work out modalities to help finance farming especially among smallholder farmers. ‘Access to markets is also key to stemming post-harvest losses,’ he said.

Nicholas Waitathu for Standard Digital, November 11th 2013.
Weed that denies Tanzania 1.7 m tonnes of maize annually

Recently, Open Forum on Agricultural Biotechnology in Africa (OFAB), Tanzania Chapter, organised its monthly meeting at COSTECH in Dar es Salaam which was attended by agricultural researchers, and media practitioners. During the meeting, researcher from Kenya, Dr Gospel Omanya explained how striga weed, a parasitic plant, is causing loss of maize in different regions in Tanzania. He was presenting a paper titled: The Role of Seed Systems in Revitalisation of Agricultural Productivity in Africa: The Case Study of Strigaway Maize in Tanzania. Striga has been a major problem in sub-Saharan Africa daunting farmers for over seven decades and Tanzania is said to have the highest number of farma affected by striga weed in the entire region as it causes a loss of about 1.7 million tonnes of maize every year in Tanzania valued at 356 million dollars. Striga is a major contributor to food insecurity, especially among rural people whose diet comprises mainly of cereal staples and particularly maize, estimating that the lost 1.7 million tonnes of maize per year can feed more than 10 million people.

In Tanzania many regions are affected by the weed. They are Mwanza, Shinyanga, Mara, Tabora, Singida, Dodoma, Morogoro, Coast, Tanga, Lindi, Ruvuma, Iringa, Mbeya, Mtwara and Rukwa. In these regions, the parasitic weed striga has infested over 960,000 ha of farmland, which accounts for almost 70 per cent of the striga weed infested area in East Africa. Tanzanians depend much on maize as their main food crop but also Tanzania is bigger compared to other East African countries of Kenya and Uganda. Other infected countries in terms of ha include Malawi (268,000), Kenya (246,000), Ethiopia (80,000) and Uganda (38,000).

Innovations such as Strigaway (IRMaize) technologies area available for control. It is apparent that innovative technologies be adopted by farmers if the numerous challenges to agricultural productivity are to be adequately addressed. Experiences from commercialization efforts of the Strigaway (IR) maize further stress the need for a functional formal seed system to reach the farmers. In this regard, the seed systems should play a crucial role towards revitalizing agricultural productivity.

African Agricultural Technology Foundation (AATF) is a not-for-profit organisation that facilitates and promotes public-private partnerships for the access and delivery of appropriate agricultural technologies for sustainable use by smallholder farmers in Sub-Saharan Africa (SSA) through innovative partnerships and effective stewardship along the entire value chain. The Foundation is a one-stop-shop that provides expertise and know-how that facilitates the identification, access, development, delivery and utilisation of agricultural technologies. AATF works towards food security and poverty reduction in Sub-Saharan Africa, and its structure and operations draw upon the best practices and resources of both the public and private sectors. It also contributes to capacity building in Africa by engaging African institutions in the execution of tasks that contribute to the Foundation’s mission and many other issues.

On its tenth anniversary AATF celebrates the achievements in managing 10 projects involving 10 countries in Africa. AATF accesses, develops, adapts and delivers appropriate agricultural technologies for sustainable use by smallholder farmers in Sub-Saharan Africa, through innovative partnerships. AATF is bringing appropriate technologies to help fix problems like bacterial wilt in banana, aflatoxins in peanuts and maize, striga ‘vampire weed’ control in maize, cassava mechanization, pod boror infestations in cowpea as well as drought tolerance in maize.

Gerald Kitabu for This Day, November 26, 2013.

Scientists battle striga (witchweed) in Uganda

Scientists in the region are battling Striga (witchweed) that has affected the productivity of staple foods such as maize, sorghum, millet and rice in the eastern part of the country. The most affected areas are mainly, Tororo, Moyo, Bugiri, Busia, Budaka and Iganga. Farmers bordering Uganda on Kenyan side and Tanzania have also been affected by the Striga weed. Seed systems manager of African Agricultural Technology Foundation (AATF), Dr. Gospel Omanya said that over 100,000 hectares of land has been affected by the striga weed in Uganda.

Striga weed is parasitic weed that affects the productivity of staple food like maize, sorghum and millet. It causes damage to its host crop before emerging from soil by producing phytotoxins which are harmful to the host crop. Omanya said that over one million hectares of land are affected by the weed in East Africa and over 40 million hectares of smallholder farmland in the sub-saharan Africa is affected.

‘Striga weed seeds remain dormant and viable in the soil for up to twenty years. With every planting season, some of the seeds germinate and infest the crops while reproducing and increasing the striga seed in the soil,’ he said.

Hundreds expected at Tenbury Well mistletoe fair

Tenbury Wells in Worcestershire, UK, claims to be the mistletoe capital and is well known for its mistletoe auctions. Its annual festival has a procession led by druids.

In 2010, conservationists warned about future supplies over fears of a decline of its habitat. Mistletoe thrives in established apple orchards, which have seen a big decline over the past 60 years. Caroline Palethorpe, festival manager, said: ‘It's important to Tenbury because it's the only place in the country where we have the unique mistletoe auctions which have been going for over 100 years. The area is renowned for fruit and particularly the apple tree, and therefore it grows in abundance.’

Poet Laureate Carol Ann Duffy performed poetry later on Saturday evening.

NEW BOOKS


We have sadly, so far, been unable to find a reviewer for this great new volume, but will hope to provide a review in the next issue. Meanwhile, the wide scope of the book may be judged from the following list of chapters.

1. Introduction: The parasitic syndrome in higher plants / H.S. Heide-Jørgensen

Part I: The Orobancheae and their parasitic mechanisms
2. The haustorium and the life cycles of parasitic Orobancheae / D.M. Joel
3. Functional structure of the mature haustorium / D.M. Joel
5. Haustorium invasion into host tissues / A. Pérez-de-Luque
6. The physiology of the established parasite-host association / J.H. Westwood
7. Host reaction to attack by root parasitic plants / M.P. Timko and J.D. Scholes
8. Seed production and dispersal in the Orobancheae / D.M. Joel
9. The seed and the seedling / D.M. Joel and H. Bar
12. Are karrikin signalling mechanisms relevant to strigolactone perception? / D.C. Nelson
13. Changing host specificities: mutations or epigenetic? / T.J.A. Bruce and J. Gressel
14. Phylogenetic relationships and evolutionary trends in Orobancheae / G.M. Schneeveiss
15. Genomic evolution in Orobancheae / S. Wicke
17. Weedy Orobancheae – The problem / J. Gressel and D.M. Joel
18. The parasitic weeds of the Orobancheae / C. Parker
19. Population diversity and dynamics of parasitic weeds / B. Román
20. Molecular diagnosis of parasite seed banks / J. Prider, K. Ophel Keller and A. McKay
22. Integrated agronomic management of parasitic weed seed banks / Y. Goldwasser and J. Rodenburg
24. Biotechnologies for directly generating crops resistant to parasites / J. Gressel


These two volumes present a comprehensive coverage of anything related to the rhizosphere covering current
knowledge on the molecular basis of plant-microbe interactions in the rhizosphere, with contributions from authors around the world. Parasitic plants and the strigolactones are covered particularly in the three chapters 33, 34 and 35 by Yoneyama and co-workers, Lopez-Raez and co-workers and Bouwmeester and co-workers listed in the Literature section below, providing an extensive coverage of chemistry and biochemistry of the strigolactones and their biological effects in planta and in the rhizosphere, particularly in the germination of root parasitic plants and the induction of hyphal branching in arbuscular mycorrhizal fungi.


**THESIS**

**Biology of Field Dodder (Cuscuta campestris Yunk.) and options for its control.** Marija Saric-Krsmanovic. PhD, Institute of Pesticides and Environmental Protection, Banatska 31b, 11080 Zemun-Belgrade, Serbia. Supervisor Dr Sava Vrbnicanin, December 2013.

**Abstract:** Determination of 23 populations of field dodder was conducted using light and scanning electron microscopy and subsequent molecular (PCR) methods in order to fully examine the biology and ecology of Cuscuta campestris and options for its control. The effects of different temperatures and rhizobacteria (PGPR) on germination of C. campestris seeds, as well as effects of different light treatments (red, far-red and blue light) on germination, growth, and height of attachment points of field dodder shoots on alfalfa stems were also investigated. We examined the effects of C. campestris on morphological (visualisation and fresh weight), anatomical (anatomy of leaf and stem of alfalfa; leaf and petiole of sugar beet) and physiological parameters (relative chlorophyll content, total carotenoids, nitrogen, phosphorus, potassium, organic and mineral matter and chlorophyll fluorescence) in alfalfa and sugar beet plants exposed and unexposed to herbicides (imazethapyr, glyphosate, propyzamide) and diquat in controlling field dodder in alfalfa crop was examined in field trials.

After examining 23 populations of field dodder, two species of the genus Cuscuta were identified: Cuscuta campestris Yunk. and Cuscuta epithymum (L.) Nath. An optimal temperature for germination of C. campestris seeds was found to be 30°C and treatment with red light (for 1h at daytime) produced the highest percentage of germinated seeds, while the highest percentage of seedlings attached to alfalfa stems at 4.65 cm height was found after treatment with far-red light (for 45 min at daytime). Also, the highest percentage of germinated field dodder seeds was recorded after treatment with the rhizobacterium Azotobacter chroococcum isolated from wheat rhizosphere. An analysis of our data showed that the highest values of most parameters (visualization and fresh weight; relative content of chlorophyll and total carotenoids, effective yield and intensity of fluorescence, variable fluorescence, variable/maximal fluorescence ratio; thickness of stem epidermis, thickness of cortex, thickness of central cylinder and stem diameter of alfalfa; thickness of upper and lower leaf epidermis, thickness of palisade and spongy mesophylls, thickness of mesophyll in alfalfa and sugar beet leaves; diameter of tracheids, petiole hydraulic conductance, xylem area, diameter of phloem cells and petiole phloem area of sugar beet) were found in non-infested alfalfa and sugar beet plants, then in infested plants treated with herbicides, and the lowest in plants infested by C. campestris but untreated with herbicides. C. campestris was found to affect and reduce nearly all parameters of stem, leaf and petiole anatomy of the host plants, in contrast to some physiological parameters. The infested alfalfa and sugar beet plants were found to have higher contents of nitrogen, phosphorus, potassium and organic matter, compared to non-infested plants. The highest efficacy in controlling field dodder in alfalfa field was demonstrated by diquat (product Reglon forte 3 l/ha), then by glyphosate (product Glifol 0.8 and 1 l/ha), while the other two tested herbicides (propyzamide – product Kerb WP-50 and imazethapyr – product Pivot 100 M) showed lower efficacy.

**FUTURE MEETINGS:**

The XVI Congress on Molecular Plant-Microbe Interactions will be held July 6–10, 2014 in Rhodes Island, Greece at the Rodos Palace Hotel. No detailed programme as yet, but parasitic plants likely to be covered. To keep track, see: http://www.mpmi2014rhodes-hellas.gr/index.php

13th World Congress on Parasitic Plants, Kunming, China, June/July, 2015. Dates to be confirmed, and other details will be available on the IPPS web-site in due course.

**GENERAL WEB SITES**

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see: http://www.parasiticplants.org/ (N.B. currently a little out of date)
For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the COST/STREAM conference see: http://streamisrael2013.wix.com/stream-israel-2013

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes up to 1995, but apparently incomplete since then) see: http://www.rmrs.nau.edu/mistletoe/

For information on future Mistel in derTumortherapie Symposia see: http://www.mistelsymposium.de/deutsch-/mistelsymposien.aspx

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vlk.ch/Informationen/Literatursuche (in German but can be searched by inserting author name).

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)

For past and current issues of the Sandalwood Research Newsletter, see: http://www.jcu.edu.au/mbil/srn/index.html

LITERATURE

• indicates web-site reference only


Abutarbush, S.M. 2013. Alfalfa dodder (Cuscuta campestris) toxicity in horses: clinical, haematological and serum biochemical findings. Veterinary Record 173(4): 95. [Of 20 horses ‘naturally exposed’ to lucerne contaminated with C. campestris in Jordan, 11 showed diarrhoea, decreased appetite, neurological signs and/or abdominal pain. The results of complete blood cell counts revealed leukocytopenia, neutropenia and thrombocytopenia.]


Adonu, C.C., Eze, C.C., Ugwuezwe, M.E. and Ugwu, K.O. 2013. Comparative study of Cusseta filiformis and Cleistopholis patens for antimicrobial activity. World Journal of Pharmacy and Pharmaceutical Sciences (WJPPS) 2(3): 1434-1445. [Extracts of C. filiformis were better antimicrobial agents than the leaf extracts of Cl. patens against Candida albicans, Staph. aureus, E. coli and Ps. aeruginosa.]


Aksoy, E., Arslan, Z.F. and Öztürk, N. 2013. Phelipanche aegyptiaca (Pers.) Pomel: a new record as a parasitic weed on apricot root in Turkey. African Journal of Agricultural Research 8(29): 4001-4006. [Recording widespread occurrence of Orobanche aegyptiaca in apricot in 5 of the 14 important apricot growing areas of Turkey. In Malatya, infestation averaged 57 shoots per m² and were over 200 per m² in some orchards.]

Aly, R. 2013. Trafficking of molecules between parasitic plants and their hosts. Weed Research (Oxford) 53(4): 231-241. [Reviewing the current knowledge on translocation of siRNAs, mRNAs, viruses, sugars,
proteins and herbicides from host to parasitic plants and the potential significance of such molecules to the parasite. Also discussing how this knowledge can contribute to the development of state-of-the-art, effective approaches to parasitic weed management.

Amer, B., Juvik, O.J., Francis, G.W. and Fossen, T. 2013. Novel GHB-derived natural products from European mistletoe (Viscum album). Pharmaceutical Biology 51(8): 981-986. [A new type of natural product derived from the methyl ester of γ-hydroxybutyric acid (GHB) coupled to hydroxybenzoic acids, namely 3-(3′-carbomethoxypropyl) gallic acid and 3-(3′-carbomethoxypropyl)-7->3″-protocatechoyl galloate were characterized from Viscum album.]

Amico, G. C., Vidal-Russell, R., Aizen, M. A. and Nickrent, D. 2014. Genetic diversity and population structure of the mistletoe Tristerix corymbosus (Loranthaceae). Plant Systematics and Evolution 300: 153-162. [This mistletoe species showed higher variation among populations in the central part of its range compared to northern and southern regions suggesting genetic mixing from pollen movement (hummingbirds) and seed movement (birds).]

Anjorin, F.B., Olakojo, S.A. and Aduloju, M.A. 2013. Testing of striga resistant composite maize varieties for response to two levels of nitrogen fertilizer up-take. African Journal of Plant Science 7(9): 432-437. [Concluding that ‘Use of Striga resistant maize varieties concomitantly with nitrogen fertilizer is recommended for farmers in S. lutea (= S. asiatica?) endemic ecotype, for higher grain yield - but abstract not too informative.]

Anon. 2011. EU Inventory-ECE Forest Damage (IDF) in Spain. European Network Monitoring forest damage. Level I. 2011 Sampling Results. Ecología (Madrid) 25: 239-278. [Noting a continued ‘worrying’ increase in mistletoe (presumably Viscum album) infestations in alder forest near the Cantabrian coasts.]


ideal hybrids for further testing. But see also Akaogu et al. above.]
Ballian, D. 2013. Genetic overload of silver fir (Abies alba Mill.) from five populations from central Bosnia and Herzegovina. Folia Forestalia Polonica. Series A, Forestry 55(2): 49-57. [The presence of mistletoe (presumably Viscum album) increased the percentage of rotten seed in infested silver fir.]
Bazgir, E., Zeidaliand, E. and Ahmadi, A. 2013. Using from sulfonylurea for control of broomrape (Orobanch cernua) in tomato fields in Khorramabad. Technical Journal of Engineering and Applied Sciences 3(19): 2437-2444. [Sulfo-sulfuron was superior to nicosulfuron or rim-sulfuron for control of O. cernua in tomato, proving selective at 50-60 g/ha.]
Bibalani, G.H. and Taheri, E. 2013. A checklist of the flora from sulfonylurea for control of broomrape (Orobanch cernua) in tomato fields in Khorramabad. Technical Journal of Engineering and Applied Sciences 3(19): 2437-2444. [Sulfo-sulfuron was superior to nicosulfuron or rim-sulfuron for control of O. cernua in tomato, proving selective at 50-60 g/ha.]
Bisikwa, J., Sekamatte, S., Kapting, I., Karuhanga, M.B., C´ebovic´, T., Popovic´, M., Ristic´, M.S. and Radanovic´, S. hermonthica].
Carrillo-Ocampo, D., Bazaldúa-Gómez, S., Bonilla-Barbosa, J.R., Aburto-Amar, R. and Rodríguez-López, V. 2103. Anti-inflammatory activity of iridoids and verbascoside isolated from Castilleja temuliflora. Molecules 18(10): 12109-12118. [C. temuliflora has been used in Mexico as a treatment for cough, dysentery, anxiety, nausea and vomiting as well as hepatic and gastrointestinal diseases. Results tended to confirm its value as an anti-inflammatory. The most active iridoid was geniposidic acid.]
Chandrakasan, L. and Neelamegam, R. 2013. GC-MS analysis on phytochemicals of Loranthus longiflorus Desr. (a hemi-parasite) leaf collected from two host trees. Advances in Plant Sciences 26(1): 205-209. [Extracts of L. longiflorus (= Dendrophthoe falcata) growing on Casuarina equisetifolia and Ficus religiosa.]
*Cheng Xi, Ruyter-Spira, C. and Bouwmeester, H.J. 2013. The interaction between strigolactones and other plant hormones in the regulation of plant development. Frontiers in Plant Science 4, art 199. (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC368363)] [Review of the current knowledge on the crosstalk between strigolactones and other plant hormones, such as auxin, cytokinin, abscisic acid, ethylene and gibberellins, in the regulation of several different physiological processes and how this hormonal crosstalk enables plants to respond to their ever changing environments.]
Chlumský, J., Koutecký, P., Jilková, V. and Stech, M. 2013. Roles of species-preferential seed dispersal by
Debajit Kalita and Jagat Saikia. 2012. Ethonomedicinal, antibacterial and antifungal potentiality of


Demirbas, S., Vlachonasios, K.E., Acar, O. and Kaldis, A. 2013. The effect of salt stress on Arabidopsis thaliana and Phelipanche ramosa interaction. Weed Research (Oxford) 53(3): 452-460. [High concentration of NaCl (50-100 mM) delayed P. ramosa seed germination and salt-treated A. thaliana seedlings were more sensitive to the parasite. At the molecular level, there was a synergistic effect of salt and P. ramosa stresses on the cold-regulated (COR) gene expression profile of treated A. thaliana seedlings.]


Dey, S.K. and Mukherjee, S.K. 2013. Range of host variation of Cuscuta (Cuscutaceae) in Nadia district (West Bengal) along with haustorial structure in some host with plants. International Journal of Pharmaceutical Research and Bio-Science, 2(4): 72-95. [Recording 25 hosts of C. reflexa and only 5 of ‘C. chinensis’ (probably C. campestris?). ‘Mikania cordata’ (almost certainly M. micrantha) noted as a major host of both species.]

Dierschke, H. 2013. (Constancy and dynamics in a species-rich calcareous beech forest. Changes within a large transect 1981-2011.) (in German). Tuexenia 33: 49-92. [Neottia nidus-avis was among only 5 species showing a pronounced increase in beech forest over a 3 decade period.]


Dor, E. and Herschenhorn, J. 2012. Allelopathic effects of Imula viscosa leaf extracts on weeds. Allelopathy Journal 30(2): 281-290. [Cuscuta reflexa among weed species highly sensitive to the extract from I. viscosa and to the ground dry leaves mixed with soil. Wheat, cotton and melon crops were resistant. The active compound was identified as the sesquiterpene lactone tayumin.]


loci, along with Patterson’s D-statistic test, were used to detect significant introgression in the “re-thamnophila” clade but not the “superba” clade of Pedicularis.”


Gajšek, D., Jarni, K. and Brus, R. 2103. Infection patterns and hosts of Arceuthobium oxycedri (DC.) M. Bieb. in Slovenia. Forest Pathology 43(3): 185-192. [In 6 of 11 populations of mixed Juniperus spp. studied, J. oxycedrus was more heavily and frequently (77%) parasitized by A. oxycedri than was J. communis (54%). Some A. oxycedri individuals were large – 25-40 cm in diameter.]

Gao JianMei, Li Ran, Zhang Lei, Jia LiLong, Ying XiXiang, Dou DeQiang, Li JianChun and Li HaiBo. 2013. Cuscuta chinensis seeds water extraction protecting murine osteoblastic MC3T3-E1 cells against tertiary butyl hydroperoxide induced injury. Journal of Ethnopharmacology 148(2): 587-595. [C. chinensis has been used traditionally in China to treat heart disease, diabetes, liver injury, cancer, and aging. In this study C. chinensis modulated the oxidative stress-induced apoptosis in MC3T3-E1 cells, probably due to its antioxidant activity.]


Gibot-Leclerc, S., Abdennobi-Abdemessed, N., Reibel, C. and Colbach, N. 2013. Non-host facilitators, a new category that unexpectedly favours parasitic weeds. Agronomy for Sustainable Development 33(4): 787-793. [Results show a nearly threefold increase in the infection of oilseed rape by Phelipanche ramosa in the presence of the non-host Convolvulus arvensis. It is suggested that a new category of 'non-host facilitator' is needed. The underlying mechanism is unknown but it was observed that C. arvensis supported secondary attachments from O. ramosa on nearby crop hosts.]

Gibot-Leclerc, S., Dessaint, F., Reibel, C. and le Corre, V. 2013. Phelipanche ramosa (L.) pomel populations differ in life-history and infection response to hosts. Flora (Jena) 208(4): 247-252. [Confirming a degree of host specialisation in two populations of P. ramosa, that on tomato/tobacco normally maturing in 14 weeks while that on oilseed rape matures only after 40 weeks. In reciprocal infections each population showed a higher aggressiveness on their natural hosts than on the other. The tomato/tobacco population completed its life cycle on both hosts within the 16 weeks of the experiment.]

Glavaš, M. 2012. (Harmful effects on silver fir caused by white mistletoe.) (in Croatian) Glasilo Biljne Zaštite 12(3): 239-244. [Viscum album occurs extensively in silver fir with up to 147 infections recorded per tree and 60% reduction in growth. The trees with diameter larger then 60 cm do not increase in volume and their yield is reduced. They may also become predisposed to attacks of pathogenic fungi a bark-beetles.]


Guaraldo, A.de C., Boeni, B.de O. and Pizo, M.A. 2013. Specialized seed dispersal in epiphytic cacti and convergence with mistletoes. Biotropica 45(4): 465-473. [Noting similar dispersal systems of epiphytic cacti in the genus Rhipsalis, and Viscae cacti, which involve the same Euphonia spp. dispersal agents. Similar fruit morphologies and fruit chemistry are apparently convergent adaptive strategies that enable seeds of both groups to reach adequate microsites for establishment in host branches.]


Huang ShuangQuan and Shi XiaoQing. 2013. Floral
isolation in *Pedicularis*: how do congeners with shared
pollinators minimize reproductive interference? New
Phytologist 199(3): 858-865. [Confirming that pollen
placement and pickup on the bumblebee *Bombus
richardsi* differed between *P. densispecta*; *P. dichotoma*
and *P. tricolor* helping to reduce reproductive
interference, but the positions of pollen placement and
stigma contact on the bee's body were not as precise as
previously thought.]

Hülsmann, L., Evers, J. and Eichhorn, J. 2103. (Mistletoe -
compared to 57-year old pines from *Viscum album* and factors
contributing to its spread.)

Hussain, S., Güzel, Y., Schönbichler, S.A.,, Rainer, M.,
Ibrahim, J.A. and Ayodele, A.E. 2013. Taxonomic
stigma contact on the bee's body were not as precise as
previously thought.

James, O., Godwin, E.U. and Agah, O.D. 2013. Anti-
venom studies on *Oliax viridis* and *Syzygium guineense*
extracts. American Journal of Pharmacology and
Toxicology 8(1): 1-8. [In Nigeria *O. viridis* is used as a
treatment for ulcers, venereal diseases, ringworm,
sleeping sickness, diarrhea, fever and for snake-bite.
Tests in rats confirmed useful anti-venom properties.]

Jin ShangWu, Chen GuiLin, Du JuanJiangMeng, Wang
LiHong, Ren Xu and An TianYue. 2014. Antioxidant
properties and principal phenolic compositions of
*Cynomorium songaricum* Rupr. International Journal of

Joel, D.M. 2013. The haustorium and the life cycles of
parasitic Orobanchaceae. Chapter 2 in: Joel, D.M.,
Gressel, J. and Musselman, L.J. (Eds) Parasitic
Orobanchaceae - Parasitic Mechanisms and Control

Joel, D.M. 2013. Functional structure of the mature
haustorium. Chapter 3 in: Joel, D.M., Gressel, J. and
Musselman, L.J. (Eds) Parasitic Orobanchaceae -
Parasitic Mechanisms and Control Strategies. Springer,
Heidelberg, pp. 25-60.

Chapter 9 in: Joel, D.M., Gressel, J. and Musselman,
L.J. (Eds) Parasitic Orobanchaceae - Parasitic
Mechanisms and Control Strategies. Springer,
Heidelberg, pp. 147-166.

Jürgens, A., Wee SukLing, Shuttleworth, A. and Johnson,
S.D. 2013. Chemical mimicry of insect oviposition
sites: a global analysis of convergence in angiosperms.
Ecology Letters 16(9): 1157-1167. [Concluding that the
emission of oligosulphide-dominated volatile blends
like those emitted by carrion has evolved independently
in at least five plant families (Annonaceae,
Apocynaceae, Araceae, Orchidaceae and Rafflesiaaceae)
and characterises plants associated with pollination by
necrophagous flies and beetles.]

Jurkovič, D., C´osic´, J., Vrandečic´, K. and Poštic´, J.
- 'an almost forgotten parasite' in
flower.

studies on *Balanophora fungosa* - a negative listed
the pharmacognostical characteristics of *B. fungosa*
and diagnostic features to differentiate it from *Scindapsus
officinalis.*]

Koech, M. and 14 others. 2011. Economic returns of
varying *Desmodium* trimming regimes in "Push-Pull"
tercropping system in western Kenya. 10th African
Crop Science Conference Proceedings, Maputo,
Mozambique, 10-13 October 2011:13-17. [Confirming
that when P is not limiting inter-cropping maize
with *D. uncinatum* or *D. intortum* (for control of *Striga
hermonthica*) can provide adequate N to enhance crop
growth and yield only after *Desmodium* becomes well
established.]

Koltai, H. 2013. Strigolactones activate different hormonal
pathways for regulation of root development in response
to phosphate growth conditions. Annals of Botany
112(2): 409-415. [A review of the current insights in
how low phosphate through strigolactone upregulation, and their interaction with auxin and ethylene, changes root architecture."


Kuijt, J. 2013. Tristerix rhodanthus, a new species of Loranthaceae from Bolivia. Brittonia, 65(3): 292-295. [T. rhodanthus is a new large-pink-flowered species, described from a single specimen parasitizing a Brachysytum sp. at 3,600 m.]

Kuijt, J. 2011. Isophasic parasitism in Phoradendron perredactum (Viscaceae). Acta Botanica Mexicana, 96: 11-13. [Pointing out that the newly described P. perredactum (see Rzedowski, 2011) exhibits isophasic parasitism, an advanced type of growth behaviour that also occurs in some Arceuthobium spp. (e.g. A. minitusstium), Mitrastema yamamotoi and Pilostyles haussknechtii. It entails longitudinal growth of the endophyte keeping pace with the longitudinal extension of the parasitized host branch and developing its first external shoots in completely predictable locations.]


Kwanda, N., Noikotr, K., Sudmoon, R., Tanee, T. and Chaveechar, A. 2013. Medicinal parasitic plants on diverse hosts with their usages and barcodes. Journal of Natural Medicines 67(3): 438-445. [In northeastern Thailand traditional usages include: Scarrula atropurpurea for nourishing blood, Dendrocthoe pentandra for high blood pressure, and Helixanthera parasitica for liver disease. Other species included in this study were D. lanosa, Macrosolen brandisianus, M. cochinchenis, Viscum articulatum and V. ovalifolium. Tag sequences from each have been submitted to GenBank databases under accession numbers JN687563-JN687578.]


Li AiRong, Guan KaiYun, Stonor, R., Smith, S.E. and Smith, F.A. 2013. Direct and indirect influences of arbuscular mycorrhizal fungi on phosphorus uptake by two root hemiparasitic Pedicularis species: do the fungal partners matter at low colonization levels? Annals of Botany 112(6): 1089-1098. [AM colonization of Pedicularis rex and P. tricolor was low, but where it did occur AM fungi strongly interfered with P acquisition by both Pedicularis species from their host barley suggesting evidence for a novel mechanism preventing the parasites from overexploiting host resources through AM fungal-induced suppression of the absorptive structures in the parasites.]


Li DongZhe and Ma WeiMin. 2013. (Effects of cynomorium decoction upon the metabolism of free radical and liver glycogen of liver tissue of exercise rats.) (in Chinese) Modern Preventive Medicine 40(9): 1478-1480. [Concluding that extract of Cynomorium coccineum ssp. songaricum has the function of protecting liver tissue of rats from free radical damage and promoting the capacity to exercise.]

Liao YanFang, Huo Lini, Chen Rui, Li PeiYuan and Lu RuMei. 2013. Antioxidant activity of Taxillus chinensis parasitizing on Toona sinensis (A. Juss) Roem. Asian Journal of Chemistry 25(14): 7790-7792. [Confirming the presence of antioxidants which may be useful for curing diseases arising from oxidative deterioration.]

californicum in relation to its legume hosts, bird dispersers and climate.


Seed morphological diversity of Pedicularis (Orobanchaceae) and its taxonomic significance. Plant Systematics and Evolution 299(9): 1645-1647. [Among seeds of 109 species of Pedicularis, the largest were P. superba (4.8 mm) and the smallest P. crenata (1.0 mm). All were reticulate except for P. pantlingii and P. confluens. Seed shape, primary ornamentation, inner tangential wall ornamentation and epidermal cell shape could be applied to identification of some species in the genus.]

Liu YingKun, Li GuoDong, Gui RenYi, Zhang Hui and Hu XiaoWei. 2013. (Determination of strigolactones extracted from root of Phyllostachys edulis by ultra performance liquid chromatography.) (in Chinese) Journal of Zhejiang A&F University, 30(4): 607-610. [A simple and highly sensitive method is described for the determination of strigolactones extracted from roots of P. edulis (Gramineae) by ultra performance liquid chromatography (UPLC) with ultraviolet (UV) detection; 5-deoxystrigol is the major component.]


Lopez-Raez, J.A., Torres-Vera, R., Kohlen, W., Charnikhova, T., Garcia, J.M., Bouwmeester, H. and Pozo, M.J. 2013. AM symbiosis as a control strategy against root parasitic plants through strigolactone reduction. IOBC/WPRS Bulletin 88: 73. (abstract only) [Overview of the knowledge about how AM fungi induce resistance to parasitic plants.]

Lu DanYi, Zhang JiaYu, Yang ZhenYa, Liu HongMing, Li Sha, Wu BaoJian and Ma ZhiGuo. 2013. Quantitative analysis of Cistanches Herba using high-performance liquid chromatography coupled with diode array detection and high-resolution mass spectrometry combined with chemometric methods. Journal of Separation Science 36 (12): 1945-1952. [Ten phenylethanoid glycosides were identified and further quantified as marker substances to distinguish between different Cistanche spp. including C. desertica and C. sinensis.]


Malik, R.A. and Gupta, R.C. 2013 Meiotic studies in some selected members of Gamopetalae from Kashmir Himalaya. Plant Systematics and Evolution 299(8): 1549-1560. [Determining the chromosome number of Euphrasia paucifolia as n = 22. Also noting the occurrence of abnormal meiosis/microporogenesis of one or other type, thereby leading to pollen anomalies.]


Massako, F., Tchmat, M., Mony, R., Yemeda, C.F.L. and Dibong, S.D. 2013. Parasitism of Dacryodes edulis by the genus Tapinanthus (Loranthaceae) and the assessment of the associated myrmecofauna in Logbessou plateau (Douala, Cameroon). Journal of Applied Biosciences, 68: 5336-5348. [Recording that Dacryodes edulis (Burseraceae) is seriously parasitized by Tapinanthus ogovensis and by T. preussii, while other trees are attacked by Phragmanthera capitata. Also identifying a number of associated ant species one of which may be damaging the parasite, but most are protective?]


Mehl, H.K., Mori, S.R., Frankel, S.J. and Rizzo, D.M. 2013. Mortality and growth of dwarf mistletoe-infected red and white fir and the efficacy of thinning for reducing associated losses. Forest Pathology 43(3): 193-203. [Thinning helped to reduce Arceuthobium abietinum f.sp. magnifica and A. abietinum f.sp. concoloris in red (Abies magnifica) and white (A. concolor) fir respectively but actual losses during this study were minor and thinning may not be justified simply for mistletoe control.]


Natalis, L.C. and Wesselingh, R.A. 2013. Parental frequencies and spatial configuration shape bumblebee behavior and floral isolation in hybridizing Rhinanthus. International Journal of Organic Evolution 67(6): 1692-1705. [When both R. minor and R. angustifolius were present in equal proportions, bees generally preferred the more rewarding and conspicuous species. However, when the frequencies were unbalanced, the more abundant species was preferred.]


Nikolov L.A., Endress P.K., Sugumaran M., Sasirat W., Vessabutr W., Kramer E.M., Davis C.C. 2013. Developmental origins of the world’s largest flowers, Rafflesiaceae. Proceedings of the National Academy of Science USA 110(46):18578–18583. [Structure, development, and gene-expression patterns revealed that the otherwise similar floral chambers in Rafflesia and Sapria were different.]

Niranjana Mahadevan and Jayasuriya, K.M.G.G. 2013. Water-impermeable fruits of the parasitic angiosperm Cassytha filiformis (Lauraceae): confirmation of physical dormancy in Magnoliidae and evolutionary considerations. Australian Journal of Botany 61(4): 322-329. [Confirming that fruits of C. filiformis are impermeable to water and require scarification for germination, a characteristic unusual in Magnoliidae.]

Nordeng, H., Al-Zayadi, W., Diallo, D., Ballo, N. and Paulsen, B.S. 2013. Traditional medicine practitioners’ knowledge and views on treatment of pregnant women in three regions of Mali. Journal of Ethnobiology and Ethnomedicine 9: 67. [Including reference to Opilia amentacea (= O. celidifolia) as being unsafe taken orally but safe dermally. Ximenia americana also mentioned but whether safe or toxic not clear from abstract.]


Oluwole, O., Osungunna, M.O. and Abimbola, Y. 2103. Phytochemical and antimicrobial screening of Globimetula oreophila (Oliv) van Tieg and Phragmanthera capitata (Spreng) Balle. International Journal of Green Pharmacy, 7(2): 127-130. [P. capitata and G. oreophila proved highly effective against Escherichia coli, Klebsiella spp., Shigella spp., Salmonella typhi, Staphylococcus aureus and Pseudomonas aeruginosa. The former was the more active.]

Oyinbo, O., Saleh, M.K. and Rekwot, G.Z. 2013. Determinants of herbicide utilization in Striga hermonthica control among maize farming households in Giwa local government area of Kaduna State, Nigeria. Russian Journal of Agricultural and Socio-Economic Sciences, 3(15): 63-67. [Showing that household size, household income and educational level were significant in influencing herbicide utilization by maize farmers while membership of farmers’associations and extension contact were significant institutional variables. Frustratingly no mention of the herbicide(s) involved.]

Technology 48(11): 2228-2238. [Mistletoe extract (presumably Viscum album) had no influence on the shelf life of fish.]

Padmanaba, M., Sheil, D., Basuki, I. and Liswanti, N. 2013. Accessing local knowledge to identify where species of conservation concern occur in a tropical forest landscape. Environmental Management 52(2): 348-359. [Local informants in villages in Indonesia provided useful, reliable information on the distribution of a range of plant and animal species including Rafflesia spp.]


Patykowski, J. and Kołodziejek, J. 2013. Comparative analysis of antioxidant activity in leaves of different hosts infected by mistletoe (Viscum album L. subsp. album). Archives of Biological Sciences 65(3): 851-861. [Finding that levels of superoxide dismutase differed somewhat according to the host on which V. album was growing. Also suggesting that V. album may be extremely tolerant to air pollution.]


Pelser P.B., Nickrent, D. L., Callado, J. R. C. and Barcelona, J. F. 2013. Mt. Banahaw reveals: The resurrection and neotypification of the name Rafflesia lagascae (Rafflesiaeaceae) and clues to the dispersal of Rafflesia seeds. Phytotaxa 131: 35–40. [Examination of the Rafflesia population from Samar Island indicates that this corresponds to the type for R. manillana, and that the name R. lagascae Blanco should be applied to the different taxon previously referred to as R. manillana from Luzon. Ants were observed dispersing seeds of R. philippensis.]


Piednoël, M., Carrete-Vega, G. and Renner, S.S. 2013. Characterization of the LTR retrotransposon repertoire of a plant clade of six diploid and one tetraploid species. Plant Journal 75(4): 699-709. [Reporting the characterization of long terminal repeat transposons in Orobanchaceae including the non-parasitic Lindenbergia as well as several closely related Orobanche and Phelipanche species. This is apparently the first report of these elements in the family.]


Piwowarczyk, R. 2013. Seed productivity in relation to other shoot features for endangered parasitic plant Orobanchus picridis F.W. Schultz (Orobanchaceae). Polish Journal of Ecology 61(1): 55-64. [Seeds per capsule in O. picridis, an endangered species in Poland and Ukraine, varied from 457 to 3,246. The mean number of seeds per shoot was 55,172 (range 8,911 to 151,050). Seed productivity depends significantly on shoot height.]

Pleines, T., Esfeld, K., Blattner, F.R. and Thiv, M. 2013. Ecotypes and genetic structure of Rhamnus alectorolophus (Orobanchaceae) in southwestern Germany. Plant Systematics and Evolution 299(8): 1523-1535. [Results of studies on 39 populations of 3 sub-species of R. alectorolophus indicate that the subspecies of R. alectorolophus do not form discrete entities and that the character combinations distinguishing them are homoplastic.]


Queijeiro-Bolaños, M.E., Cano-Santana, Z. and Castellanos-Vargas, I. 2013. Does disturbance determines the prevalence of dwarf mistletoe (Arceuthobium, Santalales: Viscaceae) in Central Mexico? Revista Chilena de Historia Natural 86(2): 181-190. [Arceuthobium globosum and A. vaginatum both infest Pinus hartwegii, to the extent of 47% and 37% of the trees respectively and tend to compete with each other. Both are affected by various types of disturbance.]


Raupp, F.M. and Spring, O. 2013. New sesquiterpene lactones from sunflower root exudate as germination stimulants for Orobanche cumana. Journal of Agricultural and Food Chemistry 61: 44. [Besides dehydrocostus lactone, costunolide, tomentosin, and 8-epiuxanthin were purified and identified. All four induced germination of O. cumana at nano-to micromolar concentrations. Costunolide did not stimulate germination of P. ramosa.]


Rhoden, S.A., Garcia, A., Azevedo, J.L., and Pamphile, J.A. 2013. In silico analysis of diverse endophytic fungi by using ITS1-5.8S-ITS2 sequences with isolates from various plant families in Brazil. Genetics and Molecular Research 12(2): 935-950. [Noting that Phomopsis and Cystospora spp. have been recorded from unspecified Viscaceae.]


Rzedowski, J. and Calderón de Rzedowski, G. 2011. (Two notable species of Phoradendron (Viscaceae) from the Oaxacan Mixtec (Mexico), one new and one supplementary.) (in Spanish) Acta Botanica Mexicana 96: 3-10. [P. peresactum, a miniature leafless and practically acaulescent parasite of Bursera discolor, is newly described and illustrated. Most individuals were branched, less than 1 cm long with
mainly female flowers, less frequent were 3 cm long, with mainly male flowers. Plus new information on P. olae concerning male plants and hosts. Both species occur in NW Oaxaca, Mexico.


Sariha Kodithala, Yoganandam, G.P. and Kiranmai, M. 2013. Pharmacognostical, phytochemical and anticancer studies of Dendrophthoe falcata (L.f.) Ettingsh. (Loranthaceae) growing on the host plant Azadirachta indica (Meliaceae). International Journal of Pharma and Bio Sciences 4(2):1010-1018. [The methanolic extract of D. e falcata shows significant anticancer activity, associated with phenolic and flavonoid constituents which may originate from the host A. indica.]

Scaffidi, A., Waters, M.T., Ghisalberti, E.L., Dixon, K.W., Flematti, G.R. and Smith, S.M. 2013. Carlactone-independent seedling morphogenesis in Arabidopsis, Plant Journal 76(1): 1-9. [Confirming that, while the commonly employed synthetic strigolactone GR24 acts non-specifically through both D14 and KA12, carlactone is a specific effector of strigolactone signalling that acts through MAX1 and D14.]

Scalon, M.C., Haridasan, M. and Franco, A.C. 2013. A comparative study of aluminium and nutrient concentrations in mistletoes on aluminium-accumulating and non-accumulating hosts. Plant Biology, 15(5): 851-857. [Analysing the concentrations in N, P, K, Ca, Mg, Cu, Fe, Mn, Zn in leaves and Al in leaves, seeds and branches of Phthirusa ovata and Psittacanthus robustus infecting Miconia albicans, an Al-accumulator, and Ph. ovata infecting Byrsonima verbascifolia, a non-Al-accumulator. On M. albicans Al accumulated only in the leaves of Ph. ovata while it occurred in all parts of P. robustus. Plus other differences.]


Seema Chauhan. 2012. Reproductive biology of Santalum album L. The International Journal of Plant Reproductive Biology 4(1): unpaginated. [Pollination of S. album was brought about by Melipona bees and the baron butterfly (Euthalia aconthea). In open pollination the fruit-set varied between 5-20%. Results and pollen-ovule ratio indicate the tree is predominantly out-breeding exhibiting facultative xenogamy.]


She GaiMei, Zhang YingJun and Yang ChongRen. 2013. A new phenolic constituent and a cyanogenic glycoside from Balanophora involucrata (Balanophoraceae). Chemistry & Biodiversity 10(6): 1081-1087. [Noting that B. involucrata is used medicinally for the treatment of irregular menstruation, cough, hemoptysis, traumatic injury and bleeding, dizziness and gastralgia in Yunnan Province, China.]

Shikha Sharma, Amrinder Kaur and Arjun Anania. 2013. Antimicrobial study of Cuscuta reflexa collected in different seasons. International Journal of Pharma and Bio Sciences 4(3): B-1393-B-1397. [C. reflexa showed highest activity against Pseudomonas aeruginosa and E. coli when collected in the rainy season while maximum activity against Staphylococcus aureus was from material collected during the spring.]


Smith, J.D., Mescher, M.C., de Moraes, C.M., Glover, B. and Kachroo, P. 2013. Implications of bioactive solute transfer from hosts to parasitic plants. Current Opinion in Plant Biology 16(4): 464-472. [Reviewing the potential effects of the translocation of bioactive non-nutrient solutes - such as phytohormones, secondary metabolites, RNAs, and proteins - on the development and physiology of parasitic plants such as Cuscuta, Orobanche and Striga spp., and on their subsequent interactions with other organisms such as insect herbivores.]

Southwell, I. 2012. Sandalwood in Australia. LINK Natural Products Digest, 8(2): 2-6. [Describing the 4 Santalum species which been developed commercially in Australia - S. acuminatum, S. lanceolatum, S. album and S. spicatum. Information is given on commercial and medicinal value of their essential oil, timber and fruits.]

relating to S. hermonthica, S. asiatica and S. gesnerioides are briefly reviewed.

Stan, R.L., Hangán, A.C., Dicán, L., Sevastre, B., Hangán, D., Cátai, C., Sarpataki, O. and Ionescu, C.M. 2013. Comparative study concerning mistletoe viscosotosins antitumor activity. Acta Biologica Hungarica 64(3): 279-288. [Classic doxorubicin therapy not only prevents the accumulation of ascitic fluid, but also significantly reduces the activity of plasma antioxidant enzymes in Ehrlich ascites carcinoma of mice. This effect was enhanced by combination with viscositosins from V. album.]

Stanga, J.P., Smith, S.M., Briggs, W.R. and Nelson, D.C. 2013. SUPPRESSOR OF MORE AXILLARY GROWTH2 1 controls seed germination and seedling development in Arabidopsis. Plant Physiology, 163(1): 318-330. [Concluding that SMAX1 is an important component of KAR/SL signalling during seed germination and seedling growth but is not necessary for all MAX2-dependent responses and Hypothesising that one or more SMXL proteins may also act downstream of MAX2 to control the diverse developmental responses to KARs and SLs.]

Start, A.N. 2013. Mistletoe flora (Loranthaceae and Santalaceae) of the Kimberley, a tropical region in Western Australia, with particular reference to fire. Australian Journal of Botany 61(4): 309-321. [The flora consisted of one genus with three species in the Santalaceae and five genera with 22 species in the Loranthaceae. Amyema was the largest genus in both regions. Host records included 165 species from 33 families. No further detail in abstract.]


Švubová, R. and Blehová, A. 2013. Stable transformation and actin visualization in callus cultures of dodder (Cuscuta europaea). Biologia (Bratislava) 68(4): 633-640. [Confirming that C. europaea callus cells are competent for transformation, but under given conditions, these cells failed to realize their morphogenic and regeneration potentials.]


[Results suggest that chlorophylls present in early developmental stages of C. europaea have functions other than for photosynthesis.]

Świerczyn’ska, J., Kozieradzka-Kiszkurno, M. and Bohdanowicz, J. 2013. Developmental and cytotoxic studies of the endosperm chalazal haustorium of Rhinanthus serotinus (Scrophulariaceae). Acta Biologica Cracoviensia. Series Botanica 55(1): 99-106. [The chalazal haustorium is a huge single cell containing two enlarged nuclei. Results suggest it is a site of intense metabolic activity.]


*Teodoro, G.S., van den Berg, E. and Arruda, R. 2013. Metapopulation dynamics of the mistletoe and its host in savanna areas with different fire occurrence. PLoS ONE 8(6): e65836. (http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0065836) [In Brazil savanna, Psittacanthus robustus is a fire sensitive species and its host Vochysia thyrsoides is fire tolerant. Confirming that P. robustus increases host mortality, but its effect is lessened by periodic burning that reduces the parasite.]


Těšitel, J., Hejcmann, M., Lepš, J. and Cameron, D.D. 2013. How does elevated grassland productivity influence populations of root hemiparasites? Commentary on Borowicz and Armstrong (Oecologia 2012). Oecologia 172(4): 933-936. [see Haustorium 63 and excuse my garbled extract. Noting that competition for light may be detrimental to hemiparasites such as Pedicularis canadensis in the seedling stage but where it arises from increased nutrient, the parasite may yet benefit.]

Tibe, O., Sutherland, I.A., Lesperance, L. and Harding, D.R.K. 2013. The effect of purified condensed tannins of forage plants from Botswana on the free-living stages of gastrointestinal nematode parasites of livestock. Veterinary Parasitology 197(1/2): 160-167. [Extracts of Viscum verrucosum and Tapinanthus oleifolius were more active against some species of gastrointestinal nematode parasites from sheep than were those from V. rotundifolium.]


Tivadar, B., Ildikó, V., Balázs, G. and Ferenc, D. 2013. (Influence of European mistletoe (Viscum album) to the structural change of apple (Malus domestica) woody tissue.) (in Hungarian) Növényvédelem 49(6): 245-252. [Acoustic measurement was more useful than impedance tomography.]


Venditti, A., Serrilli, A.M. and Bianco, A. 2013. Iridoids from Bellardia tricazo (L.). All. Natural Product Research, 27(15): 1413-1416. [Identifying 8 iridoid glucosides from B. tricago, 3 of them for the first time; also D-mannitol.]

Venette, R.C., Kriticos, D.J. and Venette, R.C. 2013. Incorporating climate change into pest risk models for forest pathogens: a role for cold stress in an era of global warming? NeoBiota 18: 131-150. [Concluding that, for Arceuthobium tsugense subsp tsugense, decreased cold stress and increased heat stress will result in distribution being moved significantly northward.]


Wang ChangBao, Xu ZengQi and Yue RenJie. 2013. Population characteristics of mistletoe (Viscum coloratum) in Wanshan mountain. Plant Science Journal 31(4): 345-352. [The frequency of V. coloratum was highest on Populus davidiana, with decreasing frequency on Betula platyphylla, Alnus sibirica, B. dahurica, Tilia amurensis, Acer tegmentosum and A. mono. Fruits were 50% red and white and dispersal was associated with Bohemian waxwing, Bombycilla garrulus.]

Wang ChaoBo; and Gong Xun. 2013. Comparative analyses of indels based on the whole chloroplast genome of Cuscuta reflexa between European and Asian populations. Plant Diversity and Resources 35(2): 158-164. [The chloroplast genome of C. reflexa from both areas encoded identical functional genes in the same order. Analyses revealed 251 insertions and 210 deletions. A majority of the indels observed were single-base but four large length mutations longer than 200 bp were also detected, including two deletions in ycf2 region, one insertion in trnF-pshE and another insertion in marK-trnQ.]


Watson, D.M. and Rawsthorne, J. 2013. Mistletoe specialist frugivores: latterday 'Johnny Appleseeds' or self-serving market gardeners? Oecologia 172(4): 925-932. [Suggesting that birds known as mistletoe specialist frugivores are better considered exploitative than mutualistic, tending to intensify local populations rather than spreading further afield, which may depend more on dietary generalists.]

Wei Qing, Yang GuoWei, Wang XiaoJie, Hu XueXia and Chen Liang. 2013. (The study on optimization of Soxhlet extraction process for ursolic acid from


Widhalm, S. 2013. (Mistletoe in cancer therapy: an update.) (in German) Zeitschrift für Phytotherapie 34(3): 112-115. [Preparations from Viscum album rich in lectins appear to inhibit angiogenesis. They may allow reductions in dose or frequency of conventional drugs and several studies have demonstrated improvement in quality of life through mistletoe therapy.]

Wong, V.L. and Bruns, T.D. 2013. Gibberellic acid induces HAUSTORIUM 64 December 2013 29

Wu ChunHua, Wang Tao, Yamaguchi, Y., Chen Yue, Han Xu ChangHua, Jia XiaoGuang, Xu Rong, Wang Yang, JiaXiaoGuang, Xu Rong, Wang Yang, Liu GuiHua. 2013. Evidence of a fungus in stimulating germination of Pterospora andromedea (Ericaceae), Madroño 60(3): 186-192. [GA was more effective than the usual host fungus in stimulating germination of Pterospora andromedea but not of Sarcodea sanguinea.]


Yu WenBin, Cai Jie, Li DeZhu and Mill, R.R. 2013. Floral ontogeny of Pedicularis (Orobanchaceae), with an emphasis on the corolla upper lip. Journal of Systematics and Evolution 51(4): 435-450. [Studies of the floral ontogeny of P. gruina and P. siphanantha confirm that floral monosymmetry of Pedicularis is established at the beginning of sepal initiation and is maintained until flowering. The development of the upper lip provides some clues to the evolution of beaked and/or toothed galeas in the genus.]

Yu WenBin, Huang PanHui, Li DeZhu and Wang Hong. 2013. Incongruence between nuclear and chloroplast DNA phylogenies in Pedicularis section Cyathophora (Orobanchaceae). PLoS ONE 8(9): e74828. [http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0074828] [The nrITS phylogeny indicates the beakless (toothed and toothless) and beaked galeas may have evolved independently within section Cyathophora, and the chloroplast phylogeny reveals that the long corolla tube with beaked galea is derived from the short one.]

Yusuf, O., Sani, I., Usman, S. and Dawang, C.N. 2013. Factors determining farmers' participation in Striga resistant maize variety (SAMMAZ 11) production in Ushongo Local Government area of Benue State, Nigeria. Journal of Agricultural Biotechnology and Sustainable Development 5(3): 48-53. [Results confirmed that education, access to credit, access to improved planting material and number of extension contacts had significant positive effects on farmers']
adoption of the *S. hermonthica*-resistant maize.
Recommending provision of more extension agents.


Zare, G. and Dönmez, A.A. 2013. Two new records of the genus *Orobanche* (Orobanchaceae) from Turkey. Turkish Journal of Botany 37(3): 597-603. [Adding *O. wowerini* and *O. reticulata* to the 37 *Orobanche* species already recorded for Turkey, and providing information on habitat, ecology.]


Zhang MoJing;, Li MeiJia, Jun RuiHong, Niu Lin, Cao XueMin, Wu Yan and Chen GuiLin. 2013. (Effect of *Orobanche cumana* parasitization on growth and antioxidant enzymes activity of different *Helianthus annuus* varieties in seedling stage.) (in Chinese) Acta Botanica Boreali-Occidentalia Sinica 33(7): 1403-1408. [The activities of protective enzymes, SOD, POD and CAT were generally higher in sunflower varieties showing resistance to *O. cumana*. The levels of these enzymes could be increased in susceptible vegetable varieties by exposing them to environmental stress.]


Zheng Lei, Cui XuSheng, Wu Yan, Zhai ZhiXi and Guo YuHai. 2013. (Study on seed yield and quality of *Cistanche deserticola* by tip pruning.) (in Chinese) Seed 32(1) 9-11. [Concluding that tip pruning at the early flowering stage could improve the seed yield and the quality of *C. deserticola*.]

Zwanenburg, B., Nayak, S.K., Charnikhova, T.V. and Bouwmeester, H.J. 2013. New strigolactone mimics: structure-activity relationship and mode of action as germinating stimulants for parasitic weeds. Bioorganic & Medicinal Chemistry Letters, 23(18): 5182-5186. [SL analogues all contain the D-ring connected with an enone moiety through an enol ether unit. SL mimics only have the D-ring with an appropriate leaving group at C-5. Here, SL mimics were used to investigate their mode of action in stimulating parasitic plant seed germination.]
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MESSAGE FROM THE IPPS PRESIDENT

Greetings to IPPS Members!

I am happy to bring you the new issue of Haustorium that has continuously been growing in content and volume, thanks to great efforts of Chris, Lytton, and Harro. In this issue, you will find two important notices for the IPPS events.

As already announced in the last issue, our next major conference, the 13th World Congress on Parasitic Plants, will take place in Kunming, the City of Eternal Spring, at Kunming Dianchi Garden Hotel & Spa, China, from July 5 to 10, 2015. Airong Li at Kunming Institute of Botany, Chinese Academy of Sciences and her colleagues with other Chinese scientists are busy organizing the congress. John Yorder will lead the programme committee. We are looking forward to welcoming you in Kunming. Details will be found in the conference website;

http://wcpp13.csp.escience.cn/dct/page/65540

The second notice is the election of the IPPS Executive Committee. According to the schedule confirmed at the last meeting, we are expected to elect half the positions in the Executive Committee; this time, Editor and Treasurer. Details will be sent in a separate mailing. I would like to ask your active participation in this important event in your society.

In Japan, fortunately, we have not yet experienced serious crop losses due to weedy parasitic plants. However, some Japanese companies that have their own crop fields or contract-farmers in areas infested by root parasitic weeds have come to notice the problems caused by these noxious weeds. An example is posted in this issue – *Striga gesnerioides* infection on tobacco in Zambia. I believe that it is important to educate people especially farmers in parasitic weeds free areas and/or regions about potential damages posed by these devastating weeds. This would help reduce, stop, and limit potential infection by parasitic weeds.

Sincerely,

Koichi Yoneyama, IPPS President
yoneyama@cc.utsunomiya-u.ac.jp

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13TH WORLD CONGRESS ON PARASITIC PLANTS

The Organizing Committee cordially invites you to the 13th World Congress on Parasitic Plants (WCPP13) to be held from 5-10 July 2015 in Kunming, the City of Eternal Spring, in Southwest China mainland. Organized by Kunming Institute of Botany (KIB), Chinese Academy of Sciences (CAS) under the auspices of the International Parasitic Plant Society (IPPS), this 6 day event will bring the WCPP legacy to East Asia for the first time.

WCPP13 will continue the long tradition of regularly assembling experts on parasitic plants from all over the world for academic meetings that started in 1973 in Malta. With the theme 'Parasitic plants: the good, the bad, and the mysterious', this congress seeks to stimulate a productive exchange of information and ideas among researchers from around the world representing a wide spectrum of disciplines and perspectives, but all focused around the common theme of plant parasitism. Conference sessions will be designed to find common interests and to include presentations at the cutting edge of parasitic plants research (concerning both weedy and non-weedy species) and of management technologies of parasitic weeds.

The ultimate objectives of WCPP13 can be summarized as ‘Concern, Control, and Collaboration’, and our meeting activities reflect these three elements: ‘Concern’ in that we hope to raise more concern on currently non-weedy parasitic plants before they become a problem; ‘Control’ in the activities that are leading to new technologies and applications for a better management of parasitic weeds; and Collaboration, the hallmark of WCPP13 permeating through all our activities.

We are looking forward to meeting researchers from all over the world for an exciting and varied scientific program. In addition to an engaging scientific program, attendees will enjoy a range of diverse social events as well as Kunming’s many attractions, including a visit to Yunnan Ethnic Village that showcases the culture and customs of all the ethnic groups in Yunnan Province. We hope that you will take the opportunity to socialize and network with new acquaintances, and build upon
those relationships which have already been established to sustain our collaboration.

Please consider attending the 13th World Congress on Parasitic Plants. Mark the date in your calendar and register for the Congress. On behalf of the Organizing Committee and the Society, we are looking forward to meeting you in Kunming.

The Congress website is:  
http://wcpp13.csp.escience.cn/dct/page/65540

Professor Koichi Yoneyama  
IPPS President  
Professor Airong Li  
Local Organizer

PARASITIC PLANTS IN THE ALGARVE REGION OF SOUTHERN PORTUGAL

The Algarve of southern Portugal has one of the richest floras in Europe. The region has an Atlantic outlook; however its flora is typically Mediterranean, and noteworthy for its extraordinary diversity of parasitic plants in particular, a handful of which are described here. A full species list of the parasitic plants in the region is included in the recently published Field guide to the wildflowers of the Algarve (Thorogood and Hiscock 2014) – the most comprehensive field guide of the flora written to date.

One of the most spectacular parasitic plants which grows in the Algarve is Cistanche phelypaea, a striking yellow holoparasite of halophytic shrubs in the Amaranthaceae family, for example Arthrocnemum perenne and Atriplex halimus. The species is rare in Europe, but fairly frequent around the coasts of the Algarve, typically in estuaries, saltmarshes and dune systems. Indeed in some places such as on the saltmarshes of Faro (the Algarve’s administrative capital) it grows in great stands, and is a real spectacle in late March to early April. Like many parasitic plants in the region, the abundance of the plant varies from year to year, and in some years (for example in 2014), it can be very scarce. The large, bright yellow, campanulate corolla suggests that the plant is insect-pollinated, however little is known about the breeding system of this species. The seeds are much larger than those of related Orobanche species, and are presumably water-dispersed. Attempts by the author to cultivate Cistanche in pots of Atriplex halimus grown in brackish water have been unsuccessful. Another even rarer holoparasite that occurs in the region is the Maltese Fungus, Cynomorium coccineum. This peculiar and poorly understood species was previously more widespread in the Algarve, but has suffered a dramatic reduction through tourist-driven development of the region’s southern coastline in recent decades. For example, the plant appears to have all but vanished from a previous stronghold at Alvor, previously a quaint fishing village where it grew alongside C. phelypaea in the saltmarshes, which have now been developed beyond recognition. Cynomorium coccineum can still be found on a few unstable sea cliffs in the Portimão area on the south coast of the Algarve in April and May. Like C. phelypaea, C. coccineum is a halophytic holoparasite which is parasitic on shrubs in the Amaranthaceae family. Very little is understood about the ecology and host specificity of this curious parasite.

The Algarve is of particular interest for its diversity of broomrapes (Orobanche spp.). Orobanche foetida is among the most common species in the west, which parasitizes legumes such as Ononis natrix and sends up spectacular, blackish-purple spikes up to a metre tall in late spring.
The far southwest of the Algarve is also home to a myriad of host-specific ecotypes in the taxonomically complex *Minores* group, for which further systematic attention is required. Common broomrape (*Orobanche minor*) is frequent in ruderal habitats on exotic host species, for example *Gazania* spp. and *Tropaeolum majus* on road cuttings and landscaped areas. *Orobanche minor* also grows on the windswept and isolated Cape St. Vincent on vetches such as *Onobrychis humilis*, alongside stands of an, as yet, undescribed taxon which shares morphological characteristics with both *O. minor* and *O. picridis*, and exclusively parasitizes carline thistles (*Carlina corymbosa*). These taxa co-occur with a third, poorly understood species, *O. calendulae* which has rather more robust spikes and a yellow (rather than pink) stigma, and infests clumps of calendula (*Calendula suffrutescens*). Gene flow amongst these co-occurring taxa cannot be ruled out. Like many of the rarer broomrapes, *O. calendulae* is poorly circumscribed and its relatedness within the *Minores* group remains unclear. It is uncommon in the region, and restricted to rocky sea cliffs and shale slopes in the far southwest. Finally, populations of a fourth cryptic taxon occur locally on dunes and coastal shales on the western sea belt of the Algarve which are parasitic on *Plantago coronopus*. This taxon is characterised by very dense, ovoid inflorescences and based on its morphology appears to be closely related to *O. amethystea* (typical populations of which occur further east in the Algarve) and also *O. litorea*, a coastal species occurring on Sicily and Sardinia. A holistic approach encompassing host specificity, morphometrics and DNA sequence data is required to tease apart the relationships of this taxonomically difficult group in the Algarve and further afield.

The curious red and yellow holoparasite *Cytinus hypocistis* is fairly frequent on rock roses (*Cistus* spp.) on dunes, garrigue and maquis in the Algarve. The closely related *C. ruber* which has pink flowers and parasitizes *Cistus albidus* also grows in the Algarve but is much less frequent. Surveys carried out by the author demonstrate that populations of *C. hypocistis* are host specific in the region, (Thorogood and Hiscock 2007) showing preferences for either *C. monspeliensis, C. ladanifer* (and sister species *C. palhinae*) or for *Halimium halimifolium*. Subtle morphological distinctions exist amongst these host-specific ecotypes, and it is possible that isolation by their respective hosts’ distinct ecologies is driving their genetic divergence; indeed genetic races of *Cytinus* associated with host lineages have been reported from across the Mediterranean basin (de Vega et al., 2008). Like many parasitic angiosperms, little is known about the ecology and life history of *Cytinus*, but it has been established that the plant is ant-pollinated (de Vega et al., 2009), and its minute, dust-like seeds appear to be wind-dispersed.

Among the most common hemiparasites in the Algarve are *Osyris alba* and *O. quadripartita* (also described as *O. lanceolata*). *Osyris alba* frequents the baroccal (eucalyptus forest fringes), whereas *O. quadripartita* is common to subdominant in sclerophyllous vegetation at sea level. Traditional morphological keys have placed importance on leaf dimensions and pinnate leaf venation which are continuous to a degree, at least in the Algarve, and flower morphology along with bract dehiscence in fruit, would appear to be more reliable diagnostics in the field. Vegetation surveys suggest that *Osyris* does not show strong host specificity in the region (Thorogood CJ and Hiscock SJ, unpublished data), and *O. alba* is established to parasitize a wide range of hosts (Qasem, 2006). However plants often appear in clumps alongside other berry-producing shrubs, presumably as a result of bird-mediated co-dispersion, which may be a catalyst for host availability.

References


Chris Thorogood
HELIXANTHERA CYLINDRICA IN CAMBODIA

Dr Chung Gait Fee recently sent us photos of this colourful mistletoe from about 160 km SW of Phnom Penh in Cambodia (70 km N. of Sihanoukeville through National Road No 4). Dr Don Kirkup has confirmed its identity as Helixanthera cylindrica and notes that there is nothing else much like it with the lax racemes, long pedicels and relatively slender large flowers. It is quite widespread and often found on cultivated trees. Flora Malesiana gives the distribution as Burma to Vietnam; Malesia: (Sumatra, Peninsular Malaysia, Borneo, Java, Celebes, Bali) and the recorded hosts include Dalbergia, Eugenia, Garcinia, Hevea, Leptospermum, Mangifera, Parkia, Planchonlla, Schima and Tristania.spp.

Photos Mr Chung Gait Fee

STRIGA GESNERIOIDES ON TOBACCO IN ZAMBIA

In December 2013, Striga gesnerioides was seen to be affecting tobacco on a farm in the Choma area, Southern Province, Zambia. A small number of crop plants were found to be infected. The parasite was then seen in a second field on the same farm in January, 2014 and was also found on a second farm where the infestation was much more extensive and the crop suffered serious symptoms of yellowing, wilting and eventually death.

The problem has been reported previously in Zimbabwe but this is thought to be the first report from Zambia.

With thanks to Messrs Peter Rorbye and Lars Gruner, Japan Tobacco International Zambia Ltd., for information and photos.

OROEN Che CRENATA IN UK – AN UPDATE

A serious infestation of Orobanche crenata in faba beans in Kent, UK, was briefly reported in Haustorium 63 and later discussed at the O. crenata Workshop in Rabat, Morocco (reported on in issue 64). The Kent infestation involved several fields, the main one having a uniform, dense population exceeding 100 spikes per sq m in places, over an area of about 15 ha. The crop was reduced by at least 80%. The origin of the infestation has not been fully explained but appears to involve the use, some time in the past, of uncertified seed (on this or the adjacent farm) obtained from a local cooperative granary which stores grain for farmers who can later retrieve seed - not necessarily their own. Such retrievals should be used only for feed, but if used for seed, it provides a possible means of spread from a distant farm. For local spread it is thought combine harvesting will have been a big contributor as the thrashing involved throws seeds into the air to be taken by the wind.

Now a new infestation has been reported further north in Hertfordshire, but somewhat nearer (20 miles) to the historic occurrences in Essex which have been recorded sporadically since the 1950s. These have been very local and usually involved only garden vegetables or wild Vicia species. Only in 1997 when peas were sown on a farm scale in the neighbourhood, there was a massive infestation of several 100 thousand plants (Adams, 2003). Peas have not been grown again and records since then for that district have once more been sporadic, the last recorded in 2006 (Rumsey, 2014).

There is no evidence for any new introduction from abroad in recent years, so it is assumed that all these instances originate from the Essex focus. We await
DNA study of seed samples to confirm this. A further unresolved question is why we have these apparently successful populations so far north of any other in Europe. Global warming is one possibility, but this should not directly favour the weed. Evolution or adaptation to local temperature and moisture conditions would seem more likely, but again no work has yet been devoted to comparing the germination and dormancy behaviour of UK samples to those from the Mediterranean.

Now there is concern that the problem could become more important in UK as new EU regulations increase the popularity of peas and beans as a rotational crop.

Meanwhile attention is drawn to the situation in Ethiopia as described by Tekley Abebe et al. (2013), listed below. There the problem was first seen in the late 1980s but is now spreading alarmingly and threatening farmers’ ability to grow any pulse crops over a substantial and increasing area of Tigray and neighbouring Provinces.

References:


Chris Parker

PRESS REPORTS

Award for conservationist (extract)

Trevor Thompson has gone from trapping possums with his parents as a youngster to winning a national conservation award. Mr Thompson, of Mt Bruce, has been presented with New Zealand Forest & Bird's annual Golden Spade award for his volunteer conservation projects in Wairarapa. At present, he is working on three major projects - with renga renga lilies on the Wairarapa coast, native species of mistletoe and the Coprosma wallii shrub.

Mr Thompson said he first developed a passion for conservation when he laid his first possum trap as a boy. ‘Like many kids of my generation, I went possum trapping for a bit of pocket money,’ said Mr Thompson. ‘After that, I just kept going. I’m interested in nature and protecting it because my parents brought me up to appreciate it.’

One of Mr Thompson’s most involved projects is propagating various species of mistletoe throughout Wairarapa, which he has been working on for 25 years. ‘I did some reading on mistletoe in Wairarapa and it said that the Tararua should be ablaze with red with all the mistletoe plants,’ he said. ‘I knew that certainly wasn’t the case.’ There are currently nine species of native New Zealand mistletoe, but populations have declined since the early 1900s due to pests and a decline in native bird species, which act as pollinators. At one point, said Mr Thompson, only three examples of Alepis flava (yellow mistletoe) existed in Wairarapa, all living in one tree - but he since increased the number of host trees to seven and propagated a dozen plants. He runs workshops for people interested in planting and propagating mistletoe, which he said is ‘quite an involved process’.

Erin Kavanagh-Hall, The New Zealand Herald July 1, 2014

The hunt for Dendropemon caymanensis

The Cayman Islands Department of Environment (DoE) are currently collaborating on a project with longtime partner Royal Botanic Gardens Kew (RGB Kew), UK, to locate a mysterious mistletoe species – Dendropemon caymanensis (Loranthaceae) - known to be located only on Little Cayman. There is very little known about this parasitic plant but records from botanist George Proctor, author of Flora of the Cayman Islands, indicate that it is possibly located within the northeastern interior of Little Cayman and is a parasite of the Headache Bush (Capparis cynophallophora) and the Black Candlewood (Erithalis fruticosa). No one has seen this plant since 1991 and there is no photographic record – just a single herbarium collection as proof of its existence. In order to find this plant, the DoE and RGB Kew used a mini unmanned aerial vehicle (UAV). The UAV is a small flying vessel with a camera; it weighs less than a kilogram and is controlled by a sophisticated remote computer system. It takes aerial photographs on a pre-programmed course, mapped using GPS coordinates.
The search team included DoE’s Research Officers Jessica Harvey and Jane Haakonsson, and GIS Officer Jeremy Olynik; and RGB Kew’s Species Conservation Assessment Officer Steven Bachman and Kew’s GIS Officer Justin Moat; and from the Blue Iguana Recovery Programme (BIRP), Frederic Burton, acting as the local plant specialist. Mr Moat and Mr Bachman are highly trained and certified UAV pilots with previous experience in the UK and Peru, and both are off to Burkina Faso after their trip to Cayman. The DoE worked closely with the Civil Aviation Authority (CAA) to establish and follow all safety protocols. This included ensuring all launch and search sites were inspected and approved by the CAA prior to the project start date. Approval also was granted by the Lands and Survey Department, and all flights were coordinated and approved by the Grand Cayman and Cayman Brac Air Traffic Control towers prior to takeoff. This is very important as flying UAVs without authorisation could be a hazard to all types of aircrafts, including police helicopters and mosquito jets. Launching and landing sites were also granted permission from the relevant land owners.

Survey areas included the Colliers Reserve and Salina Reserve in Grand Cayman, where locations of the host plant species are already known. Images taken from these areas will be compared with images taken in Little Cayman. The project will also allow the DoE to try a new method of monitoring the booby colony in the Booby Reserve on Little Cayman, which could prove highly time and energy efficient compared to previous monitoring techniques.

Upon completion of this project the DoE hopes to determine the true status of the endemic *Dendropemon caymanensis* in the Cayman Islands, while also gathering data on the current status of the booby breeding area in the Booby Pond Reserve. This project was possible with assistance from the Mohamed Bin Zayed Conservation Group, which donated just more than US$3,000 to the project through a grant; the Cayman Islands National Trust including BIRP; the CAA; and RGB Kew.

This project started on 12 June and was completed on 19 June. For more information, contact the DoE at doe@gov.ky, at 949-8469 during working hours or on our Facebook page.

Angela Piercy, Cayman Islands Government
4 July 2014

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**The hunt for *Dendropemon caymanensis*. 2**

*Extract from further press release: Researchers hunt down mystery plant*

Although the search team was unable to see any signs of the species, Ms. Harvey said there is a chance it could show up in the footage captured through a mini aerial drone, which takes photographs on a pre-programmed course mapped out using GPS coordinates. ‘We are still waiting for all the imagery from the drone to be processed, which may take some time ... We hope to get it in the next couple weeks,’ she said.

Mr. Proctor discovered two specimens of the plant in Little Cayman, which he said was related to *D. purpureus* and *D. rigidus* but a lot smaller.

Jewel Levy, Cayman compass.com
18 July, 2014

NB See also the literature item Caraballo-Ortiz and Carlo, 2013.

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**Results show Africa can eradicate *Striga***

In the last three years, the ISMA project has deployed an integrated approach for managing *Striga* while improving soil fertility and reducing the *Striga* seed bank for sustainable increases in crop yields in some selected communities in Nigeria and Kenya. Dr David Chikoye, IITA Director for Southern Africa, said results from the project showed that the battle against *Striga* could be won. ‘We will eradicate *Striga* in Africa just as America did,’ he said at the Annual Review and Planning Meeting of ISMA in Abuja held 21-23 May.

IITA Deputy Director General for Research, Dr Ylva Hillbur, in her opening remarks called for concerted efforts from partners to tackle the *Striga* challenge. Over 70 stakeholders gathered in Abuja for the 3-day annual event which sought to evaluate the successes, challenges, and opportunities of the project, identify gaps, and plan how to implement the decisions to successfully scale out *Striga* management technologies to rural farmers in the next coming year.

Dr Mel Olouch, ISMA Project Manager, said ‘We have established partners and stakeholder capacity in Kenya and Nigeria and installed *Striga* seed processing facilities in Kenya; awareness is high. Already, registration of the herbicide has been
achieved in both countries and we expect to release two IR maize varieties in Nigeria in 2014 (see following item). He said that some of the scaling up approaches that need to be adopted include the use of volunteer farmers to reduce costs and increase ownership, and use of complementary inputs and empowerment of stakeholders to give farmers the best technologies.

Specifically, these included cultural practices such as intercropping maize with legumes (soybean and groundnut); crop rotation of maize with soybean; a ‘push-pull’ technology that involves intercropping cereals with Striga-suppressing Desmodium forage legume; using Striga-resistant maize and cowpea varieties; using maize varieties resistant to Imaazpyr (IR)—a BASF herbicide (StrigAway®) which is coated on the maize seeds and which kills the Striga; and adopting Striga biocontrol technologies which uses a Striga host-specific fungal pathogen.

The Senior Program Officer for Agriculture Development of the Bill & Melinda Gates Foundation, Dr Yilma Kebede, in his address, looked at future plans for the project while expressing that the project is close to reaching farmers and addressing their concerns/problems due to Striga. He emphasized that there needs to be concerted efforts to profile the farmers reached such that the take-home message will be sustainable for them in the long run. ‘Demonstrations need to be focused and there is greater need to engage a wide range of stakeholders in controlling Striga. The various institutions involved should synergize to promote the project and scale out to farmers because no one partner will be responsible for the success of the technologies in the end,’ he said.

Infesting up to 4 million hectares of land under maize production in sub-Saharan Africa, Striga causes farmers yield losses of up to 80% representing about US$1.2 billion, and affects approximately 100 million people on the continent.

Project partners include CIMMYT, AATF, ICIP, Bayero University, KNARDA, BSADP, seed and chemical companies, extension workers, scientists and the private sector.

Adeleke Mainasara, Africa Science News
26 May 2014

Nigeria releases first generation of herbicide-resistant hybrids

The Nigerian National Variety Release Committee (NVRC) has released the first generation of maize hybrids, resistant to metsulfuron methyl herbicide, that are also endowed with resistance to the noxious parasitic weed Striga hermonthica. The hybrids were developed by the International Institute of Tropical Agriculture (IITA) in partnership with DuPont Pioneer Seeds using conventional breeding with funding from IITA and the Integrated Striga Management in Africa (ISMA) project as part of strategies to control S. hermonthica in maize. The hybrids were released as P48W01 and P48W02 and are recognized as IITA IR-Maize Hybrid 2 and IR-Maize Hybrid 4. The hybrids have a yield potential of up to 5 t/ha under Striga infestation in comparison with local varieties that produce less than 1 t/ha in such conditions. ‘These hybrids are the product of introducing a single nuclear gene that confers resistance to imidazolinone herbicides, including metsulfuron methyl (MSM), into inbred lines with known field resistance to S. hermonthica,’ IITA Maize Breeder, Dr. Abebe Menkir, said.

Recent baseline studies conducted under the ISMA project showed that farmers ranked Striga as the number one constraint to maize production in northern Nigeria, with 50 to 100% of the households reporting Striga incidence in their farms. The parasitic weed infests more than 9 million ha planted to millet, maize, and sorghum in Nigeria and severely lowers the production capacity of these crops. Dr Menkir said yield losses in maize from damage by S. hermonthica varied from 20 to 80% among subsistence farmers, but 100% loss could occur in susceptible cultivars under severe infestation in marginal production conditions.

The released herbicide-resistant hybrids allow seeds to be planted that have been treated with low doses of metsulfuron methyl herbicide. This targets S. hermonthica before or at the time of its attachment to the maize root, killing the parasite underground before it inflicts damage on the crop. These hybrids can thus be used to deplete the Striga seed bank in the soil and minimize yield losses in subsequent cereal crops. MSM-treated seeds of these hybrids can be integrated into the diverse farming systems in Nigeria because the herbicide effectively controls the parasite at a low rate of application.

The ISMA project works with the private sector to catalyze the process of producing and marketing
treated seeds of herbicide-resistant maize hybrids to smallholder farmers in Nigeria to control S. hermonthica. Other collaborating partners engaged in extensive testing of these hybrids include the Institute for Agricultural Research (IAR) and Agricultural Development Programs in Bauchi and Kano States. The ISMA project is being implemented by IITA in partnership with CIMMYT, ICIPE, BASF Crop Chemical, AATF and national partners in Kenya and Nigeria.

Crusoe Osagie, ThisDayLive
01 Jul 2014

New initiative to upscale commercialisation of anti-striga weed in maize technology launched

A new initiative has been launched to upscale use of commercialisation of StrigAway™ – an herbicide-resistant seed and treatment – to improve productivity and competitiveness of smallholder maize farmers. The initiative funded by the USAID brings together the African Agricultural Technology Foundation (AATF) and Feed the Future Partnering for Innovation and will help AATF and its partners, BASF, International Maize and Wheat Improvement Center (CIMMYT), and six local seed companies, promote the technology package in Kenya, Tanzania, and Uganda.

‘This partnership is really about increasing the food security of thousands of smallholder farmers in East Africa. Farmers who have access to this technology will have better maize yields and higher earnings from the sale of excess produce,’ said Denis T. Kyetere, the Executive Director, AATF.

StrigAway™ combats Striga, a parasitic plant that affects the agricultural productivity of approximately 1.4 million hectares in Kenya, Tanzania, and Uganda. Commonly known as witchweed, this parasitic plant can cause a 20 to 80 percent crop loss in maize, leading many farmers to abandon fields with heavy Striga infestation. Maize, the staple food for the majority of East Africans, is especially susceptible to Striga and continuous cereal monocropping has intensified the Striga problem. StrigAway™, which includes conventionally bred herbicide resistant maize varieties and an herbicide seed coating, was developed by BASF and CIMMYT.

As part of the United States government’s Feed the Future Initiative, Partnering for Innovation is expanding commercial access of transformational technologies to smallholder farmers to improve productivity and incomes quickly and sustainably. ‘Large problems can’t be solved alone, which is why this is Feed the Future Partnering for Innovation’s largest grant to date, totaling more than US$3 million. It involves multiple partners including an international NGO, a multi-national corporation, a research institute, and local private sector companies,’ said Brenna McKay, Partnering for Innovation Grants Program Director.

By the end of the three-year performance-based grant, there will be a total of 4,000 demonstration plots and nearly 1,000 metric tonnes of seed sold to over 20,000 smallholders in the target countries. Technical support for local seed companies will ensure the seed is commercially multiplied, treated, and available for purchase through a vast network of agricultural input retailers for smallholder farmer customers. AATF will work with partner seed companies to promote StrigAway™, including managing a discount programme for select agro-dealers, offering promotional seed packs to farmers, and leading a campaign to increase the understanding of the product.

Raymond Gichuki, Africa Science News
04 February 2014

Finding a cure for cancer with mistletoe? Believe Big is helping to kiss cancer goodbye

Mistletoe therapy is used widely in Germany and Switzerland for cancer treatment. However, until a clinical trial is done here in the United States, it cannot be offered to patients as standard of care. Studies in Europe have shown that mistletoe treatments along with a high alkaline diet are key components that can aid the body when fighting and overcoming cancer. The liquid extract of the mistletoe plant has been used as an alternative method to treat cancer for close to a century. Mistletoe injections are among the most widely used unconventional cancer treatments in Europe. In Europe, the most common commercial preparations are sold under the trade names Iscador and Helixor. Currently, only the European species of the mistletoe plant (Viscum album) is used for cancer.

Believe Big founder, Ivelisse Page, was cured of her stage 4 colon cancer by using mistletoe extract and a high alkaline diet. She is now 5 years cancer free. Clinical trials are typically funded by pharmaceutical companies but mistletoe is natural, so this is not an option. This is truly an historic event because this clinical trial is patient driven and
is being entirely funded by private donations. Currently only 50 Anthroposophic physicians are trained to treat with mistletoe in the U.S. ‘We have 90% of the money needed to start Phase I of the trial. We are thrilled to be taking the first steps towards a cure for this devastating disease,’ said Patty Buddemeyer, Assistant Director of Believe Big.

European oncologists have used extracts of mistletoe for the past 90 years. One study showed that individuals who took mistletoe extract in addition to their conventional treatment lived 40% longer. Currently, 1 out of every 3 oncologists in Germany prescribes mistletoe. Not only has mistletoe been found to diminish tumor-related pain, increase the immune response, prevent re-occurrence during the watchful waiting period, but it also offsets the terrible side affects of chemotherapy—nausea, vomiting, and lack of appetite.

Believe Big is a non-profit organization formed in 2011 to help families navigate the cancer journey by providing resources, direction and hope. Now Believe Big and Johns Hopkins are collaborating on a mistletoe clinical trial that brings the conventional and complimentary medical communities together. Johns Hopkins researchers say mistletoe treatment can change the way doctors go after cancer. Dr. Luis Diaz, professor of oncology and senior researcher at Johns Hopkins, and Dr. Peter Hinderberger, expert in complementary medicine, both treated Ivelisse and are leading the clinical trial at Johns Hopkins. Dr. Hinderberger has used mistletoe in his practice successfully for over three decades. The clinical trial team is hoping that with this study, mistletoe will be included in the standard of care treatment protocol for cancer.

For more information about Believe Big and to find an Anthroposophic physician who is currently treating with mistletoe, visit http://www.believebig.org.

Anyone wishing to be a part of this historic event can make a tax deductible donation for this trial by visiting http://www.gofundme.com/believebig-mistletoeTrial.

Read the full story at http://www.prweb.com/releases/2014/02/prweb11548215.htm

Read more at: http://www.digitaljournal.com/pr/1719032#ixzz2swCLw025

Digital Journal, Baltimore, MD
February 04, 2014

THESES


Abstract:
Lodgepole pine (Pinus contorta) forests are widely distributed throughout western North America. However, the lodgepole pine forests of central Oregon are ecologically unique to the region, with a mixed severity fire regime, low cone serotiny, and their presence as a climax species. Although much research has been conducted regarding the stand structure and disturbance regimes of lodgepole pine, most of the research regarding lodgepole pine has occurred in the intermountain west. Research findings from other geographical locations may not be applicable to central Oregon lodgepole pine forests, given their distinctive ecological attributes. Lodgepole pine forests are subject to three widespread disturbance regimes: mountain pine beetle, dwarf mistletoe, and fire. Although much is known about each of these disturbances in lodgepole pine, little is known about their interactive effects. These disturbances occur pervasively in lodgepole pine and are known to co-occur on the landscape, so their effects must be investigated and interpreted simultaneously. This thesis describes the combined influences of dwarf mistletoe and mountain pine beetle on stand structure, canopy fuels, and fire behavior in central Oregon lodgepole pine forests.

We randomly selected and sampled 39 0.075-hectare plots within 13 stands in the Deschutes National Forest in central Oregon. The plots varied from 0 to 4 in average dwarf mistletoe rating (DMR) and all had experienced a mountain pine beetle mortality event 21 to 28 years prior to sampling. In Chapter 2, we compared stand density, stand basal area, canopy volume, proportion of the stand in dominant/codominant, intermediate,
suppressed cohorts, and average height and average diameter of each cohort, across the range of DMR. We found strong evidence of a decrease in canopy volume, suppressed cohort height, and dominant cohort diameter with increasing DMR. There was strong evidence that as DMR increases, proportion of the stand in the dominant/codominant cohort decreases, while proportion of the stand in the suppressed cohort increases. Structural differences associated with dwarf mistletoe create heterogeneity in this forest type and may have a significant influence on the productivity, resistance, and resilience of these stands. These findings show that it is imperative to incorporate dwarf mistletoe effects when studying stand productivity and ecosystem recovery processes.

In Chapter 3, we compared canopy base height, the fuel parameter that drives passive crown fire, and canopy bulk density, the fuel parameter that drives active crown fire, over the range of DMR to determine the effect of dwarf mistletoe on canopy fuels. We then used BehavePlus to model passive crown fire and active crown fire in our plots. We found strong evidence of a decrease in canopy base height with increasing DMR. There was suggestive evidence of decrease in canopy bulk density with increasing DMR, after accounting for stand density. The results of the fire behaviour modelling suggest that at low to moderate wind speeds, likelihood of passive crown fire increases with increased DMR. However, under more extreme weather (wind speeds >20 mph), the effect of dwarf mistletoe on passive crown fire potential was not shown to be important. The potential for active crown fire was extremely low in our plots, regardless of DMR. These findings show that dwarf mistletoe is having a significant effect on the potential for passive crown fire in lodgepole pine forests 21 to 28 years post-mountain pine beetle epidemic, and should be considered in future research regarding post-mountain pine beetle fuels and fire behaviour.

**Resistance of chickpea (Cicer arietinum) and tomato (Solanum lycopersicum) to field dodder (Cuscuta campestris).** Hadas Miryamchik. MSc Thesis Hebrew University of Jerusalem July 2013. Supervisors Raruch Rubin and Yaakov Goldwasser

**Summary**

Field dodder (Cuscuta campestris Yuncker), is a worldwide troublesome above-ground holoparasite that sustains on plants and substantially reduces crop yields. Field dodder seedlings coil around host stems and leaves, produce pre-haustoria that establish a connection to the host plant by haustoria that penetrate and fuse into the host vascular tissues. The parasite then exploits the host plant by withdrawing assimilates and other solutes causing severe damage to the host plant.

At first I scanned a wide range of chickpea genotypes in order to reveal resistant genotypes to field dodder infection. Those genotypes were determined by using a parasitic development index set by visual parameters. Two genotypes which exhibited good tolerance to the parasite were found: the variety ‘ICCV 95333’ from ICRISAT and the Israeli variety ‘Hazera 4’ from ‘Hazera Genetics’. In addition- two dodder-resistant, ‘Heinz’ canning tomato varieties were included. Both genotypes were grown in pots sown with field dodder. In the resistant genotypes the parasite failed to penetrate the epidermis and the vascular systems of the host. We found that this phenomenon also occurs but at less intensity in secondary attachments obtained by placing coiling field dodder stem segments on the mature resistant chickpea and tomato host plants.

**Anatomic sectioning and microscopic examination** - This staining was carried out by the assumption that woody materials such as lignin contribute to the resistant mechanism in the resistant genotypes. Samples of tomato and chickpea stems infested by field dodder were collected and fixed in FAA, embedded in paraffin and in the end were sliced by microtome (Leica RM2245) at a thickness of 12 microns. The samples were stained in safrnin and fast green and then examined under a light microscope. I found that the internal structure of the stems was similar in the susceptible genotype and resistant genotype whether parasitized or non-parasitized with field dodder. These data suggest that the observed tolerance is due to factors in the outermost stem layer that separate the plant from the surrounding environment. In the resistant tomato genotype, pre-haustoria could not penetrate through the epidermis. Cells in the outer layer of the pre-haustoria turned black, which indicates cell death resulting from a HR (Hypersensitive Response) reaction at the contact area.

**Image processing system LC-Polscope** - This system was used in order to evaluate the cellulose fibers content. This image processing system helps calculate the Retardance parameter which indicates cellulose fiber layer thickness and density. I found that the resistance mechanism in tomato and chickpea is not associated with the thickness of the cellulose crystal structure in the stems.
Removal of the epicuticular layer and epidermis of the host plant - This experiment was carried out by applying a uniform layer of cellulose acetate dissolved in acetone on the plant stem or by fine cutting with a scalpel. The results suggest that those layers in chickpea and tomato plants may have a partial role in the mechanism of resistance. While working on this thesis I found that in some experiments the resistance phenomena decreased. So I decided to examine the influence of different environmental factors on the resistant phenomena and tried in parallel to increase the parasite control by combining the resistant genotype with selective herbicides as described below.

Environmental factors: temperature, day length and shading - Each of these factors was examined separately in a controlled Phytotron. High temperatures of 43/82 °C (day/night) negatively affected dodder germination, penetration and later on the development of attachments to the host. All the environmental factors affected the vitality of the host and thus indirectly affected the development of the attacked parasite. A short day regime (8 light hours) influenced the development of chickpea plants by encouraging vegetative growth but did not affect the resistance mechanism to field dodder. Light intensity (shading) affected plant growth and development and as the shading increased, the vitality of the host plant reduced, resulting in a concomitant parasite-inhibited growth. These experiments that were conducted under controlled environment conditions did not reveal differences between susceptible and resistant genotypes. Although I could not detect a specific factor affecting the resistance phenomenon, it is likely that environmental factors influence host-parasite interaction. Further studies should focus on the interaction of these environmental factors in order to elucidate the role of environmental factors involved in this phenomenon.

In addition to the studies mentioned above I examined the effect of various herbicides including cell division inhibiting herbicides (pendimethalin, trifluralin, pronamid and isoxaben) and ALS (acetolactate synthase) inhibiting herbicides (imazapic, imazamox, sulfosulfuron and rimsulfuron) by direct application to field dodder seedlings, host foliage, and root application by drench to tomato and chickpea plants parasitized by dodder.

Cell division inhibitors applied directly to dodder seeds in Petri-dish experiments delayed dodder seedling early development, and inhibited their growth when applied post emergence on chickpea grown in pots. Pronamid direct application to germinating field dodder seedlings in Petri-dish experiments reduced dodder shoot length to about 40% of the untreated control. Post-emergence application of pronamid in pot experiments caused lesser damage to the parasitized chickpea host then to the non-parasitized control plants, probably due to the fact that some of the herbicide was drawn from the host by the parasite as the parasite employs a strong metabolic sink in host-parasite interactions. Nevertheless in some of the plants, after a short period I observed a regeneration of treated dodder. ALS- inhibiting herbicides did not inhibit the growth of germinating dodder seedlings when applied directly to the seeds in Petri dish. However, they were quite effective on dodder when applied on the host foliage or roots (by drench) to chickpea and tomato genotypes. The application of ALS-inhibiting herbicides on field dodder that did succeed to parasitize resistant tomato plants, in most cases significantly reduced field dodder weight in a higher manner then the reduction of field dodder weight parasitizing the susceptible tomato genotypes treated with the same herbicides. This was evident especially with the herbicide rimsulfuron. It seems that application of these herbicides on resistant genotypes results in better dodder control along with minimal damage to the host. In the majority of herbicides applied on dodder-parasitized chickpea and tomato plants we observed initial inhibition of field dodder but after a certain period stem regeneration occurred. Total parasite control was achieved only in imazapic application on tomato and chickpea plants.

The approach of combining repeated applications of reduced herbicide rates on resistant crop genotypes is promising, but further research is needed before implementing this approach safely and effectively under field conditions.

OTHER FORTHCOMING MEETING

5th International Conference on Alternative Methods of Crop Protection. Lille, France, 11-13 March, 2015. Sessions will include one on resistance and varietal selection.

For information contact AFPP, 42 rue Raymond Jaclard, F-94140 Alfortville. Email afpp@afpp.net. Website www.afpp.net.
In the inaugural issue of Haustorium (December 1978) the purpose of the newsletter was stated as serving ‘. . . a useful purpose in keeping workers in contact with each other and with research results which are not always readily available to all concerned.’ From the beginning, an emphasis of our newsletter has been to provide reviews of parasitic plant research, research that has grown exponentially in the more than 35 years we have published Haustorium.

In a continuing commitment since then, Chris Parker has assiduously searched archival and non-archival literature for Haustorium and with characteristic pith and clarity has written brief summaries that are published in each issue of the newsletter. On few occasions, he asks other experts to write them. These entries provide the world’s most extensive review of the literature on parasitic plants, a database of inestimable value for researchers. Recently, he collated all the published issues into two large, searchable pdf files. Issues 1 through 48 can be accessed at http://ww2.odu.edu/~lmusselm/haustorium/pdf/haustorium1-48.pdf and issues 49 through 64 at http://ww2.odu.edu/~lmusselm/haustorium/pdf/haustorium49-64.pdf! New issues will be added to the latter, as they are published.

We hope this resource will enhance the value and accessibility of this literature.

Lytton John Musselman, Old Dominion University

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see: http://www.parasiticplants.org/ (N.B. currently a little out of date)
For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml
For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php
For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/
For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/
For information on the COST/STREAM conference see: http://streamisrael2013.wix.com/stream-israel-2013
For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp
For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/
For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/
For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/
For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes up to 1995, but apparently incomplete since then) see: http://www.rmr.sau.edu/mistletoe/
For information on future Mistel in der Tumortherapie Symposia see: http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx
For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).
For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)

LITERATURE

- indicates web-site reference only

A record 346 items are listed below. Those in bold are the editors’ (but mainly one editor’s) personal selection of the top twenty.

of Animal and Plant Sciences 24(1): 310-314. [Confirming some antioxidant and antibacterial activities in *O. foetida* and *O. crenata.*]


Abualhasan, M., Jaradat, N., Abu-Hasan, N., Almasri, M., Taha, A.A., Rabbaa, A., Natsheh, N., Shalalfeh, S. and Najib, M. 2014. Bioactivity of *Viscum album* extracts from olive and almond host plants in Palestine. Pharmacognosy Journal 6(2): 38-44. [Claiming that extracts of *V. album* showed differing activity depending on the host but not clear from abstract. But clear that activity was higher against *Staphylococcus aureus* than against gram-negative bacteria.]

Agbenin, N.O. 2014. Effect of aqueous extract of some plants on soil micro-fauna and micro-flora in *vitro*. Archives of Phytopathology and Plant Protection 47(2): 205-211. [High doses of *Viscum album* were somewhat toxic to a range of nematodes.]


Akinwale, R.O., Badu-Apraku, B., Fakorede, M.A.B. and Vroh-Bi, I. 2014. Heterotic...
grouping of tropical early-maturing maize inbred lines based on combining ability in *Striga*-infested and *Striga*-free environments and the use of SSR markers for genotyping. Field Crops Research 156: 48-62. [Correlation analyses showed that grouping using GD was more consistent with grouping based on SCA under *Striga*-free than under *Striga*-infested environments. The HSGCA method was the most effective in classifying early maturing maize inbreds under *Striga*-infested and *Striga*-free environments. A total of 4 and 8 inbred testers were identified under *Striga*-infested and *Striga*-free environments, respectively.]

Aksoy, E., Arslan, Z.F., Tetik, Ö. and Eymırlı, S. 2014. Soil landscape and stand conditions in *Cola attiensis* in Côte d'Ivoire. International Journal of Biosciences (IJB) 4(5): 102-113. [Surveying the flora associated with the IUCN red-listed *C. attiensis*, a plant with valuable medicinal uses, and finding an association with the parasitic *Okoubia aubrevillei* (‘Ochtonemataceae’ in the abstract but more correctly Santalaceae or Cervantesiaceae).]


*Aly, R., Dubey, N.K., Yahyaa, M., Abu-Nassar, J. and Ibdah, M.* 2014. Gene silencing of *CCD7* and *CCD8* in *Phelipanche aegyptiaca* by tobacco rattle virus system retarded the parasite development on the host. Plant Signaling and Behavior 9(5): e29376. [Results suggest an important role for the strigolactone-associated genes (*PaCCD7* and *PaCCD8*) in the parasite life cycle.]

Aliyu, M.M., Musa, A.I., Kamal, M.J. and Mohammed, M.G. 2014. Phytochemical screening and anticonvulsant studies of ethyl acetate fraction of *Globimetula braunii* on laboratory animals. Asian Pacific Journal of Tropical Biomedicine 4(4): 285-289. [Results suggest that extracts of *G. braunii* (Loranthaceae) may be useful in the management of petit mal epilepsy and lend credence to the ethnomedical use of the plant in the management of epilepsy.]


Bangkok, Thailand, 5-7 February 2013 (O27): 17. [Melientha suavis (Opiliaceae) is shown to be parasitic on S. grandiflora. Acetobacter diazotrophicus and Pseudomonas fluorescens enhanced haustoria formation.]

Ančić, M., Pernar R., Bajić, M., Seletković, A. and Kolić, J. 2014. Detecting mistletoe infestation on Silver fir using hyperspectral images. iForest 7: 85-91. [Silver fir (Abies alba) is one of the most important commercial and ecological species in Croatia, and is damaged by Viscum album ssp. abietis. Surveying for mistletoe used a hyperspectral scanner and spectral signatures for fir and mistletoe were obtained. The results were also confirmed by aerial surveying with a non-pilot aircraft from a height of ca. 30 m above the crowns.]

Armbruster, W.S., Shi XiaoQing and Huang ShuangQuan. 2014. Do specialized flowers promote reproductive isolation? Realized pollination accuracy of three sympatric Pedicularis species. Annals of Botany 113(2): 331-340. [Studies on P. densisipica, P. tricolor and P. dichotoma in China suggest that the specialized flowers of this group are unlikely to have increased the potential for reproductive isolation or influenced rates of speciation.]

Arriola Padilla, T., González Hernández, A. and Romero Sánchez, M.E. 2013. True haustoria on Silver fir using hyperspectral images. iForest 7: 85-91. [Silver fir (Abies alba) is one of the most important commercial and ecological species in Croatia, and is damaged by Viscum album ssp. abietis. Surveying for mistletoe used a hyperspectral scanner and spectral signatures for fir and mistletoe were obtained. The results were also confirmed by aerial surveying with a non-pilot aircraft from a height of ca. 30 m above the crowns.]

Armitage, J.D. 2014. Discussion of the challenges associated with recognising infra-specific variation in a hierarchical system of classification, illustrated using two colour forms of Lathraea clandestina. New Journal of Botany 4(1): 42-46. [The use of form names to recognize single-character variants such as white and pink forms of L. clandestina is examined and found to be inherently contradictory to hierarchical classification. An extension of the Group system employed for cultivated plants to plants occurring in the wild is advocated.]

Arroyo, J.M., Munguia-Vega, A., Rodríguez-Estrella, R. 2014. Bascompte, J. 2013. Isolation of 18 microsatellite loci in the desert mistletoe Phoradendron californicum (Santalaceae) via 454 pyrosequencing. Applications in Plant Sciences 1(12): 1300048. [Concluding that levels of polymorphism are adequate for studies of diversity and fragmentation in natural populations of P. californicum. Cross-species amplifications in P. juniperinum and P. diguetianum only showed four markers that could be useful in P. diguetianum.]


Atera, E.A., Kondo, F. and Itoh, K. 2013. Evaluation of intercropping and permaculture farming system for control of Striga asiatica in maize, Central Malawi. Tropical Agriculture and Development 57(4): 114-119. [A cowpea intercrop reduced S. asiatica but failed to increase yield. ‘Permaculture’ (maize planted in the same plot with soybean, bambara bean, cotton, pigeon pea and marigold) reduced Striga and increased maize yield by 28%.]

Austad, I. and Rydgren, K. 2014. Establishment of herb-rich hay-meadows. Results from a field experiment at the The Heiberg Collection-Sogn Folk Museum. Blytia 72(1): 3-18. [Rhinanthus minor among species used to enrich hay meadows and relatively easy to introduce.]


Badu-Apraku, B., Fakorede, M.A.B. and Oyekunle, M. 2014. Agronomic traits associated with genetic gains in maize yield during three breeding eras in West Africa. Maydica 59(1): 49-57. [A review concluding that substantial progress has been made in breeding for cultivars with combined tolerance/resistance to the three stresses – Striga, drought and low nitrogen - during the past 22 years.]

Bai Ying, Li HaiYan and Chen ShiXian. 2013. Composition analysis and immunological activities of the oligosaccharides isolated from...
Cistanche deserticola. International Proceedings of Chemical, Biological and Environmental Engineering (IPCBEE) 50: 157-162. [Tests indicated that extracts of C. deserticola presented significant effect on the mouse spleen index, increasing the phagocytes activity of macrophages and stimulating antibody-producing cell proliferation.]


Barbu, C. 2013. Radial increments distribution on silver fir trees’ stems affected by mistletoe (Viscum album ssp. abietis). A case study in Eastern Carpathians. Lucrări Științifice, Universitatea de Științe Agricole Și Medicină Veterinară ”Ion Ionescu de la Brad” Iași, Șeria Horticultură 56(2): 419-424. [Confirming increasing reductions in radial growth of silver fir with increasing density of V. album.]


Carballo-Ortiz, M.A. and Carlo, T.A. 2013. Resurrection of Dendropemon sintenisii (Loranthaceae): an endemic mistletoe from Puerto Rico. Phytotaxa 82(1): 1-6. (http://dx.doi.org/10.11646/phytotaxa.82.1.1) [D. sintenisii was thought to be known only from its original collection in Puerto Rico in 1885 and Kuijt (2011) (see Haustorium 61) included it in D. caribaeus, but the authors have re-identified...]


Bellot, S. and Renner, S.S. 2014. The systematics of the worldwide endoparasite family Apodanthaceae (Cucurbitales), with a key, a map, and color photos of most species. Phytotaxa 36: 41-57. [Using morphological, nuclear 18S, and mitochondrial matR data, the taxonomy of Apodanthaceae was revised. The 36 names published in the family where reduced to ten biological species in two genera, Apodanthes and Pilostyles. Berlintiance aethiopica is now recognized as Pilostyles aethiopica.]
40 specimens as *D. sintenisii* that were collected in Puerto Rico from 1913 to 2012. They explain the taxonomic confusion and provide illustrations, information on morphology, distribution, host plants and an updated key of the 4 species found in Puerto Rico.

Cardoso, C. And 16 others. 2013. Natural variation of rice strigolactone biosynthesis is associated with structural variation and the deletion of two MAX1 orthologs. *PNAS* 111: 2379–2384.

Chaskda, A.A., Mwansat, G.S. and Ottosson, U. 2013. Implications of flower developmental stage, plant isolation and microclimatic condition on a hemiparasitic plant-avian pollinator interaction. *Journal of Natural Sciences Research* 3(15): 26-32. [Visits by pollinating birds in Nigeria are shown to be maximum when flowers of *Topinambur sessilifolius* are ripe but unopened. Higher temperatures decreased visits.]


Chen JiHang, Wong HoiShan and Ko KamMing. 2014. *An ursolic acid-enriched extract of Cynomorium songaricum protects against manadione cytotoxicity in H9c2 cells. Molecules* 19(2): 1576-1591. [Herba Cynomorii was unsuitable.]


Chitnag, M., Rugare, J.T. and Mabasa, S. 2014. Screening maize (*Zea mays*) genotypes for tolerance to witchweed (*Striga asiatica* L. Kuntze) infection. *Journal of Agricultural Science* (Toronto) 6(2): 160-169. [A pot experiment in which 7 out of 10 entries showed little damage and were apparently tolerant to *S. asiatica*.]

Costea, M., García-Ruiz, I., Dockstader, K. and Stefanovic’, S. 2013. More problems despite bigger flowers: systematics of *Cuscuta tinctoria* clade (subgenus *Grammica*, Convolvulaceae) with description of six new species. *Systematic Botany* 38(4): 1160-1187. [This installment in a series of works on subgenus *Grammica*, uses molecular (*trnL-F* and ITS) and morphological evidence to clarify the evolution and taxonomy of these dodders. An identification key, descriptions, geographical distribution, ecological data, and illustrations are provided for all taxa, some of which are newly described here.]


Daksobler, I., Anderle, B., Zupan, B. and Vreš, B. 2014. (Novelties in the flora of Slovenia.) (in Slovenian) *Hladnikia* 33: 3-30. [Mentioning new records for *Orobanche panicii*, *Tozzia alpina* and *Viscum album* in the same issue of this journal (pp. 73-77).]
referring to an older record (pre-1952) of *Corallorrhiza trifida*.


de Vega, C., Herrera, C.M and; Döttterl, S. 2014. Floral volatiles play a key role in specialized ant pollination. Perspectives in Plant Ecology, Evolution and Systematics 16(1): 32-42. [The volatiles 4-oxoisophorone, (E)-cinnamaldehyde, and (E)-cinnamyl alcohol were the most abundant compounds in *Cytinus hypocistis* flowers, attracting 4 ant pollinator species.]

Demey, A., Rütting, T., Huygens, D., Staelens, J., Herny, M., Verheyen, K. and Boeckx, P. 2014. Hemiparasitic litter additions alter gross nitrogen turnover in temperate semi-natural grassland soils. Soil Biology & Biochemistry 68: 419-428. [Results support the hypothesis that litter from hemi-parasitic plants increases soil N availability more than non-parasitic litter, but contradicts the expectation that the hemiparasitic litter effect would be more pronounced in an oligotrophic system (involving a *Pedicularis* sp.) as compared to a mesotrophic one involving a *Rhinanthus* sp.]


Dicu, G., Teodorescu, E.A., Dumitrescu, N.C., Boaghe, N. and Ionita, M. 2011. Research regarding the virulence of broomrape parasite (*Orobanche cumana* Wallr.) in southeastern of Romania. Scientific Papers - Series A, Agronomy 54: 256-261. [While *O. cumana* races E and F have been well controlled by resistant varieties, Race G is proving more difficult and it is suspected that a new race G+ may have evolved, partially overcoming the resistance in variety PR64A71.]


Dimitrijevic´, A., Pejovic´, I., Imrovski, I., Dedic´, B., Pajevic´, S. and Miladinovic´, D. 2013. DNA isolation from dry samples of broomrape - the effect of isolation method and sample storage on DNA yield and quality. Romanian Agricultural Research 30: 349-357. [DNA isolation with DNeasy® Plant Mini Kit, Qiagen and a protocol by Rogers and Bendich (1985) could be recommended for future studies based on dried material of *Orobanche cumana*.]

Domina, G., Greuter, W., Marino, P. and Schäfer, P.A. 2013. Types of names of *Orobanche* taxa described from North Africa. Plant Biotaxonomia 147(3): 758-766. [Accepted names and synonyms of the recognized taxa are given. Three species are illustrated, and one new combination (*O. inexpectata*) is proposed.]

Dong ShuQing, Gao RuiBin, Yang Yan, Guo Mei, Ni JingMan and Zhao Liang. 2014. Simultaneous determination of phenylethanoid glycosides and aglycones by capillary zone electrophoresis with running buffer modifier. Analytical Biochemistry 449: 158-163. [Relating to analysis of extracts of *Cistanches* spp.]


parasitises Notobasis syriaca and Cirrhus phyllocephalum but is shown to be able to parasitise safflower, lettuce, gazania (Gazania uniflora), vetch (Vicia sativa) and artichoke. Sunflower, tomato, carrot, chrysanthemum and cabbage did not support the parasite.\]

Dostalík, T., Münzbergová, Z. and Plačková, I. 2014. High genetic diversity in isolated populations of Thesium ebracteatum at the edge of its distribution range. Conservation Genetics 15(1): 75-86. [Populations of the endangered T. ebracteatum in Central Europe occupying an area greater than 300 m² showed high genetic diversity, whereas small populations contained less genetic diversity. Conservation priorities are discussed.]

Drumeva, M., Yankov, P., Nenova, N. and Shindrova, P. 2014. Investigation on the resistance of doubled haploid sunflower lines to some biotic factors. Agricultural Science and Technology 6(1): 11-13. [Gamma-induced parthenogenesis was applied to 15 doubled haploid fertility restorer sunflower lines. Seven lines showed resistance to Orobanche cumana (races A-F) and 4 of these were also resistant to downy mildew.]

Duca, M., Glijin, A. 2013. The broomrape effect on some physical and mechanical properties of sunflower seeds. Analecta Ştiinţifice ale Universităţii 'Al I Cuza' din Iaşi. (Serie Noulă) Secţiunea II a. Biologie Vegetală 59(2): 75-83. [Studying the effects of Orobanche cumana infection on sunflower seed parameters and finding the most affected were 1000-grain weight (-20,1%) and mass of 1000 kernels (-20,7%).]


Dunn, R.M., Tallowin, J.R.B., Peel, S., Chesterton, C., Cooke, A., Jefferson, R., Martin, D., Smith, B., Smith, S. and Tallowin, J. 2012. Negative effect of early-stage restoration plant species on recruitment of late-stage restoration species. Aspects of Applied Biology115: 151-156. [Sowing Rhinanthus minor at 10 kg/ha was among treatments used in a study which concluded that the hypothesis that generalist species used in the early stage of biodiversity restoration act as facilitators for the establishment of late-stage habitat specialists, is wrong.]


Encheva, J. 2013. Application of embryo culture method in combination with gamma irradiation and ultra sounds (Part I). Helia 36(59): 71-83. [Mutation caused by gamma ray and ultra sound respectively contributed to the paternal components of sunflower hybrids Rada and Yana, each showing immunity to Orobanche cumana race G.]


Evans, B. and Borowicz, V. 2013. Verbesina alternifolia tolerance to the holoparasite Cuscuta gronovii and the impact of drought. Plants 2(4): 635-649. [Parasitism by C. gronovii reduced both shoot and root mass of V. alternifolia more
strongly in well-watered conditions than those under drought stres, indicating reduced tolerance to parasitism when water was readily available.]
Fadini, R.F., Mellado, A. and Ghizoni, L.P. 2014. A host creates an enemy-free space for mistletoes by reducing seed predation caused by a woodboring beetle: a hypothesis. Biotropica 46(3): 260-263. [An intriguing report suggesting that the beetle Hypothenemus obscerus may contribute to the host-specificity of Psittacanthus plagiophyllus in Brazil, as it preys on the parasite seeds on non-host trees but avoids the main host tree (sadly un-named in the abstract) apparently because of its gum exudates.]


Fernando, H.S.D. and Karunaratne, M.M.S.C. 2013. Mella (Olax zeylanica) leaves as an eco-friendly repellent for storage insect pest management. Journal of Tropical Forestry and Environment 3(1): 64-69. [Results confirm that the powder or methanol extracts of O. zeylanica act as repellants for the rice weevil Sitophilus oryzae.]

Fierbinteanu, A. and Dinca, V. 2013. Research on genetic and breeding sunflower for resistance to broomrape parasite (Orobanche cumana) in Romania. Scientific Papers - Series A, Agronomy 56: 242-245. [Reviewing the occurrence of O. cumana in Romania, the difficulty in finding resistance to new races and suggesting recommendations for reducing sunflower yield loss.]

*Filella, I., Primante, C., Llusia, J., Gonzalez, A.M.M., Seco, R., Farré-Armengol, G., Rodrigo, A., Bosch, J. and Peñuelas, J. 2013. Floral advertisement scent in a changing plant-pollinators market. Scientific Reports 3(3434): srep03434. (http://www.nature.com/srep/2013/131205/srep03434.html) [Showing that scent advertisement is higher in species that bloom early in the flowering period when pollinators are scarce than in species blooming later in the season (including Orobanche latisquama) when there is a surplus of pollinators relative to flowers.]


García, M.A., Costea, M., Kuzmina, M. and Stefanovic’, S. 2014. Phylogeny, character evolution, and biogeography of Cuscuta (dodders; Convolvulaceae) inferred from coding plastid and nuclear sequences. American Journal of Botany 101(4): 670-690. [This is the first phylogenetic study (using rbcL and nrLSU) of Cuscuta that sampled all recognized sections and subsections of the genus. After removing discordant taxa, 4 well-supported major clades were recovered. Ancestral state analyses showed dehiscent fruits and globose stigmas to be ancestral whereas style number was ambiguous. Biogeographical reconstructions suggest an Old World origin for the genus and subsequent spread to the Americas as a consequence of one long-distance dispersal.]

Gaudin, Z., Cerveau, D., Marnet, N., Bouchereau, A., Delavault, P., Simier, P. and Pouvreau, J.B. 2014. Robust method for investigating nitrogen metabolism of 15N-labeled amino acids using AccQ.Tag ultra performance liquid chromatography-photodiode array-electrospray ionization-mass spectrometry: application to a parasitic plant-plant interaction. Analytical Chemistry (Washington) 86(2): 1138-1145. [Showing that young parasite tubercles assimilate inorganic N as 15N-ammonium when supplied directly through batch incubation but not when supplied by translocation from host root phloem, whereas 15N-glutamine mobility from host roots to parasite tubercles suggests that the host-derived glutamine acts as an important nitrogen-containing storage compound in the young tubercle of Phelipanche ramosa.]

commenting on the presence of mistletoe (presumably *Viscum album*) as a symptom, rather than a cause of crown decline."


Hadizadeh, F., Mehrvarz, S.S. and Mirpour, M.S. 2014. *Effect of Bacillus spp. on seed germination of selected species of the genus Cuscuta (Convolvulaceae). Modern Phytomorphology 6: 97-101.* [Germination of *C. monogyna*, *C. europaea* and *C. campestris* was inhibited by *B. pumilus*, *B. megaterium* and *B. licheniformis*.]


Phylogenetics and Evolution 72: 1-6. [A molecular phylogenetic study using nuclear ITS and plastid *rps16*, *trnL-trnF*, *trnS-trnG* produced a monophyletic Ehretiaceae containing *Bourreria* s.l., *Cortesia*, *Ehretia* s.l., *Halagna*, *Lepadocoria*, *Rochefortia*, and *Tiquilia* as well as the parasitic genera *Lennoa* and *Pholisma*.]

Gu Li, Xiong WenTing, Wang Chao, Sun HongXia, Li GuoFu and Liu Xin. 2013. *Cistanche deserticola* decoction alleviates the testicular toxicity induced by hydroxyurea in male mice. Asian Journal of Andrology 15(6): 838-840. [Extracts of *C. deserticola* alleviated the spermatogenetic cell degeneration induced by hydroxyurea and modulated the serum sex hormone levels to some extent.]

Guerra, T.J. and Pizo, M.A. 2014. Asymmetrical dependence between a Neotropical mistletoe and its avian seed disperser. *Biotropica* 46(3): 285-293. [Concluding that the mistletoe *Struthanthus flexicaulis* in SE Brazil depends more on the main bird fruit disperser *Elaenia cristata*, responsible for 96% of its dispersal, than the bird depends on the mistletoe, which represents only 34% of its diet.]

Gutiérrez, N. and 14 others. 2013. QTLs for Orobanche spp. resistance in faba bean: identification and validation across different environments. *Molecular Breeding* 32(4): 909-922. [Seven QTLs for *O. crenata* were identified but differed between Spain and Egypt. Three QTLs for *O. foetida* were detected. Co-localization of Oc8 and Oc9 in chromosome V confirms a common resistance against both *O. crenata* and *O. foetida*, as previously reported.]


types of non-glandular and 7 types of glandular trichomes are described from *E. stricta.*


He LiLi, Lv WenLiang and Sun GuiZhi. 2014. Nutritive value of winter-collected annual twigs of main European woody species, mistletoe and ivy and its possible consequences for winter foddering of livestock in prehistory. Holocene 24(6): 659-667. [Confirming the superior nutritive value of *Viscum coloratum* among plants known to have some activity against liver cancer.]


Hemant Nagar, Tiwari, D.K., Gaurav Dwivedi, Tripathi, R.K. and Jitendra Jena. 2013. *Loranthus longiflorus* protect central nervous system against oxidative damages of electromagnetic radiation on rat. International Journal of Green Pharmacy 7(4): 328-331. [Claiming that *L. longiflorus* (in India) may protect the central nervous system against oxidative damage from mobile phone electromagnetic field.]


Hou XiaolI, Sun MingXue, Gao HuanHuan, Cui Yan and Xiao Kai. 2013. Chemical constituents from the stems of *Dendrotrophe frutescens.* Biochemical Systematics and Ecology 51: 156-159. [Identifying 8 compounds including a furan-2-carbonyl C-glycoside together with a series of polyphenols and their glycosides.]


Hu Yang, Tian ChengMing, Cairangdanzhou, Li ZhouYuan, Li Tao, Hu Yue and Li JiRun. 2014. (Spatial distribution pattern of *Arceuthobium sichuanense* and its correlation with environment in Xianmi forest region of Qinghai, northwestern China.) (in Chinese) Journal of Beijing Forestry University 36(1): 102-108. [Concluding that crown density, slope, slope position, elevation and stand type were the main factors dictating the frequency of *A. sichuanense.*]


IITA. 2014. Research-for-development project chalks up significant progress to save maize from parasitic Striga weed in Nigeria. IITA The Bulletin No 2219:1. [Reporting on the...
Integrated Striga Management in Africa (ISMA) project being implemented in Nigeria and Kenya, funded by the Gates Foundation. See Press Release ‘Results show Africa can eradicate Striga’.

Inoue, T., Yamauchi, Y., Eltayeb, A.H., Samejima, H., Babiker, A.G.T. and Sugimoto, Y. 2013. Gas exchange of root hemi-parasite Striga hermonthica and its host Sorghum bicolor under short-term soil water stress. Biologia Plantarum 57(4): 773-777. [The higher transpiration rate of S. hermonthica even under water stress, thanks to higher stomatal density, induces continued transfer of water and solute from the host to the parasite leading to severe damage to the host.]

Ismail, A.E.A. 2013. Integration between nitrogen, manure fertilizers, cultural practices and glyphosate on broomrape (Orobanche crenata Forsk) control in faba beans (Vicia faba L.). Bulletin of Faculty of Agriculture, Cairo University 64(4): 369-378. [Field experiments involving 56 treatments repeated over two seasons supported the use of N fertilizer, and fenugreek inter-cropping, as alternatives to glyphosate which also gave good selective control.]


Ivanova, D., Milev, I., Vachev, T., Baev, V., Yahubyan, G., Minkov, G. and Gozmanova, M. 2014. Small RNA analysis of Potato Spindle Tuber Viroid infected Phelipanche ramosa. Plant Physiology and Biochemistry 74: 276-282. [Results suggest the involvement of various small RNA classes in the P. ramosa response to PSTVd infection.]

Jamil, M., Charnikhova, T., Ali, Z., Wainwright, H. and Bouwmeester, H.J. 2014. Effect of phosphate-based seed priming on strigolactone production and Striga hermonthica infection in cereals. Weed Research (Oxford) 54(3): 307-313. [A very interesting demonstration that seed priming with phosphate can result in lower exudation of strigolactones and less S. hermonthica seed germination and may hence be an effective and affordable strategy to reduce S. hermonthica infection in cereals. Further results awaited with interest.]


Jia YaMin, Guan QuNong, Jiang Yong, Salh, B., Guo YuHai, Tu PengFei and Du CaiGan. 2014. Amelioration of dextran sulphate sodium-induced colitis in mice by echinacoside-enriched extract of Cistanche tubulosa. Phytotherapy Research 28(1): 110-119. [Results support the potential of C. tubulosa extracts for clinically treating inflammatory bowel disease.]


Johri, P.K., Ruchita Tripathi and Reeta Johri. 2014. Testicular protein profile (SDS-PAGE) study of
tested reversible male antifertility and aphrodisiac polyherbal preparation fed albino rats with special reference to zinc deficiency. Biochemical and Cellular Archives 13(2): 277-279. [Santalum album among 24 aphrodisiac medicinal plants shown to have no undesirable toxic effects on testicular proteins.]


parasite plant in GSFC township, Vadodara, Gujarat, India. Lifesciences Leaflets 5(5): 50-59. [Recording some 35 host species of *D. falcata* and the birds associated with those hosts; confirming *Nectarinia* spp. and *Dicaeum* spp. as the main seed-dispersers or pollinators for the mistletoe.]


Kamble, V.R. and Agre, D.G. 2013. New report on *Alectra vogelii* and *Dicaeum* spp. as decomposing germination stimulants prior to action. Crop Protection 61: 11-15. [Demonstrating that aqueous solutions of either strigolactone analogues, including GR 24 and N-(2,2-dimethyl-5-oxo-1,2,5-oxadiazol-4-yl)-2-methylpropan-2-amine, were tested on a variety of weed species, including *S. asiatica*, *S. hermonthica* and *S. gesnerioides*.

Kamara, A.Y., Ekeleme, F., Jibrin, J.M., Tarawali, G. and Tofa, I. 2014. Assessment of level, extent and factors influencing *Striga* infestation of cereals and cowpea in a Sudan Savanna ecology of northern Nigeria. Agriculture, Ecosystems & Environment 188: 111-121. [A survey in Jigawa State, showed that the severity of *S. hermonthica* attack on sorghum and millet was high in all the communities studied. Also, most cowpea plants in fields surveyed in most communities were attacked by *S. gesnerioides.* Field infestation was largely related to poor soil fertility.]

Kamara, A.Y., Ewansiha, S.U. and Menkir, A. 2014. Assessment of nitrogen uptake and utilization in drought tolerant and *Striga* resistant tropical maize varieties. Archives of Agronomy and Soil Science 60(2): 195-207. [Suggesting that drought-tolerant cultivars are more responsive to N than controls. Response of *Striga*-resistant cultivars not clear from abstract.]

Kamble, V.R. and Agre, D.G. 2013. New report on AMF colonization in root parasite *Striga gesnerioides* and its host *Lepidagathis hamiltoniana* from high altitude region of Maharashtra. International Multidisciplinary Research Journal 3(2): 27-31. [Confirming the presence of arbuscular mycorrhizal fungi in the roots of both *S. gesnerioides* and its host, *L. hamiltoniana.* Species detected included *Gigaspora* spp., *Glomus epigaeum*, *G. occulatum* and *G. macrocarpum*, the latter being the most abundant.]

Kannan, C. and Zwanenburg, B. 2014. A novel concept for the control of parasitic weeds by decomposing germination stimulants prior to action. Crop Protection 61: 11-15. [Demonstrating that aqueous solutions of either borax or thiourea rapidly decompose typical strigolactone analogues, including GR 24 and Nijmegen-1, within an hour, suggesting a possible means of control in the field.]

Karanja, J., Nguluu, S.N., Wambua, J. and Gatheru, M. 2013. Response of cowpea genotypes to *Alectra vogelii* parasitism in Kenya. American Journal of Biotechnology 12(47): 6591-6598. [Cowpea yield losses due to *A. vogelii* have been estimated to range from 50 to 100% in Mbeere, Kitui and Makueni districts. Among 123 lines tested, Kir/Nya-005 and Mbe/Mach-022 showed complete resistance to *Alectra*. Sia/Cia-004, Mbe/Mach-014 and Kib-006 were tolerant giving high grain yields despite heavy infestation.]

*Striga asiatica* is also a problem and cowpea is grown as a rotational trap crop.}
Karaya, H., Njomge, K., Mugo, S., Ariga, E.S., Kanampiu, F. and Nderitu, J. 2014. Combining ability of maize (Zea mays) inbred lines resistant to Striga hermonthica (Del.) Benth evaluated under artificial Striga infestation. African Journal of Agricultural Research 9(16): 1287-1295. [Results suggest a predominance of additive gene effects in the inheritance of Striga resistance traits as opposed to dominance gene effects. Inbred lines with good GCA for yield and resistance traits were identified as TESTR 151, TESTR 156 and OSU231//56/44-6-4-17-3.]


Khalil, N.A.A., Dagash, Y.M. and Yagoub, S.O. 2013. Effect of sowing date, irrigation intervals and fertilizers on safflower (Carthamus tinctorius L.) yield. Discourse Journal of Agriculture and Food Sciences 1(5): 97-102. [Results were incidentally affected by serious infection of safflower with Orobanche crenata which was the first record in Sudan.]


Kong XiangPei, Zhang MaoLin and Ding ZhaoJun. 2014. D53: the missing link in strigolactone signaling. Molecular Plant 7(5): 761-763. [A study of some new structures with strigolactone activity. They possess a common dimethylbutenolide motif but their structure varies in the ABC part of the molecules: one, ‘23’ has the same ABC part as GR24, while ‘31’ and AR36 carry, respectively, an aromatic ring and an acyclic carbon chain.]


Kuijt, J. 2013. A brief taxonomic history of neotropical mistletoe genera, with a key to the genera. Blumea 58(3): 263-266. [Contains the author’s perspective on the taxonomic history of Loranthaceae, Viscaceae, and the eremolepidaceae mistletoes (Midosendraceae not discussed). The key is the first published that incorporates all the small-flowered X=8 neotropical Loranthaceae genera, including the recently resurrected genera Peristethium and Passovia.]

Kumar, A.M. 2014. Recurrence of sandal spike disease in Karnataka - an alert. Current Biotica 7(4): 253-255. [Reviewing the occurrence of this phytoplasma disease in sandal (presumably Santalum album) in Karnataka.]

Kumar, K.N.S., Sangeetha, B., Rajalekshm, M., Ravishankar, B., Muralidhar, R. and Baumgartner, S. 2013. Effects of lipophilic extract of Viscum album L. and oleasonic acid on migratory activity of NIH/3T3 fibroblasts and on HaCat keratinocytes. Evidence-based Complementary and Alternative Medicine 2013: Article ID 718105. [Results support the observation that V. album lipophilic extract might modulate wound healing related processes in vivo.]

Kurt, G. and Tepe, I. 2014. (Determination of seed dispersal mechanisms of smoothseed alfalfa dodder (Cuscuta approximata Bab.) in Van.) (in Turkish) Yüzüncü Yıl Üniversitesi Journal of Environmental Sciences 13(12): 1622-1625. [In a 1999 study, the number of pods per plant and an average of 21 seeds in 4 kg of soil, confirming crop seed as the main means of spread but manure also important.]

Kwaga, Y.M. 2013. Direct and indirect contributions of yield attributes to the kernel yield of groundnut (Arachis hypogaea L.) grown under Alternaria infestation at Samaru, Nigeria. American-Eurasian Journal of Agricultural & Environmental Sciences 13(12): 1622-1625. [In a 1999 study, the number of pods per plant exhibited the highest percentage yield contribution to kernel yield.]


LeBlanc, M., Kim, G.J., Patel, B., Stromberg, V. and Westwood, J. 2013. Quantification of tomato and *Arabidopsis* mobile RNAs trafficking into the parasitic plant *Cuscuta pentagona*. New Phytologist 200(4): 1225-1233. [Proposing that mRNAs traffic into *C. pentagona* via multiple routes, or that other mechanisms for selective uptake and mobility exist between host and parasite.]

Lee Corre, V., Reibel, C. and Gibot-Leclerc, S. 2014. Development of microsatellite markers in the branched broomrape *Phelipanche ramosa* L. (Pomel) and evidence for host-associated genetic divergence. International Journal of Molecular Sciences 15(1): 994-1002. [Individuals collected on oilseed rape were strongly differentiated from individuals collected on hemp or tobacco, suggesting that *P. ramosa* infecting oilseed rape forms a genetically diverged race.]

Lee ShinHae, Kim InBo, Kim JongBae, Park DongHo and Min KyungJin. 2014. The effects of Korean mistletoe extract on endurance during exercise in mice. Animal Cells and Systems 18(1): 34-40. [Viscum album ssp. coloratum enhances the exercise performance in a sedentary mouse group, but did not further enhance it when combined with exercise training, suggesting that it could be an excellent mimetic of exercise.]


Mapongmetsem, P.M. and Diksia, M. 2014. Vegetative propagation of local fruit trees by air layering in the Guinean Savannah Highlands (GSH). Journal of Sustainable Forestry 33(1): 21-32. [Reporting that rooting of layered *Ximenia americana* was lower than for some other woody species.]

Masciadi, S., Stutz, S. and García-Rodríguez, F. 2013. Modern pollen-vegetation relationship of plant communities in the Uruguayan Atlantic coast. Brazilian Journal of Botany 36(1): 31-44. [In a study of pollen capture by lakes (as a guide to palaeo studies), *Tripodanthus acutifolius* (Loranthaceae) was among good indicators of the coastal forest.]

Mavundza, E.J., Maharaj, R., Chukwuje kwu, J.C., Finnie, J.F. and van Staden, J. 2013. Larvicidal...


Midega, C.A.O., Salifu, D., Bruce, T.J., Pittchar, J., Pickett, J.A. and Khan, Z.R. 2014. Cumulative effects and economic benefits of intercropping maize with food legumes on Striga hermonthica infestation. Field Crops Research 155: 144-152. [Field work in Kenya comparing 5 potential legume intercrops with Desmodium intortum. Groundnut reduced Striga but failed to increase yield. Crotonalria and greengram intercrops reduced Striga, and increased yields to a lesser extent than D. intortum, which gave the highest economic return, but they could be of value as part of an integrated approach.]


Misra, B.B. and Satyahari Dey. 2013. Quantitative and qualitative evaluation of esquiterpenoids from essential oil and in vitro somatic embryos of east Indian Sandalwood (Santalum album) tree by HPTLC and GC. Open Access Journal of Medicinal and Aromatic Plants (OAJMAP) 4(1): 1-9. [Meaning sesquiterpenoids?] *Misra, B.B. and Satyahari Dey, 2014. Culture of East Indian sandalwood tree somatic embryos in air-lift bioreactors for production of santalols, phenolics and arabinogalactan proteins. AoB Plants 2013, plt025. (http://aobpla.oxfordjournals.org/content/5/plt02 5.full) [Results indicate that 10-L-capacity air-lift bioreactors are capable of supporting somatic embryo cultures of Santalum album, while the extracellular medium provides opportunities for production of industrial raw materials such as santalols, phenolics and arabinogalactan proteins.]


Molina, J. and 16 others. 2014. Possible loss of the chloroplast genome in the parasitic flowering plant Rafflesia lagascae (Rafflesiaceae). Molecular Biology and Evolution 31(4): 793-803. [Illumina whole genome sequencing was used to generate a sequence which was assembled into a draft mitochondrial genome. Only fragments of plastid genes were detected
and one third of these were derived from the host via horizontal gene transfer. These data suggest Rafflesia lacks a plastid genome or, if it is present, it is in cryptic form at very low levels.

Molinero-Ruiz, L., García-Carneros, A.B., Collado-Romero, M., Raranciuc, S., Domínguez, J., and Melero-Vara, J.M. 2014. Pathogenic and molecular diversity in highly virulent populations of the parasitic weed Orobanche cumana (sunflower broomrape) from Europe. Weed Research (Oxford) 54(1): 87-96. [Analyses of O. cumana populations confirmed race F present in Spain, Hungary and Turkey and race G also in Turkey. Populations within South Spain, Central Spain, Hungary and Turkey were each genetically uniform.]

Montejo Valdés, L.A., Muñoz, B.C., Sánchez, J.A. and Gamboa, A. 2014. (Seed variability among plant species from a tropical evergreen forest in Sierra del Rosario, Cuba.) (in Spanish) Bosque 35(1): 37-47. [Undeveloped embryos of rudimentary types, linear or capitate, were found in Schoepfia didyma (Olacaceae).]

*Morawetz, J.J. 2013 A clearing protocol for whole tissues: an example using haustoria of Orobanchaceae. Applications in Plant Sciences 1(1): 1200361. (http://www.bioone.org/doi/full/10.3732/apps.1200361) [Stockwell’s bleach proved to be useful in removing tannins from haustoria within 3–10 days, after which they were successfully cleared in a solution of lactic acid saturated with chloral hydrate at 42°C.]

Moupela, C., Doucet, J.L., Daïnou, K., Tagg, N., Bourland, N. and Vermeulen, C. 2014. Dispersal and predation of diaspores of Coula edulis Baill. in an evergreen forest of Gabon. African Journal of Ecology 52(1): 88-96. [Camera-trap photographs have shown 7 animal species involved in the dispersal/predation of C. edulis (Olacaceae), bush pig being the main consumer and predator of seeds. No seeds emerged intact from elephant faeces.]

Mudrůk, O., Mládek, J., Břažek, P., Leš, J., Doležal, J., Nekvapilová, E. and Těšítel, J. 2014. Establishment of hemiparasitic Rhinanthus spp. in grassland restoration: lessons learned from sowing experiments. Applied Vegetation Science 17(2): 274-287. [Concluding from a range of field studies in the Czech Republic that mowing or grazing, litter removal, proper timing of sowing, and use of the seeds from local seed sources should considerably increase probability of the successful introduction of Rhinanthus.]
Napier, K.R., Mather, S.H., McWhorter, T.J. and Fleming, P.A. 2014. Do bird species richness and community structure vary with mistletoe flowering and fruiting in Western Australia? Emu - Austral Ornitholog 114(1): 13-22. [Mistletoebirds (Dicaeum hirundinaceum) were significantly more likely to be recorded during months when ripe fruit of Amyema preissii and A. miquelii were present and the overall bird species richness was higher for these survey months.]

Nardella, E., Gatta, G. and Giuliani, M.M. 2014. (Water stress on tomato, a high risk of low yields.) (in Italian) Informatore Agrario 70(12): 69-72. [Commenting that results were influenced by a dense infestation of Orbanche ramosa which is spreading fast in Foggia province.]


Neetu Bais, Arun Kakkar, Mishra, V.K., Rajendra Singh and Prachi Khare. 2014. Comparative study on antibacterial activity of ethyl acetate extract of Cuscuta reflexa grown on Cassia fistula and Ficus benghalensis. International Journal of Pharmaceutical Sciences and Research (IJPSR) 5(1): 137-141. [Extracts from C. reflexa grown on the two host species were effective against most of the bacteria tested but that grown on Ficus was inactive against Salmonella typhi while that grown on Cassia was inactive against Escherichia coli.]


Nikolov, L.A., Endress, P.K., Sugumaran, M., Sasirat, S., Vessabutr, S., Kramer, E.M. and Davis, C.C. 2013. Developmental origins of the world’s largest flowers, Rafflesiaaceae. Proceedings of the National Academy of Sciences of the United States of America 110(46): 18578-18583. [Comparative studies of structure, development, and gene-expression patterns were used to investigate the homology of floral organs in Rafflesiaaceae. The diaphragm in Rafflesia is derived from the petal whorl whereas in Sapria it develops from a ring structure located between the perianth and the stamen whorl; thus these tissues are not homologous.]

Nikolov, L., Staedler, Y., Manickam, S., Schönemberger, J., Endress, P., Kramer, E. and Davis, C.C. 2014. Floral structure and development in Rafflesiaaceae with emphasis on their exceptional gynoecia. American Journal of Botany 101: 225-243. [Serial sectioning, SEM, and x-ray tomography of floral buds were employed to study the structure and development of all three Rafflesiaaceae genera. The shoot apex of Rafflesiaaceae forms secondarily via internal cell separation (schizogeny) along the distal boundary of the host-parasite interface. Similarly, the clefts of the gynoecium form via schizogeny within solid tissue, and no carpels are initiated from the floral apex. Secondary derivation of the inner gynoecium surface is otherwise unknown in angiosperms.]

Nikolov, L., Tomlinson, P., Manickam, S., Endress, P., Kramer, E. and Davis, C. 2014. Holoparasitic Rafflesiaaceae possess the most reduced endophytes and yet give rise to the world’s largest flowers. Annals of Botany 114: 233-242. [Serial sectioning and staining were employed to characterize the structure of the endophytes in Rafflesia, Sapria and Rhizanthes. The endophyte consists of uniseriate filaments oriented radially within the host. A protocorm then forms an endogenously originating shoot apex by formation of a secondary morphological surface.]

Nobis, M., Nowak, A., Nobis, A., Paszkó, B., Piwowarczyk, R., Nowak, S. and Plášek, V.


Pan ShaoBin, Wang Xiao, Duan WenJuan, Yu ZongYuan, Zhang Lin and Liu Wei. 2014. Preparative isolation and purification of flavonoids from Cuscuta chinensis Lam. by high-speed countercurrent chromatography. Journal of Liquid Chromatography & Related Technologies 37(15): 2162-2171. [Five flavonoids, quercetin-3-O-β-D-apiofuranosyl-(1->2)-β-D-galactoside, hyperoside, kaempferol-3-O-β-D-glucoside, kaempferol, quercetin, and...
chlorogenic acid isolated from the seeds of C. chinensis.

Parker, C. 2014. The continuing threat from parasitic weeds. Outlooks on Pest Management 25(3): 237-242. [Here he goes again – trying to scare us into thinking parasitic weeds are important! Reviewing the on-going menace from spread and/or intensification of Striga, Orobanche, Alelecta, Cuscuta and Arceuthobium spp. Nice pictures.]


Patel, S. and Panda, S. 2014. Emerging roles of parasitic weeds are important! Reviewing the on-going menace from spread and/or intensification of Striga, Orobanche, Alelecta, Cuscuta and Arceuthobium spp. Nice pictures.

Pelser, P.B. and Barcelona, J.F. 2013. Discovery through photography: Amyema nickrentii, a new species of Loranthaceae from Aurora Province, Philippines. Phytotaxa 125: 47-52. [A. nickrentii differs from all other described Amyema species in having a whorled leaf arrangement with mostly nine flat linear leaves per node. NB Congratulations to Dan on the second species to be named in his honour, the first being Phoradendron nickrentii (Kuijt, 2011, Novon 21:444-462).]


Perreira, R.N., Delistioianov, N., Perotta, J.H., Magalhães, G.M., Favoretto, S.M. and Alessi, A.C. 2014. Catuama and bilobalide on peripheral nerve regeneration in rats following sciatic nerve section. Ciência Rural 44(5): 854-860. [Ptychopetalum olacoides (Olacaceae) is one of 4 components in ‘Catuama’, used in Brazil for its neuroprotector, anti-inflammatory, antioxidant and antidepressant effects. But not showing significant effect in this study.]


Pop, C., Ranga, F., Fetea, F. and Socaciu, C. 2013. Application of three alternative technologies (spray drying, fluid bed drying and freeze drying) to obtain powdered formulas from plants with antimicrobial potential. Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Animal Science and Biotechnologies 70(1): 95-103. [Spray drying and freeze drying were superior to fluid bed as techniques for preparation of extracts including those from Viscum album.]

Pop, C., Vodnar, D., Ranga, F. and Socaciu, C. 2013. Comparative antibacterial activity of different plant extracts in relation to their bioactive molecules, as determined by LC-MS analysis. Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Animal Science and Biotechnologies 70(1): 86-94. [Extracts of Viscum album were active against Escherichia coli.]


Prider, J. and Williams, A. 2014. Using dazomet to reduce broomrape seed banks in soils with low moisture content. Crop Protection 59: 43-50. [Pot and field studies in Australia confirmed the effectiveness of dazomet for control of Orobanche ramosa but noted that it took longer to be effective under drier conditions.]

of Pharma and Bio Sciences 4(4): P-413-P-428. [A review including mention of *Dwendrophoe falcata*.]


Quan JiShu, Jin MeiHua, Xu HuiXian, Qiu DeLai and Zhao LiQing. 2014. (New fraction isolated from *S. album* for authentication of *Orobanche alsatica* and *O. ritro* (Orobanchaceae) in the Iberian Peninsula.) (in Spanish) Acta Botanica Malacitana 38: 155-159. [Relating to *Orobanche icterica* and *O. alsatica*, also known from Central and Eastern Europe.


Robertson, O., Maron, M., Buckley, Y. and McAlpine, C. 2013. Incidence of competitors and landscape structure as predictors of woodland-dependent birds. Landscape Ecology 28(10): 1975-1987. [Abundance of the noisy miner is more important than other factors, including unspecified mistletoe abundance, in the decline of woodland bird diversity.]

mainly for maintaining plant water level and reducing water stress and the raised K status of the leaf played a significant role in this.] Rumpf, S.B., Semenchuk, P.R., Dullinger, S. and Cooper, E.J. 2014. Idiosyncratic responses of high Arctic plants to changing snow regimes. PLoS ONE 9(2): e86281. (http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0086281) [Reduced snow levels and earlier as well as later snowmelt had a negative effect on the average plant size of Pedicularis hirsuta.]

Rumsey, F. 2014. Orobanche crenata Forssk. (carnation-scented or bean broomrape) – a growing problem? BSBI News 125: 46-47. [An account of the outbreak of O. crenata in faba bean in UK last year with an outline of the previous history of the weed going back to 1950 in Essex, UK but not seen in that area since 2006 (until this year – see Update above).]

Sadana, T.S., Govindappa, M. and Ramachandra, Y.L. 2013. Isolation and characterization of D-isolation and characterization of D-galactose, N-acetylgalactosamine, fructose, maltose specific lectin from eight different endophytic fungi of Viscum album L. Asian Journal of Biomedical and Pharmaceutical Sciences 3(26): 11-20. [Confirming the presence of lectins in V. album and in a range of endophytic fungi including Aspergillus flavus, Fusarium moniliforme, F. oxysporum and Trichothecium sp.]

Sakulnarmrat, K., Sreednicki, G. and Konczak, I. 2014. Composition and inhibitory activities towards digestive enzymes of polyphenolic-rich fractions of Davidson's plum and quandong. LWT - Food Science and Technology 57(1): 366-375. [A polyphenolic-rich fraction from the fruits of quandong (Santalum acuminatum) comprising quercetin and cyanidin 3-glucoside, was the most effective inhibitor of pancreatic lipase.]


Saric ´Krsmanovic´, M., Božic´, D., Pavlovic´, D., Radiivojevic´, L. and Vrbnićanin, S. 2013. Temperature effects on Cuscuta campestris Yunck. seed germination. Pesticidi i Fitomedicina 28(3): 187-193. [Over 90% germination of acid-scarified seed of C. campestris was obtained at 25 and 30°C. Without scarification, germination was improved by stratification at 4°C for 30 days but did not exceed 40%].


Semercı, A. 2013. Economic analysis of sunflower production in the view of orobanche resistance conditions. Pakistan Journal of Agricultural Sciences 50(3): 499-504. [In a detailed economic analysis, O. cumana-resistant sunflower gave
higher yields and economic return than imidazolinone (IMI)-resistant or non-resistant sunflower in Thrace, Turkey. No indication of Orobanche control by IMI herbicide.]
*Shen Hao, Xu ShuJun, Hong Lan, Wang ZhangMing and Ye WanHui. 2013. Growth but not photosynthesis response of a host plant to infection by a holoparasitic plant depends on nitrogen supply. PLoS ONE 8(10): e75555. [http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0075555] [Mikania micrantha suffers more severe inhibition in growth from Cuscuta campestris at low than at high nitrate levels, attributed to a higher proportion of host resources transferred to the parasite rather than a greater parasite-induced reduction in host photosynthesis.]
Singh, L.J. and Vinay Ranjan. 2013. Dendrophthoe globrescens (Blakely) Barlow (Loranthaceae) - an addition to the flora of Tamil Nadu, India. Indian Journal of Forestry 36(4): 523-524. [Including illustrations.]
Smith, R.G. and Cox, D.A. 2014. Effects of soil amendments on the abundance of a parasitic weed, yellow rattle (Rhinanthus minor) in hay fields. Weed Science 62(1): 118-124. [Amending hay fields with wood ash or sawdust may be an effective strategy for managing R. minor infestations which are becoming increasingly problematic in fields in the northeastern United States.]
Thus, partial mycoheterotrophy may be much more widely distributed among orchids than hitherto assumed.


Sui Xiaolin, Li AiRong, Chen Yan, Guan KaiYun, Zhuo Lu and Liu YanYan. 2014. Arbuscular mycorrhizal fungi: potential biocontrol agents against the damaging root hemiparasite Pedicularis kansuensis? Mycorrhiza 24(3): 187-195. [Showing that P. kansuensis which causes loss of herbage yield in China, can be suppressed by the AM fungus Glomus mosseae with significant benefit to the host Elymus nutans.]


Sun SiSheng, Chen XiaoMei and Guo ShunXing. 2014. Analysis of endophytic fungi in roots of Santalum album Linn. and its host plant Kuhnia rosmarinifolia Vent. Journal of Zhejiang University (Science B) 15(2): 109-115. [Surveying the wide, but different, ranges of host endophytes of S. album and K. rosmarinifolia.]


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**IPPS MEMBERSHIP**

Membership in the IPPS is open to individuals and organizations of all nations that are interested in the objectives of the Society.

Annual membership fees: regular membership 30 €

To obtain a Registration Form visit the IPPS website (http://www.parasiticplants.org/) or contact:

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**HAUSTORIUM 65**

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Send material for publication to any of the editors.

**NB.** Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be down-loaded from the IPPS website (see above).
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PRESIDENT’S MESSAGE

Dear IPPS Members,

Greetings and best wishes for 2015.

This will be a special year for IPPS as this summer the 13th World Congress on Parasitic Plants will take place on July 5-10 in Kunming, China, for the first time in Asia. Please see the meeting section of this issue to find and confirm important information on the Congress such as registration and abstract submission dates. John Yoder with other members of scientific committee have been working extensively on the scientific program and you will find session chairs/modulators and keynote lectures on the tentative program. I encourage all of you to attend and enjoy great scenery, food, culture, and of course science.

I am pleased to announce the result of the recent IPPS elections. First of all, I thank everyone who participated in the election process and extend congratulations to Hinanit Koltai and Philippe Simier for being elected to office.

Full list of IPPS officers is now:
President – Koichi Yoneyama (continuing)
Vice President – Julie Scholes (continuing)
Secretary – John Yoder (continuing)
Treasurer – Philippe Simier (newly elected)
Editor – Hinanit Koltai (newly elected)
Member at large – Ahmet Uludag (continuing)

We are very grateful to Philippe Delavault and Harro Bouwmeester for their excellent service and contributions to the society. Philippe Delavault completed his second round of term as Treasurer (8 years!) to keep IPPS bank account safely in France. Harro as Editor has helped Chris and Lytton increase volume and contents, and deepen the science in Haustorium. Any contributions or other ideas you have for Haustorium can now be sent to Hinanit as well as to Chris or Lytton.

There will be another important meeting in 2015, the 1st International Congress on Strigolactones which will be held on 1-6 March in Wageningen, the Netherlands. Harro Bouwmeester and colleagues are busy organizing the congress. Although strigolactones were first identified as germination stimulants for root parasitic weeds, now they are recognized as a novel class of plant hormones. The Congress will summarize old and new evolving aspects in biology, biochemistry, chemistry, and molecular biology of strigolactones. Details can be found at www.strigolactones.org.

I hope this year brings further new insights into parasitic plants.

See you in Kunming, China!

Koichi Yoneyama, IPPS President
yoneyama@cc.utsunomiya-u.ac.jp

THE 13TH WORLD CONGRESS ON PARASITIC PLANTS

The 13th World Congress on Parasitic Plants (WCPP13) will be held on Sunday July 5 to Friday July 10, 2015 in Kunming, Yunnan Province, Southwest China. The venue will be Yunnan Dianchi Garden Resort Hotel & Spa. Further details can be found at the conference website http://wcpp13.csp.escience.cn/dct/page/65540. Abstract submission and online registration services are now available.

NOTE FROM THE NEW EDITOR

Dear all,

Initially, I would like to thank the members of the IPPS for the opportunity to fulfil the role of Editor for the IPPS, which I gladly accept.

I look forward to highlighting exciting new developments associated with Parasitic Plant research. The comparison between biological systems is, in my belief, a decided contributor to the better understanding of evolutionary and developmental processes. And it is through this comparison and integrative insight that I plan to present future developments. In the current issue I choose to highlight an exciting new development in the Parasitic Plant field of study, which relates to new findings about the exchange of signalling between host and parasite. Due to several new research studies we have gained better insight into both signals and receptors, thereby providing us a deeper understanding of the evolutionary process of this elaborate host-parasite communication.

I look forward to sharing with you my thoughts and insights, and hope to benefit the field of Parasitic Plants during these years of service.

Sincerely,
Hinanit Koltai, PhD
Editor, IPPS
STRIGOLACTONE AND KARRIKINS: SIGNALS AND THEIR RECEPTORS IN PLANT AND PARASITIC-PLANT GERMINATION

A marked advance was made in the last two years in our understanding of the signaling pathways associated with two classes of seed germination stimulators, strigolactones and karrikins. Back in 1966 strigolactones were first identified as crystalline, highly active germination stimulants of parasitic plants isolated from cotton-root exudates (Cook et al., 1966). In 1972, the structure of strigol was elucidated (Cook et al., 1972). Since then, numerous studies have shown that strigolactones are secondary metabolites, produced and exuded from the roots, which act as stimulators of seed germination in parasitic plants, including Striga and Orobanche (reviewed by Xie et al., 2010).

In plants, similarly to other plant hormones, strigolactones are sensed by a specific reception system (reviewed by Koltai, 2014). The F-box protein MAX2/D3/RMS4 component of this reception system was identified several years ago (Stirnberg et al., 2002; Ishikawa et al., 2005; Johnson et al., 2006). Significantly, max2 mutants were hyposensitive to both Red and Far-Red light-induced seed germination, suggesting a role for MAX2 in this process (Shen et al., 2007).

In the past 2 years additional components of the strigolactone receptor and signaling pathway were discovered. These include D14, identified in rice (Arite et al., 2009). Crystallization of its ortholog from petunia (DAD2), showed it to be a protein with an α/β-hydrolase fold and a canonical catalytic triad with a large internal cavity. Moreover, DAD2 interacted in a yeast two-hybrid assay with the petunia MAX2A only in the presence of the synthetic strigolactone GR24 (Hamiaux et al., 2012). This interaction resulted in hydrolysis of GR24 by DAD2 (Hamiaux et al., 2012). The rice D14 was shown to bind to GR24 (Kagiyama et al., 2013) and to function as a cleavage enzyme of strigolactones (Nakamura et al., 2011; Waters et al., 2014). Another signal for seed germination in plants is the strigolactone-similar class of compounds, the karrikins, originally found in forest-fire smoke (Flematti et al., 2004). Karrikins use a KAI2 (D14-LIKE)–MAX2-dependent pathway to regulate seed germination in Arabidopsis, as well as seedling growth and leaf and rosette development (Waters et al., 2012; Nelson et al., 2011; Waters et al., 2014) and require the F-box protein MAX2 (Nelson et al., 2011). However, karrikins in their pure form do not induce parasitic plant seed germination (Nelson et al., 2009; Scaffidi et al., 2014).

This strigolactone/karrikins reception module seem to have been conserved during plant evolution (Waldie et al., 2014). Therefore, it was expected to find similar components of strigolactone reception also in parasitic plants. Indeed, Liu et al. (2014) found in Striga hermonthica that ShMAX2 is involved in strigolactone perception. This is since expression of ShMAX2 in Arabidopsis was able to complement the Arabidopsis max2-1 mutant phenotypes, including the root and shoot phenotype, and the response to strigolactones (Liu et al., 2014). However, Striga MAX2 could not complement the hyposensitivity to Far Red light for seed germination in Arabidopsis max2-1. It might be that ShMAX2 does not recognize the Arabidopsis KAI2, involved in Arabidopsis seed germination (Liu et al., 2014).

Together, these evidences suggest that karrikins and strigolactones operate by different mechanisms in their germination stimulation action (Nelson et al., 2009). This notion is fortified by the findings that parasitic plant germination activity is dependent on the part of the molecule attached to the D-ring (Zwanenburg et al., 2013), absent in karrikins (Chiwocha et al., 2009). Hence, the signal reception and/or response of seed germination might be different between parasitic plants and other plant species. Future studies may provide better insight into this subject and indicate some evolutionary changes evolved in parasitic plants in relation to plant signal recognition and response.

References


Hinanit Koltai

RESEARCH ON PARASITIC PLANTS IN TROPICAL BRUNEI DARUSSALAM, BORNEO

Brunei Darussalam is a tiny, natural gas- and oil-rich Sultanate situated on the north-western edge of the island of tropical Borneo, an island which is also a part of Indonesia and Malaysia. About 54% of Brunei’s land area remains covered by unlogged primary forest.

The Sultanate possesses a high level of biodiversity compared to other countries in the region, including parasitic plants. Surveys carried out researchers lead by Kushan Tennakoon, Linda Lim, Aywen Chak, Quang-Vuong Le and

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Roshanizah Rosli, (based at the Universiti Brunei Darussalam) with their collaborators Lytton Musselman (Old Dominion University, USA) and Jay Bolin (Catawba College, USA) have recorded large populations of identified and unidentified mistletoes of the families Loranthaceae and Viscaceae (Chak, 2009) parasitizing hedgerow trees and tropical heath forest trees, dodders (Cuscuta) parasitizing grass patches and shrubby vegetation along the closely- knit waterways and Cassytha growing extensively in the sea-shore strand vegetation.

This rich parasitic flora in the Sultanate provides multiple avenues for research and draws international and local students for studies of biology, physiology and biochemistry of parasite-host associations in the tropics. So far, four BSc. (Honours) and three MSc. students have completed research projects on parasitic plants (biology and physiology of Cassytha filiformis and Cuscuta australis; phytochemistry of mistletoes and Cassytha) at the Universiti of Brunei Darussalam. One PhD project on the investigation of physiology and biochemistry of Bornean mistletoes as well as Cassytha is currently underway.

An overview of recently completed studies on parasitic plants in Brunei Darussalam is given here:

The different levels of dependence of parasitic plants on associated hosts provide opportunities to study resilience and the physiological nature of parasite and host counterparts. The occurrence of the same parasitic plants parasitizing different host species, or different parasites growing on the same host species at similar sites in Brunei Darussalam (especially in tropical heath forests) aids the elucidation of mistletoe-host physiology under similar natural conditions. For example, in twelve mistletoe-host associations, Tennakoon et al. (2011) showed evidence of uncorrelated $\delta^{13}$C values and significantly correlated $\delta^{15}$N values between mistletoe and associated host, demonstrating the nitrogen dependence of mistletoe on its host. Le et al. (2014) evaluated the overall impact of hosts on tropical mistletoes by comparing photosynthetic capacity (light saturated photosynthesis, apparent quantum yield, light compensation point and instantaneous CO$_2$ assimilation rates) and photosynthesis-related characteristics (stomatal conductance, transpiration rate, water use efficiency, specific leaf area, leaf dry matter content, chlorophyll profiles) of four Dendrophthoe curvata-host associations. This study demonstrated that host-specific responses have driven the intra-specific variation in mistletoe physiology in aspects of photosynthesis and photosynthesis-related attributes.

Furthermore, Tennakoon et al. (2014) provided the first account of mineral nutrition and stable isotope relationships ($\delta^{13}$C and $\delta^{15}$N) of two hyperparasitic Viscum articulatum- primary parasitic plant (Dendrophthoe curvata and Macrosolen cochinchinensis)-host-plant (Mangifera Indica and Durio zibethinus) associations found in Brunei Darussalam. The $\delta^{13}$C partitioning patterns for hyperparasites, primary parasites and hosts were non-linear in contrast to linear patterns reported from the literature for autoparasitic mistletoe associations, demonstrating fundamental differences between nutrition in hyperparasites and autoparasites.

Other ongoing research includes the mineral accumulation and anti-oxidant properties of mistletoes (Yun 2014; Pin 2014, unpublished data), haustorial biology and the impacts of Cassytha filiformis on the growth and development of selected Bornean hosts (Rosli 2014, unpublished data) and the impact of Cuscuta on Mikania under drought stress (Le et al. unpublished data).

An interesting find is the paucity of flowering for Cuscuta that is widespread across the Sultanate in the vegetative state (Chak et al. 2010). In studies of 500 dodder populations in Brunei Darussalam over 7 years, only one produced flowers. DNA sequence analysis of internal transcribed spaces (ITS) of nuclear ribosomal RNA genes and chloroplast trnL-F intergeneric spacers (Bieber et al., 2010) revealed that flowering and non-flowering dodders are the same species (Cuscuta australis Brown). The perennating mechanism originally described for C. reflexa (see Chak et al. 2010 and references therein) differs from the perennation of C. australis observed in Brunei, whereby the young perennating shoots originate directly from the central core of the Cuscuta vegetative body host pith instead of the ‘concealed’ absorbing tissues of haustoria embedded in host pith reported for C. reflexa. During the perennating stage of Cuscuta, several young shoots of varying lengths emerge at several points along the parental strands. Further elongation of these young shoots results in the fresh attack of any nearby potential host plants.

The dearth of flowering populations of C. australis in Brunei is still a mystery. Interestingly, ongoing studies reveal flowering and perennating C. australis populations with different total antioxidant capacity, phenolic and flavonoid contents suggesting the different potential medicinal constituent profiles (Le et al., unpublished data).

Many questions related to biology and biogeography of angiosperm parasitic plants in Brunei remain. For example, identification of mistletoes in the canopies of tropical heath and mixed dipterocarp forests; what factors determine the distribution of mistletoes, Cuscuta, and Cassytha in Brunei Darussalam; why dodders growing here adopt different proliferative strategies (flowering and perennating); and how this trait affects the spread rate of dodders in Brunei Darussalam. In addition, the potential medicinal values of the
same parasitic plants associated with different hosts, and grown in contrasting habitats (seashore, tropical heat and mixed dipterocarp vegetation) of tropical Brunei Darussalam are yet to be unravelled. These questions need to be answered sooner than later before some of these pristine habitats in this tiny Sultanate are lost. Parasitic plant research at the University of Brunei Darussalam is supported by a research grant awarded to Kushan Tennakoon by the Brunei Research Council (UBD/S&T 8). Lytton Musselman acknowledges generous support of a Fulbright Specialist Award as well as the Mary Payne Hogan fund of Old Dominion University.

References

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BIOLICAL CONTROL OF STRIGA IN KENYA - UPDATE

The development of biological control of Striga hermonthica began in West Africa back in the 1990s using the plant pathogen Fusarium oxysporum f.sp. strigae. In 2009 the idea of using the same pathogen isolate (Foxy 2) was initiated and field trials, though subject to quarantine restrictions were initiated in Western Kenya. In 2011, this work was supported by the ISMA project managed by IITA and funded by BMGF. An update of the ISMA project in West Africa was recently reported in Haustorium (No 65, page 7, July 2014). Despite extensive trials the isolate Foxy 2 showed little effect on Striga hermonthica in Kenya when growing in association with maize (Avedi et al, 2014 – see Literature section below).

Collection of infected Striga plants with the visible characteristics of Fusarium oxysporum was undertaken in maize fields in Western Kenya in 2012. These pathogens were isolated and sent to University of Stellenbosch to the laboratories of Altus Viljoen where comparative analysis of Kenyan and West African isolates from Striga plants showed that the populations from the two regions were genetically different from each other.

Plate 1. The effect of the Striga biocontrol agent Fusarium oxysporum f. sp. strigae isolate FK3 on the development of Striga plants when pots were inoculated with Striga hermonthica. CR = control, LR = low rate, MR = medium rate and HR = high rate of FK3 in the growing medium.

One of the Kenyan isolates, FK3, was selected for trials to evaluate the effect on Striga hermonthica development in
pot-grown maize. Trials over two seasons have shown a significant reduction in Striga development when FK3 was planted at low, medium and high rates (Plate 1). The FK3 was grown on a rice based product, dried and ground, before being incorporated into the pot soil prior to planting at rates of $7.5 \times 10^7$ (low rate), $1.5 \times 10^8$ (medium rate) and $6 \times 10^8$ (high rate) CFUs per pot. The performance of the isolate FK3 has shown considerable promise and plans to register this as a biopesticide in Kenya are being evaluated. Maize cob and grain weight were moderately increased and stover weight more significantly increased.

Henry Wainwright, The Real IPM Company (K) Ltd and Altus Viljoen, University of Stellenbosch, South Africa.

MISTLETOES AND MEDICINE: A PLEA FOR BETTER TAXONOMY

While reading some of the citations in Haustorium, I discovered a problem that, upon further examination, appears to be extensive. This involves the misidentification of mistletoes used in some biomedical studies. The high volume of publications is because, in some cases, research has demonstrated efficacy in treating serious human diseases such as hypertension, diabetes, epilepsy, and cancer.

The citations listed below that motivated me to write this were Ajani et al. (2014a, b) and Channabasava et al. (2014). I wish to state that I do not wish to single out these particular authors but am simply using them as examples of a pervasive problem. The authors use the name *Loranthus micranthus* (with no authority). If this were *L. micranthus* Hook. f., then this is a synonym for *Ileostylus micranthus* (Hook. f.) Tiegh. But *Ileostylus* is a mistletoe endemic to New Zealand that is highly unlikely to be the subject of these studies. In both cases the mistletoe was collected locally, in Nigeria and India, respectively. For the Nigerian mistletoe, a synonym exists with similar spelling: *Loranthus micrantherus* Engl. which is now correctly called *Englerina gabonensis* (Engl.) Balle. It is possible the mistletoe being used is *Englerina*, but this needs to be confirmed. Using the name *L. micranthus* for a mistletoe collected in India is more perplexing and is perhaps due to the unwise reliance on vernacular names.

About four years ago Chris Parker noticed this same error* and contacted an author working in Nigeria who also pointed out a similar problem on the misuse of the name *Viscum album* L. which does not occur in Nigeria. Despite these alerts, the practice of using incorrect names continues, even in recently published review articles.

In a search of my Endnote reference database that contains all of the citations listed in past Haustorium newsletters the name *Loranthus micranthus* was used in the following journals: African Journal of Biotechnology, American Journal of Pharmacology and Toxicology, Asian Journal of Biomedical and Pharmaceutical Sciences, Asian Pacific Journal of Tropical Medicine, Bio-Research, Current Research, Drug plants, European Journal of Medicinal Plants, Fitoterapia, International Journal of Pharma and Bio Sciences, Journal of Ethnopharmacology, Journal of Pharmacy and Pharmacology, Journal of Tropical Medicine, Pharmaceutical Biology, and Phytopharmacology and Therapeutic Values. I then searched for this binomial using Google Scholar and added the following journals: Biochemistry Research International, Current Research Journal of Biological Sciences, Evidence-Based Complementary and Alternative Medicine, Global Advanced Research Journal, Journal of Pharma and Bio Sciences, Journal of Pharmaceutical and Allied Sciences, Natural Product Research (Formerly Natural Product Letters), Pharmaceutical Biology, Phytochemistry Letters, Planta Medica, Research Journal of Medicinal Plant, and Scientia Africana. Although some of these journals are from developing nations, others are from the United States and Europe, demonstrating that this taxonomic problem is not being detected among a wide range of authors, journals, reviewers, and editors.

So is my plea for better taxonomy really relevant to this line of scientific inquiry? Should authors, reviewers, editors, etc. be more stringent when reviewing the biological sources of...
the chemical constituents used in such pharmacological and biomedical studies? I propose that poor plant taxonomy can inhibit scientific progress and this view is shared by others (see Boyle et al. 2013, BMC Bioinformatics 14:16). The ability of, say, a British scientist to accurately replicate a study conducted in India depends upon gaining access to the exact same plant material used in the original study. Were vouchers deposited in herbaria? Are these available (ideally digitally) for the scientific community to examine and evaluate as to the taxonomic name being used?

To avoid sounding too accusatory, I want to end by being more introspective. As a taxonomist, I must ask myself if I have done a good job in providing to the scientific community and general public the tools needed to properly identify parasitic plants such as mistletoes. This is not an easy task as there are nearly 1000 species of Loranthaceae and 570 species of Viscaceae alone. As the author of the ‘Parasitic Plant Connection’ (http://www.parasiticplants.siu.edu/), I have attempted to make information about mistletoes readily accessible to everyone. But despite providing descriptions, images, literature, etc. there still does not exist a way to identify mistletoes worldwide in a ‘one stop shopping mode’. Yes, taxonomic keys exist for all of these plants but they were published in many different places, often in sources that are difficult to obtain. Moreover, the botanical terminology used is often technical thus not particularly accessible to the non-specialist. Given that many modern curricula often do not emphasize basic plant taxonomy, maybe it is not unexpected to see increasing problems among the consumers of taxonomic information, such as ethno-pharmacology and other biomedical disciplines. I view this trend as a ‘call to action’, motivating me to develop new, innovative methods for mistletoe identification.

Daniel L. Nickrent

*Chris Parker regrets that having identified this problem 4 years ago he continued to repeat the mistake in several more recent issues. Apologies for causing undue excitement to *Beostylus* buffi.

PRESS REPORTS

**MSU professor wins grant for work in Africa**

BOZEMAN – Women in one Kenyan village are fighting malnutrition with a toothpick, fungus and a clump of treated rice, says Montana State University professor David Sands.

Now women in 50 Kenyan villages can do the same with the $100,000 grant Sands just received from the Bill & Melinda Gates Foundation. The Gates Foundation announced Nov. 20 that Sands was one of more than 80 people this year to receive a Grand Challenges Explorations Grant to carry out their bold ideas for overcoming challenges to global health. As MSUs first recipient, Sands said he will share his 18-month grant with his Kenyan collaborators. ‘It’s very scary. Be careful what you dream for’, Sands said, explaining that he now has to prove his discovery in a wider arena.

Fifty-five women from the village of Ekwanda have been testing his discovery since 2006, said Sands, a professor in the Department of Plant Sciences and Plant Pathology. Ekwanda is a small rural village north of Kisumu, the principal city in western Kenya. The women - most of them widows whose husbands have died from HIV, malaria, dengue fever or other causes - are responsible for growing food and providing an income for their families. However, a parasitic weed called *Striga*, or witchweed, kills 30 to 80 percent of their corn, millet and sorghum before the crops break the surface of the ground. The women spend 80 percent of their waking hours during weeding season (three to five months a year) weeding. ‘If they can’t produce corn, they starve,’ Sands said.

Sands was inspired to help by his late brother, Dr. John P. Sands, Jr., who was chairman of the Urology Department and director of Surgical Services at the Naval Medical Center San Diego before retiring from the Navy in 2000. Later, while working in a hospital in west Kenya, John Sands realized that malnutrition was the number one problem behind his patients health issues. ‘They were starving to death,’ Sands said. To look for solutions, the brothers formed The Starfish Foundation about five years ago through the All Souls Episcopal Church of Point Loma in San Diego, and David Sands headed into the cornfields of Kenya. Perhaps he could find unhealthy *Striga* that would indicate the presence of a natural enemy or a weakness he might exploit. The search paid off when Sands discovered four strains of fungus among the weeds. After testing them in his MSU lab, he focused on improving one fungus to make it even more effective against *Striga*. Sands also developed a simple, inexpensive way to grow and plant the fungus. It involved growing the fungus in a petri dish. ‘After three days, its fungal paradise,’ Sands said. Then he placed about 50 wooden toothpicks in the petri dish so they were coated by fungus. After three days, he removed the toothpicks and set them aside to dry. The coated toothpicks will last five years if they stay wrapped, Sands said.

When the time came to plant corn, he placed one coated toothpick into a batch of boiled, cooled rice or sorghum, Sands said. After three days in a covered container, the rice turned pink and he had enough fungus to fight *Striga*. The
women of Ekwanda placed the rice into a hole on top of compost. Then they planted three kernels of corn on top of it. The women of Ekwanda helped prove that the fungus kills *Striga* without harming the environment, Sands said. They also demonstrated that the *Striga* biocontrol would save labor, increase crop yields and create more room to grow crops.

Sands shared his technique with Kenyan plant pathologist Sila Nzioka who came to MSU in 2011 to learn it from Sands. Nzioka works in the Kenya Agricultural Research Institute, the equivalent of the U.S. Department of Agriculture. Sands also described his discovery to the Gates foundation when he applied for a grant earlier this year. On the merit of that 1 ½-page application - without knowing Sands name, institution or research history, to avoid prejudice or preference - the Gates foundation awarded him a grant. It was his fifth attempt, Sands said. He encouraged other researchers to keep trying for such grants. He also urged MSU students to look for global problems they can help solve and warned them that problems are interwoven. In Kenya, for example, the women who tested his techniques not only faced malnutrition, but drought, the possibility of crop failure and socio-economic problems.

‘I teach all my students this: If you want to work on a world-class problem, you have to work on four,’ Sands said. ‘They don’t come in nice single packets. … You have to figure out how to weave through them all.’ In addition to the grant from the Bill & Melinda Gates Foundation, Sands has received funding for his *Striga* research from other foundations, including the Charles A. and Anne Morrow Lindbergh Foundation. The Starfish Foundation paid for supplies, as well as the salary of Lydia Anderson of Missoula, who worked on the *Striga* project as an undergraduate student. Anderson graduated in 2012 with a bachelors degree in biology.


**Desert mistletoe: 'tree thieves' in the American Southwest** (abridged)

This is the time of year when hanging mistletoe beckons loving couples to share a romantic moment. But, in the desert regions of northern Mexico and in the American Southwest, a very different type of mistletoe can be found. Check out these fascinating photos of desert mistletoe.

Desert mistletoe (*Phorodendron californicum*), unlike its commonly hung broadleaf cousins sold during this festive season, may not be so welcoming to those looking to steal a holiday kiss, since it grows in trees and shrubs covered with thorns. The desert mistletoe is a common perennial found in the Mojave and Sonoran Deserts, locations that are less than 4,000 feet (1,220 meters) in elevation. The plant is a hemi-parasite, which means it carries out photosynthesis in its many green stems while obtaining additional nutrients and water from the host plant upon which it grows. In these arid regions, the desert mistletoes’ most common host plants are the desert legume trees and shrubs that grow there. The common varieties of mesquite, palo verde, and ironwood, *Olneya tesota*, trees as well as an occasional catclaw acacia, *Acacia greggii*, creosote bush, *Larrea tridentata* and the varieties of desert buckthorn shrubs play host to these slow-growing invaders.
jointed green stems that are primarily leafless. The clusters tend to hang down from the host and can grow to lengths of 36 inches (1 m) in six to eight years. This non-aggressive pathogen’s leaves have been reduced to scales. The tiny, petal-less flowers bloom from January to March, and are known for producing a strong fragrance.

Shortly after blooming, the flowers produce an abundance of red fruit. The seeds of the fruit are covered with a gelatinous material that makes them extremely sticky. They are a favorite food for the birds of the desert that often get the sticky seeds stuck to their beaks or feet. As they wipe their beaks and feet clean on another branch, or even another tree, the mistletoe seeds now become planted on a new potential host. Since the seeds also have a tough seed coat, they easily pass through the bird’s digestive system and become deposited onto new branches through their droppings.

Mistletoe depends upon bird

We might not have mistletoe were it not for a bird known as the phainopepla (*Phainopepla nitens*). For a variety of reasons the phainopepla is one of our most interesting desert inhabitants. It breeds in the desert but can’t be considered a resident since it departs at the beginning of summer. The male phainopepla is jet black, a color that absorbs more heat than any other - seemingly a poor adaptation for an animal spending a great deal of time in the desert. Finally, the phainopepla grows its own source of energy by planting mistletoe seeds. Flocks, some of which contain 30 or 40 phainopeplas, return to the desert in October when temperatures begin to cool. Males establish territories around patches of mesquite, palo verde and related species but only those parasitized by mistletoe plants. Fruits of the mistletoe provide nourishment and moisture and are a critical component of the phainopepla’s winter diet. Only the flesh of mistletoe berries, however, is actually digested. The mistletoe seeds pass through the bird’s alimentary canal unharmed. Seed-laden droppings accumulate on branches lying beneath phainopepla perches and eventually a seed succeeds in germinating and pushing its rootlet into an aging stem. Ultimately, the new mistletoe plant produces berries eaten by phainopeplas, as well as other desert birds. In addition to mistletoe berries, flying insects are also captured and eaten. Insects are a
critical food resource especially during spring and summer when nestlings require a diet high in protein.

Courtship for the phainopepla begins as early as January and can last through April. One of the first indications of the breeding season is the building of a nest by the male. Nest construction is the male’s responsibility alone and if his creation is accepted, a female takes up residence in his territory. The female lays from 2 to 5 speckled eggs and the young fledge within 5 weeks after the last egg is laid. Usually by the end of April, all young have left the nest. In late spring phainopeplas disappear from the desert until the following October.

For many years it was not clear where phainopeplas went. Researchers now know, however, that phainopeplas travel to less stressful climates at higher elevations or along the southern California coast. In these localities a second brood is raised giving phainopeplas the distinction of being the only bird to nest in two entirely different environments within a single year. They utilize the mild climate of the warm Sonoran Desert during winter, nest there in early spring when a burgeoning insect population is available for their young and then vacate the desert during the stressful months of summer. Late spring departure may partially explain how male phainopeplas can get away with being black in a desert environment. By way of contrast, ravens (which are also black) must endure intense solar radiation year-round since they are permanent desert residents.

Male phainopeplas can be distinguished from other birds by their jet black coloration, red eyes and white wing patches that can only be seen in flight. Females are gray with paler wing patches and brown eyes. Both sexes have a distinctive head crest. A short, soft, single whistle characterizes the Phainopepla’s call.

Look for phainopeplas wherever large mistletoe plants are parasitizing cat’s claw, palo verde and other perennials belonging to the Pea Family of plants.

James Cornett, The Desert Sun, December 6, 2014

Native mistletoe, Western Australia’s Christmas tree, declining in urban areas

The Western Australian Christmas tree, a variety of mistletoe, has declined by 90 per cent in urban areas of Perth in the past 30 years. *Nuytsia floribunda* was dubbed the native Christmas tree by colonists because it bursts out in orange blooms in December. WA Wildflower Society’s Bronwyn Keighery said the group had investigated where the trees grew. ‘Ever since Europeans started clearing the state, they left the trees because they were so beautiful,’ she told 720 ABC Perth. ‘What we have been doing is looking at the trees that were left amongst houses and parkland and found that most of those have disappeared. ‘The trees that were in patches of urban bushland were still there.’ We think about 90 per cent of the trees that are not in bushland have disappeared. In bushland nearly 100 per cent have remained.’

Ms Keighery said the findings highlighted the importance of preserving even small areas of bushland in the metropolitan area. ‘Places like the Inglewood Triangle and Kensington Bushland in south Perth, these patches are really important for keeping even common plants,’ she said. The nuytsia have an additional Christmas association - the tree is also the world's largest variety of mistletoe. In European tradition, mistletoe is hung as Christmas decoration and people caught beneath are expected to kiss. They are hemiparasitic plants, and grow by attaching themselves to host plants and draw water and nutrition from the host. ‘They grow from Kalbarri to Esperance, and have a number of Noongar words associated with them, including the name Mooja, and different groups of Noongars used them in different ways,’ Ms Keighery said. ‘It seems that the Noongar around Perth saw them as spirits of the dead and left them alone, while other Aboriginal groups pulled the roots up to eat that material, which is quite sweet.’

The WA Wildflower Society recently ran a treasure hunt to encourage Perth residents to take more notice of the Christmas trees, by attaching QR codes to 23 trees and awarding prizes of nuytsia seedlings for spotting them.

Emma Wynne 720 ABC Perth 19 Dec 2014

Photo: *Nuytsia floribunda*, the Australian mistletoe, in bloom in Western Australia. (Flickr: Graeme Churchard)
WEEDSBOOK – THE AFRICAN WEED SCIENCE NETWORK

Weedsbook is a newly established online African Weed Science Network (www.afroweeds.org/network). It is a bilingual (English/French), free and open-access, online exchange platform for professionals working on weeds in Africa. It currently has more than 330 members from all over Africa and Europe. Weedsbook has been established to better inform weed scientists in the region and to enhance the outreach of their work.

Weedsbook contains discussion groups on topics such as weed identification, distribution and one on parasitic weeds. Members can discuss, ask questions or get assistance for instance with the identification of encountered weed species. Weedsbook provides recent relevant scientific publications and guides to weed identification, management recommendations, and information on research grants and scholarships and it enables members to share relevant news such as outcomes from their work (e.g. publications) and to upload or download photos, videos or other media.

Each member can generate a personal profile with information on their work, contact details and relevant internet links. It enables members to inform other members on their expertise and interests which in turn helps to link up with relevant new partners.

In summary, Weedsbook is easy to use, and it enables you to:

- Enhance your network of peers
- Share, communicate and learn
- Get assistance or provide assistance on weed related queries
- Be alerted on new weed science products, or announce your own products
- Be informed (or inform your peers) on new funding opportunities, conferences and other relevant events

Membership is open and free. To join:

Go to www.afroweeds.org/network - click on ‘Register’ - complete the form - click on ‘Register’ - confirm the Weedsbook e-mail sent to your e-mail address

At first use: enter your user name and password and click on ‘Login’

For help or other queries, please contact Dr Jonne Rodenburg (AfricaRice): j.rodenburg@cgiar.org

THESES


The broomrape *Phelipanche ramosa* L. Pomel is a parasitic weed widespread in Mediterranean Europe whose control is extremely difficult in agroecosystems. One of the biological features of this parasitic plant is that it germinates only in response to germination stimulants exuded by the roots of surrounding host plants. After attachment to the host root and connection to their vascular tissues, broomrape uptakes water and nutrients needed for their development. In France, the adaptation of this broomrape to tobacco, hemp and especially to winter oilseed rape (*WOSR; Brassica napus* L.) crops has become a major agricultural problem in the most infested areas. Considering the current recommendations of significant inputs reduction in sustainable agriculture (pesticides and fertilizers) and the importance of nitrogen nutrition for *WOSR* productivity, there was a need to investigate the impact of new crop management practices such as lower nitrogen inputs on the *WOSR* - broomrape interaction. Therefore, the aim of this thesis was to elucidate the role of nitrogen in this interaction. To achieve this, the work was organized around two distinct roles of this nutrient. First, we evaluated the effect of contrasting N fertilization regimes (and two associated minerals, sulfur and phosphorus) on the sensitivity of *WOSR* facing broomrape by analyzing the ability of *WOSR* roots to exude germination stimulants and to be parasitized by broomrape. In the second part of the study, through an approach of $^{15}$N isotope tracing coupled to a primary metabolite profiling, a thorough analysis of the global N fluxes in the interaction was conducted. This led to the identification of the transferred compounds (amino acids, carbohydrates, organic acids and glucosinolates) from *WOSR* to broomrape and to the characterization of the metabolic pathways of these compounds used within the parasite. Therefore, this work required methodological developments allowing the rapid assessment of germination rate of broomrape seeds through a high-throughput process and the analysis of $^{15}$N amino acids by UPLC-PDA-ESI-MS.

Thus, the beneficial effect of sulfur fertilization on the production or exudation in the rhizosphere of the main stimulant of broomrape seed germination, the 2-phenylethyl isothiocyanate (2-PEITC), has been demonstrated. Likewise, the decrease of *WOSR* susceptibility to broomrape, evaluated by the number and the total biomass of attached broomrapes, during a nitrogen deficiency, was also evidenced. Analysis of the overall N fluxes ( stable isotope tracing and amino acids profiling) highlighted the early role of supernumerary sinks represented by broomrapes for reduced nitrogen assimilated by the host *WOSR*. Indeed, the parasitic sink proved to be dominant at the end of the vernalization compare to the own
sinks of WOSR (in a susceptible WOSR genotype - broomrape interaction) particularly for foliar N newly assimilated during this period. Thus, this competition strongly inhibited the post-vernalization development of WOSR. Analysis of compounds transferred from the host and accumulated into the parasite highlighted the importance of glutamine as a long-distance nitrogen carrier, but also the role of WOSR specific compounds such S-methylcysteine sulfoxide (SMCSO) and glucoconolactones in the interaction, and asparagine in N remobilization into the parasite.

These results open up interesting perspectives in terms of control methods compatible with existing agro-environmental directives, including the selection of more nitrogen efficient WOSR genotypes and an increased monitoring of sulfur fertilization in early culture (period of high WOSR susceptibility to broomrape). This work has also highlighted the influence of WOSR genetics on N source-sink control within the interaction (comparative study of susceptible and resistant WOSR genotypes). The study of WOSR mechanisms involved in the control of parasitic sink appears as one of the major perspectives because breeding for tolerance to face broomrape is becoming an increasingly important issue.

FORTHCOMING MEETINGS

The 1st International Congress on Strigolactones. 1-6 March, 2015. Wageningen, the Netherlands. 1st International Congress on Strigolactones we bring together scientists from these different disciplines to exchange ideas and knowledge on Strigolactones and to increase the solidarity and collaboration within the strigolactone community. For further information go to: http://www.strigolactones.org/

5th Intenational Conference on Alternative Methods of Crop Protection. Lille, France, 11-13 March, 2015. Sessions will include one on resistance and varietal selection. For information contact AFPP, 42 rue Raymond Jaclard, F-94140 Alfortville. Email afpp@afpp.net. Website www.afpp.net.

The 13th World Congress on Parasitic Plants. 5-10 July, 2015. Kunming, Yunnan Province, Southwest China. Further details can be found at the conference website http://wcpp13.csp.escience.cn/dct/page/65540.

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, current issue of Haustorium, etc. see: http://www.parasiticplants.org/

For the 13th IPPS Congress see http://wcpp13.csp.escience.cn/dct/page/1

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For the Strigolactone Congress see: www.strigolactones.org

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the COST/STREAM conference see: http://streamisrael2013.wix.com/stream-israel-2013

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

For information on future Mistel in der Tumortherapie Symposia see: http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)

For ‘Weedsbook’ online African Weed Science Network, see: www.afrweeds.org/network

And for entertainment as well as instruction watch a video of the germination of Cuscuta campestris and attachment on chickpea, see http://youtu.be/ulFulwqC9qo (with thanks to Yaakov Goldwasser).
LITERATURE

Entries in bold are the editors’ personal selection of the top ten items.


and polyphenol oxidase in roots of tomato assumed to be responsible for increasing resistance to O. ramosa. But no data on the levels of infection with and without the treatments.]

Alemede, I.C., Fasanya, O.O.A. and Aghana, E.O. 2014. Physiological response of Savanna Brown (SB) does to treatment with mistletoe extract (Phragmanthera nigritana) and Clomid®. Journal of Biology, Agriculture and Healthcare 4(12): 114-117. [Concluding that split doses of 250 mg/kg P. nigritana extract administered twice in a day as a drench can be recommended for use (presumably to induce ovulation) since the effects were not deleterious to the does.]

Alemede, I.C., Fasanya, O.O.A. and Oke, A.O. 2013. Growth and reproductive performance of rabbits fed mistletoe leaves (Phragmanthera nigritana). Journal of Agriculture, Forestry and Social Sciences 11(1): 249-255. [Concluding that P. nigritana can be used to feed rabbit does without any deleterious effect on performance.]

Alemede, I.C., Fasanya, O.O.A. and Oke, A.O. 2013. Growth and reproductive performance of rabbits fed mistletoe leaves (Phragmanthera nigritana). Journal of Agriculture, Forestry and Social Sciences 11(1): 249-255. [Concluding that P. nigritana can be used to feed rabbit does without any deleterious effect on performance.]


Athiroh, N., Permatasari, N., Sargowo, D. and Widodo, M.A. 2014. Effect of Scurrula atropurpurea on nitric oxide, endothelial damage, and endothelial progenitor cells of DOCA-salt hypertensive rats. Iranian Journal of Basic Medical Sciences 17(8): 622-625. [Methanolic extract of S. atropurpurea is able to modulate total plasma nitrate/nitrite levels and diminish endothelial damage via increasing endothelial progenitor cells.]

Avedi, E.K., Ochieno, D.M.W., Ajanga, S., Wanyama, C., Wainwright, H., Elzein, A. and Beed, F. 2014. Fusarium oxysporum f. sp. strigae strain Foxy 2 did not achieve biological control of Striga hermonthica parasitizing maize in Western Kenya. Biological Control 77: 7-14. [An honest report on a careful study at 2 sites under quarantine conditions which failed to show any significant reduction of S. hermonthica by F. oxysporum. Quoting ‘varying reasons for the disparities’ between these and the results obtained elsewhere, but these are not explained in the abstract (see further Note above).]


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Baheti, D.G. and Kadam, S.S. 2014. Antiurolithiatic activity of different plants extracts on zinc disc implantation induced urolithiasis. Der Pharmacia Lettere 6(4): 201-207. [An extract of Dendrophthoe elasti showed significant improvement in urinary parameters along with prevention...
of stone formation suggesting significant antiurolithiatic activity.]

Baird, I. R. C. 2014. A novel observation of putative aerial hemiparasitism in Exocarpsinus aphyllus (Santalaceae). Queensland Naturalist 52:48-52. [A large individual of Exocarpsinus aphyllus, which is typically a root hemiparasite, was seen growing from the branch of Eucalyptus largiflorens. The connection was not dissected to determine the structure of thehaustorium.]

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Barcelona, J. F., Manting, M. M. E., Arbolonio, R. B., Balasubramanian, D., Lingakumar, K. and Arunachalam, A. 2104. Physiological adaptations in large individual of (Santalaceae). Queensland Naturalist 52:48-52. [India showed that photosynthesis was very low in M. tinctoria which is an advanced obligate hemiparasite on Santalum album. The connection was not dissected to determine the structure of thehaustorium.]


Brand, J.E., Sawyer, B. and Evans, D.R. 2014. The benefits of seed enrichment on sandalwood (Santalum spicatum) populations, after 17 years, in semi-arid Western Australia. Rangeland Journal 36(5) 475-482. [A comprehensive study of natural populations of S. spicatum and the benefits of various management methods.]

Candia, A.B., Medel, R. and Fontúrbel, F.E.. 2014. Indirect positive effects of a parasitic plant on host pollination and seed dispersal. Oikos 123(11):1371-1376. [The presence of the mistletoe Tristerix corymbosum (Loranthaceae) might be responsible for the higher reproductive success showed by the parasitized fraction of Rhaphithamnus spinosus (Verbenaceae) populations.]

Cardoso, C., Charnikho, T., Jamil, M., Delaux, P.M., Verstappen, F., Amin, M., Lauressergues, D., Ruyster-Spira, C. and Bouwmeester, H. 2014. Differential activity of Striga hermonthica seed germination stimulants and Gigaspora rosea hyphal branching factors in rice and their contribution to underground communication. PLoS ONE 9(8): e104201. (http://www.plosone.org/article/info%3Adoi%2F10.1371) [Identifying a range of strigolactones and other compounds with varying activity on Striga germination, and hyphal branching, suggesting that it should be possible to find rice varieties able to stimulate mycorrhiza but still be low-stimulant for Striga.]

confirmed in extracts of L. micranthus (?Loranthus micranthus = Englerina gabonensis) in which octadecenoic is the main component.


Cho Hwajin, Na KookJoo, Kim DoWan, Choi YoungEarl, Ma JaeSook and Jeong InSeok. 2014. Chemical pleurodesis using a Viscum album extract in infants with congenital chylothorax. European Journal of Pediatrics 173(6): 823-826. [First trials of the intrapleural instillation of an extract of V. album (Abnobaviscum Q®) in two infants not responding to standard conservative management and thoracic duct ligation. Resulted in improvement in both children with no side effects related to the extract after 2 years and 9 months, respectively.]


Dakskobler, I. 2014. Phytosociological description of Quercus petraea forest stands with Chamaecytisus hirsutus and Erica carnea in the Vipavski brda (southwestern Slovenia). Acta Silvae et Lignii 103: 1-20. [In this region Q. petraea is associated with Loranthus europaeus.]


Dickinson, S.E., Olson, E.R., Levenson, C., Janda, J., Rusche, J.J., Alberts, D.S. and Bowden, G.T. 2014. A novel chemopreventive mechanism for a traditional medicine: east Indian sandalwood oil induces autophagy and cell death in proliferating keratinocytes. Archives of Biochemistry and Biophysics 558: 143-152. [Results suggest that a ‘purified’ extract from sandalwood (presumably Santalum album) may exert beneficial effects upon skin, reducing the likelihood of promotion of pre-cancerous cells to actinic keratosis and skin cancer.]


abstract how significant the differences were, nor where the work was conducted.] Dossou-Aminon, I., Loko, L.Y., Adjatin, A., Dansi, A., Elangoan, M., Chaudhary, P., Vodouhé, R. and Sanni, A. 2014. Diversity, genetic erosion and farmer's preference of sorghum varieties [Sorghum bicolor (L.) Moench] in North-eastern Benin. International Journal of Current Microbiology and Applied Sciences 3(10): 531-552. [Recording a wide variety of sorghum lines used by farmers, but also a worrying rate of loss of older varieties and the need for their conservation if problems of drought and Striga are to be adequately addressed in future.]

Dovala, A.C. and Monteiro, A. 2014. (Striga asiatica chemical control by seed coating imazapyr resistant maize hybrids.) (in Portuguese) Revista de Ciências Agrárias (Portugal) 36(4): 466-474. [Study in Angola confirming excellent control of S. asiatica and doubling of maize yield with use of IR maize hybrids ZM521, ZM523 e ZM625.]

Dovala, A.C. and Monteiro, A. 2013. (Striga asiatica in maize in the Planalto Central of Angola - legumes and grass trap intercropping.) (in Portuguese) Revista de Ciências Agrárias (Portugal) 37(1): 80-88. [Apparently providing evidence for the benefits of Tripsacum laxum as a trap crop and of Desmodium uncinatum, Cajanus cajan, Mucuna pruriens, Tephrosia sp. and Crotalaria sp. as intercrops.]

Dovala, A.C. and Monteiro, A. 2014. (Nitrogen effect on Striga asiatica emergence in maize (Planalto Central of Angola).) (in Portuguese) Revista de Ciências Agrárias (Portugal) 37(1): 89-99. [Application of N at 90 kg/ha gave 90% reduction in S. asiatica but maize yield was highest at 60 kg/ha.]


Durand-Gillmann, M., Cailleret, M., Boivin, T., Nageleisen, L.M., Davi, H., Bréda, N. and Peifer, M. 2014. Individual vulnerability factors of silver fir (Abies alba Mill.) to parasitism by two contrasting biotic agents: mistletoe (Viscum album L. ssp. abietis) and bark beetles (Coleoptera: Curculionidae: Scolytinae) during a decline process. Annals of Forest Science 71(6): 659-673. [A. alba has been weakened by successive severe drought periods while V. album and bark beetles contribute actively to the process of decline.]

Durouex, F. and Guillet, T. 2013. (Chemical control of broomrape (Phelipanche ramosa) in winter rape.) (in French) In: Journées Internationales sur la Lutte contre les Mauvaises Herbes, 22e Conférence du COLUMA, Dijon, France, 10-12 Décembre 2013: 269-277. Best control of P. ramosa was achieved using an imazamox-tolerant variety with imazamox applied in October and February, or in October, November and February but the treatment had not at that time been registered.]

Ekeleme, F., Jibrin, J.M., Kamara, A.Y., oluoch, M., Samndi, A.M. and Fagge, A.A. 2014. Assessment of the relationship between soil properties, Striga hermonthica infestation and the from-farm yields of maize in the dry savannas of Nigeria. Crop Protection 66: 90-97. [Recording S. hermonthica in all maize fields sampled and corresponding losses in maize yield. Concluding that the consistent correlation with low soil fertility indicates this should be the main thrust of any control programme.]


Fan RongHua, Ma YuYing, Yuan HongXia, Zhang YongZhi, Wei BinBin, Zhao YunLi and Yu ZhiGuo. 2014. A new flavonoid glycoside and four other chemical constituents from Viscum coloratum and their antioxidant activity. Heterocycles 89(6): 1455-1462.


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González, A.M., Fabián Popoff, O. and Salgado Laurenti, C. 2014. Structure of staminate flowers, microsporogenesis, and microgametogenesis in Helosis cayennensis var. cayennensis (Balanophoraceae). Anales del Jardín Botánico de Madrid 70(2): 113-121. [Concluding that despite the extreme reduction of flowers, the anatomic characteristics are perfectly normal and functional, and thus highly similar to other Helosidoideae. Sterile parts of flowers and inflorescence maintain the same distinctive and aberrant features of the plant vegetative parts.]

Granot, G. and Grafi, G. 2014. Epigenetic information can reveal phylogenetic relationships within Zygophyllales. Plant Systematics and Evolution 300(8): 1819-1824. [Krameria citoides showed the presence of H3K9me2 (a methylated lysine of histone protein H3) which is unlike other tested genera in Zygophyllaceae which lack this protein. The authors use these data to question the placement of Krameriaceae in Zygophyllales.]


Guo HuiMin, Zhang JingZe, Gao WenYuan, Qu Zha, and Liu ChangXiao. 2014. Anti-diarrhoeal activity of methanol extract of Santalum album L. in mice and gastrointestental effect on the contraction of isolated jejunum in rats. Journal of Ethnopharmacology 154(3): 704-710. [Results support the traditional use of S. album as a anti-diarrhoeal treatment.]


434. [Describing *S. himalayana* (Rafflesiaeaceae) a total root parasite of *Cissus elongata* and other species of family Vitaceae threatened with extinction; sighted only a few times since its first discovery. It is proposed for conservation as a flagship species in the Namadapha biosphere reserve.]

Houngbedji, T., Nicolardot, B., Shykoff, J. and Gibot-Leclerc, S. 2013. (Study of the infection of the parasitic plant *Rhampicarpa fistulosina* in rice in Togo.) (in French) In: Journées Internationales sur la Lutte contre les Mauvaises Herbes, 22e Conférence du COLUMA, Dijon, France, 10-12 Décembre 2013: 107-112. [A survey in 2012 showed that *R. fistulosina* was found in 80% of the 33 lowland rice crops visited in Togo. Farmers use weeding and chemical fertilizers but always at lower input rates than national standards.]

Hu GaoSheng, Jia JingMing and Kim DohHoon. 2014. Residual effects of five parasitic plant *Phelipanche aegyptiaca* in rice in Togo. (Study of the infection of the parasitic plant *Rhampicarpa fistulosina* in rice in Togo.) (in French) In: Journées Internationales sur la Lutte contre les Mauvaises Herbes, 22e Conférence du COLUMA, Dijon, France, 10-12 Décembre 2013: 113-121. [Flax, maize and sunflower among crops with potential as trap crops for control of *Striga hermonthica* (Del.) Benth and *Orobanche ramosa* L. germination. Persian Gulf Crop Protection 2(4): 7-14. [Reporting negligible germination of *S. hermonthica* from undiluted exudates of *D. uncinatum, D. intortum, D. tortuosum*, or *D. dichotomum*, while there was significant germination from *D. distortum* (in figure labelled *D. tortuosum*). No germination of *O. ramosa* by any *Desmodium* sp. Results included very variable results with GR24.]

Ifeanyi, F.O., Richard, C.E. and Effiong, U.E. 2014. Assessment of some toxic metal concentrations in selected ready-to-use medicinal plant roots and stem barks in Ibadan, Nigeria. Journal of Scientific Research and Reports 3(3): 427-436. [Confirming that the levels of toxic metals were acceptable in a range of medicinal products studied including *Olax subscorpiodea*.]

Ijoyah, M.O. 2014 Maize-soybean intercropping system: effects on *striga* control, grain yields and economic productivity at Tarka, Benue State, Nigeria. International Letters of Natural Sciences 14: 69-75. [Intercropping maize with soybean reduced *Striga hermonthica* numbers by over 50% and increased maize and total crop yield.]


Jun RuiHong, Chen GuiLin, Li MeiJia and Li Wei 2014. (Effect of different resistant sunflower varieties root exudates on germination of *Orobanche cumana* seeds.) (in Chinese) Acta Botanica Boreali-Occidentalia Sinica 34(7): 1397-1403. [Results suggest that the ‘immune’ variety MGS may have some inhibitory components in its root exudates.]


Khan, M.I. and Giridhar, P. 2014. The berries of Santalum album L. as a new source of cyanidin-3-glucoside and chemical profiling during different stages of berry development. Proceedings of the National Academy of Sciences India. Section B, Biological Sciences 84(3): 689-694. [Concluding that only the mature, black berries of S. album should be harvested for maximum yield of anthocyanin pigment.]


Kim, G.J., LeBlanc, M.L., Wafula, E.K., dePamphilis, C.W. and Westwood, J.H. 2014. Genomic-scale exchange of mRNA between a parasitic plant and its hosts. Science (Washington) 345(6198): 808-811. [Recent work has documented lateral gene transfer (LGT) in several taxa and their hosts from diverse clades. This paper is the first to show large numbers-thousands-of genes moving bidirectionally. Cuscuta pentagona (often considered conspecific with C. campestris) is an ideal organism to investigate LGT because it is easy to grow and has a broad host range.]

Kim JongJin, Hwang YunHo, Kang KyungYun, Kim Inbo, Kim JongBae, Park JongHwan, Yoo YongChoon, and Yee SungTae. 2014. Enhanced dendritic cell maturation by the B-chain of Korean mistletoe lectin (KML-B), a novel TLR4 agonist. International Immunopharmacology 21(2): 309-319. [Confirming that the B-chain lectin from Viscum album var. coloratum exhibits potent immunomodulatory properties, suggesting that it be considered a potential dendritic cell-based cancer therapy and immunoadjuvant.]

*Kim, K-W., Yang, S-H. and Kim, J-B. 2014. Protein Fractions from Korean Mistletoe (Viscum album coloratum) Extract Induce Insulin Secretion from Pancreatic Beta Cells. Evidence-Based Complementary and Alternative Medicine 10.1155/2014/703624. (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4053293/ ) [The protein fractions enhanced the insulin secretion from pancreatic β-cells without any cytotoxicity. Transcription factors that regulate the expression of insulin genes were upregulated and significantly lowered the blood glucose level and the volume of drinking water in alloxan-induced hyperglycaemic mice.]


Ko SukMin, Kwon YongKook, Kim JongHyun, Song InJa, Lee HyoYeon, Choi DongWoog, Liu JangR and Kim SukWeon. 2014. Transcriptome analysis of mistletoe (Viscum album) haustorium development. Horticulture, Environment and Biotechnology 55(4): 352-361. (A study that has potential for elucidating the genetic and developmental facets of haustorial penetration. By using expression sequence tags, the authors were able to analyze a transcriptome showing genes affecting cell wall elasticity and other factors important for haustorial penetration and attachment.)

signals in symbiotic and parasitic plant interactions is discussed in view of the existence of other plant-derived substances that are able to promote these plant interactions. Also, possible strigolactone use in agriculture practices is suggested.

Kuijt, J. 2014. Five new species, one new name, and transfers in Neotropical mistletoes (Loranthaceae), miscellaneous notes, 61-68. Novon 23(2): 176-186. [Proposing new combinations for Maracanthus costaricensis (=Oryctina costaricensis) and Passovia pedunculata (=Loranthus pedunculatus), and describing 5 new species of Loranthaceae, Psittacanthus longiflorus, Struthanthus cajamarcanus, S. ophiostylus and Tristerix divaricatus all from Peru and S. truncatus from Colombia. The name Passovia pedunculata is neotypified.]


Li MaoXing, Xi XiRui, Tao Rui and Cao XinYuan. 2014. Phytochemistry and pharmacology of the genus Pedicularis used in traditional Chinese medicine. American Journal of Chinese Medicine 42(5):1071-1098. [Reviewing the use of Pedicularis spp. in Chinese medicine, their chemical components and their uses including antitumor, hepatoprotective, anti-oxidative, antihaemolysis, antibacterial activity, fatigue relief of skeletal muscle, nortropic effect and other activities.]

Li XiuHui, Gou ChunYan, Yang Huasheng, Qiu JinPeng, Gu Tao and Wen Tao. 2014. Echinacoside ameliorates D-galactosamine plus lipopolysaccharide-induced acute liver injury in mice via inhibition of apoptosis and inflammation. Scandinavian Journal of Gastroenterology 49(8): 993-1000. [Echinacoside, the active component of extracts from Cistanche salsa can provide a pronounced protection against acute liver injury in mice.]

Lira-Noriega, A. and Peterson, A.T. 2014. Range-wide ecological niche comparisons of parasite, hosts and dispersers in a vector-borne plant parasite system. Journal of Biogeography 41(9): 1664-1673. [Studying whether the distribution of Phoradendron californicum is mediated by host distributions (host niche hypothesis, HNH), the mistletoe’s autecology (parasite niche hypothesis, PNH) or that of its vectors (vector niche hypothesis, VNH), and concluding that results match PNH. The parasite has a strictly circumscribed ecological niche, and host species become infected with mistletoe only where they overlap its suitable areas.]

Lu, J.K., Xu, D.P., Kang, L.H. and He, X.H. 2014. Host-species-dependent physiological characteristics of hemiparasite Santalum album in association with N2-fixing and non-N2-fixing hosts native to southern China. Tree Physiology 34(9): 1006-1017. [Comparing the growth, in pots, of S. album on Bischofia polycarpa and Dracoictomelon duperreanum and N2-fixing hosts Acacia confusa and Dalbergia odorifera. Perhaps showing that growth of S. album was best on D. odorifera, but abstract not clear.]

African Journal of Microbiology Research 8(27): 2624-2630. [Noting that *R. leguminosarum* induces resistance to *O. crenata* in peas, and showing that the heat-stable bacterial surface carbohydrates lipopolysaccharides reduced *O. crenata* infection significantly at concentrations as low as 1 and 0.5 mg/ml.]

Maina, S.W. and Gowland-Mwangi, J. 2014. Using agricultural shows to create demand for Desmodium seeds in “push pull” technology adoption in Western Kenya. International Journal of Agricultural Extension 2(1): 43-46. [Emphasising the need to encourage farmers to purchase seed of *Desmodium* spp. for control of *Striga*.]


Marinkovic’, R., Jockovic’, M., Jeromela, A.M., Marisavljevic’, D. and Sakač, Z. 2014. Resistance evaluation of different inbreds and hybrids of sunflower to broomrape (*Orobanche cumana* Wallr.). Ratarstvo i Povrtarstvo 50(3): 53-59. [Providing detailed results from the testing of a wide range of new lines at sites in Serbia, Romania and Turkey. A number were found resistant to the most virulent race E biotypes of *O. cumana* and some of these also showed superior agronomic characteristics.]


Mellado, A. and Zamora, R. 2014. Generalist birds govern the seed dispersal of a parasitic plant with strong recruitment constraints. Oecologia 176(1): 139-147. [Although specialist mistletoe feeders are assumed to be most important in ensuring dispersal, a study on *Viscum album* subsp. *austriacum* recorded 11 bird species involved, including some very effective non-specialised feeders.]

Mesfin Abate, Firew Mekbib, Temam Hussien, Wondimu Bayu and Fasil Reda. 2014. Assessment of genetic diversity in sorghum (*Sorghum bicolor* (L.) Moench) for reactions to *Striga hermonthica* (Del.) Benth. Australian Journal of Crop Science 8(8): 1248-1256. [Identifying a number of landraces that combined high grain yield with low or moderate *Striga* emergence, of potential for further breeding and selection.]


Misra, B.B and Satyahari Dey. 2014. Immunolocalization of α-santalol in sandalwood. Journal of Essential Oil Research 26(4): 238-246. [Using polyclonal rabbit antibodies to immunolocalize α-santalol in sandalwood indicating its localization in the vascular bundles of somatic embryos and leaves, whereas distribution was evident in secondary xylem, cortical parenchyma and epidermis of the mature stem.]

Breeding 3(3): [In an ICRISAT study, 5 QTLs with linked markers associated with Striga resistance were mapped in sorghum variety N13 and used in conjunction with others to select within progeny from crosses with 3 preferred farmer varieties in Sudan, leading to the development of 4 lines with good Striga-resistance and high yield.]


Moupela, C., Vermeulen, C.; Doucet, J.L., Dainou, K. and Lebally, P. 2014. Importance of Coula edulis Baill. for the people of South-East Gabon: harvest levels and economic potential. Tropicultura 32(1): 37-45. [Suggesting that the economical potential of the edible fruits of C. edulis (Olacaceae) could be improved if a sustainable production strategy through domestication processes and agroforestry practices was developed.]

Musselman, L.J. 2014. The well-travelled tallow wood, Ximenia americana. Chingcupain. The Newsletter of the Southern Appalachian Botanical Society 22(3): 1. [A general description of X. americana, occurring locally in USA, parasitic on a wide range of woody hosts, but also widespread in Africa, where the plum-like fruits are consumed fresh and also used as a source of oil. There was an article on it by Lytton in Haustorium 61.]


Naumann, J., Salomo, K., Der, J.P., Wafula, E.K., Bolin, J.F., Maass, E., Frenzke, L., Samain, M.-S., Neinhuis, C., dePamphilis, C.W. and Wanke, S. 2013. Single-copy nuclear genes place haustorial Hydnoraceae within Piperales and reveal a Cretaceous origin of multiple parasitic angiosperm lineages. PLoS ONE 8:e79204. [Molecular dating showed that Hydnoraceae evolved ca. 91 mya. After examining other parasite groups, the ‘temporal specialization hypothesis’ was proposed where older lineages tend to be more specialized.]

Nazaruddin, D.A., Fadilah, N.S.M., Zulkarnain, Z., Omar, S.A.S. and Ibrahim, M.K.M. 2014. Geological studies to support the tourism site: a case study in the Rafflesia trail, near Kampung Jedip, Lojing Highlands, Kelantan, Malaysia. International Journal of Geosciences 5(8): 835-851. [The area is famous for its Rafflesia and has become one of the tourism attractions in Kelantan. Studies conclude that this area should be supported as a sustainable tourism site.]

Infestation in rainfed lowland rice in Benin. Agricultural Systems 130: 105-115. A survey of 231 fields showed that 72% were infested by *Rhamphicarpa fistulosa* with average density of 109 plants m$^{-2}$. Occurrence was most likely on infertile soils in valley bottoms. Helpful control practices included late sowing, timely application of post-emergence herbicide, three hoe or hand weeding operations, medium-rate fertilizer application and prolonged fallow.

Ndagurwa, H.G.T., Dube, J.S., Mlambo, D. and Mawanza, M. 2014. The influence of mistletoes on the litter-layer arthropod abundance and diversity in a semi-arid savanna, Southwest Zimbabwe. Plant and Soil 383(1/2): 291-299. [Showing that *Erianthemum ngamicum* and *Pilosepalus kalachariensis* infesting *Acaia karoo* increase the abundance and diversity of litter-dwelling and -foraging arthropods due to increase in the quality and quantity of litterfall beneath infected trees. Effect from *Viscum verrucosum* less marked.]

Neetu Bais and Arun Kakkar. 2014. Bioassay-guided phytochemical analysis of active fraction of *Cuscuta reflexa* grown on *Cassia fistula* by LC-MS. International Journal of Pharma and Bio Sciences 5(3): P-585-P-592. [Concluding that the antibacterial activity of fraction-8 was due to the presence of derivatives of quinoxin, quercitin, and chromenones.]


Nikolov, L.A., Tomlinson, P.B., Manickam, S., Endress, P.K., Kramer, E.M. and Davis, C.C. 2014. Holoparasitic Rafflesiaceae possess the most reduced endophytes and yet give rise to the world's largest flowers. Annals of Botany 114(2): 233-242. [This paper confirms the mycelium-like endophyte, the body of the parasite within its host (always a member of the grape family, Vitaceae) and shows for the first time the unique development of the protocorm. Despite the microscopic nature of the endophyte, discussed in detail, the largest known flower is produced from these strands of cells.]


Nzioki, H.S., Kinyua, Z.M., Karanja, J., Nguluu, S., Wambua, J. and Gatheru, M. 2014. Pot and field evaluation of *Fusarium oxysporum* isolates for biological control of *Alectra vogelii* weed in semi-arid eastern Kenya. International Journal of AgriScience 4(7): 383-391. [Reporting promising results with a range of isolates of *F. oxysporum*, one of which applied to planting holes in the field, reduced *A. vogelii* by 60% and increased cowpea yield by 70%.]

Olorunfemi, O.D., Ogunlade, I., Fakayoode, S.B. and Adegkunle, O.A. 2014. Ensuring improved livelihood opportunities for resource-poor maize farmers through the dissemination of Striga control methods in Kwara State, Nigeria. Albanian Journal of Agricultural Sciences 13(2): 80-88. [Emphasising the need to support the 4 main sources for diffusing Striga control methods in the area, namely neighbours and friends, government agencies, agricultural extension agents and farmers groups.]

Orhan, N., Hoşbaş, S., Orhan, D.D., Aslan, M. and Ergun, F. 2014. Enzyme inhibitory and radical scavenging effects of some antiidiabetic plants of Turkey. Iranian Journal of Basic Medical Sciences 17(6): 426-432. [Noting that *Viscum album* ssp. *album*, and ssp. *austriacum* are used traditionally for treatment of diabetes in Anatolia, but no results with these are mentioned in the abstract.]


Parvender Sheoran, Punia, S.S., Samunder Singh and Dhiraj Singh. 2014. *Orobanche* weed management in mustard:
opportunities, possibilities and limitations. Journal of Oilseed Brassica 5(2): 96-101. [O. aegyptiaca is a major problem in mustard (Brassica juncea) in Haryana, Punjab, northern Rajasthan, western UP and NE Madhya Pradesh. Field trials and larger-scale multi-location testing over 4 seasons confirmed that a split application of glyphosate 25 g/ha at 30 days after sowing followed by 50 g/ha at 55 days provided 70-80% reduction in Orobanche and 15-20% yield increase with negligible signs of damage.]
Piwowarczyk, R., Halanski, A.T. and Durska, E. 2014. Seed and pollen morphology in the Orobanche alsatica complex (Orobanchaceae) from central Europe and its taxonomic significance. Australian Systematic Botany 27(2): 145-157. [Differences in hosts and ecological preferences confirm the separation of the three examined taxa, O. alsatica, O. bartlingii and O. mayeri, but seed and pollen morphology are too variable to be reliable taxonomic characters.]
Poonam Agrawal, Kirti Laddha and Ashok Tiwari. 2014. Isolation and HPLC method development of azafrin from Alectra parasitica var. chitrukantensis. Natural Product Research 28(13): 940-944. [Presumably the rhizomes of A. parasitica are a source of saffron (azafran in Spanish).]
Reger, B., Mellert, K.H. and Ewald, J. 2014. (Indicator species of nutrient-poor sites in mountain forests of the Bavarian Alps.) (in German) Tuexenia 34: 39-51. [Melampyrum sylvaticum noted as closely connected to nutrient-poor calcareous sites on limestone and dolomite.]
Ridenour, W.M., Callaway, R.M. and Cavieres, L.A. 2014 Parasitism by Cuscuta chilensis and gender affect how the nurse cushion Larreta acuulis increases diversity in Andean alpine communities. Journal of Vegetation Science 25(6): 1474-1483. [Infection of L. acuulis (Apiaceae) by C. chilensis was greater on female host plants than on male, and increased a number of the beneficial insects associated with the host plant.]

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Rodenburg, J., Cissoko, M., Kayeke, J., Dieng, I., Khan, Z.R., Midega, C.A.O., Onyuka, E.A. and Scholes, J.D. 2015. Do NERICA rice cultivars express resistance to *Striga hermonthica* (Del.) Benth. and *Striga asiatica* (L.) Kuntze under field conditions? Field Crops Research, 170: 83–94. [Resistance to *Striga asiatica* and *S. hermonthica* in NERICA rice cultivars previously identified under lab (in vitro) conditions was confirmed in the *Striga*-infested fields.]

Rowntree, J.K., Barham, D.F., Stewart, A.J.A. and Hartley, S.E. 2014. The effect of multiple host species on a keystone parasitic plant and its aphid herbivores. Functional Ecology 28(4): 829-836. [Noting that the activity of *Aphis gossypii* on *Rhinanthus minor* was reduced when it parasitised *Lotus corniculatus*, Other results suggested that host mixtures generally benefited aphids and that the specificity of host attachment alters the impact of this keystone parasitic plant on its own herbivores and, potentially, on the wider plant and herbivore community.]


Ruszkiewicz-Michalska, M. and Polec´, E. 2014. Additions to *Ramularia* species (hyphomycetes) in Poland. Mycotaxon 127: 63-72. [As *R. melampyri* (a leaf-spot fungus) new for Poland infects *Melampyrum* spp., currently classified in *Orobanchaceae*, the implications of the new systematics of *Scrophulariaceae* s.l. for the taxonomy of *Ramularia* and related *Mycosphaerella* species are discussed briefly.]


Shamrov, I.I. 2014. (The gynoecium formation in *Buddleja davidii* (Botanicheski Zhurnal 99(7): 729-748. [Including comparisons with Scrophulariaceae and referring to the complex bundle formed in the center of the ovary due to fusion of four ventral bundles as in *Striga gesnerioides* and possibly *S. elegans.*]


Phytotherapy Research 28(6): 925-932. [Results help to explain the anti-inflammatory properties of S. album.]

Shui XiaoRong, Tang ShaoHu and Lei Wei 2014. Bioinformatic analysis of transcription factor MYB 1 and its targeted-regulatory microRNAs. Research on Crops 15(3): 687-696. [In this study, MYB1 from four plant species including Morella rubra, Orobanche ramosa, Leucaena leucocephala and Epimedium sagitatum, was investigated using bioinformatic tools and methods. MYB1 transcription factors have a significant role in regulating plant secondary metabolisms and microRNAs negatively regulate gene expression by inhibiting translation of the target mRNA. MYB1 genes ORF and protein structure were elucidated from these plant species and 3-D models were constructed. Also, possible regulatory miRNAs were predicted.]


Sipes, S., Huff Hartz, K., Amin, H., Anterola, A. and Nickrent, D. 2014. Floral scent and pollinators of the holoparasite Pilostyles thurberi (Apodanthaceae). Journal of Pollination Ecology 12: 31-39. [The pollinators of Pilostyles thurberi were identified as the bee Augochloropsis metallica (Halictidae) and eumenine potter wasps (Vespidae). GC/MS analysis of the floral scent was shown to contain an unusually simple bouquet of raspberry ketone and several eugenols.]

Smith, D.R. and Asmail, S.R. 2014. Next-generation sequencing data suggest that certain nonphotosynthetic green plants have lost their plastid genomes. New Phytologist 204(1): 7-11. [Findings on the preservation of plastid DNA and their loss is discussed based on next-generation organelle-genome sequencing in different plants including a Rafflesia sp. that have lost photosynthetic capabilities]

Smith, L., Hofstetter, R. and Mathiasen, R. 2013. Insect communities associated with Douglas-fir dwarf mistletoe witches’ brooms in northern Arizona. Southwestern Naturalist 58(4): 395-402. [Somewhat more Chrysomelidae, Phaleothripidae, Pteromalidae, Miridae, Berytidae, and Braconidae were found on branches infested by Arceuthobium douglasii than on uninfested branches.]

Sokho Kim, Dongho Lee, Jae-Kyung Kim, Jae-Hun Kim, Jong-Heum Park, Ju-Woon Lee and Jungkee Kwon. 2014. Viscothionin isolated from Korean Mistletoe improves nonalcoholic fatty liver disease via the activation of adenosine monophosphate-activated protein kinase. Journal of Agricultural and Food Chemistry 62(49): 11876-11883. [Viscothionin, extracted from Viscum album coloratum, given orally to high fat diet-induced obese mice was shown to reduce non-alcoholic fatty liver disease via the adenosine monophosphate-activated protein kinase signaling pathway, suggesting possible usefulness in treatment of obesity.]


Takem, L.P., Udia, P.M. and Poh, C.F. 2014. Anti-secretory, gastroprotective and anti-ulcer activities of aqueous extract of Phragmanthera capitata S. Balle in rats. International Journal of Pharmaceutical Sciences and Research (IJPSR) 5(8): 3560-3565. [Extracts of P. capitata, parasitic on e.g. avocado are used traditionally in Cameroon, and this study showed it to have significant anti-secretory, gastroprotective and anti-ulcer activities.]

Talve, T., Mürk, M., Lindell, T. and Oja, T. 2014. Rhinanthus plants found in calcareous fens on Gotland (Sweden): are they related to Rhinanthus osiliensis from Saarremaa (Estonia)? Biochemical Systematics and Ecology 54: 113-122. [Bayesian clustering analysis and the principle coordinate analysis showed that R. osiliensis and Rhinanthus sp. from Gotland are genetically differentiated and could not be the same species. Further research needed.]


Těšítel, J., Těšítelová, T., Fisher, J.P., Lepš, J. and Cameron, D.D. 2015. Integrating ecology and physiology of root-hemiparasitic interaction: interactive effects of abiotic resources shape the interplay between parasitism and autotrophy. New Phytologist 205(1): 350-60. [Describing a glasshouse experiment with Rhinanthus electorolophus. Manipulating mineral nutrients and water. had profound interactive effects on the performance of both the parasite and its hosts, as well as the balance of above-ground biomass between them.]


Toh, S., Holbrook-Smith, D., Stokes, M.E., Tsuchiya, Y. and McCourt, P. 2014. Detection of parasitic plant suicide germination compounds using a high-throughput Arabidopsis HTL/KAI2 strigolactone perception system. Chemistry & Biology 21(8): 988-998. [Showing that strigolactones and cotylimides promote an interaction between HTL/KAI2 and the F-box protein MAX2 in yeast, and that this effect can be used as a screening method. Some compounds identified in this way were shown to stimulate Striga hermonthica germination.]


Virtue, J., Prider, J. and Williams, A. 2014. Host range of branched broomrape (Orobanche ramosa subsp. mutelii) in South Australia. Plant Protection Quarterly 29(2): 46-54. [Among crop species, cultivars in the Brassicaceae were classified as high risk hosts Common vetch was the most susceptible legume host, while medics and clovers were less susceptible, and field peas were not hosts. Crops in Solanaceae and Cucurbitaceae were not as susceptible as reported elsewhere. Non-crop hosts were mostly in the Asteraceae and Brassicaceae.]


Wagner, S.T., Hesse, L., Isnard, S., Samain, M.S., Bolin, J., Maass, E., Neinhuis, C., Rowe, N.P. and Wanke, S. 2014. Major trends in stem anatomy and growth forms in the perianth-bearing Piperales, with special focus on Aristolochiaceae. Annals of Botany 113(7): 1139-1154. [Anatomical studies of stem anatomy in representatives of Piperales with perianths, including Hydnora, were conducted. The hypothesis that the vegetative organs of Hydnora is a rhizomes is confirmed.]

Wang Qing, Huang HengZhi, Wang Jun, Pan Yao, Song Ping and Shen LiXin. 2014. (The species association of parasitic/epiphytic plants of ancient cultivated tea plantation in Jingmai-Mangjing.) (in Chinese) Journal of West China Forestry Science 43(3): 45-50. [Documents the presence of Balanophora as part of the ancient tea forests in this province of China which includes the greatest diversity of tea.]

Weigend, M., Luebert, F., Gottschling, M., Couvreur, T.L.P., Hilger, H.H. and Miller, J.S. 2014. From capsules to nutlets - phylogenetic relationships in the Boraginaceae. Cladistics 30(5): 508-518. [Four chloroplast genes for 89 ingroup taxa were used to generate a well-supported phylogeny of Boraginaceae. Lennoaceae was sister to Ehretiaceae in the woody Boraginaceae II clade and considered by the authors part of this family.]

Wong HoShan, Chen Na, Leong PouKuan and Ko KamMing. 2014. β-sitostanol enhances cellular
glutathione redox cycling by reactive oxygen species generated from mitochondrial respiration: protection against oxidant injury in H9c2 cells and rat hearts. Phytotherapy Research 28(7): 999-1006. [Assessing the role of β-sitosterol in the 'Yang-invigorating' action of Cistanche tubulosa and observing that its protective effect against myocardial ischemia/reperfusion injury was seen in female but not male rats ex vivo.]

Wong, HoiShan, Chen JiJiang, Leong PouKuan, Leung HoiYan, Chan WingMan and Ko KamMing. 2014. Cistanches herba reduces the weight gain in high fat diet-induced obese mice possibly through mitochondrial uncoupling. Journal of Functional Foods 10: 292-304. [Results suggest that extracts of Cistanche deserticola or C. tubulosa prevent obesity and the associated health consequences such as diabetes, cardiovascular diseases and metabolic syndrome.]


Yamato, M., Oghara-Tsujita, Y., Takahashi, H. and Yukawa, T. 2014. Significant difference in mycorrhizal specificity between an autotrophic and its sister mycoheterotrophic plant species of Petrosaviaceae. Journal of Plant Research 127(6): 685-693. [Twenty two fungal partners were detected in the autotrophic Japonolirion osense while the mycoheterotrophic Petrosavia sakuraii had only one, suggesting that fungal partners are not necessarily shifted, but rather selected for in the course of the evolution of mycoheterotrophy.]


Yang XiaoJing and 10 others. 2014. Comparative pharmacokinetics with single substances and Semen cuscutae extract after oral administration and intravenous administration Semen cuscutae extract and single hyperoside and astragalin to rats. Analytical Methods 6(18): 7250-7259. [Involving seeds of Cuscuta chinensis.]

Yonli, D., Raore, H., Sawadogo, B., Bonzi-Coulibaly, Y., Tapsoba, I., Bellvert, F., Comtes, G., Sereme, P., Sankara, P. and Bally, R. 2013. (Exploitation of allelopathic properties of local plants against Striga hermonthica in Burkina Faso.) (in French) In: Journées Internationales sur la Lutte contre les Mauvaises Herbes, 22e Conférence du COLUMA, Dijon, France, 10-12 Décembre 2013: Dijon, France, 10-12 décembre 2013: 837-844. [Water extracts of Ceiba pentandra, Eucalyptus camendulensis and Faidherbia albida caused some inhibition of S. hermonthica germination, but concentrations used were hardly practical?]


Yu Rui and Ma YongQing. 2014. (Melon broomrape and sunflower broomrape seeds germination induced by hemp (Cannabis sativa L.) plants.) (in Chinese) Journal of China Agricultural University 19(4): 38-46. [Activity of extracts and exudates from C. sativa suggest its potential as a trap crop for Phelipanche aegyptiaca and to a lesser extent Orbanche cumana.]

Zaroug, M.S., Zahran, E.A.B., Abbasher, A.A. and Aliem, E.A.A. 2014. Host range of field dodder (Cuscuta campestris Yuncker) and its impact on onion (Allium cepa L.) cultivars grown in Gezira state Sudan. International Journal of AgriScience 4(7): 356-361. [C. campestris infected 19 plant species in 12 families. Among the most affected crops were onion, tomato, chickpeas, Corchorus spp., Erca sativa and lime. Yields of 3 varieties of onion were reduced by 30-60%.]


Bouwmeester, H.J. 2014. Rice cytochrome p450 MaX1 homologs catalyze distinct steps in strigolactone biosynthesis. Nature Chemical Biology, 10: 1028–1033. [Reporting that two members of CYP711 enzymes can catalyze two distinct steps in strigolactone biosynthesis, identifying the first enzymes involved in B-C ring closure and a subsequent structural diversification step of strigolactones.]


Zhou JunFang, da Silva, J.A.T. and Ma GuoHua. 2014. Effects of smoke water and karrikin on seed germination of 13 species growing in China. Central European Journal of Biology 9(11): 1108-1116. [Germination of Santalum album was stimulated by gibberellic acid but not by karrikin, suggesting functions and/or metabolic pathways are different.]

Zhou ShengLiang, Yan ShuZhen, Wu ZhenYing and Chen ShuangLin. 2014. Endophytic fungi associated with Macrosolen tricolor and its host Camellia oleifera. World Journal of Microbiology & Biotecnology 30(6): 1775-1784. [Identifying a wide range of endophytic fungi in both M. tricolor and its host C. oleifera, broadly similar in each but differing significantly in detail.]


Zippel, E. 2014. (From Achillea millefolium to Viscum album - the German genebank network for crop wild relatives (CWR).) (in German) Zeitschrift für Arznei- & Gewürzpflanzen 19(2): 81-87. [No abstract available.]

**IPPS MEMBERSHIP**

Membership in the IPPS is open to individuals and organizations of all nations that are interested in the objectives of the Society.

Membership fees are $50 for 2 years, which will be collected at the Congress.

To obtain a Registration Form visit the IPPS website (http://www.parasiticplants.org/) or contact:

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**HAUSTORIUM 66**

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Send material for publication to any of the editors.

**NB.** Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be downloaded from the IPPS web-site (see above).
# HAUSTORIUM

*Parasitic Plants Newsletter*

ISSN 1944-6969  
Official Organ of the International Parasitic Plant Society  

**July 2015**  
**Number 67**

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PRESIDENT’S MESSAGE

Dear IPPS members,

I am very pleased to announce that we had an excellent meeting at the 13th World Congress on Parasitic Plants, held from July 5 to 10 in Kunming, China. More than 100 participants from around the world really enjoyed the science, social activities, beautiful food and drink, in typical Chinese surroundings. I would like to extend grateful thanks to Ai-Rong Li, Yongping Yang, and their team for their perfect preparation, arrangements, and warm hospitality. I also thank John Yoder for his excellent job in arranging the scientific program and all session organizers for their efforts in preparation and management of sessions. All of the keynote lectures were very informative and helped us to catch up with recent advances in various research areas related to parasitic plants. In addition, oral and poster presentations were all of good quality and, in particular, those selected for student/young scientist awards were excellent.

Finally, I would like to thank all attendees for their active participation and discussions. Details of the meeting will be found in this issue. The book of abstracts and a group photo can be found on the IPPS website (http://www.parasiticplants.org).

The IPPS executive committee members had nominated Diego Rubiales unanimously for an IPPS Honorary Fellow award, and Diego received this award at the conference dinner. We all acknowledge his great contributions to both parasitic plant science, in particular the breeding of resistant cultivars, and to IPPS. Diego was the Editor of IPPS from 2005–2010 and program chair at the 10th World Congress on Parasitic Plants (Kusadasi, Turkey).

Also at the conference dinner, we expressed our special thanks and appreciation to the two founding Editors of Haustorium and honorary members of the IPPS, Chris Parker and Lynton Musselman, for their extensive and intensive long-lasting contribution in gathering all available literature on various aspects of parasitic plants, reviewing, compiling, and distributing updated knowledge to all of us. Although they are still very active, we would like to organize a small group of IPPS members for supporting editorial works of Haustorium.

In a final session prizes were awarded for the best student oral presentations, to (1st) Zhen-Zhen Yang (student, Penn State Univ.) (2nd) Satoko Yoshida (postdoc, RIKEN) and (3rd) Song-Kui Cui (student, RIKEN) and for the best student posters, to (1st) Yasunori Ichihashi (postdoc, RIKEN) and (2nd) Chun Su (student, Univ. Virginia). It is time to start thinking about our next congress, the 14th World Congress on Parasitic Plants. If you would like to invite our next congress to your country, please send me an e-mail notice. In addition, I welcome any suggestions and comments for possible congress venues as we would like to select a place that is most convenient to as many IPPS members as possible.

Next year, we will be holding elections to fill the offices of Vice President, Secretary, and one Member at Large. I encourage you to nominate, vote, and be active in your society. Please send me nominations for these positions.

Sincerely,

Koichi Yoneyama, IPPS President
yoneyama@cc.utsunomiya-u.ac.jp

MEETING REPORTS

13th WORLD CONGRESS ON PARASITIC PLANTS,
KUNMING, 5-9 JULY, 2015

Just about 100 delegates from at least 23 different countries met in Kunming for a wonderfully well-conducted meeting in the comfort of the Yunnan Dianchi Garden Resort Hotel.

Molecules and Biochemistry:
The keynote lecture in this section was by Harro Bouwmeester (Wageningen University, the Netherlands), on ‘Structural diversity in the strigolactones: biosynthesis and biological significance’. The fact that the strigolactones play multiple roles in the rhizosphere as well as in the host plant itself seems to have resulted in the evolution of an enormous structural diversity the biological significance of which we are only just beginning to understand. The current knowledge on the biosynthesis and structural diversification of strigolactones and their perception in host and parasite and the strategy to further elucidate their biological significance was discussed. This was followed by Koichi Yoneyama (Utsunomiya University, Japan) discussing the ‘Structure- and stereo-specific transport of strigolactones from roots to shoots.’ Although it is generally accepted that strigolactones (SLs) mainly produced in roots move acropetally to shoots and inhibit axillary bud outgrowth, it was suggested that both endogenous and exogenous SLs move sympetally in plants. In addition, by using deuterium-labeled SLs, transport of root-applied SLs to shoots was found to proceed in a highly structure- and stereo-specific manner. Details of xylem sap analyses and feeding experiments were explained and discussed in relation to SL transport in plants.

Salim Al-Babili (KAUST, Saudi Arabia) talked on ‘Carlactone: biosynthesis and application’. Carlactone is an intermediate of the strigolactone biosynthetic pathway, which is formed from all-trans-carotene by the sequential activity of the all-trans/9-cis-carotene isomerase DWARF27 and the carotenoid cleavage dioxygenases 7 and 8 (CCD7, CCD8). To explore the potential of this pathway in converting carotenoids other than all-trans-carotene and in producing carlactone-like compounds that might lead to other type(s) of strigolactones, the substrate specificities of the involved enzymes, using in vitro assays were...
investigated. The results demonstrate that the rice -ionone ring containing bicyclic carotenoids, i.e. -carotene and – cryptoxanthin mediates the isomerization reaction in the -ionone ring containing moiety of the substrate. CCD7 enzymes show a wide substrate- and a very narrow stereospecificity, converting different 9-cis-configured carotenoids, including 9-cis-carotene, 9-cis-zeaxanthin and 9-cis-lutein. These data indicate the possibility of the formation of hydroxylated carlactones. Initial studies showed that carlactone can induce seed germination in *Striga* at considerable levels but has largely only MAX1-dependent activity in *Arabidopsis*. Carlactone analogues exerted very high activity in inducing seed germination. However, this activity was dependent on the species. In addition, the compound showed strigolactone-like activities in *Arabidopsis*. Alessio Cimmino (Università di Napoli, Italy) spoke on ‘Fungal and plant metabolites for the biocontrol of some parasitic plant species’. He presented an interesting approach for broomrape (*Orobanche* and *Phelipanche* spp.) and dodder (*Cuscuta* spp.) management. The possibility to use microbial or plant metabolites to stimulate and/or inhibit broomrape seed germination in the absence of the host was explored and plant and fungal metabolites also evaluated for their inhibitory effects on germination and growth of *Cuscuta* species. Isolation and chemical characterization of some plants, plant root exudates and fungal metabolites for these purposes was described.

Rosemary Ahom (University of Agriculture, Makurdi, Nigeria) described the identification of potential allelochemicals in velvet bean (*Mucuna cochinchinensis*) for the control of *Striga hermonthica*. Plant growth-inhibitory compounds from the roots of *M. cochinchinensis* were more active than those from leaves and seed. Six phenolic/flavonone compounds including gallic acid, cafffeic acid, L-dopa, tyrosine, quercetin and isovetexin were isolated and identified in velvet bean leaves, root and seed.

Kristen Clermont (Virginia Tech, USA) spoke on ‘Comparative metabolomic analysis of early parasite development of *Phelipanche aegyptiaca* and *Triphysaria versicolor.*’ Comparative profiling of primary metabolites involved in carbon and nitrogen assimilation by the two parasites provided a rationale for targeting aspartate-family amino acid biosynthesis as a means of disrupting their growth. This work also adds metabolomic data to current Parasite Plant Genome Project transcriptome datasets.

Chong Yang (Zhejiang University, China) described physiological and biochemical responses of three sunflower cultivars, TK0409 (confectionery type and susceptible), S606 (oil type and intermediate) and JY207 (oil type and resistant) differing in their sensitivity to *Orobanche cumana* inoculation. The effect of *O. cumana* inoculation on physiological and biochemical changes in these cultivars suggested that the enhanced plant growth, low oxidative stress, stimulated antioxidant activities, lignin and phenolic contents were associated with improved infection tolerance in cultivar JY207 as compared to TK0409 and S606. Higher concentration of phenolics and lignins in resistant cultivar JY207 was observed under *O. cumana* inoculation that may play a possible role in infection prevention.

**Relevant posters** included the identification of germination stimulants exuded by sunflower varieties differing in tolerance of *Orobanche cumana*; altitude and location effects on stimulant exudation by *Houttuynia cordata*; chemicals selectively regulating strigolactone function; possible effects of *Striga* infection on the morphology of rice via strigolactone biosynthesis or signalling pathways; and strigolactone profiles in sorghum in relation to AM fungal symbiosis.

**Genes and genomes:**

In a keynote lecture by Jim Westwood (Virginia Tech, USA) on ‘Genome level interactions in the parasite-host complex’ he noted that parasites are locked in an arms race with their hosts that drives evolution of both sides. Parasitic plants do not merely siphon off host water and nutrients, but rather have sophisticated mechanisms to redirect host resources while simultaneously subverting host defences. Recent demonstrations of parasitic plants exchanging macromolecules such as proteins and nucleic acids with their hosts suggest a novel type of interaction that greatly expands the potential mechanisms available to the parasite for host manipulation. This is especially true for *Cuscuta*, where RNA exchange includes some transmission to the host, raising the potential for regulation of host gene expression. It is suggested to consider parasites and their hosts as parts of a supra-organismal system in which the parasite-host complex is greater than the individual genetics of its members.

Gunjune Kim (Virginia Tech, USA) also referred to the large scale, bidirectional movement of macromolecules including mRNA, proteins and viruses between *Cuscuta* and *Arabidopsis*. Transcriptome data via Illumina sequencing from *Cuscuta* stems near the point of attachment to various hosts indicate that *Cuscuta* interacts with each different host in a specific manner and understanding the dynamics of specific interactions may advance understanding of *Cuscuta* parasitism.

Wei-Shu Fan (Inner Mongolia University, China) described the sequencing of the complete mitochondrial and plastid genome of *Castilleja paramensis* and investigation of changes in the organelle genomes that may result from a parasitic lifestyle. *C. paramensis* appears to be the donor for a transfer event involving the atp9 and ccmF genes into another Andean plant. The results are consistent with a reduction in photosynthetic activity but retention of full mitochondria function in *C. paramensis*. Guang-Da talked about using transcriptome data to assemble mitochondrial and chloroplast genes of *Cynorhormium songaricum*, a parasitic plant occurring across China, Mongolia and Central Asia which is used as a medicinal herb. Its hosts are mainly *Nitraria* spp. The data were used to assemble unigenes of the mitochondrial and chloroplast genes.

Ken Shirasu (Riken, Japan) gave a keynote lecture on ‘Vascular hijack by parasitic plants’. Understanding the mechanisms underlying the hijacking process, involving the haustorium, is an important step to develop a strategy to fight against the weedy parasites. Next-generation
sequential and bioinformatics, as well as genetic analyses revealed the dynamic reprogramming of the parasite cells upon infection. The molecular mechanisms behind the uniqueness of parasitic plants was discussed. **Hailey Larose** (Virginia Tech, USA) described pre- and post-germination transcriptome analysis and presented findings of genes expressed during the break from dormancy of *O. cumana* and *O. cernua*. These were sequenced and differential expression analysis performed between the various stages. **Guiling Sun** (Kunming Institute of Botany) studied the horizontal transfer of novel Class II hAT transposons from Brassicaceae to root parasitic Orobanchaceae. This first case of a class II transposon laterally transferred among eudicots was characterized, and it was suggested to be involved with direct transport of DNAs through haustoria, followed by the insertion catalyzed by the transposase itself. **Zhen-Zhen Yang** (Pennsylvania State University, U.S.A.) spoke on ‘Comparative transcriptome analyses reveal core parasitism genes and suggest gene duplication and repurposing as sources of structural novelty’. The genetic basis for the evolution of haustoria was studied by comparative transcriptome sequencing in three species of Orobanchaceae. Newly identified ‘parasitism genes’ were identified, most of them derived from gene duplications in a common ancestor of Orobanchaceae and the related non-parasitic *Mimulus guttatus*. Additionally, the signature of relaxed purifying selection and/or adaptive evolution at specific sites was detected in many haustorial genes, and may play an important role in parasite evolution. **Xin-Hua Zhang** (South China Botanical Garden, China) talked on transcriptome profiling during haustorium development in *Santalum album*. A combination of next-generation sequencing and cytological and morphological studies was used to identify changes in gene expression and metabolic pathways associated with the development of the *S. album* haustorium. *S. album* obtains some of its water and simple nutrients by tapping into host roots. A substantial number of the identified differentially expressed genes were involved in cell wall metabolism and protein metabolism, as well as mitochondrial electron transport functions. Phytohormone-mediated regulation was also found to play an important role during haustorium development.

**Host parasite interactions:**

**Julie Scholes** (University of Sheffield, UK) delivered a key note lecture focused on ‘Deciphering the molecular mechanisms of resistance to parasitic plants’. Studies have been focused on the identification of mechanisms and genes underlying resistance (and susceptibility) in cereal hosts to different ecotypes and species of *Striga* with the aim of designing novel control strategies and/or breeding durable resistance against these parasites. Mapping populations has helped identify a highly significant Quantitative Trait Locus (QTL) underlying the resistance phenotype that contains many orthologs of disease resistance genes, while use of a range of comparative genomic and molecular approaches helps to identify which of the candidate gene(s) is/are responsible for the resistance phenotype.

**Suo Qiu** (University of Sheffield, UK) talked on ‘Understanding the genomic basis of virulence in the parasitic weed *Striga hermonthica*’. A population genomic approach were taken to locate virulence loci within the *S. hermonthica* genome that allow parasites to overcome host resistance genes. Differences in allele frequencies between the *Striga* plants growing on two contrasting rice cultivars were compared at Single Nucleotide Polymorphism (SNP) level and at the gene level. SNP analyses revealed that many genes were highly significantly differentiated between the *Striga* individuals growing on the susceptible and resistant cultivars and are therefore excellent candidates for virulence determinants. **Xiao-Yan Jia** (Virginia Tech, USA) studied pectin methylesterases (PME) which are secreted by parasitic plant intrusive cells during invasion and were hypothesized to facilitate penetration. From transcriptomic data analyses of Parasitic Plant Genome Project (PPGP), two orthologs of pectin methylesterase inhibitor (PMEI) unigenes were identified showing specific upregulation in the penetration stage of all three parasites *Phelipanche aegyptiaca, Triphysaria versicolor* and *Striga hermonthica*. Preliminary data showed that PaPMEI1 ectopic expression in *Arabidopsis* plants exhibited an aerial rosette phenotype when grown under short day condition. PaPMEI1-OX lines retained ability to host *P. aegyptiaca* growth and no significant morphological difference was observed in parasite development compared to those inoculated on wild type plants. **Loren Honaaas** (Pennsylvania State University, USA) discussed ‘Risk versus reward’ in *Triphysaria versicolor*: a facultative parasite and a model plant for parasitic Orobanchaceae. In a study of host-dependent growth patterns host-dependent phenotypes displayed by the parasite provided insight into reproductive strategies and host choice mechanisms in this species. **Muvari Connie** (University of Massachusetts, USA) described a greenhouse study showing that cultivars of cranberry varied in overall levels of some phenolics but not in phytohormone levels but also that Tjiurutue gypsy moth damage delays parasite attachment, indicating that a host plant’s single interaction with one herbivore species can alter subsequent interactions with a prevalent parasitic plant, broadening our knowledge about community dynamics. **Jianqiang Wu** (Kunming Institute of Botany, China) showed that host mRNAs and proteins can be translocated to *Cuscuta australis* and that when one soybean plant is attacked by *Spodoptera litura*, certain systemic signals are induced and transmitted to both *C. australis* and another soybean host via the *C. australis*. These signals induce increased levels of jasmonic acid-isoleucine conjugates in the first soybean plant but not in *C. australis*. This and RNA-seq analysis revealed that the *Cuscuta* mediates inter-plant signalling and may provide hosts with certain fitness advantages by sending ‘insect attack’ alerts from infested to non-infested systemic plants. **Petra Světlíková** (Kunming Institute of Botany, China) described macro- and microscopic observations of hydathode trichomes on the leaves of *Rhinanthus alectorolophus*. Gas-exchange measurements were combined to find a correlation among guttation, respiration,
and transpiration, a pattern attributable to active water secretion. The observations reveal water secretion from the glandular trichomes present on the abaxial leaf side. Based on the carbon budget calculations, a potential role of the trichomes in the evolution of holoparasitism within the clade is proposed. Satoko Yoshida (RIKEN, Japan) described a model plant system using the facultative parasite Phtheirospermum japonicum. The hairy root transformation system allowed visualization of expression of cell marker genes and plant hormone responsive genes by in vivo imaging. Transcriptome analysis was done to identify genes expressed during haustorium formation. Reverse genetic studies using RNAi techniques revealed that auxin-biosynthesis gene YUC3 is involved in haustorium formation. Furthermore, the genome of P. japonicum was sequenced for comparative analyses with obligate parasites and non-parasitic plants. Mutant collections from P. japonicum ethyl methanesulfonate (EMS)-mutagenized lines also revealed possible genetic components involved in plant parasitism. Pradeepa Bandaranayake (University of Peradeniya, Sri Lanka) described ‘Functional characterization of haustorial hair development in Triphysaria versicolor’. Twenty-two genes whose mutations in Arabidopsis lead to changes in root hair phenotypes, including hairless roots and changes in root hair number, morphology, position and length, were selected for this study. Current results identifying parasite genes that function in haustorial hair development using RNAi technology were discussed. Song-Kui Cui (RIKEN, Japan) talked about ‘Haustorial hairs are controlled by root hair genes and involved in parasitism’. From a forward genetic screening with EMS (ethyl methanesulfonate)-mutagenized P. japonicum seeds 3 lines of mutants lacking haustorial hairs were isolated. These mutants also lack root hairs, suggesting that haustorial hairs are controlled by genetic components involved in root hair development. Indeed, PjEXP18, the orthologous gene to Arabidopsis root hair specific EXPA18, was expressed in both root hairs and haustorial hairs, suggesting similar genetic identity. All three mutants show reduced number of haustoria upon host rice root infection, suggesting a role of haustorial hairs on the efficient host detection or host attachment. The genes responsible for the mutants may be involved in host signal perception. Vincent Goyet (University of Nantes, France) discussed haustorium formation in the obligate parasitic plant Phelipanche ramosa. Papillae were induced in P. ramosa germinating seeds upon treatment with biological extracts. Seeds with these structures showed a significantly higher infection rate on Brassica napus roots compared to untreated germinating seeds. P. ramosa seeds displaying pre-haustorium structures were taken for transcriptomic approaches using a P. ramosa microarray. As a complementary approach, a functional validation approach based on fast calli generation from P. ramosa germinating seeds was developed. Relevant posters included identification of parasite effectors mediating Striga gesnerioides-host plant interactions; a comparison of the mitochondrial genomes of Cistanche spp.; horizontal gene transfer between Cistanche desertica and its host; the mitochondrial gene sequence and gene transfer in Cynomorium spp.; the molecular basis for the convergent evolution of parasitism; and the evolution and expression profile of transcription factors in three Orobanchaceae.

A paper on economic losses from parasitic weeds in rice in Africa by Jonne Rodenburg (Africa Rice Centre, Tanzania) was presented by Julie Scholes. Estimates suggest that up to 2.5 million farmers are suffering up to 2.5 million tons in lost yield. At least 40% of rice crops may be infested by Striga species causing 40-70% yield loss worth $26-160 million. Rhamphicarpa fistulosa is becoming increasingly serious and causing comparable losses. Countries most seriously affected include Guinea, Cote d’Ivoire, Nigeria, Uganda, Tanzania and Madagascar. Roshanizah Rosli (Universiti Brunei, Darussalam) described the occurrence of Cassytha filiformis in Brunei on at least 24 species in 5 families. Germination and penetration were described and it is shown to reduce photosynthesis in its hosts. Mohammed Zaroug, (University of Gezire, Egypt) described the severe damage to carrots caused by infestation by Cuscuta campestris. Bo Xia (Shenyang Agricultural University, China) reported on the serious damage caused by Arceuthobium sichuaneuse on Picea species. Reductions in needle size and shoot length were more serious in P. crassifolia than in P. purpurea, the damage being caused apparently by competition for nitrogen and for water. A keynote paper by Danny Joel (Niew Ya’ar Research Center, Israel) described the interesting transition of Orobanche cumana from wild hosts to sunflower in Russia and its subsequent spread to most other sunflower-growing regions, including Israel in the 1970s, where it damages the very susceptible confectionery sunflower crop. Over the years there has been the gradual development of a form infesting tomato which is now widespread and severe. This may be the result of some hybridisation with O. cernua. Ahmed Uludag presented a paper by Filiz Arsian (GAP Research Institute, Turkey) exploring the possible effects of climate change and concluding that Orobanche, Philananche, Striga and Viscum problems could all be increased in the future. Gen-Sheng Bao (Lanzhou University, China) gave the first of several papers and posters on Pedicularis kansuensis increasingly infesting high altitude pastures on the Qinghai-Tibetan plateau. This contribution showed that grasses and legumes were the main hosts, their suppression allowing an increase in species richness. Lynton Musselman presented a paper by Jay Bolin et al. (Catawba College, North Carolina, USA) describing the interesting genera Hydnora and Prosopanche (Hydnoraceae). The nomenclature is clarified, host range, varying smells and pollination systems, some involving endothermy, described. Also a probable new species from Dhofar, Oman. Curiously no seed has ever been persuaded to germinate. Curious and varied pollination systems in the Balanophoraceae were also the theme of the paper by Nina Hobbhahn (University of Capetown, South Africa). Motion sensitive cameras showed that Mystropetalon thomii is pollinated by 4 different mammals, attracted to the
copious sweet nectar while the foul-smelling *Sarcophyte sanguinea* attracts beetles and insects who achieve pollination without receiving any reward. Nina also treated us to illustrations of many other exotic and colourful Balanophoraceae and what is known of their varied pollination strategies.

**Posters** related to this topic included one rather surprisingly showing arbuscular mycorrhiza stimulating *Striga hermonthica* rather than reducing it. Several others concerned various aspects of the *Pedicularis kansuensis* problem - on its relationship with AM fungi, one on root morphology, others on genetic variation and on soil nutrient status. A final one described techniques for cultivation of the medicinally important *Cistanche deserticola*.

**Control and Management:**

The final day began with a keynote lecture from John Pickett (Rothamsted Research, UK) providing us with a history and update on the companion-cropping (‘push-pull’) technique for *Striga hermonthica* control developed by ICIPE in Kenya and now being used by many thousand farmers in East Africa. Latest work is with the more drought-tolerant *Desmodium indicum* and *D. intortum*, allowing wider use, especially in sorghum. The technique is also working well on *S. asiatica*. Understanding of the active substances involved (C-linked glycosides of apigenin) and the genes involved in their synthesis is allowing exploration of their possible transfer to cowpea and other legumes, which could lead to control of other Orobanchaceae.

A further keynote presentation by Joseph Hershenhorn (Newe Ya’ar Research Center, Israel) reviewed the mechanism of action of the amino-acid inhibiting herbicides – glyphosate, sulfonyl ureas and imidazolinones in controlling *Orobanche* and *Phelipanche* spp. It had previously been assumed that the parasites acquired all their nutrition including amino-acids from their hosts, but it is now confirmed that they do have their own amino-acid biosynthesis mechanisms and that it is disruption of these in the parasite that is responsible for their control.

Yongqing Ma (Northwest A&F University, China) showed how successful use of alternative crops as trap-crops can depend on the varieties used. Varieties of wheat, maize, cotton, soyabeans, rice, switchgrass and millet varied in the quantity and type of strigolactones exuded and gave very different results in the germination of *Orobanche* spp.

Yakkov Goldwasser (Hebrew University of Jerusalem, Rehovot, Israel) had studied the application of granular combinations of trifluralin, pendimethalin and isoxaben for control of *Cascuta campestris* in tomato, chickpea and watermelon. Application of pendimethalin prior to *C. campestris* germination gave best results.

Joseph Hershenhorn (Newe Ya’ar Research Center, Israel) indicated that the current methods for control of *Phelipanche aegyptiaca* in tomato in Israel depend on a complex, delicate sequence of chemical treatments and showed that repeated overall application of the established and inexpensive growth regulator, maleic hydrazide, provided excellent selective control and is currently being registered for use in Israel. Musa Kolo (Federal University of Technology, Minna, Nigeria) had tested *Hyptis suaveolens*, *Senna obtusifolia* and *Desmodium intortum* as intercrops, within row, in maize grown on ridges and recorded significant delays in emergence of *Striga hermonthica* and 50% increases in crop yield. Peter Toth (Slovak University of Agriculture, Nitra, Slovakia) described an intriguing means of detecting the early stages of attachment of *Orobanche cumana* to the roots of sunflower by detection of volatile emissions from the leaves of the crop in response to parasite attachment, potentially allowing for suitable control methods to be applied. It has, however, yet to be confirmed that these emissions are characteristic of *Orobanche* infection and are not stimulated by other pathogens.

**Related posters** included one on control of *Orobanche cumana* by herbicide and by salicylic acid seed treatment, another on its genome sequence. One appraised the tendency to host specificity in populations of *Phelipanche ramosa* in France and another related to the difficulty of controlling *Pedicularis kansuensis* with herbicides.

**Host resistance:**

A final keynote lecture was presented by Diego Rubiales (Institute for Sustainable Agriculture, Cordoba, Spain) described the continuing search for good sources of resistance to *Orobanche* spp. in legume crops, noting that the parasite has been known in the Mediterranean region for over 2000 years – yet there has been no natural or human selection of crops with resistance. Some good resistance has now been found in vetch and in pea (2 cultivars are about to be released after 20 years of work) and there is some indication of a source of low-stimulant exudation in faba bean, but for many crops, alternative methods are still needed, including e.g. intercropping with fenugreek.

Evgenia Dor (Newe Ya’ar Research Center, Israel) described the use of chemical mutagenesis for the conversion of an established tomato variety HRT, to create HRT1, resistant to ALS-inhibiting herbicides including the imidazolinones imazapic and imazapyr. Three applications of either herbicide completely suppressed emergence of *Phelipanche aegyptiaca* resulting in a doubling of yield.

Johann Louarn (Laboratoire des Interactions Plantes Micro-organismes, Toulouse, France) described studies of a cross between two sunflower lines with resistance to some of the most virulent races of *Orobanche cumana*, mapping QTLs for low stimulant, incompatible attachments etc. in the diverse progeny. A final presentation by Steven Runo (Kenyatta University, Kenya) emphasised the continuous evolution or selection for virulence in *Striga hermonthica* in response to development of new sorghum varieties and described promising work with wild sorghum types with potentially more durable resistance.

The Abstracts are available at:

Hinanit Koltai and Chris Parker
Papers and posters presented:

NB Only the presenter’s name is included below. He/she may not always be the senior author.

Molecules and Biochemistry

Harro Bouwmeester - Structural diversity in the strigolactones: biosynthesis and biological significance.

Koichi Yoneyama - Structure- and stereo-specific transport of strigolactones from roots to shoots.

Salim Al-Babili - Carlactone: biosynthesis and application.

Alessio Cimmino - Fungal and plant metabolites for the biocontrol of some parasitic plant species.

Rosemary Ahom - Identification of potential and potency of allelochemicals in velvet bean (Macuna cochinchenensis (Wight) Burck) for the control of Striga hermonthica (Del.) Benth.

Kristen Clermont - Comparative metabolomic analysis of strigolactone biosynthesis and biological significance.

Chong Yang - Identification of natural germination stimulants from root exudates of sunflower cultivars differing in tolerance to Orobanche cumana.

Yongqing Ma - Altitude and location have more effect on contents of germination stimulants for broomrape seeds than extraction methods from the crude extracts of Houttuynia cordata.

Tadao Asami - Chemicals selectively regulating SL functions.

Richard Louden - Can Striga-induced changes to strigolactone biosynthesis or signalling pathways explain key alterations in the morphology of its rice host?

Mahdere Shimels - Strigolactone profiles in Sorghum bicolor: in relation to arbuscular mycorrhizal fungal symbioses.

Genes and Genomes:

James Westwood - Genome level interactions in the parasite-host complex.

Gunjune Kim - Cuscuta gene expression and transcript exchange varies depending on host species.

Weishu Fan - First complete mitochondrial genome from a parasitic plant (Castilleja paramensis).

Guangda Liu - Using transcriptome data to assemble mitochondrial and chloroplast genes of Cynomorium songaricum.

Ken Shirasu - Vascular hijack by parasitic plants.

Hailey Larose - Pre- and post-germination transcriptome analysis of two species of parasitic Orobancheae.

Guiling Sun - Novel Class II hAT transposons were laterally transferred from Brassicaceae to root parasitic Orobancheae.

Zhenzhen Yang - Comparative transcriptome analyses reveal core parasitism genes and suggest gene duplication and repurposing as sources of structural novelty.

Xinhua Zhang - Transcriptome profiling during haustorium development in the root hemiparasite Santalum album Linn.

Host Parasite Interactions:

Julie Scholes - Deciphering the molecular mechanisms of resistance to parasitic plants.

Suqiu Qiu - Understanding the genomic basis of virulence in the parasitic weed Striga hermonthica.

Xiaoyan Jia - Engineering host cell wall to increase resistance against Phelipanche aegyptiaca.

Loren Honas - Risk versus reward: host dependent parasite phenotypes in the facultative generalist Triphysaria versicolor.

Muvari Tjiurutue - Gypsy moth damage delays parasite attachment to cranberry hosts.

Jianqiang Wu - Parasitic plant, Cuscuta australis, transmits inter-plant herbivory-induced signals.

Petra Svetlikova - The physiological role of hydathode trichomes in parasitic Orobancheae.

Chun Su - Identification of parasite effectors mediating Striga gesnerioides-host plant interactions.

Yuxia Song - Comparison of mitochondrial genomes between Cistanche deserticola and Cistanche tubulosa.

Lei Shi - A horizontal gene transfer between Cistanche deserticola and its host Haloxylon ammodendron.

Guilin Chen - Mitochondrial gene sequence analysis of parasitic plant Cynomorium and horizontal gene transfer study.

Yasunori Ichihashi - Molecular basis for the convergent evolution of parasitism in plants.

Yu Wang - Evolution and expression profile of transcription factor families in three parasitic plants of the Orobancheae.

Satoko Yoshida - Genomic and genetic analyses of haustorium formation using Phtheirospermum japonicum as a model parasitic plant.

Pradeepta Bandaranayake - Functional characterization of haustorial hair development in Triphysaria versicolor.

Songkui Cui - Haustorial hairs are controlled by root hair genes and involved in parasitism.

Vincent Goyet - Towards the understanding of haustorium formation in the obligatory parasitic plant Phelipanche ramose.

Girija Vijayraghavan - Host parasite interactions and nutrient dynamics of Dendrophthoe falcata (L.F.).

Ecology, phylogeny and evolution:

Jonne Rodenburg - The economic losses caused by parasitic weeds in rice in Africa.

Roshanizah Rosli - An ecophysiological study of the hemiparasitic Cassytha filiformis L. (Lauraceae) in Brunei Darussalam, Borneo.

Mohamed Zaroug - Field dodder (Cuscuta campestris Yuncker) a new pest of carrot (Dacus carota L.) in Gezira Scheme, Sudan.

Awad Taha - Compatibility and incompatibility of some monocotyledonous plant species to field dodder (Cuscuta campestris Yuncker).

Bo Xia - Impact of Arceuthobium songaricum infection on needles and current-year shoots of Picea crassifolia and Picea pungens trees.

Daniel Joel - Factors affecting host range of weedy Orobancheae: the Orobanche cumana case.
Post-Congress field tour

The advertised post-Congress tour had to be cancelled for lack of takers but four of us were immensely fortunate that Prof Ai-Rong Li and Prof Kai-Yun Guan were prepared to arrange an alternative botanical excursion with vehicle and student guides, following much the same itinerary. First to Lijiang where we were joined by Dr ZhiFa Chen, local staff-member of the Kunming Institute of Botany who guided us to their Field Station at 3,200 m (10,500 ft). From there we climbed on foot to 3,700 m (12,000 ft) enjoying the varied flora including many parasitic, weedy, beautiful and interesting species, all patiently identified for us by Dr Chen. Among the parasitics was an abundance of Pedicularis species (China has 363 species), especially the magnificent and common P. rex Among the beautiful were meadows covered with Primula conspersa. On the way down the mountain we stopped at 2,700 m to collect the mistletoe Taxillus caloreas causing significant damage to the pine Pinus amandii. The next day we drove from Dali up onto Cangshan mountain, again to 3,200 m. On the way the roadside was often dominated by the introduced Eupatorium adenophorum (Chromolaena adenophora) well-known in this region for killing horses. Higher up, again plenty of Pedicularis spp. Among other interesting species was the small blue-flowered Gentiana panthaiaca whose flowers closed within 30-60 seconds of any disturbance. (blowing or shaking).

We are profoundly grateful to all those who made this trip possible – Profs Ai-Rong Li and Kai-Yun Guan for their detailed arrangements, to Xiao-Lin Sui and Lei Xiang for their patient attendance on us, to Dr Chen for his expert botanical help and not least to our very able driver, Yun Liang.

Chris Parker, Peter Toth, Ahmed Uludag, John Yoder
THE 1ST INTERNATIONAL CONGRESS ON STRIGOLACTONES, WAGENINGEN, THE NETHERLANDS, 1-6 MARCH 2015,

From 1-6 March 2015 the Laboratory of Plant Physiology of Wageningen University hosted the 1st International Congress on Strigolactones in collaboration with the COST action STREAM, funded by the European Commission. The local organising committee consisted of Harro Bouwmeester, Rina Anthounis, Henk Hilhorst, Sander van der Krol and Carolien Ruyter-Spira. The meeting was sponsored by Syngenta, the Royal Academy of Sciences of the Netherlands (KNAW), the Wageningen University and Research Center LEB foundation, and COST action STREAM. The program of the meeting covered all the important areas in the research on strigolactones. Each session featured a number of invited speakers, leaders in their respective fields and a number of speakers were selected from the submitted abstracts, all together offering a rich program with 45 talks and 60 poster presentations. Special attention was paid to poster viewing. Posters were on display throughout the entire meeting, with selected poster viewing and flash presentations scheduled every day. Four posters got special awards for best poster in a number of categories. The meeting was attended by 135 participants.

In the first session on Biosynthesis and transport the advances on the biosynthesis of strigolactones were reported by Shinjiro Yamaguchi, Salim Al-Babili, Philip Brewer and Zhang Yanxia. Exciting is the discovery of strigolactone-like, carlactone-derived, compounds that do not have the characteristic B and C-ring but nevertheless exhibit biological activity. As discussed by Shinjiro Yamaguchi, this was first discovered in Arabidopsis but now seems to be a common phenomenon in other plant species as well. The core biosynthetic pathway of strigolactones and strigolactone-likes is now elucidated up to carlactone (Salim Al-Babili) and the strigolactone-like carlactonolactone (Shinjiro Yamaguchi) and towards the canonical strigolactones, 4-deoxyorobanchol and orobanchol in rice (Zhang Yanxia). However, questions remain with regard to the role of LBO, a strigolactone(-like) biosynthetic enzyme with unknown function (Philip Brewer), how the methoxy group is introduced and what the role is of diverse decorations of other canonical strigolactones as well as strigolactone-likes. The work of Enrico Martinoia on the transport of strigolactones begins to shed light on directional internal transport of strigolactones as well. After their discovery of PDR1 as strigolactone exporter they now showed that PDR1 is also localised acropetally in root cells, suggesting that in the root tip the transporter is involved in acropetal transport of strigolactones.

In the session Perception of strigolactones and downstream signaling an update was given on the state-of-the-art with regard to strigolactone perception and binding by D14 (Kimberley Snowden, Yoshiya Seto), the subsequent binding of SL/D14 to the SCFMAX2 complex which then targets SMAXL proteins for ubiquination and proteasome mediated destruction (Jiayang Li, Stephanie Kerr). Interestingly, both the signaling molecule and the receptor of SL are subject to signaling related turnover (Pilar Cubas). A strong case was made for true targets of strigolactone signaling based on multiple complementary evidence (Tom Bennett). An interaction between strigolactones and auxin and cytokinins links to flavonol formation, which in turn affects lateral root development (Sofie Goormachtig).

In the session Chemistry of strigolactones, Binne Zwanenburg gave an overview of this field and his contribution to it in the past 20 years. As an example of biology-guided synthesis of strigolactone analogs Tadao Asami presented their work on the optimisation of strigolactone analogs using binding to D14 to guide the synthesis. An important tool in the characterisation of the strigolactone receptors is the use of fluorescent strigolactone analogs, which was discussed by Cristina Frandi and Francois-Didier Boyer. The latter presented a molecule that will fluoresce only upon hydrolysis by the D14 receptor. Claudio Scepantti discussed the possibilities to use strigolactone analogs in agriculture while Antonio Evidente discussed alternatives for strigolactones that can be extracted from fungi and plants.

In the session Strigolactones in plant development, Ottoline Leyser and Christine Beveridge presented their progress on, respectively, the understanding of the role of strigolactones and carbohydrate signalling in the regulation of the oldest known developmental process controlled by strigolactones, shoot branching. Hinanit Koltai and Soizic Rochange presented the role of strigolactones in the regulation of root architecture and leaf serration, while Thomas Greb, Yasmine Ligerot discussed the role of downstream targets (SMXLs), auxin in the regulation of plant development by strigolactones. Alexander van der Krol presented a role for strigolactones in plastidial stromule formation, which turns out to be independent of the conventional role of MAX2 in strigolactone signaling.

Martin Parniske and Kohki Akiyama introduced the session Strigolactones and AM fungi with, respectively, presentations on the wider molecular dialog between plants and fungi and the role of strigolactones in this dialog. The session continued with presentations on the role of abiotic stress on the plant-AM interaction and the role of strigolactones in this (Juan Antonio Lopez-Raez) and the molecular mechanisms involved in plant-AM interaction (Eloise Foo, Caroline Gutjahr).

In the session Evolution of strigolactones the speakers tried to tie together the evidence we have from several different systems about how strigolactones and
strigolactone signalling may have evolved. Steven Smith approached this question with a comparison between karrikin and strigolactone signalling, while Catherine Rameau presented the results they have on strigolactone signalling in *Physcomitrella patens*. Along the latter line, Sandrine Bonhomme and Mauricio Lopez-Obando discussed the role of MAX2 and D14-LIKE1s in *P. patens*. Shigeoh Toh and Evgenia Dor discussed the involvement of strigolactones in germination of non-parasitic and parasitic plants, respectively.

The discussion on the role of strigolactones in germination in parasitic plants was continued in the session **Strigolactones and parasitic plants** in which Koichi Yoneyama first reviewed the role of natural strigolactones in parasitic plant germination. Subsequently, Peter McCourt and David Nelson discussed the evidence that D14-LIKE1 homologs in parasitic plants seem to have evolved to detect strigolactones in the exudates of their hosts. Jean-Bernard Pouvreau discussed the mechanism by which strigolactones induce germination in parasitic plants through catabolism of ABA in which DNA methylation seems to play a role. Yukihiro Sugimoto described the identification of the sunflower strigolactone, heliolactone, with an intriguing strigolactone-like structure. Radi Aly and Stefano Pavan subsequently described approaches using genetic modification and selection, respectively, to breed crops that have reduced strigolactone secretion and hence display resistance towards parasitic plants.

**Poster awards:** The Syngenta-sponsored poster award of €500,= for the best poster on the possible application of strigolactones in agriculture was awarded to Ivan Visentin for his poster entitled Strigolactones as root-to-shoot signals in tomato plants under osmotic stress. There were also three COST action Stream Poster awards for the best posters in three of the COST actions working groups.

**Outlook:** The meeting was very successful; there was a spirit of enthusiasm and excitement about all the important science going on in the field. In a meeting with the scientific committee during the 1st ICS we reached the conclusion that the meeting was timely and highly useful. We decided to try to organise these meetings also in the future, preferably on a regular, biannual basis. It was decided to have the 2nd ICS in Turin in spring 2017. The meeting will then be organised by Cristina Prandi and Hinanit Koltai again in conjunction with COST action STREAM.

**Harro Bouwmeester**  
Conference Chair and Local host

**Papers presented with direct reference to parasitic plants:**

Evgenia Dor - The development of a new race of *Orobanche cumana* with a wider host range is due to changes in seed response to strigolactones.

Koichi Yoneyama - Natural strigolactones as germination stimulants for root parasitic plants.

Peter McCourt - Chemical genomics and strigolactone biology.

David Nelson - Neofunctionalization of KAI2 ligand-specificity likely enabled host-perception in parasitic weeds.

Jean-Bernard Pouvreau - DNA methylation regulates *P. ramosa* seed germination by controlling strigolactone-dependent expression of *PrCYP707A1*, an ABA catabolic gene.

Radi Aly - Enhanced host resistance to parasitic weeds by silencing and blocking key-genes involved in strigolactone pathway.

Yukihiro Sugimoto - Heliolactone, a non-sesquiterpene lactone germination stimulant for root parasitic weeds from sunflower.

Stefano Pavan - Characterization of the first pea (*Pisum sativum* L.) natural strigolactone-deficient mutant resistant to crenate broomrape (*Orobanche crenata* forsk.).

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**THE 50TH ANNIVERSARY OF THE WEED SCIENCE SOCIETY OF ISRAEL, 24 FEBRUARY, 2015**

On February 24, 2015 the Weed Science Society of Israel (WSSI) celebrated its 50th Anniversary on the occasion of the society's 23rd Biennial Meeting, which was held at the Faculty of Agriculture, Food & Environment of the Hebrew University of Jerusalem, in Rehovot.

The WSSI was founded by Dr. Gideon Cohen and other scientists of the Agricultural Research Organization and the Extension Service of the Ministry of Agriculture, with the original aim ‘to extend, share and distribute knowledge regarding weed control in Israel’. Since then the WSSI unites all persons who are involved in weed research and weed management in the country, including researchers, students, Extension Service personnel, experts from chemical companies, herbologists of the Plant Protection and Inspection Services, and interested farmers. One of the main characteristics of the WSSI is its intimate interaction with farmers. During its 50 years the WSSI organized hundreds of field excursions, courses and seminars.

Twenty three scientific lectures were presented in our 23rd Biennial Meeting, including four scientific sessions: Broomrape Physiology and Genetics; Ecological and Non-chemical Weed Control; Chemical Weed Control; and Weed and Crop Resistance to Herbicides. At the General Assembly a presentation about ‘Simazine, dalapon and WSSI funny stories from the 2nd Weed Control Symposium in 1966’ was given by Mr. Doron Baum (CTS group). Certificates of Honour were presented to recently retired
members. The ‘Goldwasser-Zysman Student Scholarship for Advanced Studies on Parasitic Plants’ was presented by Dr. Yaakov Goldwasser on behalf of his family in memory of family members who died during the Holocaust, with the aim of strengthening advanced studies on parasitic plants in modern Israel. The scholarships were awarded to Ms. Tal Shilo from Newe Ya’ar Research Center for her thesis ‘Physiological aspects of the interaction between tomato and Egyptian broomrape’ and to Mr. Amnon Kochavi from the Faculty of Desert studies at the Ben-Gurion University of the Negev, for his thesis ‘The effect of abiotic stresses on broomrape-host plant interactions’.

WSSI president Mr. Shaul Graf passes the gavel to the new president Dr. Evgenia Dora

The conference ended with a formal anniversary dinner, during which WSSI members and invited guests enjoyed delicious food and made a toast in honor of the occasion. Honorary WSSI president Prof. Baruch Rubin shared his memories about his start in weed research after joining the WSSI in 1967. Dr. Tuvia Yaakobi presented a film about the use of sprayers in the late 1960s. Ex Head of the Weed Research Department at Newe Ya’ar Research Center, Dr. Yeshayahu Kleinfeld, congratulated all present WSSI members on the society’s anniversary and wished WSSI 50 more years of fruitful research. Mr. Evgeny Smirnov presented a film about the history of the WSSI. The members shared joyful memories of WSSI activities.

WSSI President Evgenia Dor
Weed Research Dept., Newe Ya’ar Research Center, ARO, Israel

THE WONDROUS CYNOMORIUM

Among the several thousand parasitic plants that thrive in a wide range of ecosystems, a few hold a special position, either for their scientific interest, economic importance, or historical relevance. Cynomorium belongs to the latter, exclusive guild.

The only genus in the family Cynomoriaceae, Cynomorium hosts two species of non-photosynthetic holoparasites growing on the roots of a variety of host plants: *C. coccineum* L., widespread in the Mediterranean region (Portugal and Spain, Italy, Greece, northern Africa) and also found in the Middle East and in the Arabian peninsula, and *C. songaricum* Rupr., which occurs in Iran, Afghanistan, China, and Mongolia (some authors consider *C. songaricum* a subspecies of *C. coccineum*).

The deep purple, fleshy flowering stems of *Cynomorium*, up to 25 cm high, emerge from a branched, subterranean and perennial rhizome. The club-shaped inflorescence bears a multitude of tiny female, male, and hermaphroditic flowers. In the case of *C. coccineum*, the stems emerge from the ground in April-May, typically associated with host plants belonging to the Chenopodiaceae, Amaranthaceae, Cistaceae and some other plant families. Recent phylogenetic studies have indicated that *Cynomorium* is not related to the tropical obligate parasites within the Balanophoraceae (which they resemble morphologically), as reported by most classifications, but rather is close to the Saxifragales (Nickrent *et al.*, 2005).

*Cynomorium coccineum*. Photo: Antonio Rescigno

Both *C. coccineum* and *C. songaricum* have a long history of use in traditional medicine. In China, *C. songaricum* – known as *Suo Yang* in the Chinese Pharmacopeia – has been indicated for the treatment of impotence, premature ejaculation, kidney-yang deficiency, and spermatorrhea (Cui *et al.*, 2013). In Saudi Arabia and bordering countries, *C. coccineum* has been known and used for centuries. Called *Tarthuth*, it was an important food source in times of famine or food shortage in desert lands, both for men and their camels, and was highly regarded in folk medicine, as a drug with aphrodisiac, spermatopoietic, tonic and astringent properties (Lebling, 2003). In the wider Mediterranean region, this plant was dubbed ‘Maltese Mushroom’, or ‘Fungus Melitensis’, owing to the fact that after learning of its curative properties from the Arabs, the Knights of Military Order of Malta introduced it in the European medical practice, and traded the plant powder for the cure
of apoplexy, dysentery, venereal diseases, ulcers, vomiting, and so on. The Knights even discovered the plant as naturally occurring in the Maltese Islands, vigorously guarding the growing sites (such as Fungus Rock, off Gozo) to protect their treasure (Lanfranco, 1960).

The large Mediterranean islands certainly make an important habitat for *Cynomorium*. Besides Malta, the plant grows on Crete, Sicily, Corsica and Sardinia. In these areas, the plant is mainly restricted to the coast or in retrodunal marshes, where it parasites halophytic plants such as *Atriplex*, *Inula*, and *Tamarix*.

Together with several colleagues, we have recently started a project aimed at the detailed characterization of the biochemical composition of *C. coccineum* as spontaneously occurring in Sardinia, and of its nutraceutical and pharmaceutical properties. In the island, this plant was traditionally used as antidiarhetic remedy, and for its astringent and antihemorrhagic properties (the aerial part was also a source of a dye for textiles and small wooden crafts).

In a first run of experiments, we evaluated the antioxidant potential of fresh specimens of *C. coccineum*. Both aqueous and methanolic extracts were rich in phenolics and flavonoids and showed a significant total antioxidant power, also exerting an *in vitro* protective effect in different bioassays of oxidative stress (Zucca et al., 2013). Further, fixed oil obtained from dried stems of the plant was able to increase the amount of essential fatty acids in normal intestinal epithelial cells (Rosa et al., 2012). Taken together, these data indicate the value of *C. coccineum* as a potential source of antioxidants and phytochemicals useful in the preparation of nutraceuticals and functional foods.

The fixed oil of *C. coccineum* also displayed a significant growth inhibitory effect on B16F10 melanoma and colon cancer Caco-2 cells, and even to potentiate the growth inhibitory effect of the antitumor drug 5-fluorouracil in Caco-2 cells (Rosa et al., 2015). Next, we attempted to assess the antifungal activity of *C. coccineum* extracts, finding that the methanolic extract was very active against *Cryptococcus neoformans*, *Candida guillermondii* and *Candida krusei* (Gonçalves et al., 2015). Thus, *C. coccineum* is indeed endowed with intriguing biological activities, revealing a so far untapped potential as source of therapeutics for specific pharmaceutical applications.

‘It ought to be kept in mind, that in ancient times most plants, especially aromatic species, or those that in one way or other struck man as having some peculiar shape or property, were made use of for medicinal or culinary purposes. Most of these plants, however, contain no real property able to combat ailments’ warns Lanfranco in his account on *C. coccineum* (Lanfranco, 1960).

Although this is a wisely cautionary approach to the much claimed (and often non-existent) properties of plants used in traditional medicine, it seems not apply to the magnificent *Cynomorium*, which has just begun to reveal its secrets.

**References**


Rosa A, Rescigno A, Piras A, Atzeri A, Scano P, Porcedda S, Zucca P. 2012. Chemical composition and effect on intestinal Caco-2 cell viability and lipid profile of fixed oil from *Cynomorium coccineum* L. Food and Chemical Toxicology 50: 3799-3807

**PRESS REPORTS**

**Mistletoebird: Australia’s native flowerpecker**

Flowerpecker birds (Dicaeidae) from the tropical regions of southern Asia are pretty little songbirds that do a fantastic job at combining the drab greys, greens, olives, whites and tans of their plumage with spectacular washes of colour.

A male Mistletoebird (*Dicaeum hirundinaceum*) near Lake Ginninderra, Canberra (Credit: Duncan McCaskill)

You might be wondering why we don’t just call the species the fire-breasted firepecker, which is objectively a far better name than the mistletoebird, but its relationship with mistletoe is what makes this bird so special. It feeds off the berries of the mistletoe plant, and in return for this constant food source, the birds have evolved to be the perfect carrier and distributor of the seeds within. Unlike many other birds, the mistletoebird has no gizzard - a specialised pouch behind its stomach - to grind its food, which means the fruit of the berries can be digested without the seeds inside being destroyed. According to scientists from James Cook University in Queensland, to further protect the consumed mistletoe seeds, the mistletoebird also has a modified sphincter muscle located at the base of its stomach, which can be closed to prevent the seeds from mixing with harsh digestive enzymes. This means they can basically travel all the way through the gut and be pooped out on the other side and still be fit for germination. ‘The seeds are sticky when excreted, and often several seeds are linked in a long glutinous thread, which adheres to the branch due to the bird’s habit of restless switching about. Which is super-gross, but kind of genius, because the seeds can stay put in the safety of mistletoe branches while they wait to be germinated, and the practice ensures a never-ending supply of mistletoe berries for the mistletoebird!’

The species is found all over Australia, except in the driest parts of Tasmania. It’s also native to the eastern Malauku Islands of Indonesia,


**Hunt to kill Red Witchweed drags past the 18 month mark**

Canegrowers Mackay is standing firmly behind its growers impacted by notifiable pest red witchweed (*Striga asiatica*) as the time spent on finding a resolution drags past the 18 month mark. Chairman Kevin Borg said deliberations between the Federal Government and Biosecurity Queensland, and other industries potentially at risk, had been underway since the Class 1 pest was first found on Mackay region farms. ‘Since then, four cane growers and one grazier have suffered significantly through what has been a very long, drawn-out process,’ Mr Borg said. ‘The gift to these primary producers of a resolution appears to be constantly hovering on an ever-moving horizon.’

Mr Borg said a recommendation has been put forward to advise on an eradication plan for red witchweed, and Canegrowers has agreed to be a part of this with a caveat that it is finalised with a mid to end of February timeframe.

‘Our growers are close to breaking point - they have lost patience, and frankly I cant blame them.’

He said he was hopeful a resolution - an effective and viable eradication and management plan - would be forthcoming by the new deadline.

Rebecca Strang, *Daily Mercury*
25th Jan 2015

**OBITUARIES**

**DALE HESS 1954-2015**

**Remembering an inspiring colleague and *Striga* expert, Dr. Dale E. Hess**

Dale Hess, a passionate plant pathologist, *Striga* expert, and teacher of agro-ecology passed away on March 1, 2015, after living with cancer for three years. He left his wife Ursula, their three sons and two grandchildren behind.

Dale Hess was born June 12, 1954 in Shirati, Tanzania. Dale’s career reflected his love to his native Africa, language, people, and the environment. After graduating from Millersville State College in 1976 and serving with Mennonite Central Committee in Burkina Faso, he was introduced to the diversity of savanna plants. While working as a plant pathologist in West Africa he became acutely aware of the importance of sustainable food production systems adapted to their cultural context. He pursued a graduate degree in the plant sciences from Purdue University in 1984, and a doctoral degree from Purdue in 1989. From 1990-2001 he served as Principal Scientist in Cereal Pathology at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in West...
Africa (Niger and Mali). From there he moved as Visiting Assistant Professor of Agronomy to Purdue University. For the last ten years he was employed by Goshen College (Indiana) and worked as the Ecological Field Station Director and Associate Professor of Agroecology in the Sustainability and Environmental Education Department.

During his studies at Purdue University, and as Principal Pathologist at ICRISAT in West Africa, Dale contributed important knowledge regarding the genetic and physiological basis of *Striga hermonthica* resistance in sorghum and pearl millet, and developed promising *Striga* management strategies, including bio-control options. Among many other exciting results, he developed (in Prof. Gebisa Ejeta’s group) the famous “agar-gel assay” as an easy, fast and cost-effective measure for a genotype’s ability to stimulate *Striga* seed germination (Hess et al. 1992; Phytochemistry 31(2): 493-497 - cited 133 times according to Google Scholar). This assay has been used by numerous people, and has also been developed further to study additional resistance mechanisms. Meanwhile, also the first *Striga*-resistant sorghum cultivars developed by marker-assisted transfer of the resistance QTL identified under Dale’s leadership in 2004 (Theoretical and Applied Genetics 109: 1005-1016) have been released by a different group in Sudan (Journal of Plant Science and Molecular Breeding, http://dx.doi.org/10.7243/2050-2389-3-3).

Dale was a great person, appreciated all over the world. He had excellent visions for a sustainable agriculture and shared his knowledge with many people. His work will live on, contributing to a better, more sustainable and food secure future.

Bettina Haussmann (Bettina.Haussmann@uni-hohenheim.de)

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YEŠHAYAHU (‘SHIEKE’) KLEIFELD 1934-2015

Yešhayahu (‘Shieke’) Kliefeld was born in 1934 in the agricultural high school Mikve Yisrael near Tel Aviv, in which his father worked as the vegetable growing manager. One year later the family moved to Moshav Netaim in central Israel in which he worked from an early age on the family vegetable farm. From early youth he learned from his father how to grow different crops and combat their pests and weeds. At age 16 Shieke moved by himself to study at the Bet-Yerach high school near the Sea of Galilee.

Following his army service he joined Kibbutz Eyal in which he worked in the vegetable fields and citrus groves. At the age of 23 after marrying Ria, the young family left the kibbutz and Shieke went to receive his B.A. and M.Sc. in agriculture in the Hebrew University of Jerusalem and later in the Rehovot Faculty of Agriculture campus of the Hebrew University of Jerusalem. The title of his M.Sc. thesis was: ‘Evaluation of herbicides for selective weed control in peanuts’. After completing his degrees he started to work as an agricultural consultant for the extension service of the Israeli Ministry of Agriculture and at the age of 30 he moved with his family to Tivon in northern Israel and joined the Newe Yaar agricultural research station of the Ministry of Agriculture. In parallel to his work he completed his PhD studies in the Hebrew University of Jerusalem and the title of his thesis being ‘Elucidating the mechanism of wheat selectivity to terbutryn’. After a few years he became head of the department in which he served until his retirement at age 65. Shieke was a member of national and international weed science societies including the WSSA and a member of numerous committees of the Ministry of Agriculture including the committee for pesticide registration. Shieke served as the President of the Israeli Weed Science Society in 1981 and was granted honorary membership in 2005. He was the Editor of ‘Aley Esev’, the bulletin of the Israeli Weed Science society. Throughout his career he published numerous papers in local and international scientific journals.

Bettina Haussmann (Bettina.Haussmann@uni-hohenheim.de)
After his retirement Shieke continued to be active as a consultant and lecturer and in recent years he developed together with the ‘Netafim’ drip irrigation company protocols for drip chemigation of herbicides in many crops. He conducted more than 100 field trials on this issue and his pride was the development of successful chemigation of herbicides to control broomrape in tomato and sunflower. Shieke was a ‘down to earth’ person with a wealth of practical knowhow in crops and weeds, extremely thorough in his research and writing and throughout his career listened to the needs of the farmers and devoted most of his time to solving their problems in the field.

Shieke died suddenly on May 5th 2015, one week before his 81st birthday in a week when he was busy with field trials and preparing a lecture on herbicide application via drip irrigation he was to present in a symposium at the same week. Shieke is survived by his wife Ria, three sons, nine grandchildren and one great granddaughter.

May he rest in peace.

Yaakov Goldwasser

NEW JOURNAL
‘ADVANCES IN PARASITIC WEED RESEARCH’

A new Frontiers journal ‘Advances in Parasitic Weed Research’ has been launched ‘The goal of this Research Topic is not only to present the most advanced research dealing with the management of parasitic weeds, but also to attract valuable articles on biology, physiology of parasitism, genetics, population dynamics, resistance, host-parasite relationships, regulation of seed germination, etc., in order to offer an outstanding windows to these enigmatic plants, and contribute to their practical management.’

Topic editors are Monica Fernandez-Aparichio, Maurizio Vuro and Hannan Eizenberg.

Publication fees can be as high as $1900 but reduced fees are available:
- ‘Frontiers is always eager to consider solutions for any barriers to publication. In cases where authors genuinely do not have the means to pay our publishing fees, they can apply for full or partial waivers depending on the financial capability of the corresponding author of the paper. Priority is given to lower income countries, but individual limiting factors affecting the corresponding author are also taken into account. Low income countries are determined based on the following guidelines:
  - Up to 100% waivers are available for corresponding authors from ‘low income’ countries, as defined by the World Bank Country Classification table calculated using the ‘Atlas method’ (GNI per capita less than US$ 664 - see this reference).

For more information see: [http://journal.frontiersin.org/journal/plant-science/section/crop-science-and-horticulture](http://journal.frontiersin.org/journal/plant-science/section/crop-science-and-horticulture)

FUTURE MEETINGS

Second International Legume Society Conference, scheduled for 11th to the 14th October, 2016 at the Tróia resort, near Lisbon, Portugal. Papers on parasitic weeds will be welcome. For more information see: [http://www.itqb.unl.pt/meetings-and-courses/legumes-for-a-sustainable-world](http://www.itqb.unl.pt/meetings-and-courses/legumes-for-a-sustainable-world)

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: [http://www.parasiticplants.org/](http://www.parasiticplants.org/)

For past and current issues of Haustorium see also: [http://www.odu.edu/~lmusselm/haustorium/index.shtml](http://www.odu.edu/~lmusselm/haustorium/index.shtml)

For the ODU parasitic plant site see: [http://www.odu.edu/~lmusselm/plant/parasitic/index.php](http://www.odu.edu/~lmusselm/plant/parasitic/index.php)

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: [http://www.parasiticplants.siu.edu/](http://www.parasiticplants.siu.edu/)

For the Parasitic Plant Genome Project (PPGP) see: [http://ppgp.huck.psu.edu/](http://ppgp.huck.psu.edu/)


For information on the EU COST 849 Project (now completed) and reports of its meetings see: [http://cost849.ba.cnr.it/](http://cost849.ba.cnr.it/)


For information on the EWRS Working Group ‘Parasitic weeds’ see: [http://www.ewrs.org/parasitic_weeds.asp](http://www.ewrs.org/parasitic_weeds.asp)

For a description and other information about the Desmodium technique for Striga suppression, see: [http://www.push-pull.net/](http://www.push-pull.net/)

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: [http://www.aatf-africa.org/](http://www.aatf-africa.org/)
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For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes up to 1995, but apparently incomplete since then) see: http://www.rmrsw.nau.edu/mistletoe/

For information on future Mistel in der Tumortherapie Symposia see: http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)

**THERAPEUTIC USES OF PARASITIC PLANTS: ARE YOU INTERESTED?**

The literature lists in Haustorium include a substantial proportion of papers on medicinal uses. We consider that these are relevant, and there is often useful incidental information on the distribution and other aspect of the species involved but we are seeking your help:

We would welcome comments on the usefulness of these references and whether we should continue including them. In this issue they are highlighted in blue.

Due to the a substantial proportion of papers on medicinal uses - is there someone who would like to help prepare the brief entries on these papers and guide our readers to the more important research results? Any contribution of this nature would be warmly acknowledged.

Do please respond to any of the editors listed at the end of the newsletter

**LITERATURE**

*indicates web-site reference only

Items in bold selected for special interest

Items in blue relate to therapeutic uses of parasitic plants

Abdalla, M.M.F., Shafik, M.M. and El-Wahab, M.M.H.A. 2014. Investigations on faba beans, *Vicia faba* L. 33. Bulk vs. individual selection in variety Cairo 25 grown under *Orobanche* stress and free field. Bulletin of Faculty of Agriculture, Cairo University 65(3): 243-254. ['Although many individual selections performed better than bulks, some bulk selections had better performance than some individual selections. Selection under *Orobanche crenata* stress condition can not be absolutely effective under stress and non stress conditions.']


Abraham Yirgu, Alemu Gezahgne, Habtemariam Kassa and Minilik Tsegay 2014. Parasitic plant in natural *Boswellia papyrifera* stands at Humera, Northern Ethiopia. Journal of Forestry Research 25(4): 923-928. [*B. papyrifera* is a source of frankincense. In the sample plot 38% of trees were infested by *Tapinanthis globiferus* (1-33 infections per tree) mainly on smaller branches. Other tree species were not infected.]

Acharya, B.D. 2013. Relationship between seed viability loss and seed bank reduction of *Orobanche aegyptiaca* Pers. using non-host crops. Ecorprint: An International Journal of Ecology 20: 97-106. [Field experiments in Nepal showed that over a period not defined in the abstract, the decline in viable seeds of *O. aegyptiaca* was 76%, most of this being due to edaphic factors, the trap-cropping effect contributing only 24%.

Acimovic‘, M., Maširevic‘, S., Balaž, J., Pavlovic‘, S., Olijača, S., Trkulja, N. and Filipovic‘, V. 2014. (Diseases and pests of fennel.) (in Serbian) Biljni Lekar 42(3): 81-88. [It is concluded that ‘mistletoe’ (not defined but presumably *Viscum album*) possesses hypoglucemic properties that can be very useful in the management of diabetic hyperglycemia.]


Adegbite, O.S., Akinsanya, Y.I., Kukoyi, A.J., Iyanda-Joel, W.O., Daniel, O.O. and Adebayo, A.H. 2015. Induction of rat hepatic mitochondrial membrane permeability transition pore opening by leaf extract of *Olax subscorpioidea*. Pharmacognosy Research 7(5)(Suppl.): 63-68. [Results suggest that extracts of *O. subscorpioidea* could have use in pathological conditions that require an enhanced rate of apoptosis.]


Anić, M., Pernar, R.; Bajic, M.; Seletkovic, A. and Kolic, J. 2014. Detecting mistletoe infestation on silver fir using hyperspectral images. iForest 7: 85-91. [Silver fir is an important crop in Croatia and Viscum album ssp. abietis is an increasingly serious problem accentuating other stress factors even leading to mortality. Surveying was performed using a hyperspectral scanner from a helicopter. Spectral Angle Mapper classification for 5° proved to be the best classification method. The results were confirmed by aerial surveying with a non-pilot aircraft from a height of about 30 m above the crowns. Results enable badly affected areas to be harvested early.]


Antonova, T.S., Stre'nikov, E.A., Guchel', S.Z. and Chelustnikova, T.A. 2014. (A variety of sunflower broomrape forms on sunflower in the South of Russia.) (in Russian) Zashchita i Karantin Rastenii 11: 45-48. [Describing a type of O. cumana producing multiple shoots from each tubercle and noting that some shoots had flowers developing below ground which produced viable seed.]


Anup Chandra. 2014 Infestation of Viscum album Linn. on Robinia pseudo-acacia Linn. Indian Journal of Forestry 37(3): 289-290. [Almost all R. pseudo-acacia were infested by V. album in the Rohru district of Himachal Pradesh surveyed.]

Armenia, Yuliandra, Y. and Sattar, M.Z.A. 2014. Comparative effectiveness of defatted hypotensive crude extract, ethyl acetate and butanolic fractions of Cassytha filiformis L. on different models of hypertensive rats. World Journal of Pharmacy and Pharmaceutical Sciences (WJPPS) 3(12): 200-208. [Results indicated that the hypotensive effectiveness of the defatted ethanolic extract of C. filiformis is better than its ethyl acetate or butanolic fractions and effects are greater on oxidative stress related hypertensive rats.]


Asmare Dejen. 2014. On-farm evaluation of push-pull system for stem borers and striga management on sorghum in Northeastern Ethiopia. Biopesticides International 10(2): 176-183. [Use of the push-pull system involving Desmodium intercrop and Napier grass surround reduced stemborer damage and emergence of Striga hermonothica leading to yield increases of 50-70% within one season as well as providing fodder, increasing soil fertility and reducing soil erosion.]

Atera, E.A., Onyang, J.C., Pham Thien Thanh, Ishii, T. and Itoh, K. 2015. Identification of QTL for Striga hermonothica resistance using backcross population derived from a cross between Oryza sativa (cv.}
Aybeke, M., Bahizire Kayeye, J.L., Ndegeyi Kabale, B., Batumike

Aydinlı, G. and Mennan, S. 2014. Effect of some plant

Badu-Apraku, B., Fakorede, M.A.B., Oyekunle, M., Yallou,

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Badu-Apraku, B., Fakorede, M.A.B., Oyekunle, M., Yallou,

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Aydınlı, G. and Mennan, S. 2014. Effect of some plant

Badu-Apraku, B., Fakorede, M.A.B., Oyekunle, M., Yallou,
produced by mixing winter and summer extracts in the edge of a high-speed rotating disk showed at least as good toxicity against cancer cells as a manually mixed extract."

Bayram, Y. and Çıkman, E. 2014. (An investigation of broomrape species (Orobanche spp.) in lentil and tomato fields, and infestation and density of Pytomyza orobanchia Kaltenbach, 1864 (Diptera: Agromyzidae) on broomrape species, in Dıyarbakır Province.) (in Turkish) Türkiye Biyolojik Mücadele Dergisi 5(2): 121-135. [In lentil fields, the density of O. crenata and O. aegyptiaca was 1-18/m², while in tomato, the density of broomrape (O. ramosa and O. aegyptiaca) was 1-10/m². All lentil and tomato fields were infested with Orobanche spp. and all the Orobanche was infested with P. orobanchia. Its possible use in integrated control is discussed.]


Bentley, J. and van Mele, P. 2015. Videos inspire farmers to experiment. Farming Matters 31(1): 38-39. [Describing the use of videos prepared by AccessAgriculture to help farmers understand that soil fertility is a key to controlling Striga (especially by using compost) and are encouraging farmers to start experimenting. See http://www.accessagriculture.org/node/1748/en for the composting video.]

Binu, N.K., Ashokan, P.K. and Balasundaran, M. 2015. Influence of different arbuscular mycorrhizal fungi and shade on growth of sandal (Santalum album) seedlings. Journal of Tropical Forest Science 27(2): 158-165. [Glomus mosseae was shown to be the most effective of 3 Glomus spp. tested and some useful data obtained on interactions with shade.]


Bozkurt, M.L., Muth, P., Parzies, H.K. and Haussmann, B.I.G. 2015. Genetic diversity of East and West African Striga hermonthica populations and virulence effects on a contrasting set of sorghum cultivars. Weed Research (Oxford) 55(1): 71-81. [This study involving samples of S. hermonthica from 5 sites in East and West Africa, and 16 sorghum cultivars demonstrated some tendency for Striga samples from East Africa to be more virulent than those from West Africa, but only 8% of genetic variation was attributable to the region of origin and 91% occurred within populations, emphasising the potential for natural selection and hence adaptation to resistant varieties locally, and the need to supplement the use of resistant varieties with other integrated techniques.]

Candia, A.B., Medel, R. and Fontürbel, F.E. 2014. Indirect positive effects of a parasitic plant on host pollination and seed dispersal. Oikos 123(11): 1371-1376. [Confirming that infestation of Rhaphithamnus spinosus by Tristerix corymbosus results in increased seed rain and seedling establishment due to seed dispersal processes rather than pollination effects.]

Cardoso, L.J.T., Mauad, L.P., Braga, J.M.A. 2015. Lophophytum weddellii Hook. f. (Balanophoraceae): first records for the Brazilian flora. Check List 11:1678. [This species, known previously only from Colombia and Peru, is reported from the Serra do Divisor National Park near the border with Peru.]

Carraz, M., Lavergne, C., Jullian, V., Wright, M., Gairin, J.E., Gonzales de la Cruz, M. and Bourdy, G. 2015. Antiproliferative activity and phenotypic modification induced by selected Peruvian medicinal plants on human hepatocellular carcinoma Hep3B cells. Journal of Ethnopharmacology 166: 185-199. [Krameria lappacea among species used traditionally for liver and digestive disorders and shown to have significant antiproliferative activity against Hep3B cells. This was associated with a lack of toxicity on primary human hepatocytes in vitro.]


Chapman, T.F. 2015. Reintroduced burrowing bettongs (Bettongia lesueur) scatter hoard sandalwood (Santalum spicatum) seed. Australian Journal of Zoology 63(1): 76-79. [The marsupial rat, B. lesueur is shown to have a valuable potential role in spreading seed of S. spicatum to new sites.]

Chkhubianishvili, T., Kakhadze, M., Malania, I., Chubinishvili, M., Shkirtladze, R. and Rizhamadze, I. 2015. Basis for developing biotechnology for plant protection means in Georgia. International Journal of Agricultural Technology 11(2): 275-286. [O. cumana is the major pest of sunflower crops in Georgia. Fusarium oxysporum var. orthoceras from Israel has shown excellent results in preliminary studies.]

inhibited germination of GR24-treated broomrape seeds.]
Clayson, C., García-Ruiz, I. and Costea, M. 2014. Diversity, evolution, and function of stoma bearing structures in Cuscuta (dodders, Convolvulaceae): from extraloral nectar secretion to transpiration in arid conditions. Perspectives in Plant Ecology, Evolution and Systematics 16(6): 310-321. [Describing the occurrence of secretory extraloral nectaries (in Monogyne species only) and stomatiferous protuberances, which are non-secretory (ubiquitous on the flowers of Cuscuta and Pachystigma, but absent on their stems, while occurring on haustorial stems of Grammica spp. – not on vegetative stems). Observations on water uptake and transpiration suggest that the latter have evolved to stimulate host water uptake under dry conditions.]
Corbet, S.A. and Huang ShuangQuan. 2014. Buzz pollination in eight bumblebee-pollinated Pedicularis species: does it involve vibration-induced triboelectric charging of pollen grains? Annals of Botany 114(8): 1665-1674. [Explosive pollen release in Pedicularis is stimulated by the precise frequency of buzzing by Bombus frisianus bees. Different species of Pedicularis require worker bees of particular size, and the frequency of buzzing may have to vary according to size and pollen load of the flowers, apparently resulting in triboelectric (static) charging.]
Costea, M., García, M.A. and Stefanovic, S. 2015. An phylogenetically based infrageneric classification of the parasitic plant genus Cuscuta (Dodders, Convolvulaceae). Systematic Botany 40(1): 269-285. [A new phylogenetic classification is proposed that places all 194 currently accepted Cuscuta species into four subgenera and 18 sections. An identification key, an overview of morphology, geographical distributions, taxonomic notes, and lists of included species are also provided.]
Dakskobler, I. 2015. (New localities and phytosociological characteristics of sites of selected rare phanerogams in Slovenia and north-eastern Italy. Hladnikia 35: 3-25. [Recording new localities in Slovenia for Orobanche elatior, O. alsatica ssp. alsatica and Pedicularis hoermanniana.]
Das, M., Fernández-Aparicio, M., Yang, Z.Z., Huang, K., Wickett, N.J., Alford, S., Wafula, E.K., Depamphilis, C., Bouwmeester, H., Timko, M.P., Yoder, J.I. and Westwood, J.H. 2015. Parasitic plants Striga and Phelipanche dependent upon exogenous strigolactones for germination have retained genes for strigolactone biosynthesis. American Journal of Plant Sciences 6(8): 1151-1166. [Results indicate that S. hermonthica and P. aegyptiaca have retained functional genes involved in strigolactone biosynthesis, suggesting that the parasites use both endogenous and exogenous strigolactones and have mechanisms to differentiate between the two.]
Dash, R., Mishra, M.M. and Ranasingh, N. 2015. Management of Cuscuta in niger under south eastern hilly regions of Odisha. Environment and Ecology 33(1B): 605-606. [Reporting partial control of Cuscuta (presumably C. campestris) and 10% yield increase in niger seed with pre-emergence treatments of pendimethalin and imazethapyr, but best treatments involved a stale seedbed which may have contributed – there was no stale seed-bed control.]
De Cuypers, C., Fromentin, J., Yocco, R.E., de Keyser, A., Guillotin, B., Kunert, K., Boyer, F.D. and Goormachtig, S. 2015. From lateral root density to nodule number, the strigolactone analogue GR24 shapes the root architecture of Medicago truncatula. Journal of Experimental Botany 66(1): 137-146. [Showing that strigolactone reduces the lateral root density in M. trunculata and affects nodulation by Sinorhizobium meliloti, increasing nodule number at 0.1 μM GR24 but strongly reducing it at 2 and 5 μM.]
Delprête, P.G. 2014. Ombrophylum guayanensis, the first record of subfamily Lophophytioideae (Balanophoraceae) in the Guayana Shield. Phytotaxa 175:263-269. [A recent collection from French Guiana was identified as a species of Ombrophylum unknown to science (O. guayanensis), which is here described and illustrated.]
effects of hemiparasitic plant removal on community structure and seedling establishment in semi-natural grasslands. Journal of Vegetation Science 26(3): 409-420. [Removal of Rhinanthus angustifolius significantly affected the abundance of species relative to control plots, both positively and negatively, and decreased the species evenness while removal of Pedicularis sylvatica only increased the abundance of some species. Juncaceae were increased by removal of either. It is proposed as a new hypothesis that species with persistent clonal spread are more vulnerable to parasitism.]


Dinesh Aryal and Nadeem Khan. 2015. Anxiolytic and motor coordination activity of ethanolic and aqueous extracts of Dendrophthoe falcata leaves in mice. International Journal of Pharmaceutical Sciences and Research (IJPSR) 6(4): 1753-1760. [Concluding that the ethanolic extract from leaves of D. falcata has anxiolytic activity, perhaps by acting as the benzodiazepine recognition site of the GABA-benzodiazepine receptor complex.]


Dong LiNa, Wang Hong, Wortley, A.H., Li DeZhu and Lu Lu. 2015. Fruit and seed morphology in some representative genera of tribe Rhinanthaeae sensu lato (Orobanchaceae) and related taxa. Plant Systematics and Evolution 301(1): 479-500. [Describing the fruit and seed morphology in 48 taxa of 22 genera in the tribe Rhinanthaeae s.l. and related genera of Orobanchaceae. Distinguishing five major types seed ornamentation viz. reticulate, crista-winged, sulcate, plicate and irregularly striate. Providing a key based only on fruit and seed characters.]

Donnapee, S., Li Jin, Yang Xi, Ge Aihua, Donkor, P.O., Gao XiMei and Chang YanXu. 2014. Cuscuta chinensis Lam.: a systematic review on ethnopharmacology, phytochemistry and pharmacology of an important traditional herbal medicine. Journal of Ethnopharmacology 157: 292-308. [C. chinensis has found use as a traditional medicine in China, Korea, Pakistan, Vietnam, India and Thailand, commonly as an anti-aging agent, anti-inflammatory agent, pain reliever and aphrodisiac. Phytochemicals isolated include at least 18 flavonoids; 13 phenolic acids; 2 steroids; 1 hydroquinone; 10 volatile oils; 22 lignans; 9 polysaccharides; 2 resin glycosides; 16 fatty acids. These phytochemicals and plant extracts exhibit a range of pharmacological activities that include hepatoprotective, renoprotective, antiosteoporotic, antioxidant, anti-aging, antimutagenic, antidepressant, improve sexual function, abortifacient effects, etc.]


El-Mokni, R., Domina, G., Sebei, H. and El-Aouni, M.H. 2015. Taxonomic notes and distribution of taxa of Orobanchaceae from Tunisia. Acta Botanica Gallica 162(1): 5-10. [Covering O. amethystea, O. canescens, O. hederae, O. litorea, O. minor and O. pubescens. O. litorea is new to North Africa, and O. canescens has been confirmed for North Africa more than 100 years after the only known collection. O. hederae and O. pubescens are new to Tunisia.]


among plants used as aphrodisiacs – but no proof of effectiveness provided.


Ezeaku, I.E., Angarawai, I.I., Aladele, S.E. and Mohammed, S.G. 2015. Correlation, path coefficient analysis and heritability of grain yield components in pearl millet (*Pennisetum glaucum* L.) parental lines. Journal of Plant Breeding and Crop Science 7(2): 55-60. [A study of 24 parental lines of pearl millet A/B pairs showed high to moderate broad-sense heritability; with panicle length expressing the highest heritability (78.95%), followed by grain yield (75.43%) and head weight (73.30%). Response to *Striga hermonthica* among the characters studied.]

Fan Rong Hua, Ding Wei, Ma Yu Ying, Lin Hong Li, Men Lei, Duan Meng Meng, Zhao Yun Li and Yu Zhi Guo. 2015. Development of a sensitive ultra high performance liquid chromatography with tandem mass spectrometry method for the simultaneous quantification of nine active compounds in rat plasma and its application to a pharmacokinetic study after administration of *Viscum coloratum* extracts. Journal of Separation Science 38(3): 530-540.


Furuhashi, T., Kojima, M., Sakakibara, H., Fukushima, A., Hirai, M.Y. and Furuhashi, K. 2014. Morphological and plant hormonal changes during parasitization by *Cuscuta japonica* on *Momordica charantia*. Journal of Plant Interactions 9(1): 220-232. [Parasitized *M. charantia* stems showed reduced photosynthetic activity while histological observation revealed an increased number of vascular bundles especially near the *C. japonica* haustoria. The defensive response of the host mainly involved the salicylic acid pathway. Drastic increase of cytokinins in host stems would play an important role for hypertrophy.]


Gathara, M., Makenzi, P., Kimondo, J. and Muturi, G. 2014. Prediction of *Orysis lanceolata* (Hochst. & Steud.) site suitability using indicator plant species and edaphic factors in humid highland and dry lowland forests in Kenya. Journal of Horticulture and Forestry 6(11): 99-106. [Known as African sandalwood, *O. lanceolata* has potential for commercial production in Africa. This survey established a consistent association with *Rhus natalensis* in highland forest. Hence the latter could be used as an indicator of suitable sites for plantations.]


Gibot-Leclerc, S., Reibel, C., le Corre, V. and Dessaint, F. 2015. Unexpected fast development of branched broomrape on slow-growing Brassicaceae. Agronomy for Sustainable Development 35(1): 151-156. [Pot experiments showed that *Phelipanche ramosa* developed faster on the relatively slow-growing *Capsella bursa-pastoris*, *C. rubella*, *Cardamine hirsuta*, *Lepidium campestre*, *L. draba* and *Sinapis arvensis* than on the fast-growing *Arabidopsis thaliana*.]

Ginman, E., Prider, J., Matthews, J., Virtue, J. and Watling, J. 2015. Sheep as vectors for branched broomrape (*Orobanche ramosa* subsp. *mutelii* [F.W. Schultz] Cout.) seed dispersal. Weed Biology and Management 15(2): 61-69. [Confirming that 7 days is a suitable quarantine period to allow loss of seed from attachment to the fleece or loss of viability following ingestion.]


Guchetl, S.Z., Antonova, T.S. and Tchelustnikova, T.A. 2014. Genetic similarity and differences between the *Orobanche cumana* Wallr. populations from Russia, Kazakhstan, and Romania revealed using the markers of simple sequence repeat. Russian Agricultural Sciences 40(5): 326-330. [Nineteen samples of *O. cumana* from Russia and Kazakhstan clustered in one gene pool while a second cluster consisted of 5 populations from Romania, all regardless of racial composition.]


Halida, J., Abubakar, L., Izege, A.U., Ado, S.G., Yakubu, H. and Haliru, B.S. 2015. Correlation analysis for maize grain yield, other agronomic parameters and *Striga* affected traits under *Striga* infested/free environment. Journal of Plant Breeding and Crop Science 7(1): 9-17. [Confirming that, unexpectedly, the flowers of *Rubia* were 37-40. [Taxis chinensis is just one of the components of Chinese herbal remedy ‘QR’ – the others being ‘Herba Epimedi, antler glue, Cibotium Barometz, eucommia bark, dipscus asper, two toothed achyranthes root, drynaria, ground beetle, scorpion, wild celery, nototerygium incisium, cow-fat seed, white mustard seed, and licorice root’. (NB. No eye of newt or toe of frog). The concoction showed useful results in adjunctive treatment of axial undifferentiated spondyloarthritis.]


Hobbhahn, N. and Johnson, S.D. 2015. Sunbird pollination of the dioecious root parasite *Cytinus sanguineus* (Cytinaceae). South African Journal of Botany 99: 138-143. [Confirming that, unexpectedly, the flowers of *C. sanguineus*, which are close to the ground under other vegetation are pollinated by sunbirds, as the floral structure and colour would suggest. Other species of *Cytinus* are pollinated by rodents or by ants. In South Africa.]


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Huish, R.D., Manow, M. and McMullen, C.K. 2015. Floral phenology and sex ratio of piratebush (Buckleya distichophylla), a rare dioecious shrub endemic to the Southern Appalachian Mountains. Castanea 80(1): 1-7. [Results on B. distichophylla (Santalaceae) show a male-biased sex ratio (61:39) of flowering individuals, with 15% nonflowering.]

Ibrahim, A., Ahom, R.I., Magani, I.E. and Musa, M.I. 2014. Spatial distribution and density of Striga hermonthica (Del.) Benth infestation associated with cereal production in Southern Guinea Savanna farming systems. Journal of Biodiversity and Environmental Sciences (JBES) 5(4): 419-427. [In Benue and Nasarawa states in southern Nigeria, 67% of the surveyed area was infested with a high density of S. hermonthica, mainly in sorghum, less in pearl millet. 40% of the farmers reported that new Striga control coping strategies, are received from extension agents, during Monthly Technology Review Meetings.]

Ifie, B.E., Badu-Apraku, B., Gracen, V. and Danquah, E.Y. 2015. Genetic analysis of grain yield of IITA and CIMMYT early-maturing maize inbreds under 2015. Genetic analysis of grain yield of IITA and sorghum, less in pearl millet. 40% of the farmers reported that new Striga control coping strategies, are received from extension agents, during Monthly Technology Review Meetings.


Aoki, K. 2015. A bioinformatics approach to distinguish gene expression in Cuscuta form new cellular connections, suggesting coordination of developmental and biochemical processes. RNA-Seq reads were classified as either belonging to the host or to the parasite. Analysis of gene expression profiles at 5 parasitizing stages revealed differentially expressed genes from both parasitic plant and a host-model, and parasites were identified as the most stable and high-yielding.]

*Ikue, D., Schudoma, C., Zhang WenNa, Ogata, Y., Sakamoto, T., Kurata, T., Furushashi, T., Krager, F. and Aoki, K. 2015. A bioinformatics approach to distinguish plant parasite and host transcriptomes in interface tissue by classifying RNA-Seq reads. Plant Methods 11(34) 16pp. (http://www.plantmethods.com/content/pdf/s13007-015-0066-6.pdf) [This paper described genomics studies of gene expression in Cuscuta. The host and the parasite form new cellular connections, suggesting coordination of developmental and biochemical processes. RNA-Seq reads were done from an interface region between C. japonica and host Impatiens balsamina. Sequencing reads were classified as either belonging to the host or to the parasite. Analysis of gene expression profiles at 5 parasitizing stages revealed differentially expressed genes from both parasitic plant and a host-model, and recovered some of the coordination of cellular processes between the two plants.]


*Ito, S. and 12 others. 2015. Strigolactone regulates anthocyanin accumulation, acid phosphatases production and plant growth under low phosphate condition in Arabidopsis. PLoS ONE 10(3) e0119724. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0119724) [Showing that the typical phosphate starvation responses in Arabidopsis are partially dependent on the strigolactone signaling pathway, suggesting a potential overlap between strigolactone signaling and phosphate starvation signaling pathways in plants.]


Kahiri, S., Rodenburg, J., Kayeke, J., van Ast, A., Makokha, D.W., Msangi, S.H., Irakiza, R. and Bastiaans, L. 2015. Can the parasitic weeds Striga asiatica and Rhamphicarpa fistulosa co-occur in rain-fed rice? Weed Research (Oxford) 55(2): 145-154. [The two species overlap in a region of southern Tanzania, but careful survey over the area, backed up by lot experiments confirm that while S. asiatica is favoured by free draining soils where non-parasitic indicator species include Pennisetum polysachichon, Rottboellia cochinchinensis and Mitracarpus hirtus, R. fistulosa is favoured by waterlogged soils associated with Ammania auriculata, Cypers distans, Fimbribistis littoralis and Orzya longistaminata. Hence different management strategies are required.]

Kaya, Y. 2014. Sunflower production in Balkan region: current situation and future prospects. Agriculture and Forestry 60(4): 95-101. [A comprehensive review of sunflower production in the Balkans and Turkey. Sunflower production is increasing in the region due to higher demand for oil crops. Turkey is the main importer in the region while other countries such as Romania, Bulgaria, Moldova and Serbia are among the main exporters in the world. Including discussion of Orobanche cumana and its control and noting that genetically herbicide resistant varieties and post-emergence application of imidazolinone herbicides controlling both O. cumana and the main broad leaved weeds, is increasing.]


*Kim KiWook, Yang SeungHoon and Kim JongBae. 2014. Protein fractions from Korean mistletoe (Viscum album coloratum) extract induce insulin secretion from pancreatic beta cells. Evidence-based Complementary and Alternative Medicine 2014: Article ID 703624. (http://www.hindawi.com/journals/ecam/2014/703624/) [Results suggest that V. coloratum could have use as a medicinal reagent to reduce blood glucose level in type I diabetic patients.]

Kim SoKho, Lee DongHo, Kim JaeKyung, Kim JaeHun, Park JongHeum, Lee JuWoon and Kwon JungKee. 2014. Viscotoxin isolated from Korean mistletoe improves nonalcoholic fatty liver disease via the activation of adenosine monophosphate-activated protein kinase. Journal of Agricultural and Food Chemistry 62(49): 11876-11883. [Viscotoxin, isolated from Viscum coloratum was shown to have potential for nonalcoholic fatty liver disease (NAFLD).]

Kim YoungJik. 2014. (Effects of dietary supplementation of red ginseng mare and Korean mistletoe powder on performance, and meat quality of broiler chicken.) (in Korean) Korean Journal of Poultry Science 41(3): 197-204. [Addition of 0.5% powder based on Viscum coloratum did not affect meat production in chickens but revealed minor improvements in lipid oxidative stability.]
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Kuijt J. 2015. New synonyms and comments on *Phoradendron* (Viscaceae). Phytologia 97(3):246-251. [Four previously published species are considered synonyms of *P. bolleanum* and five other names were synonymized. An amended description, illustration, and neotype are provided for *P. calvinii* Wiens.]


*Krause K. 2015. Grand-scale theft: Kleptoplasy in parasitic plants? Trends in Plant Science 20:196-198. [Based on experimental data from photosynthetic model plants, the author speculates about the possibility that *Rafflesia* has sequestered whole plasids from its host.]


Kudra, A., Chemining’wa, G.A. and Onwonga, R.N. 2014. Relationships between agronomic practices, soil chemical characteristics and *Striga* reproduction in dryland areas of Tanzania. Journal of Agricultural Sciences and Technology 2: 1134-1141. [Apparent some indication that increased potassium levels increased *Striga* infestation, but not clear what species of *Striga* involved, nor in which crop it was occurring. In view of the following, presumably *S. asiatica* in sorghum.]


Kuijt, J. 2015. Santalales. Pages 1-189 in Kubitzki, K, ed. The families and genera of vascular plants. XII Flowering plants: eudicots Santalales, Balanophorales, vol. 12. Cham Switzerland: Springer International Publishing. [A review of many aspects of the largest order of parasites, including information on their morphology, anatomy, fruits, seeds, seedlings, germination, parasitism, ethnobotany, and the author’s own view on their classification. The section on chemosystematics was written by K. Kubitzki; Balanophoraceae by B. Hansen and K. Kubitzki.]

Krause K. 2015. Grand-scale theft: Kleptoplasy in parasitic plants? Trends in Plant Science 20:196-198. [Based on experimental data from photosynthetic model plants, the author speculates about the possibility that *Rafflesia* has sequestered whole plasids from its host.]
63-65. [In this study in vitro cultures of P. ramosa were established on solid and liquid media in parallel. Results point out that development of P. ramosa calli was origin specific. The effect of antibiotic kanamycin on in vitro cultures of P. ramosa was examined with the aim to develop system for its genetic manipulation and selection of transgenic tissue using kanamycin-resistance approach. The selection pressure of kanamycin was stronger in liquid grown cultures.]


Larsen, B.H.V., Soelberg, J. and Jäger, A.K. 2015. COX-1 inhibitory effect of medicinal plants of Ghana. South African Journal of Botany 99: 129-131. [Extracts of Thunningia sanguinea (Balanophoraceae) showed over 90% inhibition of COX-1 activity at 0.1 µg/mL lending support to its use the traditional medicine system in Ghana.]

Lechat, M-M., Brun, G., Montiel, G., Véronési, C., Simier, P., Thoiron, S., Pouvreau, J-B. and Delavault, P. 2015. Seed response to strigolactone is controlled by abscisic acid-independent DNA methylation in the obligate root parasitic plant, Phelipanche ramosa L. Pomel. Journal of Experimental Botany 66(11): 3129-3140. [Seed dormancy release of the obligate root parasitic plant, P. ramosa, requires a minimum 4-day conditioning period followed by stimulation by host-derived germination stimulants, such as strigolactones. Germination is then mediated by germination stimulant-dependent activation of PrCYP707A1, an abscisic acid catabolic gene. The molecular mechanisms occurring during the conditioning period that silence PrCYP707A1 expression and regulate germination stimulant response are almost unknown. Here it is shown that the DNA methylation status during the conditioning period plays a crucial role independently of abscisacidic acid in the regulation of P. ramosa seed germination by controlling the strigolactone-dependent expression of PrcyP707A1.]


Li HongWu, Zhu Hui, Zhang ChongHai, Zhu WenYuan and Xia MingYu. 2014. (The effect of Paenonia veitchii Lynch and Cuscuta chinensis Lam extract on tyrosinase activity and expression of mRNA in guinea pig melanocytes.) (in Chinese) Chinese Journal of Dermatovenereology 28(12): 1216-1219. [Concluding that an ethanol extract of C. chinensis can up-regulate melanocyte tyrosinase activity and mRNA expression, and then induce the generation of cutaneous melanin, thus showing potential for treating pigmental disorders such as vitiligo.]

Li ZhenHua, Long Ping, Bai Sarula, Yang DaWei, Zhu Hong, Cui ZhanHu, Zhang ChunHong and Li MinHui. 2014. Chemical constituents from Cymbalaria dahurica L. (Scrophulariaceae). Biochemical Systematics and Ecology 57: 11-14. [Sixteen compounds, including 12 flavonoids and 4 iridoids, were extracted from the hemiparasite Cymbalaria dahurica (now in Orobanchaceae).]


Liu, J., He, H., Vitali, M., Visentin, I., Charmikhova, T., Haider, I., Schubert, A., Ruyter-Spira, C., Bouwmeester, H.J., Lovisolo, C. and Cardinale, F. 2015. Osmotic stress represses strigolactone biosynthesis in Lotus japonicus roots: exploring the interaction between strigolactones and ABA under abiotic stress. Planta 241(6): 1435-1451. [In L. japonicus, SL-depleted plants showed increased stomatal conductance, both under normal and stress conditions, and impaired resistance to drought associated with slower stomatal closure in response to abscisic acid (ABA). This confirms that SLs contribute to drought resistance in species other than Arabidopsis. However, osmotic stress rapidly and strongly decreased SL concentration in tissues and exudates of wild-type Lotus roots, by acting on the transcription of biosynthetic and transporter-encoding genes and independently of phosphate abundance. It was proposed that a transcriptionally regulated, early SL response to abscisic acid (ABA). This confirms that SLs contribute to drought resistance in species other than Arabidopsis. However, osmotic stress rapidly and strongly decreased SL concentration in tissues and exudates of wild-type Lotus roots, by acting on the transcription of biosynthetic and transporter-encoding genes and independently of phosphate abundance. It was proposed that a transcriptionally regulated, early SL decrease under osmotic stress is needed (but not sufficient) to allow the physiological increase of ABA in roots. This work shows that SL metabolism and effects on ABA are seemingly opposite in roots and shoots under stress.]

Liu QuanYu, Wang Fei, Zhang Lei, Xie JieMing, Li Peng and Zhang YongHong. 2015. A hydroxylated lupeol-based triterpenoid ester isolated from the Scurrula parasitica parasitic on Nerium indicum. Helvetica
Chimica Acta 98(5): 627-632. [A range of compounds were isolated from S. parasitica, six of which showed activity against cancer cell lines, PANC-1, HL-60, and SGC-7901. Activity apparently depended on the 3-OH group in lupeol-based triterpenoids.]


Liu Yang, Xiu Xiaoyou and Wang Wei Yun. 2015. (Optimization of phenylethyl alcohol glycosides extraction process from Cistanche tubulosa by response surface analysis (RSA)). (in Chinese) Journal of Anhui Agricultural University 42(2): 294-298. [Microwave extraction method showed the highest yield of phenylethyl alcohol glycosides in the shortest time, followed by the ultrasonic extraction method. The ethanol extraction method showed the lowest efficiency.]

Lone, Z.A., Yaqoob Lone, Khan, S.S., Wani, A.A. and Ma Yue Feng, Guo Cheng Lin, Ma Yong Lin, Qin Jian Lin, Lu Rong Sheng, Du Xiao Li, Huang Xuan Guang, Luo En Bo, Lu Qian, Li Gang, Wei Lu Yi and Yang Si Xia. 2014. (Investigation and analysis on garden dodder damage situation in Guangxi.) (in Chinese) Journal of Southern Agriculture 45(12): 2001-2006. [In a survey of 16 cities Cuscuta chinensis, C. japonica, C. reflexa and Cassytha filiformis were recorded on 62 hosts. C. japonica was the predominant problem.]


Maikumbi, D., Dielio, A., Kanampiu, F., Mugo, S. and Karaya, H. 2015. Agronomic performance and genotype × environment interaction of herbicide-resistant maize varieties in eastern Africa. Crop Science 55(2): 540-555. [In trials involving both Striga hermonthica and S. asiatica the best IR (imidazolizinson-resistant) maize variety, STR-VE-216, with herbicide seed-dressing yielded the Striga-tolerant and commercial genotypes by 113 and 89%, respectively, under Striga-infested conditions. Genotype × environment interactions were generally low.]

Manickavasagam, S. and Rameshkumar, A. 2013. Four new species of Gonotocerus Nees (Hymenoptera: Mymaridae) and a key to the species of asulcifrons group from India. Oriental Insects 47(1): 86-98. [Apparently occurring on Santalum spp.]

Manoj Kumar, Pandya-Kumar, N., Dam, A., Haor, H., Mayzlish-Gati, E., Belausov, E., Winingher, S., Abu-Abied, M., McErlean, C.S.P., Bromhead, L.J., Prandi, C., Kapulnik, Y. and Koltau, H. 2015. Arabidopsis response to low-phosphate conditions includes active changes in actin filaments and PIN2 polarization and is dependent on strigolactone signalling. Journal of Experimental Botany 66(5): 1499-1510. [PIN2 expression, PIN2 plasma membrane localization, endosome trafficking, and actin bundling were examined under low-Pi conditions: a MAX2-dependent reduction in PIN2 trafficking and polarization in the PM, reduced endosome trafficking, and increased actin-filament bundling were detected in root cells. Exogenous supplementation of the synthetic SL GR24 to a SL-deficient mutant (max4) led to depletion of PIN2 from the PM under low-Pi conditions. It was suggested that changes in PIN2 polarity, actin bundling, and vesicle trafficking are involved in the response to low Pi in roots, dependent on SL/MAX2 signaling.]

Maranho, A.S. and de Paula, S.R.P. 2014. (Diversity in an urban green area: qualitative evaluation of urban forest of the Federal University of Acre campus, Brasil.) (in Portuguese) Agro@mbiente On-line 8(3): 404-415. [Noting that Oryctanthus florulentus and Phthirusa stelis were frequent parasites in city trees, the latter predominant, occurring in 27% of the surveyed trees, Caesalpinia peltatae being the most frequent host followed by Mangiferina indica and Terminalia catappa.]

in response to variations in the physical environment. Photosynthetica 52(4): 493-500. [Mingquatia guianensis (Olacaceae) among species studied.]


Messias, P.A., Vidal Júnior, J.de D., Koch, I. and Christianini, A.V. 2014. Host specificity and experimental assessment of the early establishment of the mistletoe Phoradendron crassifolium (Pohl ex DC.) Eichler (Santalaceae) in a fragment of Atlantic Forest in southeast Brazil. Acta Botanica Brasileira 28(44): 577-582. [Although Lithraea molleoides, Tapirira guianensis and Siparuna guianensis were the commonest hosts, P. crassifolium appeared to have a wide host range and its prevalence or lack of it is more dependent on dispersal limitation than on mistletoe-host compatibility.]

Miao ZhongQin, Zhao DongPing and Guo YuHai. 2014. (Pectinase and cellulase produced by the parasite plant Cistanche tubulosa are involved in parasitising its host root.) (in Chinese) Journal of China Agricultural University 19(6): 88-94. [Confirming that pectinase and cellulase are involved in the invasion of the root of Tamarix chinesis by C. tubulosa haustoria.]


Mohammadi, A. 2014. Biological control of Orobanche ramosa by Fusarium solani. International Journal of Advanced Biological and Biomedical Research 2(11): 2751-2755. [Isolates of F. solani from diseased O. ramosa on tomato, eggplant, melon, and watermelon fields in Southern Khorasan were tested and found pathogenic to all stages of the parasite. But no mention of crop safety.]

*Mohsen Marvibaigi, Eko Supriyanto, Neda Amini and Fadzilah Adibah, A.M. 2014. Preclinical and clinical effects of mistletoe against breast cancer. BioMed Research International 2014: Article ID 785479. (http://www.hindawi.com/journals/bmri/2014/785479/) [Reviewing the benefits of Viscum album-based therapy in treatment of breast cancer and concluding there is ‘evidence that there might be a combination of pharmacological and motivational aspects mediated by the mistletoe extract application which may contribute to the clinical benefit and positive outcome such as improved quality of life and self-regulation.”]

Molehin, O.R. and Adefegha, S.A. 2015. Antioxidant and Ximenia americana [area.) (in Portuguese) Revista Caatinga 28(2): 188-196. [In the absence of evidence that 'safou' — Dacryodes edulis (Burseraceae), butterfruit in English - is extensively parasitized by Tapinanthes ogovenosis and by T. preussii.]


Murage, A.W., Midega, C.A.O., Pitchar, J.O., Pickett, J.A. and Khan, Z.R. 2015. Determinants of adoption of climate-smart push-pull technology for enhanced food security through integrated pest management in eastern Africa. Food Security 7(3): 709-724. [The new ‘climate-smart push-pull’ involves the more drought tolerant Desmodium intortum with Brachilia cv mulato II as the border crop. This detailed socio-economic study suggested that the revised technology should be acceptable and profitable (marginal rate of return over 100% for sorghum and maize) over considerable areas of Striga hermonthica-infested Kenya, Tanzania and Ethiopia, with gender, perceptions of Striga severity, technology awareness and input market access the most likely factors that would positively influence the decision to adopt.]

Musyoki, M.K., Cadisch, G., Enowashu, E., Zimmermann, J., Muema, E., Beed, F. and Rasche, F. 2015. Promoting effect of Fusarium oxysporum [f.sp. strigae] on abundance of nitrifying prokaryotes in a maize rhizosphere across soil types, Biological Control 83: 37-45. [It was concluded that ‘Foxy-2 F. oxysporum did not pose a negative effect on targeted indigenous microorganisms, but the underlying mechanisms for the observed promoting effect of ammonia-oxidizing archaeaa abundance are yet to be understood.]


Mussyoki, M.K., Cadisch, G., Enowashu, E., Zimmermann, J., Muema, E., Beed, F. and Rasche, F. 2015. Promoting effect of Fusarium oxysporum [spp. strigae] on abundance of nitrifying prokaryotes in a maize rhizosphere across soil types. Biological Control 83: 37-45. [Concluding that F. oxysporum (Foxy-2) applied to soil for control of Striga hermonthica did not pose a negative effect on targeted indigenous microorganisms, but the underlying mechanisms for an observed promoting effect on ammonia-oxidizing archaea (AOA) by Foxy-2 inoculation are yet to be understood.]


Mwangi, B., Obare, G. and Murage, A. 2014. Estimating the adoption rates of two contrasting Striga weeds control technologies in Kenya. Quarterly Journal of International Agriculture 53(3): 225-242. [A survey of 326 maize farmers in Western Kenya found 37% using push-pull technology, involving the use of Desmodium and 36.3% using Imidazolinone-resistant maize treated with herbicide. Potential take-up was estimated at 56% and 46% respectively.]


[Ximenia caffra is among plants used traditionally to control M. ovinus (a tick-like fly) but in this study of 12 species, X. caffra was relatively ineffective.]


Nwaehujor, C.O., Ode, J.O., Nwinyi, F.C. and Asuzu, O.V. 2014. Mechanism of action involved in the hepatoprotective activities of methanol extract of Cassytha filiformis L. aerial parts in CCl4-induced liver damage. Comparative Clinical Pathology 23(6): 1749-1755. [Extracts of C. filiformis are used in Nigeria to treat liver disorders including hepatitis and alcohol intoxication. Findings of this study suggest that a methanol extract of C. filiformis could be useful in protecting hepatocytes from toxins especially from alcohol intoxication.]

Ogunmefun, O.T., Olatunji, B.P. and Adarabioyo, M.I. 2015. Ethnomedicinal survey on the uses of mistletoe in South-western Nigeria. European Journal of Medicinal Plants 8(4): 224-230. [This study confirms the local beliefs in the merits of a range of mistletoes harvested from cocoa and Cola spp. including Phragmanthera, Agelanthus, Globimetula and Tapinanthes spp. for the treatment of diabetes, hypertension, insomnia and infertility but gives no details on individual species.]


Research 6(10): 27-3. [Recording relatively high antioxidant activity in Balanophora abbreviata.]

Patrick-Iwuanyanwu, K.C., Onyeike, E.N. and Adhikari, A. 2014. Isolation, identification and characterization of gallic acid derivatives from leaves of Tapinanthus bangwensis. Journal of Natural Products (India) 7: 14-19. [Describing the isolation of three gallic acid derivatives from the ethyl acetate fraction of leaves of T. bangwensis, which could be responsible for the therapeutic potential of this species.]

Paudel, P.N. and Rajendra Gyawali. 2014. Phytochemical screening and antimicrobial activities of some selected medicinal plants of Nepal. International Journal of Pharmaceutical and Biological Archives 5(3): 84-92. [The extract of Oxyris wightiana was among a number of species showing high activity against Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Proteus mirabilis, Salmonella typhi and Salmonella paratyphi. It was also active against Candida albicans but not against Trichoderma viridae.]


Pavlù, V., Pavlù, L. and Fraser, M.D. 2014. Long-term effects of extensification regimes on soil and botanical characteristics of improved upland grasslands. In: Hopkins, A. et al. (eds) EGF at 50: The future of European grasslands. Proceedings of the 25th General Meeting of the European Grassland Federation, Aberystwyth, Wales, 7-11 September 2014: 251-253. [Noting that lime application had relatively little effect on plant species composition, but decreased Rhinanthus minor which can initiate further steps within the extensification process. The most effective management for grassland biodiversity restoration was hay cutting with aftermath grazing.]


Pineda-Martos, R., Pujadas-Salvà, A.J., Fernández-Martínez, J.M., Stoyanov, K., Velasco, L. and Pérez-Vich, B. 2014. The genetic structure of wild Orobanche cumana Wallr. (Orobanchaceae) populations in eastern Bulgaria reflects introgressions from weedy populations. The Scientific World Journal 2014: Article ID 150432. (http://www.hindawi.com/journals/tswj/2014/150432/ ) [Populations of O. cumana were collected from wild hosts – mainly Artemisia maritima, but also A. arvensis and Chamamaelum nobile (also Asteraceae). These populations were not clearly genetically differentiated from populations attacking sunflower and could be equally virulent on crop varieties with resistance to races B to D, though none infected P96 with resistance to race F. Results emphasise the risks of out-crossing with ‘wild’ populations contributing to breakdown in resistance.]

Piwowarczyk, R. 2014. Orobanche flava (Orobanchaceae) in Poland: current distribution, taxonomy, hosts and plant communities. Biodiversity: Research and Conservation 34: 41-52. [Describing the taxonomy, biology and ecology of O. flava, occurring in southern Poland, mainly in the Carpathian mountains and, sporadically, in the Sudeten mountains.]


Piwowarczyk, R. and Krajewski, L., 2015. Orobanche elatior and O. kochii (Orobanchaceae) in Poland: distribution, taxonomy, plant communities and seed micromorphology. Acta Societatis Botanicorum Poloniae 84(1): 103-123. [Reporting a critical revision of herbarium and literature data on O. elatior s.l. in Poland, separating O. elatior s.s. from the closely related O. kochii. The taxonomy, host preferences (all on Centaurea spp. ?), and ecology are discussed and diagnostic features of the seeds described.]

Piwowarczyk, R., Madeja, J. and Nobis, M. 2015. Pollen morphology of the Central European broomrapes (Orobanchaceae: Orobanche, Phelipanche and Orobanchella) and its taxonomical implications. Plant Systematics and Evolution 301(2): 795-808. [Palynological data from 25 (18 new) species of Orobanche and Phelipanche are reported. The pollen of one species, O. coerulescens, is divergent prompting the authors to (controversially) segregate it into their newly named genus Orobanchella.]

Poczai, P., Varga, I. and Hyvönen, J. 2015. Internal transcribed spacer (ITS) evolution in populations of the hyperparasitic European mistletoe pathogen fungus, Sphaeropsis visc (Botryosphaeriaceae): the utility of
ITS2 secondary structures. Gene 558(1): 54-64. [Relating to S. visci occurring on V. album in Hungary.]

Praseeja, R.J., Sreejith, P.S. and Asha, V.V. 2015. Studies on the apoptosis inducing and cell cycle regulatory effect of Cuscuta reflexa Roxb chloroform extract on human hepatocellular carcinoma cell line, Hep 3B. International Journal of Applied Research in Natural Products 8(2): 37-47. [Results showed that the extract of C. reflexa is able to induce apoptosis in Hep 3B cells in a dose and time dependent manner through the intrinsic mitochondrial apoptotic pathway. It is thus a potential candidate for further development as an anti-HCC drug.]


*Qian ChaoDong, Fu YuHang, Jiang FuSheng, Xu ZhengHong, Cheng DongQing, Ding Bin, Gao ChengXian and Ding ZhiShan. 2014. Lasiodiplodia sp. ME4-2, an endophytic fungus from the floral parts of Viscum coloratum, produces indole-3-carboxylic acid and other aromatic metabolites. BMC Microbiology 14: 297. (http://www.biomedcentral.com/content/pdf/s12866-014-0297-0.pdf) [Identifying a fungal endophyte of V. coloratum as Lasiodiplodia sp., based on its molecular biological characteristics. Isolating 5 aromatic compounds from its culture, especially 2-phenylethanol, a common component of floral essential oils. Thus endophytic fungi isolated from plant flowers may be promising natural sources of aromatic compounds.]

Raftoyannis, Y., Radoglou, K. and Bredemeier, M. 2015. Effects of mistletoe infestation on the decline and mortality of Abies cephalonica in Greece. Annals of Forest Research 58(1): 55-65. [Showing significantly lower water potentials and higher photochemical efficiencies in Viscum album than in Greek fir branches and confirming a correlation between V. album infestation and decline of the fir.]

Rahmat, Z.B., Addo-Fordjour, P., Asyraf, M. and Rosely, N.F.N. 2014. Mistletoe abundance, distribution and associations with trees along roadsides in Penang, Malaysia. Tropical Ecology 55(2): 255-262. [In a survey the most abundant mistletoe species was Scirrula ferrarigina (718 individuals) followed by Dendrophthoe pentandra (585 individuals). Tahebuia pallida was the most frequently parasitised host.]


Ranjan, A., Ichihashi, Y., Farhi, M., Zumstein, K., Townsley, B., David-Schwarzt, R., Sinha, N.R., Edwards, R. and Hannah, M. 2014. De novo assembly and characterization of the transcriptome of the parasitic weed dodder identifies genes associated with plant parasitism. Plant Physiology 166(3): 1186-1199. [Infection of tomato by Cuscuta pentagona is accompanied, in the parasite, by increased expression of genes underlying transport and transporter categories, response to stress and stimuli, as well as genes encoding enzymes involved in cell wall modifications while expression of photosynthetic genes is decreased in the dodder infective stages compared with normal stem. In addition, genes relating to biosynthesis, transport, and response of phytohormones, such as auxin, gibberellins, and strigolactone, are differentially expressed in the dodder infective stages compared with stems and seedlings.]


Reblin, J.S. and Logan, B.A. 2015. Impacts of eastern dwarf mistletoe on the stem hydraulics of red spruce and white spruce, two host species with different drought tolerances and responses to infection. Trees: Structure and Function 29(2): 475-486. [Exploring why Arceuthobium pusillum is more damaging on white spruce (Picea glauca) than on red spruce (P. rubens). Red spruce apparently protects whole-tree resources from A. pusillum by shedding infected branches but this is not due to any greater susceptibility to water stress-induced xylem failure.]

from both amplified fragment length polymorphism and morphometric analyses that they are well-differentiated genetically and morphologically, and therefore, should be considered distinct species.]


Robart, B.W., Gladys, C., Frank, T. and Kilpatrick, S. 2015. Phylogeny and biogeography of North American and Asian Pedicularis (Orobanchaceae). Systematic Botany 40(1): 229-258. [Nuclear ITS and plastid matK were used to construct a phylogeny incorporating 28 North American and 102 Asian/European species of Pedicularis. Probable ancestral areas and dispersal routes were analyzed using the biogeographic program S-DIVA.]

Rodenburg, J., Cissoko, M., Kayeke, J., Dieng, I., Khan, Z.R., Midega, C.A.O., Onyuka, E.A. and Scholes, J.D 2015. Do NERICA rice cultivars express resistance to Striga hermonthica (Del.) Benth. and Striga asiatica (L.) kuntze under field conditions? Field Crops Research 170: 83-94. [For the first time, confirming Striga-resistance in the field for NERICA-2,-5,-10 and -17 (against S. asiatica) and NERICA-1 to -5,-10, -12, -13 and -17 (against S. hermonthica). Despite high Striga-infestation levels, yields of 1.8 t ha⁻¹ were obtained with NERICA-1, -9 and -10 (in the S. asiatica-infested field) and 1.4 t ha⁻¹ with NERICA-3, -4, -8, -12 and -13 (in the S. hermonthica-infested field).]

Rodenburg, J., Morawetz, J.J. and Bastiaans, L. 2015. Rhamphicarpa fistulosa, a widespread facultative semi-parasitic weed, threatening rice production in Africa. Weed Research (Oxford) 55(2): 118-131. [A valuable general review of the apparently increasing problem of R. fistulosa in rice in Africa, involving estimated losses of $150M. Reasons for its spread are not fully understood and although 2,4-D and fertilizer are among possible control measures, the scope for further research on these and a range of other aspects of this problem are discussed in detail.]


Rosa, A., Nieddu, M., Piras, A., Atzari, A., Putzu, D. and Rescigno, A. 2015. Maltese mushroom (Cynomorium coccineum L.) as source of oil with potential anticancer activity. Nutrients 7(2): 849-864. [Cynomorium coccineum is used in traditional medicine and as an emergency food in Mediterranean countries. Oil extracted from dried stems shows potential benefits in cancer prevention, for nutraceutical and pharmaceutical applications.]

Massachusetts. Also, use of quinclorac is currently restricted due to export (residue) issues.


Saricicek, B., and; Aktas, F. 2013. Determination of feed value with using in vitro gas production technique of mistletoes (Viscum album L.) silages relating to different hosts. Vth International Balkan Animal Conference, BALNIMALCON 2013, Abstract Book, 3-5 October 2013, Tekirdag, Turkey: 199. [Concluding that silages made from Viscum album can be suggested as an alternative forage source for ruminants since they have high levels of nutrients and other suitable qualities.]


Sateesh Suthari, Sreeramulu, N., Omkar, K., Reddy, C. and Vatsavaya Raju. 2014. Intracultural cognizance of medicinal plants of Warangal North Forest Division, Northern Telangana, India. Ethnobotany Research and Applications 12: 211-235. [Including the use of Dendrophthoe falcata for fever among a total of 257 species listed.]


Scotton, M., Piccinin, L. and Coraiola, M. 2015. Seed production of a subalpine Festuca nigrescens-Agrostis capillaris semi-natural grassland in the eastern Italian Alps. Plant Biosystems 149(2): 404-414. [Noting that the seed production of the main grasses Festuca nigrescens and Agrostis capillaries was affected by the presence of Rhianthus freynii.]

Shafik, M.M., Abdalla, M.M.F. and El-Wahab, M.M.H.A. 2014. Investigations on faba beans, Vicia faba L. 34. Selection methods vs. original seeds of variety Cairo 4 from healthy and infested plots evaluated under Orobanche infestation. Bulletin of Faculty of Agriculture, Cairo University 65(3): 255-264. [Relating to testing of numerous samples of faba bean Cairo 4, known to have tolerance to O. crenata.]


Shi, B.X., Chen, G.H., Zhang, Z.J., Hao, J.J., Jing, L., Zhou, H.Y. and Zhao, J. 2015. First report of race composition and distribution of sunflower broomrape, Orobanche cumana, in China. Plant Disease 99(2): 291-292. [Races A, D, E and G were the main race types of O. cumana in China. Race D was the predominant type and had the widest distribution. Race G was the highest level race type in this study, but was mainly limited to the western part of Inner Mongolia.]

Shin KyungHa and 9 others. 2015. Effectiveness of the combinational treatment of Laminaria japonica and Cistanche tubulosa extracts in hair growth. Laboratory Animal Research 31(1): 24-32. [Results suggest that combinational oral treatment with C. tubulosa with L. japonica can prevent hair loss and improve alopecia, perhaps mediated by their anti-inflammatory activities.]


Siuli Batabyal, Tinkari Dalal and Jagatpati Tah. 2014. Responses of some phyto-hormones for vegetative propagation of an ancient precious wood plant:
Journal of Agricultural and Environmental Information Systems (IJAES) 6(2): 40-76. [Including an item on ‘the mining of efficient fuzzy bio-statistical rules for plant associations around sandalwood (Santalum album)’ in Tamil Nadu.]

Sönmez, T. 2014. (Effect of mistletoe on growth of Scotch pine (Pinus silvestris L.).) (in Turkish) Artvin Coruh Universitesi Orman Fakultesi Dergisi 15(1): 64-72. [Results suggest that Viscum album reduced the annual diameter increment of P. sylvestris by 40% within 10 years, the height growth by 47% and the double bark thickness by about 25%. (Or was the V. album associated with weaker trees? Ed.)


Stachnowicz, W. 2013. Melampyrum cristatum L. - a rare river corridor plant in Wielkopolska and Poland. Biodiversity: Research and Conservation 32: 29-44. [Describing the distribution of C. cristatum in Poland, once thought extinct but now found at sites along the Warta river. Its scarcity may be connected to the changeable water regime in floodplains, as well as potential limitations of myrmecochoric seed dispersal.]


Steele, M.L., Axtner, J., Happe, A., Kröz, M., Matthes, H. and Schad, F. 2015. Use and safety of intratumoral application of European mistletoe (Viscum album L) preparations in oncology. Integrative Cancer Therapies 14(2): 140-148. [In a survey of the results of 862 injections in 123 patients over 6 years with V. album preparations. Virtually no serious adverse reactions were recorded. There were more mild to moderate
Su, H.-J., Hu, J.-M., Anderson, F.E. and Nickrent D.L. 2015. Phylogenetic relationships of Santalales with insights into the origins of holoparasitic Balanophoraceae. Taxon 64(3): 491-506. [A seven gene by 197 taxon matrix was analyzed to examine relationships within Santalales, particularly the position of Balanophoraceae. The latter was shown to be composed of two clades here referred to as Balanophoraceae s. str. and Mystropetalaceae (Dactylanthus, Hachettea, and Mystropetalon).]

Su Xiaojuan, Liu GuangDa, Liu Ying, Feng Xiaoyu and Chen GuiLin. 2015. (Mitochondrial gene intron sequences analysis of medicinal parasitic plant Cynomorium songaricum.) (in Chinese) Genomics and Applied Biology 34(2): 373-381. [Cox1 gene group I introns in angiosperm always have the phenomenon of horizontal gene transfer (HGT). The sequences of mitochondrial Cox1, Cox2 and nad1 genes in medicinal parasitic plant C. songaricum was amplified and analyzed. The phylogeny of coxl gene intron results did not match another three, which suggested the intron may have horizontal gene transfer (HGT) phenomenon. The result suggested the intron of coxl gene may have function, and most likely codes endonuclease, which can promote the intron to transfer.]

Sui Yi and Zhang Ling. 2014. (A preliminary investigation on the spatial distribution patterns of mistletoes in polyculture and monoculture plantations in Xishuangbanna, Southwest China.) (in Chinese) Journal of Yunnan University - Natural Sciences Edition 36(5): 755-764. [Studies of the spatial structures of different mistletoe species (not specified) in stands of various diversity suggest that increasing the diversity of the hosts in the plantation may be a good way to reduce mistletoe infection prevalence, and to increase the productivity and efficiency.]

Sunitha, S.N. 2014. Regenerative effect of L-ascorbic acid on the in vitro grown plants. British Biotechnology Journal 4(12): 1238-1252. [Santalum album included in studies indicating that L-ascorbic acid could be used as a general growth enhancer and in the regeneration of whole plants.]

Sweta Bhan, Lalit Mohan and Srivastava, C.N. 2015. Combinatorial studies on thermosensitization of nanoencapsulated temephos and Cuscuta reflexa. International Journal of Pharmacy Research and Bio-Science 4(1): 20-35. [A nano-formulation based on the larvicide temephos and C. reflexa was tested on larvae of Anopheles stephensi and Culex quinquefasciatus at a range of temperatures and was found efficient against both species at 20°C.]


Syed Saeed-ul-Hassan, Shahid Rasool, Muhammad Khalil-ur-Rehman, Saiqa Ishaq, Shahid-ul-Hassan and Imran Waheed and Saeed, M.A. 2014. Phytochemical investigation of irritant constituents of Cuscuta reflexa. International Journal of Agriculture and Biology 16(6): 1194-1198. [C. reflexa can cause skin irritation. This study isolated a number of components which were confirmed to cause irritation to rabbit skin.]

Tájk, P. 2014. (Flora and vegetation of Hornáckova louka (Slavkovský les Protected Landscape Area, Czech Republic).) (in Czech) Erica (Plzeň) 21: 3-37. [Pedicularis sylvatica subsp. sylvatica among the more important species recorded.]


Teixeira-Costa, L. and Ceccantini, G. 2015. Embolism increase and anatomical modifications caused by a parasitic plant: Phoradendron crassifolium (Santalaceae) on Tapirira guianensis (Anacardiaceae). IAWA Journal 36(2): 138-151. [Showing that T. guianensis wood expressed a higher density of embolized vessels, narrower vessel lumen diameter, higher vessel density, taller and wider rays, and fibres with thinner cell walls, mainly in the downstream sections of the parasitized branches. Apparently induced by a combination of water stress, unbalanced auxin/cytokinin concentrations due to phloem disruptions caused by the parasite’s penetration and action; and by higher than usual ethylene levels.]


Teklay Abebe, Yemane Nega, Muez Mehari, Adhiena Mesele, Assefa Workineh and Hadas Beyene. 2015. Genotype by environment interaction of some faba bean genotypes under diverse broomrape environments of Tigray, Ethiopia. Journal of Plant Breeding and Crop Science 7(3): 79-86. [Six faba bean genotypes were tested across six environments for resistance to Orobanche crenata. Line ILB4358 gave highest consistent yield (approximately double that of the susceptible check) and lower O. crenata numbers followed by line Sel.F5/3382/2003-4.]
physiology of root-hemiparasitic interaction: interactive effects of abiotic resources shape the interplay between parasitism and autotrophy. New Phytologist 205(1): 350-360. [Showing that mineral nutrition and water supply had complex effects on the relative performance of Rhinanthus alectorolophus and its maize or wheat hosts. The effects of the parasite on the hosts were least when nutrient and water supply were both either high or low. Conversely the growth of the parasite was greater when either water or nutrient were limiting – being greatest at high nutrition and low water supply.]


Trabelsi, I., Abbes, Z., Amri, M. and Kharrat, M. 2015. duodenal ulcer in Mali. Results confirm that leaves of plant traditionally used against wounds and gastro-ulcer.

Opilia celtidifolia 'remarkable' extent.

voluntary ethanol intake in male Wistar rats to a administration of an extract of medicine for the treatment of alcoholism. Repeated rhombifolia

of Ethnopharmacology 161: 170-174. [The leaves of

lyophilized aqueous extract in male Wistar rats. Journal

root exudates collected from putative didehydro-orobanchol isomer was isolated from M. truncatula as a didehydro-orobanchol isomer. In this study, a strigolactone produced by the model legume didehydro-orobanchol isomer, from M. trunculata was identified from Jodina rhombifolia, O. celtidifolia may be useful in the treatment of gastric ulcer.


Tokunaga, T., Hayashi, H. and Akiyama, K. 2015. Medicaco, a strigolactone identified as a putative didehydro-oroobanchol isomer, from Medicago truncata. Phytochemistry 111: 91-97. [A major strigolactone produced by the model legume M. truncata (barrel medic) has been tentatively identified as a didehydro-oroobanchol isomer. In this study, a putative didehydro-oroobanchol isomer was isolated from root exudates collected from M. trunculata grown hydroponically under phosphate-starved conditions. The structure and absolute configurations of this strigolactone, named medicaco, were determined. Plausible biosynthetic pathways from 4-deoxyoroobanchol to medicaco are also proposed.]

Trabelsi, I., Abbes, Z., Amri, M. and Kharrat, M. 2015. Performance of faba bean genotypes with Orobanche foetida Poir. and Orobanche crenata Forsk. infestation in Tunisia. Chilean Journal of Agricultural Research 75(1): 27-34. [Seven new small–seeded faba bean genotypes showed moderate to high resistance to both O. foetida and O. crenata in field trials, better than released ‘resistant’ varieties Baraca and Najeh. Yield loss to O. foetida was 92% in susceptible variety, 60% in Baraca and only 14% in the best of the new lines.]


Ueno, K. Furumoto, T., Umeda, S., Mizutani, M., Takikawa, H., Batchvarova, R. and Sugimoto, Y. 2014. Heliolactone, a non-sesquiterpene lactone germination stimulant for root parasitic weeds from sunflower. Phytochemistry 108: 122-128. [Identifying heliolactone, a carlatkla-type molecule exuded by sunflower line 2607A, which induces germination of Striga hermonthica, Orobanche cumana, O. minor, O. crenata, and Phelipanche aegyptiaca while the related dehydrocostus lactone and costunolide also from sunflower root exudates, were effective only on O. cumana and O. minor. Heliolactone exudation was reduced by N and P, whereas costunolide exudation was increased with higher fertility.]


Vennila, V. and Anitha, R. 2015. In vitro evaluation of anti-arthritic activity in different solvent extracts from Cuscuta reflexa. World Journal of Pharmacy and Pharmaceutical Sciences (WJPPS) 4(4): 1340-1350. [Identifying heliolactone, a non-sesquiterpene lactone germination stimulant for root parasitic weeds from sunflower. Phytochemistry 108: 122-128. [Identifying heliolactone, a carlatkla-type molecule exuded by sunflower line 2607A, which induces germination of Striga hermonthica, Orobanche cumana, O. minor, O. crenata, and Phelipanche aegyptiaca while the related dehydrocostus lactone and costunolide also from sunflower root exudates, were effective only on O. cumana and O. minor. Heliolactone exudation was reduced by N and P, whereas costunolide exudation was increased with higher fertility.]


Vogan, P.J. and Schoettle, A.W. 2015. Selection for resistance to white pine blister rust affects the abiotic stress tolerances of limber pine. Forest Ecology and
Wang ChunYang, Liu Yang, Li SiShen and Han GuanZhu. 2015. Insights into the origin and evolution of the plant hormone signaling machinery. Plant Physiology 167(3): 872-886. [Use of comparative genomic and phylogenetic approaches suggest that strigolactone signaling pathways originated in charophyte lineages along with those for auxin and cytokinin.]


Wang LinLin, Ding Hui, Yu HeShui, Han LiFeng, Lai QingHai, Zhang LiJuan and Song XinBo. 2015. Cistanches Herba: chemical constituents and pharmacological effects. Chinese Herbal Medicines 7(2): 135-142. [A general review of the pharmacological uses of Cistanche deserticola and C. tubulosa, including kidney-deficiency-induced diseases such as infertility, forgetfulness, hearing lost, chronic constipation, etc.; also antioxidant, estrogenic, anti-osteoporotic, and anti-inflammatory effects.]

Wang LiSong, Jia Yu, Zhang XianChun, Qin HaiNing. 2015. (Overview of higher plant diversity in China.) (in Chinese) Biodiversity Science 23(2): 217-224. [Including some impressive statistics – the Chinese flora includes over 35,000 spp. of higher plants (over 17,000 endemic) and noting that the top ten genera include Pedicularis with 363 species, 283 of which are endemic.]

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HAUSTORIUM 67
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NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be downloaded from the IPPS web-site (see above).
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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

Warm greetings and very best wishes for 2016.

14th World Congress on Parasitic Plants. I am pleased to announce that the 14th World Congress on Parasitic Plants will take place on June 25-30, 2017 in Asilomar, CA, USA. Details will be posted by John Yorder who, together with his colleagues will organize the congress.

IPPS elections. As mentioned in the last issue of the newsletter, we will be holding elections to fill the offices of Vice President, Secretary, and Member at Large. I encourage you to nominate, vote, and be active in your society. The IPPS officers serve staggered four-year terms with about half of the Executive Committee elected every two years to maintain continuity on the Committee. The vice president, Judie Scholes, ascends to the Presidency at the end of the term. Please send me nominations for these positions by the end of January. Elections are expected to be held in February. The ‘active’ IPPS members who attended the 12th and/or 13th WCPP will be eligible to vote.

Parasitic plant photos. The photo library on our website has been expanding slowly but still lacks some of weedy parasites including Striga, Orobanche, Phelipanche, and Alectra spp. Photos of these important parasites should be included in the library. Please send your photos to me.

Farewell. This is the final message from me as the IPPS president. First of all, I would like to express my sincere thanks to all of the IPPS members and in particular to the Executive Committee members and the editors of Haustorium who have encouraged and supported me throughout my term. I have been fortunate enough to have chances to meet and discuss with the IPPS members at the WCPPs and also on other occasions. Although I will step down from the IPPS Presidency, I would like to continue and enjoy research on parasitic plants. So, I would like to meet and discuss with you at the next occasion, the 14th WCPP.

Koichi Yoneyama, IPPS President
yoneyama@cc.utsunomiya-u.ac.jp

MEETING REPORTS

Meeting of COST Action FA1206, Strigolactones: biological roles and applications. 15-18 September, 2015, Bucharest, Romania.

Presentations of greatest relevance to us here included the following.

In the lecture ‘The toothpick method of Striga biocontrol: deployable and inexpensive for smallholder farmers’. David Sands described the successful development of effective biocontrol agents, including strains of Fusarium oxysporum for control of noxious weeds by selecting for natural hypervirulent variants of Fusarium. For Striga biocontrol, he used variants that excrete leucine, tyrosine and methionine, interfering with the Striga’s amino acid biosynthesis. These host-specific yet enhanced strains can kill their target host more rapidly, reducing the amount of inoculum needed, thus being more affordable. Three strains of the fungus Fusarium oxysporum f.sp. strigae (Foxy T14) were coated onto toothpicks and given to 500 smallholder farmers (85% women) for trials in western Kenya in 2014. Once this inoculum was co-planted with maize seeds, a decrease in Striga counts and an average yield increase of 43 - 56% was recorded.

Maurizio Vurro presentation, titled ‘Goodness of microbes to biodegrade strigolactones was focused on seed germination. It was hypothesized that microbes could detect and biotransform strigolactones, preventing germination of parasitic weed seeds, and thus they could be used as biocontrol agents, acting as a ‘physiological’ barrier against parasitic weeds. To prove this hypothesis, fungi with different ecological functions were considered for their possible capability to metabolize strigolactones. Differences were observed among microorganisms, treatments and compounds used.

Peter Tóth presented ‘What are the similarities in strigolactone requirements of various broomrapes during the germination?’ To better establish taxonomic relationships and species identification within the Orobanchaceae the authors studied the germination of seeds of seventeen different broomrape species induced by the synthetic analogue of strigolactones, GR24. The species, Orobanche alba, O. alsatica, O. caryophyllacea, O. crenata, O. cumana, O. elatior, O. flavua, O. hederae, O. lutea, O. minor, O. paludiflora, O.
reticulata, Phelipanche aegyptiaca, P. arenaria, P. nana, P. purpurea and P. ramosa belong to the seven taxonomical subsections of the genus Orobanche and two subsections of the genus Phelipanche. Seeds of P. aegyptiaca, P. nana, P. purpurea, P. ramosa, O. crenata, O. cumana, and O. minor were highly sensitive to GR24, while O. alba, O. caryophyllacea and P. arenaria were less sensitive, and O. alsatica, O. elatior, O. flava, O. hederae, O. lutea, O. pallidiflora, and O. reticulata were irresponsive to GR24. Also, the phylogenetic analysis based on flower volatiles as a layout to compare evolutionary similarities between broomrapes in terms of requirements for germination stimulants was used.

Diego Rubiales presented ‘Strigolactone content in crops: how can breeders make direct use of this to select for Orobanche resistance or trap crops in large segregating populations?’. This talk was focused on several different alternatives for management of Orobanche spp. An alternative strategy to resistance breeding could be the exploitation of suicidal germination by synthesizing and directly applying strigolactones to the field. In addition, breeding for high strigolactone exudation levels could result in more effective trap crops. Another potential application is intercropping. Inhibitory activity of accompanying inhibitory crops could be increased by selecting for increased production and exudation of such allelopathic metabolites. Any of these breeding approaches is possible by simple selection of existing variation or by various biotechnological approaches. In any case, it was suggested that a closer interaction of breeders with chemists and biochemists is needed. Recent developments in screening and analytical protocols allow a better understanding of the underlying mechanisms. However, they are still time consuming and therefore, unaffordable for breeders that need to handle massive amounts of segregating populations involving thousands of plants in order to discard most of them and to retain only the really interesting ones. Therefore, faster although sufficiently reliable throughput screenings methods are still needed.

Some other relevant papers and posters included:

**Strigolactones - Chemistry and Biochemistry**

Chris McErlean – Synthesis of Strigolactone mimics: Outcomes and Opportunities

Francisco Macias – New Multifunctional Parasitic Weed Stimulants

Petr Tarkowski – LC - MS studies of strigolactones

Mirostrigolactoneav Strnad – Recent progress in hormonomics of strigolactone mutants and strigolactone biological chemistry

Stefano Parisotto – Strigolactones mechanism of action and distribution in living organisms: a chemical contribution

Binne Zwanenburg – New convenient route to solanacol

Piermichele Kobauri – Development of a ligand - based pharmacophore model for predicting strigolactones activity in parasitic weed germination as well as the hormone roles in plants

Melissa Van Overtveldt – The development of isoindole based fluorescent Strigolactones

**Strigolactones as Plant Hormones**

Francesca Baroccio - Conceivable registration procedures for strigolactones

**Strigolactones as Signals for Parasitic Plants**

Alessio Cimmino and Antonio Evidente - Inuloxins: plant sesquiterpene lactones inhibiting parasitic plant seed germination.

Nada Grahovac - Examination and the role of strigolactones in sunflower resistance to broomrape.

Salar Torabi - Inhospitable signaling in Lotus japonicus.

Hianit Koltai


Relevant papers included:

(showing presenting author only):

D. Moreau (INRA Dijon, France) - Trophic relationships between host and parasitic plants: a case study with the parasitic plant species Phelipanche ramosa.

S. Kabiri (Wageningen University, The Netherlands) - Exploring the life-history strategy of the facultative root parasitic weed Rhamphicarpa fistulosa.

R. Perronne (INRA Dijon, France) - Assessment of phylogenetic signal in the germination ability of broomrape (Phelipanche ramosa) on Brassicaceae hosts.
LITERATURE HIGHLIGHT – STRIGOLACTONE BIOLOGY

Recently, two new insights as to strigolactone biology were achieved. One is related to the function of strigolactone receptors from the parasitic plant *Striga hermonthica*. Tsuchiya et al. (2015) developed a fluorescence turn-on probe (YLGs) and used it to illuminate signal perception by the *Striga* strigolactone receptor. The strigolactones analog was shown to bind to and act via ShHTLs, the diverged family of α/β hydrolase-fold proteins in *Striga*. Notably, HTL is also named KAI2 (more on KAI2 is in Conn et al., 2015, and below). Live imaging using YLGs revealed that a dynamic wavelike propagation of strigolactone perception wakes up *Striga* seeds. It was concluded that ShHTLs function as the strigolactone receptors mediating seed germination in *Striga*. A clade of polyspecific receptors, including one that is sensitive to picomolar concentrations of strigolactone was identified. Moreover, the structure of the sensitive receptor shows an unexpectedly large ligand-binding pocket, which may explain how *Striga* manages to sense higher a concentration range of strigolactones than *Arabidopsis*. Thus, it might be that the sensitivity of *Striga* to strigolactones from host plants is driven by receptor sensitivity. Importantly, by this method a bioassay was established that can be used to identify chemicals and crops with altered strigolactone levels.

The second insight highlights the diversity of strigolactone receptors in multiple lineages of parasitic plants and their close relatives. In *Arabidopsis*, the α/β-hydrolase D14 acts as a strigolactone receptor that controls shoot branching, whereas its ancestral paralog, KA12, mediates karrikin-specific germination responses. It was found that KA12, but not D14, is present at higher copy numbers in parasitic plant species than in nonparasitic relatives. KA12 paralogs were found to be distributed into three phylogenetic clades in parasitic plant species. Also, based on homology models it was found that the ligand-binding pockets of KA12d, the fastest-evolving clade, resemble D14 and that KA12d transgenes confer strigolactone-specific germination responses to *Arabidopsis*. It was concluded that convergent evolution has occurred to allow developmental responses to strigolactones in angiosperms and host detection in parasitic plants.


Hinamit Koltai

CUSCUTA PENTAGONA AND C. CAMPESTRIS: TWO SPECIES, ONE PROBLEM OF MISTAKEN IDENTITY

‘Cuscuta pentagona’ is gradually emerging as a model organism for the study of dodgers. Hundreds of studies, especially in North America, have claimed they used it. Therefore, it may come as a surprise to some that the majority of these studies were probably conducted on a different species, *C. campestris*. This is not a trivial nomenclature issue like in the colloquial “tomato-tomahto”, it is a lost/mistaken identity problem with detrimental implications that go beyond a name confusion. Multiple floristic and taxonomic studies (Austin 1986; Musselman 1986; Costea and al. 2006; Stefanović and al. 2007) have indicated that *C. pentagona* and *C. campestris* are different species.
It is unclear why biodiversity sources such as USDA Plants (http://plants.usda.gov/java/), Tropicos (http://www.tropicos.org/), to name just a few, persist in maintaining that C. campestris is a synonym of C. pentagona. The objective of this brief note is to raise awareness of the situation of these two species, provide some information on how to distinguish them, and explain why it is important to do so.

The two species have evolved within the same North American group of species (section Cleistogrammica; García et al. 2014; Costea et al. 2015a), which may explain their morphological affinities. Full details of the intricate evolutionary history of this clade, including the fact that C. campestris is a hybrid species and C. pentagona is one of its putative progenitors, are published in the December issue of Taxon (Costea et al. 2015b). The two species can be distinguished using molecular means, but also morphologically (Fig. 1):

1. Flowers 1.4–2.1 (–2.5) mm long; calyx angled, lobes forming prominent angles at sinuses; corolla tube 0.7–1.2 mm long; capsules 1.9–2.4 × 1.6–2.5 mm …………………… Cuscuta pentagona (Fig. 1 A–C)

1. Flowers 2.1–4 (4.4) mm long; calyx not angled (rounded), lobes not forming prominent angles at sinuses; corolla tube 1.1–2.2 mm long; capsules 1.3–3 ×1.9–3.5 mm ………… Cuscuta campestris (Fig. 1 D–F)

Establishing the correct identity of species in the case of C. pentagona and C. campestris is of great pragmatic significance because the two species have a different distribution, ecology and ‘behavior’. C. pentagona is confined to the territory of the U.S.A. and the scarcity of herbarium specimens collected in the last two decades suggests a degree of rarity at least in some of the states. This species occurs in natural habitats such as meadows, prairies, open areas in forests, and although a few specimens of C. pentagona were also collected from ruderal habitats (e.g., margins or roads or abandoned fields), there are no occurrences of this species as an agricultural weed or invasive plant. In contrast, C. campestris has become one of the most widespread agricultural dodder pests worldwide. Because most studies on Cuscuta try to understand various biological aspects in order to devise better strategies of prevention, control and eradication (e.g., reviewed by Dawson et al. 1994; Costea and Tardif 2006), the identity of the species studied is of paramount significance. Using material of the seemingly harmless C. pentagona to study a pest such as C. campestris would likely lead to misleading results. Fortunately, seeds of C. pentagona are more difficult to obtain and most of the articles claiming they used this species most likely studied C. campestris. However, a degree of uncertainty has been created, and since most studies are not accompanied by herbarium vouchers or other identification means, the identity of the plant material used cannot be elucidated anymore.

Cuscuta campestris is a great species to conduct research on. It germinates rapidly and reliably; its seedlings can attach to numerous host species;
selfing provides reproductive assurance and plants produce numerous seeds; the life cycle is relatively short (50–80 days), and numerous molecular tools have been developed for it. There is only one thing left to do: to know that we study it. Incidentally, the entire plastid genome (Funk et al. 2007) of supposedly C. gronovii, a dodger that belongs to another North American clade (Costea et al. 2015a), is also based on C. campestris. True identity matters!

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https://www.wlu.ca/page.php?grp_id=2147andp=8968


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NB In the above article, the authors regretted that they were not able to illustrate the pentagonal shape of the calyx of C. pentagona with photographs of fresh material for lack of availability. If you can provide such pictures the editors will welcome them for inclusion in a future issue.

SYSTEMATIC STUDIES ON CISTANCHE SPP. AND THE HERBAL PRODUCT ‘CISTANCHES HERBA’

Cistanche Hoffmg. et Link, a genus of the Orobanchacea family, with 22 species worldwide, is mainly distributed in the arid lands and deserts in the northern hemisphere, including Xinjiang, Inner Mongolia, Ningxia autonomous regions, Gansu provinces of China, as well as Iran, India, Mongolia, etc. The Cistanche species are perennial parasitic herbs, and commonly attach to the roots of sand-fixing plants, such as Haloxylon ammodendron, Kalidium foliatum, and Tamarix spp.

There are four species and one variety of Cistanche in China, i.e. Cistanche deserticola Y.C. Ma, C. tubulosa (Schenk) R. Wight, (also known as C. mongolica Beck in China), C. salsa (C.A. Mey.) G. Beck, C. salsa var. albiflora P.F. Tu et Z.C. Lou, and C. sinensis G. Beck. ‘Cistanches Herba’ (CH), ‘Rou Cong Rong’ in Chinese, first recorded in Shen Nong’s Chinese Materia Medica, the oldest work of traditional Chinese medicines, refers to the dried succulent stems of the Cistanche plants. CH has been regarded as a superior tonic and is honored as the ‘Deserts Ginseng’. The scientific values of CH lie in the treatment of kidney deficiency, impotence, female infertility, morbidity leucorrhrea, profuse metrorrhagia, and senile constipation. It has been the most frequently prescribed drug and health food against kidney deficiency in China for successive dynasties. Among Cistanche species,
only *C. deserticola* was recorded in the Chinese Pharmacopoeia (2000 edition), but the wild resource of *C. deserticola* is on the edge of extinction due to over-harvesting, and it was listed as one of the Class II plants needing protection in China. Thus, *C. tubulosa* was then added to the 2005 edition Chinese Pharmacopoeia as an alternative, for its comparable chemical constituents, pharmacological activities, and its relative abundance in comparison with *C. deserticola*. *C. tubulosa* is similar to *C. deserticola* morphologically but differs in having rounded, rather than acuminate anther cells.

Pengfei Tu and his group in the School of Pharmaceutical Sciences, Peking University, China, have devoted themselves to the systematic study of *Cistanche* for more than 20 years to clarify in depth the active components and the underlying mechanisms, to screen out new activities, to cultivate the *Cistanche* herbs and their hosts, to address the deficiency of the natural resources and to protect the deserts for their benefit.

Their achievements may be listed as follows:

From in-depth phytochemical investigations of *Cistanche* plants more than 150 compounds have been isolated and identified, including 32 new ones. It is noteworthy that attention was paid to the polysaccharides in *C. deserticola* for the first time. A total of 17 new polysaccharides were purified, and six were found to have immunologic competence.

Extensive pharmacological activity evaluations have been performed on the crude extracts as well as the purified compounds from *Cistanche* plants towards anti-kidney deficiency, anti-constipation, anti-aging, myocardial protection, etc. The underlying molecular mechanisms have been disclosed using various cellular and animal models. The promising possibility of phenylethanoid glycosides (PhGs) for the treatment of Alzheimer’s, Parkinson’s, and coronary artery diseases has been indicated for the first time, expanding the traditional usages of CH. In addition, 17 neuroprotective metabolites have been isolated and identified from the biological samples following the administration of CH extract and single compounds, and their kinetics *in vivo* have also been characterized.

A new drug against vascular dementia has been developed from the total PhGs of *C. tubulosa* and a new drug certificate was obtained from the China Food and Drug Administration (FDA) in 2005. Recently, echinacoside, the primary effective
constituent of *C. tubulosa*, was made the subject of an Investigational New Drug Application to CFDA of China. In addition, serial health products have been developed from CH. Simultaneous determination of several chemical markers along with fingerprinting has been accomplished using HPLC and LC-MS. Chemical and quality investigations have been carried out to screen the suitable planting areas, harvest times and processing methods for CH. *C. tubulosa* as an alternative source of CH was recommended and finally included in Chinese Pharmacopoeia (2005 edition), efficiently addressing the scarcity of *C. deserticola*. Moreover, the official quality standard of CH in Chinese Pharmacopoeia has been improved since the 2010 edition, based on the research work performed by Prof. Tu’s group.

The species, distribution and production of the genus *Cistanche* in China have been investigated and meaningful advice provided regarding resource protection and sustainable utilization of the natural resources of *Cistanche* plants. The biological characteristics of *C. deserticola*, *C. tubulosa*, and their hosts have been systematic illustrated, providing a basis to advance the cultivation technologies.

Efforts have been addressed to the cultivation technologies of *C. deserticola*, *C. tubulosa* and their hosts. Inductive agents for seed germination and inoculation agents were selected from various candidates; the methods for nutrition mediation, paper inoculation, and the determination of the seed germination ratio were developed and the quality standard of the seeds was established. Furthermore, the standard operating procedure for cultivation and the demonstration bases for *C. deserticola* and *C. tubulosa* were also established.

In order to solve the resource shortage of Cistanches Herba and conserve the desert habitats, Prof. Tu’s group has cultivated *Haloxylon ammodendron* in the deserts of Alxa in Inner Mongolia over 100,000 ha and inoculated *C. deserticola* on 20,000 ha. They have also cultivated *Tamarix* spp in Kotan, Xinjiang over 26,000 ha and inoculated *C. tubulosa* on 20,000 ha. The practice of this project respects the desert and creates a new model of sustainable desert conservation in Chinese style, contributing greatly to the improvement of the local environment, economic development and the security of minority areas.

In 2014, the output of fresh *C. tubulosa* was 10,000 tons in Yutian county, Xinjiang, and sales amounted to 100 million (RMB) yuan. In 2015, the output was 150,000 tons and the sales were 130 million (RMB) yuan.

Serial publications have been released, including 147 articles and 15 patents (including 3 international patents). In particular, 2 new drug certificates related to this project have been granted.

Professor Yong Jiang,
State Key Laboratory of Natural and Biomimetic Drugs, School of Pharmaceutical Sciences, Peking University, Beijing, China
email: yongjiang@bjmu.edu.cn

**PRESS REPORTS**

**Boost the odds after cancer by reducing stress and focusing on healing** (abridged)

Reducing stress and making lifestyle changes can yield remarkable results.

You can help your body fight cancer by reducing stress and focusing your efforts on healing. One of the most comprehensive intervention studies in cancer research, published in Archives of General Psychiatry, evaluated the effects of stress-management techniques such as relaxation on cancer recurrence following removal of a malignant melanoma. Not only did members of the relaxation group experience reduced psychological distress, they also had more active immune systems than those in the control group. A six-year follow-up showed a trend toward greater recurrence and higher mortality rates in the control group compared to the relaxation group. The bottom line is that patients who focus on reducing stress and healing have a better prognosis. People also have lower rates of developing cancer in the first place if they follow these practices. Given what we know about the connection between immune function and stress—as reported in the journal Cancer—this is not surprising.

The aggressive conventional treatments that patients receive often do a good job of killing cancerous cells. The problem is that these same therapies also leave the immune system severely weakened at a time when you need it to be strong. You must have a well-functioning immune system...
to patrol your tissues and identify abnormal cells before they have an opportunity to manifest as a clinical disease. The first year after being told you’re in remission is the most important time to support your immune system. There are many natural therapies and lifestyle changes that can be done.

Mistletoe therapy is just one thing that can be used to effectively boost the immune system. Mistletoe has been shown in the journal Cancer Letters to stimulate increases in the number and the activity of several types of white blood cells. Immune-system-enhancing cytokines such as interleukin-1, interleukin-6, and tumour necrosis factor alpha are released by white blood cells after exposure to mistletoe extracts, according to research by Tibor Hajtó published in Oncology and Cancer Research. It is also possible to make simple dietary changes that can significantly reduce inflammation and further support the functioning of the immune system.

Patients need continued support after they are treated for cancer. They need to be supported mentally and physically in order to further reduce the risk of recurrence. Naturopathic doctors excel at providing this much-needed support to patients and helping them get back on the path to wellness.

Adam McLeod, The Georgia Straight
October 21st, 2015

Miracle mistletoe saved my life, says cancer sufferer given weeks to live 10 years ago

Xavier Granier, 79, was given just weeks to live 10 years ago. He claims the plant more normally associated with furtive Christmas kissing has given him a fresh lease of life. When doctors at Aberdeen Royal Infirmary told him his throat cancer was terminal, he refused to accept the bleak news. Instead he opted to undergo radical mistletoe treatment, an alternative therapy he credits with lengthening his life. He had injections of a special mistletoe solution three times a week for five years and is now in remission.

Xavier - who moved to Aberdeen from France where he was born - said: ‘I think that my body and perhaps my brain never really accepted the promised death and the mistletoe boosted this resistance. ‘Either way the extra time I have with my grandchildren is a joy.’

The cancer was diagnosed in 2004 after the former maintenance engineer developed a hoarse voice. Despite extensive medical treatment, the cancer would not be beaten. A suggestion to try Dr Stefan Geider at the Camphill Wellbeing Trust, Aberdeen, followed, launching the mistletoe treatment. Xavier’s recovery was deemed so remarkable, the details were published in the prestigious medical Journal of Laryngology and Otology.

Mistletoe in medicinal form is thought to work by improving patients immune systems allowing them to fight cancer. ‘Mistletoe is not a miraculous cure,’ said Dr Geider. ‘However, the majority of the patients we see tell us that they experience an improved quality of life. ‘For some, like Xavier, it appears that mistletoe therapy also increases life expectancy. ‘Mistletoe therapy is one of the most frequently-prescribed complementary therapies for cancer in central Europe. ‘It has a good safety record but we desperately need more research to discover exactly how mistletoe works and for which cancers it might improve outcomes.’

Although mistletoe treatment is in its infancy in the UK, it has been used in other parts of Europe for years and is prescribed to around half of cancer sufferers in Germany.

The average cost of treatment is £1,000 a year. It is only available on prescription.

Siobhan McFadyen and John Jeffy, The Mirror
13th September, 2015

Gates Foundation supports KAUST with $1.5 million for parasitic weed research in Africa

Research aims to enhance food security for millions in Africa

The Bill & Melinda Gates Foundation has approved funding of $1.5 million for King Abdullah University of Science and Technology (KAUST) to conduct scientific research towards eradicating a destructive parasitic weed in croplands throughout sub-Saharan African countries.

Commonly known as ‘witchweed’, the Striga hermonthica weed destroys millions of hectares of crops in sub-Saharan Africa every year by siphoning off valuable water and nutrients. Considered one of the hardest parasitic plants to control, Striga infestation devastates much-needed cereal yields, depriving rural families across the
region of much of their livelihood. Solutions for eradicating and combating *Striga* are greatly needed, particularly for pearl millet.

Dr. Salim Al-Babili, who is leading this effort at KAUST, explained: ‘Pearl millet is the staple food crop for millions of rural families in semi-arid regions of Africa, Asia and the Middle East. *Striga* can destroy an entire year's cereal yield, causing billions of dollars in losses every year. Additionally, *Striga* is becoming more severe due to climate change conditions. This project aims to provide lifesaving *Striga* control methods to enhance food security in the region and potentially in other parts of the world.’

Building on his expertise gained from his work on golden rice, Al-Babili is teaming up with universities in Burkina Faso, Japan, and the Netherlands, to shed light on the biological compounds in pearl millet involved in the infestation and to identify low-cost methods for reducing and eventually eliminating *Striga* seed banks in infested soils.

Hassan Al-Damluji, Head of Middle East Relations at the Bill & Melinda Gates Foundation, commented: ‘Our generation faces an unprecedented global challenge of feeding 9 billion by 2050 and we see Africa's farmers as one of the key solutions to this problem. But when seven out of ten people living in sub-Saharan Africa are farmers, it’s clear that they will require more support to address issues like *Striga* infestations in order to not only increase productivity, but grow more nutritious food for their families and communities. Investing in Africa's farmers requires strong global partnerships, and this is why we are very pleased to collaborate with KAUST, an institution ranking among the world's leading universities in the fields of agricultural and biological science. Through this partnership, we look forward to supporting *Striga*-prone areas of sub-Saharan Africa and enabling Africa to be able to feed itself - and help feed the world - within a generation.’

AAAS
1 December 2015.

**BOOK REVIEW**


This is the most comprehensive book about the biology of, and control strategies for, the parasitic plants in the family Orobancheae. Weedy parasitic Orobancheae species such as witchweeds (*Striga*) and broomrapes (*Orobanche* and *Phelipanche* spp), have devastating effects on world agriculture. It is important to uncover the underlying biology of their parasitism, so that affective management strategies can be developed. However, this book has a much broader scope than the understanding of plant parasitism for weed management. The 26 Chapters, each of which was written by leading scientists, have successfully highlighted the fascinating biology of these parasitic plants, despite their noxious behaviors. Since the hemiparasitic species that were previously placed in the Scrophulariaceae were reclassified into the Orobanchaceae family about a decade ago, the Orobanchaceae now represents the largest family of parasitic plants. The Orobanchaceae is recognized as a model parasitic family that includes species showing various levels of host dependency, from non-parasites to facultative hemiparasites, obligate hemiparasites, and holoparasites. Recent advances in molecular and genomic technologies have significantly contributed to studies of parasitic mechanisms, evolution, and genomics in this family.

The main body of the book is divided into two parts. Part 1 contains cutting-edge information about all aspects of parasitism, including the structure, development, and function of the haustorium; nutrient transfer and the physiology of the parasite-host association; host reactions to parasitic plants; seed production and germination; the strigolactones and host-parasite signaling mechanisms; the parasite genome, phylogenetics, evolution, and epigenetics; and parasite ecology. Part 2 is dedicated to the weedy species and their management: the problems posed by the weedy parasites; population diversity and dynamics; molecular diagnosis of seed banks; and a detailed discussion of the various management strategies, including agronomic, chemical and biotechnological approaches, host breeding for resistance, allelopathy, and biological control. Each chapter provides the newest information about its
subject, along with a comprehensive background and thoughtful discussions.

The book contains micrographs and schematic models of haustoria in various species. The haustorium is a common organ in all parasitic plants, but it shows diversity in its structures and functions in various species. For example, haustoria may be terminal or lateral, and they may invade xylem or phloem tissues. A better understanding of the commonalities and differences among various parasitic plants will provide clues about the fundamental roles of the haustorium in parasitism.

Details on the germination strategies of obligate (mainly weedy) parasites are described in Chapters 8 to 12. Unlike facultative parasites, the obligate parasites only germinate in the vicinity of host roots. Strigolactones have been known as germination stimulants for obligate parasites in the Orobanchaceae for half a century, and became a topic of interest for plant science research after the recent discovery of their function as endogenous phytohormones. Studies of the molecular mechanisms of strigolactone biosynthesis and signaling, together with studies on the structure and physiology of the parasite seeds, have provided new clues about the unique germination patterns of parasitic weeds. It may be possible to exploit these features for weed management. Chapter 12 describes the karrin perception system in Arabidopsis. Karrin is a compound that shares structural similarity with strigolactones and is a germination stimulant for some plants but not those in the Orobanchaceae. The chapter predicted the recent discovery of strigolactone receptors in weedy parasites that are indeed paralogues of the karrin receptor in Arabidopsis (Conn et al., 2015; Tsuchiya et al., 2015).

Technical and theoretical information about control strategies are provided in Part 2. This part also emphasizes the rapid host shifts of parasitic plants and the diversity of seed populations, which easily leads to the breakdown of host resistance. Each chapter consolidates the importance of combining multiple management strategies, since no single strategy can provide resistance to the parasite in long-term. There is a need to develop novel parasite resistance strategies.

In addition to the detailed information about parasite biology, this book contains insightful discussions by each scientist. These discussions often contain cross-references to other chapters of the book so that readers can follow one subject from a different point of view.

All authors are to be congratulated for their contributions to this valuable book. This book is a ‘must have’ for scientists, students, and breeders who are interested in, or affected by, parasitic plants. This book will contribute to numerous future studies on the elucidation of plant parasitism and ultimately to eliminate these devastating weeds.

Satoko Yoshida, RIKEN Yokohama Institute, Japan.

THEESIS


Strigolactones (SLs) are an important class of plant signalling molecules with in- and external functions, above- as well as belowground. In Chapter 1 I introduce the SLs, their structural diversity, biosynthesis and perception and their rhizosphere role as signalling molecules that stimulate hyphal branching in arbuscular mycorrhizal (AM) fungi, a process that is beneficial for the establishment of an efficient symbiosis between the fungus and its host. Unfortunately, the SLs also induce the germination of root parasitic plants, such as Striga hermonthica. As a survival strategy, seeds of these parasitic plants will only germinate when they perceive this germination signal from their host which is betraying its presence. After germination, the parasitic plants attach to the host root by forming a root invasive organ called haustorium, through which water and nutrients are taken up from the host. This causes tremendous yield losses in crops worldwide. Just quite recently it was discovered that the SLs are also newly identified phytohormones with multiple physiological roles in various plant developmental processes, such as the regulation of shoot branching and root architecture. This new role has tremendous implications for the evolution of parasitism and complicates control measures based on altered strigolactone production by crops. Rice (Oryza sativa) is an important cereal crop supplying food to more than half of the world population. Rice also
secretes SLs into the rhizosphere which is taken advantage of by *Striga*. Understanding the mechanism of how SLs are synthesised in the host plant rice and perceived by the parasitic plants is important for the management of root parasitic weeds in agriculture. The objective of my work was to gain more insight in the biosynthetic pathway of the SLs in the host plant rice and the molecular mechanism of signal perception in the parasite *Striga*. To achieve the first objective, I used a genetic approach to map quantitative trait loci (QTL) related to SL production using an F6 recombinant inbred line (RIL) population of Bala x Azucena (Chapter 3). I showed that the susceptibility to *Striga* infection correlates with the SL levels in the host plant, with the lowest *Striga* emergence occurring with the low SL producing parent line Bala. A major QTL (qSLB1.1) for *Striga* germination, production of SLs ent-2'-epi-5'-deoxystrigol (ent-2'-epi-5DS) and orobanchol and several other SL related traits was identified on rice chromosome 1. Subsequent molecular analysis of this QTL region revealed the presence of a rearrangement in the genome of Bala, causing a natural deletion of two rice cytochrome P450 (CYP) MAX1 homologues, Os01g0700900 (Os900) and Os01g0701400 (Os1400). *Arabidopsis MAX1* has been reported to play a role in SL biosynthesis and in order to investigate whether this also holds for the rice MAX1 homologs, we used a complementation approach and transformed *Arabidopsis max1* and Bala with these MAX1 homologues (cloned from Nipponbare). Both genes rescued the branching phenotype of *Arabidopsis max1* and in Bala increased the level of the SL, ent-2'-epi-5DS, confirming the strong association of SL production with these two rice MAX1 homologues.

Subsequently, I characterized the biochemical function(s) of these two CYP proteins in SL biosynthesis by reconstitution of the SL biosynthetic pathway in *Nicotiana benthamiana* (Chapter 4). Previously, the biochemical evidence of the sequential involvement of *DWARF 27* (D27), *CAROTENOID CLEAVAGE DIOXYGENASE 7* and -8 (CCD7 and CCD8) in the biosynthesis of the SL precursor carlactone (CL) from all-trans-β-carotene had been provided. Transient overexpression of these genes in *N. benthamiana* leafs, resulted in the production of CL. Co-expression of the MAX1 ortholog Os900, which was identified in the SL QTL mapping study, with this set of CL biosynthetic genes, resulted in the consumption of CL to form predominately the SL ent-2'-epi-5DS, suggesting that Os900 is involved in the ring closure of CL to form SL. Intriguingly, the second rice MAX1 homologue from the SL QTL region, Os1400, was found to be stereo-selectively converting ent-2'-epi-5DS to orobanchol. This is the first enzyme involved in SL structural diversification that is identified.

As SLs are secreted by host plants to the rhizosphere where they stimulate germination of root parasitic plant seeds, it is of great importance to study why parasitic plant seed germination largely depends on SL signalling and how these molecules act during this process. In Chapter 5, I show the conservation of the SL biosynthesis genes (CCD7 and CCD8) in *Striga*. Although in our study we observed that the SL profile identified in *Striga* mirrors the SL profile of its hosts and is thus not conclusive in answering the question whether *Striga* produces SLs, fluridone treatment of *in vitro* grown *Striga* plants (without host) resulted in increased shoot branching, suggesting the inhibition of endogenous SL production. Subsequently, I characterized the homolog of the SL signalling component F-box protein MAX2 from *Striga*, ShMAX2. ShMAX2 showed the capacity to restore various characteristic *Arabidopsis max2* mutant phenotypes, including shoot branching, primary root length, high irradiance response (HIR) and seed germination upon GR24 application under optimal light conditions. However, ShMAX2 was not able to complement the Very Low Fluence Response (VLFR) of max2 mutant seed germination. Together these results start to shed light on the question why *Striga* needs exogenous SLs for its seed germination. Finally, I discussed several intriguing questions that are related to the main findings of this thesis, which are important for understanding the biosynthesis and signal transduction of SLs (Chapter 6). Taken together, as a breakthrough, this thesis provides the first scientific evidence of how the SL ent-2'-epi-5DS is formed and how this molecule is converted to orobanchol, representing the first identified SL diversification step in the host plant. Furthermore, this thesis identified the first SL signalling component, ShMAX2, from a root parasitic plant species, which is paving the way for furthering our understanding of how SLs are perceived by the parasites. The knowledge gained can likely also be used to improve crop breeding or design for parasitic weed resistance.
Dear Colleague,

As the coordinator of the Working Group ‘Parasitic Weeds’ within the EWRS, I am conducting a quick survey of individuals within the scientific community (mainly European) that have worked in the past (or hopefully are still working) on different aspects of parasitic weeds (management, biology, physiology, etc.). The idea is to renew the interest in those topics at the European level (and within the EWRS, too!), and to organize a more interactive group, with a mailing list, more frequent contacts, and possibly the opportunity to meet at workshops and conferences. In the last years the presence of such topics at the EWRS meetings have slowly decreased, despite the great interest of the scientific community and the great impact of parasitic weeds in the agriculture, all over the World. As you might know, there are several ‘communities’ interested to different subjects related to parasitic weeds, e.g. IPP Society, COST STREAM, World Congress on Parasitic Plants, World Congress on Strigolactones, but none of them is specifically oriented to approaches and research for effective parasitic weed management.

In this first round of contacts I would be very glad if you could just send an e-mail to me at maurizio.vurro@ispa.cnr.it and let me know if you are working on parasitic weeds, and if you would like to join this free group. If you wish, it would be great (if you have not yet done) if you could register to the mailing list to the following website: http://srv00.area.ba.cnr.it/mailman/listinfo/parasitic-weeds or by sending an e-mail directly to me.

Moreover, I would be glad if you could supply me with a few names of colleagues that could be interested to join the group, with their e-mail address, or directly pass this information (or the whole newsletter) to other colleagues potentially interested in these subjects.

Once I collect this general information I will circulate a more informative mail (probably a sort of questionnaire) and some ideas on possible future initiatives. Please also consider that the mailing list is a moderated one. This means that no spam will circulate through it, and that colleagues can deliver (after my approval) messages to the whole group, regarding information (e.g. announcements, delivery of new publications, requests, etc) related to parasitic weeds.

Currently, there are over 120 colleagues already registered to the mailing list.

Thank you in advance for your interest.

I wish you all the best, and look forward to hearing from you.

Maurizio Vurro maurizio.vurro@ispa.cnr.it

ERRATUM: ‘ADVANCES IN PARASITIC WEED RESEARCH’

In the last issue of Haustorium this was referred to as a ‘new journal’, which is not strictly true. It is rather a special issue within the New Frontiers postings. For more information see: http://journal.frontiersin.org/journal/plant-science/section/crop-science-and-horticulture

VIDEOS

How African rice farmers can reduce Striga problems in their crop

A farmer-to-farmer instruction video on the parasitic weed Striga and soil management in upland rice has been produced by the Africa Rice Center (AfricaRice) and its partners as part of the African Development Bank-funded project ‘Support to Agricultural Research for Development of Strategic Crops in Africa (SARD-SC).

Striga is a widespread problem in upland rice in sub-Saharan Africa. The video explains the agronomic principles that help rice farmers to reduce Striga problems in their crop. The 21-minute video shows four different principles that contribute to a reduction in Striga infestation:

1. Crop rotation or intercropping, including leguminous species
2. Direct seeding in previous crop residues without soil tillage
3. Fertilizing the soil with chemical and organic fertilizers, and
4. The use of a Striga-resistant rice variety

The first three practices also strongly benefit soil conservation and soil fertility. Farmers describe in their own words their experiences with these practices and explain why and how it is done.
The video is a product of a close collaboration among AfricaRice, the French agricultural research for development organization (CIRAD), the national program of Madagascar (FOFIFA) and the Association of Direct Seeding in Madagascar (GSDM). The video is available in five languages, English, French, Malagasy, Swahili and Portuguese on AfricaRice YouTube site:

- Striga Management -- https://youtu.be/EguvQQDV1Wo
- La gestion du Striga -- https://youtu.be/AHENJmVfCZM
- Ady aminy Striga – https://youtu.be/arn5AstS0Jo
- Udhibiti wa viduha -- https://youtu.be/n3rMGOh3QVU
- Maneio de Striga -- https://youtu.be/AyQL21x7ObU

Yellow witchweed (Alectra vogelii) on cowpea

A short video describing the life cycle of Alectra vogelii and the damage that it can cause to cowpea. And indicating VULI AR1 and VULI AR2 as resistant varieties available in Tanzania. Available with commentaries in English: https://www.youtube.com/watch?v=R9TB7M9SUHF or in Swahili: https://www.youtube.com/watch?v=B8jMXlVUGBM

POSITIONS AVAILABLE

Post-doc position available at KAUST

A postdoctoral position in Plant Biochemistry and Metabolism is currently available in the Center for Desert Agriculture at King Abdullah University of Science and Technology (KAUST, for further information about the University, please visit our website: www.kaust.edu.sa). We are looking for an excellent candidate with proven experience in LC-MS and the isolation and quantification of biological compounds. Experience in enzymology is a plus.

Our group is interested in the formation and biology of isoprenoid derived plant hormones, particularly strigolactones (see Alder et al., 2012 Science 335, 1348-1351). Using combined enzymology-based and genetic approaches, we want to identify novel plant signaling molecules related to abiotic stress and plant development.

The post will require: Strong work ethic and close attention to detail: Ability to work independently and as part of a research team: Proven record of scientific and technical publications: Excellent English writing, communication and inter-personal skills.

Required qualifications: PhD in biochemistry, metabolomics or enzymology

For more information and application form, please contact Prof. Dr. Salim Al-Babili, e-mail: salim.babili@kaust.edu.sa

Asilomar Bio – combating parasitic weeds

Asilomar Bio are developing a non-toxic product that can be applied to infested fields to eliminate parasitic weeds. They are advancing this research with the support of the Bill and Melinda Gates Foundation, with field trials in Kenya and Uganda.

They are seeking to fill three posts related to this and other projects. These are:

- Field Trial Manager - Agronomy Team
- Research Associate – Chemistry Team
- Research Associate – Plant Science Team

For further information go to: http://www.asilomarbio.com/careers

And/or send a resume and brief description of interest to Travis Bayer (t.bayer@asilomarbio.com).

FORTHCOMING MEETINGS


7th International Weed Science Congress 19-25 June 2016, Prague, Czech Republic. Sessions will include: Parasitism - mechanisms and molecular basis; Distribution and impact of parasitic weeds. Control of parasitic weeds. For those who were not able to submit an abstract in time, the registration site will be open again in mid February 2016 with the possibility to submit an abstract for poster presentation. If you are interested in doing so, please, send your contact information to the congress secretariat (e-mail address: twsc2016@guarant.cz) and we will
remind you as soon as the registration site opens again. This possibility is intended only for authors who did not submit any abstract yet. For more information see: http://www.iwsc2016.org/topics/


The meeting is convened under IUFRO programme Unit 7.02.11 – ‘Parasitic flowering plants in forests’ - and will cover systematics, ecology, pharmacology, economics, wildlife, management, host parasite interactions, etc. The organizing committee is inviting interested people to submit abstracts for consideration in oral and poster sessions. Deadline for abstracts March 15. Registration will open April 1st. The organizing committee includes: David Shaw, USA, Marcelo Wagner, Argentina, David Watson Australia, Simon Shamoun, Canada, and Robert Mathiasen, USA.

Ashland is near the California border area where mistletoes in the Viscaceae (Arceuthobium, Phoradendron) are abundant and important to forest ecology and management. Two full day field outings are planned to natural areas, managed forests, national forests, and national parks. The region is very diverse with high plant endemism. For further detail see the IUFRO website: http://www.iufro.org/science/divisions/division-7/70000/70200/70211/

**Second International Legume Society Conference,** Tróia, Portugal, 11-14 October, 2016. For more information see: http://www.istqb.unl.pt/meetings-and-courses/legumes-for-a-sustainable-world

**14th IPPS World Congress on Parasitic Plants.** Asilomar Conference Grounds in Pacific Grove California, USA, June 25-30, 2017. Details will be available via the IPPS website in due course.

**GENERAL WEB SITES**

For individual web-site papers and reports see LITERATURE

* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: http://www.parasiticplants.org/

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see: http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the COST/STREAM conference see: http://streamisrael2013.wix.com/stream-israel-2013

For information on the EWRs Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

For The Mistletoe Center (including a comprehensive Annotated Bibliography on mistletoes up to 1995, but apparently incomplete since then) see: http://www.rmrs.nau.edu/mistletoe/

For information on future Mistel in derTumortherapie Symposia see: http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au (Search Santalum)
LITERATURE

*indicates web-site reference only

Items in bold selected for special interest.

Items in blue relate to therapeutic uses of parasitic Plants.


Abdullah, H.M., Farag, M.A., Abdel-Naim, A.B., Ghareib, S.A. and Abdel-Sattar, E.A. 2015. Mechanistic evidence of Viscum schimperi (Viscaceae) antihyperglycemic activity: from a bioactivity-guided approach to comprehensive metabolite profiling. Phytotherapy Research 29(11): 1737-1743. [V. schimperi is known in Saudi Arabia for its anti-diabetic properties. This study concluded that oleanane triterpenes and O-caffeoyl quinic acid conjugates were the major compounds that might account for the antihyperglycemic effect of the plant.]


Amina Mustafa, Mejhabeen Hameed, Rukhsana Jabeen and Aasiya Hamzazai. 2015. Ethno botanical study of plants used by people of Quetta as cosmetics and phytochemical test of some selected plants. American-Eurasian Journal of Agricultural & Environmental Sciences 15(4): 523-528. [Santalum album...
listed among sources of herbal cosmetics in Pakistan."


Andreao-Jimenez, B., Ruyter-Spira, C., Bouwmeester, H.J. and Lopez-Raez, J.A. 2015. Ecological relevance of strigolactones in nutrient uptake and other abiotic stresses, and in plant-microbe interactions below-ground. Plant and Soil 394(1/2): 1-19. This review presents the different roles of strigolactones below-ground, emphasizing phosphorus uptake by the plant by regulating root architecture and the establishment of mutualistic symbiosis with arbuscular mycorrhizal fungi. The agronomical implications of strigolactones below-ground and their potential use in sustainable agriculture are addressed.]


Antonova, T.S., Alonso, L.C., Strel’nikov, E.A. and Araslanova, N.M. 2015. Stimulating effect of the root exudates of sorghum, millet, and Sudan grass on the seed germination of broomrape (Orobanche cumana Wallr.) infesting sunflowers in Russia. Russian Agricultural Sciences 41(5): 347-351. [A laboratory study suggesting that 3 samples of sugar sorghum, two samples of Sudan grass, and five cultivars of common millet stimulated the germination of O. cumana and could be suitable as trap crops.]


Ayres, D.R., Fleishman, E., Launer, A., Lee, A.K. and Zippin, D. 2015. Genetic structure and demography of Chloropyron palmatum, an endangered annual plant. Madroño 62(3): 139-149. [Studies of C. palmatum (previously Cordylanthus palmatus) and C. molle in saline and alkaline wetlands in California confirm they are genetically distinct and do not usually hybridise.]


7(4): 385-392. [Confirming the antihypertensive effect in rats, of oleanolic acid isolated from *Viscum articulatum.*] 

Badr, J.M. 2015 Chemical constituents of *Phragmanthera austroarabica* A. G. Mill and J. A. Nyberg with potent antioxidant activity. Pharmacognosy Research 7(4): 335-340. [Confirming that the antioxidant activities of the compounds isolated from *P. austroarabica* can justify its use as a traditional medicine for treatment of diabetes in Sausi Arabia.] 


Bao GenSheng, Saikkonen, K., Wang HongSheng, Zhou LiaNyu, Chen ShuiHong, Li ChunJie and Nan ZhiBiao. 2015. Does endophyte symbiosis resist allelopathic effects of an invasive plant in degraded grassland? Fungal Ecology, 2015 17, 114-125. [Grasses *Stipa purpurea* and *Elymus tangutorum* were reduced by extracts from *Pedicularis kansuensis* but less so when the grasses were infected by endophytic fungi.] 

Bao GenSheng, Suetsugu, K., Wang HongSheng, Yao Xiang, Liu Li, Ou Jing and Li ChunJie. 2015. Effects of the hemiparasitic plant *Pedicularis kansuensis* on plant community structure in a degraded grassland. Ecological Research 30(3): 507-515. [Studies of the host range of *P. kansuensis* showed that Poaceae, Rosaceae and Fabaceae were preferentially parasitized. Biodiversity was greater in its presence than when it was removed.] 


Bakoush, S.M.M., Yaacob, W.A. and Adam, J.H. 2015. Antioxidant activities, total phenolic and flavonoid contents of the aqueous extracts from *Rafflesia cantleyi* bud parts. Research Journal of Medicinal Plant 9(7): 347-353. [Confirming that the bracts of the *R. cantleyi* bud possess significant free radical scavenging property attributable to its phenolic compounds. Results support the traditional medicinal use as an energy drink due to its natural sources of antioxidants.] 

Balachandran, N. 2015. Notes on double and hyperparasitism in tropical dry evergreen forest of Tamilnadu. Indian Forester 141(1): 114-115. [Recording unspecified *Cassitya* sp. growing on *Dendrophthoe falcata*, growing on *Gmelina asiatica.*] 


Bhale, U.N. 2014. Prospective of leaf extracts with different effects. Mycorrhiza 25(7): 573-585. [Showing that the ephemeral ‘roots’ of Cuscuta were more infected by AM fungi and benefitted in terms of longer independent growth, than C. campestris which was little infected and did not benefit. The ability to interact with AM fungi together with the capacity to absorb water, tend to support the idea that the ‘roots’ are indeed true roots.]

Behdarvandi, B., Guinel, F.C. and Costea, M. 2015. Differential effects of ephemeral colonization by arbuscular mycorrhizal fungi in two Cuscuta species with different ecology. Mycorrhiza 25(7): 573-585. [Showing that the ephemeral ‘roots’ of C. gronovii were more infected by AM fungi and benefitted in terms of longer independent growth, than C. campestris which was little infected and did not benefit. The ability to interact with AM fungi together with the capacity to absorb water, tend to support the idea that the ‘roots’ are indeed true roots.]


Bista, A. 2015. Effects of nitrogenous fertilizers on seed germination of Orobanche solmsii C.D. Clarke. Ecoprint: An International Journal of Ecology 21: 73-78. [Seven nutrient chemicals applied in vitro pre-germination on O. solmsii seed germination. 4% and 16 mM were all inhibitory. Post-conditioning ammonium nitrate and ammonium chloride reduced germination by 43% and 41%.


Blažek, P. and Lepš, J. 2015. Victims of agricultural intensification: mowing date affects Rhinanthus spp. regeneration and fruit ripening. Agriculture, Ecosystems & Environment 211: 10-16. [Studies on R. minor (a vernal ecotype) and R. alectorolophus (an aestival ecotype) confirmed that where meadows are mown in the period when plants are not able to regenerate and not enough fruits have ripened, Rhinanthus populations could undergo a massive decline. Concluding that the optimal time for mowing in the Czech Republic would be mid-June.]

Burns, A.E., Taylor, G.S. and Watson, D.M. Cunningham, S.A. 2015. Diversity and host specificity of Psylloidea (Hemiptera) inhabiting box mistletoe, Amyema miqueli (Loranthaceae) and three of its host Eucalyptus species. Austral Entomology 54(3): 306-314. [Studying the psylloids (Hemiptera: Psylloidea), inhabiting Amyema miqueli, and hosts Eucalyptus blakelyi, E. melliodora and E. polyanthemos. Two were associated with A. miqueli and 18 with the Eucalyptus spp.]

Butaud, J.F. 2015. Reinstatement of the Loyalty Islands sandalwood, Santalum austrocaledonicum var. glabrum (Santalaceae), in New Caledonia. PhytoKeys 56(1): 111-126. [Previously considered a synonym of the type variety, The Loyalty Islands sandalwood is reinstated as Santalum austrocaledonicum var. glabrum Hür; its distinctiveness is supported by morphological and genetic studies.]

Cardoso, L.J.T. and Braga, J.M.A. 2015. A new Caribbean species of Helosis (Balanophoraceae) with a revised key to the genus. Systematic Botany 40(2): 597-603. [Helosis antillensis is described and illustrated; related to H. cayennensis, but distinguished by runners with remarkable verrucous surface projections, an inflorescence stalk up to 4.5 cm long, etc.]

Carneiro, L.T., Aguiar, A.J.C., Martins, C.F., Machado, I.C. and Alves-dos-Santos, I. 2015. Krameria tomentosa oil flowers and their pollinators: bees specialized on trichome elaiophores exploit its epithelial oil glands. Flora (Jena) 215: 1-8. [Krameriae are all pollinated by oil-seeking bees. Confirming that 21 Apidae visited the flowers, including the oil-bee Centris hyptidis specialized on trichome elaiophores as well as stingless-bees which foraged for pollen. Centris nitens and Trigona fulviventris were the most frequent visitors.]

Cardona-Medina, E. and Muriel Ruiz, S.B. 2015. Seed germination and plant development in Escobedia grandiflora (Orobanchaceae): evidence of obligate hemiparasitism? Acta Biológica Colombiana 20(3): 133-140. [Concluding that E. grandiflora (looks like a Cycnium sp.) does not require a host for germination and may survive for 6 months without a host but fails then to flower or fruit, hence effectively obligate. Develops flowers 28 weeks after attachment to Paspalum spp.]
Čavar, S., Zwanenburg, B. and Tartowski, P. 2015. Strigolactones: occurrence, structure, and biological activity in the rhizosphere. Phytochemical Review 14: 691-711. [This review presents the available spectroscopic data of structures of strigolactones, their occurrence in the plant kingdom, as well as germination and hyphal branching activities. The structures of 7α- and 7β-hydroxyorobanchol and 7-oxoorobanchol have recently been established. See Khetkam et al. 2014. (Haustorium 67)]


Couvreur, J.M., Fiévet, V., Smits, Q. and Dufréne, M. 2015. Evaluation of the "observer effect" in botanical surveys of grasslands. Biotechnologie, Agronomie, Société et Environnement 19(2) 132-142. [Rhinanthus minor involved in some of the ecological surveys, whose methodology is discussed.]


Cui Bei, Lin Ruozhu, Zhao WenXia and Lan ZongKe. 2014. (Ecological damage assessment of Loranthus tanakae (Loranthaceae) in the south slopes of Qinling Mountain.) (in Chinese) Scientia Silvae Sinicae 50(10): 86-93. [Concluding that Quercus aliena var. acutisserrata. was the preferred but not exclusive host of L. tanakae. Host trees could be seriously damaged by death of distal parts of branches.]


gene transfer is shown to be ‘astonishingly’ high in the mitochondrial genome, and appreciable in the nuclear genome. Although explicit tests remain to be performed, some transgenes have been hypothesised to be functional in their recipient species, thus providing a new perspective on the evolution of novelty in parasitic plants.

De Freitas, J.D. and Rossi, M.N. 2015. Interaction between trophobiont insects and ants: the effect of mutualism on the associated arthropod community. Journal of Insect Conservation 19(4): 627-638. [Studying a system comprising *Psittacanthus robustus*, three trophobionts and two tending ants and showing that locally, the abundance and species richness of the whole arthropod community did not decrease when mutualism was present, but the feeding group composed by predators was negatively affected by mutualism.]

de Vasconcelos, G.C.L. and de Melo, J.I.M. 2015. (Flora of the State of Paraíba, Brazil: Loranthaceae Juss.) (in Portuguese) Acta Scientiarum - Biological Sciences 37(2): 2, 238-250. [Providing a key to the ten species recorded in Paraíba: *Passovia* (one species), *Psittacanthus* (two species), *Pasillanthus* (one species) and *Struthanthus* (six species). *Struthanthus concinnus* was found for the first time in Paraíba.]

Delchev, G. and Georgiev, M. 2015. Achievements and problems in the weed control in oil-bearing sunflower (*Helianthus annuus* L.). Scientific Papers - Series A, Agronomy 58: 168-173. [Noting that herbicides are being successfully used for control of weeds in naturally herbicide-resistant sunflower, including *Orobanche cumana*, but that there is a problem controlling volunteer sunflowers in following crops.]


Devkota, M.P. Macklin, J. and Nickrent, D.L. 2015. The status of the mistletoe genus *Dufrenoya* Chatin (Amphorogynaceae) with a specific focus on Nepal. Flora (Jena) 215: 75-83. [This study examined the morphology, anatomy, taxonomy, phylogeny, and distribution of *Dufrenoya platyphylla* and *D. granulata* in Nepal]


Dominighini, A., Ferrero, M., Crosetti, D., Ronco, M.T., González, J., Ufrí, L., Wagner, M., Gurni, A., Carnovale, C.E. and Luquita, A. 2015. Effects of proanthocyanidin enriched extract from *Ligaria cuneifolia* on plasma cholesterol and hemorheological parameters. *In vivo* and *in vitro* studies. Clinical Hemorheology and Microcirculation60(3): 141870. [This study confirmed that extract of *L. cuneifolia* increased blood viscosity and decreased plasma cholesterol in rats.]

Ebrahim, L. and Hassannejad, S. 2015. Allelopathic effects of Syrian bean caper (*Zygophyllum fabago* L.) on seed germination and seedling growth of eastern dodder (*Cuscuta monogyna* Vahl.). Journal of Biodiversity and Environmental Sciences (JBES) 7(2): 253-260. [Suggesting that all parts of *Z. fabago* dried and applied at 2.5-10% reduced germination and growth of *C. monogyna* seedlings (in Bangladesh).]

El-Rabiai, G.T. and Al-Tira, M. 2015. Checklist of the flora of Wadi Haboon at Al Jabal Al Akhdar
Encheva, J., Georgiev, G. and Penchev, E. 2015. Heterosis effects for agronomic ally important traits in sunflower (Helianthus annuus L.). Bulgarian Journal of Agricultural Science 21(2): 336-341. [Describing a hybrid involving the restorer line 278R which apparently combines high resistance to Orobanche cumanica races-A-G in Bulgaria and immunity to Plasmopara helianthi-races 300, 700 and 731 but abstract (in English) not easy to follow.]

Endress, P.K. 2015. Patterns of angiospermy development before carpel sealing across living angiosperms: diversity, and morphological and systematic aspects. Botanical Journal of the Linnean Society 178(4): 556-59. [This paper surveys the different means of carpel closure in angiosperms. For some families in Santalales (traditional concepts), older literature was reviewed with respect to carpel number and free-central placentation. Rafflesiaceae and Balanophoraceae s.l. are listed as examples of gynoecia without primary morphological space.]

Evans, B.A. and Borowicz, V.A. 2015. The plant vigor hypothesis applies to a holoparasitic plant on a drought-stressed host. Botany 93(10): 685-689. [In studies with Cuscuta gronovii on Verbesina alternifolia results suggest drought stress experienced by a host weakness source strength and reduces uptake by the holoparasite acting as a sink.]


Pan YanNan, Huang YuQiu, Jia TianZhu, Geng TongTong, Zhu Yan and Shi Ji. 2015. (Research progress on processing of Cistanches herba.) (in Chinese) Drugs and Clinic 30(6): 737-741. [A review detailing the constituents, the uses, the processing, and the changes involved in the course of processing.]

Farzan, S. 2014. Field dodder (Cuscuta campestris) does not promote nutrient transfer between parasitized host plants. Southwestern Naturalist 59(4): 515-519. [Results suggest that few (if any) nutrients passed through C. campestris from one tomato host donor to a recipient tomato plant and that shading the donor did not impact the growth of the receiver plant.]


Fontúrbel, F.E., Jordano, and Medel, R. 2015. Scale-dependent responses of pollination and seed dispersal mutualisms in a habitat transformation scenario. Journal of Ecology (Oxford) 103(5): 1334-1343. [The highly specialized mutualistic system involving Tristerix corybosus, its humming bird pollinator and marsupial disperser appear to be responding positively to the habitat structure modifications associated with Eucalyptus plantations. However, the actual costs (e.g. reduced gene flow, increased herbivory) in these transformed habitats are yet to be assessed.]


Gai XiangYun and 10 others. 2015. Echinacoside induces rat pulmonary artery vasorelaxation by opening the NO-cGMP-PKG-BK channels and reducing intracellular Ca” levels. Acta Pharmacologica Sinica 36(5): 587-596. [Studying the vasorelaxant effect of echinacoside a phenylethanoid glycoside from Cistanches tubulosa (and the Tibetan herb Lagottis brevitatula).]

Gebrelibanos Gebremariam and Dereje Assefa. 2015. Memory enhancement of acteoside (Verbascoside) in a senescent mice model induced by a combination of D-gal and AlCl₃. Phytotherapy Research 29(8): 1131-1136. [Results support the use of Cistanche deserticola for memory enhancement and indicate that the effects of acteoside are induced via promotion of nerve growth factor and tropomycin receptor kinase A expression.]

Garcia, G.R.M., Hennig, L., Sieler, J. and Girija, T. 2015. Control of hemiparasite, Phelipanche aegyptiaca in potato crop. Journal of Agricultural Science and Technology B 4(10): 771-778. [Doses of fluridone applied to potato at up to 20 µM/ha were apparently safe and doses of 10 µM/ha at 20 and 35 days reduced P. aegyptiaca by 99%.]

Haidar, M., Jaafar, H., Mosleh, F.A., Karam, N. and Ghandour, A. 2015. Fluridone: an effective approach to control Phelipanche aegyptiaca in potato crop. Journal of Agricultural Science and Technology B 4(10): 771-778. [Doses of fluridone applied to potato at up to 20 µM/ha were apparently safe and doses of 10 µM/ha at 20 and 35 days reduced P. aegyptiaca by 99%.]

Haidar, M. and Shdeed, E. 2015. Phelipanche aegyptiaca management with glyphosate in potato. American Journal of Plant Sciences 6(16): 2540-2549. [Best selective control of P. aegyptiaca in potato was obtained by sequential applications of glyphosate at 60 and 80 g.ai.ha⁻¹. Higher rates reduced yield. Ammonia gas, phosphoric acid and sulfuric acid were ineffective.]

Han SeungYeon, Hong ChangEui, Kim HwanGyu and Lyu SuYun. 2015. Anti-cancer effects of enteric-coated polymers containing mistletoe lectin in murine melanoma cells in vitro and in vivo. Molecular and Cellular Biochemistry 408(1/2): 73-87. [Confirming effects of extracts of Viscum album var. coloratum on mouse melanoma and showing that this is associated with the lectin component which increases activated multiple caspases and decreases in the expression of procaspase-3 and 8.]

Gao Li, Peng XiaoMing, Huo ShiXia, Liu XinMing and Yan Ming. 2015. Memory enhancement of acteoside (Verbascoside) in a senescent mice model induced by a combination of D-gal and AlCl₃. Phytotherapy Research 29(8): 1131-1136. [Results support the use of Cistanche deserticola for memory enhancement and indicate that the effects of acteoside are induced via promotion of nerve growth factor and tropomycin receptor kinase A expression.]

Gebrelibanos Gebremariam and Dereje Assefa. 2015. Nitrogen fertilization effect on grain sorghum (Sorghum bicolor L. Moench) yield, yield International Journal of Agricultural Research 10(1): 14-23. [Recording increases in sorghum yield with application of N, maximal at 150 kg/ha. Striga hermonthica infestation was reduced by 36%.

Girija, T. 2015. Control of hemiparasite, Dendrophthoe falcata on tree crops. Proc.Volume II 25th Asian-Pacific Weed Science Conference, Hyderabad, India, October 13-16, 2015: 139. [D. falcata in mango, cocoa and sapota was successfully controlled for 6 months by thorough wetting with ethephon at 8,000 to 10,000 ppm.]


Graffis, A.M. and Kneitel, J.M. 2015. A parasitic plant increases native and exotic plant species richness in vernal pools. AoB Plants 7: pv100. (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4612139/) [Studying the effects of removing the endemic Cuscuta howelliana from pools in California and showing that its reduction of its main native host, Eryngium castrense contributes to increased species richness.]


Haidar, M., Jaafar, H., Mosleh, F.A., Karam, N. and Ghandour, A. 2015. Fluridone: an effective approach to control Phelipanche aegyptiaca in potato crop. Journal of Agricultural Science and Technology B 4(10): 771-778. [Doses of fluridone applied to potato at up to 20 µM/ha were apparently safe and doses of 10 µM/ha at 20 and 35 days reduced P. aegyptiaca by 99%.]


Hosseini, A. 2015. New mechanical methods and treatments for controlling of leafy mistletoe (Loranthus europaeus Jacq.) on Persian oak trees (Quercus persica). International Journal of Environmental Sciences 5(4): 848-855. [Reporting successful control of L. europaeus in Iran by removal of infected branches and caulking the cut surfaces with clay or Glue-stick can simply and inexpensively eliminate the mistletoe and prevent its re-establishment on the treated branch. Covering by black plastic had only a temporary effect.]

Hu Xi, Wu FuChuan, Guo Wei and Liu Nian. 2014. Identification of potential cultivation region for Santalum album in China by the MaxEnt ecologic niche model. Scientia Silvae Sinicae 50(5): 27-33. (Using the MaxEnt ecological model it was shown that, besides the traditionally accepted regions of western Hainan province, and Leizhou Peninsula of Guangdong province, the southeast coast of Guangdong and Fujian Province were also identified as highly suitable for cultivation o S. album.)

Ibdah, M., Dubey, N.K., Eizenberg, H., Dabour, Z., Abu-Nassar, J., Gal-On, A. and Aly, R. 2015. Cucumber mosaic virus as a carotenoid inhibitor reducing Phelipanche aegyptiaca infection in tobacco plants. Plant Signaling and Behavior 9(10) e972146. (http://www.tandfonline.com/doi/full/10.4161/pstb.32096 [Showing that CMV downregulated the enzyme phytoene desaturase(PDS) and reduced significantly both carotenoid production and Phelipanche infection in tobacco host roots infected with both CMV and P. aegyptiaca, apparently due to reduced strigolactone exudation. Suggesting that attenuated CMV strains may provide a safe means for enhancing crop resistance against parasitic weeds.]


Ichihashi, Y., Mutuku, J.M., Yoshida, S. and Shirasu, K. 2015. Transcriptomics exposes the uniqueness of parasitic plants. Briefings in Functional Genomics 14(4): 275-282. [Current technical advances in next-generation sequencing and bioinformatics have allowed dissection of the molecular mechanisms behind the uniqueness of parasitic plants at the genome-wide level. In this review, recent key findings are summarised, mainly in transcriptomics that will provide insights into the future direction of parasitic plant research.]

degradation and habitat loss caused by heavy exploitation in eastern Indonesia, there has been significant reduction in genetic variability associated with clonality on fragmented or isolated habitat, in which the remnant mother trees reproduced asexually. This has resulted in inbreeding depression and sexual reproductive failure. Genetic infusion and enhancement of population size is recommended.

Jahan, I.A., Akbar, P.N., Mohammad Enayetullah, Nazir Ahmmad, Mohammad Nuruddin and Ahmed, M.R. 2015. Elemental and fatty acid content of four medicinal plants: Kaeempferia rotunda, Cuscuta reflexa, Centella asiatica and Asparagus racemosus. European Journal of Medicinal Plants 10: 4. [Concluding that, as a medicinal plant, Cuscuta reflexa is a good source of the elements Na, K, Mg and Cr, whereas Cu, Cd and Mn are only present in trace amounts. Significant amounts of fatty acids were also detected that come with ‘immense biological properties.’]

Jang JiYeon, Kim SeYong, Song KyungSik and Seong YeongHee. 2015. Korean mistletoe (Viscum album var. coloratum) inhibits amyloid β protein (25-35)-induced cultured neuronal cell damage and memory impairment. Natural Product Sciences 21(2): 134-140. [Confirming the activity and potential value of extracts of V. album var. coloratum in preventing the progression of Alzheimer's disease.]

Johnsen, H.R., Striberny, B., Olsen, S., Vidal-Melgosa, S., Fangel, J.U., Willats, W.G.T., Rose, J.K.C. and Krause, K. 2015. Cell wall composition profiling of parasitic giant dodder (Cuscuta reflexa) and its hosts: a priori differences and induced changes. New Phytologist 207(3): 805-816. [A simple definition of parasitic plant is a plant that produces a ustosorum putting that organ at the center of understanding the host-parasite interface. The authors of this paper advance our understanding through their study of the pectinolytic activity in haustorial extracts. Response to these compounds was much lower in resistant hosts.]

Kannan, C., Pathak, A. Zwanenburg, B. 2015. Applicability of borax and thiourea for management of Orobanche. Proc.Volume II 25th Asian-Pacific Weed Science Society Conference, Hyderabad, India, October 13-16, 2015: 134. [Confirming in vitro that germination of ‘O. crenata’ (fortunately for India - as that is where the work was done - a mis-identification of O. cernua) by tomato exudate or Nijmegen-1 was prevented by 1mM borax or thiourea, without risk to tomato. NB. Item by Kannan et al. listed in Haustorium 67 also referred wrongly to O. crenata – should have been O. cernua.]


Karti, R., Barus, T., Surbakti, R. and Simanjuntak, P. 2015. Anticancer activity of bioactive compounds from fruits of Bawang hutan (Scorodocarpus borneensis Becc). Asian Journal of Chemistry 27(12): 4663-4665. [Dehydroxyscorodocarpin B was isolated from fruits of S. borneensis (Olacaceae) and shown to have anticancer activity against L-1210 cell line.]


Kibuge, R.M., Kariuki, S.T. and Njue, M.R. 2015. Influence of fuel properties on the burning characteristics of sour plum (Ximenia americana L.) seed oil compared with Jatropha curcas L. seed oil. Renewable Energy 78: 128-131. [Concluding that X. americana seed oil, when blended with kerosene in ratio above 10% can supplement kerosene as biofuel.]

Kim GunJune and Westwood, J.H. 2015. Macromolecule exchange in Cuscuta-host plant interactions. Current Opinion in Plant Biology 26: 20-25. [Reviewing studies that show RNAs move bidirectionally between hosts and parasites and involve a large number of different genes. Although the function of mobile mRNAs has not been demonstrated in this system, small RNAs are also transmitted and a silencing construct expressed in hosts is able to affect expression of the target gene in the parasite. High throughput sequencing of host-parasite associations has the potential to greatly accelerate understanding of this remarkable interaction.]


Kohai, H. 2015. Cellular events of strigolactone signalling and their crosstalk with auxin in roots. Journal of Experimental Botany 66(16): 4855-4961. [In this review the strigolactone signalling pathway is presented and the resulting changes in actin-filament bundling, cellular trafficking, and PIN localization in the plasma membrane. Also presented is the involvement of strigolactones with the response to phosphate conditions in roots.]


Kuijt, J. and Graham, J.G. 2015. Two new species of Loranthaceae from central Peru. Novon 24(2): 173-178. [Describing and illustrating Gaiadendron coronatum, closely related to G. punctatum but with distinct calyx lobes that develop into a tubular structure in fruit; and Peristethium graminii, distinguished by its 5-merous flowers, the papery scales at the base of a determinate inflorescence, and by its essentially sessile anthers.]

Kuljit Kaur, Ramanpreet, Gupta, R.C. and Santosh Kumari. 2015. Cyto-morphological studies of some dicot plants from Rajasthan (India). Japan, Cytologia 80(3): 353-362. [Noting that ‘Orobanche ramosa (n=12) is the first diploid cytotype report from India.’]


Kumar, K.N.S., Saraswathy, A. and Amerjothy, S. 2015. Survey report on hosts and haustoria of Helicanthus elastica (Desr.) Danser in Udupi and Dakshina Kannada district of Karnataka and Kasaragod district of Kerala, India - a concise review plus some new additions. Indian Forester 141(4): 448-451. [Helicanthus elastica (Loranthaceae) identified on 15 new host species in this area. A total of 54 have been recorded, mango the commonest.]


Lenta, B.N. and 10 others. 2015. Two 2,6-

Ladokun, O., Ojezele, M. and Arojojoye, O. 2015. Comparative study on the effects of aqueous extracts of Viscum album (mistletoe) from three host plants on hematological parameters in albino rats. African Health Sciences 15(2): 606-612. [Results suggest that extracts from mistletoe growing on cocoa, kola and coffee contain agents that could stimulate the production of leucocytes and could serve as immune boosters; BUT ‘Viscum album’ is certainly a misnomer and we do not know what species were in fact involved.]

Lechat, M.M., Brun, G., Montiel, G., Véronési, C., Simier, P., Thoiron, S., Pouvreau, J.B. and Delavault, P. 2015. Seed response to strigolactone is controlled by abscisic acid- independent expression of PrCYP707A1. [Results show that the ABA-mediated drought resistance pathway in,Cuscuta australis is highly insensitive to abscisic acid-induced suppression of hypocotyl elongation and seed germination. USA, PLoS ONE 10(8) e0135197. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0135197) ‘Given that Cuscuta plants are no longer severely challenged by drought stress, we hypothesize that the ABA-mediated drought resistance pathway in Cuscuta spp. might have had degenerated over time during evolution.’]


Li WenLan, Sun XiangMing, Song Hui, Ding JingXin, Bai Jing and Chen Qiang. 2015. HPLC/Q-TOF-MS-based identification of absorbed constituents and their metabolites in rat serum and urine after oral administration of Cistanche deserticola extract. Journal of Food Science 80(9): H2079-H2087.

Li YuLi, Wang XiLiang, Chen TingTing, Yao FuWen, Li CuiPing, Tang QingLi, Sun Min, Sun GaoYuan, Hu SongNian, Yu, J. and Song ShuHui. 2015. RNA-seq based de novo transcriptome assembly and gene discovery of Cistanche deserticola fleshy stem. PLoS ONE 10(5): e0125722. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0125722) [A collection of enzyme genes related to biosynthesis of lignin and phenylethanoid glycosides were identified from the assembled and annotated transcripts, and the gene family of PAL was also predicted. The sequence data from this study will provide a valuable resource for conducting future phenylethanoid glycosides biosynthesis researches and Kos, J. 2015. Effects of herbaceous plant preparation of Cistanche on in vitro cytokine expression by rat osteoblasts. Veterinarski Arhiv 85(3): 335-345. [Exposure of osteoblasts to extract of C. deserticola promoted the gene expression of OPG and RANKL and reduced the gene expression of OPG/RANKL and OPN, and thus, could maintain the balance of bone formation and resorption during bone metabolism.]

*Li Juan, Hettenhausen, C., Sun GuiLing, Zhuang HuiFu, Li JianHong and Wu JianQiang. 2015. The parasitic plant Cuscuta australis is highly insensitive to abscisic acid-induced suppression of hypocotyl elongation and seed germination. USA, PLoS ONE 10(8) e0135197. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0135197) ['Given that Cuscuta plants are no longer severely challenged by drought stress, we hypothesize that the ABA-mediated drought resistance pathway in Cuscuta spp. might have had degenerated over time during evolution.‘]
and functional genomic studies in this important medicinal plant.


Liu MinLu, Yu WenBin, Kuss, P., Li DeZhu and Wang Hong. 2015. Floral nectary morphology and evolution in Pedicularis (Orobanchaceae). Botanical Journal of the Linnean Society 178(4): 592-607. [Concluding that the nectary in beaked species may be a vestigial structure retained during a recent rapid radiation of Pedicularis, especially in the Himalaya-Hengduan Mountains of south-western China.]

Liu YeWei, Bu LingNa, Zhao JianXi and Wei JianTeng. 2015. Intracellular metabolomic approach for evaluating antioxidant capacity and its application. Journal of Liquid Chromatography & Related Technologies 38(12): 1179-1184. [The antioxidant activities of Cynomorium songaricum was successfully evaluated using the intracellular metabolomic approach described.]

Lopez Laphitz, R.M., Ezcurra, C., Vidal-Russell, R. 2015. Revisión taxonómica del género sudamericano Quinchamalium (Schoepfiaceae). Bol. Soc. Argent. Bot. 50:235-246. [In this study, 28 species or infraspecific taxon names are reduced to synonymy with Q. chilense.]


Ma YuYing, Fan RongHua, Duan MengMeng, Yu ZhiGuo and Zhao YunLi. 2015. A study of pharmacokinetic interactions among co-existing ingredients in Viscum coloratum after intravenous administration of three different preparations to rats. Pharmacognosy Magazine 11(43): 455-462. [A detailed study confirming complex, extensive pharmacokinetic interactions among the 4 main active components in V. coloratum extract used in China as a herbal medicine to treat a variety of diseases, including cardiovascular diseases, cancer, hypertension, hepatitis and haemorrhage.]


McGimpsey, V.J. and Lord, J.M. 2015. In a world of white, flower colour matters: a white-purple transition signals lack of reward in an alpine Euphrasia. Austral Ecology 40(6): 701-708. [Noting that only white flowers in E. dyeri are fertile, and suggesting that, once pollinated, they quickly change from white to purple, which pollinating insects (mainly bees and syrphid flies tend to avoid, to ensure they are more likely to visit the white flowers that still require pollination.]

Magrach, A., Rodríguez-Pérez, J., Piazzon, M. and Santamaria, L. 2015. Divergent effects of forest edges on host distribution and seed disperser activity influence mistletoe distribution and recruitment. Journal of Ecology (Oxford) 103(6): 1475-1486. [Studying the interactions between Tristerix corymbosus, its main host Campsidiun valdavianum and its only seed disperser, the marsupial Dromiciops gliroides, especially in relation to forest edges.]


Malik Neeraj and Charaya, M.U. 2013. Deleterious rhizosphere microbes, arbuscular mycorrhizal fungi and quorum management as emerging tools for the biological management of weeds. Vegetos 26(3s): 246-258. [Noting that some deleterious rhizospheric fungi have been found to suppress Orobanche cumana.]

Annals of the Missouri Botanical Garden 100(4): 329-363. [Fossil evidence was assembled for all asterid lineages for which verifiable fossils exist. Loranthaceae are part of Santalales, the first-branching clade of superasterids. Unequivocal fossil loranth pollen is documented from the early Eocene.]


*Matura, R., Švátek, M., Pálková, M., Volařík, D. and Vrška, T. 2015. Mistletoe infection in an oak forest is influenced by competition and host size. PLoS ONE 10(5): e0127055. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0127055) [Finding, in Czech Republic that the probability of occurrence of Loranthus europaeus on individual stems (mainly Quercus spp.) was affected mostly by stem size, whereas competition had the most important effects on the probability of mistletoe occurrence on whole trees as well as on mistletoe abundance. Therefore, we confirmed our hypothesis that competition among trees has a negative effect on mistletoe occurrence.]

Mauro, R.P., Lo Monaco, A., Lombardo, S., Restuccia, A. and Mauroimale, G. 2015. Eradicacion of Orobanche/Phelipanche spp. seedbank by soil solarization and organic supplementation. Scientia Horticulaterae 193: 62-68. [Finding 99% reduction in viable seeds of unspecified broomrape (presumably Phelipanche ramosa) after one season of solarisation in southern Italy but this became 100% with the addition of organic matter to the soil.]

Mbogo, P.O., Dida, M.M. and Owuor, B. 2015. Generation means analysis for estimation of genetic parameters for Striga hermonthica resistance in maize (Zea mays L.). Journal of Agricultural Science (Toronto) 7(8): 143-155. [‘The results reveal the involvement of duplicate epistasis where the dominance estimate and dominance × dominance interaction had opposite signs. The presence of duplicate type of gene interaction confirms the importance of dominance gene effects.’]


Meng Wei, Wang YingZhen, Guan RenWei, Zhou JianYong, Wang LingLing, Lin HuiBin and Lin JianQiang. 2015. (Study on the fingerprints of cuscutae semen from different hosts by HPLC.) (in Chinese) China Journal of Traditional Chinese Medicine and Pharmacy 30(4): 1079-1082. [Concluding that the main components in extracts of Cuscuta chinensis and C. australis from different hosts are similar but with different ratios.]


*Moral, J., Lozano-Baena, M.D. and Rubiales, D. Phytochemistry 113: 79-86. [Studies 11(2): 508-521. [International Journal of Innovation and Applied National Park (DR Congo).] (in French) living in the submountain area of Kahuzi-Biega of woody forestry resources by the population Birhashirwa, R.N. and Habimana, H. 2015. (Use for pearl millet, Belzile, F. 2015. Construction of a genetic map C.T., Vigouroux, Y., Haussmann, B.I.G. and conditioning period up tol 40 days. The impact of the type of water stress on seed germination was similar, although the radicle growth of seeds under osmotic stress was lower than under matric stress, which could explain the lower infiltration of *O. crenata* in regions characterized by saline soil.]

*Moniodis, J., Jones, C.G., Barbour, E.L., Plummer, J.A., Ghisalberti, E.L. and Bohllmann, J. 2015. The transcriptome of sesquiterpenoid biosynthesis in heartwood xylem of Western Australian sandalwood (*Santalum spicatum*). Phytochemistry 113: 79-86. [While the terpene synthases in this and previously cloned sandalwoods do not explain the prevalence of *E.E*.-farnesol in *S. spicatum*, the genes identified in this and previous work can form a basis for future studies on natural variation of sandalwood terpenoid oil profiles.]

*Moral, J., Lozano-Baena, M.D. and Rubiales, D. 2015. Temperature and water stress during conditioning and incubation phase affecting *Orobanche crenata* seed germination and radicle growth. Frontiers in Plant Science 6(June): 408. (http://journal.frontiersin.org/article/10.3389/fpls.2015.00408/full) [Seeds of *O. crenata* germinated between 5 and 30°C with a maximum around 20°C. and germination increased logarithmically with length of conditioning period up tol 40 days. The impact of the type of water stress on seed germination was similar, although the radicle growth of seeds under osmotic stress was lower than under matric stress, which could explain the lower infiltration of *O. crenata* in regions characterized by saline soil.]


*Murage, A.W., Pittchar, J.O., Midega, C.A.O., Onyango, C.O. and Khan, Z.R. 2015. Gender specific perceptions and adoption of the climate-smart push-pull technology in eastern Africa. Crop Protection 76: 83-91. [Concluding that women have a marginally greater appreciation of the benefits of the push-pull technology involving intercropping with *Desmodium* spp. for control of *Striga* spp.]

*Mutuku, J.M., Yoshida, S., Shimizu, T., Ichihashi, Y., Wakatake, T., Takahashi, A., Seo, M. and Shirasu, K. 2015. The *WRKY45*-dependent signaling pathway is required for resistance against *Striga hermonthica* parasitism. USA, Plant Physiology 168(3): 1152-1163. [The susceptibility phenotype in the *WRKY45*-knockdown plants was recovered by foliar JA application. These results point to a model in which *WRKY45* modulates a cross talk in resistance against *S. hermonthica* by positively regulating both SA/benzothiadiazole and JA pathways.]

*Naitormmbaide, M., Djondang, K., Mama, V.J. and Koussou, M. 2015. Screening of some varieties of maize (*Zea mays* L.) for resistance to *Striga hermonthica* (Del) Benth in the Chadian savannah. Journal of Animal and Plant Sciences (JAPS) 24(1): 3722-3732. [Reporting increasing infestation of maize by *S. hermonthica* in Chad, associated with declining soil fertility. Maize varieties 2009TZE W-DT-STR and STR-W-2009TZEEN proved resistant to *Striga* giving grain yields of 4 t/ha compared with 2.3 t/ha in a control. Furthermore, greater straw yield, trampled in with animal manure contributed to improved fertility.]


Nickrent, D.L. and García, M.A. 2015. Lacomucinaea, a new monotypic genus in Thesiaceae (Santalales). Phytotaxa 224:173-184. Lacomucinaea lineata shows it is most similar to remaining Thesium are now monophyletic.


Norsuhailla Abdul Wahab, Rohaima Ahdan, Zahidah Ahmad Aaufa, Kiong KinWeng, Mohd Hafizan Johar, Zatilah Mohd Shariff and Amin Ismail. 2015. Nutritional values and bioactive components of under-utilised vegetables consumed by indigenous people in Malaysia. Journal of the Science of Food and Agriculture 95(13): 2704-2711. [Champerea manillana (Opiliaceae) has high calcium content.]

Nutan Jadhav, Sangeeta Kulkarni, Arati Mane, Roshan Kulkarni, Aparna Palshetker, Kamalinder Singh, Swati Joshi, Arun Risbud and Smita Kulkarni. 2015. Antimicrobial activity of plant extracts against sexually transmitted pathogens. Natural Product Research 29(16): 1562-1566. [Cuscuta reflexa and Cassytha filiformis included in the study but apparently no outstanding results recorded.]


Ogunmefun, O.T., Ekundayo, E.A., Oggunusi, T.A., Olowoyeye, A.H., Fasola, T.R. and Saba, A.B. 2015. Antimicrobial activities of Phragmanthera incana (Schum.) Balle, a mistletoe species harvested from two host plants against selected pathogenic microbes. Annual Research & Review in Biology 8(3): ARRB.14947. [Confirming a moderate antimicrobial potential of the extracts of P. incana. Extracts from plants growing on kolanut were found to be more effective than from those growing on cocoa.]

Okazawa, A. and Wakabayashi, T. 2014. Development of parasitic weed control method by metabolic analysis. Seibutsu-kogaku Kaishi 92(10): 549-552. [Reporting the discovery of nojirimycin a glycol hydrolysis inhibitor, which inhibits the germination of Orobanche minor as well as inhibiting the root growth of other plants including Striga and Phtheirospermum spp. Instability in soil means it will be necessary to find more stable analogues.]

gesnerioides in cowpea (Vigna unguiculata (L.) Walp.). African Journal of Biotecnology 14(27): 2179-2190. [SCAR markers, 61RM2 and C42-2B were identified having 98% and 96% efficiency respectively in identifying resistance to races SG1, SG3 and SG5 of Striga gesnerioides.]

Ondoua, J.M., Dibong, S.D., Taffouo, V.D. and Ngotta Biyon, J.B. 2015. (Parasitism of cocoa seed fields by Loranthaceae in the locality of Nkoemvone (southern Cameroon)) (in French) Journal of Applied Biosciences. 85: 7794-7803. [Five species recorded on cocoa, the commonest being Phragmanthera capitata; others were Globimetula dinklagei, Phragmanthera nigritana, Tapinanthes ogowensis and Tapinanthes preussii. In the absence of other control methods it is suggested to plant mistletoe-resistant clones ICS 46 and UPA 146.]


Patel, J.N. and Patel, N.K. 2015. Ethnobotanical uses of wild plants from Amirgadh Taluka, Banaskantha Dist., Gujarat. Lifesciences Leaflets 67: 142-147. [Plants used by a tribal group who live in dense forest far away from hospitals, include ‘Cuscuta chinensis’ (probably C. campestris).]


Patrick-Iwuanyanwu, K.C., Sajjad Ali, Choudhary, M.I., Muhammad Ismail and Saima Rasheed. 2015. In vitro antioxidant and antiglycation studies on African mistletoe (T. bangwensis (Engler and K. Krause), Danser) and ring worm plant (S. alata (Linn.) Roxb) from Nigeria. Journal of Biodiversity and Environmental Sciences (JBES) 6(1): 378-386. [Confirming that extracts of T. bangwensis leaves showed antioxidant and antiglycation properties.]

Petersen, G., Cuenca, A. and Seberg, O. 2015. Plastome evolution in hemiparasitic mistletoes. Genome Biology and Evolution 7(9): 2520-2532. [Complete plastome sequences are reported for Osyris alba, Viscum album, V. crassulae, and V. minimum. All are smaller than typical non-parasitic angiosperms, with intergenic spacer size reductions, but most notable are gene losses or pseudogenizations of protein-coding genes including all 11 ndh genes.]


**Pratima Gautam and Richhariya, G.P. 2015.**

Ethnoveterinary medicinal plants used by tribal’s and rural communities of Chitrakoot, Distt.-Satna (M.P.). International Journal of Pharmacy and Life Sciences (IJPLS) 6(4): 4427-4430. [C*uscuta reflexa* among 23 plants used in traditional veterinary medicine.]

Preston, C.D. and Pearman, D.A. 2015. Plant hybrids in the wild: evidence from biological recording. Biological Journal of the Linnean Society 115(3): 555-572. [Reviewing the occurrence of natural hybrids in UK and noting that there are few annual or biennial hybrids except for numerous annual *Euphorasia* hybrids.]

**Prider, J. 2015.**

The reproductive biology of the introduced root holoparasite *Orobanche ramosa* subsp. *mutelii* (Orobanchaceae) in South Australia. Australian Journal of Botany 63(5): 426-434. [Identifying characters that contribute to the success of this introduced plant, including self-pollination, rapid maturation of the reproductive stages and high seed output, up to 200,000 seeds per plant. Vigilance is required so that plants can be controlled before they set seed.]

Punia, S.S. and Duhan, A. 2015. Innovations in management of *Orobanche* in mustard. India Farming 65(7): 29-33. [A general review relating especially to Harayana state, India. Apart from cultural practices giving partial control, overall sprays twice with glyphosate at 25 and 50 g/ha can control the *Orobanche* (not specified but presumably *O. aegyptiaca*) with some modest increases in yield.]

Qu ZhengYi, Zhang YuWei, Yao ChunLin, Jin YinPing, Zheng PeiHe, Sun ChengHe, Liu JunXia, Wang YuShuai and Wang YingPing. 2015. Chemical constituents from *Orobanche cernua* Loefling. Biochemical Systematics and Ecology 60: 199-203. [Identifying 17 compounds, including eleven phenylpropanoid glycosides, two flavonoids, one lignan, and three phenolic acids isolated from the fresh whole plant of *O. cernua*. (not certain whether this is *O. cernua* s.s. or could be *O. cumanii*).]

Queijeiro-Bolaños, M.E. and Cano-Santana, Z. 2015. Temporal dynamics of dwarf mistletoe infestation (*Arceuthobium globosum* and *A. vaginatum*) in Zoquiapan CienciaUAT 9(2): 6-14. [Studying changes over time in populations of *A. vaginatum* and *A. globosum* on *Pinus hartwegii* in Mexico in relation to fire and logging.]

Qian Xiong, Xu ShaoZhong, Zhao ChangLing, Meng HengLing and Wen GuoSong. 2015. cDNA cloning and expression analyses of the isoflavone reductase-like gene of *Dendrobium officinale*. Pakistan Journal of Botany 47(4): 1265-1270. [The full length of the isoflavone reductase-like gene (IRL) cDNA of *Dendrobium officinale* was cloned and its expression levels were determined in organs and tissues of *D. officinale* plants at different ages. The nearest phylogenetic relationship was with phenylcoumaran benzyl ether reductase (PCBER) of *Striga asiatica*. DoIRL was expressed in all organs and tissues of *D. officinale* plants at different ages at comparatively low levels, whereas the highest expression was in leaves of two-year-old plants.]


Ramachandra Prasad, T.V., Mishra, J.S. and Girija, T. 2015. Management of parasitic weeds in India. 25th Asian-Pacific Weed Science Society Conference, Hyderabad, India. Souvenir 20-24. [Reviewing occurrence and control of parasitic weeds in India, especially *Orobanche aegyptiaca* in mustard, *O. cernua* in tobacco; *Striga asiatica* and *S. densiflora* in cereals (noting that the new hybrids of pearl millet are generally not attacked); *Cuscuta campestris* and *C. reflexa* (noting useful resistance to *C. campestris* in some lucerne, green gram and black gram varieties); and mistletoes, especially *Dendrophthoe falcata* in a wide range of forest and fruit species (noting control by 2,4-D and ethephon).]


Samejima, H. and Sugimoto, Y. 2015. (Outcomes of research on controlling a root parasitic weed, Striga hermonthica, and extension activities for farmers in Gadaref State, Sudan.) (in Japanese) In: Symposium on 'Researches in tropical agriculture and the implementation in society: how is the output adapted to a community?'. Research for Tropical Agriculture 8(1): 11-14. [No English abstract available.]


Satou, T., Ogawa, Y. and Koike, K. 2015. Relationship between emotional behavior in mice and the concentration of (+)-α-santalol in the brain. Research 29(8): 1246-1250. [Results support results obtained previously using the Morris maze test in the same mouse model of senescence, and the use of traditional medicinal herbs containing acteoside (from Cistanche deserticola) for neuroprotection and memory loss.]
Scalon, M.C. and Wright, I.J. 2015. A global analysis of water and nitrogen relationships between mistletoes and their hosts: broad-scale tests of old and enduring hypotheses. Functional Ecology 29(9): 1114-1124. [Studying two hypotheses relating to mistletoes a) that high transpiration is needed to satisfy nitrogen requirement and b) that leaf mimicry reduces herbivory. Studies on 168 mistletoe/host pairs suggest that N is NOT particularly limiting and that the mimicry hypothesis is also not clearly supported.]


*Senait Girma, Mirute Giday, Berhanu Erko and Hassen Mamo. 2015. Effect of crude leaf extract of Osyris quadripartita on Plasmodium berghei in Swiss albino mice. BMC Complementary and Alternative Medicine 15(184): (16 June 2015). (http://www.biomedcentral.com/1472-6882/15/184) [The study supports the traditional use of O. quadripartita for the treatment of malaria. However, further confirmatory studies including the isolation and characterization of the active anti-malarial compound are needed.]


Shomar, A., Al-Hussein, N., Al-Shamaa, K. and Bayaa, B. 2015. Effect of some herbicides in controlling broomrapes (Orobanche spp.) and major weeds in food legume (chickpea, lentil and faba bean) crops. Arab Journal of Plant Protection 33(2): 164-176. [Reporting effects of a mix of imazethapyr and pendimethalin applied twice, pre- and early post-emergence, for control of Orobanche spp. and other weeds. Results unsatisfactory in chickpea and lentil but useful in faba bean.]


Skippington, E., Barkman, T.J., Rice, D.W. and Palmer, J.D. 2015. Miniaturized mitogenome of the parasitic plant Viscum scurrauloides is extremely divergent and dynamic and has lost all nad genes. Proceedings of the National Academy of Sciences of the United States of America 112(27): E3515-E3524. [This is another example of the use of powerful tools of genomic studies to better understand parasitism. The authors looked at the mitochondrial genome of this mistletoe and report the loss of Respiratory Complex I, the only known multicellular organism with this feature. The authors refer to this mistletoe as having a ‘onderfully bizarre mitogenome’ The paper discusses other components of the mitogenome and relate it to the parasitic behavior of the plant. The Palmer lab in Indiana has been a leader in such studies.]
Sodde, V.K., Lobo, R., Kumar, N., Maheshwari, R. and Shreedhara, C.S. 2015. Cytotoxic activity of *Macrosolen parasiticus* (L.) Danzer on the growth of breast cancer cell line (MCF-7). Pharmacognosy Magazine 11(42 (Suppl.): 156-160. [A range of tests confirmed significant cytotoxic activity. However the aqueous extract of *M. parasiticus* demonstrated higher activity against MCF-7 breast cancer cells than the methanolic.].


Suetsumu, K. 2015. Seed dispersal of the hemiparasitic plant *Thesium chinense* by *Tetramorium tsushimae* and *Pristomyrmex punctatus*. Entomological Science 18(4): 523-526. [Reporting collection of seeds of *T. chinense* in Japan by ants and storage in nests providing protection from the seed predator *Canthophorus niveimarginatus* and placing them close to roots of grasses on which it is parasitic.]

Sui XiaoLin, Huang Wei, Li YunJu, Guan KaiYun and Li AiRong. 2015. Host shoot clipping depresses the growth of weedy hemiparasitic *Pedicularis kansuensis*. Journal of Plant Research 128(4): 563-572. [Clipping the host *Elymus nutans* significantly reduced growth of *P. kansuensis* without affecting the productivity of the host, suggesting grazing should help to reduce the parasite.]


Surendra Singh, Shekhawat, B.S. and Savitri Sharma. 2015. Management of *Orobanchaceae* in mustard. Proc. Volume III (posters) 25th Asian-Pacific Weed Science Society Conference, Hyderabad, India, October 13-16, 2015: 488. [Pyrazosulfuron ethyl at 200 g/ha, pre-plant incorporated was the best of a range of herbicides, providing good selective control of unspecified *Orobanchaceae* (probably *O. aegyptiaca*). Imazapac post-emergence was also good.]
manage human health, although the involvement of phloridzin-sensitive transport should be reduced.’"

Tarantino, E., Lops, F., Disciglio, G., Carlucci, A., Gatta, G. and Frabboni, L. 2015. (Contain Phelipanche ramosa on processing tomatoes.) (in Italian) Informatore Agrario 71(33): 68-71. [P. ramosa could be decreased with deep ploughing (50 cm). Among other control methods the bio-stimulating Radicon compost activated with Fusarium oxysporum, mineral nitrogen fertilizer, sulphur and use of improved cultivars resistant to the parasite gave adequate control, with obvious positive impact on yield.]


Toh, S., Holbrook-Smith, D., Stogios, P.J., Onopriyenko, O., Umba, S., Tsuchiya, Y., Savxchenko, A. and McCourt, P.M. 2015. Structure-function analysis identifies highly sensitive strigolactone receptors in Striga. Science 350(6257): 203-207. (https://www.sciencemag.org/content/350/6257/203.abstract) [The function of 11 strigolactone receptors from the parasitic plant Striga hermonthica using chemical and structural biology was characterized. A clade of polyspecific receptors, including one that is sensitive to picomolar concentrations of strigolactone was identified. A crystal structure of a highly sensitive strigolactone receptor from Striga revealed a larger binding pocket than that of the Arabidopsis receptor. By expressing strigolactone receptors in Arabidopsis, a bioassay that can be used to identify chemicals and crops with altered strigolactone levels was developed.]


Trevisan, S., Manoli, A., Ravazzolo, L., Botton, A., Pivo, M., Masi, A. and Quaggiotti, S. 2015. Nitrate sensing by the maize root apex transition zone: a merged transcriptomic and proteomic survey. Journal of Experimental Botany 66(13): 3699-3715. [New details of the transcriptomic and proteomic responses to nitrate availability in maize seedlings roots are presented. The results highlighted a complex transcriptomic and proteomic reprogramming that occurs in response to nitrate, emphasizing the role of this root zone in sensing and transducing nitrate signal. A relationship of nitrate with biosynthesis and signalling of several phytohormones, such as auxin, strigolactones, and brassinosteroids is evident, as well as to cytoskeleton activation and cell wall modification.]

349(6250): 864-868. [see Literature Highlight above.]

Ueno, K., Sugimoto, Y. and Zwanenburg, B. 2015. The genuine structure of electrol: end of a long controversy. Phytochemistry Reviews 14(5): 835-847. [Establishing the genuine structure of electrol, the stimulant for Striga gesnerioides isolated from cowpea. Please note that structures of orobanchol and electrol (orobanchyl acetate) have been revised]

van der Ent, A. and Wong, K.M. 2015. Range extension of Christisonia scortechinii from mainland Southeast Asia into Borneo, and notes on the distinction between Aegineta and Christisonia (Orobanchaceae). Botanical Studies 56: 28. [This taxonomic study concludes that C. scortechinii is more widespread than previously thought, including Laos, China, Borneo and the Philippines. Christisonia sinensis and C. wightii are reduced to synonyms of C. scortechinii.]

Vidal-Russell, R. and Premoli, A.C. 2015. Nothofagus trees show genotype difference that influence infection by mistletoes, Misodendraceae. Australian Journal of Botany 63(6): 541-548. [Allozymes were used to test for genetic differences between host Nothofagus trees infected or not infected by Misodendrum. Sites with higher degrees of infection by M. punctulatum were distinguished in the ordination, and host genetic structure could be maintained by the mistletoe via host selection.]

von Schoen-Angerer, T., Madeleyn, R., Kienle, G., Kenne, H. and Vagedes, J. 2015. Viscum album in the treatment of a girl with refractory childhood absence epilepsy. Journal of Child Neurology 3(8) 1048-1052. [V. album appears to have been a necessary adjunct treatment for this child to become free of epileptic seizures (in Germany).]

Wakabayashi, T. and 13 others. 2015. Planteose as a storage carbohydrate required for early stage of germination of Orobanche minor and its metabolism as a possible target for selective control. Journal of Experimental Botany 66(11): 3085-3097. [Results suggest that planteose is a storage carbohydrate required for the early stage of germination of O. minor. Nojirimycin bisulfite was found to alter the sugar metabolism and to selectively inhibit the germination of O. minor. It also inhibited radicles in Striga hermonthica and Phlomispernum japonicum, suggesting it could be a promising starting point from which to develop specific herbicides against these parasites.]


Yobo, C.M. and Ito, K. 2014. Availability and size class distribution of the most popular indigenous fruits trees and implications for sustainable harvest around the Ivindo National Park, Gabon. International Journal of
Biodiversity and Conservation 6(11): 777-789. [Including discussion of *Coula edulis* (Olacaceae) and the degree to which it is being overharvested in the wild and the need to encourage on-farm cultivation.]

*Yu WenBin, Liu MinLu, Wang Hong, Mill, R.R., Zhang Meng, Ma YongQing, Zhong WenJin, Jia HAUSTORIUM 68 December 2015 39 Yuan, Y., Zhou, R., Fu, J., Zhao, J. and Lu, Z. 2015. *Loranthus grewingkii* sequences, this paper shows that the Iranian [Using mostly previously published DNA Plant Taxonomy and Geography 70(2): 199-206. study on (ITS) and chloroplast nuclear ribosomal internal transcribed spacer representing 104 out of 130 series in the classification system of Tsoong. Species with opposite-/whorled-leaved were monophyletic but overall there was little correlation between the phylogenetic tree and the morphology-based classification.]


Zanjanchia, P. and Mehrvarza, S.S. 2015. The generic position of *Loranthus grewingkii* of Loranthae (Loranthaceae) inferred from the nuclear ribosomal internal transcribed spacer (ITS) and chloroplast trnL-F sequences: a case study on *Loranthus* in Iran. Webbia: Journal of Plant Taxonomy and Geography 70(2): 199-206. [Using mostly previously published DNA sequences, this paper shows that the Iranian *Loranthus grewingkii* is sister to *L. europaeus*.]


Zhang Meng, Ma YongQing, Zhong WenJin, Jia XueTing, Wu DanRui, Yu Rui and Ye XiaoXin. 2015. N-P-K ratio affects exudation of germination stimulants and resistance of tobacco seedlings to broomrapes. Plant Growth Regulation 76(3): 281-288. [Confirming that stimulation of *Orobanchaceae* and *Phelipanche* by root exudates from tobacco seedlings was decreased under higher N and P nutrition. Further, in a Petri dish study, increased vulnerability to *P. aegyptiaca* infection was observed in one variety of tobacco under nitrogen- and potassium-deficient conditions while it occurred in a second variety under nitrogen- and phosphate-deficient conditions. The results showed that macro-nutrient ratios can affect both the exudation of germination stimulants and the resistance of tobacco seedlings.]

Zhang XinHua, Berkowitz, O., da Silva, J.A.T., Zhang MuHan, Ma GuoHua, Whelan, J. and Duan Jun. 2015. RNA-seq analysis identifies key genes associated with haustorial development in the root hemiparasite *Santalum album*. Frontiers in Plant Science, 6(September): 661. [Results suggest that genes encoding nodulin-like proteins may be important for haustorial morphogenesis in *S. album*.]


Zhu NingBo, Chen Lei, Bai Yun, Li XueWu, Cairang DanZhou, Li Tao, Li JiRun and Tian ChengMing. 2015. Anatomical study on endophytic system of dwarf mistletoe (*Arceuthobium sachuanense*). Acta Botanica Boreali-Occidentalia Sinica 35(7): 1342-1348. [A detailed description of the progression of penetration and development following penetration of *A. sachuanense* into a host not named in the abstract but presumably a *Picea* sp.]

Zimmermann, J., de Klerk, M., Musyoki, M.K., Viljoen, A., Watson, A.K., Beed, F., Gorler, M., Cadisch, G. and Rasche, F. 2015. An explicit AFLP-based marker for monitoring *Fusarium oxysporum* fsp. *striag* in tropical soils. Biological Control, 89: 42-52. [Reporting the isolation of a specific AFLP allowing the identification of *F. oxysporum* and hence a means of monitoring the abundance of e.g. the *Striga*-specific ‘Foxy -2’ in the soil under different soil conditions and the presence of *S. hermonthica*.]

account. (wileyonlinelibrary.com) DOI
10.1002/ps.4105. [In this review strigolactones
are discussed in light of their production in
extremely low quantities in plants. Therefore,
their total synthesis is highly relevant for
confirming the structures assigned on the basis
of spectroscopic and other physical data. A
second important theme highlighted in this
review is the design and synthesis of
strigolactone analogues that have a simplified
structure while still featuring the essential
bioproperties. This review summarises the
strategy and synthesis of naturally occurring
strigolactones, and the design and synthesis of
analogues with appreciable bioactivity.
Unfortunately, there are incorrect structures;
solanacol (Fig. 1), C ring orientation in Scheme
12, and medicaol (Fig. 7).]

IPPS MEMBERSHIP
Membership in the IPPS is open to individuals and
organizations of all nations that are interested in
the objectives of the Society. Membership fee for 2
years is 50 € and will be included in the registration
for the IPPS meeting (WCCP).
To obtain a Registration form visit the IPPS website
(http://www.parasiticplants.org/) or contact:
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HAUSTORIUM
Parasitic Plants Newsletter
ISSN 1944-6969
Official Organ of the International Parasitic Plant Society
(http://www.parasiticplants.org/)

July 2016 Number 69

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PRESIDENT’S/EDITOR’S MESSAGE

Dear IPPS Members,

It is an honour and a pleasure to start my term as President of the IPPS and I look forward to working with new and existing members of the Executive Committee and everyone involved in parasitic plant research. I hope that together we can take the society forward and continue the excellent work of Koichi Yoneyama.

On behalf of the society I would like to thank Koichi for all the time and hard work he has committed to the IPPS over the last eight years as Vice President and then President of the Society. During his time as President, Koichi oversaw the elections to the Executive committee, the Parasitic Plant Congress in Kunming, China in 2015, which was a huge success and he dealt with the general business of the society very effectively. Finally, I would like to say a personal thank you to Koichi, as I have very much enjoyed working with him during the last four years and learning how the society works.

One of my first and easy tasks is to encourage everyone to attend the 14th World Congress on Parasitic Plants (WCPP) ‘From Genome to Field’, which will be held at the Asilomar Conference Center, Pacific Grove, California from Sunday June 25th to Friday June 30th 2017. The Further details of the venue, the scientific program, which is currently being put together, and details about registration can be found on the website (www.WCPP14.org).

There are two more meetings of interest to parasitic plant researchers, the Second International Legume Society Conference which will be held in Tróia, Portugal, from the 11th -14th October, 2016 and the 2nd International Congress on Strigolactones, which will take place in Turin, Italy from the 27th – 30th of March 2017. Further information about both conferences is provided on page 10 of Haustorium.

I look forward to seeing everyone in Asilomar!

Best wishes,

Julie Scholes, IPPS President
J.Scholes@Sheffield.ac.uk

MEETING REPORTS

THE 6TH INTERNATIONAL INTERDISCIPLINARY MISTLETOE SYMPOSIUM, 12-14 November 2015, Nonnweiler, Saarland, Germany

Over 100 scientists and doctors from a variety of scientific disciplines and therapeutic approaches met at the European Academy in Otzenhausen for the 6th International, Interdisciplinary Mistletoe Symposium, entitled ‘Mistletoe in Tumour Therapy – Basic Research and Clinical Practice’. The symposium was coordinated by Dr. Rainer Scheer and organised by numerous medical and pharmaceutical professional associations together with the Karl and Veronica Carstens Foundation.

Over the 3 days, the latest results from research and clinical medicine were presented, discussed and compared in 46 lectures, producing a multidimensional and comprehensive picture of the current state of scientific knowledge on mistletoe extracts. The specific areas dealt with included manufacture and testing as well as regulatory assessment of mistletoe preparations, the effects of various ingredients, in vitro and in vivo pre-clinical studies, studies on immunology and cytotoxicity, clinical results obtained in various applications and tumour entities in both human and veterinary medicine, reports from medical practice and clinical studies designed to demonstrate specific effects, the efficacy, the safety and tolerance of mistletoe preparations. Oncological guidelines and the treatment of pancreatic and gastro-intestinal tumours were chosen as a topic for special attention and also dealt with in depth in a podium discussion. A particular focus was placed on the results of the pioneering Phase III study conducted by Galun and Tröger, as well as the controversial debate this has kindled in the literature.

The organisers hope that in future the Mistletoe Symposia will prove to be a forum for scientific exchange and discussion of questions relating to safe and reliable use of mistletoe in tumour therapy between professional associations and representatives not only of complementary, but also of conventional oncology.

All the abstracts from the symposium are published in English in Phytomedicine 22 (2015) Supplement 1 and are freely available on the Internet at www.ScienceDirect.com.

The summary papers that are still in stock are available on request from the author of this article. It is again planned
to make the full texts of all contributions to the symposium available in a book published by KVC-Verlag, Essen. The print and online version will probably be available by the end of 2016.

The Mistletoe Symposia have been held every 4 years since 1995. This year’s participants again rated the congress as important and stimulating in terms of the results presented, the quality of the lectures, the discussions, the opportunity for individual conversations as well as the possibility to establish contacts. This was further underscored by the harmonious atmosphere as well as the excellent culinary, spatial and technical setting of the venue throughout the symposium.

It is planned to continue this fruitful exchange at the 7th Mistletoe Symposium in 2019, again at the European Academy in Otzenhausen and again with simultaneous Mistletoe Symposium in 2019, again at the European Academy in Otzenhausen and again with simultaneous interpretation into English. For more information about this and previous Mistletoe Symposia visit www.mistelsymposium.de.

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7TH INTERNATIONAL WEED SCIENCE CONGRESS, 19-25 June, 2016, Prague, Czech Republic.

At the 7th International Weed Science Congress a total of 35 papers on parasitic weeds were presented. The studies presented at the meeting, excluding the country-specific species inventory studies, covered 9 species of parasitic plants. The studies on broomrapes (Orobanche cumana, O. cernua, O. coerulescens, Phelipanche ramosa) were dominating. Other species were P. aegyptiaca, Cascuta campestris, Viscum album, Striga hermonthica and Rhamphicarpa fistulosa.

Against O. cernua in tobacco in India, an integrated management approach, using pre-emergence herbicide and plant hole application of neem cake was recommended. In sunflower in Hungary, genetic variation in resistance against O. cumana was observed among 32 commercial varieties. In Israel the resistance mechanism against O. cumana, was characterized in sunflower variety EMEK 3 and it was found that the parasite intrusive cells are stopped during the penetration attempt, indicating a ‘post-attachment’ mechanism. Control of this broomrape species in sunflower can be enhanced by exogenously applied salicylic acid, which is shown to trigger a defence response in the host plant. A combination of O. cumana-tolerant sunflower variety Emeg 5 with one foliar application of imazapic at 3.6 g ha⁻¹ applied at the 6-leaf stage, was sufficient to decrease parasite infection and increase sunflower seed yield from 630 kg ha⁻¹ to 2,500 kg ha⁻¹. In Greece, O. cumana in sunflower was effectively controlled by Herbicide Resistant Crop (HRC) technologies ExpressSun® and especially Clearfield®.

In Texas, USA, a new outbreak of P. ramosa was observed in 2015 after a containment programme had stopped in 2008. A taskforce was set-up that will work on increased awareness on the re-occurrence of this weed and on ways to prevent further spread. In France, a cropping systems model, called PHERASYS, was developed to identify entry points for control of P. ramosa. Simulations showed that burying seeds by tillage may not be efficient to deplete the parasite seed bank, because of low seed mortality, but delaying crop sowing could reduce crop infestation due to the parasite seed dormancy characteristics. For Egyptian broomrape, P. aegyptiaca, a decision support system, called PICKIT, was developed for affected tomato growers in Israel, based on chemical control. This support system is now being adopted by commercial growers. To optimize this system, a molecular marker approach has been developed and tested to quantify broomrape seeds in soil samples, that could be used to map the within-field distribution, with the aim to conduct more site-specific herbicide applications. Another approach to support such site-specific chemical control was by early recognition of broomrape parasitism in an existing crop, that works through narrow-band spectral signatures of broomrape-infected plants.

The mechanism of control by glyphosate in a glyphosate-tolerant tomato variety has been studied. Glyphosate prevents self-production of aromatic amino acids in P. aegyptiaca by inhibition of the enzyme 5-enolpyruvylshikimate-3-phosphate synthase. In Iran, the genetic diversity of P. aegyptiaca has been studied, both on the molecular basis, as well as on the host preference and sensitivity to sulfosulfuron herbicide. In Turkey, rimsulfuron herbicide application to control P. ramosa in tomato was most effective following three applications via chemigation at 15, 30, and 45 DAP. Another approach tested in Turkey was to graft tomato varieties. Combinations of commercial varieties Newton/King Kong, Beril/Yedi, Selin/Kemerit reduced the number of broomrape plants and tubercles, and this method could be further explored as a solution for growers.

The use of a bio-herbicide to control O. cumana in sunflower was studied in Turkey. Amino acid salt, applied both to the soil and on the parasitic weed, was effective for control and could be recommended for organic sunflower farming where broomrape is problematic. A bio-control option to control broomrapes was also studied (in vitro) in Italy. Strains of fungi Trichoderma harzianum and Fusarium oxysporum proved to metabolize strigolactones, particularly 5-deoxystrigol and 4-deoxyorobanchol (around 73 and 69 %, respectively). In Israel, stimulant-dependent host
specificity of *Phelipanche* and *Orobanche* spp. was investigated for sunflower and tomato. *O. cernua* response to the strigolactones orobanchol, 2’epiorobanchol, 5-deoxystrigol and fabacyl acetate was highly specific, matching the tomato, as well as other Solanaceae spp. profile. No *O. cernua* response was observed after exposure of dehydrocostus-lactone and costunolide, coming from sunflower roots, the exact opposite of the *O. cumana* response to these compounds. *P. egyptiaca* proved to have the widest host range.

A study carried out in Poland provided the first evidence of host-to-parasite mitochondrial gene transfer in *Orobanche coerulescens* belonging to the section Inflatae which also contains the weedy species *O. cumana* and *O. cernua*.

On *Cuscuta* spp., studies on species distribution have been conducted in Russia and in Turkey. In Russia, 17 species of *Cuscuta* were identified and in Turkey (East Anatolia), through a combination of DNA extraction, cloning and sequencing from herbarium specimen, 8 species have been found. *C. campestris* was reported as an alien invasive species in sugar beet, while *C. polygonorum* was observed as a weed in apple orchards. In Serbia a study on the effects of *C. campestris* on sugar beet plant physiology showed that both the chlorophyll content and a number of chlorophyll fluorescence parameters were negatively affected by infection. In Israel, for control of *C. campestris* in water melon and chickpea, application of granular pendimethalin (‘Corral’ 2.68%, G) proved effective, as it prevented the parasite from attaching to its host stem. In the USA, integrated management of *Cuscuta* in cranberry using an AHP (Analytical Hierarchy Processing) model, was tested with growers with an objective to design farm-specific dodder management programs. AHP proved a useful decision support tool for growers.

A pot experiment with sorghum and different seed densities of *S. hermonthica* was conducted to parameterize a simulation model to investigate the density-dependent population regulation. Density dependence as well as inverse density dependence was observed depending on the life-cycle stage. The resulting overall fitness of *S. hermonthica* was not seed density dependent, as the population growth rate was constant over the range of densities. In India, for the control of *S. asiatica* in sugar cane, a combination of pre-emergence herbicide (atrazine) and trash mulching proved effective. Tolerance to *S. asiatica* has been identified in mutant rice varieties in Madagascar and these are being further tested in farmers’ fields. Against *S. asiatica* and *S. hermonthica*, resistance has been identified in wild sorghum types. Profiles of differentially expressed genes between *S. hermonthica* infecting wild and cultivated sorghum and between *S. hermonthica* and *S. asiatica* infecting cultivated sorghum have been compared. Identified genes/loci will provide a platform for enhancing resistance of sorghum to *Striga* spp. using a genetic modification (GM) or a non-GM approach. Promising advances were also reported on bio-control of *S. hermonthica*, with a technology that actually seems feasible and effective in farmers’ fields. The strategy entails primary inoculum delivery of the *S. hermonthica*-controlling fungus *F. oxysporum* f.sp. *strigae* on lab-prepared toothpicks, provided to farmers, and secondary inoculum, by the farmer him/herself, through boiled rice applied in the maize planting whole. The approach has resulted in average on-farm maize yield increases of 42-57% in western Kenya. A technology based on placing imazapyr herbicides within so-called sub-granules (30 to 60 µm) pressed into 2 to 4 mm conventionally dimensioned granules (for ease of application), applied with ALS resistant maize seeds, proved efficient to control *Striga*. Advantage of this method is the slow release of the herbicide and therefore a prolonged efficacy.

On another parasitic weed that parasitizes cereal hosts, the facultative parasite *Rhamphicarpa fistulosa* (rice vampireweed), results on studies on its distribution and host-parasite interactions were presented. It occurs in 28 rain-fed rice producing countries in Africa causing annual losses of 204,000 tons of milled rice worth US $82 million. Simulation studies showed that non-responsiveness to rice root exudates represents an opportunistic strategy, which is advantageous in combination with some important life history characteristics of this facultative parasite.

In Turkey, an inventory of the presence of *Viscum album* was conducted in two provinces (Aydin and Denizli) in Turkey. It was found on wild pear, pear, apricot, almond, black pine, poplar, willow and acacia trees. The survey showed that 33% to 76% farmers (depending on the province) had knowledge of this weed.

Jonne Rodenburg

**Papers and posters presented:**

Tal Shilo *et al.* - Aspects of glyphosate mechanism in Egyptian broomrape control

Hanan Eizenberg *et al.* - Assimilating a decision support system ‘PICKIT’ for Egyptian broomrape (*Phelipanche aegyptiaca*) control in processing tomato in Israel

Noam Ariel *et al.* - Molecular markers for identification and quantification of broomrape (*Orobanche* and *Phelipanche* spp.) seeds in a soil sample

Steven M. Runo *et al.* - Striga/sorghum arms race during domestication as revealed by Dual RNA-seq
Mihály Zalai et al. - Greenhouse and open-field testing methods for infection and virulence of broomrape \((\text{Orobanche cernua})\) in sunflower \((\text{Helianthus annuus})\)

Amnon Cochavi et al. - Early recognition of broomrape parasitism by physiological measurements and narrow-band spectral signatures

Oz Bendavid et al. - Integrated approach for alleviating the injury of sunflower broomrape \((\text{Orobanche cumana})\) in sunflower

Paula R. Westerman et al. - Density-dependent population regulation in the hemi-parasite, Striga hermonthica, on sorghum

Chinnagounder Chinnusamy - Integrated management of parasitic weed \((\text{Orobanche cernua})\) infesting transplanted tobacco in red sandy loamy soils

Chinnagounder Chinnusamy - Management of Striga asiatica in early planted sugarcane in red gravel soil fields of Southern India

Dana S., Eizenberg et al. - Genetic characterization of resistance of sunflower \((\text{Helianthus annuus L.})\) to sunflower broomrape \((\text{Orobanche cumana W.})\)

Denis L. Belkin - Distribution and impact of the genus Cuscuta L. in Russia

Fatma Keskin et al. - Determination of phylogenetic relations of species belonging to the genus dodder \((\text{Cuscuta spp.})\) that problem in agricultural and non-agricultural lands in eastern Anatolia (Turkey)

Lammert Bastiaans et al. - Rhamphicarpa fistulosa, an emerging parasitic weed problem in rain-fed lowland rice production systems in sub-Saharan Africa

Manoa Raharivelo et al. - In vitro screening of Malagasy rain fed mutant rice lines F154 and B22, tolerant to Striga asiatica

Marija M. Saric-Krsmanovic et al. - The effect of field dodder \((\text{Cuscuta campestris Yunk.})\) on chlorophyll fluorescence and chlorophyll content parameters of alfalfa and sugar beet plants

Muthukumar Bagavathiannan et al. - Branched broomrape \((\text{Orobanche ramosa})\): A serious threat to Texas vegetable industry

Dina Plakhine et al. - Stimulant dependent host specificity of root parasitic weeds \((\text{Phelipanche} \text{ and} \text{ Orobanche} \text{ spp.})\)

Chong Yang et al. - Alleviation of root holoparasitic \((\text{Orobanche cumana})\) infection by exogenously applied salicylic acid in host crop Helianthus annuus

Magdalena Denysenko et al. - The evidence of the host-to-parasite gene transfer in Orobanche

Angela Boari et al. - Biological control of parasitic weeds by using strigolactone-degrading fungi

David C Sands et al. - Striga biocontrol: A readily deployable and inexpensive method for smallholder farmers

Yaakov Goldwasser et al. - Cuscuta campestris control with granular pendimethalin in chickpea and watermelon

On Rabinovitz et al. - Phelipanche aegyptiaca control in processing tomatoes by weekly drip chemigation of imazapic at low application rates

Noushin Nezamabadi et al. - Investigating broomrape \((\text{Phelipanche aegyptiaca})\) populations genetic diversity, host preferring and response to herbicides and benzothiadiazole

Olivia Pointurier et al. - Modelling cropping system effects on branched broomrape dynamics in interaction with weeds

Martin Reisser et al. - Novel high capacity slow release herbicide formulations with new uses

Selvinaz Karabacak et al. - Broomrape \((\text{Orobanche} \text{ spp.})\) control with some organic herbicides in sunflower

Emre E. Muslu et al. - Controlling broomrape in tomato with rimsulfuron

Ilhan Uremis et al. - Grafting attempts for broomrape management

Nurcan Büyükkurt et al. - Alien species in sugar beet fields in Turkey

Bilal Esitmez - The role of soil parameters on weed distribution in apple orchards

Hilary A Sandler - Using analytic hierarchy processing and grower feedback to promote adoption of integrated management strategies for dodder \((\text{Cuscuta} \text{ spp.})\) in cranberry

Petros Vahamidis et al. - Spatial and temporal changes on weed flora and Orobanche cumana abundance in sunflower fields: An impact assessment of environmental, management and site factors

**INTERNATIONAL CONFERENCE ON PULSES.** Marrakesh, Morocco, 13-15 April, 2016

**Papers/posters presented included:**

Diego Rubiales - Integrated management of parasitic weeds to reclaim pulses area in Mediterranean region

Fouad Maalouf et al. - Breeding for post-emergence herbicide tolerance in cool-season food legumes

Joseph Mbasani Mams et al. - Assessment of tolerance level of Moroccan lentil genotypes against Orobanche crenata

Mounia Ennami et al. - Host differentiation and variability of Orobanche crenata populations from legume species in Morocco as revealed by cross infestation and molecular analysis

Mounia Ennami et al. - In vitro culture of Orobanche crenata

Aziza M Hassanine et al. - Orobanche crenata effect on some faba bean genotypes and the genetic variation between three Orobanche isolates

Rifai Mohammed, et al. - Screening of lentil germplasm to identify the sources of resistance against Orobanche crenata
The male Mistletoebird at its nest with hungry chicks demanding attention.

Its appearance in any area is governed by the fruiting of mistletoe. The Mistletoebird in turn helps to spread the plant due to the large quantity of mistletoe berries that passes through the bird, which in turn regenerates new plants. It seems ironic then that while the Mistletoebird has evolved into an extremely efficient local distributor of mistletoe seeds, the bird needs the mistletoe but the mistletoe certainly does not need the bird. Aside from the mistletoe berries these birds feed on berries of other plants, as well as insects. During the first few days of life the female incubates the eggs alone.

Mistletoebirds are usually seen flying very rapidly from tree to tree, gaining their power of strong swift flight from long, narrow wings.

Maitland Mercury, May 6, 2016.

Vampire vine helps to destroy alien European weeds in Australia

Let the plant wars begin. A parasitic vine that sucks the life out of feral weeds is being billed as a promising new agent for biocontrol.

Cassytha pubescens, or devil’s twine, is the first native plant to be investigated as a weapon against invasive weeds introduced to Australia by European settlers in the early 1800s. Robert Cirocco of the University of Adelaide says the vine is able to kill all the ‘major baddies’ – gorse, Scotch broom and blackberry – by attaching small suckers to the plants’ stems and extracting their water and nutrients. ‘This is important because these weeds cost us millions of dollars annually to eradicate, not to mention their incalculable costs to our native biodiversity,’ he says.
The most notorious of these alien weeds, European gorse \textit{(Ulex europaeus)}, costs more than A$7 million (US$5.5 million) each year to clear from natural habitats and farmland with a mixture of herbicides, mechanical removal and burning. Cirocco and his colleagues showed that devil’s twine can destroy gorse by reducing its water and nutrient intake, which in turn harms photosynthesis. ‘Less photosynthesis translates to less carbohydrate, and less carbohydrate translates to less growth,’ says Cirocco.

The gorse plants that the researchers studied were in the Mount Lofty Ranges in South Australia, where many had been naturally infected with \textit{C. pubescens} in the area. ‘You could see a \textit{Cassytha} infection front that was leaving dead gorse in its wake,’ says Cirocco.

The work was presented at the Natural Resource Management Science Conference in Adelaide last week. According to Cirocco, the biggest advantage of \textit{C. pubescens} as a potential biocontrol agent is that it already occurs naturally across large tracts of eastern Australia. As a result, there is little danger that the vine will itself become a menace, as with the cane toads introduced to Australia in 1935 to control beetles that devastated sugar-cane crops. \textit{C. pubescens} also fulfils the brief of being far more toxic to non-native than native plants.

‘\textit{Cassytha} is not the smartest thing – it will pretty much go for anything it can get its suckers on, including barbed wire,’ says Cirocco. ‘But research shows that \textit{Cassytha} has a much greater effect on invasive weeds, perhaps because native plants have co-evolved with it, so they have likely developed mechanisms of resistance or tolerance.’

Cirocco says the next step will be to conduct field trials to confirm the effectiveness of \textit{C. pubescens} against gorse in a variety of natural habitats. ‘\textit{Cassytha} continues to show promise as an effective native biocontrol against major invasive weeds, so it’s definitely worth exploring,’ he says.
Forest in its Bogus Basin Forest Health Project plan. ‘Large brooms (dense clumps of branches) on trees infected with dwarf mistletoe may fall, especially under the weight of heavy snow. These trees present a safety hazard to the public on alpine and Nordic ski trails and roads, as well as recreation facilities.’ Standing dead trees are normal in any forest, but Boise National Forest officials state, ‘in recent years there has been a dramatic increase in the number of trees killed by dwarf mistletoe, Douglas-fir beetle and Western bark beetle.

In 2007, the Forest Health Protection Department within the U.S. Forest Service reported Douglas-fir dwarf mistletoe infected almost 80 percent of all stands within the Bogus Basin area. Dwarf mistletoe infected trees are likely to have their branches collapse under heavy snow, posing a risk to nearby skiers and snowboarders. The seriousness of the forest’s ill health came to a head two years ago, when Idaho Gov. C.L. ‘Butch’ Otter submitted a request to U.S. Agriculture Secretary Tom Vilsack, asking for landscape-scale treatments to national forests throughout Idaho. Chief of the U.S. Forest Service Tom Tidwell gave Otter his blessing to treat the areas needing help because of the high risk of insect and disease mortality. Bogus Basin is one of 50 landscape areas throughout the state in need of heavy treatment. A plan was crafted between the Boise Forest Coalition—made up of citizens with a diverse set of perspectives on forest management—and the Boise National Forest.

According to the plan, ‘The desired condition for the proposed project is a healthy forest that facilitates and enhances public recreation and is resilient to natural disturbances such as insects, disease and wildfire.’ Treatments are slated to begin in fall 2016 or summer 2017. Some treatments may need to be repeated every five to 10 years to continue removing dwarf mistletoe-infected trees and beetle-killed trees that pose a hazard on the ski resort.


**Appeal for sightings of rare mistletoe in Abel Tasman National Park**

The public have been asked to keep an eye out for scarlet mistletoe in the Abel Tasman National Park (New Zealand). The at risk plant is declining and has flowers that are an important source of nectar for birds like tui, kaka and bellbird.

Scarlet mistletoe or *Peraxilla colensoi*, has bright red explosive flowers that are an important source of nectar for birds like tui, kaka and bellbird.

The mistletoe is rarely seen in the national park and is classified as at risk and declining. A 2013 survey by the Department of Conservation found only 16 plants in the Canaan area of the park. The mistletoe is seen as one of the parks indicator species as it is very susceptible to possum browsing. This month, Project Janszoon botanist Dr Philip Simpson found another, previously unknown, site where the mistletoe is growing near Canaan.
‘No one can appreciate how rare the sight of a red flowered mistletoe is nowadays. I noticed that the bases of all the branches of the trees nearby were smoothed and horizontal, suggesting a long history of possums climbing up, using the tree to gain entry to the succulent mistletoe leaves above,’ Simpson said. ‘It is likely that long term and sustained 1080 (sodium fluoroacetate poisoning) has saved this plant from certain death.’

There are three species of mistletoe in the park, Peraxilla colensoi and Peraxilla tetrapetala have red flowers while Alepis flavida which has orange and yellow flowers has only been found once in the park.

Simpson is asking visitors to the park to report any sightings of mistletoe. ‘Now is a great time to try to locate these and get an idea of how others are doing. These elusive beautiful plants are a treat to see and to have one beside the track and only just above eye level gives truly a wonderful experience,’ he said. As well as looking for the flowers another good way to spot mistletoe is to look for the bright red petals on the ground.

If you find a mistletoe please take a photo and note the location, preferably with GPS coordinates and notify Project Janszoon at info@janszoon.org

Uganda: NARO makes breakthrough on sorghum

National Semi-Arid Resources Research Institute (NaSARRI) has developed five sorghum types that are tolerant to Striga and drought. This was revealed by Dr. Michael Ugen, director of research, NaSARRI, while meeting farmers in Mayuge and Namatumba districts during a participatory sorghum variety selection exercise.

Striga and drought are key production constraints in sorghum production with a potential to cause up to 100 per cent yield loss in sorghum particularly in the north, north-eastern and eastern Uganda where sorghum production is prominent. The two constraints to production are highly reinforced by low soil fertility and weather variability. ‘Climate change has highly affected sorghum production in many parts of the country but this breakthrough is a ray of hope to Uganda’s sorghum farmers’, said Dr Ugen. The candidate varieties are earmarked to address food security and improve household income since they are resilient to Striga and drought and also high yielding.

The sorghum genotypes which are scheduled for release in 2017 are the result of more than two years of research. ‘Sorghum is a major crop in the main producing areas and NaSARRI is determined to always provide reliable seed to farmers through research,’ said Johnnie Ebiyau, a senior research officer, NaSARRI. ‘The sorghum lines are high yielding giving up to 3,000 kilogrammes per hectare.’

Sorghum is the third most important staple cereal crop after maize and millet and its production in Uganda is estimated to be at 376,000 metric tonnes annually. Steven Koma, the chairperson, Ntalinga farmers’ group, Mayuge District, reiterated the urgent need for better sorghum varieties if the required production is to be attained. ‘We are excited to have participated in the evaluation of these genotypes and can’t wait to have them in this region for production,’ added Paul Magemeso, a farmer in Nakalama Village, Iganga district. ‘Most of us depend on sorghum for food and income but Striga was frustrating us’.

Besides food, sorghum is gaining importance in the manufacturing industry for production of beverages, medicine, feeds, paper, ethanol, and food dyes.

NaSARRI is one of the research institutes under NARO and is based in Serere District.

Umar Kyeyune

Help ‘Believe Big’ and Johns Hopkins Sidney Kimmel Cancer Center Kiss Cancer Goodbye

One last push in funding is needed for the Premiere U.S. Mistletoe Clinical Trial.

Due to the fundraising efforts of Believe Big, Johns Hopkins is preparing to begin a clinical trial on Mistletoe Extract to help ‘Kiss Cancer Goodbye.’ Not only has mistletoe (Viscum album) been found to diminish tumor-related pain, increase the immune response, prevent reoccurrence during the watchful waiting period, but it also offsets the harsh side affects of chemotherapy: nausea, vomiting, and lack of appetite.

Most clinical trials are typically funded by pharmaceutical companies, but because mistletoe is a natural substance, this is not an option. This is truly historic because this clinical trial is entirely patient driven and is being entirely funded by private donations. Even though mistletoe is used all over the world and proven effective in treating cancer, until a clinical trial is done here in the United States, oncologists cannot offer this treatment as standard of care. Currently only 50 physicians are trained to treat with mistletoe in the US. ‘We have been able to raise over $395,000 to start the clinical trial,’ said Ivelisse Page, Executive Director & Co-founder of Believe Big. While European oncologists have used extracts of mistletoe for
the past 90 years, it is not available through oncologists in
the U.S. Currently, 1 out of every 3 oncologists in
Germany prescribes mistletoe.

Believe Big is a non-profit organization formed in 2011 to
help bridge the gap between conventional and
complementary medicine for fighting cancer. Now
Believe Big and Johns Hopkins are collaborating on a
mistletoe clinical trial that brings the conventional and
complementary medical communities together. Johns
Hopkins researchers say mistletoe treatment could change
the way doctors go after cancer. Believe Big founder,
Ivelisse Page was healed of stage 4 colon cancer using
mistletoe Extract, surgery, and a high alkaline diet. She is
now 7 years cancer free and the health advocate that
began this effort. Dr. Luis Diaz, professor of oncology and
senior researcher at Johns Hopkins, and Dr. Peter
Hinderberger, expert in complementary medicine, both
treated Ivelisse and are helping to lead the clinical trial at
Johns Hopkins along with Dr. Channing Paller. Dr.
Hinderberger has used mistletoe in his practice
successfully for over three decades. The clinical trial team
is hoping that with this study, mistletoe will be included in
the standard of care treatment protocol for cancer.

For more information about Believe Big and to find a
physician who is currently treating with mistletoe, visit
http://www.believebig.org. Anyone wishing to be a part of
this historic event can make a tax-deductible donation for
this trial by visiting: www.believebig.org/Donate.html

GENERAL WEB SITES

For individual web-site papers and reports see
LITERATURE

* these websites may need copy and paste.

For information on the International Parasitic Plant
Society, past issues of Haustorium, etc. see:
http://www.parasiticplants.org/

For past and current issues of Haustorium see also:
http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the 14th IPPS World Congress on Parasitic Plants.

For the ODU parasitic plant site see:
http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see:
http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see:
http://ppgp.huck.psu.edu/ *

For information on the new Frontiers Journal ‘Advances
in Parasitic Weed Research’ see:
http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research

For information on the EU COST 849 Project (now
completed) and reports of its meetings see:
http://cost849.ba.cnr.it/ *

For information on the COST/STREAM 2nd International
Congress on Strigolactones;
http://www.strigolactones2017.it/

For information on the EWRS Working Group ‘Parasitic
weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the
Desmodium technique for Striga suppression, see:
http://www.push-pull.net/

For information on the work of the African Agricultural
Technology Foundation (AATF) on Striga control in
Kenya, including periodical ‘Strides in Striga
Management’ and ‘Partnerships’ newsletters, see:
http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on
Striga) see: http://www.accessagriculture.org/ *

For information on future Mistel in derTumortherapie
Symposia see:
http://www.mistelsymposium.de/deutsch/-
mistelsymposien.aspx

For a compilation of literature on Viscum album prepared
by Institute Hiscia in Arlesheim, Switzerland, see:
http://www.vfk.ch/informationen/literatursuche (in
German but can be searched by inserting author
name).

For the work of Forest Products Commission (FPC) on
sandalwood, see: http://www.fpc.wa.gov.au (Search
Santalum)
LITERATURE

*indicates web-site reference only

Items in bold selected for special interest

Items in blue relate to therapeutic uses of parasitic plants


Ahamide, I.D.Y., Tossou, M.G., Adomou, A.C., Houeno n, A., Trichkova, T., Rat, M. Akhtouch, B., del Moral, L., Leon, A., Velasco, L., Fernández-Martínez, J.M. and Pérez-Vich, B. 2016. Genetic study of recessive broomrape resistance in sunflower. Euphytica 209(2): 419-428. [Crosses between the Orobanche cumana Race F-resistant lines K-96 and P-96 and the susceptible P-21 suggest that the resistance is mainly controlled by a dominant-recessive epistasis at two loci. Five QTL on LG 2, 3, 4, 5, and 6 were associated with broomrape resistance traits. Concluding that K-96 and P-96 have complementary QTL with minor effect on broomrape resistance. They are, therefore, good donor sources for marker-assisted pyramiding programmes.]

Aksoy, E., Arslan, Z.F., Tetik, Ö. and Eymirli, S. 2016. Using the possibilities of some trap, catch and Brassicaceae crops for controlling crenate broomrape a problem in lentil fields. International Journal of Plant Production 10(1): 53-62. [Results suggest that lentil could be useful as a catch crop and flax as a trap crop, for reduction of Orobanche crenata. Broccoli also had some beneficial effect but methodology not clear.]

Ali-Babili, S. and Bouwmeester, H.J. 2015. Strigolactones, a novel carotenoid-derived plant hormone. Annual Reviews in Plant Biology 66: 161-186. [An excellent review of strigolactones as plant hormones, describing their chemistry, biosynthesis, and biological functions. The definition and nomenclature of strigolactones proposed in this review have been accepted by many scientists. Due to very rapid progress in this research area, new important findings need to be added.]


Akça, A. and Işık, D. 2016. (Determination of weeds species in sugar beet (Beta vulgaris L.) cultivation areas in Kayseri.) (in Turkish) Bitki Koruma Bülteni 56(1): 115-124. [Cascuta (unspecified) recorded in 46% of fields in this region of Central Turkey.]

Al-Babili, S. and Bouwmeester, H.J. 2015. Strigolactones, a novel carotenoid-derived plant hormone. Annual Reviews in Plant Biology 66: 161-186. [An excellent review of strigolactones as plant hormones, describing their chemistry, biosynthesis, and biological functions. The definition and nomenclature of strigolactones proposed in this review have been accepted by many scientists. Due to very rapid progress in this research area, new important findings need to be added.]


Alakesh Phukan, Bolin Chetia, Handique, J.G. and Devid Kardong. 2016. Antimicrobial, antioxidant activities and...


An Yu, Ma YongQing, Shui JunFeng and Zhong WenJin. 2015. Switchgrass (Panicum virgatum L.) has ability to induce germination of Orobanche cumana. Journal of Plant Interactions 10(1): 142-151. [Concluding from laboratory testing of various extracts of P. virgatum varieties at different stages of growth that it may be useful as a trap crop for O. cumana but without confirmation from appropriate field experiment.]


Anon. 2016. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnean Society 181(1): 1-20. [Focusing just on features that relate to parasitic plants, the following changes were made. Cynomoriumae were placed in Saxifragales (in agreement with Nickrent et al. 2005). Apodanthaceae were classified in Cucurbiteae (in agreement with Nickrent et al. 2004 and Filipowicz & Remen 2010). Hydnoraceae were lumped into Aristolochiaceae (see Naumann et al. 2013 - justified?). Santalales are now part of a clade called Superasterids. The familial classification within the sandalwood order proposed by Nickrent et al. (2010) was not followed. Moreover, in contrast to Hu et al. (2015), Balanophoraceae are monophyletic and placed in Santalaceae based on an unpublished study by J.W. Byng.]


environments and should be commercialised for improved nutrition and food security in sub-Saharan Africa.

Bai Yun, Chen Lei, Zhu NingBo, Li XueWu, Cairang DanZhou, Wu YouLin and Tian ChengMing. 2016. (Genetic diversity and population genetic structure of Arceuthobium xichuense.) (in Chinese) Acta Botanica Boreali-Occidentalia Sinica 36(3): 458-466. [Nuclear ribosomal ITS-1 sequences were generated for 9 populations showing high (48.6%) variation among populations.]


Baltazár, T., Pejchal, M. and Varga, I. 2015. Modelling the distribution of European mistletoe (Viscum album) with dependence on local factors in the Castle Park in Lednice. Acta Universitatis Agriculturae et Silviculterae Mendelianae Brunensis 63(3): 1441-1452. [Recording a range of factors influencing the occurrence of V. album on Acer campestre, A. platanoides, A. pseudoplatanus, Crapeagus monogynog, C. pedicellata, Juglans nigra, Robinia pseudoacacia, Tilia cordata and T. platyphyllos. J. nigra had the highest infestations.]


Barksdale, V., Newell, M. and Duran, K.L. 2015. Nuclear intergenic DNA sequence divergence in a Texas dwarf mistletoe (Arceuthobium divaricatum) population. BIOS (Ocean Grove) 86: 47-52. [The Guadalupe Mt. population of A. divaricatum differed from neighboring populations by 3.8% suggesting it may merit recognition as a separate subspecies.]


Beccarisi, L.; Marino, F., Medagli, P., Zizzi, T. and Minonne, F. 2015. (Inventory of the vascular flora of the Natural Reserve of Torre Guaceto (Apulia, Italy).) (in Italian) Thalassia Salentina 37: 11-56. [Noting that species in danger of extinction include Cytinus ruber.]

Bello, T.T., Mohammed, S.G., Kamara, A.Y., Gashua, A.G., Kurawa, I.A. and Adamu, U.A. 2015. Effect of imazapyr treated maize on Striga infestation and time of intercropping cowpea in Samaru, Nigeria. Bayero Journal of Pure and Applied Sciences 8(1): 84-88. [Confirming that IR (imidazolinone-resistant) maize hybrids ASII28-1, ASII28-2, ASII28-3 and ASII28-4 were undamaged by imazapyr seed treatment and there was 100% suppression of Striga hermonthica. Cowpea inter-planted from 2 weeks later was undamaged.]

Biyon, J.B.N., Dibouo, S.D., Taffouo, V.D., Biaf, J.M. and Bilong, P. 2015. Parasitism of rubber trees by Loranthaceae in the South-west region of Cameroon. Journal of Applied Biosciences 96: 9055-9062. [Confirming that ASII28-1, ASII28-2, ASII28-3 and ASII28-4 were undamaged by imazapyr seed treatment and there was 100% suppression of Striga hermonthica. Cowpea inter-planted from 2 weeks later was undamaged.]


Blážek, P., Lepší, J., Fajmon, K., Těšitel, J. and Wesselingh, R. 2016. Response of two hemiparasitic Orobanchaceae species to mowing dates: implications for grassland conservation and restoration practice. Plant Ecology and Evolution 149(1): 31-38. [Experiments in Czech Republic showed that populations of Rhinanthus major (=R. angustifolius) and Melamphyrum nemorosum are susceptible to early (June) mowing, while mowing in July was not a problem.]


Bouraoui, M., Abbes, Z., Rouissi, M., Abdi, N., Hemissi, I., Kouki, S. and Sifi, B. 2016. Effect of rhizobia inoculation, N and P supply on Orobanche foetida parasitising faba bean (Vicia faba minor) under field conditions. Biocontrol Science and Technology 26(6): 776-791. [In field trials a Rhizobium strain ‘Mat’ reduced O. foetida by 50% and increased faba bean yield threefold. Yields reduced 95% in controls. No mention in abstract of the effects of a second Rhizobium, nor of N and P.]


Cabrera, A., Celis, R. and Hermosín, M.C. 2016. Imazamox-clay complexes with chitosan- and iron(III)-modified smectites and their use in nanoformulations. Pest Management Science 72(7): 1285-1294. [A natural smectite modified with the biopolymer chitosan or with Fe3+ cation was used to create controlled release formulations of imazamox for control of unspecified Orobanchaceae spp. Results suggested full activity and much reduced loss by leaching.]

Caires, C.S. and de Azevedo, C.O. 2015. Peristethium phaneroneurum (Loranthaceae): a new combination expands the distribution of the genus from Honduras to Brazil. Rodriguésia 66: 859-861. [A new combination, Peristethium phaneroneurum, is proposed, based on Struthanthus phaneroneurum, described from Honduras in 1940 by Paul C. Standley. This new combination extends the geographical distribution of the genus from Honduras to the ecotone Amazon-Cerrado region of Brazil.]

Caires, C.S. and Proença, C.E.B. 2015. Typification of two neotropical names of Loranthus Jacq. (Loranthaceae). Candollea 70: 197-199. [The original specimens of Loranthus cucullaris Lam. (= Psittacanthus cucullaris) were located in Paris and the former neotypification proposal for this name is thus rejected. The identity and typification of Loranthus bracteatus (= Loranthus cucullaris) and Loranthus florulentus (= Orictanthus florulentus), are discussed.]

Callmader, M.W., Luino, I., Da-Giau, S., Rakotovao, C. and Gautier, L. 2014. A synoptic revision of the Malagasy endemic genus Socratina Balle (Loranthaceae). Candollea 69: 65-73. [The genus Socratina endemic to Madagascar was revised and three species are recognized, including a new one, Socratina philippsoniana Callm. & Luino.]


Carlón, L., Gomez Casares, G., Laínz, M., Moreno Moral, G., Sánchez Pedraja, O. and Schneeweiss, G.M. 2016. Index of Orobanchaceae. (http://www.farmalieergenes.com/Otrospdf/publica/Orobanche%20Index.htm) [This web page provides nomenclatural information for all genera and species of Orobanchaceae. This up-to-date treatment provides links between accepted names and synonyms with extensive referencing. A massive effort that resulted in an extremely valuable resource!]

Castagneri, D., Bottero, A., Motta, R. and Vacciano, G. 2015. Repeated spring precipitation shortage alters individual growth patterns in Scots pine forests in the Western Alps. Trees: Structure and Function 29(6): 1699-1712. [The influence of mistletoe (presumably Viscum album) was also included in the study but apparently less important than drought.]

Catteau, L., van Bambeke, F., Quetin-Leclercq, J., Garcia-Viguera, C., Gil-Izquierdo, A., Moreno, D.A., Baenas, N. 2015. Preliminary evidences of the direct and indirect antimicrobial activity of 12 plants used in traditional medicine in Africa. Phytochemistry Reviews 14(6): 975-991. [Methanol extracts of Tapinanthus bangwensis were active against Staphylococcus aureus MRSA ATCC33591 and improved the activity of ampicillin on that organism.]

development of alternative industrial production systems for sandalwood oil fragrances.]

*Chai Min, Zhu Xiaofei, Cui Hongxia, Jiang Chuangdao and Zhang Jinzheng. 2015. Lily cultivars have allelopathic potential in controlling Orobanche aegyptiaca Persoon. PLoS ONE 10(11): e0142811. (http://journals.plos.org/plosone/article?id=10.1371/journal.lpone.0142811) [Reporting on pot and laboratory experiments which showed germination stimulation from a range of different extracts of Lilium longiflorum hybrids, and also, perhaps more significantly, from soils in which the lilies had grown.]

Chai Yangyang and Zhao Min. 2016. Purification, characterization and anti-proliferation activities of polysaccharides extracted from Viscum coloratum (Kom.) Nakai. Carbohydrate Polymers 149: 121-130. [Three polysaccharides isolated from V. coloratum are characterised and shown to have anti-proliferation ability against HepG2 cells and HepG2.2.15 tumour cells]


Chen Qingliang, Guo Yuhai, Jiang Yong and Tu Pengfei. 2016. Mechanism of fluridone-induced seed germination of Cistanche tubulosa. Pakistan Journal of Botany 48(3): 971-976. [Concluding that GAs and ABA play key roles in the seed germination of C. tubulosa and that fluridone inhibits ABA biosynthesis but increases the concentration of GAs in seeds. Fluridone may initiate other processes associated with germination.]

Chen, Q.L. and Jiang, Y. 2016. A convenient and accurate seed germination assay for root parasitic plants. Seed Science and Technology 44(1): 212-217. [Describing a procedure for seed conditioning and germination of Striga and Orobanche in the same Petri dish involving an inverted filter paper method. This provides a 'platform' for the seeds and does not involve the use of Whatman glass fibre filter paper, thereby reducing costs.]

Chinsembu, K.C. 2016. Ethnobotanical study of medicinal flora utilised by traditional healers in the management of sexually transmitted infections in Seshete District, Western Province, Zambia. Revista Brasileira de Farmacognosia 26(2): 268-274. [Ximenia caffra one of the more frequent of 52 species used traditionally to treat sexual diseases in this region.]


Chlumský, J., Koutecký, P., Placková, I. and Štech, M. 2016. Is genetic diversity congruent with morphological diversity across the distributional range of the Melampyrum subalpinum group (Orobanchaceae)? Flora (Jena) 220: 74-83. [High differentiation among populations of M. subalpinum suggests that current gene flow between populations is limited. The high inbreeding coefficient in some populations indicates some level of selfing within the populations. The pollination experiment does not contradict the possibility of autogamy. In general, the data are congruent with the central-marginal model with more variable Austrian populations and less variable isolated and probably partly inbreeding Czech and Slovak populations.]

*Cho Wonbun Choi Insu and Choi Byounghee. 2015. Development of microsatellite markers for the endangered Pedicularis ishidoyana (Orobanchaceae) using next-generation sequencing. Applications in Plant Sciences 3(12) 1500083. (http://www.bioone.org/loi/apps) [The study identifies microsatellite markers which are expected to be useful for studies of the population genetics of P. ishidoyana in Korea.]


Cirocco, R.M., Facelli, J.M. and Watling, J.R. 2016. Does light influence the relationship between a native stem hemiparasite and a native or introduced host? Annals of Botany 117(3): 521-531. [Growth of the host Leptospermum myrsinoides was unaffected by parasitism from the Australian native Cassythya pubescens while that of Ulex europaeus, was reduced. In neither case was the effect altered under low light, but the growth of the parasite was slightly reduced on U. europaeus.]

Cirocco, R.M., Facelli, J.M. and Watling, J.R. 2016. High water availability increases the negative impact of a native hemiparasite on its non-native host. Journal of Experimental Botany 67(5): 1567-1575. [Results suggest that increased growth of C. pubescens under wet conditions, perhaps associated with high stomatal conductance resulted in a larger demand for resources.
from the host, *Ulex europaeus*, leading to poorer host performance.]
Cirrocro, R.M., Waterman, M.J., Robinson, S.A., Facelli, J.M. and Watling, J.R. 2015. Native hemiparasite and light effects on photoprotection and photodamage in a native host. Functional Plant Biology 42(12): 1168-1178. [Infection of *Leptospernum myrsinoides* with *C. pubescens* significantly decreased all foliar pigment concentrations (except chlorophyll b) in *L. myrsinoides* in both high and low light. Xanthophyll cycle (violaxanthin, antheraxanthin, zeaxanthin; VAZ) and chlorophyll (Chl) both high and low light. Xanthophyll cycle (violaxanthin, antheraxanthin, zeaxanthin; VAZ) and chlorophyll (Chl) decreased in parallel in response to infection, hence the VAZ/Chl ratio in the host was unaffected and photodamage avoided.

Cochavi, A., Rubín, B., Smirnov, E., Achdari, G. and Eizenberg, H. 2016. Factors affecting Egyptian broomrape (*Orobanche aegyptiaca*) control in carrot. Weed Science 64(2): 321-330. [Glyphosate applied 3 times at up to 108 g/ha can provide selective control of *O. aegyptiaca* in carrot, but is damaging to carrot at 28-22°C day/night temperatures. Imazapic and imazamox were selective.]

Cocoletzi, E., Angeles, G., Ceccantini, G., Patrón, A. and Francisco Ornelas, J. 2016. Bidirectional anatomical effects in a mistletoe-host relationship: *Psittacanthus schiedeanus* mistletoe and its hosts *Liquidambar styraciflua* and *Quercus germana*. American Journal of Botany 103(6): 986-997. [The phloem of *P. schiedeanus* has larger sieve elements, companion cells, and sieve plate areas when it is parasitizing *L. styraciflua* than *Q. germana*; however, the parasite produces systemic effects on the phloem of its hosts, reducing the size of phloem in *L. styraciflua* but increasing it in *Q. germana*.]


Costea, M., Stefanović, S., García, M.A., Cruz, S. de la, Casaza, M.L. and Green, A. J. 2016. Waterfowl endozoochory: an overlooked long-distance dispersal mode for *Cuscuta* (dodder). American Journal of Botany 103(5): 957-962. [Several hundred seeds of *C. campestris* and (?) *C. pacifica* were identified from the guts of pintail ducks, with over 50% germination capacity, helping to explain past long-distance movements of *Cuscuta* spp. prior to those assisted by man.]]


Cuevas Guzmán, R., Santana Michel, F.J., Sánchez Rodríguez, E.V. and Núñez López, N.M. 2016. (Cervantesiaceae: new record of a naturalized family for the Flora of Mexico.) (in Spanish) Acta Biológica Colombiana 21(2): 431-436. [Recording for the first time in Mexico the naturalized species *Acanthosyris glabrata*, and hypothesising how it may have been introduced from Ecuador.]

Cui QingLing, Pan YingNi, Xu XiaoTong, Zhang WenJie, Wu Xiao, Qu ShouHe and Liu XiaoQiu. 2016. The metabolic profile of acteoside produced by human or rat intestinal bacteria or intestinal enzyme in vitro employed UPLC-Q-TOF-MS. Fitoterapia 109: 67-74. [Identifying a range of metabolites of acteoside from *Cistanche deserticola* created in the gut or in gut bacteria, some of which may have equal or more activity compared with the parent compound.]

Cui SongKui, Wakatake, T., Hashimoto, K., Saueret, S.B., Toyooka, K., Yoshida, S. and Shirasu, K. 2016. Haustorial hairs are specialized root hairs that support parasitism in the facultative parasitic plant *Phtheirospermum japonicum*. Plant Physiology 170(3): 1492-1503. [Using haustorial hair defective (hhd) mutants of *P. japonicum* to confirm that haustorial hairs assist in, but are not essential for, the attachment and penetration of the haustorium.]

Cusimano, N. and Wicke, S. 2016. Massive intracellular gene transfer during plastid genome reduction in nongreen Orobanchaceae. New Phytologist 210(2): 680-693. [Plastid genomes (plastomes) analyses of Orobanchaceae indicate that the first functional gene losses occurred within 10 Myr of the transition to obligate parasitism (~50 Myr). Nonessential DNA appears to be eliminated much faster in the plastomes of nonphotosynthetic parasites than in their other cellular genomes.]

**HAUSTORIUM 69 July 2016**


daBruyn, R.A.J., Paetkau, M., Ross, K.A., Godfrey, D.V. and Friedman, C.R. 2015. Thermogenesis-triggered seed dispersal in dwarf mistletoe. Nature Communications 6: 1-5. [Dwarf mistletoe fruits display an anomalous increase in surface temperature by an average of 2.1±0.8°C over an average time of 103±29s before explosive dehiscence. Scanning calorimetry show an exothermic event in the non-reversible heat flow just prior to discharge. These results support thermogenesis-triggered seed discharge, never before observed in any plant.]


Dakskobler, I. 2016. (New localities and phytosociological characteristics of sites of selected vascular plants in Slovenia.) (in Slovenian) Hladnikia 37: 72-93. [Including reference to Oxyria lanceolata (= Oxyria wightiana var. rotundifolia.)]


Daňková, I., Žemlička, M., Švajdlenka, E., Bartl, T. and Šmejkal, K. 2016. The chemotaxonomic significance of phenylethanoid glycosides of Lathraea squamaria L. (Orobanchaceae). Biochemical Systematics and Ecology 64: 53-56. [Describing two isomeric phenylethanoid glycosides, acteoside and isoacteoside, not previously described in this plant. Also, unsubstituted benzoic acid, and the iridoid glycoside aucubin. Their chemotaxonomic significance is discussed.]

oxysporum, nitrogen and sulphur mineral fertilisers, Enzoe™ soil fumigant (sodium tetrathiocarbonate) and a resistant tomato genotype. Chlorophyll levels were reduced in infected tomatos.


Dlamu, T.T., Ouwegambeleke, A.S. and Enchezeyi, A.R. 2016. Mistletoe presence on five tree species of Samaru area, Nigeria. African Journal of Plant Science 10(1): 16-22. [Acacia lebbeck was infected by Tapinanthus dodoneifolius, T. globiferus, Globimetula braunii, G. oreophila, Englerina lecardii and Tapinanthus belvisii. Other trees affected by one or more mistletoe species were Citrus grandis, Khaya senegalensis, Terminalia mantaly and Terminalia catappa.]

Dor, E., Smirnov, E., Galili, S., Guy, A. and Hershenhorn, J. 2015. Characterization of the novel tomato mutant HRT, resistant to acetolactate synthase-inhibiting herbicides. Weed Science 64(2): 348-360. [Describing development of the tomato mutant line HRT, obtained by ethyl methanesulfonate seed mutagenesis from the commercial tomato line M82. Line HRT proves highly resistant to imazamox, imazapic, and imazapyr, but does not differ from M82 in its response to the sulfonylurea herbicides trifloxysulfuron, sulfosulfuron and chlorosulfuron. Complete control of O. aegyptiaca achieved with 2-3 post-emergence applications of imazapic.]

Doweld, A.B. 2015. (2391) Proposal to conserve the name Razumovskya Volgodin ex Krasnop. (fossil Cyanophyceae (vel Cyanobacteria)) against Razoumovska Hoffm. (Angiospermae: Loranthaceae). Taxon 64: 1062-1063. [The cyanobacterial fossil name Razoumovska is proposed for conservation over Razoumovska, a synonym of Arceuthobium (Viscaceae, not Loranthaceae).]

Edewor, T.I., Owa, S.O., Ologan, A.O. and Akintemi, F. 2016. Quantitative determination of the saponin content and GC-MS study of the medicinal plant Cassytha filiformis (Linn.) leaves. Journal of Coastal Life Medicine 22(2): 134-144. [Surveying 173 papers and finding just 3 with meaningful results supporting some degree of benefit from mistletoe therapy, but even these lacking fully adequate evidence.]

Evans, M., Bryant, S., Huntley, A.L. and Feder, G. 2016. Cancer patients’ experiences of using mistletoe (Viscum album): a qualitative systematic review and synthesis. Journal of Alternative and Complementary Medicine 22(2): 134-144. [Surveying 173 papers and finding just 3 with meaningful results supporting some degree of benefit from mistletoe therapy, but even these lacking fully adequate evidence.]

Faboro, E.O., Wei LiQing, Liang ShaoBo, McDonald, A.G. and Obafemi, C.A. 2016. Characterization of dichloromethane and methanol extracts from the leaves of a medicinal plant: Globimetula oreophila. Industrial Crops and Products 83: 391-399. [The ethnopharmacological uses G. oreophila include treatment of cancer, hypertension, diabetes, and as diuretic agent. This study analyses its chemical constituents without suggesting which are pharmacologically active.]


Flematti, G.R., Scaffidi, A., Waters, M.T. and Smith, S.M. 2016. Stereospecificity in strigolactone biosynthesis and perception.Planta 243(6): 1361-1373. [Detailed explanation of stereochemistry of natural and synthetic strigolactones. Reference for stereochemical structures was proposed. It seems to be reasonable to add ‘ent’ only to non-natural strigolactones with the 2’S configuration.]


Frezistas, A.V.L., Coelho, M.F.B., Pereira, Y.B., Freitas Neto, A. E. and Azevedo, R. A. B. 2015. (Diversity and uses of medicinal plants in homegardens at the community São João da Varzea, Mossoró, RN.) (in Portuguese) Revista Brasileira de Plantas Medicinais 17(4 Suppl. 2): 845-856. [Including reference to *Ximenia americana* but not included among the most promising.]

Frisby, T. 2015. Antifungal activity in extracts of plants from southwestern Oklahoma against *Aspergillus flavus.* Oklahoma Native Plant Record 15(1): 78-95. [*Castilleja indivisa* among 40 species providing strong inhibition of *A. flavus* when tested as a crude extract but not among the few that retained this activity after dialysis.]

Galindon, J.M.M., Ong, P.S. and Fernando, E.S. 2016. *Rafflesia consueloae* (Rafflesiaceae), the smallest among giants; a new species from Luzon Island, Philippines. PhytoKeys 61: 37-46. [*R. consueloae* is distinct in its small-sized (10 cm diameter) flowers, the upright perigone lobes, and prominently cream-white disk surface, often devoid of processes.]


Gao, F.-M., Chen, L., Tian, C.-M., Cairang, D.-Z., Zhou, W.F., Yang, Q.-Q., Zhao, H.-C. and Wu, Y.-L. 2015. Effects of *Arcueothrium sichuanense* infection on photosynthesis and transpiration of *Pinus wilsonii.* Acta Phytopathologica Sinica 45:14-21. [Host tree needle length and width were smaller but specific leaf area was larger in infected vs. control trees. Infection reduced net photosynthesis rate, transpiration rate, and stomatal conductance but sub-stomatal CO₂ concentration was not influenced.]


Goldwasser, Y., Miryamchik, H., Rubin, B. and Eizenberg, H. 2016. Field dodder (*Cuscuta campestris*) - a new model describing temperature-dependent seed germination 64(1): 53-60. [Devising a model by which thermal time can be used to predict germination of *C. campestris.*]

*Graffis, A.M. and Kneitel, J.M. 2015. A parasitic plant increases native and exotic plant species richness in vernal pools. AoB Plants 7: plv100. (http://aobpla.oxfordjournals.org/content/7/plv100.full) [Removal of *Cuscuta hovelliana* resulted in greater species richness, perhaps via suppression of the dominant *Eryngium castrense.*]}

Gu Li, Xiong WenTing, Zhuang YanLei, Zhang JianShuang and Liu Xin. 2016. Effects of *Cistanche deserticola* extract on penis erectile response in castrated rats. Pakistan Journal of Pharmaceutical Sciences 29(2): 557-562. [Results indicated that extract of *C. deserticola* facilitated the penis erectile response and modulated the serum hormone level to some extent.]

Guo JingJing, Pan Wei, Chen MeiWan, Wang ChunMing and Wang YiTao. 2015 Overview of Taiwan’s indigenous ethnopharmacology in the perspective of traditional knowledge protection. Chinese Journal of Integrative Medicine 21(12): 949-954. [Including reference to *Taxillus liquidambaricus* but no detail in abstract.]

Haidar, M. and Shabala, S. 2015. Ion flux kinetics in blue light-grown field dodder (*Cuscuta campestris*) seedlings. Weed Biology and Management 15(4): 159-164. [Vanadate, a known blocker of the plasma-membrane H⁺-ATPase, completely prevented both H⁺ and the Ca²⁺ flux responses and inhibited coiling and prehaustoria development, confirming its key role in the growth of *C. campestris* and its adaptive response to the environment.]


Hao, B., Caulfield, J.C., Hamilton, M.L., Pickett, J.A., Midega, C.A.O., Khan, Z.R., Wang, J. and Hooper, A.M. 2016. Biosynthesis of natural and novel C-glycosylflavonoids utilising recombinant *Oryza sativa* C-glycosyltransferase (OsCGT) and *Desmodium incanum* root proteins. Phytochemistry 125: 73-87. [A rice C-glycosyltransferase was used to generate novel mono-C-glucosyl-2-hydroxyflavanones as putative biosynthetic intermediates to examine the potential of *D. incanum* biosynthetic CGTs to produce novel di-C-
glycosylflavones, compounds implicated in the allelopathic biological activity of Desmodium against Striga.


Hassan, M.B., Baiyegunhi, L.J.S., Orttmann, G.F. and Abdoulaye, T. 2016. Adoption of Striga (Striga hermonthisca) management technologies in northern Nigeria. Agrekon 55(1/2): 168-188. [Marital status, household size, farm size and access to cash remittances are most significant factors influencing adoption of ISMA technology (Integrated Striga Management – not defined here but presumably involving tolerant maize varieties, rotation with soyabean and other inputs?). Farmers who adopted ISMA technologies obtained higher output than the non-adopters, resulting in a positive effect on their total farm income.]

Hegenauer, V., Fürst, U., Kaiser, B., Smoker, M, Zipfel, C., Felix, G., Stahl, M. and Albert, M. 2016. Detection of the plant parasite Cuscuta reflexa by a tomato cell surface receptor. Science 353(6298): 478-481. [CuRel1, a canonical plasma-membrane localized pattern recognition receptor (PRR), required for the recognition of microbe-associate molecular pattern (MAMP)-like molecule (Cuscuta factor) from Cuscuta reflexa, was found to be responsible for resistance in cultivated tomato. Introduction of CuRel1 gene into susceptible lines made them more resistance to C. reflexa.]


Holzapfel, S.A., Dodgson, J. and Maheshwaran Rohan. 2016. Successful translocation of the threatened New Zealand root-holoparasite Dactylanthus taylorii (Mystropetalaceae). Plant Ecology 217(2): 127-138. [Confirming successful establishment of D. taylorii (also placed in Balanophoraceae) from seed at 22 of 24 sites after 10 years. First emergence occurred after 4 years. Each site had a range of possible host species. Success was greater under closed canopy than in open habitat.]

Houngbédji, T. and Gibot-Leclerc, S. 2015. First report of Rhampficarpa fistulosa on peanut (Arachis hypogaeas), soybean (Glycine max), and tossa jute (Corchorus olitorius) in Togo. Plant Disease 99(11): 1654-1655. [Reporting the occurrence of R. fistulosa on cowpea, soyabean and tossa jute, causing estimated yield losses of 7-9%.]


Idu, M., Ovuakporie-Uvo, O. and Nwoako, M.J. 2016. Phytochemistry and microscopy of Tapinanthus doneofolius (DC) (Danser) (Santalales: Loranthaceae) (African mistletoes) from guava, rubber and orange host trees. Brazilian Journal of Biological Sciences 3: 27-35. [Result of phytochemical analysis showed the presence of oxalate, phytate, saponin, alkaloid, glycoside and tannin in this mistletoe.]

Ikeda, H., Fukuda, T. and Yokoyama, J. 2016. Endophytic fungi associated with a holoparasitic plant, Balanophora japonica (Balanophoraceae). American Journal of Plant Sciences 7(1): 152-158. [Isolating 23 fungal strains from B. japonica growing on Symplocos lacinifolia in Japan, including Trichoderma-Hypocrea (also recorded on the host), Penicillium and Phiallemonium. This complex differed from that reported on B. harlandii or on Rafflesia cantleyi.]


Journal of Physiology and Pharmacology 94(1): 104-111. [Concluding that extract of C. salsa may be a potential therapeutic candidate for treatment of benign prostatic hyperplasia owing to its ability to regulate the expression of inflammatory and apoptosis-related proteins.]


Johnson, B.I., De Moraes, C.M. and Mescher, M.C. 2016. Manipulation of light spectral quality disrupts host location and attachment by parasitic plants in the genus Cuscuta. Journal of Applied Ecology 53(3): 794-803. [Studies with C campestris on tomato and C. gronovi on ‘jewelweed’ (Impatiens capensis?) showed that high red:far-red ratio light greatly reduced infection in both cases. Tomato showed some short-term effects from high red:far-red but it is concluded that a suitable shading of crop at the critical stage could contribute to useful selective control.]

Jonstrup, A., Hedrén, M. and Andersson, S. 2016. Host environment and local genetic adaptation determine phenotype in parasitic Rhinanthus angustifolius. Botanical Journal of the Linnean Society 180(1): 89-103. [Studying two ecotypes of R. angustifolius under varying conditions, most characters were plastic other than node number. Concluding that the complex phenological and morphological variation in this species is caused by a combination of genetically determined ecotypic differentiation and plastic responses to the host environment and other factors.]

Jose Mathew and George, K.V. 2015. Christisonia mira (Orobanchaceae): a new plant species from southern Western Ghats, India. Telopea 18: 425-431. [C. mira newly found in Kerala.]


Kaitera, J. and Witzell, J. 2016. Phenolic profiles of two Melampyrum species differing in susceptibility to Cronartium rust. European Journal of Plant Pathology 144(1): 133-140. [Finding differing complexes of phenolics in M. sylvaticum and M. pratense which could explain why the former, with kaempferol and luteolin flavonoids, is susceptible to Cronartium flaccidum and acts as an alternate host to this important stem rust of pine, while the latter, with chlorogenic acid, flavanones and apigenin flavonoids, is resistant.]


Kamran, S.H., Mobasher Ahmad, Durre Shahwar and Muhammad Ajab. 2016. Anti-diabetic and anti-oxidant status of Loranthus pulvulentus obtained from two different hosts., Bangladesh Journal of Pharmacology 11(1): 181-189. [Showing that leaves of L. pulvulentus (=Scurrula pulvrenta) growing on Dalbergia sissoo has potential anti-diabetic activity whereas L. pulvulentus growing on Populus nigra does not.]

Kang SukNam 2016. Ethanol extracts from mistletoe (Viscum album L.) act as natural antioxidants and antimicrobial agents in uncooked pork patties during refrigerated storage. Asian-Australasian Journal of Animal Sciences 29(1): 109-118. [Showing that the antioxidant properties of extract from V. album ssp. coloratum helped preserve the freshness of uncooked pork patties (in Korea).]


Kapulnik, Y. and, Koltai, H. 2916. Fine-tuning by strigolactones of root response to low phosphate. Journal of Integrated Plant Biology 58(3): 203-212. [In this review the role and activity of strigolactones under conditions of phosphate deprivation is presented. Under these conditions, their levels of biosynthesis and exudation increase, leading to changes in shoot and root
development. At least for the latter, these changes are likely to be associated with alterations in auxin transport and sensitivity.

Kelt, D.A. and 10 others. 2016. The avifauna of Bosque Frayo Jorge National Park and Chile’s Norte Chico. Journal of Arid Environments 126: 23-36. [Incidently noting the remarkable coevolutionary association between the Chilean Mockingbird (Mimus thencus) and endoparasitic mistletoe, Tristerix aphyllus.]


Kuijt, J., Harrison, J. and Harrison, L. 2015. Endemism in two new species of *Dendrophthora* (Viscaceae) from Cerro Jefe, Panama. Phytologia 97: 139-144. [Two new species, *Dendrophthora foritis* J. Kuijt and *D. perlicarpa* J. Kuijt are described and illustrated from the Cerro Jefe area, Panama.]


Kuijt, J. 2016. A nomenclatural note on *Struthanthus acuminatus* (Loranthaceae). Phytologia 98: 118. [One of the earliest recorded species of South American Loranthaceae is often cited as *Struthanthus acuminatus* (Ruiz & Pavon) Blume, however, Blume did not actually make this combination. To clarify Blume’s taxon, the following comb. nov. is presented along with full synonymy: *Struthanthus acuminatus* (Ruiz & Pavon) Kuijt, comb. nov.]

Kuijt, J., Harrison, J. and Harrison, L. 2016. A third endemic *Dendrophthora* (Viscaceae) from Cerro Jefe, Panama. Phytologia 98: 142-145. [A rare new species, *D. primaria*, is described and illustrated. It is believed to be endemic to the Cerro Jefe area, as are two previously described species of the genus and several other mistletoes in Loranthaceae.]

Kuijt, J. 2016. The guide of the perplexed: essential nomenclature and iconography of the mistletoes of the New World. (accessed 10 August 2016 http://www.tropicos.org/Project/Mistletoes) [Nomenclature for 26 genera and 725 species of mistletoes is presented representing four families: Loranthaceae, Misodendraceae, Santalaceae, and Viscaceae.]


Le, Q.V., Tennakoon, K.U., Metali, F., Lim, L.B.L. and Bolin, J.F. 2016. Ecophysiological responses of mistletoe *Dendrophthoe curvata* (Loranthaceae) to varying environmental parameters. Journal of Tropical Forest Science 28(1): 59-67. [Functions of *D. curvata* in Brunei Darussalam varied depending on the host *Andira inermis*, *Mangifera indica* or *Vitex pinnata* and on changes in light intensity, leaf temperature and atmospheric CO₂ concentrations. Effects of elevated carbon dioxide were long term due to the partial dependence of mistletoe on host-derived carbon.]

Lehn, C.R., Salis, S.M. and Mattos, P.P. 2015. Ecological aspects of *Langsdorffia hypogaea* (Balanophoraceae) parasitism in the Pantanal wetlands. Acta Botanica Brasilia 29(4): 608-612. [Determining that *Protium heptaphyllum* and *Cordiera sessilis* were the commonest host tree for *L. hypogaea* and that seed dispersal for both host and parasite was by mammals including collared peccaries (*Pecari tajacu*).]

*Leite de Vasconcelos, G.C. and Miranda de Melo, J.I. 2016. Flora of the Parque Nacional do Catimbau, Pernambuco State, Brazil: Loranthaceae (in Portuguese). Hoehnea 43. (http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2236-89062016000200317) [Four species of *Psittacanthus* and *Struthanthus* were recorded with *S. confertus* recorded for the first time in Pernambuco.]

*Leong PouKuan, Wong HoiShan, Chen JiHang and Ko KamMing. 2015. Yang/Qi invigoration: an herbal therapy for chronic fatigue syndrome with Yang deficiency? Evidence-based Complementary and Alternative Medicine 2015, Article ID 945901. (http://www.hindawi.com/journals/ecam/2015/945901/) ['By virtue of their ability to enhance mitochondrial function and its regulation, Yang- and Qi-invigorating tonic herbs, such as *Cistanche Herba* (*Cistanche deserticola*) may therefore prove to be beneficial in the treatment of chronic fatigue syndrome with Yang deficiency.']


*Li JunMin, Jin ZeXin, Hagedorn, F. and Li MaiHe. 2014. Short-term parasite-infection alters already the biomass, presumably resulting from reduced root growth of the *Milania.*]

*Li JunMin, Yang BeiFen, Yan QiaoDi, Zhang Jing, Yan Min and Li MaiHe. 2015. Effects of a native parasitic plant on an exotic invader decrease with increasing host age. AoB Plants 7: pls031. (http://aobpla.oxfordjournals.org/content/7/pls031.full) [In Zhejiang Province, China, reduction of *Bidentis pilosa* by *Cuscuta australis* was much greater when the parasite was introduced to the host at 59 days after sowing than at 84 days, although the parasite grew even better on the older host. Parasite infection reduced the concentrations of total phenolics, total flavonoids and saponins only in the younger host plants. For its use for biocontrol of *B. pilosa* early application would be essential.]

Li Li; Cao Jin and Zhang QingSheng. 2016. (Determination of geniposidic acid in herba cistanche by high performance liquid chromatography.) (in Chinese) Journal of Food Safety and Quality 7(3): 933-937. [Describing a fast and accurate method, used to show differences in geniposodic acid in *Cistanche deserticola*, *C. tubulosa* and *C. salsa.*]

Li Lun, Zhu ChunYun, Liu XiaoLi, Gu Wen Yi, Wei HaiBin and Hu Yue. 2015. (The Principal Component Analysis of environmental factors of *Arceuthobium sichuanense,* (in Chinese) Journal of West China Forestry Science 44(6): 55-60. [Factors affecting the severity of *Arceuthobium sichuanense* on spruce, a major diseases in Qinghai province, China include canopy density, herbaceous biomass, elevation, PH value and slope, the most important being canopy density. Incidence is lower when the forest canopy density is over 0.7, while it becomes serious when the density is 0.4-0.5.]

*Li Nan, Wang JianPing, Ma Jun, Gu ZhiQiang, Jiang Chao, Yu Lie and Fu Xiaojie. 2015. Neuroprotective effects of Cistanches Herba therapy on patients with moderate Alzheimer's disease. Evidence-based Complementary and Alternative Medicine 2015: Article ID 103985. (http://www.hindawi.com/journals/ecam/2015/103985/) [The study involved treatment of 11 Alzheimers patients with ‘Cistanches Herba’, based on *Cistanche deserticola* for 48 weeks compared with patients given Donepezil or none. Both treatments showed significant difference from controls reducing changes in volume of hippocampus and decreasing the levels of T-tau, TNF-α, and IL-1β. Concluding that Cistanches Herba could improve cognitive and independent living ability of moderate Alzheimer patients.]

Li Yang, Zhou GuiSheng, Peng Ying, Tu PengFei and Li XiaoBo. 2016. Screening and identification of three typical phenylethanoid glycosides metabolites from Cistanches Herba by human intestinal bacteria using UPLC/Q-TOF-MS. Journal of Pharmaceutical and Biomedical Analysis 118: 167-176. [Exploring the metabolism, by human intestinal bacteria, of acteoside, isoacteoside, and 2′-acetylacteoside the three main phenylethanoid glycosides occurring in *C. desertiflora*, and confirming that the metabolites had comparable bioactivity to the original compounds.]

library in haustorial organogenesis induced by DMBQ in *Striga asiatica* identified genes involved in cell wall expansion and vascular tissue development, nutrient metabolism and transport, hormone regulation, and cellular defense. Results suggest an elaborate and global response closely tied to plant defense and redox chemistry.


Liu YaNan, Li Yan, Yang FuSheng and Wang XiaoQuan. 2016. Floral nectary, nectar production dynamics, and floral reproductive isolation among closely related species of *Pedicularis*. Journal of Integrative Plant Biology 58(2): 178-187. [Finding surprising variation in nectary morphology, nectar quality, and nectar production dynamics in flowers of *Pedicularis* section *Cyathophora* in China and suggesting that they may have played a role in speciation.]


Lopez Laphitz, R. M., Ezcurra, C., and Vidal-Russell, R. 2015. Morphological variation in *Quinchamalium* (Schoepfiaceae) is associated with climatic patterns along its Andean distribution. Systematic Botany 40(4): 1045-1052. [Q. chilense was shown via morphometric analyses to be a single, polymorphic, widespread species with a continuum of morphological variation (either genotypic or environmental phenotypic plasticity).]

López-Ráez, J.A. 2016. How drought and salinity affect arbuscular mycorrhizal symbiosis and strigolactone biosynthesis? Planta 243(6): 1375-1385. [This paper reviews the importance of AM symbiosis in alleviating plant stress under unfavourable environmental conditions, making emphasis on the role of strigolactones. A better understanding of the mechanisms that regulate this beneficial association will increase its potential use as an innovative and sustainable strategy in modern agriculture.]

Luo YaHuang, Sui Yi, Gan JianMin and Zhang Ling. 2016. Host compatibility interacts with seed dispersal to determine small-scale distribution of a mistletoe in Xishuangbanna, Southwest China. Journal of Plant Ecology 9(1): 77-86. [Findings suggest that seed dispersal interacts with host compatibility and canopy cover to determine establishment success, survival and the observed distribution patterns of *Dendrophthoe pentandra* in plantation and rainforest.]

*Louarn, J., Boniface, M-C., Pouilly, N., Velasco, L., Pérez-Vich, B., Vincourt, P. and Muñoz, S. 2016. Sunflower resistance to broomrape (*Orobanche cumana*) is controlled by specific QTLS for different parasitism stages. Frontiers in Plant Science, May 10, 2016. (http://journal.frontiersin.org/article/10.3389/fpls.2016.00590/full?utm_source=newsletter&utm_medium=email&utm_campaign=Plant_Science-w27-2016) [A population of 101 recombinant sunflower inbred lines from a cross between HA89 and LR1 were studied and QTL mapped for resistance shown at 3 growth stages. Different QTL were identified for each race – F from Spain and G from Turkey - and for the 3 stages of development, indicating several quantitative resistance mechanisms]*

Lü ShiHong Huang FuZhao, Lu ShuHua, Xu GuangPing, Zeng DanJuan and Li XianKun. 2016. (Effects of Shrub-grass on direct seeding of *Cyclobalanopsis glauca* and *Malania oleifera* in rocky desertification mountains in southwest Guangxi.) (in Chinese) Plant Science Journal 34(1): 38-46. [Results suggest that establishment of *M. oleifera* (Olacaceae) was better under shrub and grass conditions, and should be considered for afforestation in rocky desertification mountains in Southwest Guangxi.]

Lyra, D., Kalivas, D. and Economou, G. 2016. A large-scale analysis of soil and bioclimatic factors affecting the infestation level of tobacco (Nicotiana tabacum L.) by *Phelipanche* species. Crop Protection 83: 27-36. [Correlation analysis demonstrated that the level of *Phelipanche* infestation correlated negatively with pH and total humidity index and positively with organic matter. *P. ramosa* was more important than *P. aegyptiaca*.]  

Mabrouk, Y., Mejri, S., Henissi, I. and Belhadj, O. 2016. Biochemical analysis of induced resistance in chickpea against broomrape (*Orobanche foetida*) by rhizobia inoculation. Phytopathologia Mediterranea 55(1): 54-61. [Rhizobium sp. strain PchAZM reduces parasitism of chickpea by *O. foetida* under greenhouse conditions by up to 90%. Infection is accompanied by enhanced levels of the defence-related enzymes phenylalanine ammonia lyase and peroxidase leading to increased levels of phenolics in the roots. cf Yassine et al., 2016 below.]


Mardian, B.C. and Borowicz, V.A. 2016. Impact of light limitation on mortality and early growth of the root
hemiparasite *Pedicularis canadensis* L. Journal of the Torrey Botanical Society 143(1): 1-7. [Confirming that shading the parasite *P. canadensis* greatly reduced its growth and allowed increased growth of the hosts (unspecified in abstract).

Maroyi, A. 2016. *Ximenia caffra* Sond. (*Ximeniaceae*) in sub-Saharan Africa: a synthesis and review of its medicinal potential. Journal of Ethnopharmacology 184: 81-100. [A comprehensive and systematic literature search on the ethnomedical uses, phytochemistry and biological activities of *X. caffra* throughout its distributional range, recording a total of 65 human and animal ailments and diseases for which it is used traditionally with a high degree of consensus for wounds, sexually transmitted infections, infertiltiy, stomach ache, fever, eye problems, diarrhea, bilharzia, menorrhagia, malaria, intestinal worms and coughs. Some uses have been validated by phytochemical and pharmacological studies but there is a need for much more systematic study.]


Martínez-Ambriz, E. and Cruz-Durán, R. 2015. *Cladocolea kuijiti* (Loranthaceae) a new species from Mexico. Phytotaxa 195: 073-078. [This new species is morphologically similar to *C. hintomii*.]

Martínez-Ambriz, E. and Lozada-Pérez, L. 2016. *Cladocolea molotensis* (Loranthaceae), a new species for the cloud forest of Guerrero, Mexico. Phytotaxa 266:151-156. [This new species is morphologically similar to *C. loniceroideus*]


Mavundza, E.J., Chukwujekwu, J.C., Maharaj, R., Finnie, J.F., van Heerden, F.R. and van Staden, J. 2016. Identification of compounds in *Olax dissitiflora* with larvical effect against *Anopheles arabiensis*. South African Journal of Botany 102: 1-3. [Identifying santalbic acid and a mixture of two closely related compounds (exocarpic acid and octadec-9,11-diynoic acid) from bark of *O. dissitifolia* and confirming that the mixture of the latter two compounds had the highest activity against *Anopheles arabiensis* larvae.]

Meena Kusi, Kanti Shrestha and Rajani Malla. 2015. Study on phytochemical, antibacterial, antioxidant and toxicity profile of *Viscum album* Linn associated with *Acacia catechu*. Nepal Journal of Biotechnology 3(1): 60-65. [Confirming substantial antioxidant activity of *V. album* extracts and also antibacterial activity against *Pseudomonas aeruginosa*]


Mellado, A. and Zamora, R. 2016. Spatial heterogeneity of a parasitic plant drives the seed-dispersal pattern of a zoochorous plant community in a generalist dispersal system. Functional Ecology 30(3): 459-467. [Showing that the distribution of other fruiting species could be influenced by frugivorous birds feeding mainly on *Viscum album* ssp. austriacum.]


Meng Hao, Li, A.Y., Costa Junior, L.M., Castro-Arellano, I. and Liu JingZe. 2016. Evaluation of DEET and eight essential oils for repellency against nymphs of the lone star tick, *Amblyomma americanum* (Acar: Ixodidae). Experimental and Applied Acarology 68(2): 241-249. [Sandalwood oil (from *Santalum album*) was among natural oils, all of which failed to match DEET in repellancy against this tick.]

Midega, C.A.O., Pickett, J., Hooper, A., Pittchar, J. and Khan, Z.R. 2016. Maize landraces are less affected by *Striga hermonthica* relative to hybrids in western Kenya. Weed Technology 30(1): 21-28. [Showing that a number of local landraces have better tolerance of *S. hermonthica* than available (unspecified) hybrid varieties.]

[Studying a wide range of factors involved in the ability of farmers to sell surplus produce from their farms and finding age of farmer (younger), farm size (larger), commodity price, location and ownership of mobile phone among the most important. Incidentally noting that Striga hermonthica and S. gesnerioides were the dominant constraints to production of maize and cowpea respectively in the states of Bauchi and Kano.]

Mijatović, K.; Stojanavić, D. 2015. (The new form of Dodder (Cuscuta trifolii Bab.) ) (in Serbian) Zaštita Bilja 66(Special Issue): 30-33. [Suggesting that a form of C. trifolii var. angustissima occurring widely in Serbia should be known as forma. luteastigma.]


Morfpy, N., Faure, L. and Nelson, D.C. 2016. Smoke and hormone mirrors: action and evolution of karrikin and strigolactone signaling. Trends in Genetics 32(3): 176-188 [The most recent discoveries of karrikin and strigolactone perception and signal transduction are reviewed. Their receptors and signaling mechanisms are presented as well as recent investigations of host perception in parasitic plants that have demonstrated that strigolactone recognition can evolve following gene duplication of KAI2.]

Mounissamy, V.M., Jarina, A. and Srinivasan, G. 2015. Anti-microbial activity of caffeic acid isolated from Casjera rheedii J.Gmelin (Opiliaceae). International Journal of Drug Formulation and Research 6(5): 33-39. [Caffeic acid isolated from aerial parts of C. rheedii (Opiliaceae) was shown to have excellent antibacterial; and antifungal activity.]

Mourão, F.A., Pinheiro, R.B.P., Jacobi, C.M. and Figueira, J.E.C. 2016. Host preference of the hemiparasite Struthanthus flexicaulis (Loranthaceae) in ironstone outcrop plant communities, southeast Brazil. Acta Botanica Brasilica 30(1): 41-46. [S. flexicaulis recorded on 15 hosts species but mainly on Mimosa calodendron, a legume attractive to bird seed dispersers. The interaction is maintained by birds depositing seeds on host branches, but also by the ability of M. calodendron to fix nitrogen. Infection frequently caused host death.]


Musyoki, M.K., Cadisch, G., Zimmermann, J., Wainwright, H., Beed, F. and Rasche, F. 2016. Soil properties, seasonality and crop growth stage exert a stronger effect on rhizosphere prokaryotes than the fungal biocontrol agent Fusarium oxysporum f.sp. strigae. Applied Soil Ecology 105: 126-136. [Confirming that F. oxysporum ‘Foxy-2’ applied to soil for control of Striga hermonthica has no adverse effects on nitrifying prokaryotes.]

Mutlu, S., İhan, V. and Turkgolu, H.I. 2016. Mistletoe (Viscum album) infestation in the Scots pine stimulates drought-dependent oxidative damage in summer. Tree Physiology 36(4): 479-489. [Results of detailed studies on pine needles indicate that the increased mortality of Pinus sylvestris in Turkey may result from very severe drought stress induced by V. album. The increase in the capacity of antioxidative enzyme systems does not protect the plant against oxidative stress in dry summer seasons.]

Mutlu, S., Osma, E., İhan, V., Turkgolu, H.I. and Atçıl, O. 2016. Mistletoe (Viscum album) reduces the growth of the Scots pine by accumulating essential nutrient elements in its structure as a trap. Trees: Structure and Function 30(3): 815-824. [Infestation by V. album led to a decrease in the availability of water and mineral nutrients, and caused a powerful inhibition of chlorophyll, dry matter,
and the length of needles by accumulating the essential nutrient minerals in its structure.


Nan ZeDong, Zhao MingBo, Zeng KeWu, Tian ShuaiHua, Wang WeiNan, Jiang Yong and Tu PengFei. 2016. Anti-inflammatory iridoids from the stems of Cistanche deserticola cultured in Tarim Desert. Chinese Journal of Natural Medicines 14(1): 61-65. [Nine iridoids were isolated and identified, 8-epi-loganic acid providing potent inhibition of lipopolysaccharide-induced nitric oxide (NO) production in BV-2 mouse microglial cells comparable to the positive control quercetin.]

Naumann, J., Der, J.P., Wafula, E.K., Jones, S.S., Wagner, S.T., Hoenaas, L.A., Ralph, P.E., Bolin, J.F., Maass, E., Neinhuis, C., Banke, S. and DePamphilis, C.W. 2016. Detecting and characterizing the highly divergent plastid genome of the nonphotosynthetic parasitic plant Hydnora visseri (Hydnoraceae). Genome Biology and Evolution 8(2): 345-363. [A greatly reduced, highly divergent, yet functional plastome of the nonphotosynthetic holoparasite H. visseri was sequenced. The plastome is 27 kb in length, with 24 genes (smallest number to date) encoding ribosomal proteins, ribosomal RNAs, tRNAs, and a few nonribosomal genes, but no genes related to photosynthesis. The inverted repeat and the single copy region are only approximately 1.5 kb, and intergenic regions have been drastically reduced. Gene order and orientation are highly similar to that seen in Piper cenocladium, a related photosynthetic plant in Piperales.]


Nazaruk, J. and Orlikowski, P. 2016. Phytochemical profile and therapeutic potential of Viscum album L. Natural Product Research 30(4): 373-385. [A general review of the chemistry and uses of V. album in traditional and official medicine, for treating hypertension or arthritis and as a hepatoprotective or a sedative drug.]

Nefzi, F., Trabelsi, L., Amri, M., Triki, E., Kharrat, M. and Abbas, Z. 2016. Response of some chickpea (Cicer arietinum L.) genotypes to Orobanche foetida Poir. Chilean Journal of Agricultural Research 76(2): 170-178. [Six genotypes of chickpea varied somewhat in susceptibility to O. foetida in pots, but infestation was in any case low. Differences showed up after attachment and did not depend on differing germination]

Ngugi, K., Ngugi, A.J., Osama, S. and Mugoya, C. 2015. Combating Striga weed in sorghum by transferring resistance Quantitative Trait Loci through molecular marker assisted introgression. Journal of Plant Breeding and Genetics 3(3): 67-76. [Confirming that resistance to Striga hermonthica from N.13 could be introduced into the susceptible local variety Ochuti to produce lines with a useful degree of resistance.]

Nguyen Van Suc and Luong Ngoc Son. 2016. Mistletoe leaves as a biosorbent for removal of Pb(II) and Cd(II) from aqueous solution. Desalination and Water Treatment 57(8): 3606-3618. [Concluding that the leaves of Scurrula parasitica have potential for the absorption of lead and cadmium from contaminated waste water.]


number of organisms associated with eye problems, especially against Gram-positive bacteria but not against P. aeruginosa.


Okoye, F.B.C. and 10 others. 2015. Flavonoid glycosides from Olax mannii: structure elucidation and effect on the nuclear factor kappa B pathway. Journal of Ethnopharmacology 176: 27-34. [Isolating, identifying and studying a range of flavonoid glycosides from the methanol extract of O. mannii and concluding that kaempferol 3-O-L-rhamnopyranoside is the one compound exhibiting promising and specific antiproliferative activity on human K562 chronic myelogenous leukemia cells and dose-dependently inhibiting NF-kB transactivation, perhaps accounting for its reported in the ethnomedicinal management of cancer and inflammation.]

Oladimeji, O.H. and Usifoh, C.O. 2015. Phytochemical and antimicrobial studies on some Nigerian medicinal plants. Journal of Pharmacy and Bioresources 12(2): 156-164. [Reporting mediocrer results for ‘Viscum album’ but some other mistletoe must have been involved.]

Olsen, S., Popper, Z.A. and Krause, K. 2016. Two sides of the same coin: xyloglucan endotransglucosylases/hydrolases in host infection by the parasitic plant Cuscuta. Plant Signaling and Behavior 11(3): e1145336. (http://www.tandfonline.com/doi/full/10.1080/15592324.2016.1145336) [Xyloglucan endotransglucosylases/hydrolases (XTHs) are essential for Cuscuta to penetrate the host. However, XTH expression also occurs in resistant tomato upon an attack by Cuscuta, suggesting that both host and parasite use these enzymes in their ‘arms race.’ This paper summarises existing data on the cell wall-modifying activities of XTHs and present a model suggesting how they might function.]

Olsen, S., Stribeny, B., Hollmann, J., Schwacke, R., Popper, Z. and Krause, K. 2016. Getting ready for host invasion: elevated expression and action of xyloglucan endotransglucosylases/hydrolases in developing haustoria of the holoparasitic angiosperm Cuscuta. Journal of Experimental Botany 67(3): 695-708. [Differentially expressed genes were identified in young haustoria of C. reflexa and C. gronovii, whose development was induced by far-red light and tactile stimuli in the absence of a host plant. Two xyloglucan endotransglucosylase/hydrolase (XTH) genes were highly expressed almost exclusively at the onset of haustorium development. It was proposed that xyloglucan remodelling by Cuscuta XTHs prepares the parasite for host infection and possibly aids the invasive growth of the haustorium.]


Oyatomi, O.A. and 12 others. 2014. Screening wild *Vigna* species and cowpea (*Vigna unguiculata*) landraces for sources of resistance to *Striga gesnerioides*. International Conference on Enhanced Genepool Utilization - Capturing Wild Relative and Landrace Diversity for Crop Improvement. Cambridge, UK, 16-20 June, 2014. Book of Abstracts: 12. [Among 45 wild *Vigna* species screened, 11 species were found to have resistance in at least some accessions, but none of these are cross-compatible with cowpea.]

Panchen, Z.A. 2016. Arctic plants produce vastly different numbers of flowers in three contrasting years at Lake Hazen, Quttinirpaaq National Park, Ellesmere Island, Nunavut, Canada. Canadian Field-Naturalist 130(1): 56-63. [A study involving *Pedicularis capitata*, suggesting that longer warmer summers with climate change may increase reproductive success, but only if sustained year on year.]

Patek, P.K. 2016. Floristical study on various host s of two parasitic species belongs to *Cuscuta* genus around the Patan District from Gujarat state, (western India). Lifesciences Leaflets 76: 34-41. [Discussing host range and damage caused by *Cuscuta* spp. 42 host species enumerated for *C. reflexa* and 25 for ‘*C. chinensis*’ (no doubt *C. campestris*).]


Pérez-Crespo, M.J., Ornelas, J.F., Martén-Rodríguez, S., González-Rodríguez, A. and Lara, C. 2016. Reproductive biology and nectar production of the Mexican endemic *Psittacanthus auriculatus* (Loranthaceae), a hummingbird-pollinated mistletoe. Plant Biology 18(1): 73-83. [Confirming that *P. auriculatus* is self compatible but cross-pollination is normally effected by humming birds or butterflies.]


**Piwowarczyk, R. 2015. Seed micromorphology of central European *Orobanchaceae* and *Phelipanche* (Orobanchaceae) in relation to preferred hosts and systematic implications. Australian Systematic Botany 28(2/3): 124-136. [A detailed electron microscope study of 160 seed samples of 26 *Orobanchaceae* taxa from 54 localities across Europe concluding that the best diagnostic features include type of ornamentation of the periclinal wall, perforation diameter (in pitted sculpture), fibrillar diameter (in fibrillar sculpture) and width of anticlinal walls. Noting that characteristics can be modified according to host.]


Qu ZhengYi, Zhang YuWei, Zheng SiWen, Yao ChunLin, Jin YinPing, Zheng PeiHe, Sun ChengHe and Wang YingPing. 2016. A new phenylethanoid glycoside from *Orobanche cernua* Loefling. Natural Product Research 30(8): 948-953. [Isolating a novel phenylethanoid glycoside, 3′-O-methyl isocrenatoside, along with methyl caffeate from the fresh whole plant of *O. cernua*, and confirming significant cytotoxicity against the B16F10 murine melanoma and Lewis lung carcinoma cell lines, respectively.]

Quang Vuong Le, Tennakoon, K.U., Metali, F., Lim, B.L.B. and Bolin, J.F. 2015. Impact of *Cuscuta australis* infection on the photosynthesis of the invasive host, *Mikania micrantha*, under drought condition. Weed Biology and Management 15(4): 138-146. [Showing that the combined effects of *C. australis* parasitism and drought significantly suppressed the photosynthesis of *M. micrantha* via both effects on stomata and on non-stomatal effects.]

Queijeiro-Bolaños, M.E. and Cano-Santana, Z. 2016. Growth of hartweg’s pine (*Pinus hartwegii*) parasitized by two dwarf mistletoe species (*Arceuthobium* spp.). Botanical Sciences (Botanical Society of Mexico) 94: 51-62. [Crown spread and dbh of host trees infected by *A. globosum*, *A. vaginatum*, or both was measured. Relative growth rate of trees infected by both was lower than uninfected or infected only by *A. vaginatum*.]

Mediterranea 22: 45-62. [Including numerous Cuscuta species.]

*Rahimi, S., Mashhadi, H.R., Banadaky, M.D. and Megasaran, M.B. 2016. Variation in weed seed fate fed to different Holstein cattle groups. PLoS ONE 11(4): e0154057. [Viability of seeds of C. campestris reduced to 50% after 65-75 hours in the guts of cattle, depending on whether feedlot, lactating etc.]


Rakesh Kumar, Nishat Anjum, Tripathi, Y.C. 2015. Phytochemistry and pharmacology of Santalum album L.: a review. World Journal of Pharmaceutical Research 4(10): 1842-1876. [An in-depth review of the pharmacological uses of S. album, ranging from antibacterial to anticancer. And noting that no significant toxicity has been indicated by sandalwood oil and its individual constituents.]


Ratliff, W.S., Walker, E.S. and Levy, F. 2015. Demographics and Cronartium appalachianum rust disease assessments in three Tennessee populations of Buckleya distichophylla (Nutt.) Torr. (Santalaceae). Castanea 80(4): 243-252. [Recording variations in male:female sex ratio, vigour and rust infection between three populations of B. distichophylla. Tree species nearest to each population were Tsuga canadensis, T. caroliniana and Pinus virginiana, primary host of the rust, leading to greater infection of that population.]


Rocha, D., Ashokan, P.K., Santhoshkumar, A.V., Aonoo, E.V. and Sureshkumar, P. 2015 Anatomy and functional status of haustoria in field grown sandalwood tree (Santalum album L.). Forest Research: Open Access 4(3): 148. [While maximum connections were formed with the roots of Casuarina sp. planted in the same “pit”, haustoria were also formed with other species, including grasses up to 3 m from the S. album.]

Rodenburg, J., Cissoko, M., Dieng, I., Kayeke, J. and Bastiaans, L. 2016. Rice yields under Rhamphicarpa fistulosa-infested field conditions, and variety selection
criteria for resistance and tolerance. Field Crops Research 194: 21-30. [Incomparisons of 64 rice varieties, 13 showed high resistance (R. fistulosa remaining small, not apparently attached to crop) 16 with moderate tolerance and 2 with high tolerance. For farmers in R. fistulosa-endemic areas the most promising varieties are probably NERICA-L-40 and -31, as they combine good yields under infested conditions with low levels of parasite infection.]

Rodenburg, J. and 13 others. 2015. An in-depth appraisal of a range of projects relating to control of parasitic weeds, Striga asiatica, S. hermonthica and Rhamphicarpa fistulosa in rice in Africa. Noting the contributions of poor soil fertility and water management and farmers’ lack of inputs and understanding of the problems, also a lack of extension agents, or of their adequate training and equipment. Merits and challenges of an integrated multi-stakeholder and multi-level research project are discussed.

Rodrigues, A. and Stefanovic’, S. 2016. Present-day genetic structure of the holoparasite Conopholis americana (Orobanchaceae) in eastern North America and the location of its refugia during the last glacial cycle. International Journal of Plant Sciences 177(2): 132-144. [Microsatellite markers were used to infer the presence of two glacial refugia, one in Florida/Alabama and one in the Appalachian Mts.]

Ruraž, K. 2015. Rare vascular plant species of xerothermic grasslands from the Sandomierz Upland. Fragmenta Floristica et Geobotanica Polonica 202(1): 109-112. [Recording new localities for the rare Orobanche kochii in this part of Poland.]

Sabroe, R.A., Holden, C R and; Gawrodnog, D.J. 2016. Contact allergy to essential oils cannot always be predicted from allergy to fragrance markers in the baseline series. Contact Dermatitis 74(1): 236-241. [Noting some occasional allergy to oil from Santalum album, not always detected when testing oil mixtures.]

Saengprakai, J., Sikkhamondhol, C., Ruengrit, N. and Sabroe, R.A., Holden, C R and; Gawkrodger, D.J. 2016. Present-day genetic structure of the holoparasite Conopholis americana (Orobanchaceae) in eastern North America and the location of its refugia during the last glacial cycle. International Journal of Plant Sciences 177(2): 132-144. [Microsatellite markers were used to infer the presence of two glacial refugia, one in Florida/Alabama and one in the Appalachian Mts.]

Sabroe, R.A., Holden, C R and; Gawrodnog, D.J. 2016. Contact allergy to essential oils cannot always be predicted from allergy to fragrance markers in the baseline series. Contact Dermatitis 74(1): 236-241. [Noting some occasional allergy to oil from Santalum album, not always detected when testing oil mixtures.]

Sawant, R.J. 2015. Plants used for bone fracture by indigenous folklore of Toranmal Plateau, Nandurbar District, Maharashtra, India. Advances in Bio Research, 6(4): 101-103. [Dendrophthoe falcata among species used on bone fractures.]

Scalon M.C., Rossatto, D.R., Domingos, F.M.C.B. and Franco, A.C. 2016. Leaf morphophysiology of a Neotropical mistletoe is shaped by seasonal patterns of host leaf phenology. Oecologia 180(1): 1103-1112. [Studies of Passovia ovata (= Phthiresa ovata) parasitizing evergreen Micoria albicans and deciduous Byrsonima verbascifolia show varying water use efficiency ratio of photosynthetic rate to transpirational water loss; also stonatal density and size, indicating morphophysiological differences in the same mistletoe species parasitizing hosts of different phenological groups.]

Basic Research and Clinical Practice. 6th Mistletoe Symposium, Nonnweiler-Ottenhausen, Germany, 12-14 November 2015. Phytomedicine 22(Suppl.1): S1-S30. (http://www.sciencedirect.com/science/journal/09447113/22/suppl/S1) [This url leads to the list of papers and provides links to the PDFs of each. See also item above.]

Segneanu, A.E., Damian, D., Hulka, I., Grozescu, I. and Salifoglou, A. 2016. A simple and rapid method for calixarene-based selective extraction of bioactive molecules from natural products. Amino Acids 48(3): 849-858. [Promoting calixerane as an aid to the selective extraction of active compounds from plant extracts such as Viscum album.]

Şestacova, T., Giscă, I., Cucereavă, A., Tabără, O., Port, A. and Duca, M. 2015. Expression of some antioxidant genes in sunflower infected with broomrape. Analele Științifice ale Universității ‘A.I. Cuza’ din Iași. (Seria Nouă) Secțiunea II a. Genetici și Biologie Moleculară 16(3): 97-106. [Expression levels of ROS-scavenging genes (MnSODI, APX3 and AOX1A) in leaves of seven sunflower genotypes infected with three Orobanche cumana Wallr. populations were assayed in plants with/without broomrape aerial shoots and control group. AOX1A was the most responsive gene, especially when infection was produced by population from Anenii Noi.]


Simirgiotis, M.J., Quispe, C., Areche, C. and Sepúlveda, B. 2016. Phenolic compounds in Chilean mistletoe (Quintral, Tristerix tetrandus) analyzed by UHPLC-Q/ORBITRAP/MS/MS and its antioxidant properties. Molecules 21(3): 245. [Hybrid ultra-HPLC hyphenated with Orbitrap mass analysis used to identify 6 anthocyanins, mainly the 3-O-glycosides of delphinidin and cyanidin. Also several phenolic acids (including feruloylquinic acid, feruloyl glucose, chlorogenic acid) and flavonols (luteolin, quercetin, apigenin, isorhamnetin and glycoside derivatives). High antioxidant activity was recorded.]

Singh, A. 2016. Evaluation of in vitro antioxidant and anti-inflammatory activities of Ximenia americana extracts. Asian Pacific Journal of Tropical Disease 6(11): 918-923. [Finding that the aqueous extract of X. americana exhibited high antioxidant activity while the methanol extract exhibited high anti-inflammatory activity. Ans suggesting that purification, characterization and structural elucidation of phenolic compounds in both extracts may help in the development of new phytopharmaceuticals.]

Shi Ping, Zhu Wei and Li XiaoMing. 2015. Cynomorium songaricum polysaccharide improves osteoporosis in ovariectomized rats. Journal of Third Military Medical University 37(23): 2360-2363. [Concluding that C. songaricum exerts potential osteotropetic effects on OVX induced postmenopausal osteoporotic rats.]

Song QingQing, Li Jun, Liu Xiao, Zhang Yuan, Guo LiPing, Jiang Yong, Song YueLin and Tu PengFei. 2016. Home-made online hyphenation of pressurized liquid extraction, turbulent flow chromatography, and high performance liquid chromatography, *Cistanche deserticola* as a case study. Journal of Chromatography, A 1438: 189-197. [The technique described is claimed to provide an economical alternative to existing methods for simultaneous determination of eight primary phenylethanoid glycosides in extracts of *C. deserticola.*]


Start, A.N. 2015. The mistletoe flora of southern Western Australia, with a particular reference to host relationships and fire. Australian Journal of Botany 63(8): 636-646. [Reporting conclusions from a 30-year study, involving 19 Loranthaceae and 2 Santalaceae. On 153 host species, including many Leguminosae, but also *Eucalyptus* and *Melaleuca* spp. Describing the role of fire in their distribution and survival.]


Sui XiaoLin, Kuss, P., Li WenJun, Yang MeiQing, Guan KaiYun and Li AiRong. 2016. Identity and distribution of weedy *Pedicularis kansuensis* Maxim. (Orobanchaceae) in Tianshan Mountains of Xinjiang: morphological, anatomical and molecular evidence. Journal of Arid Land 8(3): 453-461. [Confirming that the predominant weedy *Pedicularis* sp. in this region is *P. kansuensis* rather than *P. verticillata* as previously assumed.]

*Sun ShiGuo* and Huang ShuangQuan 2015. Rainwater in cupulate bracts repels seed herbivores in a bumblebee-pollinated subalpine flower. AoB Plants 7: plv019. [http://aobpla.oxfordjournals.org/content/7/plv019.full] [The bracts of *Pedicularis* fill with water when it rains. Draining these bracts did not affect pollinators or nectar robbers but did allow more seed predation.]

Svobodová, Š., Košnar, J., Koutecký, P., Štech, M. and Wesselingh, R. 2016. Microsatellite analysis of four similar *Euphrasia* (Orobanchaceae) species changes the traditional view of this group. Plant Ecology and Evolution 49(1): 45-58. [*There are three well supported groups in the studied dataset of *Euphrasia* species. Delimitation of *E. stricta* and *E. nemorosa* is in concert with traditional views, but delimitation of the third group changes the traditional distinction of two mostly early-flowering species in the study area.*]

Světlíková, P., Blažek, P., Mühlstinová, R., Těšítel, J. and Wesselingh, R. 2016. Tracing nitrogen flow in a root-hemiparasitic association by foliar stable-isotope labelling. Plant Ecology and Evolution 149(1): 39-44. [Confirming the effectiveness of brushing leaves with 15-N-urea as a simple and precise labelling method, which can be applied in greenhouse and field experiments to examine the nitrogen flows between root hemiparasites such as *Rhinanthus major* and host such as wheat.]

Taylor, A. and Burns, K. 2016. Radial distributions of air plants: a comparison between epiphytes and mistletoes. Ecology 97(4): 819-825. [Interestingly, concluding that mistletoes (unspecified, presumably various, in New Zealand) oriented northwest, parallel to gradients of higher light intensity, temperature, and lower humidity, while non-parasitic epiphytes oriented away from the sun to the southeast.]


plants are functionally classified into root hemiparasites, root holoparasites, stem parasites and endophytic parasites. Evolving from root hemiparasites, advanced parasitic plants are hypothesized to have been released from ecological constraints with increasing ability to acquire resources from the host and increasing host specificity. Hemiparasites are more speciose (by one order of magnitude) than holoparasites and thus are proposed to have more evolutionary stability.]

Tjirutue, M.C., Sandler, H.A., Kersch-Becker, M.F., Theis, N. and Adler, L.A. 2016. Cranberry resistance to dodder parasitism: induced chemical defenses and behavior of a parasitic plant. Journal of Chemical Ecology 42(2): 95-106. [Five cranberry cultivars differed little in their susceptibility to unspecified Cuscuta (presumably C. gemonii) but in all cases infection induced production of salicylic acid which may influence other organisms.]

Toh, S., Holbrook-Smith, D., Stogios, P.J., Onopriyenko, T., Toshkova, T. and Baeva, G. 2014. Control in tomato with combinations of metham-sodium or dazomet with trifluralin or maleic hydrazide.]

[Isolating two new polysaccharides from C. songaricum. Isolation and antiviral activity of water-soluble Cynomorium songaricum Rupe. polysaccharides. Journal of Asian Natural Products Research 18(2): 2, 159-171. [Isolating two new polysaccharides from C. songaricum with high activity against HIV infection of MT-4 cells.]

Tyszczuk-Rotko, K., Doman’ska, K., Sadok, I., Wójciak-Kosior, M. and Sowa, I. 2015. Voltammetric procedure for the determination of oleanolic and ursolic acids in plant extracts. Analytical Methods 7(22): 9435-9441. [quantification of oleic acid in extracts from Viscum album by square-wave voltammetric measurement ‘overlapped’ with that by HPLC.]


[Over 130 volatile organic compounds were collected from flowers of over 25 Orobanchaceae using dynamic headspace sampling and analyzed using GC-MS. Principal components analysis showed groupings consistent with recognized species.]

Tsuchiya, Y., Yoshimura, M., Sato, Y., Kuwata, K., Toh ShiGeo, Holbrook-Smith, D., Zhang Hua, McCourt, P., Itami, K., Kinoshita, T. and Hagihara, S. 2015. Probing strigolactone receptors in Striga hermonthisc with fluorescence. Science (Washington) 349(6250): 864-868. [A fluorescence turn-on probe (YLG) was developed, which activates strigolactone signaling and illuminates signal perception by the strigolactone receptors. Live imaging using YLGs revealed that a dynamic wavelike propagation of strigolactone perception wakes up Striga seeds. ShHTLs were shown to be function as the strigolactone receptors mediating seed germination in Striga.]


Turner, R.J. and Smith, P. 2016. Mistletoes increasing in eucalypt forest near Eden, New South Wales. Australian Journal of Botany 64(2): 171-179. [Noting an increase in mistletoes, chiefly Amyema pendula and Muellerina eucalyptoides inside eucalypt forests between 1990 and 2006. Densities are not greatly affected by prescribed light burning but are probably influenced by occasional severe wild fires.]


Tyszczuk-Rotko, K., Doman’ska, K., Sadok, I., Wójciak-Kosior, M. and Sowa, I. 2015. Voltammetric procedure for the determination of oleanolic and ursolic acids in plant extracts. Analytical Methods 7(22): 9435-9441. [quantification of oleic acid in extracts from Viscum album by square-wave voltammetric measurement ‘overlapped’ with that by HPLC.]

Uchôa, V. T.; Sousa, C.M.M., Carvalho, A.A., San’Ana, A.E.G. and Chaves, M.H. 2016. Free radical scavenging ability of Xenima americana L. stem bark and leaf extracts. Journal of Applied Pharmaceutical Science 6(2): 91-96. [Showing that extracts of stem bark and leaves of X. americana contained epicatechin and quercetin, respectively, both proving highly active as antioxidants.]
Ethnopharmacology 177: 126-139. [Including reference to *Ximenia americana* but no detail in abstract.]


*van Zeijl, A., Liu Wei, Xiao TingTing, Kohlen, W., Yang WeiCai, Bisseling, T. and Geurts, R. 2015. The strigolactone biosynthesis gene DWF27 is co-opted in rhizobium symbiosis. BMC Plant Biology 15: 260. (http://bmcplantbiol.biomedcentral.com/articles/10.1186/s12870-015-0651-x ) [It is shown that the phosphate-starvation responsive strigolactone biosynthesis gene MtD27 is also rapidly induced by rhizobium lipo-chitoooligosaccharide signals in an *MnNSP1* and *MnNSP2*-dependent manner. Additionally, it is shown that MtD27 is co-expressed with MtCCD7 and MtCCD8 in nodule primordia and in the infection zone of mature nodules.]

Varzaru, I., Untea, A.E. and Van, I. 2015. Determination of bioactive compounds with beneficial potential on health in several medicinal plants. Romanian Biotechnological Letters 20(5): 10773-10783. [Noting the use of *Euphrasia rostkoviana* for eye disorders, associated with its higher than average content of lutein and zeaxanthin, and of vitamin E.]


*velasco, L., Pérez-Vich, B. and Fernández-Martínez, J.M. 2016. Research on resistance to sunflower broomrape: an integrated vision. OCL - Oilseeds and Fats, Crops and Lipids 23(2): D203. (http://www.oocl-journal.org/articles/oocl/full_html/2016/02/oocl160002-s/oocl160002-s.html) [A general review of the problems of breeding sunflower varieties resistant to *Orobanche cumana* and concluding that most important is not relying only on single dominant genes, but following instead pyramiding strategies. These should give priority to combining complementary mechanisms of resistance under both qualitative (vertical) and quantitative (horizontal) genetic control.]

Venditti, A., Frezza, C., Serafini, M. and Bianco, A. 2016. Iridoids and phenylethanoid from *Pedicularis kernerii* Dalla Torre growing in Dolomites, Italy. Natural Product Research 30(3): 327-331. [Describing the occurrence of 10 compounds in *P. kernerii*.]

Venditti, A., Frezza, C., Scibba, F., Foddai, S., Serafini, M., Nicoletti, M. and Bianco, A. 2016. Secoiridoids and other chemotaxonomically relevant compounds in *Pedicularis*: phytochemical analysis and comparison of *Pedicularis rostrato.capitata* Crantz and *Pedicularis verticillata* L. from Dolomites. Natural Product Research 30(15): 1698-1705. [The exclusive presence of 8-epiligostic acid (13), campneoside II, cistantubuloside C1, ligustroside and excelside B in *P. rostrato.capitata*, and angoroside A, cistantubuloside B1 and wiedemannioside C in *P. verticillata* could be considered specific markers for these two species.]

Vente, M., Todt, H. and Breckle, S.W. 2015. Influence of halophytic hosts on their parasites-the case of *Plicosepalus accuriae*. AOB Plants 7: plu084. (http://aobpla.oxfordjournals.org/content/7/plu084.full) [*P. accuriae* grows on both halophytic and non-halophytic hosts in Israel. On halophytic hosts, including *Tamarix* spp. the leaves become succulent with up to 3 times the water content and the leaf volume increased up to 5 times. It can be classified as a facultative eu-halophyte, which increases its halo-succulence according to the host.]

Vittorazzi, C., Endringer, D.C., de Andrade, T.U., Scherer, R. and Fronza, M. 2016. Antioxidant, antimicrobial and wound healing properties of *Struthanthus vulgaris*. Pharmaceutical Biology 54(2): 331-337. [Confirming antioxidant and antibacterial activity in *S. vulgaris* which, together with strong ability to stimulate proliferation and migration of fibroblasts, provides support for its traditional use in Brazil to bathe wounds.]

Vugin, A.F., Bassols, G.B. and Varela, B.G. 2015. (Anatomical changes in epidermis of infected leaves of *Phoradendron bathyoryctum* Eichler (Viscaceae). ) (in Spanish) Domínguezia 31(2): 17-24. [Describing the symptoms on the leaves of *P. bathyoryctum* caused by an unidentified pathogen. Incidentally noting that *P. bathyoryctum* grows on a number of host trees and is used traditionally to reduce blood-pressure.]


Wang FengXia, Liu Qin, Wang Wei, Li Xibo, and Zhang Ji. 2016. A polysaccharide isolated from *Cynomorium songaricum* Rupr. protects PC12 cells against H2O2-

Wang HongJuan, Li WeiTao, Liu YaNan, Yang FuSheng and Wang XiaoQuan. 2015. Range-wide multilocus phylogenetic analyses of Pedicularis sect. Cyathophyllum (Orobanchaceae): implications for species delimitation and speciation. Taxon 64(5): 959-974. [Three low-copy nuclear and two chloroplast genes were used to infer a phylogeny of this Section. Results suggest some species reassignments and molecular dating suggests the uplift of the Qinghai-Tibet Plateau played an important role in speciation in this Section.]


*Wang YueHua, Xuan ZhaoHong, Tian Shuo and Du GuanHua 2015. Echinacoside protects against 6-hydroxydopamine-induced mitochondrial dysfunction and inflammatory responses in PC12 cells via reducing ROS production. Evidence-based Complementary and Alternative Medicine 2015: Article ID 189239. (http://www.hindawi.com/journals/ecam/2015/142059/) [Confirming that treatment with echinacoside (from Cistanche salsa) significantly attenuated changes induced by 6-hydroxydopamine and the associated inflammatory responses, thus of potential value in treatment of Parkinson’s Disease.]

Wazis, C.H., Timothy, S.Y., Yesufu, H.B., Mashi, J.S. and Kida, M.Y. 2015. Evaluation of antinociceptive activity of ethanol whole plant extract of Viscum album L. in rats. Journal of Pharmaceutical and Scientific Innovation (JPSI) 4(6): 289-294. [The ethanol whole plant extract of V. album was found to be relatively non-toxic and contain active constituents which might be responsible for its observed antinociceptive activity. Results amply justify the traditional use of this plant as an analgesic.]

Wesselingh, R.A. and Wesselingh, R. 2016. Within-population variation in the relation between node number and flowering time in Rhinanthus angustifolius (Orobanchaceae). Plant Ecology and Evolution 149(1): 21-30. [The number of nodes produced before the first flower is an important trait linked to flowering time. Studying ecotypes with naturally different flowering times showed that both genetically determined (node number) and phenotypically plastic (plant size) traits contribute to variation in flowering time within populations, and even under strong selection against late flowering, wild populations may harbour enough variation to react to a decrease in this selection pressure by later mowing.]


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*Wong HoiShan, Chen JiHang, Leong PouKuan, Leung HoiYan, Chan WingMan and Ko KamMing. 2015. A Cistanches Herba fraction/sitosterol causes a redox-sensitive induction of mitochondrial uncoupling and activation of adenosine monophosphate-dependent protein kinase/peroxisome proliferator-activated receptor γ coactivator-1 in C2C12 myotubes: a possible mechanism underlying the weight reduction effect. Evidence-based Complementary and Alternative Medicine 2015: Article ID 142059. (http://www.hindawi.com/journals/ecam/2015/142059/) [Confirming that treatment with echinacoside (from C. salsa) significantly attenuated changes induced by 6-hydroxydopamine and the associated inflammatory responses, thus of potential value in treatment of Parkinson’s Disease.]

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You ShuPing, Zhao Jun, Ma Long, Tudimat, M., Zhang ShiLei and Liu Tao. 2015. Preventive effects of phenylethanol glycosides from Cistanche tubulosa on bovine serum albumin-induced hepatic fibrosis in rats. Daru - Journal of Pharmaceutical Sciences 23: 52. [C. tubulosa is a traditional Chinese herbal medicine that is widely used for regulating immunity. This study confirmed that the main active components, phenyl ethanol glycosides have a significant activity against hepatic fibrosis.]


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**IPPS MEMBERSHIP**

Membership in the IPPS is open to individuals and organizations of all nations that are interested in the objectives of the Society. Membership fee for 2 years is 50 € and will be included in the registration for the IPPS meeting (WCCP).

To obtain a Registration form visit the IPPS website (http://www.parasiticplants.org/) or contact:
Dr. Philippe Simier Laboratoire de Biologie et Pathologie Végétales (LBPV) IFR 149 Qualité et Santé du Végétal (QUASAV) Université de Nantes 2 rue de la Houssinière BP 92208 44322 Nantes Cedex 03 France

**HAUSTORIUM 69**

Zhang XiaoMing, Liu Bo, Guo QiaoSheng, Song LingShan, Chen Lu and Wang ChangLin. 2016. Construction of a haustorium development associated SSH library in *Thesium chinense* and analysis of specific ESTs included by *Imperata cylindrica*. Biochemical Systematics and Ecology 64:46-52. *(T. chinense* is a facultative hemiparasite that can invade host plants by inducing haustoria on neighboring host roots to access the water and nutrients of the host. Suppression subtractive hybridization (SSH) was performed to identify the differentially expressed genes during haustorial development. The results indicated that the relative quantities of TcPME, TcAux/IAA, TcPrx and TcPAL were affected by the secretions of the *Imperata cylindrica* root that *T. chinense* accreted and that these effects were meaningful to the development of the haustorium of *T. chinense*.)

Zhao Wei, Zhang YunXia, Liang JiaFen, Chen DaCan, Li HongYi and Xuan GuoWei. 2016. *(Experience of TCM master XUAN Guo-wei in treating skin disease by using herbs from south of the Five Ridges.)* (in Chinese) China Journal of Traditional Chinese Medicine and Pharmacy 31(1): 117-120. *(Noting that Pro Xuan uses *Striga asiatica* to eliminate dampness and relieve stagnation’.)

*Zhen Jing, Guo Yue, Villani, T., Carr, S., Brendler, T., Mumbengegwii, D.R., Kong AhNg [Kong, A.N.T.], Simon, J.E. and Wu QingLi. 2015. Phytochemical analysis and anti-inflammatory activity of the extracts of the African medicinal plant *Ximenia caffra*. Journal of Analytical Methods in Chemistry 2015: Article ID 948262. ([http://www.hindawi.com/journals/jamc/2015/948262/](http://www.hindawi.com/journals/jamc/2015/948262/)) [Identifying 10 polyphenols in the extract of *X. caffra*, quercetin-rutinoside being the commonest, and showing that it inhibits the mRNA expression of proinflammatory genes (IL-6, iNOS, and TNF-α) by using RT-qPCR, implying anti-inflammatory effects.].


MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

I wish you all a very Happy New Year and lots of exciting discoveries about parasitic plants in the coming year!

There are two very interesting meetings that involve parasitic plants on the horizon. The first is the 2nd International Congress on Strigolactones that will be held in Turin, Italy from 27th-30th March 2017 and includes two sessions on strigolactones and parasitic plants.

The next major conference is of course, the 14th World Congress on Parasitic Plants, that will take place in Asilomar, California, USA from June 25th – 30th 2017. John Yoder is the local organizer and details of Registration and Abstract submission are available on the WCPP-14 website (http://www.wcpp14.org). Please note that registration closes on June 1st and abstracts should be submitted as soon as possible and no later than 14th April 2017. The venue looks fantastic and the meeting is a great opportunity to see friends and make new contacts and collaborations.

I look forward to seeing everyone in June

Best wishes,

Julie Scholes, IPPS President
J.Scholes@Sheffield.ac.uk

MEETING REPORTS


This meeting was part of the activities by COST ACTION FA1206: ‘Strigolactones: biological roles and applications.’ The participants to the meeting were welcomed by Peter Toth and Radoslava Matusova, Local Organizers, and by the Dean’s Delegate for International Relations of the Slovak University of Agriculture.

Oral presentations at the meeting are listed below.

Also, a round-table discussion was initiated, and the costs of strigolactone applications in agriculture; the amount of strigolactone to be used in fields and the possible impacts on the soil were discussed, as well as the related regulations in different countries. Ethical aspects of strigolactone applications were raised and valuable types of crops to be used. It was concluded that there is a need to provide the Agricultural Ministries of the involved countries, both at national and European level, with scientific and reasonable recommendations on the use of strigolactones and bio-stimulators in fields and related impacts on soil and also human bodies.

An enjoyable post-conference tour took us to Demänovská Valley in the second highest Slovak mountain range ‘Low Tatras’ - along the creek Demänova. The aim of the tour was particularly to observe natural populations of Orobanche flava, and evaluate their impact on the host plant, a white-flowered butterbur (Petasites kablikianus or perhaps P. albus). O. flava is one of many wild broomrapes, interesting also because its seeds do not react to GR24. Other parasites observed included a Melampyrum species, either Melampyrum pratense or M. sylvatica and a Euphrasia sp.; also the mycoheterotrophs Neottia nidus-avis and Monotropa uniflora.

Orobanche flava on Petasites ?kablikianus.
Photo Chris Parker

Oral presentations:

Danny Joel (The Volcani Center, Agricultural Research Organization, Israel) - ‘Germination stimulants interaction with Orobanche cumana and their role in its evolution as an agricultural weed’
The meeting was located in the complex geologic and botanic region of the Pacific Coast in southern Oregon, along the California border. The area is mountainous, with steep environmental gradients, as well as a unique serpentine rock, and endemic plants. Mistletoes in the Viscaceae are abundant here, but no other families of mistletoe are present in the region.

Scientific conferences are peculiar affairs. On one hand, they’re expensive and inconvenient; on the other, they’re informative and enjoyable. Every now and then, you’re fortunate enough to participate in that rarest of conferences—one that enlightens and energizes. The Ashland mistletoe conference was one such gem, among the most inspiring meetings I’ve attended in twenty-odd years. The breadth of expertise among the delegates spanned forestry, plant pathology, plant anatomy, molecular phylogenetics, community ecology and palaeontology, but we could all speak freely using the common language of mistletoes. We were treated to Clyde Calvin (University of California) sharing his insights on why the Viscaceae are such a successful lineage (the first public presentation he’s given in 19 years). Gehard Glatzel (Austrian Academy of Sciences) reviewed deciduousness in mistletoes, suggesting protection from frosts as a selective mechanism. Cynthia Ross-Friedman (Thompson Rivers University in Canada) synthesized her transdisciplinary research on ‘the little bang’—the mechanistic basis of explosive seed discharge in dwarf mistletoes, revealing the critical role of thermogenesis in triggering discharge. Eva-Maria Sadowski (Georg-August-University of Göttingen, Germany) showed how little we know about the early history of mistletoes, reviewing dwarf mistletoe fossils from Baltic amber and suggesting mistletoes were already operating as ecological keystones in the Eocene. Gregorio Ceccantini (University of São Paulo, Brazil) shared exquisite images of thin sections and carefully-prepared haustorial specimens, demonstrating how mistletoes cause whole-of-tree hydraulic effects in infected hosts.

The scientific program was complemented by two day-long field trips with equal doses of...
spectacular scenery and abundant mistletoes. Bob Scharpf shared his extensive knowledge of dwarf mistletoes and their effects on coniferous hosts. Dave Shaw (University of Oregon) was on hand, identifying trees and birds, squirrels and wildflowers and pointing out key features of infected stands, while Shawn Kenaley (Cornell University) kept a sharp eye out for rusts and other fungi. A real highlight was being in the field with Bob Mathiasen (Northern Arizona University) who convinced us that although subtle characteristics of dried herbarium specimens may be difficult to distinguish, dwarf mistletoe species are best identified by growth habit, phenology, host identity and distributional range.

In addition, we had 18 other presentations by colleagues from Brazil, Australia, Germany, Austria, USA, and Canada, with 6 graduate students presenting. Many of the presenters have submitted manuscripts for a special section of the journal Botany, which may include 12 papers and is due to publication in 2017.

Southern Oregon University was an ideal conference venue, with seamless organization thanks to Brianna Beene (University of Oregon). For a more thorough summary of the conference with details of all speakers, presentations, field trips (and piles of mistletoe photos), you can scroll through: https://storify.com/D0CT0R_Dave/mistletoe-conference


A special issue of the journal ‘Botany’ will feature papers from the conference.

Presentations:

Watson, Dave - Of mistletoes and mechanisms: advances in understanding their ecological role and ecosystem function.
Hagar, Joan - Bird abundance and diversity are associated with oak mistletoe in Willamette Valley oak woodlands.
Flanders, Nicholas - The role of generalist avian frugivores in determining the distribution of the mistletoe Phoradendron leucarpum.
Eric Forsman - Dwarf mistletoe and the spotted owl.

Mathiasen, Robert - The classification of Arceuthobium campylopodum, A. laricis, and A. tsugense based on morphology and host range affinities.
Wilson, Carol - Epiparasitism in mistletoe (Santalales): An overlooked topic in forest biology.
Ashworth, Vanessa - Phylogenetic relationships in Phoradendron (Viscaceae).
Schneider, Adam - The role of host specificity in speciation: Insights from American Orobanche (Orobanchaceae).
Calvin, Clyde - The Viscaceae, why so successful?
Glatzel, Gerhard - Deciduousness in mistletoes.
Cynthia Ross-Friedman - The Little Bang Theory: explosive seed discharge in dwarf mistletoe.
Isikhuemen, Ekeoba - The African mistletoe: from noxious weed to cure-all medicine.
Sadowski Eva-Maria - Macrofossil evidence of Eocene dwarf mistletoes and their implications for Baltic amber forest.
Ceccantini, Gregorio - A single mistletoe can cause a systemic hydraulic effect in the host tree.
Klutsch, Jennifer - Dwarf mistletoe induced defense chemical accumulation in jack pine alters tree resistance to a non-native bark beetle- associated fungi.
Logan, Barry - A dispatch from the East: divergent responses white spruce and red spruce to eastern dwarf mistletoe infection along the coast of Maine.
Muir, John - Monitoring western hemlock dwarf mistletoe infection of regenerating coast western hemlock forests in British Columbia.
Ritter, Scott - The relationship between dwarf mistletoe infestation intensity and stand structure, canopy fuels, and surface woody debris in lodgepole pine forests.
Shaw, Dave - Fire and dwarf mistletoe in Western North America.
Ceccantini, Gregorio - Mistletoe with giant woody gall: Interpretation of the anatomic-hydraulic connection between Psittacanthus robustus and Vochysia thyrsoides and the discovery of new structures in the haustorium.
Teixeira-Costa, Luiza - Multiple vs. single connections: What does it mean for the parasite?
Watson, Dave - On tropical mistletoes: noteworthy advances, recent insights, emerging opportunities.

Dave Watson, Dave Shaw (USA, Coordinator, IUFRO 7.02.11)

CUSCUTA PLANIFLORA IN WESTERN IRAN

*Cuscuta planiflora* Ten. (red or small-seeded dodder) is an annual parasitic plant. It has recently become invasive in west of Iran. Its major areas of infestation are in Ilam province between southern parts of the highlands of Zagros mountain and tropical areas with range into neighbouring provinces like Khuzestan and Kermanshah. It is gradually increasing in natural landscapes and parasitizing many broadleaf plant species from different families including Asteraceae (*Centaurea* sp., *Echinops* sp.), Brassicaceae (*Brassica* spp., *Diplotaxis harra*), Geraniaceae (*Erodium* sp.), Papilionaceae (e.g. *Astragalus* spp., *Ononis* sp.), Polygonaceae and (*Rumex ephedroides*). The infestation is so high that host plants are affected (Taab, personal observations).

The infestation is so high that host plants are affected (Taab, personal observations).

Infestation of *C. planiflora* on *Ononis spinosa*. Photo Prof. Alireza Taab.

The seeds of *C. planiflora* remain viable in the soil for more than 20 years (Dawson et al. 1994). Flowering of small-seeded dodder may occur from January to May (Meeuse and Welman 2000) and even longer in June (Taab, personal observation). Seed of dodder species have a hard seed coat that is broken down over time through natural processes (Dawson et al. 1994). The optimum temperature for seed germination of *Cuscuta* spp. was found to be between 30 to 33°C (Zaki et al. 1998) perhaps the reason why the species has becoming invasive in warmer climates probably as a consequence of raising temperature brought about by climate change.

Pastures in the infested area are used by farmers for feeding livestock. Therefore, dispersal of the species might be accelerated by grazing animals as seeds may pass through birds’ and mammals’ digestive tracts alive (Lee and Timmons 1980) or in mud adhering to feet of animals (Cooke 2001 cited in Pratt, 2002) and be spread through their movement. Because dodder seeds are usually dispersed near parent plants so wind has little effect on their dispersal due to the seed weight and shape (Dawson et al. 1994).

The small-seeded dodder is expected to have a wide range of hosts, due to the adaptability of this genus (Pratt, 2002). Reported hosts of small-seeded dodder include citrus, grapes, faba beans, *Indigofera* spp., lucerne, *Melilotus* spp., clover, eggplant, tomato, capsicum, onion, *Barleria* spp., *Merremia* spp., cucumber, chrysanthemum and sugar beet and many other related species. Non-crop hosts include *Centaurea* spp., *Plectanthrus* sp., *Solanum* spp., *Rumex* spp. and *Senecio vulgaris* (Orloff et al. 1989, Sher and Shad 1989, Parker and Riches 1993, Zaki et al. 1998, Meeuse and Welman 2000, Cooke 2001 cited in Pratt, 2002). It has also been reported on canola and lupins in Australia (Pratt, 2002) and as a serious weed in alfalfa, safflower, melons, onions, carrots, berseem (*Trifolium alexandrinum*), ber tree (*Ziziphus mauritiana*) and sugar beets etc. in Pakistan (Iqbal et al.,
Thus, it can potentially be problematic for agricultural crops in nearby infested areas.

Dodder species like *C. planiflora* that have a wide host range and invade native vegetation may significantly impact biodiversity in infested areas. For example, wild and domesticated honey bees are likely to suffer because of reduction of appropriate flowering plants. High infestation of dodder can also be a hindrance to wildlife movement (Pratt, 2002) in natural vegetation. Parasites like dodder usually weaken the host and may cause its death before reproduction. Therefore, the number of host plants are reduced over time and they could be replaced by non-host plants. This will have consequences for balance of wild life and food chains.

In conclusion, the infestation of *C. planiflora* will probably advance into more areas due to its adaptability, high potential of seed production, long survival of seeds, presence of seed dispersal vectors, and lack of control measure. The profitability of infested pastures will be reduced due to reduction of broadleaf and favorite plants for grazing animals. The biodiversity of wild life will also be affected as a consequence of dodder invasion. Due to difficulties with control of parasitic weeds in natural landscape (i.e. accessibility, costs and restriction of using herbicides), appropriate control measures e.g. biological option, need to be evaluated and adapted.

**Acknowledgment:**
I acknowledge the help of Prof. Lytton John Musselman in identifying the *Cuscuta* species.

**References:**


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**LITERATURE HIGHLIGHTS**


Many years ago when there were steam engines and rational political discourse, I launched my botanical career with a study of the structure and development of haustoria. So I was particularly interested in this recent review which makes it very clear that we have made epochal progress in understanding this most fascinating and specialized organ, the very essence of parasitism in plants.

After a concise and helpful introduction to the haustorium and its distribution in families of modern angiosperms (but only eudicot) phylogeny, the authors describe the anatomy of the haustorium including helpful, clear micrographs. The emphasis here, as in the rest of the paper, is on the genus *Cuscuta* (Convolvulaceae) and the Orobanchaceae, including both holo- and hemi-parasites of the...
latter. There is a helpful review of development of the parasitic organ including haustorial inducing factors. This is followed by a section on functions, including host invasion, host immunity avoidance, and nutrient transfer.

One of the most helpful components of this review is the treatment of transfer of genetic material, via mRNA exchanges. Years ago, a researcher who had sequenced the DNA of a parasite expressed amazement to me that there was DNA from another plant in the parasite—inexplicable at the time. Horizontal gene transfer is more common in parasitic plants than in other angiosperms. In fact, horizontal gene transfer—in both directions, host to parasite and parasite to host—has been recorded in 10 of 12 parasite lineages. (see separate Literature Highlight on this topic below)

This leads to the final section, dealing with the evolution of the haustorium. Haustoria share many structural and functional features, a remarkable example of homoplasy. Like earlier workers, the authors note that the function of a lateral root—traversing endodermis, cortex, and epidermis—is similar to a haustorium.

In this paper, as in other reviews, the presence of a storied cambium present in all haustoria from diverse lineages is not mentioned. And why are there no known monocot parasites? Is it related to the lack of a storied cambium?

This paper provides an excellent review of haustoria. Although, as noted, it is restricted largely to two taxa, it is suitable for use in plant physiology, plant pathology, and other courses.

Lynton Musselman


Significant advances in the use of *Fusarium oxysporum* isolates for *Striga hermonthica* biocontrol have occurred since their isolation and collection from several regions in Africa (Ciotola et al. 1995; Kroschel et al. 1996; Marley et al. 1999). Results from various field trials (Ciotola et al. 2000; Marley and Shebayan 2005; Venne et al. 2009; Watson 2013) were often very encouraging, but successful control of *S. hermonthica* has been difficult to achieve.

Control was tried using different formulations (seed coating and pesta granules) and different isolates of *F. oxysporum* f. sp. *strigae* [M12-4A (origin Mali), PSM197 (origin Nigeria) and Foxy 2 (Ghana)] on *Striga*-resistant and *Striga*-susceptible varieties of sorghum and maize in Benin and Burkina Faso (Venne et al. 2009). Isolates Foxy 2 and PSM197 were more effective than M12-4A and pesta granules performed better than the seed coat formulation. When combined with a *Striga*-resistant maize line, *F. oxysporum* f. sp. *strigae* reduced *Striga* emergence over 90%. However, when used in Kenya, Foxy 2 did not perform well indicating the need to collect region-specific isolates adapted to local conditions for successful *Striga* control (Avedia et al. 2014).

Local production of *F. oxysporum* M12-4A was investigated with subsistence farmer families in four villages in Mali to evaluate as a cottage industry model for biological control of *S. hermonthica* (Bastiani 2001). Dried chlamydospores, produced off-location (Ciotola et al. 2000) and stored in small gelatin pill capsules were distributed to farmers for on-farm production of inoculum using locally available tools. Farmer-prepared chopped sorghum straw suspension was cooked in village kettles and when cooled the farmer added the chlamydospore powder from the capsule. After 10 days, the colonized straw was dried and ground into a powder combined with Arabic gum and used to coat farm-saved sorghum seeds (Bastiani 2001). Results were variable and limited due to contamination in production kettles.

A recent intriguing paper by Nzioki et al. (2016) *‘Striga’ biocontrol on a toothpick: a readily deployable and inexpensive method for smallholder farmers’ significantly advances the use of *Fusarium* for biocontrol of *Striga*. Potential contamination of small-holder-farm-production of biocontrol inoculum has been greatly reduced by off-farm laboratory production of the starter culture (the primary inoculum) and the provision of plastic containers with lids to produce secondary inoculum on rice for field application. Results of the 500-farmer field trials are impressive indeed and credited to the training of the smallholder farmers by an NGO network to produce the biocontrol inoculum, apply the product in their maize fields and collect agronomic data. This paper supports the feasibility of on farm cottage industry
production of a biocontrol agent but will require significant resources to be sustainable.

References:


Alan Watson, McGill University.

Literature Highlight: more horizontal gene transfer associated with parasitism

Parasitic plants lead the plant kingdom in horizontal gene transfer (HGT) events, exhibiting more HGT cases than fully autotrophic plants. The reason proposed to explain this has been that the physical connection between parasites and their hosts facilitates asexual transfer of genes between species. A recent paper supports this idea and establishes a strong correlation between HGT and host dependency. Yang et al. studied transcriptomic and genomic sequences from Orobancheaceae parasites ranging from the facultative Triphysaria versicolor to the obligate holoparasite Phelipanche aegyptiaca and identified a total of 52 instances of HGT. Most of these cases involved Phelipanche and Orobanche, fewer were associated with Striga, and Triphysaria had the fewest (just slightly more than the single HGT event detected in the non-parasitic relative, Lindenbergia philippensis). These findings highlight the importance of host dependency in HGT, although it is less clear which aspects of parasite biology are important. Haustorial anatomy and phloem connections may be involved, but the proximity of germline cells to the haustoria may be crucial for integration of transferred DNA. For Phelipanche, Orobanche and Striga, the location of the seedling shoot apex near the haustoria may increase chances of host gene integration as compared to plants like Triphysaria in which the haustoria form at a greater distance from shoot meristems.

The discovery of dozens of new horizontally acquired genes presents an abundance of material to consider with respect to the potential functions of HGTs in the recipient species (e.g. Yang et al. found a number of HGTs with defense-related annotations). Among the intriguing finds are transposon genes, including a couple of hAT transposons that were described in a publication by Sun et al. just a few months earlier. HGT of transposons could impact...
parasite evolution due to their role in genome expansion as well as their ability to alter expression of neighboring genes. Taken together, these two papers present evidence that horizontally acquired genes function in parasite species. A large proportion of the HGT events show greatest expression in haustorial stages, suggesting that acquired genes contribute to plant parasitic capabilities.

The specific mechanisms enabling HGT in plants remain unresolved, but both the Yang et al. and Sun et al. papers provide strong evidence that DNA is transferred between species, rather than HGT proceeding through an RNA intermediate. Although questions still surround the evolutionary role, function, and mechanisms of HGT, these papers make it clear that parasitic plants will continue to be among the most valuable systems for elucidating answers.

Sun, T., Renner, S.S., Xu, Y.X., Qin, Y., Wu, J.Q. and Sun, G.L. 2016. Two hAT transposon genes were transferred from Brassicaceae to broomrapes and are actively expressed in some recipients. Science Reports 6: 12.


Jim Westwood.

PRESS REPORTS

Herbicide gun gives mistletoe the kiss-off

While most of us may just associate mistletoe with Christmas parties, the fact is that it can be a nuisance in the wild. It's a parasitic plant (a group of plants, actually) that grows in trees or shrubs, penetrating their branches to absorb water and nutrients. In sufficient numbers, mistletoe plants can actually kill their host. That's why scientists are taking the offensive, with a system that shoots herbicide up into trees' high branches.

A prototype of the mistletoe-killing gun.

The setup was developed by a team from Mexico's INECOL institute led by researcher Mayra del Ángel, and working with colleagues at the Advanced Technology Center in Queretaro (CIATEQ).

It consists of a paintball-like gun, along with capsules containing a bio-herbicide that kills mistletoe while not harming the host plant. Using compressed air, the gun can shoot those capsules to a height of up to 25 m (82 ft), allowing them to hit mistletoe clusters that would otherwise be difficult to reach. Each capsule has two layers, made up of a blend of three biodegradable polymers. This formulation allows it to remain intact even upon rapid acceleration (such as when it's being shot out of the gun), yet still split open upon contact with its leafy target.

In field tests, the technology has been found to be effective at eradicating mistletoe infestations. According to Ángel, the capsules could also be adapted to deliver substances such as fertilizer or insecticide.

Ben Coxworth, August 11, 2016

Boise National Forest Seeks Public Comment on Bogus Basin Forest Health Project.

Further to this story from the last issue, a new press report at http://www.idahostatesman.com/outdoors/playings-outdoors/article98909682.html includes a dramatic video emphasising the devastating effects of the combination of dwarf mistletoe, Arceuthobium douglasii and bark beetles on Douglas fir in the Bogus Basin Forest. Infection rates vary from 50-98%.
Mistletoe and other plant parasites for the garden

Mistletoe isn’t the only plant parasite you can grow in your garden: these vampires of the plant world come in all colours and sizes.

Mistletoe brings green life to the bare trees of winter and is a symbol of fertility and renewal in the darkest days of the year. Mistletoe gains part of the nutrition it needs through stealing nutrients and water from its host plant. In the case of the European Mistletoe (*Viscum album*), apple, hawthorn and poplar trees are the preferred hosts, but it is known to grow on many other species too. It gains the nutrients and water it needs by both photosynthesising and by sending specialised roots called haustoria deep into its host tree’s vascular tissue.

In the garden, mistletoe is not the easiest plant to establish, but if you follow certain rules you may be able to get some going on an apple tree or hawthorn.

• The seed must be fresh, as it has a short viability period (about four weeks).

• Once rubbed onto the bark of a tree it needs to be protected from the hungry beaks of birds such as blue tits and great tits. You can do this by making a small cage of chicken wire around the area with the seeds.

• It can take anything up to four years for the seedlings appear. It needs to be sown on the younger branches of a healthy tree as here its root can penetrate the bark more easily.

With more than 4000 known parasitic species of plants, mistletoe is certainly not the only parasite worth trying in your garden, and some are easier to grow. In particular, there is an amazing family of plants called the Orobanchaceae that contains more than 90 different genera (only three of which are not parasitic). Some of them make excellent garden plants if you can provide the right conditions and hosts to allow them to establish themselves.

A mat of purple toothwort flowering at the base of a tree is a sight to behold. Photo: Chris Thorogood

Yellow rattles (*Rhinanthus* spp.), eyebrights (*Euphrasia* spp.) and Indian paintbrushes (*Castilleja* spp.) are all hemiparasitic (like mistletoe), but they attach themselves to the roots of grasses, not trees. They are important in helping to create those longed-for wildflower rich meadow landscapes that have become so popular in gardens. By weakening the grasses on which they live, they allow other flowering plants a chance among the sward, while adding their brightly coloured flowers to the overall tapestry of the meadow. Louseworts (*Pedicularis* spp.) are also worth trying to find, although only a few have ever been offered by UK nurseries. With well over 300 species to choose from, they are an incredible and rewarding genus to try to grow. I first encountered *Pedicularis sylvatica* as a child on the upland moors of Wales and it has remained one of my favourite UK native species ever since.

A seemingly much more sinister group of plants, the holoparasites, get all their nutrition from their host plant, producing no chlorophyll themselves. Sometimes they can even live out their entire life inside their host, only showing themselves when they flower.
Ivy broomrape is one of the most seductive of the plant parasites. Photo: Chris Thorogood.

Purple toothwort (Lathraea clandestina), also in the Orobanchaceae, prefers to attach itself to the roots of willow and alder but will grow happily on a range of hosts. It can take 10 years to flower if grown from seed but can also be introduced to a garden by being transplanted if you are quick about it. To see a mat of this plant in full flower at the base of a tree is quite a sight to behold. But true broomrapes (Orobanche and Cistanche spp.) are in my opinion the most seductive of these vampires of the plant world. Looking like tatty orchids, they come in the most unusual range of colours from bright yellow through to muted burned tones and the most crystal clear of whites. As they lack leaves, they seem to stand out in a way that few other plants do in a garden. Some, like the ivy broomrape (Orobanche hederae), are little trouble to grow, but be careful with others, as some species can be problematic for agricultural crops and while not killing their host (as this would kill themselves) they can cause severe reduction in crop productivity. It is with this warning that I leave you to mull over growing some of these most unusual of plants, whose lives are so attached to the lives of others, and to think about the mistletoe above your heads and the incredible feat of evolution that allows some plants this strange strategy for survival.


Parasitic vine in trees threatens Gurgaon’s green cover

Trees in the city of Gurgaon, Harayana State in India, are being threatened by ‘amar bel’ (Cuscuta) (NB – or could it be Cassytha filiformis? – Ed.) - a parasitic vine that is spreading to several trees, predominantly along the road from Huda Metro station to Sushant Lok. This creeper grows on the host plant and draws nutrition, causing the death of the host. Environmentalists have raised concerns over the issue and alleged that the Haryana Urban Development Authority (Huda) officials are yet to act on it. Environmentalists said that the yellow vine, which does not have roots, captures the host completely, rendering it incapable of processing sunlight for photosynthesis, leading to its death.


The city is already reeling under low forest cover, which is less than 1% of the urban area. Also, trees are being cut for large-scale infrastructure projects. In this scenario, it becomes imperative that the creeper, which can reduce the green cover further, be eradicated. ‘Although Huda officials are aware of the destruction that is being caused by Amar Bel, no action has been taken to remove the creeper,’ Devjani Roy of Sushant Lok phase 1 said. She also said that when she approached Huda officials regarding the issue, she was informed that the department did not have labour and ladder to remove the creeper from the trees. ‘Officials do not have any intention of removing these creepers,’ she said.

Vivek Kamboj, an environmentalist, said, ‘This is a major concern as this part of the country does not have enough green cover and the growth of trees is also not very fast because of less rainfall and bad soil quality.’ Meanwhile, Huda officials said that they are working on a plan to remove the parasitic vine from the trees. ‘We are developing a plan to figure out the areas in which trees are being affected. We might use pesticides to remove this creeper from the entire city. At present, the creeper is threatening age-
old trees in the city. We will take action within the month,' VK Nirala, executive engineer, horticulture wing, Huda, said.


THE PARASITE PROJECT - INTEGRATED RESEARCH ON PARASITIC WEEDS IN RICE

PARASITE (Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment) is a research project focusing on parasitic weeds - *Rhamphicarpa fistulosa*, *Striga asiatica*, *S. aspera* and *S. hermonthica* - in rain-fed rice. It is a collaboration between Wageningen University, Africa Rice Center and National Agricultural Research and Extension Systems (NARES) from Benin, Côte d’Ivoire and Tanzania that started in December 2010. Because of interactions and interdependencies among factors, stakeholders and processes at the plant, crop, household, village and country level the leading hypothesis for this project was that only with an integrated, trans-disciplinary approach could effective and durable solutions to parasitic weed problems be explored. The project is approaching its end and can boast significant advances with respect to insights and understanding of the problem and identified leads to solutions.

Research focused on revealing the biology and ecology of the poorly studied weed *R. fistulosa*. A study revealed that *R. fistulosa* and *S. asiatica*, while appearing in nearby fields, hardly overlap and that soil moisture plays a crucial role in defining their ecological niche (Kabiri et al., 2015). These two parasitic weeds also differ in terms of seed biology. In contrast with the obligate parasites of the *Striga* genus, host plant root exudates do not have an influence on seed germination of the facultative parasite *R. fistulosa* (Kabiri et al., 2016). The facultative nature of *R. fistulosa* renders rotation with incompatible hosts, or fallow, ineffective. Furthermore, resistance to *R. fistulosa* cannot be based on low stimulant exudation. Experiments showed that low infestations cause major losses in rice grain yield. Part of the loss can be attributed to an inhibitory effect on host plant photosynthesis. The average *R. fistulosa*-inflicted relative grain yield loss in the field was 50%, but ranged from a loss of 24% to 73% for the worst performing rice variety (Rodenburg et al., 2016a).

A herbarium study of specimens in public herbaria in Africa and abroad was conducted to find locations of the four main species of parasitic weed in rain-fed rice systems (Rodenburg et al., 2016b). These locations were compared to rain-fed rice area coordinates from which overlap estimates were calculated. This information, together with data on agronomic losses, control efficacies and rice prices was input for a stochastic model used to generate estimates of economic losses caused by parasitic weeds in rice. We found that together they invade 1.34 million ha of rain-fed rice in Africa affecting an estimated 950,000 rural households. Continent-wide production losses were estimated at 497 million kg per year, comparable to 15 million rice meals a day, valued at US$200 million.

Large-scale farmer and field surveys were held in Benin, Tanzania and Côte d’Ivoire (664 farmers) to compare the impact of parasitic weeds on rice production, farmers’ decisions and management abilities. The results showed that *R. fistulosa* affected 72% of the surveyed rice plots at an average infestation of 109 plants per m² (N’cho et al., 2014). The likelihood and the severity of infestation were found to be negatively correlated, suggesting that farmers who encountered the parasites more frequently, were better prepared for taking actions. Hand weeding was the most frequently used (87%) weed management practice followed by hoe weeding (62%), fertilizer use (55%), and herbicide use (53%). In Côte d’Ivoire and Benin parasitic-weed-induced productivity losses ranged from 21% to 50%. A lower weeding labour inefficiency was associated with larger farms, crops with a single, early weeding strategy and farmers with a higher education level. There was no evidence that farmers can manage the parasitic weed problem efficiently with the currently used manual weeding regimes.
For effective, locally accessible and socially and economically acceptable parasitic weed management strategies for rice farmers a stepwise approach was followed. In three affected rice growing areas in Tanzania surveys and workshops were organized (in total around 120 farmers). In one of these hotspots, Kyela, about 60 supplementary researcher-managed and then 40 farmer-managed participatory on-farm experiments were conducted. Farmers’ current control strategy is mostly limited to hand weeding, but farmers were aware of a wider range of control options. Based on informal farmer discussions, sowing time, rice variety and soil amendment were marked as feasible control options and tested in a farmer-participatory manner in four years of experimentation in upland (*S. asiatica* infested) and lowland (*R. fistulosa*-infested) rice. Application of locally accessible rice husks was appreciated by farmers as a suitable and cheap alternative to expensive inorganic fertilizers. Farmers also noticed that the control of *R. fistulosa* in lowlands was best realized by planting earlier while for *S. asiatica*, late planting was preferred. Late planting in turn was enabled by the much-appreciated resistant and short-duration NERICA-10.

Several workshops were held with stakeholders in Tanzania and Benin to identify barriers in the crop protection system to deal with parasitic weeds and to find entry points for innovation (Schut et al., 2015a,b,c). These activities led to a better understanding among stakeholders that solutions to parasitic weed problems require innovations not only at the farm level but also addressing systemic problems at higher levels. It was noted that plant health services were mostly reactive rather than preventive. Also, most attention was devoted to dealing with pest outbreaks such as armyworms, quelea quelea, locusts and rodents and not with parasitic weeds that take time to spread (Schut et al., 2015c). This also explains the long time it usually takes between the identification of an outbreak of parasitic weeds and actions to control it. There was no direct linkage and structural collaboration between various agencies (plant health services, research, local government/extension). Another major challenge was insufficient capabilities and resources to support operations of the plant health services and extension (Schut et al., 2015a). The participatory workshops involving stakeholders from government agencies, the private sector (including farmers) and NGOs...
resulted in the identification of several entry points for innovation: (i) Increased awareness of parasitic weeds (ii) Co-developing parasitic weed management strategies (iii) Collaboration and interaction across levels (iv) Policy coherence and allocation of resources.

PARASITE publications:


Jonne Rodenburg and Lammert Baastians.

INDEX OF OROBANCHACEAE

Our publicly accessible website on Orobancheae s. str. is a collection of web pages, all of them completely interrelated, continuously updated, and freely accessible to all researchers. The main body of the website is the Index of Orobancheae. On this web page, the result of many years of work by our research group, we offer a list with the correct
(in the authors’ opinion) nomenclatural information for all species treated. In addition, we offer an Annotated Checklist of Host Plants of Orobanchaceae, a web page providing a list of host plants in order to facilitate the identification of different Orobanchaceae species. All taxa on this list have been previously confirmed by our group, avoiding many of those mentioned in the literature which have not been confirmed or which seem to us wrong and may only lead to confusion. Most of the species treated are included in a Card Index in which we list each species according to its accepted name, basionym, synonyms, type locality, type, details of designation, host, comments, chromosomatic number, images, distribution, examined specimens, and records and references from the literature. We also include a web page, Images of Orobanchaceae, with numerous photographs and drawings in which site users can observe the variability of this family. Finally, we offer a list of References (Index of Orobanchaceae) used in our work, including, whenever possible, links to the original works.

The information is available in:


Óscar Sánchez-Pedraja

BIODIVERSITY HERITAGE LIBRARY – AN INTERESTING RESOURCE

This site lists thousands of out-of-print publications from 1450 onwards, which have been scanned and made available on line at http://biodiversitylibrary.org/browse/year#/titles, free of charge. It can be searched by date, author or subject and includes e.g. Beck-Mannagetta’s monograph on Orobanche. There are a number of publications by Yuncker but sadly not his monograph on Cuscuta.

HAUSTORIUM COMPOSITE FILES

– a reminder and an apology. All past issues of Haustorium should be available in two pdf files (issues 1-48, and issues 49-70), allowing easy searching for authors, species, etc. These are available on the IPPS website. Apologies that the second file had not been updated recently, but you should find it complete now, or very shortly.

FORTHCOMING MEETINGS


6ème COMAPPI Conference sur les Moyens Alternatifs de Protection pour une Production Intégrée, Lille, France,21-23 March, 2017. For more information see www.afpp.net

11th International Conference on Pests in Agriculture, Montpellier, France, 25-26 October, 2017. For more information see: www.afpp.net

Chemical Ecology: new contributions to plant protection against pests. Montpellier, France, 24 October, 2017. For more information see www.afpp.net
GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: http://www.parasiticplants.org/

For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtml

For the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see: http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For information on the COST/STREAM 2nd International Congress on Strigolactones, Turin, 2017: see http://www.strigolactones2017.it/

*For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/

For the Annotated Checklist of Host Plants of Orobanchaceae, see: http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

* For information on future Mistel in derTumortherapie Symposia see:

http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx

For a compilation from the Misteltoes: Pathogens, Keystone Resource, and Medicinal Wonder Meeting in Ashland, Oregon, July, 2016, see: https://storify.com/D0CT0R_Dave/mistletoe-conference

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/ informationen/literatursuche

(in German but can be searched by inserting author name).

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au/sandalwood

For 6th Mistletoe Symposium, Germany, November 2015 see: http://www.sciencedirect.com/science/journal/094447113/22/supp/S1

LITERATURE

*indicates web-site reference only

Items in bold selected for special interest

Items in blue relate to therapeutic uses of parasitic plants


extract improved the efficiency of plant regeneration and transformation of somatic embryos of *M. sativa* into plantlets from 26% to 52% Transformation efficiency was 29 and 15% for medium supplemented with dodder extract and without the extract, respectively. The antibacterial assay showed that the extract was effective against some strains of *A. tumefaciens*, suggesting using *C. campestris* extract as a good natural source of antimicrobial agents and plant growth regulator.

Badu-Apraku, B., Yallou, C.G., Alidu, H., Talabi, A.O., Akaogu, I.C., Annor, B. and Adeoti, A. 2016. Genetic improvement of extra-early maize cultivars for grain yield and *Striga* resistance during three breeding eras. Crop Science 56(5): 2564-2578. [Reviewing the progress made in breeding for high yielding and tolerant extra-early maize cultivars during the last three decades, noting an average rate of increase in grain yield of 42 kg ha⁻¹ yr⁻¹ under *Striga*-infestation, corresponding to 2.5% annual genetic gain.]

Baltazár, T., Varga, I. and Pejchal, M. 2016. (Feasible methods for controlling European mistletoe (*Viscum album* L.,) (in Hungarian) Növényvédelem 52(7): 360-372. [Noting the impracticality of pruning and herbicides for control of *V. album*, but suggesting that fungal biocontrol by *Sphaeropsis visci*, (= *Phaeobotryosphaeria visci*) can be effective.]


Boari, C., Ciasca, B., Pinida-Martos, R., Lattanzio, V.M.T. 2016. Parasitic weed management by using strigolactone-degrading fungi. Pest Management Science 72(11): 2043-2047. [Four fungal strains, *Fusarium oxysporum*, *F. solani* (biocontrol agents of *P. ramosa*), *Tricoderma hazianum* (potential biopesticide), and *Botrytis cinerea* (phytopathogenic fungus) were examined for their degrading activity of four SLs, strigol, 5-deoxystigol (5DS), and GR24. *T. harzianum* and *F. oxysporum* more rapidly degraded (or metabolized) strigolactones than did the other two fungi. Among the SLs examined, 5DS and 4DO proved to be the most degradable ones, suggesting that major metabolic reactions were not hydrolysis but probably hydroxylations on the AB rings.]

Bolin, J., Tennakoon, K.U., Majid, M.B.A. and Cameron, D.D. 2016. Isotopic evidence of partial mycoheterotrophy in *Burmannia coelostis* (Burmanniaceae). Plant Species Biology (doi:10.1111/1442-1984.12116) [Five populations of the photosynthetic species *Burmannia coelostis* were studied to determine whether it is mycoheterotrophic. Stable isotope profiles of δ 13C showed enrichment relative to surrounding C3 plants but this was not the case for δ 15N. These results are suggestive of partial mycoheterotrophy.]


Cala, A. Ghooray, K., Fernández-Aparicio, M., Molinillo, J.M.G., Galindo, J.C.G., Rubiales, D and Macias, F.A. 2016. Phthalimide-derived strigolactone mimics as germinating agents for seeds of parasitic weeds: Pest Management Science 72(11): 2069-2081. [19 N-substituted phthalimides containing a butenolide ring and different substituents in the aromatic ring were synthesised and assayed against weeds *Orobanche minor*, *O. cumana*, *Phelipanche ramosa* and *P. aegyptiaca*. The phthalimides were about 1/1000–1/100 as active as GR24 on these parasite seeds. Seeds of *P. aegyptiaca* and *P. ramosa* responded to phthalimides carrying various substituents while only some of them were effective in eliciting *O. cumana* germination.]

Chen ZhiDuan and more than 25 others! 2016. Tree of life for the genera of Chinese vascular plants. Journal of Systematics and Evolution 54(4): 277-306. [DNA sequences of four chloroplast genes and one mitochondrial gene were used to
produce a phylogenetic tree for 6098 Chinese vascular plant species. Overall relationships were generally congruent with previous comprehensive studies with the exception of a paraphyletic Santalaceae.

Cui QingLing, Pan YingNi, Bai XueWei, Zhang Wei, Chen LiXia and Liu XiaoQiu. 2016. Systematic characterization of the metabolites of echinacoside and acteoside from *Cistanche tubulosa* in rat plasma, bile, urine and faeces based on UPLC-ESI-Q-TOF-MS. Biomedical Chromatography 30(9): 1406-1415. [Analysis of bile samples revealed 49 metabolites of echinacoside and acteoside from *C. tubulosa*.]

Darvishzadeh, R. 2016. Genetic variability, structure analysis, and association mapping of resistance to broomrape (*Orobanche aegyptiaca* Pers.) in tobacco. Journal of Agricultural Science and Technology 18(5): 1419-1429. [89 tobacco genotypes assessed for susceptibility to *O. aegyptiaca*. ‘TB 22’ and ‘Kramograd NH 659’ appeared to be immune. Finger-printing of these identified 5 SSR loci from linkage groups 2, 10, 11 and 18 of tobacco reference map as DNA markers to be linked to gene(s) controlling broomrape resistance in tobacco.]


De Groot, A.C. and Schmidt, E. (eds) 2016. Essential oils: contact allergy and chemical composition. London, UK: CRC Press Inc. pp. 1058. [Covering 91 essential oils and 2 absolutes, this book presents an alphabetical list of all 4350 ingredients that have been identified in them, a list of chemicals known to cause contact allergy and allergic contact dermatitis, and tabular indications of the ingredients that can be found in each essential oil. Including oils based on *Santalum* spp.]

Deepa, P. and Yusuf, A. 2016. Influence of different host associations on glutamine synthetase activity and ammonium transporter in *Santalum album* L. Physiology and Molecular Biology of Plants 22(3): 331-340. [Highest glutamine synthetase activity was expressed in a *Mimosa pudica* – *S. album* association compared to other leguminous and non-leguminous host associations. The association of N-fixing host with *S. album* enhanced C and N levels in order to maintain the C/N value. The relative increase in SoAMT1:2 expressions and up-regulated glutamine synthetase activity positively affected the growth parameters in sandal when associated with leguminous hosts.]

Diptirani Rath, Kar, D.M., Panigrahi, S.K. and Lakmidhar Maharana. 2016. Antidiabetic effects of *Cuscuta reflexa* Roxb. in streptozotocin induced diabetic rats. Journal of Ethnopharmacology 192: 442-449. [Concluding that the methanolic extract of *C. reflexa* has significant antidiabetic effects and improves metabolic alterations thereby justifying its traditional folkloric claims.]

Dossou-Aminon, I., Dansi, A., Ahissou, H., Cissé, N., Vodouhè, R. and Sanni, A. 2016. Climate variability and status of the production and diversity of sorghum (*Sorghum bicolor* (L.) Moench) in the arid zone of northwest Benin. Genetic Resources and Crop Evolution 63(7): 1181-1201. [A useful analysis of factors affecting sorghum cultivation, noting *Striga hermonijhica* among the three most serious problems, along with climate change and soil fertility. Also commenting on serious genetic erosion as older varieties are being lost.]


were to some extent proportional to the dry weight of the parasite, but somewhat greater and were greatest on reproductive organs. Grass pea was most susceptible and pea least.

Furuhashi, T., Nakamura, T., Fragner, L., Roustan, V., Schön, V. and Weckwerth, W. 2016. Biodiesel and poly-unsaturated fatty acids production from algae and crop plants - a rapid and comprehensive workflow for lipid analysis. Biotechnology Journal 11(10): 1262-1267. [Cuscuta japonica among plants on which the technique was used.]


Georgiev, G. 2016. Characterization of the Bulgarian sunflower hybrid Valin. Agricultural Science and Technology 8(3): 183-188. [Describing the origin and characteristics of sunflower hybrid Valin, which shows high resistance to mildew and 100% resistance to Orobanche cumana races A-F.]

Gibot-Leclerc, S., Perronne, R., Dessaint, F., Reibel, C. and Le corre, V. 2016. Assessment of phylogenetic signal in the germination ability of Phelipanche ramosa on Brassicaceae hosts. Weed Research 56(6): 452-461. [Looking for correlation between the phylogenetic closeness of wild relatives to each other, or to oilseed rape (Brassica napus) and their ability to germinate P. ramosa - and failing.]


Hacham, Y., Hershenhorn, J., Dor, E., Amir, R. 2016. Primary metabolic profiling of Egyptian broomrape (Phelipanche aegyptiaca) compared to its host tomato roots. Journal of Plant Physiology 205: 11-19. [Primary metabolic profiling using GC-MS for the early developmental stage of P. aegyptiaca and of infested and non-infested tomato roots indicated that the levels of metabolites in P. aegyptiaca, including intermediates of TCA cycle, amino acids (aspartate family, branched chain, and aromatic), sugars, polyols, sugar acids, and organic acids were significantly higher compared to the infected roots, while the levels of some metabolites such as sucrose and arabinose were lower. Infection did not change the levels of most metabolites in the tomato except for maltose, trehalose, etc., whose levels increased in the infected roots. These results indicate that the parasite did not significantly affect the host primary metabolic pathways.]


Hayatu, M., Shehu, M. and Haruna, H. 2016. Effect of different levels of Striga gesnerioides on the growth and yield of some local and improved cowpea (Vigna unguiculata (L) Walp) varieties. Bayero Journal of Pure and Applied Sciences 9(1): 76-81. [In a pot experiment, cowpea varieties IT99K-241-2 and DANILA were proportionately damaged by additions of 0.1 or 0.5 g. S. gesnerioides seed per pot, while IT97K-499-35 and IT98K-205-8 showed immunity and were undamaged.]

that the tomato plant is resistant to *C. reflexa* because it can sense a small-peptide factor (*Cascuta* factor) thanks to the cell surface receptor-like protein CUSCUTA RECEPTOR 1 (CuRe1) and this increases resistance to *C. reflexa* infestation. Other factors also contribute to establish full resistance of tomato to *C. reflexa.*


Ishida, J.K., Watakatake, T., Yoshida, S., Takebayashi, Y., Kasahara, H., Wafula, E., dePamphilis, C.W., Namba, S. and Shirasu, K. 2016. Local auxin biosynthesis mediated by a *Mimosa pudica* – *S. album* association compared to other leguminous and non-leguminous host associations. The association of *N*₂ fixing host with *S. album* enhanced C and N levels in order to maintain the C/N value. The relative increase in SaAMT1;2 expressions and up-regulated glutamine synthetase activity positively affected the growth parameters in sandal when associated with leguminous hosts.

Jage, H., Klenke, F. Kruse, J., Kummer, V. and Scholler, M. 2016. (A contribution to the flora of plant parasitic microfungi from Rügen and Vilm Island (Mecklenburg-Vorpommern).) (in German) Bulletin : BfN - Skripten (Bundesamt für Naturschutz) 435: 47 pp. [A mycofloristic survey on plant parasitic microfungi yielded 232 species on 233 host species, and 351 parasite-host-combinations were detected, including *Cronartium flaccidum on Euphrasia stricta, Melampyrum arvense and Odontites vulgaris, and Podophora phtheirospermi on Euphrasia stricta and Melampyrum arvense.*]


compounds some of which stimulate germination of Striga seeds, such as Uncinanone B, and others that dramatically inhibit their attachment to host roots, such as Uncinanone C and a number of di-C-glycosylflavones, resulting in suicidal germination. The technique has already been adopted by about 125,000 farmers in eastern Africa, significantly increasing maize yields.


Khosla, A. and Nelson, D.C. 2016. Strigolactones, Kim JunHeon, Jang MiYeon, Shin EunSik, Kim Khan, S.W., Surayya Khatoon, Qammar Abbas, protein interactions among these signaling components has been explored. Proposing protein-polyubiquitinated and proteolyzed following as well as downstream targets that are signaling system in angiosperms and parasites, [Reviewing recent studies on the strigolactone perception. The basis for protein-component was likely.


Kosachev, P.A. 2016. (The system and conspectus of the genus Pedicularis (Orobanchaceae) of Altay Mountains and Tian Shan.) (in Russian) Biological Bulletin of Bogdan Chmelinskiiy Melitopol State Pedagogical University 6(1): 115. [A classification of Pedicularis spp. from this central Asian moutainous region was proposed based on previous molecular phylogenetic studies. The conspectus included 61 species in 32 series and 7 sections.]

Kuijt J. 2016. Measurements and taxonomy in Arceuthobium (Viscaceae). Phytologia 98:186-189. [Recent studies of the Arceuthobium campylopodium complex utilized standardized internodal measurements. Because stem internodes continue to elongate from year to year, such measurements should not be used as support for recognizing infraspecific taxa.]

Laitinen, R.K., Hellström, K.O. and Wälli, P.R. 2016. Context-dependent outcomes of subarctic grass-endophyte symbiosis. Fungal Ecology 23: 66-74. [Infection of Festuca rubra by the endophyte Epichloë festucae made it resistant to parasitism by Rhinanthus minor, but increased the susceptibility of unspecified ‘riverside grasses’ to the parasite (in Finland).]

Lallemand, F., Guadeul, M., Lambourdrière, J., Matsuda, Y., Hashimoto, Y. and Selosse, M.A. 2016. The elusive predisposition to mycoheterotrophy in Ericaceae. New Phytologist 212(2): 314-319. [Phylogenetic analyses of mycoheterotrophic Ericaceae and their fully photosynthetic relatives were conducted using nuclear (ITS, 28S) and chloroplast (matK) genes. Pterosporaeae was sister to Monotropeae, thus their common ancestor was likely.
mycoheterotrophic, and this clade was sister to autotrophic Arbutoideae. In Pyrolaeae, Pyrola and Orthilia (mixotrophic) were sister to autotrophic Chinaphila and Moneses. Thus, mycoheterotrophic had two independent origins in Ericaceae.

Lee JaeHyeon, Lyu DongPyo and Kim GabTae. 2016. (A study on the habitat environment and mutualism with ants of genus Melampyrum) (in Korean) Korean Journal of Environment and Ecology 302 139-145. [Studying M. setaceum var. nakaiianum, M. roseum var. ovalifolium and M. roseum on hosts thought to be Quercus mongolica and/or Carex siderosticta and their associated ant species.]

Leite de Vasconcelos, G.C. and Miranda de Melo, J.I. 2016. (Flora of the Parque Nacional do Catimbau, Pernambuco State, Brazil: Loranthaceae) (in Portuguese). Hoehnea 43. [This flora, in a semi-arid region on Pernambuco state, northeast of Brazil, found two species each of Psittacanthus and Struthanthus.]

Li Lang, Madriñán, S. and Li Jie. 2016. Phylogeny and biogeography of Caryodaphnopsis (Lauraceae) inferred from low-copy nuclear gene and ITS sequences. Taxon 65(3): 433-443. [Focused mainly upon relationships among Old and New World Caryodaphnopsis, additional sampling in the family included 12 other genera including the parasitic vine Cassythia. It emerged with strong support as sister to a clade containing core Lauraceae plus Neocinnamomum. Molecular dating indicated this split occurred in the Cretaceous.]

Li Meng, Li YunJing, Liu WeiWei, Li RongLi, Qin CuiYing, Liu Nan and Han Jing. 2016. The preparation of Cistanche phenylethanoid glycosides liquid proliposomes: optimized formulation, characterization and proliposome dripping pills in vitro and in vivo evaluation. European Journal of Pharmaceutical Sciences 93: 224-232. [Results showed that Cistanche phenylethanoid glycoside liquid proliposome dripping pills offer a good way to improve the oral delivery of Cistanche extracts.]

Li WeiQiang, Kien Huu Nguyen, Watanabe, Y., Yamaguchi, S. and Lam Son Phan Tran. 2016. OaMAX2 of Orobanche aegyptiaca and Arabidopsis AtMAX2 share conserved functions in both development and drought responses. Biochemical and Biophysical Research Communications 478(2): 521-526. [A MAX2 ortholog was cloned from O. aegyptiaca for complementation analyses using the Arabidopsis Atmax2 mutant. The so-called OaMAX2 gene could rescue phenotypes of the Atmax2 mutant in various tested developmental aspects, including seed germination, shoot branching, leaf senescence and growth and development of hypocotyl, root hair, primary root and lateral root. OaMAX2 could enhance the drought tolerance of Atmax2 mutant, suggesting its ability to restore the drought-tolerant phenotype of mutant plants defected in AtMAX2 function. Thus, this study provides genetic evidence that the functions of the MAX2 orthologs, and perhaps the MAX2 signaling pathways, are conserved in parasitic and non-parasitic plants. Furthermore, the results of this study enable development of a strategy to fight against parasitic plants by suppressing the MAX signaling, which ultimately leads to enhanced productivity of crop plants.]

*Lim YaChee, Rajabalaya, R., Lee HuanFang, Tennakoon, K.U., Quang Vuong Le, Idris, A., Zulkipli, I.N., Keasberry, N. and David, S.R. 2016. Parasitic mistletoes of the genera Scurrula and Viscum: from bench to bedside. Molecules 21(8): 1048. (http://www.mdpi.com/1420-3049/21/8/1048/htm) [Reviewing therapeutic uses and noting that Scurrula spp. have many of the same characteristics as Viscum spp., inhibiting cancer growth due to presence of phytoconstituents such as quer cetin and fatty acid chains. They also possesses TNFα activity to strengthen the immune system to combat cancer. Both genera are rich in antioxidants that confer protection against cancer as well as neurodegeneration, etc. Suggesting the need for clinical trials on Scurrula extracts.]

Liu XiaoJin, Xu DaPing, Yang ZengJiang and Zhang NingNan. 2016. Effects of abscisic acid on growth, photosynthesis and antioxidant enzyme activities of Santalum album seedlings. Journal of Nanjing Forestry University (Natural Sciences Edition) 40(3): 57-62. [Foliar application of 1 mg/l abscisic acid increased net photosynthesis rate, stomatal conductance, transpiration rate and chlorophyll a content in leaves of sandal wood seedlings. Rates of 10 and 100 mg/l were detrimental.]

Liu XiaoJin, Xu DaPing, Yang ZengJiang and Zhang NingNan. 2016. Heartwood proportion and distributions of essential oil content and composition of Santalum album in Jianfeng mountain, Hainan. Journal of South China Agricultural University 37(5): 66-71. [Concluding that Hainan is a suitable region for growth of S. album given the good growth performance, high heartwood proportion and essential oil content. Noting that sapwood may have greater quantity of oil but lower quality.]

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*Louarn, J., Boniface, M.C., Pouilly, N., Velasco, L., Pérez-Vich, B., Vincourt, P. and Muñios, S. 2016. Sunflower resistance to broomrape (*Orobanche cumana*) is controlled by specific QTLs for different parasitism stages. Frontiers in Plant 7(May): 590. (http://journal.frontiersin.org/article/10.3389/fpls.2016.00590/full) [A population of 101 recombinant inbred lines derived from a cross between HA89 and LR1 with differing resistance characteristics, were assessed for resistance to *O. cumana* races F and G at 3 stages after attachment. Results indicated that there are several quantitative resistance mechanisms controlling the infection by *O. cumana* that can be used in sunflower breeding.]

Lu ChengWei, Lin TzuYu, Huang ShuKuei and Wang Su. 2016. Echinacoside inhibits glutamate release by suppressing voltage-dependent Ca2+ entry and protein kinase C in rat cerebrocortical nerve terminals. International Journal of Molecular Sciences 17(7): 1006. [Results suggest that the inhibitory effect of echinacoside from ‘Herba Cistanche’ (based on unspecified *Cistanche* sp(p), but probably *Cistanche deserticola* and/or *C. tubulosa*) on evoked glutamate release is associated with reduced voltage-dependent Ca²⁺ entry and subsequent suppression of protein kinase C activity.]

Luebert, F. and 20 others. 2016. Familial classification of the Boraginales. Taxon 65(3): 502-522. [The familial classification in this order has been controversial, thus a consensus classification was proposed based on molecular and morphological characters and that considered nomenclatural stability. The order contains eleven families: Boraginaceae s.str., Codonaceae, Coldeniaceae, Cordiaceae, Ehretiaceae, Heliotropiaceae, Hoplestigmataceae, Hydrophyllaceae, Ehretiaceae, Heliotropiaceae, Codonaceae, Coldeniaceae, Cordiaceae, and Wellstediaceae.]

Lumbroso, A. and 13 others. 2016. Simplified strigolactams as potent analogues of strigolactones for the seed germination induction of *Orobanche cumana* Wallr. Pest Management Science 72(11): 2054-2068. [Strigolactams in which the lactone moiety of the C ring in canonical strigolactones was replaced with a lactam moiety were synthesized and examined for their germination stimulation of *O. cumana* seeds. Among them, GR28 (double bond isomer of GR7) strigolactam was found to be ca. 100-fold more active than GR24 and the activity resides only one of its four stereoisomers. Simple chemical modifications to its dihydro- and diacetyloxydihydro-derivatives further enhanced the activity. These strigolactoms were slightly more resistant to hydrolysis than strigolactones as expected.]

Macedo, D.G. and 15 others. 2016. Versatility and consensus of the use of medicinal plants in an area of cerrado in the Chapada do Araripe, Barbalha-CE-Brazil. Journal of Medicinal Plants Research 10(31): 505-514. [Ximenia americana among the species considered most worth further study.]


Mellado, A., Morillas, L., Gallardo, A. and Zamora, R. 2016. Temporal dynamic of parasite-mediated linkages between the forest canopy and soil processes and the microbial community. New Phytologist 211(4): 1382-1392. [Viscum album ssp. austriacum, presumably on pine and/or larch, increased the amount, quality, and diversity of organic matter beneath the host canopy, directly through its nutrient-rich litter and indirectly through a reduction in host litterfall and an increase in bird-derived debris, resulting in enriched niches able to support
larger and more functionally even soil microbial communities.


*Mohsen Marvibaigi, Neda Amini, Eko Supriyanto, Moon MinHo, Jeong HyunUk, Choi JinGyu, Jeon napus* Phelipanche ramosa relationships between the parasitic plant species *Aparicio, M.* and Colbach, N. 2016. Trophic Pointurier, O., Reibel, C., Strbik, F., Fernández- and *Striga*-resistance and their exudation of sorgomol, orobanchol and 5-deoxystrigol, and finding 5-deoxystrigol to have a significant correlation with *Striga* infection.[/n]

*Moreau, D., Gibot-Leclerc, S., Girardin, A., Pointurier, O., Reibel, C., Srnbik, F., Fernández-Aparicio, M. and Colbach, N. 2016. Trophic relationships between the parasitic plant species Phelipanche ramosa (L.) and different hosts depending on host phenological stage and host growth rate. Frontiers in Plant Science 7(7): 1033. (http://journal.frontiersin.org/article/10.3389/fpls.2016.01033/full) (The reduction in host growth resulting from *P. ramosa* parasitism on *Brassica napus* (oilseed rape), *Capsella bursa-pastoris* and *Geranium dissection* varied from 34-84%. The complex of variation according to host species, growth stage and light level is to be incorporated into a model.)


Mustarichie, R., Warya, S., Saptarini, N.M. and Musifroh, I. 2016. Acute and subchronic toxicities of Indonesian mistletoes *Dendrophthoe pentandra* L. (Miq.) ethanol extract. Journal of Applied Pharmaceutical Science 6(9): 109-114 ref.27. [Traditionally *D. pentandra* is used in Indonesia is to cure cough, hypertension, diabetes, cancer, ulcers, smallpox, diuretic, skin infection and after child-birth. This study suggested that there is a level of toxicity which would make it unsafe for prolonged use.]

Ndagurwa, H.G.T., Ndarevani, P., Muvengwi, J. and Maponga, T.S. 2016. Mistletoes via input of nutrient-rich litter increases nutrient supply and enhance plant species composition and growth in a semi-arid savanna, southwest Zimbabwe. Plant Ecology 217(9): 1095-110. [Infestation of trees by mistletoes (unspecified in abstract but presumably *Plicosepalus kalachariensis* and *Viscum verrucosum* as in following item) resulted in increases of soil nutrient concentrations by 34% for N, 36% for Mg, 46% for P and up to 72% for K , which in turn led to increase in the species richness, density and biomass yield of the understory grass community.]

vverrucosum) compared with 90% for nests in other substrates over the 50-day nesting period.]


(http://bmccomplementaltermed.biomedcentral.com/articles/10.1186/s12906-016-1395-3) [Studying the anti-proliferative, pro-oxidant and pro-apoptotic potential of stem of Elytranthe parasitica (Loranthaceae), finding potent cytotoxic activity in a against HepG2 hepatocellular carcinoma cell line and concluding that the active fraction could be a promising contender in the treatment of hepatocellular carcinoma.]


*Ortiz-Bustos, C.M., Pérez-Bueno, M.L., Barón, M. and Molinero-Ruiz, L. 2016. Fluorescence imaging in the red and far-red region during growth of sunflower plantlets. diagnosis of the early infection by the parasite Orobanche cumana. Frontiers in Plant Science 7(June): 884. (http://journal.frontiersin.org/article/10.3389/fpls.2016.00884/full) [UV-induced multicolor fluorescence imaging (MCFI) used to measure fluorescence emitted by chlorophyll (Chl) at 680 nm (red, F680) and 740 nm (far-red, F740) by seedlings of sunflower infested or otherwise by O. cumana . Effects of parasitism could be detected as early as 2 weeks after infection.]


Pelser, P.B., Nickrent, D.L. and Barcelona, J.F. 2016. Untangling a vine and its parasite: host specificity of Philippine Rafflesia (Rafflesialesaeae). Taxon 65(4): 739-758. [A molecular phylogeny using nuclear and chloroplast genes was constructed for parasitized and non-parasitized Tetrastigma hosts (11 of the 13 species of Philippine Rafflesia). Six of the eight Tetrastigma lineages were parasitized, most hosting more than one Rafflesia species and four Rafflesia species parasitize multiple Tetrastigma lineages. Thus Rafflesia is less host-specific than previously thought, but specific to some degree given un-parasitized sympatric Tetrastigma.]

Pignone, D. and Hammer, K.. 2016. Parasitic angiosperms as cultivated plants? Genetic Resources and Crop Evolution 63(7): 1273-1284. [Reviewing the uses of parasitic plants, mainly as medicinal plants, fruit trees and some as vegetables. Olacaceae (1), Opiliaceae (1), Santalaceae (6), Viscaceae (1), Ximeniaceae (1) and Orobanchaceae (3) contain cultivated species (number in brackets). Santalum spp. and Viscum album are of greater importance for the
production of sandalwood oil and anti-cancer medicine, respectively.]  
*Ramón, P., De la Cruz, M., Zavala, I. and Zavala, M.A. 2016. Factors influencing the dispersion of Arceuthobium oxycedri in Central Spain: evaluation with a new null model for marked point patterns. Forest Pathology. (http://onlinelibrary.wiley.com/doi/10.1111/efp.12279/full). [Models were used to simulate seed dispersal and these were compared to observed patterns].


Ronald, M., Charles, M., Stanford, M. and Eddie, M. 2016. Existence of different physiological 'strains' of Striga asiatica (L.) Kuntze on sorghum species [Sorghum bicolor (L.) Moench and Sorghum arundinaceum (Desv.) Stapf] in Zimbabwe. Research on Crops 17(3): 468-478. [Reporting some differences in the response of 9 sorghum cultivars and one wild sorghum to S. asiatica at two widely spaced sites in Zimbabwe, but not clear how significant these differences were.]

Roquet, C., Coissac, É., Cruaud, C., Boleda, M., Boyer, F., Alberti, A., Gielly, L., Taberlet, P., Thuiller, W., van Es, J. and Lavergne, S. 2016. Understanding the evolution of holoparasitic plants: the complete plastid genome of the holoparasite Cytinus hypocistis (Cytinaceae). Annals of Botany 118(5): 885-896. [The complete plastome of C. hypocistis shows it is only 19.4 kb in size and contains only 23 genes. All coding regions had high substitution rates compared to photosynthetic Malvales. Some regions were under relaxed negative selection which typically follows loss of photosynthesis; however, strong positive selection was seen for rpl22.]


Sahli, H.F., Krushehnycky, PD., Drake, D.R. and Taylor, A.D. 2016. Patterns of floral visitation to native Hawaiian plants in presence and absence of invasive Argentine ants. Pacific Science 70(3): 309-322. [Observing that where argentine ants (Linepithema humite) are present flowers of several species are less frequently visited by Hylaexx bees, effects on pollination and seed set of Santalum haleakalae not clear from abstract.]

Sakamoto, Y., Oghara-Tsuji, Y., Ito, K., Sueotsugu, K., Yokoyama, J., Yamazaki, J., Yukawa, T. and Maki, M. 2016. The tiny-leaved orchid Cephalanthera subaphylla obtains most of its carbon via mycoheterotrophy. Journal of Plant Research 129(6): 1013-1020. [Stable isotope levels of 13C and 15N were used to examine the degree of mycoheterotrophism in five Cephalanthera species, one of which has reduced leaves (C. subaphylla). Species with leaves of normal size were significantly less
enriched in $^{13}$C than C. subaphylla, thus this species is strongly mycoheterotrophic whereas the others were partially mycoheterotrophic.]

*Samejima, H., Babiker, A.G., Mustafa, A. and Sugimoto, Y. 2016. Identification of Striga hermonthica-resistant upland rice varieties in Sudan and their resistance phenotypes. Frontiers in Plant Science 7(May): 634. (https://www.cabdirect.org/cabdirect/abstract/20163264205) [Among 27 rice lines assessed for post-attachment resistance to S. hermonthica, Umgar and NERICA5 were consistently superior to others, confirmed in the field. NERICA13 showed partial resistance. Umgar was found also to show low stimulant activity.]

Samejima, H., Babiker, A.G., Takikawa, H., Sasaki, M. and Sugimoto, Y. 2016. Practicality of the suicidal germination approach for controlling Striga hermonthica. Pest Management Science 72(11): 2035-2042. [T-010, a simple carbamate containing the D ring structure was evaluated for its efficacy as a suicidal germination inducer for S. hermonthica in greenhouse and field experiments. Formulated (10% wettable powder) T-010 applied at 0.1, 1, and 10 kg a.i. ha$^{-1}$ to the soil containing S. hermonthica seeds that had been conditioned by repeated irrigations effectively reduced Striga emergence in pots by 94-100%. A field trial with the same rates reduced Striga emergence by 33% and increased sorghum shoot and head dry weight by up to 40% and 240% respectively.]


Shilo, T., Zygier, L., Rubin, B., Wolf, S. and Eizenberg, H. 2016. Mechanism of glyphosate control of Phelipanche aegyptiaca. Planta 244(5): 1095-1107. [By using a glyphosate-resistant tomato genotype as the host for P. aegyptiaca, both endogenous 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) inhibition and a deficiency of aromatic amino acids in the parasite after glyphosate treatment were observed. These results clearly demonstrate that the presence of an active EPSPS and aromatic amino acid biosynthesis pathway in P. aegyptiaca which is effectively inhibited by the herbicide glyphosate.]

Shutoh, K., Kaneko, S., Suetsugu, K., Naito, Y.I. and Kurosawa, T. 2016. Variation in vegetative morphology tracks the complex genetic diversification of the mycoheterotrophic species Pyrola japonica sensu lato. American Journal of Botany 103(9): 1618-1629. [Pyrola japonica s.l. has at least three separate genetic lineages that have different leaf morphologies. The genetic lineages (assessed from three noncoding plastid regions) and their coexistence could have led to the variable leaf size and suggest the possibility that gene flow from partial to full
mycoheterotrophs could reverse the evolutionary transition to full mycoheterotrophy.]

Smith, J.D., Woldemariam, M.G., Mescher, M.C., Jander, G. and de Moraes, C.M. 2016. Glucosinolates from host plants influence growth of the parasitic plant Cuscuta gronovii and its susceptibility to aphid feeding. Plant Physiology 172(1): 181-197. [Glucosinolates from Arabidopsis thaliana tended to reduce the vigour of C. gronovii but also reduced the feeding of pea aphids (Acyrthosiphon pisum) on the parasite, while the feeding of green peach aphids (Myzus persicae) was unaffected on the parasite but reduced on the Arabidopsis.]

Suaza-Gaviria, V., Pabón-Mora, N. and González, F. 2016. Development and morphology of flowers in Loranthaceae. International Journal of Plant Sciences 177(7): 559-578. [The anatomy and morphology (using LM and SEM) of eight species in six genera of New World Loranthaceae was examined. Based on this sampling, a number of plesiomorphic and apomorphic characters were proposed for the family.]


Sun ShiGuo, Armbruster, W.S. and Huang 2016. Geographic consistency and variation in conflicting selection generated by pollinators and seed predators. Annals of Botany 118(2): 227-237. [Studies of pollination and seed predation in 17 populations of Pedicularis rex in China indicate opposing selection in operation: pollinators generated selection for greater floral exsertion beyond the bracts, but seed predators generated selection for reduced exsertion above the protective pools of water, although the strength of the latter varied across populations.]

Sun, T., Renner, S.S., Xu, Y.X., Qin, Y., Wu, J.Q. and Sun, G.L. 2016. Two hAT transposon genes were transferred from Brassicaceae to broomrapes and are actively expressed in some recipients. Science Reports 6: 12. [see Literature Highlight above.]

Takahashi, I., Fukui, K. and Asami, T. 2016. Chemical modification of a phenoxyfuranone-type strigolactone mimic for selective effects on rice tillering or Striga hermonthica seed germination. Pest Management Science 72(11): 2048-2053. [Chemical modification of phenoxyfuranone-type SL mimics (debranones) revealed that 2-chloro derivative was more active than GR24 in rice tillering assay but 20-fold less active in S. hermonthica seed germination assay.]


*Tjurutue, M.C., Palmer-Young, E.C. and Adler, L.S. 2016. Parasite removal, but not herbivory, deters future parasite attachment on tomato. PLoS ONE 11(8): e0161076. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0161076) [Showing that prior mechanical damage, or feeding of Spodoptera exigua, on tomato, did not influence the host’s susceptibility to Cuscuta campestris. Susceptibility was also unaffected by current Cuscuta infection, but was reduced where the parasite had been removed.]

*Tjurutue, M.C., Stevenson, P.C. and Adler, L.S. 2016. Messages from the other side: parasites receive damage cues from their host plants. Journal of Chemical Ecology 42(8): 821-828, [Damage to lupin hosts (Lupinus texensis) by beet armyworm (Spodoptera exigua) significantly increased jasmonic acid (but not alkaloid) levels in both the lupin host and the attached parasite, Castilleja indivisa. However, feeding by the larvae of the butterfly Junonia
coenia was greater on parasite when it was attached to the damaged than to the undamaged host plants.]
Tong ZeYu and Huang ShuangQuan. 2016. Pre- and post-pollination interaction between six co-flowing Pedicularis species via heterospecific pollen transfer. New Phytologist 211(4): 1452-1461. [Studying possible cross-pollination between 4 species of Pedicularis, in Wuhan, China, unspecified in the abstract except for the long-styled P. densisipica and recording less than 10% pollen deposited in the ‘wrong’ flowers, thanks to Bombus species generally sticking to one species, while possibility of cross-fertilization is further reduced by variations in style length.]
Torres-Vera, R., García, J.M., Pozo, M.J. and López-Ráez, J.A. 2016. Expression of molecular markers associated to defense signaling pathways and strigolactone biosynthesis during the early interaction tomato-Phelipanche ramosa. PMPP Physiological and Molecular Plant Pathology 94: 100-107. [Results suggest that the three principal defence regulating hormonal pathways - salicylic acid, jasmonic acid and abscisic acid - are induced after infection, and are therefore, likely involved in the defence response in tomato. Additionally, an induction of the strigolactone biosynthesis genes SID27 and SICCDS is thought to be involved.]
*Trabelsi, I., Yoneyama, K., Abbas, Z., Amri, M., Xie, X., Kisugi, T., Kim, H.I., Kharrat, M. and Yoneyama, K. 2017. Characterization of strigolactones produced by Orobanche foetida and Orobanche crenata resistant faba bean (Vicia faba L.) genotypes and effects of phosphorous, nitrogen, and potassium deficiencies on strigolactone production. South African Journal of Botany 108: 15–22. (http://issdli.com/download/136692) [Some Tunisian faba bean genotypes partially resistant to O. foetida and O. crenata were found to produce at least 3 strigolactones - orobanchol, orobanchyl acetate, and an isomer of fabacyl acetate. In the partially resistant genotypes, except for G5 which appeared to produce strigolactones at levels similar to those produced by susceptible cultivar G9 (Badi), impaired stimulant production confers resistance to Orobancha. Other mechanisms, acting after induction of seed germination seem to be implied in the resistance of G5. Both nitrogen and phosphate deficiencies enhanced stimulant exudation in genotypes G5 and G9.]
*Twardziok, M., Kleinsimon, S., Rolff, J., Jäger, S., Eggert, A., Seifert, G. and Delebinski, C.I. 2016. Multiple active compounds from Viscum album L. synergistically converge to promote apoptosis in Ewing sarcoma. PLoS ONE 11(9): e0159749. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0159749) [A combination of an aqueous extract from Viscum album and a triterpene extract solubilized with cyclodextrins demonstrated synergistic activity on Ewing sarcoma (bone cancer) cells inhibiting proliferation and inducing apoptosis in a dose-dependent fashion and may be considered an adjuvant therapy option for pediatric patients with Ewing sarcoma.]
Wang LiWei, Sun Jian, Zhao Bing and Zhao MingXia. 2016. (Laxative function of dietary fiber from Cistanche deserticola) (in Chinese) Journal of Food Safety and Quality 7(9): 3740-3744. [Confirming a useful laxative function in fibre from C. deserticola.]
*Wang YongLin, Li XueWu, Zhou WeiFen, Li Tao and Tian ChengMing. 2016. De novo assembly and transcriptome characterization of spruce dwarf mistletoe Arceuthobium sichuanense uncovers gene expression profiling associated with plant development. BMC Genomics 17: 771. (http://bmcgenomics.biomedcentral.com/articles/10.1186/s12864-016-3127-y) [Study of the transcriptomic processes underlying physiological traits and development in A. sichuanense on the host Picea crassifolia reveals tissue-specific gene expression patterns and pathways in S. sichuanense and suggest a difference between photosynthetic and non-photosynthetic tissues in plants. The data can potentially be used for future investigations on endophytic parasitism and S. sichuanense -host interaction, and it dramatically increases the available genomic resources for Arceuthobium and dwarf mistletoe communities.]
Wang XiangPing, Yu WenBin, Sun ShiGuo and Huang ShuangQuan. 2016. Pollen size strongly correlates with stigma depth among Pedicularis species. Journal of Integrative Plant Biology 58(10): 818-821. [Phylogenetic independent contrast analysis revealed that pollen grain volume was more strongly correlated with
stigma depth than with style length in 42 bumblebee-pollinated Pedicularis species, consistent with Darwin's functional hypothesis between pollen size and stigma depth.


Westerman, P.R., Hemerik, L., van der Werf, W., Stomph, T.J. and van Mourik, T.A. 2016. (Competition in populations of the hemi-parasitic plant Striga hermonthica on a sorghum host.) (in German) Julius-Kühn-Archiv 452: 100-102. [Pot experiments confirming strong intraspecific competition in populations of S. hermonthica, which was most intense during the holoparasitic phase.]

Wu ZhaoXi, Wang QianYang, Zhu KeShong, He Jun and He Jun. 2016. (Effect of different drying methods on the two flavonol glycosides content in Thesium chinense Turcz.) (in Chinese) Journal of Yunnan Agricultural University 31(4): 696-699. [Extracts of T. chinense have anti-inflammatory and analgesic activities. This study confirmed that the highest levels of kaempferol and quercetin glycosides are in the leaf and stem, and the best drying temperature is 60 or 80°C. The best drying method is drying’ (sic!).]

*Yan HongYu, Hu JiaLin, Bi Lei, Zhang Yuan and Fei Yang. 2016. Effects of Loranthus tanakae extracts on growth of Rhodopseudomonas palustris. (in Chinese) Zhongguo Weishengtaxixue Zazhi / Chinese Journal of Microecology 28(9): 1002-1004. [Confirming that the growth of R. palustris, a bacterium recognised as improving water quality, was promoted at low concentrations of L. tanakae extracts.]
Yang XianYing, Liu AiLin, Liu ShuJing, Xu XiaoWei and Huang LinFang. 2016. Screening for neuraminidase inhibitory activity in traditional Chinese medicines used to treat influenza. Molecules 21(9): 1138. [Extracts from *Cynanchum wilfordii* and *Balanophora involucrata* significantly inhibited neuraminidase activity at a concentration of 40 µg/mL, confirming their clear anti-influenza viral effects.]

Yang, Z.Z., Zhang, Y.T., Wafula, E.K., Honaas, Yao ZhaoQun, Tian Fang, Cao XiaoLei, Xu Ying, Z. Z., Zhang, Y. T., Wafula, E. K., Honaas, Yao ZhaoQun, Tian Fang, Cao XiaoLei, Xu Ying, and others. 2016. Horizontal gene transfer is more frequent with increased heterotrophy and contributes to parasite adaptation. PNAS 113(45): E7010-E7019. [see Literature Highlight above.]

Yao ZhaoQun, Tian Fang, Cao XiaoLei, Xu Ying, Chen MeiXiu, Xiang BenChun and Zhao SiFeng. 2016. Global transcriptomic analysis reveals the mechanism of *Phelipanche aegyptiaca* seed germination. International Journal of Molecular Sciences 17(7): 1139. [Deep RNA sequencing, including de novo assembly and functional annotation was performed on *P. aegyptiaca* germinating seeds. The assembled transcriptome was used to analyze transcriptional dynamics during seed germination. Key gene categories involved were identified. Overall, 5324 differentially expressed genes among dormant, conditioned, and GR24-treated seeds were identified. Moreover, ABA and ethylene were found to play important roles in this process. GR24 application resulted in dramatic changes in ABA and ethylene-associated genes.]

Yin XueZhe, Wang YuJiao, Yin JiFeng and others. 2016. (Effect of *Boschniakia Rossica* polysaccharides on expression of NF-κB in H2O2-damaged HepG2 cells.) (in Chinese) Chinese Journal of Gerontology 36(13): 3108-3110. [Concluding that B. rossica reduces the levels of iNOS and HO-1 proteins, probably via the reduction of NF-κB activation.]


You ShuPing, Zhao Jun, Ma Long, Mukaram Tadimat, Zhang ShiLei and Liu Tao. 2016. (Effect and mechanism of *Cistanche* phenylethanoid glycosides on rats with immunological liver fibrosis.) (in Chinese) Chinese Journal of Pharmacology and Toxicology 30(5): 504-510. [Extracts of unspecified *Cistanche* sp. can significantly reduce the degree of BSA-induced liver fibrosis in rats. The mechanism may be associated with down-regulation of two types of collagens and suppression of the activation of hepatic stellate cells.]


Zamaloa, M. del C. and Fernández, C. A. 2016. Pollen morphology and fossil record of the feathery mistletoe family Misodendraceae. Grana 55(4): 278-285. [Fossil Misodendrum pollen was analyzed and features allowed differentiation of two groups that were in general agreement with subgenera Misodendrum and Angelopogon. UPGMA analyses of fossil and extant pollen showed Miocene pollen was most similar to subgenus Angelopogon whereas Eocene pollen was dissimilar to extant species.]

Zhang Chao, Chen Lei, Tian ChengMing, Li Tao, Wang Rong and Yang QiQing. 2016. (Predicting the distribution of dwarf mistletoe (Arceuthobium sichuanense) with GARP and MaxEnt models.) (in Chinese) Journal of Beijing Forestry University 38(5): 23-32. [While the main distribution area of A. sichuanense (on *Picea* spp.) is in Qinghai, Gansu, Sichuan and Tibet, the model suggests the junction area of Qinghai, Gansu and Sichuan as the most suitable for it.]

Zhang Li, Yue XinXia, Zhang Lei, Zhao JinFang, Chen YiMin, Cao ZhiJian and Lin YongLin. 2016. Anti-osteoporosis effect of *Cistanche deserticola* Ma extract in ovariectomized rats. Tropical Journal of Pharmaceutical Research 15(9): 1929-1933. [The study indicates that an extract from *C. deserticola* prevents OVX-induced osteoporosis in rats, ‘and could be used for treating osteoporosis in elderly women’.]

Zhenzhen Yang, Zhenzhen Yang, and others. 2016. Horizontal gene transfer is more frequent with increased heterotrophy and contributes to parasite adaptation. Proceedings of the National Academy 113(45): E7010-E7019. [http://www.pnas.org/content/113/45/E7010.a bstract] [See Literature Highlight above.]

Zhou QinFen, Li Jie, Tan ManLiang and Luan LianJun. 2016. (Optimization of saponification

Zimmermann, J., Musyoki, M.K., Cadisch, G. and Rasche, F. 2016. Biocontrol agent *Fusarium oxysporum* f. sp. *strigae* has no adverse effect on indigenous total fungal communities and specific AMF taxa in contrasting maize rhizospheres. Fungal Ecology 23: 1-10. [Confirming that *F. oxysporum* 'Foxy 2' had no adverse effect on other soil microflora when used as a biocontrol agent against *Striga hermonthica*.]

Zucca, P., Argiolas, A., Nieddu, M., Pintus, M., Rosa, A., Sanna, F., Sollai, F., Steri, D. and Rescigno, A 2016. Biological activities and nutraceutical potentials of water extracts from different parts of *Cynomorium coccineum* L. (Maltese Mushroom). Polish Journal of Food and Nutrition Sciences 66(3): 179-188. [Studies in Italy show that the different traditional medicinal uses of *C. coccineum* depend on different tissues. Thus antioxidant activity was mainly due to anthocyanins in the external layer, whereas the external layer and peeled plant extracts both inhibited the microbial growth of several Gram-positive strains. In contrast, the whole plant extract had the highest anti-tyrosinase activity and exhibited pro-erectile activity when administered subcutaneously.]

Zwanenburg, B., Mwakaboko, A.S. and Chinnaswamy Kannan. 2016. Suicidal germination for parasitic weed control. Pest Management Science 72(11): 2016-2025. [A general perspective describing suicidal germination inducers as a possible control measure for root parasitic weeds. Results of field experiments with Nijmegen-1 and Nijmegen-1 Me (containing an additional methyl group at 3’ of the butenolide ring) at 6.25 g/ha to tobacco fields infested with *Phelipanche ramosa* resulted in generally good to excellent control when suitable pre-conditioning had occurred. Other options for parasitic weed control are also discussed.

**IPPS MEMBERSHIP**

Membership in the IPPS is open to individuals and organizations of all nations that are interested in the objectives of the Society. Membership fee for 2 years is 50 € and will be included in the registration for the IPPS meeting (WCCP). To obtain a Registration form visit the IPPS website (http://www.parasiticplants.org/) or contact:

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**HAUSTORIUM 70**

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Send material for publication to any of the editors.

NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge and may also be down-loaded from the IPPS web-site (see above).
HAUSTORIUM
Parasitic Plants Newsletter
ISSN 1944-6969
Official Organ of the International Parasitic Plant Society
(http://www.parasiticplants.org/)

July 2017 Number 71

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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS members,

I hope you have had a good summer.

The 14th World Congress on Parasitic Plants took place in Asilomar Conference Center, California from the 25th – 30th June. About 80 participants from around the world attended the meeting, which was excellent both scientifically and socially and the location was beautiful! I would like to thank John Yoder and his team for their hospitality, their hard work and excellent organisation, before and during the meeting, which made it very enjoyable and a great success.

I would also like to thank the scientific committee and the session organisers for their input into the scientific programme and the organisation of the individual sessions. We had excellent keynote, oral and poster presentations as described by Chris Parker in his report (below). It was great to see the rapid progress in all areas of parasitic plant research since the last meeting and it will be fascinating to see how the large volume of information coming from the sequencing of different parasitic plant genomes will advance our understanding of their evolution, ecology, physiology and interactions with their hosts over the next few years. The book of abstracts from the meeting and photographs can be downloaded from the Congress website (http://www.wcpp14.org).

I would particularly like to congratulate all the students and young scientists who gave oral presentations and posters at the meeting; all were of very high quality. As we have done in previous meetings, awards were made for the best student oral and poster presentations. This year the award for the best oral presentation went to Pauline Duriez, INRA, Toulouse, France, for her presentation on the ‘Molecular characterization of the major resistance gene OR9 controlling resistance to O. cumana in sunflower’. Equal second place went to Emily Beardon, University of Sheffield, for her presentation on the Identification of a Striga resistance QTL in a rice mapping population’ and to Guillaume Brun, University of Nantes, France, for his presentation entitled ‘Parasitic and non-parasitic plants share a germination stimulant signaling pathway leading to seed germination through abscisic acid catabolism’.

The judges found it impossible to distinguish between the top three posters so prizes were awarded equally to Magdalena Denysenko-Bennett, Jagiellonian University, Poland, for her poster on ‘Horizontal transfer of a plastid sequence from Cuscuta to Orobanche’, Hiroaki Samejima for his poster on the ‘Practicality of the suicidal germination approach for controlling Striga hermonthica in Sudan, and to Daniel Steele for her poster on ‘Exploring the evolutionary origin of haustoria in root parasitic plants’. I would also like to thank the judges, Denneal Jamison-McClung, Duncan Cameron and Philippe Delavault for their hard work!

Finally I would like to highlight the message from Chris Parker about the future of Haustorium. As you know Chris puts a huge amount of work into Haustorium and he hopes to continue to provide the main editorial input into Haustorium for the moment but he won’t always be able to do this, so we need to think about options for the future. Chris is asking for offers of assistance, with or without the Literature section. If you are interested in helping Chris put together and edit Haustorium, or have views and ideas about the way forward for Haustorium, please could you contact any one of the editors, or myself so that we can plan for the future.

With very best wishes,

Julie

Julie Scholes, IPPS President (j.scholes@sheffield.ac.uk)

MEETING REPORTS


The Congress was organized by the University of Turin, which chairs and coordinates COST Action FA1206 “Stream” (http://www.cost.eu/COST_Actions/fa/FA1206), a scientific network entirely focused on the study of the biological roles and the applications of strigolactones. About 180 scientists participated in this event. Among them were senior academics and established leaders in the field, young and emerging investigators as well as leading scientists from industry. The symposium programme featured special and plenary lectures, invited lectures, short communications, poster sessions, and exhibitions.

In addition to the presentation and discussion of many new research activities, this was a great occasion to renew the interdisciplinary, collaborative atmosphere in the strigolactone scientific community as well as to set up an inspirational and mind-opening meeting for young scientists. Many younger researchers attended the congress, making new fruitful contacts and strengthening their scientific international network.

Among the different subjects related to strigolactones, parasitic plants were widely discussed and the new research in this field was presented. Subjects relating to parasitic plants included the distribution of canonical and non-canonical strigolactones in the plant kingdom; the development of a germination stimulant for the parasitic
plant *Striga*; strigolactone biosynthesis and its regulation; a protein approach towards investigating parasitic plant germination; a study on the germination activity of dehydrocostuslactone derivatives on parasitic weeds; root, plant and fungal metabolites for alternative and biological control of parasitic plants; the *Orobanche cumana x O. cernua* genetic system providing insight into the regulation of host specificity in a parasitic plant; OaMAX2 of *Phelipanche aegyptiaca* and *Arabidopsis* AtMAX2 share conserved functions in both development and drought responses; evaluation of germination stimulant activity of the guaianolide lappalone and its derivatives on parasitic weeds. In addition, several posters were presented of relevance to parasitic plants. Relevant papers are listed below.

Most of the presentations are due to be published in a special issue of *Journal of Experimental Botany*. A book of abstracts is available, to COST Stream members only, at: [http://www.strigolactones2017.it/](http://www.strigolactones2017.it/)

To see the photo gallery go to [http://www.strigolactones2017.it/81/photo-gallery](http://www.strigolactones2017.it/81/photo-gallery) and enter the password: gallery2017

**Oral presentations:**

Yuichiro Tsuchiya *et al.*; Development of a germination stimulant for a parasitic plant *Striga*.

Daoxin Xie *et al.*; DWARF14 is a non-canonical hormone receptor for strigolactone.

Shinjiro Yamaguchi; Strigolactone biosynthesis and its regulation.

Koichi Yoneyama *et al.*; Distribution of canonical and non-canonical strigolactones in the plant kingdom.

Lucas Braem *et al.*; A protein approach towards investigating parasitic plant germination.

Calà A. *et al.*; A study on the germination activity of dehydrocostuslactone derivatives on parasitic weeds.

Antonio Evidente *et al.*; Root plant and fungal metabolites to alternatively and biologically control of parasitic plants.

Hailey Larose *et al.*; The *Orobanche cumana x Orobanche cernua* genetic system provides insight into the regulation of host specificity in a parasitic plant.

Weiqiang Li and Lam-Son Phan Tran; OaMAX2 of *Orobanche aegyptiaca* and *Arabidopsis* AtMAX2 share conserved functions in both development and drought responses.


**Posters:**

Khan, Z.R. *et al.*; Suicidal germination of *Striga* in the presence of the host plant

Adéla Hýlová et al.; Strigolactone-auxin conjugated mimics as germination stimulants for root parasitic weeds.

Marko Kebert et al.; Bioactivity profile of metabolites isolated from *Vicia faba* roots parasitized by *Orobanche crenata*.

Alexandre Lumbroso et al.; Simplified strigolactams as potent analogues of strigolactones for the seed germination induction of *Orobanche cumana* Wallr.

Emilian Georgescu, Radoslava Matusova et al.; New affordable strigolactone analogues as active ingredients for plant protection products.

Stefano Pavan et al.; Low strigolactone production in a pea line resistant to *Orobanche crenata* is associated with lower expression of two biosynthetic genes.

### 14th IPPS World Congress on Parasitic Plants.

**Asilomar Conference Grounds in Pacific Grove California, USA, June 25-30, 2017.**

The 14th World Congress on Parasitic Plants was held at the extensive Asilomar Conference Center, a stone’s throw from the Pacific Ocean. About 80 delegates gathered on Sunday 25th June and Proceedings ran from Monday 26th to Thursday 29th.

Each section of the programme was introduced by a keynote speaker reviewing their own and others’ work on a particular topic. This pattern proved extremely informative. After an introduction from our able host, John Yoder, the first session on ‘Genes and genomes’ began with Peter McCourt (University of Toronto) setting a challenging pace with an extremely detailed appraisal of the mechanisms involved in the response of plants to strigolactones, using *Arabidopsis* to highlight the role of a/b hydrolases. James Bradley (Sheffield University) compared *Striga asiatica* ecotypes from USA, non-virulent on rice, and from Africa, with varying virulence on rice. Whole genomes were re-sequenced and SNPs identified.

Kohki Shimizu (Osaka Prefecture University) reported on patterns of gene expression in the development of vascular differentiation in the haustorium of *Cuscuta japonica* parasitizing soyabean.

A second keynote paper, presented by Stéphanie Muñoz (University of Toulouse) reported an increasing problem from *O. cumana* in sunflower in France since 2007, and described a major collaborative project between France and Spain involving the detailed sequencing of the genome of *O. cumana* (race F), likely to be of value in many aspects of its biology and control. Hui-Jian Su...
For the session on ‘Parasitic Plant Biology’ Philippe Delavaunt (Nantes University) presented a keynote paper on the biology of Phelipanche and Orobanche. Among many other detailed findings, germination of *P. ramosa* by rape-seed is shown to be stimulated, not by strigolactones, but by isothiocyanates from the host roots. These do not stimulate *P. aegyptiaca* or *Orobanche* spp. 

Pradeepa Bandaranayake (University of Peradeniya) reported on her studies showing that genes controlling the development of the sticky haustorial hairs of *Triphysaria versicolor* differ from those involved in regular root hair development. Huiting Zhang (Penn State University) reviewed a programme aimed at understanding the genetic changes associated with parasitism, by sequencing the transcriptomes in three genera of Orobanchaceae, with emphasis on those involved in production of pectate lyases. Guillaume Brun (Nantes University) showed that stimulation of seeds of a range of parasitic species by various stimulants always involved up-regulation of an ABA-catabolism gene. Hijiri Fujioka (Kobe University) confirmed that stomata in *Striga hermonthica* are unaffected by ABA. Seed germination was also unaffected by ABA, even though ABA levels increased after GR24 application. Songkui Cui (Nara Institute of Science and Technology) described mutants of *Pheirospermum japonicum* with abnormal elongated haustoria associated with defects in genes transmitting ethylene signalling. One poster described how, as *Santalum album* shows high variability when grown from seed, a micro-propagation protocol has been developed based on the clonal propagation of axillary buds from identified superior genotypes.

The first keynote paper for the session ‘Host resistance’, presented by Satoko Yoshida (Nara Institute of Science and Technology) reviewed a wide range of work on haustorial initiation and attachment, including the derivation of DMBQ from lignins. Emily Beardon (Sheffield University) described the identification of an *S. hermonthica* resistance QTL in a rice mapping population. (Congratulations to Emily on winning best student presentation award for this.) Jim Westwood (Virginia Tech.) discussed the role of jasmonic and salicylic acids in the defence of *Arabidopsis* against pathogens, and the possible ways in which *P. aegyptiaca* may interfere with its defence mechanisms by secretion of certain proteins.

In a further keynote paper, Steven Runo (Kenyatta University) studied a wide range of wild sorghums for their mechanisms of resistance to *S. hermonthica* and the genes involved in their resistance. Pauline Duriez (INRA, Toulouse) narrowed down the location of the OR7 locus in sunflower showing resistance to *O. cumana* race F, to a small region of chromosome 7 and identified genes with possible relevance. Xavier Grand (BIOGEMMA, France) described a genome-wide association study and bulk segregant analysis to highlight new genomic regions controlling sunflower resistance to *O. cumana*. Posters were also presented relating to variations in strigolactone exudation in pearl millets; resistance in sunflower to *O. cumana* induced by a plant growth regulator; and describing genes in *Arabidopsis* controlling immunity to pathogens, of relevance to response to *P. aegyptiaca*.

For the session ‘Host-Parasite Interactions’, Markus Albert (University of Tübingen) presented a keynote paper on defence-triggering molecules in *C. reflexa* and their recognition in host plants, with particular reference to tomato. Hailey Larose (Virginia Tech.) studied crosses between *O. cernua* and *O. cumana* as a means to identify genes responsible for their differing responses to strigolactones and dehydrocostus lactone. Saima Rashid (Penn. State University) described work with *C. pentagona* suggesting that dodder-derived mRNAs target host mRNAs during parasitism, thus enhancing parasite fitness. Thomas Spallek (RIKEN CSRS) studied the role of cytokinins in the development of vascular connections and host root morphology when *Pheirospermum japonicum* parasitises *Arabidopsis*. Alberto Martin-Sanz (Pineer Hi-Bred, Spain) reported on studies of a population of *O. cumana* race G in southern Spain with greater genetic diversity than other samples of race G. Anna Krupp (University of Hohenheim) studied the penetration of *O. cumana* into roots of sunflower and detected a previously unknown type of resistance reaction. Koh-Ayoki (Osaka University) reported on studies of the apoplastic and symplastic connections between *C. campestris* and *Arabidopsis* and between *P. aegyptiaca* and tomato. Topics of relevant posters included improvement in the methodology of *Cuscuta*-host interactions; the differing success rates of *Triphysaria* parasitizing a range of hosts; the evolutionary origin of haustoria within Orobanchaceae; the interesting phenomenon of self-recognition in root parasitic plants; and the regeneration of haustorial tissue from callus derived from seed explants in *Cynomorium songaricium*. Two relevant posters described the apparent horizontal transfer of a plastid sequence *trnL-trnF* from a *Cuscuta* sp. to *Orobanche rigens*, either directly, or more probably by transfer via a common host species; and studies of *P. aegyptiaca* growing on mutant *Arabidopsis* with varying abnormalities in amino-acid metabolism which did not result in significant differences in parasite growth.
For the session ‘Ecology, Phylogeny and Evolution’ Claude dePamphilis (Penn. State University) presented the key-note paper, discussing horizontal gene transfer in the context of the various ways in which genes have been modified or introduced, as parasitic plants developed haustoria. Peter Toth (Slovak University of Agriculture, Nitra) identified a wide range of volatiles emitted by Orobanche and Phelipanche spp. including one apparently specific to broomrapes, and also showed how they are surely involved in attracting the fly Phytophymza orobanchia. Alex Twyford (University of Edinburgh) had studied the 21 species of Euphrasia in UK, grown on many hosts. Genome sequencing showed deep divergence according to ploidy level and high genome homogenisation due to hybridity, with species maintained by few genomic regions. Lyton Musselman (Old Dominion University) described the role of generalist fruit-eating birds in the distribution of Phoradendron leucocarpum. Joshua Der (California State University, Fullerton) described a clarification of the phylogeny of Santalales with the help of sequencing of chloroplast, mitochondrial and nuclear ribosomal RNA contigs. Susann Wicke (University of Münster) studied the plastid genomes of a range of Orobanchaceae to refine understanding of the transition from photosynthetic to non-photosynthetic physiology. Yasunori Ichihashi (RIKEN CSRS) reported on studies of the LBG (lateral organ boundaries domain) gene and its possible role in haustorium formation. Ai-Rong Li (Kunming Institute of Botany) concluded that the extremely rapid development of Pedicularis kansuensis as a weed of pastures in SW China since 2000 could be attributed to a combination of its high genetic diversity, and physiological variability, combined with climate warming and the introduction of susceptible forage grasses without adequate quarantine to control its spread. One relevant poster described distinct changes in sorghum root structure in response to the soil microbiome and suggested this could influence the crop’s susceptibility to Striga.

The session on ‘Molecules and Biochemistry’ was introduced by a key-note paper from Hannan Eisenberg (Newe Ya’ar Research Center) describing the successful development of sophisticated procedures for the control of O. cumana in sunflower and O. aegyptiaca in carrot based on thermal time models to predict the stage of growth of the parasite before emergence and repeated herbicide applications in conjunction with suitable irrigation techniques. These have led to highly significant yield increases in both target crops. Jos Raaijmakers (Netherlands Institute of Ecology) described the PROMISE programme, being devised to study all aspects of the interaction of the roots of sorghum and of Striga, with the soil microbiome with the objective of manipulation to improve crop resistance to the parasite. Yaakov Goldwasser (The Hebrew University of Jerusalem) described the successful control of C. campestris in chickpea by granular pendimethalin. Ahmet Uludag (Düze University) described a severe, new infestation of apricot by O. aegyptiaca which was controlled by cultivation and mulching.

A further key-note paper was presented by Jonne Rodenburg (Africa Rice Center) reviewing the increasing importance of rice in Africa and the range of Striga species and Rhamphicarpa fistulosa causing serious
losses in both West and Eastern Africa. Approaches to control have included resistant varieties, especially for Striga spp., and a range of agronomic techniques, varying according to cropping system and parasite species. David Sands (Montana State University) described the novel and highly promising approach to control of S. hermonthica species, based on the selection of strains of Striga-specific Fusarium oxysporum (non-toxic, non-GMO) with elevated secretion of leucine, tyrosine and methionine. These are cultured and applied to toothpicks which farmers use to produce an inoculum in boiled rice which is applied to the planting holes. Results with 500 farmers in Kenya have been highly successful. Amit Paponisch (The Hebrew University of Jerusalem) described trials to help understand the variable performance of sulfosulfuron in Kenya have been highly successful. Amit Paponisch

Field trips were arranged for one afternoon, with a choice of Monterey, nearby large-scale agriculture, or to the Point Lobos Sate Natural Reserve, where the one parasite to be seen was a Castilleja sp.

We thank John Yoder and his many colleagues for a thoroughly memorable, enlightening and enjoyable Congress. Thankyou John.

Oral presentations (followed by the name of the presenter if it was not the senior author):

McCourt, P. - Applying chemical biology to probe parasitic plants

Bradley, J. - A comparative genomics approach to investigate the genetic differences between Striga asiatica ecotypes

Shimizu, K. et al. - Expression of genes involved in vascular differentiation in haustorium of Cuscuta japonica

Gouzy, J. et al. - The complete genome sequence of Orobanche cumana (sunflower broomrape) (Stéphane Muños)

Huei-Jiun Su et al. - An extremely reduced and AT-rich plastid genome in the holoparasitic plant Balanophora

Delavault. P. et al. - The biology of Phelipanche and Orobanche

Bandaranayake, P.C.G. et al. - Root hair and haustorial hair development pathways in Triphysaria versicolor share some genes but not all

Zhang, H. et al. - Functional analyses of parasitism genes in haustoria formation and development

Brun, G. et al. - Parasitic and non-parasitic plants share a germination stimulant signaling pathway leading to seed germination through abscisic acid catabolism

Fujioka, H. et al. - Stomatal closure and germination in Striga hermonthica are not sensitive to abscisic acid

Cui, S. et al. - The role of ethylene signaling in the haustorium development in the facultative root parasitic plant Phtheirospermum japonicum

Yoshida S. et al. - Molecular basis of haustorium formation in parasitic Orobanchaceae

Beardon, E. et al. - Identification of a Striga hermonthica resistance QTL in a rice mapping population

Clarke, C. et al. - Characterization of the Phelipanche-host defense interaction (James Westwood)

Runo, S et al. - Sorghum resistance and Striga virulence as two sides of the same coin

Duriez, P. et al. - Molecular characterization of the major resistance gene OR9 controlling resistance to O. cumana in sunflower

Grand, X. et al. - Genetic and biological approach to decipher O. cumana resistance in sunflower wild relatives

Albert, A. et al. - Defense-triggering molecules of Cuscuta reflexa and their recognition in host plants

Larose, H. et al. - The Orobanche cumana x Orobanche cernua genetic system provides insight into the regulation of host specificity in a parasitic plant

Shahid S. et al. - Examining mobile small RNAs exchanged between the parasitic plant dodder and its host

Spallek, T. et al. - Using hypertrophy to study interspecies signaling between parasitic plants and their hosts

Martín-Sanz, A. et al. - Increase virulence in sunflower broomrape (Orobanche cumana Wallr.) populations from southern Spain is associated with greater genetic diversity
Krupp, A. et al. - Histological studies on different interactions of Orobanche cumana with its host sunflower
Aoki, K. et al. - Apoplastic and symplastic interactions between parasitic plants and host plants
DePamphilis, C. et al. – Sorghum resistance and Striga virulence as two sides of the same coin.
Tóth, P. et al. - Insect plant interaction in broomrapes
Twyford, A. et al. - On the nature of species differences in hemiparasitic Euphrasia
Flanders, N. et al. - The role of generalist avian frugivores in determining the distribution of the mistletoe Phoradendron leucarpum (Lyton Musselman)
Der, J.P. - The role of strigolactone level and Toh, S. - The evolution of host-plant interactions of Orobanchaceae with the sandalwood order (Santalales)
Ichihashi, Y. et al. - A phylogenomic analysis of relationships between parasitic plants and the sandalwood order (Santalales)
Wicke, S. et al. - Integrating nuclear gene data sheds new light on organellar genome evolution in Orobanchaceae
Goldwasser, Y. et al. - Broomrape (Cuscuta campestris in chickpea with granular pendimethalin
Aksoy, E. et al. - Control of Cuscuta campestris in chickpea with granular pendimethalin
Rodenburg, J. and Bastiaansm L. - Parasitic weed management in apricot plantations (Ahmet Uludag)
Sands, D.C. et al. - The application of amino acid inhibition to control parasitic plants
Paporisch, A. et al. - Evidence for sulfsulfuron leaching and degradation and its effect on Phelipanche aegyptiaca control in tomato

Posters:
Guilin Chen - Comparative transcriptome analysis of genes involved in flavonoid biosynthesis of Cynomorium songaricum Rupr.
Kountche, B.A. - transcriptome and morphological profiling reveal variation in SLS biosynthesis in Striga hermonthica pearl millet lines.
Lerner, F. - Induced resistance of sunflowers against Orobanche cumana by plant growth regulators.
Clarke, C. – Arabidopsis defense mutants reveal pathways important in host susceptibility to parasitism by Phelipanche aegyptiaca
Bernal-Galeano, V. - Optimizing methodology to evaluate Cuscuta-host interactions.
Honaas, L. - Risk versus reward: host-dependent parasite mortality rates in the facultative generalist Tryphysaria versicolor.
Steele, D.B. and Yoder, J. – Exploring the evolutionary origin of haustoria in root parasitic plants
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Kawa, D. - Impact of soil microbes on sorghum root architecture and resistance to Striga hermonthica.
Djibril, Y. - Suicidal germination of Striga hermonthica induced by local plant products in Burkina Faso.
Wang Xiaqin – Structure, bioactivities and determination of the chemical constituents from Orobanche aegyptiaca.
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Chis Parker.
AGALINIS FASCICULATA – A NEW PROBLEM IN PINE PLANTATIONS IN S.E. USA

Loblolly pine (Pinus taeda L.) is the most widely planted pine species in the southern United States due to its ability to grow well on diverse sites. Parasitic plants can reduce the growth of loblolly pine by attaching to the roots. Over the years, several publications have documented the devastating impact that Seymeria (Seymeria cassioides Orobanchaceae) can have on loblolly pine. The related fascicled gerardia or purple false foxglove (Agalinis fasciculata) has recently been found at numerous locations in young loblolly pine stands in southern Georgia.

Landowners in the Southeastern United States are planting loblolly pine more than any other pine species because it can be grown on many different soil types and drainages. Also, it responds well to silvicultural inputs such as fertilization. It was estimated that in 2013, over 756 million seedlings of loblolly pine were grown in forest tree nurseries (South and Harper 2016), more than any other pine species.

After planting, diseases and insects can reduce growth. Fusiform rust (Cronartium fusiforme), pitch canker (Fusarium circinatum), and Nantucket pine tip moth (Ryacionia frustrana) can damage loblolly pine growth. Recently, A. fasciculata has been observed in some three-year-old loblolly pine plantations causing loss of growth, and occasionally, mortality. In many cases, height is greatly reduced and needles are brown. Often the tree’s lower limbs are dead, resulting in the tree’s crown receding which further reduces the tree’s growth. As genetically uniform stock is usually planted, growth is uniform except in plots infested by A. fasciculata. By the third or fourth year of growth, the observed damage to the pines is in striking contrast to uninfested plots.

We are conducting tests on germination to determine the role of light in the germination of A. fasciculata seed. We also plan to conduct pot experiments to determine the relative pathogenicity to slash pine (Pinus elliottii Engelm.), a native pine species of commercial importance in the American Southeast. Preliminary observations suggest that slash pine may be less susceptible to parasitism than loblolly pine.

After a tract is harvested and before planting, it is common practice to prepare the site using herbicides to control vegetation that will compete with the seedling. It
is thought that herbicide rates used to control hardwoods and shrubs are sufficient to control *A. fasciculata*. Since the parasitic plant is an annual, applying the herbicide before flowering, or no later than late August in the Southeastern United States is crucial for the treatment to be effective. Additional work is planned to better understand how to control *A. fasciculata* in loblolly pine plantations.

The parasite obviously thrives in disturbed areas and is often abundant along roadsides, old fields, and pine plantations. It is common throughout much of the southern United States but has never been implicated in damage to questa. Though this was predicted some years ago (Musselman and Mann, 1978).

*Agalinis* means remarkable flax, an appropriate name for a remarkable plant.

Literature Cited:


Alan B. Wilson, Research and Development, Rayonier, Yulee, Florida; Lytton J. Musselman, Old Dominion University, Norfolk, Virginia

PRESS REPORTS

PROMISE Micro-organisms will help African farmers: soil microbes to the rescue

Sorghum is the fifth most important cereal in the world. In sub-Saharan Africa, many farmers rely on this grain for food and feed. But *Striga*, a parasitic weed, can have a devastating impact on crop yield. With an 8-million-dollar grant from the Bill & Melinda Gates Foundation, an international team will now explore the potential of soil microbes to offer crop protection. The Netherlands Institute of Ecology (NIOO-KNAW) is coordinating this 5-year project.

With the world population growing and environmental problems increasing, we’re facing a huge challenge to secure our food production. How can we feed so many people in a sustainable way? Fortunately, nature has billions of potential helpers on offer. Microbes are often associated with disease and decay. But the vast majority supports us with essential services, ranging from purifying our water to breaking down toxins and protecting crops against diseases and pests.

In sub-Saharan Africa, sorghum is a major resource for food and feed. But its production is severely constrained by the parasitic plant *Striga*. Known as 'witch weed', this widespread, purple-flowered beauty feasts on the roots of sorghum and there isn’t much smallholder farmers can do. Current research shows that the average yield loss of sorghum in Sub-Saharan Africa due to *Striga* can exceed 50%, aggravating poverty and hunger. But this could be about to change.

NIOO microbial ecologist and project coordinator Jos Raaijmakers is leading an effort to search for new sustainable solutions to this old but growing problem. Over the next five years, an African-American-European research team will do exactly that. The project funded by the Bill & Melinda Gates Foundation has been aptly named PROMISE, which stands for 'Promoting Root Microbes for Integrated Striga Eradication'.

‘Our goal is to reduce the substantial damage to sorghum caused by *Striga* with the help of micro-organisms,’ explains Raaijmakers. ‘The PROMISE project will carry out the first step by mapping the potential of micro-organisms present in African soils. Our strength lies in an ecosystem approach, studying the ‘teamwork’ between microbes, plants, soil characteristics and management practices used by farmers. There is no ‘silver bullet’ or holy grail: the solution asks for an integrated strategy.’ The team consists of scientists from the Netherlands, Ethiopia and the United States. NIOO’s research partners are the Ethiopian Institute of Agricultural Research (EIAR,Ethiopia), the company AgBiome and the University of California, Davis (United States), and the Westerdijk Fungal Biodiversity Institute and University of Amsterdam (Netherlands). Together, they will carry out research from lab to greenhouse and field.

Ethiopia was chosen as it is one of the countries where the impact of *Striga* on sorghum is most devastating. For the project to make a lasting contribution to solving the problems of these farmers, it will be vital to improve local research facilities, train local researchers and share knowledge.
So what might an actual solution look like? Raaijmakers: ‘We are thinking in more than one direction. For instance, we hope to protect sorghum plants with micro-organisms that suppress Striga infections as well as micro-organisms that can reduce the large number of Striga seeds present in the African soils.’ This will take time to develop. ‘We expect the first practical applications in ten years from now.’

For more about the PROMISE project please visit: http://www.promise.nioo.knaw.nl

With more than 300 staff members and students, NIOO is one of the largest research institutes of the Royal Netherlands Academy of Arts and Sciences (KNAW). The institute specialises in water and land ecology. As of 2011, the institute is located in an innovative and sustainable research building in Wageningen, the Netherlands. NIOO has an impressive research history that stretches back 60 years and spans the entire country, and beyond.


**Mistletoe complicates forest thinning efforts**

Should we save mistletoe for the bluebirds? Or hack away at it to save the ponderosa? And should we sacrifice a 400-year-old tree to help its neighbors? Those perplexing questions dog the Forest Service in its sweeping plan to save the forest by cutting millions of trees on 1.2 million acres — including all of Rim Country and much of the White Mountains of Arizona.

The Forest Service held a public forum in Payson last week in its historic effort to design a healthy, fire-resistant ecosystem, with the help of a reinvented timber industry. The sweeping study follows in the footsteps of an earlier assessment of 600,000 acres, mostly in the Flagstaff area. Only a handful of people showed up to scratch their heads at the complexity of playing God on a forestwide scale. The controversial Four Forest Restoration Initiative continues to struggle for traction, but by 2018 the Forest Service hopes to finish this second Environmental Impact Statement so contractors can ramp up to clearing 50,000 acres of forest every year. But that will require what to do about things like mistletoe — a tree parasite. (*Arceuthobium vaginatum*) It can play a valuable role in the ecosystem, but it can also plague trees in the current, deeply unnatural environment dominated by tree thickets and crown fires.

The Forest Service is now pondering how hard to work on controlling mistletoe infestations. That decision, in turn, could impact a crucial, previous decision to leave almost all of the remaining big, old-growth ponderosa pines alone. Mistletoe feeds on the trees on which it grows. But it also offers up berries savored by many bird species, which in turn eat tree-munching insects like bark beetles. In a healthy forest, the trees shrug off the effects of the mistletoe, which releases mostly futile spores — which drift to the ground without landing on another tree to infect.

Pre-settlement forests were dominated by giant, centuries-old trees. Low-intensity ground fires kept the saplings and debris on the forest floor cleaned up and tree densities down to about 50 per acre. Mistletoe infested trees even grew mutant-looking lower branches, which meant those ground fires would often pick off the infested trees. But then loggers removed most of the big trees. Some estimates suggest only 1-3 percent of the ponderosa pines in the forest now are old-growth trees, although they once dominated the landscape. Then fire suppression and grazing eliminated these frequent, low-intensity ground fires. As a result, vast stretches of forest now have 1,000 trees per acre.

In this new, unnaturally dense forest, the trees struggle to get enough water and nutrients, leaving them vulnerable to mistletoe infestations. Moreover, the mistletoe spores on the big trees drift down to infest thickets of trees below. So now mistletoe represents a potential plague. On average in Rim Country and the White Mountains, 5-10 percent of the trees are infected, according to a Forest Service report on current conditions. However, in about 41 percent of the Rim Country project area the parasite infests 20 and 80 percent of the trees.

So here’s the question: Should the Forest Service tell the 4FRI contractor to take out many of the affected trees in infested areas? The question turns out to be politically charged. The first version of the plan didn’t focus much on mistletoe. But it turns out Rim Country and the White Mountains have higher infection rates than the Flagstaff area, said Scott Russell, 4FRI chief executive officer for the Forest Service. Moreover, so long as mistletoe infests the young trees targeted by the project, the question answers itself. The thinning project will remove the great majority of those small trees — mostly under 16-18 inches in diameter. These young trees grow in thickets on millions of acres.

But things get dicey when the mistletoe infests those surviving, big, old-growth trees. For starters, the mistletoe spores can rain down on a larger area from the upper branches of a 400-year-old ponderosa pine with a 30-inch diameter trunk. But does that matter if loggers remove the tree thickets beneath? Remember, even in the unlikely event the mistletoe actually kills the giant, yellowbelly ponderosa, the dead snag left behind will benefit wildlife for decades. But what if the mistletoe grows in one of the rare clusters of big trees? In that case, the infected trees in...
that cluster could eventually infest all the others. Wouldn’t it make sense to cut down some of the big, infected trees in that situation? That’s the question the Forest Service faces as it tinkers with the formula for a healthy forest. The question sounds innocent enough — but it’s politically explosive. The 4FRI concept has united environmentalists, loggers and local officials behind the idea of thinning small trees and saving old trees. So the whole 4FRI effort is built on the foundation of the ‘large tree retention strategy.’

The Forest Service and the anxiously watching environmental groups can easily monitor whether the 4FRI contractor is cutting ponderosas greater than 18 inches in diameter just by looking at the log pile. But once the Forest Service lets the 4FRI contractor cut some of those big trees — enforcing the ‘large tree retention strategy’ becomes far more difficult. And that’s why a humble parasite like mistletoe can complicate the only major project likely to prevent a plague of crown fires on millions of acres in the next 50 years.

Peter Aleshire, EurekAlert AAAS, 21 April, 2017

Mistletoe research may keep you healthy

A new study examines the spread of mistletoe - a parasitic plant - and finds that the plant’s success is determined not only by its compatibility with a host tree but also whether or not the plants’ fruiting seasons overlap. Knowing what factors are necessary for the parasite to spread may help scientists better understand the variability of other parasitic interactions, including infectious diseases. ‘We wanted to address an ongoing debate about the multiple determinants in the spread of parasitic plants,’ says Suann Yang, assistant professor of biology at SUNY Geneseo and co-author of the study published in Journal of Ecology. ‘But the questions we address also apply to other parasitic relationships, including viruses and bacteria.’

Yang and her collaborators, researchers at The Pennsylvania State University and the Island Ecology and Evolution Research Group (IPNA-CSIC), Spain, conducted the four-year field research project in sections of the University of Puerto Rico’s Finca Montaña, a mix of cattle pasture and forest patches.

‘For mistletoe, we found that the availability of suitable host species during germination and establishment is most important,’ says Marcos Caraballo Ortiz, a biology Ph.D. candidate at Penn State and lead author of the study. ‘But, a very close second has to do with the timing of when hosts produce fruit in relation to when mistletoe is fruiting.’ Mistletoe seeds are spread by birds who eat the berries’ nutritious pulp. Like many fruits, the berries act as a laxative, which allows the seeds to pass through the bird quickly without damage. Birds disperse the seeds for germination - seed rain - when they perch. ‘Mistletoe is not like a dandelion - its seeds are not spread randomly by the wind,’ Yang says. ‘There is a bit more precision needed - and risk - because it relies on birds to bring its seeds to the right host.’ For the study, the researchers identified the tree species in several forest fragments and tallied the number of mistletoe plants (Dendropemon caribaeus) living on the trees. They found that more mistletoe was found on spiny fiddlewood than on any other tree species. They also found that fiddlewoods (Citharexylum spp.) were disproportionately favored by seed-bearing birds over the other main host species, the day-blooming jasmine and white indigo berry. Although these other trees are quite common, less than five percent of the mistletoes were on them.

To investigate the discrepancy between host species, the researchers ‘planted’ rows of mistletoe seeds on the branches of eleven plant species. Surprisingly, the mistletoe had a very low survival rate on spiny fiddlewood—less than 10 percent compared to other trees where survival rates were higher than 20 percent. Suitability, they found, doesn’t explain why so many mistletoes are found on this seemingly ‘favorite’ host. ‘It’s extraordinarily hard for the seedlings to survive on this particular host,’ Caraballo says. ‘But, in the end, we think the majority of the population of mistletoe plants were in these trees because they were ‘flooded’ with seed rain from the birds.’

Birds that disperse mistletoe seeds - gray kingbirds and northern mockingbirds, in particular - don’t tend to bring them to the best hosts; that’s not their goal. Instead, they visit trees that are fruiting and providing food. ‘The presence of fruit on the landscape that the birds prefer can be as beneficial to mistletoe as the presence of a compatible host,’ says Tomás Carlo, associate professor of biology at Penn State and senior author. ‘The fruit of the spiny fiddlewood is one of the top three fruits eaten by gray kingbirds and northern mockingbirds at our study site. ‘We found that the eating habits of the birds led them
to visit the spiny fiddlewood frequently, and that increased the amount of mistletoe seed that was delivered. This host is filled with the parasitic plant, but it’s not because the majority of the mistletoe seedlings survive on them,’ Caraballo explains.

‘A broader, community ecology approach like ours, that looked beyond plant species, can yield surprising insights. It’s important to remember that the relationship of a parasite to one host is not independent of the other species that are interacting with them,’ Carlo says. 'Similar to how mistletoe spreads through an environment, there are many emerging diseases, like Zika and Dengue viruses, that spread between hosts by a dispersal agent - mosquitoes, in these cases - whose behavior depends on certain environmental conditions or specific preferences. Paying attention to these factors can help us understand why a parasitic plant or disease appears to favor a particular host.’

This research was supported by the National Science Foundation and the Alfred P. Sloan Foundation. Aarón González Castro and Claude dePamphilis also collaborated on the study. For full text of the article in Journal of Ecology go to: http://onlinelibrary.wiley.com/doi/10.1111/1365-2745.12795/full

Virginia Tech researcher part of $14 million NSF program for improved genomic tools
Parasitic plant researcher Jim Westwood is one of eight researchers selected for funding by a new $14 million National Science Foundation grant program that helps scientists develop genomic tools to better understand the structure and function of organisms. Westwood, a professor of plant pathology, physiology, and weed science in the College of Agriculture and Life Sciences, studies how parasitic plants, such as Cuscuta, are able to invade their hosts and steal water and food without providing anything in return. Westwoods award will allow him to expand the use of Cuscuta as a research model system by developing plant transformation methods to genetically test gene function and providing techniques and tips on growing Cuscuta to other scientists. He will also develop instructional materials about the model system to be used at the high school and college levels.

‘Cuscuta provides a fresh perspective for understanding plant science because its evolution to parasitism has resulted in exaggerated features that push the boundaries of plant capabilities,’ writes Westwood, who is also affiliated with Virginia Techs Fralin Life Science Institute. ‘For example, Cuscuta seedlings can identify host locations and grow toward them, demonstrating an ability to detect and respond to other plants in their environment.’

This summer, Roanoke Valley Governors School for Science and Technology student Madelyn Nichols will assist Westwood with the project, along with other Virginia Tech graduate and undergraduate students. The project is funded for three years. Known specifically as the Enabling Discovery through Genomic Tools program, the award is administered by NSFs Biological Science Directorate, and awardees include researchers from other universities such as Oregon State University, Pennsylvania State University, and Michigan State University. ‘EDGE awards can bridge significant gaps in genomic research capabilities,’ said James Olds, NSF assistant director for Biological Sciences. ‘Every breakthrough made by one of these projects has the potential to lead to many more discoveries, as they will provide valuable new tools for entire fields of science.’

Westwood is an expert in the field of parasitic plants. In 2016, he and a team of researchers determined that parasitic plants use horizontal gene transfer, which is a non-sexual type of transfer that allows them to steal DNA from a host plant. In 2014, he discovered cross-species movement of messenger RNA, a potentially new form of plant communication between parasitic plants and their hosts.

Cuscuta, also known as dodder, is detrimental to crop growth across the world, and new control strategies are desperately needed.

THESIS
Interaction of arbuscular mycorrhizal fungi (AMF) and herbicides on Striga hermonthica (Del.) Benth management. Suha Hassan Ahmed Elhag, Doctor in Environment (Bio pesticides), Sudan Academy of Sciences, February 2017 (Supervisors Abdel-Gabar Eltayeb Babiker and Migdam Elsheikh Abdelgani)

Parasitic weeds of the genus Striga, pose a severe problem to agriculture. They inflect significant losses in yields of staple food crops in sub-Saharan Africa where low soil fertility and low-input farming are predominant. The parasites are thus a genuine threat to food security. Furthermore, they are difficult to control by conventional methods. The present work, comprising 4 experiments was undertaken during the period July 2013 to September 2015 at the Striga research facilities, the College of Agricultural Studies, Sudan University of Science and
Technology, Shambat, Khartoum North. The objectives of the study were to evaluate the effects of several treatments including nitrogen, as urea, the herbicides triclopyr and chlorsulfuron, *Glomus* sp. arbuscular mycorrhizal fungi (AMF), *Bacillus megaterium* (BMP), a phosphorus releasing bacterium, and phosphorus as (P2O5) in various combinations on *Striga hermonthica* parasitism and sorghum growth. The Sorghum cultivar Wad-Ahmed was used in all experiments. Treatments were arranged in Complete Randomized Design (CRD) with four replicates. Parameters measured were *Striga* emergence, *Striga* dry weight, AMF colonization and selected sorghum growth attributes. In the first experiment, nitrogen alone, applied as urea, suppressed the parasite emergence completely early in the season. Triclopyr at 0.3 and 0.4 kg a.e. ha-1 reduced *Striga* emergence by 20-50% and 58.8% early and late in the season, respectively. Triclopyr at 0.3 kg a.e. ha-1 applied subsequent to nitrogen at 43.8 kg ha-1 caused poor control of the parasite. Triclopyr, nitrogen and their combination increased sorghum height by 9-19, 15-25 and 2-19%. In the second experiment, *Glomus mosseae* reduced *Striga* emergence by over 80%, and *Striga* biomass, at harvest, by 78%. Unrestricted *Striga* growth reduced sorghum height by 43 and 60% at 30 and 45 DAS, respectively. Sorghum infested by *Striga* and inoculated with *G. mosseae*, on the other hand, displayed 98 and 153% increase in height and 329% in dry weight over the respective *Striga* infested control. In the absence of *Striga*, *G. mosseae* increased sorghum total dry weight by 6% in comparison to the corresponding *Striga* free control. However, in presence of *Striga*, the fungus increased sorghum dry weight by over 3-fold in comparison to the *Striga*-infested *G. mosseae* free control. In the third experiment, unrestricted *Striga* parasitism reduced sorghum height by 48-54% and dry weight by 73%. *Glomus* sp., isolated from an onion field and propagated on Sudan grass (*Sorghum bicolor var. sudanese*) alone, reduced *Striga* emergence by 87-100%, improved sorghum height by 89-115% and sorghum total dry weight by 38%. The bacterium (BMP), alone, 67-103% and 162%, respectively. The combinations *Glomus* sp. and the bacterium further reduced *Striga* emergence by 93-100% and increased sorghum height and total dry weight by 116-139% and 378.6%, respectively.

Supplementation of the combination, *Glomus* sp. and the bacterium, with phosphorus decreased *Striga* infestation by 88-100%, increased sorghum height by 98-125% and total dry weight by 362%. In the fourth experiment, in the untreated infested sorghum *Striga* displayed early emergence and was 16 and 20 plants/pot early in the season (30 and 60 DAS) and 50 and 62 plants/pot late in the season (90 and 120 DAS). Chlorsulfuron at 1.8-3 g a.e. ha-1, alone, reduced *Striga* emergence by 62-79% and 64-72% early and late in the season, respectively and the corresponding reductions in biomass at harvest were 55-74%. *Glomus* sp., alone, reduced *Striga* emergence by 72-100% and the reduction in biomass at harvest was 74%. The combinations chlorsulfuron and *Glomus* sp. reduced *Striga* emergence by 68-100% and 76-83% early and late in the season, respectively and the reductions in *Striga* biomass at harvest were 67-808%. Unrestricted *Striga* parasitism reduced sorghum height, leaf area, number of leaves, leaf chlorophyll contents and sorghum biomass by 20-23, 10-23, 19-25% and 18-56%, respectively in comparison to the *Striga* free control. Chlorsulfuron, alone, increased sorghum height, leaf area, number of leaves, chlorophyll contents and sorghum biomass by 7-53, 15-55%, 21-64 and 29-128% in comparison to the *Striga* infested control, respectively. The corresponding increments for *Glomus* sp. alone were 43-92, 28-51, 67-151 and 61-206%, for the same parameters respectively. The combinations chlorsulfuron and *Glomus* sp. invariably, resulted in the highest increments in sorghum height, leaf area, number of leaves, chlorophyll contents and biomass. Of all treatments, chlorsulfuron at its lowest rate (1.8 g a.e. ha-1) in combination with *Glomus* sp. resulted in the highest increments in sorghum growth attributes. Further, the herbicide at its lowest rate (1.8 g a.e.ha-1), middle rate (2.4 a.e.ha-1) and highest rate (2.9 a.e.ha-1) reduced mycorrhizal colonization by 6, 18 and 51%, respectively. The results suggest the potentials of several treatments including the herbicide triclopyr when applied subsequent to nitrogen, *Glomus* sp., each, alone and in combinations with BMP and chlorsulfuron at its lowest rate (1.8g a.e.ha-1) as promising candidates for further investigations. Further, the results revealed the suppressive effects of chlorsulfuron at the rate (2.4 g a.e.ha-1) recommended by the Agricultural Research Corporation for *S. hermonthica* control on *Glomus* sp. isolated from an onion field. Moreover, the results indicate the need for further studies on practicability and economic feasibility of these treatments and the possibility of using them as components of integrated packages for *S. hermonthica* management

**THE TOOTHPICK PROJECT**

Montana State University is conducting research into the application of the biocontrol of weeds. In an effort to expand the use of this effective technology in *Striga* management across Africa, we are selecting scientists from *Striga*-infested countries for an in-depth training in the technology, to take place at Montana State University over 2-3 weeks in early 2018. Thanks to generous support from the Ohrstrom Foundation, full and partial scholarships are available (including airfare).

The technology involves:
1. Fungal isolation;
2. Virulence testing;
3. Metabolic selection of improved virulence (without GMO);
4. Laboratory production of primary inoculum;
5. Field testing on smallholder farms;
6. Coordination with NGO’s for distribution to smallholder farmers;
7. Media relationships; and
8. Permits and registration activities.

Working in western Kenya, we have had very positive results with finding, then using metabolic selection, then distributing a technology package of effective biocontrol fungi for control of Striga hermonthica on maize. The smallholder farmers in 500 on-farm trials were enthusiastic that they could grow their own biocontrol fungi and increased their maize yields by 42% (short season) and 56% (long season). Please review the report for these trials, funded by a Grand Challenges Exploration grant from the Bill & Melinda Gates Foundation: http://journal.frontiersin.org/article/10.3389/fpls.2016.01121/full.

The fungi (Fusarium oxysporum) were host-specific, non-toxigenic, and could be grown (with care) on the farm or as a community effort. We are currently scaling up manufacturing production and distribution in Kenya.

If you and your Institute have an interest in this Striga biocontrol technology, please submit an application for a 2-3 week training workshop at Montana State University held in January 2018 (dates to be determined). Fluency in English and/or French is anticipated.

Please fill out this form and send it to toothpickprojectinfo@gmail.com. Please don’t hesitate to email if you have any questions about the technology or this training program at any point of the application process.

PARASITIC PLANT LITERATURE

Between us we have a over 20 box files of reprints on (mainly weedy) parasitic plants. Also many theses, proceedings of parasitic weed/plant meetings, and books on parasitic plants. Many of these are inherited from the old Weed Research Organisation and include some very early literature. Anyone interested in all or any such material please contact Chris Parker. There are also many weed floras (non-parasitic) which will eventually be begging a good home.

Chris Parker and Charlie Riches.
associates often includes “grey literature” and papers from non-English journals. Such citations are often more difficult to find using conventional search engines. The bargraph below shows the results of searching 10 keywords related to parasitic plants. If you would like this EndNote library, simply email me.

Daniel Nickrent (Southern Illinois University, Carbondale, IL USA) nickrent@plant.siu.edu

FORTHCOMING MEETINGS

Toothpick Project, Biological control workshop, Montana State University, Jan 2018. See above. For more information: toothpickprojectinfo@gmail.com.

18th European Weed Research Society Symposium, 17-21 June 2018, in Ljubljana, Slovenia. Abstracts are due by 17 November 2017. For more information go to: http://www.ewrs2018.org/

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: http://www.parasiticplants.org/
For past and current issues of Haustorium see also: http://www.odu.edu/~lmusselm/haustorium/index.shtmlF or the ODU parasitic plant site see: http://www.odu.edu/~lmusselm/plant/parasitic/index.php
For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/
For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/ *
For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see: http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research
For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/
For information on the COST/STREAM 2nd International Congress on Strigolactones, Turin, 2017: see http://www.strigolactones2017.it/
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*For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/
For the Annotated Checklist of Host Plants of Orobanchaceae, see: http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm
For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp
For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/
For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/
For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/ *
For information on future Mistletoe in derTumortherapie
Symposia see: http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx
For a compilation from the Mistletoes: Pathogens, Keystone Resource, and Medicinal Wonder Meeting in Ashland, Oregon, July, 2016, see: https://storify.com/D0CT0R_Dave/mistletoe-conference
For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).
For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au/sandalwood
For 6th Mistletoe Symposium, Germany, November 2015 see:
http://www.sciencedirect.com/science/journal/09447113/22/supp/S1
*For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/
For the Annotated Checklist of Host Plants of Orobancheaceae, see: http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm
For information on the EWRS Working Group 'Parasitic Weeds' see: http://www.ewrs.org/parasitic_weeds.asp
For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/
For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodic ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/
For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/ *
For information on future Mistletoe in derTumortherapie Symposia see: http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx
For a compilation from the Mistletoes: Pathogens, Keystone Resource, and Medicinal Wonder Meeting in Ashland, Oregon, July, 2016, see: https://storify.com/D0CT0R_Dave/mistletoe-conference
For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).
For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au/sandalwood
For 6th Mistletoe Symposium, Germany, November 2015 see:
http://www.sciencedirect.com/science/journal/09447113/22/supp/S1

LITERATURE

*indicates web-site reference only

Items in bold selected for special interest

Items in blue relate to therapeutic uses of parasitic Plants

maturing white maize inbreds with genes from *Zea diploperennis* under multiple environments. *Euphytica* 213(1): 24. [Sixty-three extra-early white maize inbred lines containing genes from *Z. diploperennis* were crossed to four elite testers to obtain 252 single-cross hybrids and evaluated under drought. *Striga hermonthica*-infested, low N and optimal environments in Nigeria. Hybrids TZdEEI 74×TZEEI 13 and TZdEEI 74×TZEEI 29 were selected for further evaluation.]

Ando, M., Kagimoto, T., Kato, S. and Komiyama, A. 2016. (The effects of canopy structure on the distribution of mistletoe (*Viscum album* L. subsp. *coloratum* Kom) in a deciduous forest.) (in Japanese) Journal of the Japanese Forest Society 98(6): 286-294. [Results indicate that *V. album* subsp. *coloratum* was more abundant on taller and more isolated trees. The main hosts were *Quercus crispula* and *Q. serrata*.


Ashworth, V.E.T.M. 2017. Revisiting phylogenetic relationships in Phoradendraceae (*Viscaceae*: utility of the *trnl*-F region of chloroplast DNA and presence of a homoplasious inversion in the intergenic spacer. *Botany* 95(3): 247-258. [From 2016 IUFRO Conference. Studies of chloroplast DNA in 8 *Phorodendron* species provided strong support for *P. californicum* as sister to a clade uniting North American species and not as sister to a clade comprising more tropical species. Consistent with results from previous studies using nrDNA, a lineage in *Phorodendron* leucarpum complex (comprising subsp. *leucarpum* and *macrophyllum*) was strongly supported, but subspecies *tomentosum* was not confidently placed.]


Baltazár, T., Varga, I. and Pejchal, M. 2016. Distribution of European mistletoe (*Viscum album* L.) according to the location of host species in the castle park of Jedinice, Czech Republic.) (in Hungarian) Erdészettudományi Közlönyek 6(1/2): 137-150. [The most frequent hosts were *Acer saccharum*, *A. sacharum* and *Juglans nigra*, with isolated trees more heavily infested than those in a closer community.]


Bezerra, A.N.S., Massing, L.T., de Oliveira, R.B., Mourão, R.H.V. 2017. Standardization and anti-inflammatory activity of aqueous extract of *Psittacanthus plagiophyllus* Eichl. (*Loranthaceae*). *Journal of Ethnopharmacology* 202: 234-240. [The study provided evidence to support the traditional use of *P. plagiophyllus* in Brazil to treat gastritis and other inflammatory disorders.]


Carlquist, S. and Guilliams, C.M. 2017. Distinctive wood anatomy of the root-parasitic family Lennoaceae (Boraginales). IAWA Journal 38(1): 3-12. [The wood of Lennoaceae differs from that in related families in lacking libriform fibres, they also lack rays within the vascular strands, and have markedly elliptical vessel-to-vessel pits without vestures. The 4 species differ from each other in minor xylary features.]


Charnikhova, T.V., Gaus, K., Lumbroso, A., Sanders, M., Vincken, J.P., de Mesmaeker, A., Ruyter-Spira, C.P., Screpanti, C. and Bouwmeester, H.J. 2017. Zealactones. Novel natural strigolactones from maize. Phytochemistry 137: 123-131. [Seven strigolactones were isolated from root exudates of maize, including two diastereomers of methyl (2E,3E)-4-(3,3-dimethyl-5-oxo-2-(prop-1-en-2-yl)tetrahydrofuran-2-yl)-2-(((4-methyl-5-oxo-2,3-dihydrofuran-2-yl)oxy)methylene)but-3-enolate, named zealactone 1a and 1b. The implications of this finding for our view of strigolactones and their biosynthesis are discussed.]

Chen Jinyuan, Chen Xuelin, Guo NanNan, Ma WenBing, Da QingJing and Zhang HaiXian. 2016. (Difference of parasitic form of Cynomorium songaricum and Cistanche deserticola.) (in Chinese) Guangxi Zhiwu / Guihaia 36(11): 1312-1317. [Describing some differences between these two species in the way the haustorium penetrates the roots of its hosts but abstract far from clear.]

(https://doi.org/10.3389/fpls.2017.00909) [Using visible-to-shortwave infrared (VIS-SWIR) hyperspectral imaging, combined with partial least squares regression, it proved possible to detect changes in macro- and micro-nutrient levels in the leaves of sunflower some time before emergence of O. cumana. These results could be used to help in the timing of herbicide application.]

Cruz Neto, O., Leal, I.R., Santos, J.C. and Lopes, A.V. 2017. A holoparasitic plant severely reduces the vegetative and reproductive performance of its host plant in the Caatinga, a Brazilian seasonally dry forest. Acta Botanica Brasilica 31(1): 147-152. [Documenting the many ways in which Cuscuta partita reduces growth and reproduction of Zornia diphylla (Fabaceae), including reduction in pollen viability.]


Di Na, Wang Jing, Cui Chao, Zheng XiQing and Wang HaiWei. 2017. (Relation between parasitic severity of sunflower broomrape and soil nutrient.) (in Chinese) Journal of Henan Agricultural Sciences 46(1): 83-87. [Sampling soils where infestation of sunflower by Orobanche cumana was light, medium or heavy indicated that heavier infestation was associated with slightly higher soil content of N and organic matter, and much higher content of P. A causal effect is suggested but not clear on what grounds. Number of sampling sites is also not indicated in the abstract.]

Ding Yan, Zhang KaiMei, Cang XiaoXin, Sun Hao, Xiao Wei and Zhu JingBo. 2016. (Advance in chemical constituents and biological activity of genus Cistanche.) (in Chinese) Journal of Dalian Polytechnic University 35(6): 395-402. [Noting that the chemical constituents of Cistanche mainly include phenylethylanoid glycosides (PhGs), benzyl alcohol glycosides, iridoids, lignans and their glycosides, which are believed to regulate the nervous system and anti-fatigue, prevent cerebral ischemia and ischemia-reperfusion. PhGs are the main active components of Cistanche playing an important role in regulation of the nervous system.]

Doležal, J., Lehecková, E., Sohar, K. and Altman, J. 2016. Oak decline induced by mistletoe, competition and climate change: a case study from central Europe. Preslia 88(3): 323-346. [Detailed analysis of the results suggest that the decline of Quercus robur in the warm, south-eastern part of the Czech Republic is at least partly attributable to infestation by Loranthus europaeus.]

Duca, M., Clapco, S. and Port, A. 2016. Analysis of the soil parameters in the context of sunflower infection by Orobanche cumana Wallr. Lucrări Științifice, Universitatea de Stiinte Agricole Și Medicină Veterinară
"Ion Ionescu de la Brad" Iași, Seria Agronomie 59(1): 49-52. [Frequency of O. cumana was positively correlated with humus, negatively with high potassium and showed no correlation with levels of N, P or ammonium.]

Dueholm, B., Bruce, D., Weinstein, P., Semple, S., Möller, B.L. and Weiner, J. 2017. Spatial analysis of root hemiparasitic shrubs and their hosts: a search for spatial signatures of above- and below-ground interactions. Plant Ecology 218(2): 185-196. [Concluding that the root hemiparasitic shrub Santalum spicatum prefers growing at distances from neighbouring plants that fulfil resource requirements both below-ground and above-ground; and presenting a hypothesis for the optimal host density and distance to host. In Australia.]


*Eizenberg, H., Plakhine, D., Ziadne, H., and Graber, E.R. 2017. Non-chemical control of root parasitic weeds with biochar. Frontiers in Plant Science 07 June 2017. (https://doi.org/10.3389/fpls.2017.00939) [Confirming that certain types of biochar, incorporated into the soil at 0.9% by weight adsorbed stimulant exuded from roots of tomato and significantly reduced infection by Phelipanche aegyptiaca, effectively alleviating crop damage. No comment on the economics of the large amount of biochar needed to treat soil to adequate dph.]

Enanni, M., Briache, F.Z., Mansi, J.M., Gaboun, F., Ghaoui, L., Belzadi, L. and Mentag, R. 2017. Genetic diversity of Moroccan Orobanche crenata populations revealed by Sequence-Related Amplified Polymorphism markers. Journal of Agricultural Science (Toronto) 9(4): 164-175. [Jaccard’s similarity coefficient and Principal Coordinate Analysis (PCoA) showed a clear differentiation among each population of O. crenata samples according to the geographical origin of population O. crenata in Morocco, suggesting the need for multisite screening trials during breeding programs.]


Fontürbel, F.E., Salazar, D.A. and Medel, R. 2017. Why mistletoes are more aggregated in disturbed forests? The role of differential host mortality. Forest Ecology and Management 394: 13-19. [Tristerix corymbosus, which is solely dispersed by the marsupial Dromiciops gliroides and parasitizes a wide range of hosts in Chile, proves less persistent in dense forest where its main host is Pluchea absinthioides, and more persistent in disturbed forest where it has more favourable hosts, Aristotelia chilensis and Rhaphithamnus spinosus. Thus its distribution is more dependent on host species than on the activity of the frugivore.]

*Fürst, U., Hegenauser, V., Kaiser, B., Körner, M., Welz, M. and Albert, M. 2016. Parasitic Cuscuta factor(s) and the detection by tomato initiates plant defense. Communicative and Integrative Biology 9(6): e1244590. (https://mail.aol.com/webmail-std/en-us/suite) [Identifying a ‘Cuscuta Receptor 1’ (CuRe1) in tomato which is critical to initiate defence responses against C. reflexa such as the production of ethylene or the generation of reactive oxygen species. But also concluding that additional defence mechanisms, or receptors, respectively, are needed to totally fend off the parasite.]


*Gillespie, M.A.K., Baggesen, N. and Cooper, E.J. 2016. High Arctic flowering phenology and plant-pollinator interactions in response to delayed snow melt and simulated warming. Environmental Research Letters 11(1): 115006. (http://iopscience.iop.org/article/10.1088/1748-9326/11/11/115006/meta) [Studying the effects of the possible predicted increased snow depth and warmer temperatures expected with climate change, on 6 species including Pedicularis hirsuta and concluding that, while flowering would be delayed somewhat, the length of flowering season would be largely unchanged. However synchronisation with insects for pollination could become a factor.]

Discussing the possible reasons why deciduous mistletoes are rare and confined to the northern fringes of Loranthaceae in Eurasia, and to Misodendraceae and the monotypic genus Desmaria (Loranthaceae) in southern South America. There are no deciduous mistletoes in the tropics and subtropics.

Gobena, D., Shimels, M., Rich, P.J., Ruyter-Spira, C., Bouwmeester, H., Kanuganti, S., Mengiste, T. and Ejeta, G. 2017. Mutation in sorghum LOW GERMINATION STIMULANT 1 alters strigolactones and causes Striga resistance. Proceedings of the National Academy of Sciences of the United States of America 114(17): 4471-4476. [The authors describe a mutation in the gene LGS1 (LOW GERMINATION STIMULANT 1), controlling a sultotransferase, which results in a change in exudation from 5-deoxystrigol to orobanchol which does not stimulate germination of Striga, conferring resistance without other side-effect.]


González, A.M. and Sato, H.A. 2016. (Vegetative anatomy of Lophophytum mirabile subsp. bolivianum (Balanophoraceae) and the effect of its parasitism in the anatomy of the roots of its host Anadenanthera colubrina var. cebil.) (in Spanish) Anales del Jardín Botánico de Madrid 73(2) unpaginated. [Describing the anatomy of L. mirabile subsp. bolivianum and its profound effects on the roots of A. colubrina var. cebil, resulting in the formation of a woody gall and secondary effects on the host timber development.]

González, F., Pabón-Mora N. 2017. On the supposed polycotyledony and lack of endosperm in Psittacanthus (Loranthaceae). Brittonia 69(2): 176–185. [The authors claim that the pluricotylar condition in ereas previously reported by several workers, was erroneous and that instead the cotyledons represent endosperm. No developmental data were provided that would support such a claim. Moreover, anatomical data contradicting their interpretation (e.g. Kuijt 1967, Can. J. Bot.) were ignored. Photos of seedlings in Fig. 1 and the illustration in Fig. 3 represent a mixture of Psittacanthus and Struthanthus, an error not recognized by the authors, thus all their conclusions must be rejected.]

González, F., Roldán, F.J. and Pabón-Mora, N. 2016. Psittacanthus corderoi, a new species of Loranthaceae from the Colombian Amazonia. Caldasia 38(2): 250-256. [Describing P. corderoi from the department of Amazonas, Colombia, similar to P. lassianthus from Guyana and Venezuela, but differing by various vegetative and floral traits, including the presence of numerous laciniae to 2 mm long on the outer surface of the petals.]

Grgić, S., Ćosić, J., Rebekić, A. and Vrandečić, K. 2016. Impact of essential oils on mycelial growth of Botrytis cinerea. (in Croatian) Poljoprivreda / Agriculture 22(2): 29-33. [Oil from ‘sandalwood’ (presumably Santalum album) was not among those showing antifungal activity.]

*Grimsson F, Grimm GW, Zetter R. 2017. Evolution of pollen morphology in Loranthaceae. Grana 56:1-101. ([Using previously published DNA data, the authors construct a phylogenetic framework upon which they propose trends in pollen evolution in Loranthaceae. They argue (controversially) that the position of Nuytsia (Australia) as sister to the remainder of the family is an analytical artefact and that instead Tupeia (New Zealand), with its unusual spheroidal pollen, occupies this position.]


Gunathilake, K.D.P.P. and Ranaweera, K.K.D.S. 2016. Antioxidative properties of 34 green leafy vegetables. Journal of Functional Foods 26: 176-186. [*Olax zeylanica among 7 species showing high carotene content, antioxidant activities and polyphenolics compared to other leaf varieties tested.*]


Hacham, Y., Hershenhorn, J., Dor, E. and Amir, R. 2016. Primary metabolic profiling of Egyptian broomrape (Phelipanche aegyptiaca) compared to its host tomato roots. Journal of Plant Physiology 205: 11-19. [GC-MS used to identify 59 metabolites in *P. aegyptiaca* and host tomato. From variations between levels in uninfected and infected host roots and in the parasite it is concluded that *P. aegyptiaca* has its own metabolism that differs significantly in its regulation from that found in its host and that the parasite did not significantly affect the host primary metabolic pathways.]

Hampel, L.D., Cheeptham, N., Flood, N.J. and Friedman, C.R. 2017. Plants, fungi, and freeloaders: examining temporal changes in the “taxonomic richness” of endophytic fungi in the dwarf mistletoe *Arceuthobium americanum* over its growing season. Botany 95(3): 323-335. [From 2016 IUFRO Conference. Distinguishing 48 taxa of endophyte, in *A. americanum*, including *Serpula, Alternaria*, and *Tremella* species. The range was generally similar in male and female plants, and tended to increase over the growing season.]


Hosseini, A. 2016. (Phenological characteristics of continental mistletoe (*Loranthus europaeus* Jacq.) for its temporal control management.) (in Persian) *Iranian Journal of Forest and Poplar Research* 24(1): Pe150-Pe161, En162. [Results of study suggested that the optimum time to remove *L. europaeus* from *Quercus brentii* in western Iran is prior to fruit ripening.]


Ishida, H., Kuroda, A., and Iwakiri, K. 2016. (Overgrowth of the hemiparasitic plant species *Taxillus yadoriki* (*Loranthaceae*) and the debilitation of its host trees in a park in Miyazaki City, Miyazaki Prefecture.) (in Japanese) *Vegetation Science* 33: 15-32. [422 host trees from 27 species were observed with *Lithocarpus edulis* the most common followed by *Quercus serrata*, *Cryptomeria japonica*, and *Eurya japonica*. The degree of debilitation and host death was highest in *L. edulis*.]


Karimmojeni, H., Ehtemam, M.H., Javadimoghadam, S., Shahbazi, S. and Bazrafshani, A.H. 2017. Egyptian broomrape (Phelipanche aegyptiaca) response to silicon nutrition in tomato (Solanum lycopersicum L.). Archives of Agronomy and Soil Science 63(5): 612-618. [Reporting that application of silicon to tomato significantly delayed infection by P. aegyptiaca and reduced the damage caused to the crop.]

Karzhaubekova, Zh.Zh. and Gemejiyeva, N.G. 2016. (The element, amino- and fatty acids composition of Cistanche salsa (Orobanchaceae) from Kazakhstan.) (in Russian) Rastitel'nye Resurysy 52(3): 424-433. [Determining the macro- and micronutrients, amino- and fatty acids in C. salsa occurring on saxaul (Haloxylon spp. – Amaranthaceae) and also in the sands of the Zhambyl region of Kazakhstan.]


Klokhaji, S.F., Alvaninejad, S., Adhami, E. and Fayyaz, P. 2016. (Effect of mistletoe (Loranthus europaeus) on some nutrients elements and morphological traits of maple trees leaves (Acer monspessulanum Subsp. Cinerascens) in Yasouj forests.) (in Persian) Iranian Journal of Forest and Range Protection Research 14(1): Pe58-Pe67. [Results from analysis of nutrients in L. europaeus and the host not clear from abstract, but leaf morphology of A. monspessulanum was apparently not affected.]


Koull, N. and Chehma, A. 2016. Soil characteristics and plant distribution in saline wetlands of Oued Righ, northeastern Algeria. Journal of Arid Land 8(6): 948-959. [Recording Cistanche tinctoria among plants around the fringe of the wetland, with lower moisture and salinity.]

Krishnaveni, T., Valliappan, R. and Selvraj, R. 2016. Phytochemical, physicochemical and antibacterial activity of Loranthus elasticus. Journal of Chemical and Pharmaceutical Research 8(10): 69-73. [An extract of L. elasticus (= Helicanthes elasticus) was found to have some anti-bacterial and anti-fungal properties.]

tomato roots but no significant differences were observed between the parasite and its host after parasitization, suggesting the occurrence of bacterial exchange between the two plants. A *Pseudomonas* strain *PehSI10*, originating from the host, suppressed ca. 80% of *P. aegyptiaca* seed germination and significantly reduced parasitism, suggesting potential for exploiting endophytes for control.}


Kutyna, I., Malinowska, K. and Malinowski, R. 2016. Soil conditions and plant communities on the summit, the slope and the depression on the edge of West Oder. Folia Pomeranae Universitatis Technologiae Stetinensis, Agricultura, Alimentaria, Piscaria et Zootechnica 328(39/3): 123-158. [Noting the occurrence of *Melampyrum arvense* among the community on the summit of this site in Poland.]


Lee JaeHyeon, Lyu DongPyo and Kim GabTae. 2016. (A study on the habitat environment and mutualism with ants of genus *Melampyrum.*) (in Korean) Korean Journal of Environment and Ecology 30(2): 139-145. [Recording the weight of elaiosomes as 1.2 mg in *M. roseum* var. *ovalifolium*, 1 mg in *M. setaceum var. nakaii* and 0.8 mg in *M. roseum*. These were growing in south-facing open forest edge with slightly acidic, shallow soil. The main ant species observed were 4 species of Myrmicaine; *Myrmica kotokai, M. excelsa, Myrmecina nipponica* and *Aphaenogaster japonica.*]

*Lee XinWei, Mohd-Noor Mat-Isa, Nur-Atiqah Mohd-Elis, Mohd Afiq Aizat-Juhari, Goh HoeHan, Dear, P.H., Chow KengSee, Jumaat Haji Adam, Rahmah Mohamed, Mohd Firdaus-Raih and Wan KiewLian. 2016. Perigone lobe transcriptome analysis provides insights into *Rafflesia cantleyi* flower development. PLoS ONE 11(12): e0167958. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0167958) [Of the 40 million sequencing reads, 79% of the transcripts had significant matches to annotated sequences in the public protein database and 6,019 transcripts could be mapped to 129 genetic pathways. 52 transcripts with very high expression in the flower transcriptome were identified that provide insights into biological processes that occur during *Rafflesia* flower development.] Li Jian, Li Mei, Gao XingXiang, Fang Feng and Dong LianHong. 2017. (Biological characteristics of Lubao No. 1 biological control agent (*Colletotrichum gloeosporioides*) and construction of a T-DNA insertional mutant library.) (in Chinese) Acta Prataculatura Sinica 26(1): 142-148. [Luba 1, based on *C. gloeosporioides* is already active against *Cascuta chiniensis*. Agrobacterium mediated transformation was used to create modified strains of *C. gloeosporioides* with more stable pathogenicity.]

*Li WenJun, Sui XiaoLin, Kuss, P., Liu YanYan, Li AiRong and Guan KaiYun. 2016. Long-distance dispersal after the Last Glacial Maximum (LGM) led to the disjunctive distribution of *Pedicularis kansuensis* (*Orobanchaceae*) between the Qinghai-Tibetan Plateau and Tianshan region. PLoS ONE 11(11): e0165700. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0165700) [Concluding from detailed genetic study that *P. kansuensis* disappeared from the Tianshan region during the last glacial maximum and then recolonised by material from the Qinghai-Tibetan Plateau. The long-distance dispersal across arid land may well have had birds or men as vector.]

Li Xi, Jang TaeSoo, Temsch, E.M., Kato, H., Takayama, K. and Schneeweiss, G.M. 2017. Molecular and karyological data confirm that the enigmatic genus *Platypholis* from Bonin-Islands (SE Japan) is phylogenetically nested within *Orobanche* (*Orobanchaceae*). Journal of Plant Research 130(2): 273-280. [Chromosome number and molecular phylogenetic analyses of *matK, rps2, ITS, phyA* and *phyB* conclusively show that *Platypholis* is part of the *Orobanche s. str. clade, thus this taxon should be referred to as *Orobanche boninsimae.*]

Li Yang, Peng Ying, Wang MengYue, Zhou GuiSheng, Zhang YuLing and Li XiaoBo. 2016. Rapid screening and identification of the differences between metabolites of *Cistanche deserticola* and *C. tubulosa* water extract in rats by UPLC-Q-TOF-MS combined pattern recognition analysis. Journal of Pharmaceutical and Biomedical Analysis 131: 364-372. [The study indicates that phenylethanoid glycosides of both species are mainly metabolized in the gastrointestinal tract of rats. The components cistanoside B, C, D, and E exist only in *C. deserticola* and release methylated hydroxytyrosol following metabolism, helping explain the differential therapeutic effect that these two species have on certain diseases.]

leukemia, cancer, dispersing blood stasis and hemolysis in Yunnan, China.

Macklin, J. and Parnell, J. 2016. *Dendromyza hiepkoana* sp. nov. from Irian Jaya and *D. staufferi* sp. nov. from Papua New Guinea (Amphorogynaceae). Nordic Journal of Botany 34(2): 169-173. [This work derives from the Ph.D. dissertation of the first author (July 2000) that was a systematic revision of Santalaceae of southeast Asia. The two new species now bring the total for the genus (including Cladomyza) to 21.]

Martínez Quesada, E. 2016. Typification of *Dendrophthora buxifolia* (Viscaceae). Rhodora 118(973): 1-12. [Designating lectotype and epitype for *D. buxifolia*, also, a lectotype for *D. buxifolia var. rotundata*, considered as a synonym.]

Li BaoDing. 2017. (Study on flavor development of chicken stewed with *Cistanche deserticola* Ma.) (in Chinese) China Condiment 42(4): 96-98. [Discussing the ways in which *C. deserticola* both enhances flavour and provides health benefits.]

Lim NamJu, Shin JunHo, Kim HyeJin, Lim Yeni, Kim JiYeon, Lee WonJun, Han SooJeong and Kwon Oran. 2017. A combination of Korean mistletoe extract and resistance exercise retarded the decline in muscle mass and strength in the elderly: a randomized controlled trial. Experimental Gerontology 87(No. Part A): 48-56. [Results suggest that a combination of *Vicus album* ssp. *coloratum* and physical exercise was useful in maintaining physical fitness in the elderly.]

Lira, J., Caires, C. and Fadini, R.F. 2017. Reaching the canopy on the ground: incidence of infection and host-use by mistletoes (Loranthaceae and Viscaceae) on trees felled for timber in Amazonian rainforests. Plant Ecology 218(3): 251-263. [19 host tree species were studied, on which the following mistletoes were recorded: *(Loranthaceae) Oryctanthus alveolatus; O. florulentus, Passovia pedunculata, Psittacanthus carnosus, P. eucalyptifolius, Struthanthus phillyreoides* and *(Viscaceae): Dendrophthora warmiingii, Phoradendron mucronatum, P. obtusissimum P. racemosum and P. inaequidensatum. Passovia and Struthanthus were the genera most commonly found. D. warmiingii and P. obtusissimum parasitized only Vochysia maxima and Parkia multijuga* respectively. Viscaceae tended to have narrower host range than Loranthaceae. Infections were unexpectedly commoner in closed forest than in open forest.]


Zhongguo Shengtai Nongye Xuebao / Chinese Journal of Eco-Agriculture 25(1): 27-35. [Noting that *Orobanchus cumana* on sunflower is mainly distributed in the northern regions of Shaanxi, Hebei, Xinjiang, Shanxi, Inner Mongolia and also in Northeast China. *O. aegyptiaca* is mainly distributed in Xinjiang and causes heavy damage to tomatoes and potatoes. Reporting useful results from trap cropping with ‘wheat, corn, cotton, soybean, etc.’, but no detail in abstract.]


Macklin, J. and Parnell, J. 2016. *Dendromyza hiepkoana* sp. nov. from Irian Jaya and *D. staufferi* sp. nov. from Papua New Guinea (Amphorogynaceae). Nordic Journal of Botany 34(2): 169-173. [This work derives from the Ph.D. dissertation of the first author (July 2000) that was a systematic revision of Santalaceae of southeast Asia. The two new species now bring the total for the genus (including Cladomyza) to 21.]


Mari, A., Ciocarlan, A., Aiello, N., Scartezzini, F., Pizza, C. and D’Ambrosio, M. 2017. Research survey on iridoid and phenylethanoid glycosides among seven populations of *Euphrasia rostkoviana* Hayne from the Alps. Phytochemistry 137: 72-80. [A detailed study of the chemical diversity among 7 populations of *E. rostkoviana*, widely used in the treatment of eye disorders, in northern Italy, including the description of two newly recorded phenylethanoid glycosides. The levels of the latter were much more variable across populations that the iridoïds.]

12.8% inhibited germination of lettuce seeds – *Phelipanche* spp. more strongly than *Cuscuta* spp.]

Martínez Quesada, E. 2016. Typification of *Dendrophthora buxifolia* (Viscaceae). Rhodora 118(973): 1-12. [A lectotype and epitype are designated for *D. buxifolia*, also, a lectotype for *D. buxifolia* var. *rotundata*, considered as a synonym.]

Mathiasen, R.L., Kenaley, S.C. and Daugherty, C.M. 2016. A morphometric analysis of *Arceuthobium campylopodium* and *Arceuthobium divaricatum* (Viscaceae). Aliso 34(1/2): 9-23. [Confirming and describing the morphological differences which support the separation of *A. divaricatum*, which parasitises only pinyon pines (*Pinus* subsection *Cembroides*), from *A. campylopodium* which parasitises *Pinus ponderosa* and *P. jeffreyi*. A ‘recent taxonomic treatment’ had proposed merging them under *A. campylopodium*.]

Matthies, D. 2017. Interactions between a root hemiparasite and 27 different hosts: growth, biomass allocation and plant architecture. Perspectives in Plant Ecology, Evolution and Systematics 24: 118-137. [A very detailed study confirming that forbs and legumes are better hosts for *Melampyrum arvense* than grasses and that the root mass of the parasite was much lower on a ‘good’ host than on a poor one. Differences in damage between similarly good hosts indicated that not only resistance but also tolerance may be important for host responses to parasitism. Other detailed results suggest significant differences from those found for the related model hemiparasite *Rhinanthis*; thus hemiparasite - host species interactions may be parasite-specific.]

Matulovic, F.M. and Oshiro, L.M.Y. 2016. (Use of essential oils as anaesthetic for handling prawn *Litopenaeus schmitti* and *Farfantepenaeus brasiliensis.* (in Portuguese) Revista Acadêmica: Ciência Animal 14: 57-68. [Oil of *Santalum* spp. may be of value as an ‘optimizer transport agent’ in conjunction with clove oil in anaestheia of prawns.]


*Meng Yongjie, Shuai Haiwei Luo Xiaofeng Chen Meng* 2017. Nature of resistance of cowpea *Alectra vogelii* at its southern limit in Tanzania, where both *S. hermonthica* and *S. asiatica* are crossing with a resistance genotype, accompanied by selection in the advanced population.]


Midence, C.A.O., Wasonga, C.J., Hooper, A.M., Pickett, J.A. and Khan, Z.R. 2017. Drought-tolerant *Desmodium* species effectively suppress parasitic striga weed and improve cereal grain yields in western Kenya. *Crop Protection* 98: 94-101. [To ensure more consistent results from *Desmodium* spp. in the push-pull system for control of *Striga*, a range of *Desmodium* spp were screened for drought stress tolerance, and *D. incanum* and *D. ramosissimum* found to give good results.]


*Molnár, A. and Végvári, Z.* 2017. Bioclimatic constraints of European mistletoe *Viscum album* at its southern distribution limit at past and present temporal scales, Pannonian Basin, Hungary. *Climate Research* 71(3): 237-248. [Concluding that the factors controlling the southern extent of *V. album* in Hungary were the temperature and aridity in July.]

*Mrema, E., Shimelis, H., Laing, M. and Bucheyeki, T.* 2017. Farmers’ perceptions of sorghum production constraints and *Striga* control practices in semi-arid areas of Tanzania. *International Journal of Pest Management* 63(2): 146-156. [A detailed socio-economic study in NW Tanzania, where both *S. hermonthica* and *S. asiatica* are...
of greatest concern to farmers. No really effective control measures are being used and the problem continues to become worse. Some supposedly resistant varieties have been used to a limited extent, but do not perform well under heavy Striga infestations.]


Mudrák, O., Bello, F.de, Doležal, J. and Lepš, J. 2016. Changes in the functional trait composition and diversity of meadow communities induced by Rhinanthus minor L. Folia Geobotanica 51(1): 1-11. [Species favoured by R. minor were those with low competitive ability, while those that were tall, clonal species without a taproot were mainly suppressed. Community weighted means, and functional diversity of grasses were not affected.]


Mustarichie, R., Warya, S., Saptarini, N.M. and Musfiroh, I. 2016. Acute and subchronic toxicities of Indonesian mistletoes Dendrophthoe pentandra L. (Miq.) ethanol extract. Journal of Applied Pharmaceutical Science 6(9): 109-114. [Results suggest the ethanol extract of D. pentandra, used in Indonesia for a wide range of ailments, has low toxicity in mice and rats but is not recommended to be used for a long period.]

Nativ, N., Hacham, Y., Herschenhorn, J., Dor and E Amir, R. 2017. Metabolic investigation of Phelipanche aegyptiaca reveals significant changes during developmental stages and in its different organs. Frontiers in Plant Science April, 2007. (http://journal.frontiersin.org/article/10.3389/fpls.2017.00491/full) [Primary metabolic and lipid profiling of P. aegyptiaca using GC-MS analysis, showed relatively small changes through developmental stages. There were, however, more distinct differences when comparing different parts of the plant.]


Niu MeiYun, Cheng QingWei, Zhang YueYa, Zhang XinHua Ma GuoHua. 2017. (Comparison of several RNA extracting methods from heartwood of Santalum album.) in Chinese Journal of Tropical and Subtropical Botany 25(1): 20-25. An [improved CTAB method and guanidine isothiocyanate-SDS method were effective methods to extract total RNA from heartwood of S. album.]

Ongachi, W., Onwonga, R., Nyanganga, H. and Okry, F. 2017. Comparative analysis of Video Mediated Learning and Farmer Field School approach on adoption of Striga control technologies in Western Kenya. International Journal of Agricultural Extension 5(1): 1-10. [Video Mediated Learning proved somewhat superior to Farmer Field Schools as a means of training farmers in technologies for control of Striga, but best results were obtained with a combination of the two.]

*Ouédraogo, P., Bationo, B.A., Sanou, J., Traoré, S., Barry, S., Dayamba, S.D., Bayala, J., Ouédraogo, M., Soeters, S. and Thiombiano, A. 2017. Uses and vulnerability of ligneous species exploited by local population of northern Burkina Faso in their adaptation strategies to changing environments. Agriculture and Food Security 6(15):(1 May 2017). (https://agricultureandfoodsecurity.biomedcentral.com/articles/10.1186/s40066-017-0090-z) [Noting that Ximenia americana, previously used as food and medicinally has been greatly reduced by drought.]

Ozberk, F., Ozberk, I., Yucel, A., Mecca, I. and Altundal, S.


Ozberk, F., Ozberk, I., Yucel, A., Mecca, I. and Altundal, S. 2016. Orobanche (Orobanche spp.) and Phellipanche (Phelpanche spp.) in lentil (Lens culinaris Medic.): impacts on yield, quality and marketing prices. In: Kovačević, D. (ed.) Proceedings, pp. 1514-1522. [Lentil in Turkey is seriously damaged by O. crenata in some regions and by P. ramosa and P. aegyptiaca in others. Quality and price per kg were not affected but the study confirmed severe economic losses due to yield reductions of 51 to 98%.


Peng Fang, Xu Rong, Wang Xia, Xu ChangQing, Liu TongNing and Chen Jun. 2016. Effect of the steaming process on quality of postharvest Cistanche deserticola for medicinal use during sun drying. Biological & Pharmaceutical Bulletin 39(12): 2066-2070. [Results suggest that steaming is effective in enhancing the appearance and quality and the concentration of some bioactive compounds in ‘Cistanches Herba’.]

*Peng WenHuang, Chen YiWen, Lee MengShiou, Chang WenTe, Tsai JenChieh, Lin YingChih and Lin MingKuem. 2016. Hepatoprotective effect of Cuscuta campestris Yunck. whole plant on carbon tetrachloride induced chronic liver injury in mice. International Journal of Molecular Sciences 17(12): 2056. (http://www.mdpi.com/1422-0067/17/12/2056/htm) [Confirming that a C. campestris whole-plant extract possesses a hepatoprotective activity to ameliorate chronic liver injury, apparently due to a decrease in malondialdehyde level by increasing the activities of antioxidant enzymes such as SOD, GPx and GGrd.]

Pérez-Crespo, M.J., Lara, C. and Ornelas, J.F. 2016. Uncorrelated mistletoe infection patterns and mating success with local host specialization in Psittacanthus calyculatus (Loranthaceae). Evolutionary Ecology 30(6): 1061-1080. [Describing studies with P. calyculatus (Loranthaceae) on native hosts Alnus acuminata, Quercus crassipes and Salix bonplandiana and the non-native Populus alba, and concluding that non-random mating could contribute to local genetic structuring of mistletoe populations.]

*Pérez-de-Luque, A., Flores, F. and Rubiales, D. 2016. Differences in crenate broomrape parasitism dynamics on three legume crops using a thermal time model. Frontiers in Plant Science 7(December 2016): 1910. (http://journal.frontiersin.org/article/10.3389/fpls.2016.01910/full) [Studies on the rate of development of O. crenata on faba bean, grass pea and lentil confirmed that there are differences in parasite virulence on the different host species. There is a sigmoidal relation between thermal time and parasite development and such relation will show the differences in parasite development between hosts. The results are of potential value in the timing of herbicide application.]


(http://journal.frontiersin.org/article/10.3389/fpls.2016.02048/full) [The plant-parasitic plant interaction is a interesting model to study sink-source relationship and phloem unloading. The application of the fluorescent symplastic tracer, carboxyfluorescein (CF) derived from carboxyfluorescein diacetate (CFDA), to the leaves of the host plant (*Brassica napus*) showed direct phloem connections at the host-parasite interface. cDNAs encoding sucrose transporters were isolated from the parasitic plant *P. ramosa* and their transient expression was characterized.]

Petrova, S.E. and Pavlenko, E.V. 2017. (Biology and morpho-anatomical peculiarities of *Pedicularis sceptrum-carolinum* (Scrophulariaceae) in the Khibiny Foothills.) (in Russian) Botanicheskii Zhurnal 102(4): 526-539. [*P. sceptrum-carolinum* parasitises *Equisetum fluviatile*, *Betula alba* and *Salix glauca* but apparently fails to make full attachment to other hosts. It fails to mature without a host. Leaves have water-excreting glands.]

Pietrzak, W., Nowak, R., Gawlik-Dziki, U., Lemieszek, M.K. and Rzeski, W. 2017. LC-ESI-MS/MS identification of biologically active phenolic compounds in mistletoe berry extracts from different host trees. Molecules 22(4): 624. [The highest content of phenolic acids was found in *V. album* berries from *Populus nigra* and highest flavonoid aglycones in those from *Tilia cordata*. Extracts decreased proliferation of human colon adenocarcinoma cells line LS180.]


Piwowarczyk, R., Pedraja, Ó.S. and Moral, G.M. 2017. *Phelipanche sevanensis* (Orobanchaceae): a new species from the Caucasus, and nomenclatural notes on similar species. Phytotaxa 292(3): 231-242. [Describing *P. sevanensis* from Armenia where it parasitises *Heracleum trachylioma*, a Caucasian endemic. It is closest to *P. heldreichii*. Also providing nomenclatural notes on *P. coelestis*, *P. hohenackeri*, *P. persica* and *P. simplex*.]

Punia, S.S. 2016. Effectiveness of different measures on control of *Orobanche aegyptiaca* in Indian mustard. Agricultural Research Journal 53(2): 276-279. [Various treatments with pendimethalin, triasulfuron, sulfosulfuron, castor cake and neem cake failed to provide adequate control of *O. aegyptiaca* in mustard, but glyphosate at 25 ga/ha (+1% ammonium sulphate) applied at 25 and 55 days after sowing gave good control and increased yields.]

Quan JiShu, Wang YuJiao, Yin JiFeng, Gao Feng and Yin XueZhe. 2016. (Inhibitory effect of polysaccharides from *Boschniakia rossica* on oxidative stress in HepG2 cells.) (in Chinese) Food Research and Development 37(11): 6-9. [An extract of *B. rossica* had an inhibitory effect on oxidative stress induced by H2O2 in HepG2 cells, and could relieve the oxidative damage of HepG2 cells.]

Quang Vuong Le, Tennenkoon, K.U., Metali, F., Lim, L.B.L. and Bolin, J.F. 2016. Host specific variation in photosynthesis of an obligate xylem-tapping mistletoe *Dendrophthoe curvata* in a Bornean heath forest. Nordic Journal of Botany 34(2): 235-243. [Describing a range of differences in photosynthesis and other metabolic activities in *D. curvata* parasitising 4 different host trees in Brunei Darussalam. Host and parasite photosynthesis were similar when the host was *Acacia auriculiformis*. Parasite photosynthesis was lower than that of *Vitex pinnata* and higher than that of *Andira inermis* and *Mangifera indica*.]

Ramírez-Fischer, F.J., Benyamini, D. and Vargas, H.A. 2016. An endangered hemiparasitic shrub is the only host plant of the little-known neotropical hairstreak *Strymon flavaria* (Lepidoptera: Lycaenidae) in the arid Andes. Journal of Insect Conservation 20(5): 923-928. [Confirming that the sole food plant for the larvae of *S. flavaria* in Chile is *Krameria lappacea*.]

Ramón, P. de la Cruz, M., Zavala, I. and Zavala, M.A. 2016. Factors influencing the dispersion of *Arceuthobium oxycedri* in Central Spain: evaluation with a new null model for marked point patterns. Forest Pathology 46(6): 610-621. [Confirming that spread of *A. oxycedri* on *Juniperus oxycedrus* depends not only on explosive dispersal but must also involve some transport on birds or small mammals.]

Rişnovaneu, L., Joiţă-Pâcureanu, M. and Gabriel Anton, F. 2016. Broomrape (*Orobanche cumana* Wallr.), the most important parasite in sunflower crop in Romania. Lucrărî Ştiinţifice, Universitatea de Stiinte Agricole Şi Medicină Veterinară ”Ion Ionescu de la Brad” Iaşi, Seria Agronomie 59(2): 209-212. [Reviewing the importance of *O. cumana* in Romania and the development of cultivars with dominant genes for resistance to races A, B, C, D, E...
Roux, A. 2016. Orobanches and some other plants devoid of photosynthesis from wild Helianthus species. But results are complicated by at least three different new populations in the country.


*Rolland, M., Dupuy, A., Pelleray, A. and Delavault, P. 2016. Molecular identification of broomrape species from a single seed by High Resolution Melting analysis. Frontiers in Plant Science 7(December, 2016): 1838. Describing a High Resolution Melting assay based on trnL and rbcL plastidial genes amplification, by which single seeds of the 8 most important Orobanchaceae and Phelipanche species can be distinguished from other species but not from each other, with 90% accuracy.


*Rubiales, D., Rojas-Molina, M.M. and Sillero, J.C. 2016. Characterization of resistance mechanisms in faba bean (Vicia faba) against Broomrape species (Orobanchae and Phelipanche spp.). Frontiers in Plant Science 7(November, 2016): 1747. Reporting on rhizotrons studies to determine resistance components in faba bean accessions against O. crenata, O. foetida var. broteri and P. aegyptiaca, and the non-virulent P. ramosa and O. foetida var. foetida. Most resistance showed up as necrosis after attachment. Cv baraca showed at least partial resistance to all parasite samples. The two non-virulent differed from all others in showing ‘negative tropism’ - (and/or lack of positive chemotropism, providing some long-overdue reminder of the importance of this factor in parasitic weed biology).


Sanchez-Puerta, M.V., Garcia, L.E., Wohlfeiler, J. and Ceriotti, L.F. 2017. Unparalleled replacement of native mitochondrial genes by foreign homologs in a holoparasitic plant. New Phytologist 214(1): 376-387. In a large-scale mitochondrial genomic study of the holoparasitic plant Lophophytum mirabile (Balanophoraceae) the unprecedented acquisition of host-derived mitochondrial genes was revealed, representing 80% of the protein-coding gene content. The genome consists of 54 circular-mapping chromosomes, 25 of which carry no intact genes. The use of host-derived genes may have a positive effect on the host-parasite relationship, but could also be the result of non-adaptive forces.

Sandner, T.M. and Matthies, D. 2017. Interactions of inbreeding and stress by poor host quality in a root hemiparasite. Annals of Botany 119(1): 143-150. In studies on Rhinanthus alectorolophus in Germany results contradict the common assumption that inbreeding depression is generally higher in more stressful environments. In addition, they support the importance of diverse host communities for hemiparasitic plants.


in patches, similar sex ratio and abundance between populations, and a generalist host preference (over 20 species). Both male and female inflorescences produce relatively dilute nectar from bracts that is collected by generalist insects and apparently a corvid bird (Cyanocorax cyanopogon).

Sarić-Krmanović, M., Božić, D., Radivoević, L., Umljendić, J.G. and Vrbičanin, S. 2016. Impact of field dodder (Cuscuta campestris Yunk.) on physiological and anatomical changes in untreated and herbicide-treated alfalfa plants. Pesticidi i Fitomedicina 31(3/4): 115-120. [Recording pigments (chlorophyll a, chlorophyll b, total carotenoids) and a wide range of anatomical features in alfalfa plants with or without C. campestris treated with imazethapyr or not. Plants infested by C. campestris had lower values of most anatomical parameters, compared to noninfested or herbicide-treated plants.]

Sayad, E., Boshkar, E. and Gholami, S. 2017. Different role combinations. High Arctic plant phenology is determined by snowmelt translocation of phloem-mobile solutes to the parasite.

Scalon, M.C., dos Reis, S.A. and Rossatto, D.R. 2017. Shifting from acquisitive to conservative: the effects of Phoradendron affine (Santalaceae) infection in leaf morpho-physiological traits of a Neotropical tree species. Australian Journal of Botany 65(1): 31-37. [Leaves of Handroanthus chrysotrichus, parasitised by Phoradendron affine were scleromorphic and showed stronger water-use control (less negative water potential) than host leaves from uninfected branches.]

Scalon, M.C., Wright, I.J. and Franco, A.C. 2017. To recycle or steal? Nutrient resorption in Australian and Brazilian mistletoes from three low-phosphorus sites. Oikos 126(1): 32-39. [Mistletoes studied in Brazil included Passovia ovata, Psittacanthus robustus, and P. crassifolium, and at 2 sites in Australia Amyema sanguinea, A. miquelli, A. congener, Dendrophile odontiocalyx, D. vitellina, Decaisnia signata and, Muellerina eucalyptoides. There was little evidence of N, Ca or Mg resorption, but, on average ca. 30% of P and ca. 20% of K were resorbed prior to leaf fall.]

Schneider, A.C. 2016. Resurrection of the genus Aphyllon for New World broomrapes (Orobanchaceae). PhytoreKeys 75: 107-118. [Based on molecular phylogenetic studies, all species in the monophyletic clade of New World broomrapes (Orobanche sects. Gymnocaulis and Nothaphyllon) are placed in the genus Aphyllon resulting in 21 new combinations.]


Sheldrake, M., Rosenstock, N.P., Revillini, D., Olsson, P.A., Wright, S.J. and Turner, B.L. 2017. A phosphorus threshold for mycoheterotrophic plants in tropical forests. Proceedings of the Royal Society of London. Series B, Biological Sciences 284(1848): 20162093. [A survey in Panama showed that mycoheterotrophs were entirely absent when soil exchangeable concentrations of P exceeded 2 mg P kg$^{-1}$. Laboratory studies confirmed that the abundance of AM fungi was greatly reduced above 2 mg P kg$^{-1}$.]


Aviscumine and ML-1 applied to glioma cells differentially modulate the expression of genes involved in the regulation of cell migration and invasion, including processes modulating cell architecture and cell adhesion, suggesting potential in the treatment of invasively growing tumors such as glioblastomas.}

Siddiqui, M.S., Memon, A.A., Shahabuddin Memon and Baloch, S.G. 2017. *Cuscuta reflexa* as a rich source of bioactive phenolic compounds. *Journal of Herbs, Spices & Medicinal Plants* 23(2): 157-168. [Among 16 phenolic compounds identified, caffeic and p-coumaric acids were the dominant constituents in both flowers and stem of *C. reflexa*. The radical scavenging potential and total phenolics content were greater in the stem than flowers, while total flavonoids and tannins were more prominent in flowers.]


*Skippington, E., Barkman, T.J., Rice, D.W. and Palmer, J.D. 2017. Comparative mitogenomics indicates respiratory competence in parasitic *Viscum* despite loss of complex I and extreme sequence divergence, and reveals horizontal gene transfer and remarkable variation in genome size. *BMC Plant Biology* 17(49): (21 February 2017). (http://bmcplantbiol.biomedcentral.com/articles/10.1186/s12870-017-0992-8)] [Aerobically respiring eukaryotes usually contain four respiratory-chain complexes (complexes I-IV) and an ATP synthase (complex V). The first loss of complex I in any multicellular eukaryote was recently reported in two hemiparasitic aerial mistletoes, *V. scurulloideum* and *V. album*. Interestingly, the study of *V. album* postulated that mitochondrial genes encoding all ribosomal RNAs and proteins of all respiratory complexes are either absent or pseudogenes, suggesting that the mitogenome and oxidative respiration may not be functional in this plant.]

Soriano, I. and Guàrdia, R. 2016. (Names of inaccurately attributed taxa to José Planellas Giralt (1820-1888).) (in Spanish) *Acta Botanica Malacitana* 41: 339-341. [Including the name *Orobanchaceae caerulea* presumably mis-applied to *O. amethystea*.]

Sotek, Z., Stasińska, M., Malinowski, R., Meller, E., Grzejszczak, G. and Kurnicki, B. 2016. Distribution and habitat properties of *Carex pulicaris* and *Pedicularis sylvatica* at their range margin in NW Poland. *Acta Societatis Botanicorum Poloniae* 85(3): 3507. [*P. sylvatica*, associated with the phytocoenoses *Nardo-Juncetum squarrosi* and *Molinio-Arrhenatheretea*, is increasingly uncommon in NW Poland, due to worsening habitat conditions (insufficient moisture, eutrophication), expansion of competitive plant species and land abandonment.]

Suaza-Gaviria, V., González, F. and Pabón-Mora, N. 2017. Comparative inflorescence development in selected Andean Santalales. *American Journal of Botany* 104(1): 24-38. Suaza-Gaviria, V., González, F. and Pabón-Mora, N. 2017. Comparative inflorescence development in selected Andean Santalales. *American Journal of Botany* 104(1): 24-38. [Concluding that all inflorescence types in Santalales can be derived from a dichasium. This paper suffers from 1) insufficient (biased) taxon sampling, 2) misidentification of taxa, 3) misleading and superficial terminology, 4) failure to apply proper methodology to address the issue of plesiomorphic inflorescence type in the order. For Phoradendreae (*Viscaceae*), the authors 1) doubt that flowers arise from an intercalary meristem, 2) provide no anatomical evidence supporting the dichasium as the inflorescence type and 3) do not explain how uniseriate, biseriate, and multisieriate inflorescences types can be derived from a dichasium.]


Şumală, R.M., Sumalan, R.L., Copolovici, L., Ciulca, S., Yvin, J.C. and Ciulca, A. 2016. Research on sunflower oil quality in the case of *Orobanchaceae cumana* attack. Research Journal of Agricultural Science 48(3): 34-38. Noting that *O. cumana* affects sunflower mostly in South-Eastern part of the Romania, especially in Buzau, Tulcea and Constanța counties. Comparison of oil from infected and uninfected plants showed that, in the varieties studied, there was no change in palmitic and stearic acid contents, but oleic and linoleic acids were increased.]

Sun LíngLíng, Ma Lu, Bu DengPan, Xu JianChu, Liu ShiJie and He MeiYing. 2017. (Effects of *Scleropyrum wallichianum* oil on *in vitro* rumen fermentation characteristics and fatty acid composition.) (in Chinese) *Chinese Journal of Animal Nutrition* 29(3): 1074-1081. [‘Under the conditions of the present study, the levels of 1%, 2% and 3% *S. wallichianum* (Santalaceae) oil can increase the contents of unsaturated fatty acids and the concentrations of volatile fatty acids, and the level of 3% has the best effect.’]
Sun Ting, Xu YuXing, Zhang DaLe, Zhuang HuiFu, Wu JianQiang and Sun GuLiNg, 2016. An acetyltransferase gene that putatively functions in anthocyanin modification was horizontally transferred from Fabaceae into the genus *Cuscuta*. Plant Diversity 38(3): 149-155. [Confirming gene transfer from unspecific Fabaceae to *C. australis* and to *C. pentagona*.]


Suvrova, R., Lukacova, Z., Kastier, P. and Blehova, A. 2017. New aspects of dodder-tobacco interactions during haustorium development. Acta Physiologiae Plantarum 39(3): 66. [Noting that the haustorium of *Cuscuta europaee* exuded de-esterified pectins, which serve as a cementing material, while there was a dramatic increase in peroxidase activity and other changes in isoenzymes composition in the stems of tobacco attacked by the parasite.]


Tanruean, K., Kaewmarin, K., Suwannarach, N. and Lumyong, S. 2017. Comparative evaluation of phytochemicals, and anti diabetic and antioxidant activities of *Cuscuta reflexa* grown on different hosts in northern Thailand. Natural Product Communications 12(1): 51-54. [The assumed active metabolites in *C. reflexa* varied only moderately according to the hosts it was growing on, with some indication that highest anti diabetic and antioxidant activity was in the parasite growing on *Coccinia grandis* compared with that growing on *Ficus racemosa* and *Samanea saman*.]

Teixeira-Costa, L., Coelho, F.M. and Ceccantini, G.C.T. 2017. Comparative phenology of mistletoes shows effect of different host species and temporal niche partitioning. Botany 95(3): 271-282. [From 2016 IUFRO Conference. Studying the contrasting phenologies of *Struthanthus martianus* and of *S. flexicaulis* in relation to those of their host trees – whether deciduous or evergreen, concluding that these species show niche partitioning to avoid competition and emphasising the uniqueness of each host-mistletoe relationship.]

Tepe, I., Celeb, S.Z., Kaya, I. and Ozkan, R.Y. 2017. Control of smoothseed alfalfa dodder (*Cuscuta approximata*) in alfalfa (*Medicago sativa*). International Journal of Agriculture and Biology 19(1): 199-203. [In a field trial in Turkey, pre-emergence imazethapyr, and pre- and post-emergence imazamox, each applied in the first season suppressed *C. approximata* in lucerne during the first year, but the effect decreased in the following years and the treatments reduced crop yield in the third year.]

Trabelsi, I., Abbes, Z., Amri, M. and Kharrat, M. 2016. Study of some resistance mechanisms to *Orobanche* spp. infestation in faba bean (*Vicia faba* L.) breeding lines in Tunisia. Plant Production Science 19(4): 562-573. [Seven breeding lines were compared with the susceptible Badi, and found to have partial resistance to both *O. foetida* and *O. crenata*, associated with reduced stimulant exudation. Lines L6 and L7 were least affected. L5 was more parasitised but yielded better, suggesting tolerance.]

Trunschke, J. and Stöcklin, J. 2017. Plasticity of flower longevity in alpine plants is increased in populations from high elevation compared to low elevation populations. Alpine Botany 127(1): 41-51. [A *Euphrasia* species was involved in the study, but sadly the abstract does not indicate how it reacted.]


Vijay, C.R., Thriveni, M.C. and Shivamurthy, G.R. 2017. Seed surface micro morphological features of the holoparasitic angiosperm *Aeginetia* spp. (*Orobanchaceae*) in South India. Proceedings of the Indian National Science Academy 83(1): 197-201. [Detailing differences in the seed sculpturing of *Aeginetia pedunculata*, *A. sessilis* and *A. indica*, and noting these as a useful means to distinguish between the otherwise morphologically similar *A. pedunculata* and *A. sessilis*.]

and Borger, C. (eds) 20th Australasian Weeds Conference, Perth, Western Australia, 11-15 September 2016: 292-295. [In a trial aiming to determine effective eradication of Striga asiatica seeds from the soil in the area of Queensland where it affects sugar cane, after 6 months a sorghum catch crop gave the greatest reduction in seed viability, followed by the fumigants diazomat and ethylene. It is estimated that the seed bank could be exhausted in 3 years.]


*Wang, Z. et al. 2017. Rafflesia tuan-mudae (Campanulaceae) and in some large angiosperm plant individuals) of trnH-psbA were generated for 35 species (140 genera). PLoS ONE 12(2):e0170286.*

This paper reports a host range extension for *R. tuan-mudae* but also steps into the complex taxonomic and nomenclatural issue surrounding these host plants. Two important publications were omitted (Veldkamp 2008, 2009); if consulted, the name *T. rafflesiae* should have been corrected to *T. coriaceum*. The introduction uses an outdated concept of Rafflesiaeaeae (broad sense, circa Flora Malesiana 1997).]

**Wang Dan, Cao SiShuo, Kang Hua, Du Jun, Kuang Rong and Borger, C. (eds) 20th Australasian Weeds Conference, Perth, Western Australia, 11-15 September 2016: 292-295. [In a trial aiming to determine effective eradication of Striga asiatica seeds from the soil in the area of Queensland where it affects sugar cane, after 6 months a sorghum catch crop gave the greatest reduction in seed viability, followed by the fumigants diazomat and ethylene. It is estimated that the seed bank could be exhausted in 3 years.]


This paper reports a host range extension for *R. tuan-mudae* but also steps into the complex taxonomic and nomenclatural issue surrounding these host plants. Two important publications were omitted (Veldkamp 2008, 2009); if consulted, the name *T. rafflesiae* should have been corrected to *T. coriaceum*. The introduction uses an outdated concept of Rafflesiaeaeae (broad sense, circa Flora Malesiana 1997).]

**Wang Dan, Cao SiShuo, Kang Hua, Du Jun, Kuang Rong and Li Minjie. 2016. (Acute and sub-chronic toxicity of Ginkgo biloba and Cistanche tubulosa formula on rats.) (in Chinese) Northwestern Pharmaceutical Journal 31(6): 599-604. [Concluding that C. tubulosa formula is a non-toxic product up to 15 g/kg over 90 days in rats.]

**Wang DeYi, Wang Qiang, Wang YingLi, Xiang XiaoGuo, Huang LuQi and Jin XiaoHua. 2017. Evaluation of DNA barcodes in different large genera were obtained from Genbank, including Pedicularis 88 species (328 samples). A combination of ITS and matK, rbcL, trnH-psbA were generated for 35 species (140 individuals) of Codiropopis and the ability of these barcoding loci evaluated for this genus. Sequences from 7 other large genera were obtained from Genbank, including Pedicularis 88 species (328 samples). A combination of ITS and matK performed best.**

**Wang HongJuan, Li WeiTao, Liu YaNan, Yang FuSheng and Wang XiaoQuan. 2017. Resolving interspecific relationships within evolutionarily young lineages using RNA-seq data: an example from Pedicularis section Cyathophora (Orobanchaceae). Molecular Phylogenetics and Evolution 107: 345-355. [RNA-seq was applied to section Cyathophora (7 taxa, 4 species) to test whether different orthologous groups (OGs) can be combined for inferring phylogenies. The results showed that all OGs can be concatenated for phylogenomic reconstruction and interspecific relationships can be robustly inferred if ≥20 single-/low-copy nuclear genes or 25 OGs are used.]

**Wang Jia, Baskin, J.M., Baskin, C.C., Liu GuoFang, Yang XueJun and Huang ZhenYing. 2017. Seed dormancy and germination of the medicinal holoparasitic plant Cistanche deserticola from the cold desert of northwest China. Plant Physiology and Biochemistry 115: 279-285. [Germination of C. deserticola takes at least 60 days to germinate. The highest germination (54.4%) was for seeds incubated in a 10^{-3} M solution of fluridone in darkness in spring that had overwintered on the soil surface in the natural habitat. Apparently, breaking of physiological dormancy occurs first and then the embryo grows to a critical length (0.44 mm) without differentiation into organs prior to seed germination.]

**Wang YaJiao, Ji LiJing, Li QuSheng, Wang LianSheng, Xiao Ying and Kong LingXiao. 2016. Isolation and identification of multifunction bio-control agent Fusarium against Orobanche cernua.) (in Chinese) Chinese Journal of Biological Control 32(6): 788-793. [Of 20 strains of *Fusarium* tested, 4 proved safe to crops and strain Br-2 (probably *F. oxysporum*) promoted the growth of tobacco, pepper and watermelon, and also had the best control effect on *O. cernua*. Seed germination was reduced by 72%, and heights of tobacco, pepper and watermelon increased 123%, 62% and 29%, respectively.]

**Wang ZhiQiang, Hwang SeungHwan, Quispe, Y.N.G., Arce, P.H.G. and Lim SoonSung. 2017. Investigation of the antioxidant and aldose reductase inhibitory activities of extracts from Peruvian tea plant infusions.** Food Chemistry 231: 222-230. [Concluding that a locally used tea infusion of a Phoradendron sp. can have useful functions as an antioxidant, aldose reductase inhibitor and anti-inflammatory agent.]

**Waser, N.M., Price, M.V., Casco, G., Diaz, M., Morales, A.L. and Solverson, J. 2017. Effects of road dust on the pollination and reproduction of wildflowers. International Journal of Plant Sciences 178(2): 85-93. [Noting that 4 species including Castilleja sulphurea growing 1-2 m from a road received substantially more dust and less pollen than those growing 40-50 m away. But seed set was not necessarily affected. Possible mechanisms discussed.]**

**Watson, D.M. 2017. On tropical mistletoes: tractable models for evolutionary ecology, ecosystem function, and phytochemistry.** Botany 95(3): 211-217. [From 2016 IUFRO Conference. Confirming the role of tropical mistletoes as facilitators for plant communities and keystone resources for animal assemblages. Further suggesting that tropical mistletoes offer many opportunities for further research and represent models...**
useful in addressing unanswered questions in biology. A good review of research on mistletoe pollination, seed dispersal, and host-range.

Watson, D.M., Milner, K.V. and Leigh, A. 2017. Novel application of species richness estimators to predict the host range of parasites. International Journal for Parasitology 47(1): 31-39. [Using 3 mistletoe species Amymea lucasii, dependent on a single host species, Amyema quandang, dependent on hosts in one genus, and Lysiana exocarpi, dependent on many genera across multiple families, to assess a results-based stopping rule (stop sampling bioregion once observed host richness exceeds 80% of the host richness predicted using the Abundance-based Coverage Estimator) to predict host range.]

Wei JianTeng, Hu QingPing, Wang NingLi, Liu YeWei, Pei Dong and Di Duolong. 2017. Evaluation and application of a novel quantitative antioxidant activity assay based on cellular metabolomics. Chromatographia 80(4): 617-627. [Describing a novel quantitative antioxidant activity assay based on cellular metabolomics, which is used to confirm useful antioxidant activity in flavanoids from Cynomorium sorrangium ]

*Wei ShuGen, Ma XiaoJun, Pan LiMei, Miao JianHua, Fu YouQing and Tian ChengMing. 2017. Impact of Arcenezothium siciuanense infection on needles and current-year shoots of Picea crassifolia and Picea purpurea in Qinghai Province, China. European Journal of Plant Pathology 147(4): 845-854. [Results demonstrated that P. purpurea may suffer more negative effects induced by A. siciuanense infections at needle and branch levels than P. crassifolia.]


*Xoler, J., Lantuit, H., Fritz, M., Macias-Fauria, M., Myers-Smith, I. and Herzschuh, U. 2016. Vegetation composition and shrub extent on the Yukon coast, Canada, are strongly linked to ice-wedge polygon degradation. Polar Research 35: 27489. (http://www.tandfonline.com/doi/pdf/10.3402/polar.v35.27489?needAccess=true) [Noting that wetland and aquatic species, including Pedicularis sudetica, grow in low-lying centres of polygons and in troughs between polygons. Warming conditions are likely to see increased competition from shrubs.]

Xia Bo, Liu LiYing, Zhang QingHe, Han FuZhong, Luo YouQing and Tian ChengMing. 2017. Impact of Plectosphaerella cucumerina in Inner Mongolia, China. Plant Disease 100(12): 2538. [Recorded on Orobanche cumana.]

*Xu XiaoXue, Zhang ZhuanZhan, Wang WenPing, Yao HuiQin and Ma XueQin. 2017. Therapeutic effect of cistanoside A on bone metabolism of ovarictomized mice. Molecules 22(2): 197. [Finding that cistanoside A from Cistanche deserticola, by down-regulating TRAF6, coordinates the inhibition of NF-kB and stimulation of PI3K/Akt pathways to promote bone formation and prevent bone resorption, confirming its potential as a promising agent for the treatment of osteoporosis.]

Yan HongYu, Hu JiaLin, Bi Lei, Zhang Yuan, Yang Fei and Yang Guan'e. 2016. (Effects of Loranthus tanakae extracts on growth of Rhodospseudomonas palustris.) (in Chinese) ZhongGuo Weishengtaxixue Zazhi / Chinese Journal of Microecology 28(9): 1002-1004. [The growth of the photosynthetic bacteria R. palustris was promoted at low concentrations of L. tanakae extracts, but inhibited at high concentrations.]

Wiesenborn, W.D. 2016. Conspecific pollen on insects visiting female flowers on the oak parasite Phoradendron coryae (Viscaceae). Western North American Naturalist 76(3): 265-274. [P. coryae, parasitizing Quercus turbinella, appeared to be pollinated mostly by Attalus fuitlis beetles due to their apparent abundance and by Liohippelates flies due to their relatively high pollen loads.]

Wilson, C.A. and Calvin, C.L. 2017. Metadata provide insights on patterns of epiparasitism in mistletoes (Santalales), an overlooked topic in forest biology. Botany 95(3): 259-269. [From 2016 IUFRO Conference. A detailed review of epiparasitism in mistletoes. Most hosts of epiparasites are Loranthaceae, while the epiparasites are mostly Viscaceae. 27 may be obligate epiparasites. There are none on Misodendraceae and few on Santalaceae. In Phlocellaria (Amphorogynaceae) all species are obligate epiparasites, mainly on Loranthaceae.]

Ye XiaoXin, Zhang Meng, Dong ShuQi and Ma YongQing. 2017. Activity of compounds from Taxillus sutchuenensis as inhibitors of HCV NS3 serine protease. Natural Product Research 31(4): 487-491. [Concluding that flavonoids and diarylheptanoids were responsible for the anti-hepatitis C virus activity in the traditional Chinese medicinal, T. sutchuenensis and that these inhibitors might serve as potential candidate of anti-HCV agents.]

Yin XueZhe, Piao Long, Jin Aihua, Gao Peng and Quan JiShu. 2016. (Anti-angiogenic effect of iridoid glucosides from Boschniakia rossica in H1-derived mice.) (in Chinese) Food Research and Development 37(14): 1-4. [Iridoid glucoside from B. rossica exhibited anti-angiogenic effect against H2 hepatoma cells in mice, and its mechanism was probably related to down-regulation of HIF-1α and VEGF proteins.]


Yohannes, T., Ngugi, K., Ariga, E., Ahonsi, M., Yao, N. and Abraha, T. 2017. A diagnostic appraisal of sorghum farming in Striga endemic areas of Eritrea. Journal of Agricultural Science (Toronto) 9(5): 133-141. [In a survey of Striga hermonthica-infested areas of Eritrea, Striga was second only to drought as the most serious constraint to sorghum yields. The crop varieties most widely selected for these conditions were 31 landraces.]

*Yoo JaeMyung, Yang JuHye, Kim YoungSoo, Cho WonKyung and Ma JinYeul. 2016. Inhibitory effect of Loranthus parasiticus on IgE-mediated allergic responses in RBL-2H3 cells. Mediators of Inflammation 2016: Article ID 8742562. (https://www.hindawi.com/journals/mi/2016/8742562/)[Results suggest that the phenolic compounds or flavonoids contained in L. parasiticus (= Scurrulka parasitica) may be associated with anti-allergic activity.]

Yoo JaeMyung, Yang JuHye, Kim YoungSoo, Yang HyelJin, Cho WonKyung and Ma JinYeul. 2017. Inhibitory effects of Viscum coloratum extract on IgE/antigen-activated mast cells and mast cell-derived inflammatory mediator-activated chondrocytes. Molecules 22(1): 37. (http://www.mdpi.com/1420-3049/22/1/37/htm)[Concluding that extracts of V. coloratum possess both anti-allergic and anti-osteoarthritic properties such that they could be considered a new herbal drug for anti-allergic and anti-osteoarthritic therapy.].

Zamaloa, M.del C. and Fernández, C.A. 2016. Pollen morphology and fossil record of the feathery mistletoe family Misodendraceae. Grana 55(4): 278-285. [SEM and LM were used to examine pollen from 7 of the 8 species of Misodendrum. Cluster analysis of pollen characters differentiates two groups (subgenera Angelopogon and Misodendrum) consistent with a previous molecular and morphological study. Fossil pollen from Miocene clustered (using UPGMA) with subgenus Angelopogon.
whereas Eocene Misodendraceae were dissimilar to all extant Misodendrum.

Zare, G. and Dönmez, A.A. 2016. Fruit and seed morphology of the tribe Orobancheae (Orobanchaceae) genera in Turkey and its taxonomic significance. Nordic Journal of Botany 34(2): 178-190. [Describing four different patterns in anticlinal and periclinal walls - smooth, perforate, microfibrillar and granulate. The first corresponds to the genus Cistanche and Orobanche anatomica, whereas types II, III and IV were found in Diphelypaea, Orobanche and Phelipanche, respectively.]

Zhang Le, Zhao YunShan, Wang, Z.A., Wei KunHua, Qiu Bin, Zhang ChunHong, Wang-Müller, Q.Y. and Li MinHui. 2016. The genus Boschniakia in China: an ethnopharmacological and phytochemical review. Journal of Ethnopharmacology 194: 987-1004. [Reviewing the literature on B. rossica and B. himalica which have long been used in traditional Chinese medicine for their multiple therapeutic uses related to enhanced renal function, erectile dysfunction, defaecate and hepatoprotective. They are also used as dietary supplements in wine, cosmetics, and other healthy food.]

Zhang WieJie, Huang Jing, Wang Wei, Li Qian, Chen Zhang XinHua, Zhao JieTang, da Silva, J.A.T. and Ma Zhang Le, Zhao YunShan, Wang, Z.A., Wei KunHua, Qiu Bin, Zhang ChunHong, Wang-Müller, Q.Y. and Li MinHui. 2016. Evaluating fate of Viscum articulatum on Quercus balout using multivariate quadratic surface based function predictive model. In: Peshin, R., Dhawan, A.K., Bano, F. and Risam, K.S. (eds) Proceedings of the Indian Ecological Society International Conference, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, India, 18-20 February 2016 pp.489. (Showing that the main factor in favour of V. articulatum parasitising Q. balout in northern India is a western slope which is moist.)

IPPS MEMBERSHIP
Membership in the IPPS is open to individuals and organizations of all nations that are interested in the objectives of the Society. Membership fee for 2 years is 50 € and will be included in the registration for the IPPS meeting (WCCP). To obtain a Registration form visit the IPPS website (http://www.parasiticplants.org/) or contact: Dr. Philippe Simier Laboratoire de Biologie et Pathologie Végétales (LBPV) SFR 4207 Qualité et Santé du Végétal (QUASAV) Université de Nantes 2 rue de la Houssinière BP 92208 44322 Nantes Cedex 03 France - philippe.simier@univ-nantes.fr,

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Send material for publication to any of the editors.

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MESSAGE FROM THE PRESIDENT

Dear IPPS members,

I would like to wish everyone a very happy New Year!

In November this year the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in collaboration with the Biosciences eastern and central Africa – International Livestock Research Institute (BecA- ILRI) Hub, organized a two-day Striga workshop on ‘Renewed Strategies for Striga Management’. The workshop brought together ideas from stakeholders and experts in different areas of Striga management and research to discuss the current status of Striga control, the impact of available technologies and new developments in Striga research worldwide with the aim of improving Striga control. The meeting was extremely interesting and one outcome was the idea to form an ‘Alliance for Striga Control in Africa’ that would define and make recommendations for Striga research investment that would hopefully result in improved strategies for control of Striga in the near future. For an overview of this meeting please see the article written by Jerome Bossuet from ICRISAT India (http://news.trust.org/item/20171208092958-qfxpo/) (see also below under Press Reports)

Next year looks like a very busy year for meetings involving parasitic plants! There are already four conferences with likely sessions on parasitic weeds: the 28th German Conference on Weed Biology and Weed Control in March in Braunschweig, Germany, the 18th European Weed Research Society Symposium in June in Slovenia, the 7th International Food Legume Research Conference, Marrakech, Morocco, and the 4th International Conference on Agricultural and Biological Sciences in Habzhou, China. Further details can be found under Forthcoming meetings. Details of other meetings and of the venue for our next WCPP meeting in 2019 will appear in the next issue of Haustorium.

With very best wishes for a successful 2018

Julie

Julie Scholes, IPPS President (j.scholes@sheffield.ac.uk)

MEETING REPORTS


The 17th International Botanical Congress was held from July 23-29 in Shenzhen, China. Nearly 7000 participants from 109 countries attended the congress. In total, 212 symposia belonging to six themes were organized, with 1447 oral presentations and 51 specially invited lectures (5 public lectures, 12 plenary lectures and 34 keynote lectures). The weeklong gathering of scientists from all around the world over such a broad scope greatly facilitated academic exchanges across disciplines and encouraged the participants to think outside the box for a better understanding of their research questions. Abstracts can be downloaded at http://www.ibc2017.cn/Download/.

Symposium: Ecology and Evolution of Parasitic Plants

The keynote lecture by Claude dePamphilis, began with a brief introduction to 11 primary lineages of haustorial parasitic plants. The focus was then on data from the Parasitic Plant Genome project and how stage-specific transcriptome data, mainly from Phelipanche aegyptiaca, Striga hermonthica, and Triphysaria versicolor, has led to the discovery of a set of evolutionarily conserved ‘parasite genes’ that are upregulated in parasitic processes of the different parasites, and originated from both Old and New genes that evolved haustorial expression and function. Manipulation of the expression of these genes is helping to understand parasite processes and suggesting ways to interrupt the parasitic process. Stolen genes, obtained via functional horizontal gene transfer (HGT) from ancient host plant lineages, and now expressed in haustorial processes form a third category of parasite genes that can be detected through careful bioinformatic analysis in Orobancheae and also in Cuscuta where especially large numbers of HGT events are being detected.

The power of comparative transcriptomics was leveraged also by Yasunori Ichihashi, to get the first glimpse at stage-specific gene expression patterns in three different parasite lineages (Orobanchaceae, Cuscuta, and Thesium chinense). A new low cost method of RNA-seq library construction was used. Comparisons of Striga and Cuscuta showed stage specific expression patterns, with many similar gene categories being enriched in haustorial libraries. A gene co-expression network found 200 robust hub genes in the Cuscuta haustorium cluster. Related genes, encoding a plant-specific transcription factor, Late Organ Boundaries Domain (LBD), is upregulated in haustoria in all three groups. This suggests that recruitment of LBD genes that serve as key developmental regulators may enable the evolution of haustoria in parasitic plants. Functional analysis is underway, with an initial experiment showing that a promoter sequence cloned from Phtheirospermum japonicum (Orobanchaceae) LBD gene drives strong expression in specific haustorial cells of this parasite.

Joshua P. Der provided an overview of the astounding
diversity of structure and parasitic ability in plants of Santalales, the largest and one of the oldest groups of parasitic plants. Non-parasites, facultative parasite, obligate parasites, trees, shrubs, mistletoes, and highly modified holoparasites (Balanophoraceae) are all found in this order of 160 genera and over 2200 species. He then presented the history and current status of phylogenetic classification of the sandalwoods, which has remained challenging in part due to extremely divergent or missing plastid genes in the holoparasites that made the relationships of Balanophoraceae very difficult to resolve. Published classifications have also disagreed on how many families should be recognized, even when referring to the same phylogenetic evidence. Recent phylogenies, based on seven shared nuclear, mitochondrial, and plastid sequences provide a well-supported backbone phylogeny that places Balanophoraceae confidently within Santalales. Der has launched an extensive new genome sequencing effort of 51 diverse Santalales species from 17 of 18 family-level clades, ‘skimming’ of data from all three genomic compartments that is rapidly expanding the molecular evidence available for high resolution phylogenetics. Alignments and phylogenies using multiple phylogenetic methods, provide 100% bootstrap support for all previously recognized families, and added resolution many areas in the tree, allowing inference of the evolutionary history of the mistletoe habit as well as further insights into relationships among major lineages within the order.

Lyton Musselman presented a study led by doctoral student Nicholas Flanders on factors that determine the distribution of the oak mistletoe, Phoradendron leucarpum, in the eastern United States. Although capable of parasitizing a wide range of hosts, P. leucarpum often has a narrow host range at a given location. What are the factors that determine host preference in a given area, and how are these patterns established and maintained? A combination of local census data and experimental plantings found overall Quercus nigra was the most common host, but maples were most common in other areas, intensity of parasitism varies from location to location. Experiments were done to investigate possible responses to volatile monoterpane cues. Statistical analysis found no significant relationship between local light level and seedling survival and establishment, but hosts in wetlands were more frequently parasitized than the same host species in drier uplands. The foraging and movement patterns of avian frugivores like the cedar waxwing likely play a more influential role in determining the observed host preferences at a given site.

Ai-Rong Li described a rapid and very recent range expansion involving the hemiparasitic Pedicularis kansuensis in western China. In just two decades, P. kansuensis has expanded into large tracts of grassland, reducing foraging quality, and threatening the local livestock industry. Dr. Li’s group is performing lab- and field-based experiments to understand what is behind this aggressive expansion and discover potential strategies for limiting its success. P. kansuensis appears to maintain high genetic variability as well as morphological and phenotypic plasticity, and like other Pedicularis species is a generalist species with many potential hosts. Imbalanced N:P ratios have a strong impact on P. kansuensis and the surrounding plant community. Results also indicate that shifts in climate are favoring P. kansuensis, as do monocultures of highly suitable hosts, overgrazing and degradation of soil quality, transport of contaminated seed lots, and a frequent lack of understanding about the dangers posed by this newly invasive species.

Peter Toth provided a fascinating analysis of plant-herbivore chemical interactions involving an oligophagous fly, Phytomyza orobanchia, that consumes the seed capsules of broomrape (Orobanche and Phelipanche species), and could act as a potential biocontrol agent for the parasites. Using Y-shaped tubes that allowed flies to choose whether to move toward either host plant or parasitic plant volatile compounds, flies were shown to be attracted by volatile chemical signals emitted by the parasites. Next, organic compounds were collected from 21 different broomrapes and their hosts, and subjected to GC-MS analysis, finding 40 mutually shared volatile compounds in all broomrapes tested. Then, detached antennae were used to measure antennal responses to the chemical signals, making it possible to pick out specific compounds that stimulated an antennal response. From a huge number of detected volatile compounds – about 150 compounds per species - field tests identified ones that were relatively attractive to P. orobanchia. Compounds eliciting a large response in the fly antenna included 3-octanol, nonanol, and tricosane, but mixtures of these three in specific ratios were particularly attractive to the fly. The results could be leveraged to create traps that could help to attract seed predators to broomrape infested fields.

Alex Twyford is using high resolution morphometrics and genome scale molecular evidence to better understand a taxonomically complex group of hemiparasites, the British eyebrights (Euphrasia spp.). Euphrasia plants and flowers are small and species display extensive phenotypic variation when grown on different hosts, leading to highly divergent classifications and recognized species numbers. Charles Darwin himself found this group to be particularly perplexing, and hoped that an energetic young scientist would one day devote himself to its solution, as Twyford is now doing! A huge common garden experiment was performed with many species grown on multiple hosts. Large host-induced phenotypic
differences were observed within and among species, but taxonomically important species traits remained relatively stable, providing support for recognized species. In contrast, ITS sequencing gave no species resolution, but did detect deeply diverged diploid vs. tetraploid lineages. Large scale genetic evidence from provided with genotyping by sequencing (GBS), resolved eight very clean clusters, some corresponding to species, and others corresponding to geographical areas such as a single island, suggesting the possibility of hybridization in local areas. This led to the important conclusion that species differences in Euphrasia could be due to differences in relatively small parts of the genome, and maintained by divergent natural selection. Susanne Wicke provided a rigorous examination of the evolution of organellar genomes and how nuclear data are helping to better understand the biology and molecular evolution of Orobanchaceae with different degrees of heterotrophic dependence. Due in large part to data generated and analyzed by Dr. Wicke and colleagues, recent years have seen major steps toward the development of a comprehensive understanding of evolution of plastid genomes in parasitic Orobanchaceae. Plastid genomes undergo rampant - and surprisingly rapid - genome reduction and gene loss, as well as accelerated rates of sequence evolution with increasing heterotrophy. In contrast, mitochondrial genomes expand in size in more heterotrophic parasites. Nuclear gene data displays a surprising retention of nuclear-encoded components of photosynthesis-related genes, suggesting a slower loss process in the nuclear genome as compared to the plastome. Shifts in rates of molecular evolution and functional constraint can be detected in parasitic plants in hemiparasitic lineages long before the loss of photosynthesis. Wicke described a co-evolutionary feedback loop that progresses at different rates, but affects all three genomic compartments.

This session was co-chaired by Wenbin Yu and Airong Li under the theme Taxonomy, Phylogenetics and Evolution. Six speakers were invited (as below). Similar to research in other plant groups, investigations of taxonomy, evolution, and symbiotic interactions involving parasitic plants at genomic levels have been hot topics that contribute greatly to our understanding of plant parasitism.

Claude dePamphilis - Genomic and evolutionary insights into being a parasitic plant: old genes, new genes, stolen genes.
Yasunori Ichihashi - A potential key factor for the evolution of parasitic plants.
Joshua P. Der - Phylogenetic analysis of relationships within the sandalwood order (Santalales).
Lyttone J, NMusselman - The role of generalist avian frugivores in determining the distribution of the mistletoes Phoradendron leucocarpum.
Ai-Rong Li - What makes Pedicularis kansuensis a successful invader?

Symposia - The biology of mycoheterotrophic plants
Sasa Stefanovic - Comparative plastome genomics in Ericaceae: plastid gene losses and rearrangements across all trophic levels
Gerhard Gebauer - Partial mycoheterotrophy is more widespread among orchids than previously assumed: A multi-element stable isotope natural abundance approach
Vincent Merckx - Arbuscular mycorrhizal interactions of mycoheterotrophic plants
Sofia Gomes - Global distribution of mycoheterotrophic plants
Sean Graham - Organellar phyllogenomics and molecular evolution in mycoheterotrophic plants
Craig Barrett - Plastid genome evolution in mycoheterotrophic orchids
E. Shepeleva - Phylogenetic Analysis of the Mycoheterotrophic Genus Thismia (Thismiaceae, Dioscoreales) Based on Molecular and Morphological Data
Lorenzo Pecoraro - Mycorrhizal Diversity and Nutritional Strategies in the Fully Mycoheterotrophic Orchid Epipogium roseum
Claude DePamphilis - Phylotranscriptomic Analysis of Mycoheterotrophic and Non-mycorrhizotropic Lineages in the Pandanales and Dioscoreales

AiRong Li and Claude de Pamphilis


Relevant presentations:
Shayanowako, A.I.T et al. - Screening maize for compatibility with F. oxysporum to enhance Striga Asiatica (L.) Kuntze. resistance
Na Zhang et al. - iTRAQ-based differential expression proteomics in roots of sunflowers differing in resistance to Orobanche cumana
Cumali Ozaslan et al. - Broomrape infestation in lentil crop and farmer knowledge on the management of parasitic weed species in Diyarbakr province, Turkey
Anil Kumar, R. et al. - Herbicidal management of parasitic Dendrophthoe in semi- temperate and temperate fruit crops of Jammu-Kashmir Himalayas
Amino acids for parasitic weed management.

Amino acids are the building blocks of proteins for all biota in agricultural systems. They are intermediaries in the soil nitrogen cycle between degradation of decaying organic matter and the mineralized nitrogen forms ammonium and nitrate. In addition, amino acids appear in the rhizosphere as a result of lysis and active efflux from microbial and plant root cells. While plants and microbes prefer to uptake inorganic nitrogen, they also present the capacity for taking up amino acids using different transport processes that present increased molecular complexity (Owen and Jones, 2001; Nasholm et al., 2009). An increased crop ability to uptake amino acids from the rhizosphere is an interesting trait to select for low nitrogen-input agronomic systems that rely on organic matter (Reeve et al., 2009; Moe 2013). Besides their role as a nitrogen source, the abundance and content of amino acids in the rhizosphere affect microbial phenotypes relevant for rhizosphere function. Microbial motility, colony development or sporulation are known to be influenced by amino acids (reviewed in Moe 2013). On the other hand, certain amino acids toxic to the microbial community are deposited in the soil by some particular species of rhizospheric biota which do not succumb to their own delivered toxicity suggesting a function in ecological niche colonization (Valle et al., 2008). Microbial-derived efflux of amino acids can also be toxic for plants. As an example, Frenching disease is a crop physiological disorder caused by high levels of isoleucine efflux by saprophytic rhizobacteria. In Frenching soils, susceptible crops develop symptoms of chlorosis, wilting and stunting (Steinberg 1946).

Plant growth inhibition observed by abundance of certain amino acids is usually the result of the activation of negative feedback during amino acid biosynthesis. This is the case with branched enzyme networks such as the biosynthesis of aromatic, branched-chain or aspartate-derived amino acids. This regulatory mechanism maximizes efficient exploitation of resources preventing too much of a specific product to be made in detriment of other products that the cell needs as well. Too much of a specific end-product shuts off its production by deactivating an enzyme participating in its synthesis. In some cases, the deactivation of the enzyme induces starvation for other amino acids produced in parallel. For example, in the above-mentioned Frenching disease, high levels of isoleucine efflux by saprophytic bacteria causes the inhibition of acetolactate synthase (ALS) an enzyme in the branched-chain pathway causing valine and leucine starvation. Similarly, key enzymes in the aspartate-pathway of amino acid synthesis can be deactivated by abundance of lysine or threonine or their combination causing methionine starvation. On occasions, such inhibition phenomena limit protein synthesis and growth and can be abolished by exogenous provision of the offended amino acid (Piryns et al., 1988; Henke et al., 1974).

The patterns of amino acid inhibition and rescue depend on a variety of factors including plant species, plant growth stage and amino acid concentration (Henke et al., 1974) which are exploitable in crop protection in order to differentially target pests without detrimental inhibition for the crop species. In fact, several crop protection methods are inspired by the natural process of amino acid inhibition. For example, herbicides such as imidazolinones and sulfonylureas inhibit the enzyme ALS, slowly killing the weed by starving it of branched-chain amino acids (Duggleby et al. 2008). Another example is the use of mycoherbicides with enhanced efficacy against weeds through increased efflux of amino acids toxic to the target weed. Such is the case of the 45- to 65-% enhancement of mortality observed in wild hemp treated with valine-overproducing variants of the mycoherbicide Fusarium oxysporum f. sp. cannabis in comparison to the weed control obtained with the wild-type F. oxysporum f. sp. cannabis strain (Tiourebaev 1999; Tiourebaev et al. 2001). Another alternative is based on the innate ability of allelopathic crops to naturally compete against weeds. Plants deposit root exudation a complex collection of chemicals with amino acids being the second most abundant class of compounds exuded (Jaeger et al., 1999) which in some cases include amino acids acting as natural herbicidal weapons. Such is the case of roots of festuca grasses that exude a potent herbicidal amino acid m-tyrosine whose weed killing action is probably caused by negative feedback for phenylalanine biosynthesis in weeds growing around them (Bertin et al., 2007). Finally, the direct application of inhibitory amino acids to agricultural soils has been effective not only for the control of weeds such as Canada thistle, red brome grass, kudzu and cannabis (Sands and Pilgeram 2009) but also other pests such as plant-parasitic nematodes (Zhang et al., 2010).

Broomrapes (Orobanche and Phelipanche species) are holoparasitic weeds that attack crops withdrawing nutritive resources from their roots via haustorial connections (Parker 2013). They are very difficult to control because once seedlings of broomrape weeds attach to the crop root they merge as a whole organism. It becomes very difficult to inhibit the development of broomrape without damaging the crop. Although broomrapes depend on the crop for essential inorganic and organic resources, they possess their autonomous amino acid biosynthesis pathways which are targeted by the amino acid-inhibiting herbicides glyphosate, imidazolinones and sulfonylureas (Dor et al., 2017). Those herbicides are delivered on the foliage of an
herbicide-tolerant crop and transported downwards to the underground parasite across the haustorium (Eizenberg et al., 2013). Those herbicides exert the inhibitory action on the aromatic and branched-chain amino acid-biosynthesis pathways locally in the parasite by inhibiting the parasite encoded EPSPS and ALS without affecting amino acid synthesis in the crop which has been selected to resist the herbicide (Dor et al., 2017). A biotechnological alternative to amino acid-inhibiting herbicides could be engineering future transgenic crops harbouring silencing constructs against the broomrape-encoded ALS or EPSPS genes. Silencing signals that specifically target the expression of parasitic weed-encoded genes have been proved to translocate across the haustorium (Tomilov et al. 2008, Aly et al., 2009).

Parasitic weed growth is inhibited by exogenous application of specific amino acids but their mode of action has not been revealed (Vurro et al., 2006; Nzioki et al., 2016; Fernandez-Aparicio et al., 2017). The lack of identification of amino acids that abolish the inhibition renders uncertain whether the inhibitory action observed is caused by specific antimetabolite effect in which negative feedback triggered by the inhibitory amino acid causes starvation for another amino acid essential for parasitic weed growth or, by a separate phenomenon of general amino acid toxicity, of yet unknown molecular basis. Anyway, the effect of amino acids in weed parasitism is considered valuable for developing alternative control strategies because it has the potential to develop species-specific pesticides due to the differential inhibition patterns between parasitic weed species and also between parasitic weed species and their crop hosts. This strategy also has the potential to develop pesticides with low persistence in the soil as the applied amino acids is expected to be rapidly depleted by soil-dwelling microbes (Jones and Kielland, 2012). Preliminary steps towards including amino acids in sustainable management strategies have been taken. For example, the germination of Phelipanche ramosa and Orobanche minor is inhibited by amino acids such as methionine at concentrations that are not inhibitory to their respective hosts tomato and red clover. Leucine and tyrosine are toxic to Striga hermonthica but innocuous to its host maize. The effects of these amino acids at field scale have been investigated in crops of red clover and maize respectively using strategies of direct soil application of methionine or using bioherbicides with high levels of leucine and tyrosine efflux. Both techniques showed significant reduction levels of parasitic weed infection (Nzioki et al., 2016; Fernandez-Aparicio et al., 2017). In addition to amino acid application via direct delivery or microbial efflux, the potential of root exudates containing orobanchicidal amino acids can be investigated in strategies of cover crops or intercrops. For example, root exudates of clover, a host crop for O. minor but not for P. ramosa are rich in glycine (Lesuffleur et al., 2007). Interestingly, glycine is reported to be a strong inhibitor of P. ramosa (Vurro et al., 2006), while it does not inhibit O. minor germination (Fernandez-Aparicio et al., 2017). Deploying such an approach opens the way to the design of sustainable alternatives finely crafted against the specific local weed problem. Another possibility could be selecting crops with altered amino acid exudation. In rhizotron experiments performed in our lab, Phelipanche seeds showed reduced capability to infect roots of tomato plants with increased efflux of lysine. This preliminary information warrants further investigations towards putting amino acid-based techniques into commercial practice for parasitic weed control.

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STRIGA ASIATICA IN RWANDA

In August 2017 I was part of an Anglican mission team partnered with ECHO (https://www.echonet.org/), an NGO that works with subsistence farmers. We conducted a training session in the village of Mybo, southeast of the Rwandan capital of Kigale. My part of the endeavor was a presentation on parasitic weeds. In my African experience I never thought of Rwanda as having a serious witchweed problem. But when I asked the farmers if they knew the plant based on images I showed, they said they were familiar with the parasite. So I asked them to bring plants from their farms to the next day’s session. To my amazement 18 of the approximately 35 farmers brought bunches of Striga asiatica from their farms, many of them in flower. These plants showed the typical habit of the parasite and had crimson flowers. They were obviously at the end of their growing season as most plants were loaded with seeds.

The crops that were reported as being affected were maize and sorghum. One farmer told me that 15 years earlier his maize field was so heavily infested that he stopped growing maize. After this interval he planted maize again earlier his maize field was so heavily infested that he stopped growing maize. After this interval he planted maize again...
PRESS REPORTS

Weeding out Striga from African drylands

Striga experts from Europe, USA, Africa and Asia gathered for two days 28-29 November 2017 at the Biosciences Hub for Eastern and Central Africa (BecA) in Nairobi to discuss viable options for tackling this weed that has plagued sub Saharan African agriculture for decades. Despite its striking purple flowers and potential medicinal uses, the parasitic (nutrient sap sucking) Striga weed or witchweed is no innocent pest. A lasting and very damaging weed for the major cereal crops in sub-Saharan Africa, it can cause up to 100% crop losses across millions of hectares of farmland and an annual loss of several billion dollars.

Once the field is infected with Striga, farmers can’t get rid of this pest easily. Like black dust, these tiny seeds produced in large quantities – one spikelet can produce over 50,000 seeds - spread rapidly within the farming community. The seeds can remain viable for up to 20 years under the right conditions until a host plant, usually a cereal crop like rice, maize, sorghum or millet, emits germination signal molecules called strigolactones at the root zone. The invisible pest develops underground, sucking life from the host root. After a month when it appears over ground, it is almost too late.

Researchers and practitioners have been on the case for decades, yet paradoxically, we still don’t know enough about the extent and intensity of Striga invasion, judging by the differences in the figures on damage impact circulated by different scientists during the workshop. And although Striga biology is now understood up to the molecular level, some practical aspects are not necessarily grasped by smallholder farmers. A young farmer who had just inherited a pristine plot of land borrowed ploughing equipment used in his father’s Striga-contaminated fields and ended up spreading the weed in one season.

Julie Scholes, a professor from Sheffield University in the UK says there is still a lot to discover at molecular level on how Striga and host plants interact. She uses rice as one of the host plants, which she inoculates with Striga seeds under rhizotrons, large perplex root chambers that facilitate easier observation of Striga invasion of the host and its development. Her work shows that there are different Striga ecotypes with varying levels of aggression depending on host plant and agroecologies.

It has been observed that poor soil fertility and drought are worsening Striga infection. Harro Bouwmeester, a professor from the University of Amsterdam has researched how soil fertility could affect plant signalling during Striga interaction with the host. He reports about 20 different types of strigolactones that may or may not be specific to the host. Experiments in West Africa showed that in phosphate deprived soils, sorghum host plants were producing more strigolactones. On the contrary, phosphate fertilization could reduce Striga occurrence by 40 to 80% and improve sorghum harvests by up to 142%. However, similar experiments in maize fields in Eastern Africa showed less effect with nitrogen fertility levels. It shows that further soil and water management research is needed to better understand which soil qualities could block or slow Striga infestation.

Prof Abdalla Mohammed who has been breeding Striga tolerant sorghum varieties using molecular marker-assisted technologies calls for integrated Striga management options combining soil fertility improvement, collective weeding, water conservation and use of improved seeds, as experienced by ICRISAT in Mali.

Many approaches have been tested to fight Striga with varying levels of success. These range from low tech solutions, like the use of trap crops, like desmodium a cover crop that induce “suicidal germination” of Striga seeds without allowing the Striga plantlet to anchor to their roots, to more sophisticated practices, like seed treatment – eg IR maize popularized by the African Agricultural Technology Foundation - or the development of Striga resistant crops through plant breeding. Most experts admit that adoption of such innovations has not been high in many African countries although there are limited studies to explain the observed low adoption among farmers.

While Jeff Ehlers, senior programme officer at the Bill and Melinda Gates Foundation recalled working in Western Kenya in late 1980s with 6 million people affected by the weed at the time, recent statistics provided by agricultural economist Hugo deGroot at CIMMYT, who studies Striga economics for years, shows that in many parts of Africa, the scenario unfortunately worsened with even more people affected.

There is a call to form an Alliance for Striga Control in Africa which could define a common research for fast action agenda to fight Striga and mobilize governments to reclaim Striga infested lands. Like the Economics of Land Degradation Initiative built a case assessing the global cost of inaction on soil fertility, Striga experts need to build a narrative on why the fight against Striga is still so important today.

Dr Senait Senay, research associate on ecological informatics at International Science & Technology Practice and Policy (INSTEP), shows how mapping scenarios of pest invasions can help prioritize geography of interventions, evaluate costs and benefits of eradication programmes. The GEMS platform
(GEMS stands for Genetics x Environment x Management x Socioeconomical data), modelling presence and absence of a pest – *Striga* in this case – against layers of environmental data like climate, soils, can then map the risks of *Striga* infestation now and in the future.

There is an urgent need to work with farmers and social scientists to understand what would trigger adoption or rejection of some interventions. The push pull approach for instance may be effective in pilot testing but farmers who practice intercropping may not want to replace essential food crop like groundnut with *desmodium* intercrop. While breeding for resistance, plant scientists should consider that farmers may reject a new variety if the shape of the plant, taste and colour of grain are far from their usual expectations.

We need to look at the practicalities, access and affordability of the solutions and ensure we use a multidisciplinary approach including microbiologists, breeders, agronomists, soil scientists, economists and sociologists.

Jerome Bossuet, ICRISAT
Friday, 8 December 2017

**Purdue poised to improve sorghum for millions with $5 million grant**

Gebisa Ejeta, a distinguished professor in the Department of Agronomy at Purdue University, has received a $5 million grant from the Bill & Melinda Gates Foundation to further his team’s research on stronger varieties of sorghum. Purdue University scientists will develop stronger, more versatile varieties of sorghum that have the potential to reach millions of African farmers. The foundation’s grant is the second for Gebisa Ejeta, a distinguished professor in the Department of Agronomy and director of the Purdue Center for Global Food Security.

Ejeta (above), the 2009 World Food Prize laureate, was recognized for his work in developing and distributing high-yielding varieties of sorghum that are also drought-tolerant and resistant to *Striga*, a parasitic weed that robs maize, sorghum, rice, pearl millet and sugarcane of necessary nutrients. *Striga* can devastate a crop and impacts more than 100 million people in Africa.

Over the last four years, Ejeta, along with his students and research collaborators, uncovered the basic genetic and biological processes that control *Striga* resistance in sorghum. They identified a gene involved with the release of a chemical from sorghum roots that signals *Striga* seed to germinate and attach to those roots. That has led to the creation of new sorghum varieties that combine *Striga*- and drought-resistance more readily using molecular technology. So far, 961 tons of seed have been distributed to more than 400,000 farmers in Ethiopia and Tanzania. ‘With more high-throughput phenotyping and the ability to sequence a large slate of genotypes, we identified an important gene that is foundational for imparting *Striga* resistance,’ Ejeta said. ‘It helps to move that gene with confidence and consider new ways of exploiting that gene. Some of that we’ve already been working on.’

This next phase of the program will focus on advancements in biological research, specifically identifying more genes involved in imparting broad-based and durable *Striga* resistance in sorghum and other crops. ‘We would have multiple genes that we can move around and pyramid together, so there is no risk of one gene breaking down in the future,’ Ejeta said.

The new project will expand to support researchers in Tanzania, Kenya, Rwanda, Sudan, Niger, Nigeria, Burkina Faso and Mali to develop a breeding pipeline for more high-yielding, nutritious, disease-resistant and drought-tolerant varieties of crops. The project plans to support private seed systems that will distribute high-quality hybrid sorghum seeds more effectively in those countries. ‘This creates opportunities for farmers and small businesses to engage in gainful employment and develop the agricultural industry in these countries,’ Ejeta said.

Brian Vallheimer,

**Kenyan scientists find new *Striga* resistance genes in wild sorghum**

Wild sorghum will soon provide a reservoir for resistance genes against *Striga*. A research team lead by Dr. Steven Runo of the Plant Transformation Laboratory (PTL) at Kenyatta University and Professor Michael Timko of University of Virginia has identified three wild sorghum accessions resistant to *Striga hermonthica* (witchweed), a parasitic plant devastating cereal production in Sub-Saharan Africa. *Striga* is a
growing pandemic in Africa and Asia, with ability to destroy a crop with up to a 100% yield loss. Today, 300 million farmers from over 25 countries in Sub-Saharan Africa incur losses in excess of $7 billion annually due to *Striga* infestation. Covering over 100 million hectares, the weed has particularly established host in key regional staple crops maize, sorghum, millet, and upland rice, greatly undermining the efforts to attain food security and economic growth. In a regional collaborative research programme published in Frontiers in Plant Science, the team reports having found potential sources of mechanical and biochemical barriers to *Striga* infection that could be employed in genetic improvement of cultivated sorghum. Wild sorghum immune to *Striga* infestation coexists with the parasite in uncultivated lands in northeastern Africa. This offers an opportunity to pinpoint key resistance genes in wild sorghum that can be stacked in farmer-preferred varieties. This study provides a potential to increase the genetic basis of cultivated sorghum with wide-reaching implications for *Striga* control in other cereal crops by pyramiding multiple resistance genes.

(For more information: e-mail mkarembu@isaaa.org)

Biotechnology News. Outlooks on Pest Management, December 2017

Why the evolutionary link between flowerpeckers and mistletoes is crucial to the forests

(abridged)

Mistletoes sustain a large number of species worldwide – flowerpeckers, the barbet-like tinkerbirds of Africa, the mistletoebird and honeyeaters of Australia, the sunbirds and white-eyes of Asia, mouse lemurs and sifakas of Madagascar, tyrant and silky flycatchers and colocolo oppossums of the Americas, the eponymous mistle thrush of Europe, myriad insects and other creatures.

You would hardly notice a flowerpecker in the rainforest – the bird is small enough to hide behind a leaf or to hold in a closed fist, and drab enough to escape the attention of anyone but an ardent birdwatcher. The undistinguished little bird is dull olive brown on top and a rather dingy white below, with a sharp, glinting, dark and attentive eye and a gently curved beak to poke among the flowers. A metallic, fidgety tick-tick-tick call announces her presence as she darts through the boughs. You have to be quick to spot her before she disappears.

I’ve traveled far from my home in the mountains of the Western Ghats in South India, to see this flowerpecker. And not just any plain flowerpecker, but a particular one: a bird flitting among the mistletoes on the same trees where I had seen the species two decades earlier. I am seated on the steps of the Dampatlang watchtower in Dampa Tiger Reserve in Mizoram. Seated two stories high on the watchtower, I am almost eye-to-eye with the flowerpecker. The bird flits from branch to branch, dives into each mistletoe cluster, peeking, probing, seeking with eye and beak. Flowerpeckers remain closely tied to the mistletoes that grow on trees. Their territories span a few hectares at most. The birds consume mistletoe flower nectar and fruits, but this is a two-way relationship. The birds pollinate the plant’s flowers and disperse its seeds.

Mistletoes have tube-like flowers. When probed by a flowerpecker’s beak, these flowers part like a curtain or pop open, dusting the bird’s head and face with pollen. After the bird sips the sugary nectar with a special tube-like tongue (who needs a straw when your tongue can roll into one?) she flies to the next flower, rubbing off some of the pollen onto the flower’s receptive female parts, triggering the latter plant’s reproduction.

Despite the flowerpecker’s name, the birds remain fruit-lovers at heart. Mistletoes often have long and overlapping flowering and fruiting seasons so there is always food for a hungry flowerpecker to find. Ripe mistletoe fruit never fails to attract flowerpeckers. The
plain flowerpecker and its close cousin in South India, the Nilgiri flowerpecker, manipulate mistletoe fruits in their beaks to gently squeeze the seed from the pulp. They swallow the sugary, nutritious pulp and wipe their bills on twigs to remove the sticky seed. If the flowerpecker swallows the fruit, the seed passes rapidly through the bird’s gut to be excreted out. To remove the still sticky seed, the birds wipe their rears on twigs or tree branches. In either case, these actions have the same result, which biologists call directed dispersal: the mistletoe seed gets planted where it is likely to germinate.

An hour later, I leave with the sense that there is more to this than just a symbiotic evolutionary link between bird and mistletoe in a forest webbed with ecological connections. Perhaps, behind the gleam of that flowerpecker’s eye, there resides, too, a desire to cultivate and protect what she consumes and an aesthetic to adorn the trees in her forest with the prettiest little plants she can find.

TR Shankar Raman is a scientist with the Nature Conservation Foundation, Mysore. His email address is: trsr@ncf-india.org

Mistletoe – WD-40?
(This appeared as a Google Alert, August 2nd 2017. We shall be interested to learn if anyone has any experience of the technique.)

Question: I read your column regularly and am interested in the one on mistletoe. I lived in Sierra Vista for 10 years and had five mature mesquite trees that had mistletoe on them. A friend who had lived there for 20 years had a new way to get rid of the parasite. He told me an entomologist friend told him that WD-40 would stop or slow down the mistletoe’s return. His instructions were: First cut small branches off at 12 to 14 inches below the growth. Be sure to clean up the stems that come off while removing them. When it’s on large branches or the trunk, skin all the mistletoe down to the bark. Spray this area right after with WD-40. The next day, spray again. Watch the spots and if any new sprouts return, do the same thing, the sooner the better. In the remaining years I lived there, it didn’t return in those spots and very few new sprouts ever came out. His theory was that WD-40 followed the ingrown fiber of the mistletoe and killed it, like it follows rust on a nut and bolt and softens it.

Answer: Cutting the small branches below the growth is an effective way to reduce the mistletoe if the infection is caught early enough. I hadn’t heard of the WD-40 method. The ingredients of WD-40 are a secret according to the manufacturer, so it’s hard to be sure of its toxicity to plants. So there might be something to this method, but because we have no research to back it up, it is still a theory. Otherwise, WD-40 is hazardous to breathe, ingest and get on your skin, so be careful when using this product. It is also not registered as an herbicide, so it’s technically illegal to use it as such.

This parasitic vine helps plants communicate

Dodder vines (Cuscuta species) can tap into multiple hosts, causing damage but also providing botanical wires that let host plants share valuable information.

Plants are quietly communicating all around us. Some send out chemical signals by air, for example, and many rely on an underground internet built by soil fungi. And some, a new study finds, can use parasitic vines as communication cables. The parasites may be harmful, but they also link multiple plants into a network, and these ‘bridge-connected hosts’ seem to capitalize by communicating through the vines. The parasites in this study are Cuscuta, a genus of about 200 species in the morning glory family. They don’t look like much at first, initially rising from the soil as a thin tendril with no roots or leaves. Their growth depends on finding a host, which they do by sniffing out odors from nearby plants. (They can even use scent to track down their favorite hosts, such as tomatoes instead of wheat.) ‘It’s really amazing to watch this plant having this almost animal-like behavior,’ biocommunication researcher Consuelo M. De Moraes told NPR in 2006.

Once it finds a suitable host, a dodder wraps around the stem and inserts fang-like ‘haustoria’ into the plant’s vascular system. A dodder can end up with haustoria in many hosts, forming clusters of connected plants that may include multiple species. As Ed Yong reports in the Atlantic, a single dodder vine is capable of linking dozens of hosts together. ‘In our lab, we could connect at least 100 soybean plants with a dodder seedling,’ study co-author Jianqiang Wu, a botany professor at the Chinese Academy of Sciences, tells Yong.
The parasites are known to take water, nutrients, metabolites and mRNA from their hosts, and their bridges ‘even facilitate host-to-host virus movement,’ the study’s authors point out. But, as they report in the Proceedings of the National Academy of Sciences, those bridges also seem to boost the hosts’ communication abilities. And they aren’t just enabling idle chatter: A dodder’s network of ‘bridge-connected hosts,’ as the researchers call them, can perform valuable community services, such as warning each other about an attack from leaf-eating caterpillars.

Many plants are able to resist herbivorous insects, using a variety of tactics to warn their neighbors as well as defend themselves. They may produce defensive toxins, for example, rallying various parts of the plant to coordinate a systemic response. ‘Insect herbivory not only activates defenses at the site of feeding,’ the researchers write, ‘but also induces unknown mobile signals that travel through vasculatures’ to other parts of the damaged leaf as well as undamaged leaves and roots. Since plants send these signals through their vascular systems, the researchers wondered if a dodder vine can inadvertently share them among its hosts, creating another channel for communication. To find out, they placed two soybean plants near each other and allowed both to be parasitized by the Australian dodder (*Cuscuta australis*), which soon formed a bridge between the two hosts.

Next, they infested one of the soybean plants with caterpillars, while keeping its partner pest-free. The second plant hadn’t suffered any bites, yet when the researchers examined its leaves, they found it had regulated hundreds of genes — many of which encode anti-insect proteins often used when under attack. When the researchers did let caterpillars attack the second soybean, it ‘consistently exhibited elevated resistance to insects,’ they write, suggesting its pre-emptive defenses paid off. But what triggered those defenses? To see if its fellow host had really sent a warning via parasitic vine, they conducted similar experiments without the dodder bridge — and found no anti-insect proteins or increased resistance in the second host. They also tested for airborne signals between two unconnected soybean plants, finding no warning like the one between bridge-connected hosts.

Dodder vines may not rival high-speed data cables, but they do transmit their hosts' signals in as little as 30 minutes, the researchers report. The vines can also carry the signals over long distances — at least 10 meters (33 feet) — and even between hosts from different species, such as rockcress and tobacco. Since caterpillars could spell disaster for a soybean plant, this kind of alert seems like a pretty big benefit. Dodder vines are still parasites, though, a term for organisms that sustain themselves at the expense of their hosts. According to the study’s authors, a dodder likely harms its victims more than it helps them.

Yet parasites also have an incentive to keep their hosts alive and viable, since they rely on them for long-term support. And even if the net impact is negative, the authors note that some parasites offer benefits beyond not killing their hosts. Roundworms have been shown to increase human fertility, for example, while other helminths can reduce autoimmunity and allergies in human hosts. Being wrapped up by a dodder definitely takes a toll, but the vines ‘could alleviate resource-based fitness costs by providing information-based benefits to their hosts,’ the researchers write. And the parasite might benefit, too, ‘given that better defended and prepared hosts could provide Cuscuta with more nutrients than undefended or naïve hosts in the face of a rapidly dispersing herbivore.’

Still, they add, dodder vines are generalists that can target a wide range of plants, and their networking services are probably a coincidence, not a co-evolved response. More research is needed to really understand this relationship, the researchers say, including how exactly the hosts’ signals are spread, how much a dodder’s perks offset its costs, and whether those benefits are ‘ecologically meaningful.’

In the meantime, research like this can help illustrate how the ecosystems around us — including apparently passive plants — are more sophisticated than they seem.

Russell McLendon  September 13, 2017.

**Native mistletoe makes a comeback in Canterbury (New Zealand)**

Ask me what I was doing in late June, up a ladder smearing bright yellow, rice-sized globules of goo onto one of my *kōwhai* trees. I could say I was making kissing a whole lot easier in my neighbourhood over Christmas. Or I could have just said I was one of more
than 300 Cantabrians taking part in a biodiversity initiative designed to get more native mistletoe growing in the region. Last year, a team led by Christchurch ecologist Kristina Macdonald, along with the University of Canterbury and the Christchurch Botanic Gardens, managed to establish 33 piritia, also known as the green mistletoe (*Ileostylus micranthus*) in the Gardens. It was no easy task. Establishment rate of the mistletoe by human dispersal of the seed is usually about 5 per cent, though the team managed nearly 9 per cent. It is spread naturally by native birds tūī, bellbird and silvereye, and to a lesser extent kererū and (the non-native) blackbird, who eat the berries and pass the seeds out the other end.

Green mistletoe, *Ileostylus micranthus*, is naturally spread by tūī, bellbird and silvereyes.

Although green mistletoe is found throughout New Zealand, it is now seldom seen in Christchurch. Kristina thinks it is an interesting aspect of our native vegetation that people often don't think about. ‘We wanted to showcase this and bring it back into the city,’ she says. Over two days in late June, when the fruit is at its rippest, about 9000 seeds were collected from two sites, one in the Port Hills and one in Teddington at the head of Lyttelton Harbour. Hundreds responded to the call for volunteers to grow the seed in their own garden. Each was given 20 seeds and, because the seeds’ viability drops quickly once picked, was told they had two days to place them in trees.

Like its European counterpart, the green mistletoe is hemiparasitic. It does not grow in soil, but takes nutrients and water from a host plant. However, it still photosynthesises and produces flowers and fruit. One of nine native mistletoes – including the presumed extinct Adams's mistletoe, which was last seen in 1954, and the two beech forest-inhabiting scarlet species – the green mistletoe (as its name suggests) has small green flowers in summer and bright yellow fruit in autumn and winter. An evergreen, it forms dense balls up to 2m in diameter, but more commonly only 1m. It is considered a sight to behold on deciduous trees in winter.

One reason this particular species of mistletoe was chosen was that it has the lowest host specificity, with more than 200 different host species, says Kristina. This meant people were more likely to have a host species in their backyard. Other mistletoes only have between 13 and 48 host species each. I chose kōwhai to plant my seeds in. But coprosma, houhere, mānuka, olearia, pittosporum, pseudopanax, tōtara and wineberry would have all been suitable natives. Recommended among the exotics are acacia, ash, lemon, maple, oak, plum (and other Prunus), robinia, silver birch, tree lucerne and willow.

After duly squishing the seeds onto and into the forks of branches, I waited… and waited. Several months later, most seeds are still there, still glistening, but there does not appear to be much happening. Not to worry, Kristina assures me. ‘Some of our ones from last season have taken more than a year to establish,’ she says. ‘On some of the ones I have looked at from this year, there is a green tip at the edge of the seed, and others haven't changed much. I would hope for germination – cotyledons emerge and look like two tiny leaves – in the next few weeks, but as long as they are holding on there is still hope.’

Peraxilla tetrapetala - red mistletoe in flower. one of the species of New Zealand native mistletoe, much favoured as a food source by possums, in flower at Arthurs Pass. Photo: Nancy Bell.

Peraxilla colensoi - scarlet mistletoe in the Abel Tasman National Park is an 'at risk' plant. It has flowers
that are an important source of nectar for birds like tūī, kākā and bellbird.

Mary Lovell-Smith, NZ Gardener

**Tenbury mistletoe auction draws crowds in bumper year**

From Kent to Scotland, people from across the UK have travelled to Tenbury Wells, Worcestershire, for the town's annual holly and mistletoe auction. One thousand lots of the plant were sold in the second of three auctions held at Burford House Garden Stores. Auctioneer Nick Champion said it was a particularly good year for mistletoe, which may be down to the weather.

For one minute video see: http://www.bbc.co.uk/news/av/uk-england-hereford-worcester-42240007/tenbury-mistletoe-auction-draws-crowds-in-bumper-year (Video journalist: Catherine Mackie)


**THESIS**

**Host range and intraspecific competition in the facultative root hemiparasite *Odontites vulgaris*.** Uwe Tobias Nickel, MSc Thesis, September 2012. Advisor: Prof. Dr. Diehtart Matthies: Philipps University of Marburg.

**Abstract**

Host plants are for hemiparasites both their main source of water and nutrients and potential competitors for light. Autotrophic plants can differ widely in their quality as hosts. To investigate the host range of the facultative hemiparasite *Odontites vulgaris* the parasite was grown in single combinations with 25 host species and also without a host in a climate chamber. *O. vulgaris* is a quite independent parasite that can complete its lifecycle without a host. The tested species varied largely in their quality as hosts and affected the growth of the parasites significantly. Shading of the parasite by its hosts had a strong negative effect on the growth of the parasite. The parasite showed most vigorous growth without a host. Legumes were good hosts, grasses were hosts of intermediate quality and non-legume forbs were bad hosts. However, there were good hosts in each of these groups. Good hosts were *Medicago sativa, Capsella bursa-pastoris, Trifolium repens, Bromus erectus, Lolium perenne* and *Matricaria chamomilla*. Very poor hosts were *Plantago lanceolata, Achillea millefolium, Chrysanthemum leucanthemum, Sanguisorba minor, Hieracium pilosella, Daucus carota, Cyno-surus cristatus* and *Anthoxanthum odoratum*. These results show that plants to which haustoria are formed in natural surroundings do not necessarily have to be hosts for the parasite. Surprisingly *O. vulgaris* could accumulate more biomass with the same amount of leaf area when grown without a host than when grown with a host. The different host species influenced architecture and morphology of the parasite and they had a highly significant effect on the chemical composition of the leaves of *O. vulgaris*. Hemiparasites often form haustoria to individuals belonging to the same species. With increasing density in monoculture *O. vulgaris* showed a decrease in biomass, needed more time to flower and formed more roots. Nutrients that were applied on the leaves of single plants were not translocated among individuals. Leaf fertilisation had even a negative effect on the treated plants.

**JONNE - MOVING ANNOUNCEMENT**

As of 1 January 2018, Jonne Rodenburg will be affiliated to the Natural Resources Institute (NRI) of the University of Greenwich. He will work as Senior Lecturer/Researcher, Agroecology, in the Agriculture, Health and Environment Department. Jonne plans to continue and deepen the type of parasitic weed research he has been doing over the past ten years at the Africa Rice Center, with a focus on cereal production systems in Africa. His contact details will be: NRI, Chatham Maritime, Kent, ME4 4TB, UK; e-mail: j.rodenburg@greenwich.ac.uk.

**BOOK**


The bulk of this 7.2 pound (3.3 kilograms) tome is plant families arranged according to the scheme of the Angiosperm Phylogeny Group (APG). Families are listed under their respective orders in the APG system. For the parasitic plant enthusiast this book is a wonderful source on information on every parasitic plant family. Lavishly illustrated, each family treatment has a section on evolution of the group, distribution, economic importance, and uses. Finding a book of 800 pages with over 2500 full color images for less than $100 is noteworthy.

**‘LORANTHUS MICRANTHUS’– CORRECTION**

I have in the past been making the wrong assumption in many past editions of Haustorium in equating ‘Loranthus micranthus’ in literature from West Africa,
with *Ileostylus micranthus*. I may have continued to do so in spite of Dan Nickrent pointing out in Haustorium 66 that ‘*L. micranthus*’ is most probably a mis-spelling of *Loranthus micrantherus*, an accepted synonym for *Englerina gabonensis*, and that *I. micranthus* does not occur in Africa. I apologise for having continued to mislead. By chance there is an item on *I. micranthus* under Press Reports above. I thank Dan for reminding me of my error and for providing the following pics of the two species, very different in flower and in distribution. If any reader has any comment on this correction, we would be pleased to hear from them. We would particularly welcome comment from West Africa, confirming the true identity of ‘*L. micranthus*’. Pictures below show just how different they are!

Chris Parker.

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**FORTHCOMING MEETINGS**

28th German Conference on Weed Biology and Weed Control 27th February to 1st March 2018 in Braunschweig, Germany.  
http://www.unkrauttagung.de/index.php?menuid=1

7th International Food Legume Research Conference, 6-8 May, 2018 in Marrakech, Morocco. Including a session ‘Biotic stresses and their management’. Abstracts due by January 31*  
http://www.fflrc.org

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**GENERAL WEB SITES**

For individual web-site papers and reports see

**LITERATURE**

* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see:  
http://www.parasiticplants.org/

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see:  
http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see:  
http://ppgp.huck.psu.edu/  *

For information on the new Frontiers Journal  
‘Advances in Parasitic Weed Research’ see:  
http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research

For information on the EU COST 849 Project (now completed) and reports of its meetings see:  
http://cost849.ba.cnr.it/

For a description of the PROMISE project (Promoting Root Microbes for Integrated *Striga* Eradication), see:  
http://promise.nioo.knaw.nl/en/about

*For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see  
http://www.parasite-project.org/

For the Index of Orobanchaceae prepared by Oscar Sánchez Pedraja, Gerald Schneeweiss and others see:  
http://www.farmalierganes.com/Otrospdf/publica/Orobanchaceae%20Index.htm

For the Annotated Checklist of Host Plants of Orobanchaceae, see:  
http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm

For the Annotated Checklist of Host Plants of Orobanchaceae, see:  
http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm

For information on the EWRS Working Group ‘Parasitic weeds’ see:  
http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the *Desmodium* technique for *Striga* suppression, see:  
http://www.push-pull.net/
For information on the work of Forest Products Commission (FPC) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/.

For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/.

For information on future Mistel in der Tumortherapie Symposia see: http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).


For 6th Mistletoe Symposium, Germany, November 2015 see: http://www.sciencedirect.com/science/journal/09447113/22/supp/S1

LITERATURE

*indicates web-site reference only

Items in bold selected for special interest

Items in blue relate to therapeutic uses of parasitic plants

Aavik, T., Talve, T., Thetloff, M., Uuemaa, E. and Oja, T. 2017. Genetic consequences of landscape change for rare endemic plants - a case study of Rhinanthes osiliensis. Biological Conservation 210(Part A): 125-135. [Concluding that the very rare endemic R. osiliensis in Estonia, is endangered by the loss of habitats and also by other changes in landscape composition, e.g. afforestation, leading to strong declines in population size accompanied by genetic bottlenecks, decreased genetic diversity and high inbreeding.]

Abate, M., Hussien, T., Bayu, W. and Reda, F. 2017. Diversity in root traits of sorghum genotypes in response to Striga hermonthica infestation. Weed Research 57(3): 303–313. [Comparing the root traits of 9 sorghum genotypes with varying susceptibility to S. hermonthica under infested and uninfested conditions. Claiming to show that low root traits are an indication of resistance.]

Agbo, M.O., Olimegwu, D.C., Okoye, F.B.C. and Osadebe, P.O. 2017. Antiviral activity of Salidroside from the leaves of Nigerian mistletoe (Loranthus micranthus Linn) parasitic on Hevea brasiliensis against respiratory syncytial virus. Pakistan Journal of Pharmaceutical Sciences 30(4): 1251-1256. [Describing the isolation of a polyphenol, salidroside, from ‘L. micranthus’ (presumably a misspelling of L. micrantherus which is a synonym of Englerina gabonensis), showing potential as an antiviral agent against respiratory syncytial virus infection.]


Albert, S., Rhumeur, A., Rivière, J.L. Chauvrat, A., Sauroy-Toucouère, S., Martos, F. and Stras, D. 2017. Rediscovery of the mistletoe Bakereilla hoyifolia subsp. bojeri (Loranthaceae) on Reunion Island: population status assessment for its conservation. Botany Letters 164(3): 229-236. [This species, thought to be extinct, was rediscovered on Reunion. One population consisting of six individuals was found growing on five host plant species from different families. The grey white-eye,
Zosterops borbonicus, was seen visiting flowers. Possible reason for decline on Reunion, compared with Madagascar and Mauritius considered to be a loss of frugivorous vertebrates early in settlement of the island.


Aybeke, M. 2017. Fusarium infection causes genotoxic disorders and antioxidant-based damages in Orobanche spp. Microbiological Research 201: 46-51. [Including conclusions that F. oxysporum induced significant irrevocable genotoxic effects on the DNA of unspecified Orobanche, degraded protein metabolism and synthesis, and finally triggered apoptosis.]


Badu-Apaku, B., Oyekunle, M., Talabi, A.O., Annor, B. and Akaogu, I.C. 2017. Changes in genetic variances and heritabilities in an early white maize population following S; selection for grain yield, Striga resistance and drought tolerance. Journal of Agricultural Science 155(4): 629-642. [Three cycles of selection were evaluated under drought and well-watered conditions at two locations in Nigeria for 2 years to determine genetic variability, gains from selection and predict response to selection for grain yield and other traits. Predicted gain based on C3 was 0.282 and 0.583 t/ha under drought and well-watered conditions. Low genetic variances, heritabilities and predicted gain for yield and other traits suggested a need to introgress drought tolerance genes into the population.]

Bao Han, Zhang QingWen, Ye Yang and Lin LiGen. 2017. Naturally occurring furanoditerpenoids: distribution, chemistry and their pharmacological activities. Phytochemistry Reviews 16(2): 235-270. [Reviewing the various naturally occurring furanoditerpenoids and their pharmacological activities and noting their occurrence in some Olacaceae.]
*Charney, N.D. and Record, S. 2016. Combining incidence and demographic modelling approaches to evaluate metapopulation parameters for an endangered riparian plant. AoB Plants 8: plw044. [Describing the modeling of habitat turnover rates, colonization rates and dispersal scales for *Pedicularis furbishiae*, a rare endemic to the Saint John River on the border of Maine, USA and predicting that observed habitat patches averaging 550 m in length receive colonizing seedlings with a yearly probability of 0.45 or 0.54, based on two different models. The results help in understanding the impact that increasing rates of habitat turnover would have on the future survival of this species.]

*Carballo-Ortiz, M.A., González-Castro, A., Yang, S., dePamphilis, C.W. and Carlo, T.A. 2017. Dissecting the contributions of dispersal and host properties to the local abundance of a tropical mistletoe. Journal of Ecology 105: 1657–1667. [The dispersal and adaptation of the mistletoe *Dendropemon caribaeus* (Loranthaceae) in Puerto Rico was studied. Compatibility between the mistletoe and host, measured by mistletoe survival and growth rate, was the most important factor for mistletoe abundance followed by phenological characteristics of the hosts.]

*Cheng Xi, Floková, K., Bouwmeester, H. and Ruyter-Spira, Caraballo-Ortiz, M.A., González-Castro, A., Yang, S., Bukowiec, G. and Bednarz, B. 2017. (Effect of common fir-decay followed by phenological characteristics of growth rate, was the most important factor for mistletoe mistletoe and host, measured by mistletoe survival and Puerto Rico was studied. Compatibility between the hosts.]

*Charney, N.D. and; Record, S. 2016. Combining incidence and demographic modelling approaches to evaluate metapopulation parameters for an endangered riparian plant.

*Cheng Xi, Floková, K., Bouwmeester, H. and Ruyter-Spira, C. 2017. The role of endogenous strigolactones and their interaction with ABA during the infection process of the parasitic weed *Phelipanche ramosa* in tomato plants. Frontiers in Plant Science 8(March): 392. [Describing the potential of weeds to influence infestations of *Phelipanche ramosa* by e.g. increasing infestation causing germination near crop roots, or by supporting the parasite to maturity and increasing the soil seed bank; or by reducing soil seed bank via suicidal germination. Early summer-emerging weed species increased parasite risk. No other notable correlations were found.]


*Coullier, P. and Poullain, C. 2016. New Caledonia: a hot spot for valuabl chemodiversity Part 3: Santalales, Caryophyllales, and asterids. Chemistry & Biodiversity 13(4): 366-379. [A total of 176 original natural compounds identified from Santalales, Caryophyllales, and asterids. Showing that the high rate of endemism is correlated with the
originality of phytochemicals encountered in New Caledonian plants and discussing the economic potential of plants and molecules with consideration of their medicinal and industrial perspectives.]
da Silva Freitas, L., Moreira, L.M., de Avila Júnior, R.S., Felestrino, É.B., Demarco, D., de Sousa, H.C., and Ribeiro, S.P. 2017. Reproductive phenology and floral visitors of a *Langsdorfiella hypogaea* (Balanophoraceae) population in Brazil. Flora (Jena) 233: 51-57. [Recording high levels of both pollinators and herbivores on *L. hypogaea*, ants being the most frequent floral visitor but a coleopteran (Nitinulidae, Stelidota) more important as a pollinator. Because of herbivory only 12% of flowers fruited.]


*Dor*, E., Galili, S., Smirnov, E., Hacham, Y., Amir, R. and Hershenhorn, J. 2017. The effects of herbicides targeting aromatic and branched chain amino acid biosynthesis support the presence of functional pathways in broomrape. Frontiers in Plant Science 8(May) 707. (https://www.frontiersin.org/articles/10.3389/fpls.2017.00707/full) [The mode of action of herbicides targeting aromatic and branched-chain amino acid, imazapyr and glyphosate, in controlling *Phelipanche aegyptiaca* was studied to clarify if this obligatory parasite has its own machinery for amino acid biosynthesis. It was found that *P. aegyptiaca* is able to synthesize branched-chain and aromatic amino acids through the activity of acetolactate synthase (ALS) and 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), respectively.]

*Dubey*, N.K., Eizenberg, H., Leibman, D., Wolf, D., Edelstein, M., Abu-Nassar, J., Marzouk, S., Gal-On, A. and Radi Aly, 2017. Enhanced host-parasite resistance based on down-regulation of *PaPrx1* target genes is likely by mobile small RNA. Frontiers in Plant Science 12 September 2017. (https://doi.org/10.3389/fpls.2017.01574) [Control of parasitic weeds based on trans-specific gene-silencing of three parasite genes was examined. Two strategies to express dsRNA containing selected sequences of three *P. aegyptiaca* genes *PaACS*, *PaM6PR*, and *PaPx1* (pma) were examined. The results pointed to a movement of mobile exogenous siRNA from the host to the parasite, leading to the impaired expression of essential parasite target genes.]

Duca, M. and Tabara, O. 2016. Histochemical aspects of *Helianthus annuus* L. - *Orobanche cumana* Wallr. pathosystem. Analele Ştiinţifice ale Universităţii 'Al I Cuza' din Iaşi. (Serie Nouă) Secţia 2 a. Biologie Vegetală 62(2): 19-28. [Histological study revealed abundant accumulation of lignin and callose in the roots of sunflower resistant to *O. cumana* cultivated in infested soil. The results indicated that the phenylpropanoid pathway was activated, synthesis of lignin was increased and the cell wall was fortified.]


Emnani, M., Briache, F.Z., Gaboun, F., Abdelwahd, R., Ghaouti, L., Belqadi, L., Westwood, J. and Mentag, R. 2017. Host differentiation and variability of *Orobanche crenata* populations from legume species in Morocco as revealed by cross-infestation and molecular analysis. Pest Management Science 73(8): 1753-1763. [Demonstrating race specificity of *O. crenata* adapted to lentil. The ability to parasitize faba bean is retained, but races adapted to lentil fare better on lentil hosts than those adapted to faba bean]


*O. minor.* Field research confirmed their inhibitory effect but revealed that methionine was more effective than the others, and that two successive applications of 6 L m$^{-2}$ of 20mM solution at 308 and 543 growing degree days inhibited *O. minor* emergence in red clover up to 67%.]

Fontürbel, F.E., Jordano, P. and Medel, R. 2017. Plant-animal mutualism effectiveness in native and transformed habitats: assessing the coupled outcomes of pollination and seed dispersal. Perspectives in Plant Ecology, Evolution and Systematics 28: 87-95. [Unexpectedly finding that in the tripartite system of mistletoe *Tristerix corymbosus*, hummingbird pollinator, and marsupial seed disperser, pollination and seed dispersal was not reduced in a transformed habitat, suggesting that the overall system benefitted from the presence of a native understory vegetation that attracts pollinators and seed dispersers and compensates for the often detrimental effects of habitat transformation.]

*Fontürbel, F.E., Salazar, D.A. and Medel, R. 2017.* Increased resource availability prevents the disruption of key ecological interactions in disturbed habitats. Ecosphere 8(4): e01768. (http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1768/ful) [Studying the pollination of *Tristerix corymbosus* in Chile by the hummingbird, *Sephanoides sepahanoides*, and its dispersed by the marsupial. *Dromiciops gliroides* in relation to habitat modification. Both are most effective in the presence of shrub and bamboo cover and moss abundance. More open habitats favour other fleshy-fruited plants which provide alternative food for the marsupial. Same study as above!]


*Fu Weirui, Lin Xiaoping, Zhang Naixin, Song Zhiping, Zhang Wenju, Yang Ji and Wang Yuguo. 2017.* Testing the hypothesis multiple origins of holoparasitism in Orobanchaceae: phylogenetic evidence from the last two unplaced holoparasitic genera, *Gleadovia* and *Phacellanthus*. Frontiers in Plant Science 8: (article 1380). (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5559707/) [Phylogenetic analysis of three nuclear and two plastid genes indicated holoparasitism evolved in the family three times. *Gleadovia* and *Phacellanthus* were placed in tribe Orobanchae and the latter should be merged with *Orobanchae sect. Orobanchae* (the authors apparently do not recognize segregate genera such as *Phelipanche*).]

*Fukui, K., Yamagami, D., Ito, S. and Asami, T.A 2017.* Taylor-made design of phenoxyfuranone-type strigolactone mimic. Frontiers in Plant Science 8(6): 936. (https://www.frontiersin.org/articles/10.3389/fpls.2017.00936/full) [Through the chemical modification of debranones (phenoxyfuranones), that are highly active in inhibiting rice tillering but less active on *Striga* germination, novel debranones have been developed carrying two electron-withdrawing groups on the benzene ring with higher *Striga* germination stimulation activities and lower inhibitory activities on rice tillering.]

Funamoto, D.and Sugiura, S. 2017. Japanese white-eyes (Aves: Zosteropidae) as potential pollinators of summer-flowering *Taxillus kaempferi* (Loranthaceae). Journal of Natural History 51(27/28): 1649-1656. [Field observations in Japan showed that *Z. japonicus* was the almost exclusive flower visitor of *T. kaempferi*. Pollen was observed on the bill and face of *Z. japonicus*, and it is believed that it may act as an important pollinator of the mistletoe.]


Gao HongWei and 12 others. 2017. Isoacteoside, a dihydroxyphenethyl glycoside, exhibits anti-inflammatory effects through blocking toll-like receptor 4 dimerization. British Journal of Pharmacology 174(17): 2880-2896. [Isoacteoside from *Monochauma savatierei* (a hemi-parasite in Orobanchaceae occurring in Eastern Asia and widely used in Chinese madicine) blocked TLR4 dimerization, which activates the MyD88-TAK1-NF-kB/MAPK signalling cascades and TRIF pathway. The results indicate that isoacteoside has potential for the treatment of inflammatory diseases.]

Gao YuQiu, Qin GuangQiu, Wen PingJing, Wang YanWu, Fu WeiZhong, He Li, Yao Siyu and Zhao Peng. 2017. Safety assessment of powdered *Cistanche deserticola* Y. C. Ma by a 90-day feeding test in Sprague-Dawley rats. Drug and Chemical Toxicology 40(4): 383-389. [No toxicity to rats was detected in a diet containing up to 8% of powdered *C. deserticola*. The upper safety level was a total 8 g/kg body weight.]

commercial samples supposedly containing Cuscuta chinensis or C. australis were analysed against a DNA bar-code and only 10 were found to be genuine. Two thirds were based on a wide range of other species including C. japonica, C. alata and C. monogyna.


The floral anatomy of this International Journal of Plant Science 178(7): 522-536. [The local maize variety supported high Striga hermonthica infestation with a yield of only 1.7 t/ha, while the tolerant SAMMAZ 17 had less Striga and yielded 4.4 t/ha, and is recommended for planting in North Central Nigeria.]


Gong Bin, Wu Xin, Wei Ting, Liao RiQuan, Su BenWei, Song JingJing, Jiang GuoHuan and Zhu KaiXin. 2017. (Isolation, identification and antitumor activity of endophytic fungi in Taxilli herba from Salix babylonica in Guangxi.) (in Chinese) Guangxi Zhiwu / Guihaia 37(5): 634-641. [A range of endophytic fungi were isolated and identified from stems, leaves and roots of Taxillus chinensis growing on Salix babylonica and some found to have anti-tumour properties.]

González F, Pabón-Mora N. 2017. Floral development and morphoanatomy in the holoparasitic Pilostyles boyacensis (Apodanthaceae, Cucurbitales) reveal chimeric half-staminate and half-carpellate flowers. International Journal of Plant Science 178(7): 522-536. [The floral anatomy of this Pilostyles species is illustrated with LM and SEM, and features, apomorphic and synapomorphic with other members of Cucurbitales, are described. The presence of chimeric flowers shows a more labile sex expression than pure monoecy.]

Griffiths, M.E., Ruiz, N. and Ward, D. 2017. Mistletoe species richness patterns are influenced more by host geographic range than nitrogen content. African Journal of Ecology 55(1): 101-110. [Challenging a previous hypothesis that mistletoes preferentially parasitize hosts with high nitrogen, this study concluded that mistletoe species richness increases on hosts with larger geographic ranges.]

*Grimsson F., Kapli P., Hofmann C.-C., Zetter R., and Grimm G.W. 2017. Eocene Loranthaceae pollen pushes back divergence ages for major splits in the family. PeerJ 5: e3373. (https://peerj.com/articles/3373/) [Newly described and existing fossil pollen were used to test molecular dating estimates of Loranthaceae diversification. Root parasites and aerial parasites (Psittacanthinae and Loranthinae) were present in the northern hemisphere at the end of the Eocene, thus pushing back the age of the crown group compared with earlier estimates.]


Hai lu, G., Khan, Z.R., Pittchar, J.O. and Ochantum, N. 2017. Radio and mobile phone ownership or access by smallholder farmers of eastern Uganda and its potential use for push-pull technology dissemination. International Journal of Agricultural Extension 5(2): 19-28. [A survey concluding that most farmers have access to both radio and mobile phones but radio is much more used for information on agricultural technology including the use of the push-pull technique for control of stem borers and Striga.]

Hasenstab-Lehman, K.E. 2017. Phylogenetics of the borage family: delimiting Boraginaceae and assessing closest relatives. Aliso 35(1): 41-49. [A molecular phylogeny using three chloroplast genes was used to assess the relationship of Boraginaceae to other orders and examine family relationships within. Recognition of Lennoaceae as separate from Ehretiaceae is supported.]

*Hill, R., Loxterman, J.L. and Aho, K. 2017. Insular biogeography and population genetics of dwarf mistletoe (Arceuthobium americanum) in the Central Rocky Mountains. Ecosphere 8(5): e01810. (http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1810/full) [A detailed ecological study comparing populations of A. americanum on lodgepole pine (Pinus contorta subsp. latifolia), in isolated ‘island’ populations with those in ‘mainland’ populations. As predicted by biogeographic theory, island allelic richness was positively correlated with geographic size of the population and negatively correlated with distance from mainland populations.]

Hira Lal, Devendra Singh and Jat, B.L. 2017. Orobanche infestation in Indian Brassica juncea L. in Ajmer districts of Rajasthan and its management. Asian Journal of Environmental Science 12(1): 1-22. [A long and detailed paper concluding that the most economically effective means to control *P. aegyptiaca* in *B. juncea* involved 125% of recommended fertilizers (N and P) plus foliar sprays of glyphosate at 25 and 50g/ha (plus ammonium sulphate) at 25 and 55 days after sowing. Applications of neem cake with or without pendimethalin and metalaxyl were not suitable.]

*HASHTOLIUM 72 DECEMBER 2017*
Huanguli, N., Saifuding, A., Naerhulan, Z. and Ayiguli, M.

Hosseini, P., Ahmadvand, G., Oveisi, M., Morshedi, P. and Gonzalez-Andujar, J.L. 2017. A modelling approach for predicting the initial phase of Egyptian broomrape (\textit{Phelipanche aegyptiaca}) parasitism in potato Crop Protection 100: 51-56. \textit{P. aegyptiaca} is important as a weed of potato in Iran. Using Gompertz and Weibull soil thermal time lag time and 50\% of \textit{P. aegyptiaca} attachments occurred after 613.75 (124.8) and 999.49 (5.98) TT respectively.

Hoyt, H.M., Hornsby, W., Huang ChingHsun, Jacobs, J.J.

*Huber, R., Schlodder, D., Effertz, C., Rieger, S. and Tröger, W. 2017. Safety of intravenously applied mistletoe extract - results from a phase I dose escalation study in patients with advanced cancer. BMC Complementary and Alternative Medicine 17(465); (18 September 2017). (https://bmccomplementalternmed.biomedcentral.com/track/cid/10.1186/s12906-017-1971-1) [Concluding that weekly infusions of 2000 mg of an aqueous extract of \textit{Viscum album} were tolerated and can be used in further studies but had a risk of causing allergic reactions and fever.]

Ishida, J.K., Yoshida, S. and Shirasu, K. 2017. Quinone oxidoreductase 2 is involved in haustorium development of the parasitic plant \textit{Phtheirospermum japonicum}. Plant Signalling and Behaviour 12(7): e1319029. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5586360/) [Showing that while quinine oxidoreductase 1 (QR 1) is involved in signal transduction leading to haustorium induction in \textit{Triphysaria versicolor}, QR 2 has the equivalent function in \textit{P. japonicum}.]


Ito, S., Yamagami, D., Umehara, M., Hanada, A., Yoshida, S., Sasaki, Y., Yajima, S., Koyzuka, J., Ueguchi-Tanaka, M., Matsuoka, M., Shirasu, K., Yamaguchi, S. and Asami, T. 2017. Regulation of strigolactone biosynthesis by gibberellin signaling. Plant Physiology 174(2): 1250-1259. [The cross talk between gibberellin (GA) and strigolactones (SLs) was studied in rice. The regulation of SL biosynthesis by GA was found to be dependent on the GA receptor GID1 and F-box protein GID2. GA treatment also reduced the infection of rice plants by \textit{Striga hermonthica}. These data suggest that GA could be used to control parasitic weed infections.]

Kaitera, J., Hiltunen, R. and Hantula, J. 2017. \textit{N. Nemesis} and \textit{Euphrasia: new alternate hosts of \textit{Cronartium} spp.} Forest Pathology 47(2): e12306. [Confirming \textit{E. stricta} and \textit{Bartsia alpina} as alternate hosts for the rust fungus \textit{C. flaccidum}. \textit{E. stricta} was also a host for \textit{C. ribicola}.]


Reducing complex symbiont of invasive mountain pine beetle. Journal of Chemical Ecology 43(5): 506-518. [Describing complex interactions between *Pinus banksiana* and *Arceuthobium americanum* resulting in reduction of the fungus *Grossmannia clavigera* and corresponding reduction in pine beetle attack.]


*Kruh, L.I., Lahav, T., Abu-Nassar, J., Achdari, G., Salami, R., Freilich, S. and Aly, R. 2017. Host-parasite-bacteria triangle: the microbiome of the parasitic weed *Phelipanche aegyptiaca* and tomato-Solamum lycopersicum (Mill.) as a host. Frontiers in Plant Science 8(March): 269. (https://www.frontiersin.org/articles/10.3389/fpls.2017.00269/full) [Showing that the endophyte communities of *P. aegyptiaca* were significantly different from that of non-parasitized tomato root, but no significant differences were observed between the parasite and its host after parasitization, suggesting the occurrence of bacterial exchange between these two plants. Also the potentially valuable finding that a *Pseudomonas* strain *PhelSI10*, originating from the tomato roots, suppressed approximately 80% of *P. aegyptiaca* seed germination and significantly reduced *P. aegyptiaca* parasitism.]


Latvis, M., Jacobs, S.J., Mortimer, S.M.E., Richards, M., Blischak, P.D., Mathews, S. and Tank, D.C. 2017. Primers for *Castilleja* and their utility across Orobanchaceae: II. Single-copy nuclear loci. Applications in Plant Sciences 5(9): 1700038. (http://www.bioone.org/doi/10.3732/apps.1700038) [From low-coverage genomes of 3 *Castilleja* taxa, 87 primers were designed for the single-copy conserved ortholog set (COSII) and the pentatricopeptide repeat (PPR) gene families, 27 of which had broader utility within Orobanchaceae.]

Latvis, M., Mortimer, S.M.E., Morales-Briones, D.F., Torpoy, S., Urie-Converts, S., Jacobs, S.J., Mathews, S. and Tank, D.C. 2017. Primers for *Castilleja* and their utility across Orobanchaceae: I. chloroplast primers. Applications in Plant Sciences 5(9): 1700020. (http://www.bioone.org/doi/10.3732/apps.1700020) [76 primer pairs to variable regions of the plastome were developed for *Castilleja* but also showed utility across other major clades in Orobanchaceae.]

Li BaoDing. 2016. Study on flavor development of chicken stewed with *Cistanche deserticola* Ma. China Condiment 42(4): 96-98. [Chicken stewed with *C. deserticola* is a nutritious dish with unique flavour, claimed to have additional benefits of including anti-aging, enhancing immunity and cardiovascular system protection.]

Li Yang, Peng Ying, Wang Meng Yue, Tu PengFei and Li XiaoBo. 2017. Human gastrointestinal metabolism of the Cistanches Herba water extract in vitro: elucidation of the metabolic profile based on comprehensive metabolite identification in gastric juice, intestinal juice, human intestinal bacteria, and intestinal microsomes. Journal of Agricultural and Food Chemistry 65(34): 7447-7456. [Identifying a wide range of the metabolites from *Cistanche deserticola* and *C. tubulosa* formed in the human gastric environment.]

Lin WeiYong, Yao Chun, Cheng, J., Kao ShungTe, Tsai Fuulen and Liu HsinPing. 2017. Molecular pathways related to the longevity promotion and cognitive improvement of *Cistanche tubulosa* in *Drosophila*. Phytomedicine 26: 37-44. [Concluding that extracts of *C. tubulosa*, used in Chinese medicine to improve sexual function and treat kidney dysfunction, can contribute to slowing aging and alleviating memory loss in *Drosophila*. Rapamycin and Notch networks, have been identified as causing these pharmacological effects and alterations in the gene expression of glutamate receptors.]

Lin Yun, Bi HaiYan, Yang ZhiRong, Luo TianLin, He ShanShan, Chen YaLi, Jing Xuan, Yun

Linares-Holguín O.O., Sánchez-Peña P., Molina-Freaner F. 2016. (Genetic diversity of the chloroplast (TrnL-F) region among populations of Pholisma culiacanum Y.) (in Spanish) Agrociencia 50:799-809. [Analysis of trnL-F sequences using 70 samples from 7 populations of this species revealed 11 haplotypes. Within-population variation was 86.5% and between was 13.5% with no significant relationship between genetic and geographic distance.]

Lomba, S., Holbrook-Smith, D. McCourt.P. 2017. The perception of strigolactones in vascular plants. Nature Chemical Biology 13(6): 599-606. [Reviewing information on strigolactone signaling which is leading to insights into parasitic plant infections, specifically focusing on how the development of chemical probes can be used in combination with model plant systems to dissect strigolactone's perception in the parasitic plant Striga hermonthica.]

Lomba, S., Subha, A. and McCourt, P. 2017. Found in translation: applying lessons from model systems to strigolactone signaling in parasitic plants. Trends in Biochemical Sciences 42(7): 556-565. [Two approaches are presented to understand how parasitic plants respond to host-derived SLs. The first involves extrapolating information on SLs from model genetic systems to dissect their roles in parasitic plants. The second uses chemicals to probe SL signaling directly in the parasite Striga hermonthica. These approaches indicate that parasitic plants have co-opted a family of α/β hydrolases to perceive SLs.]

*Logacheva, M.D., Schelkunov, M.I., Shtratnikova, V.Y., Matveeva, M. and Penin, A.A. 2016. Comparative analysis of plastid genomes of non-photosynthetic Ericaceae and their photosynthetic relatives. Scientific Reports 6(30042): srep30042. (http://www.nature.com/articles/srep30042) [The plastomes of the nonphotosynthetic Monotropa uniflora (46 kbp) and Hypopitys monotropa (35 kbp) were determined as was the photosynthetic Pyrola rotundifolia (169 kbp).]


Marques, F.M., da Costa, M.R., Vittorazzi, C., Gramma, L de S.dos S., Barth, T., de Andrade, T.U., Endringer, D.C., Scherer, R. and Fronza, M. 2017. In vitro and in vivo anti-inflammatory effects of Struthanthus vulgaris. Planta Medica 83(9): 770-777. [S. vulgaris is probably the most common medicinal mistletoe plant in Brazil, and has been used in folk medicine as an anti-inflammatory agent and for cleaning skin wounds. The study confirmed that an ethanol leaf extract exhibited prominent anti-inflammatory effects, endorsing its usefulness as a medicinal therapy against inflammatory diseases.]


Medina M.N.D. and Cruz R.D. 2016. Partial mitochondrial DNA barcode of Rafflesia mira Fernando & Ong, 2005 (syn. Rafflesia magnifica Madulid, Tandang, Agoo, 2005) using matR with phylogenetic analysis of selected Rafflesia species in the world. International Journal of Environment, Agriculture and Biotechnology (IJEB) 1:374-380. [Partial matR sequences from three accessions of R. mira were analyzed along with 15 other Rafflesia species. Weaknesses include the use of Neighbor-Joining instead of model-based phylogenetic methods (that have been proven to be superior with these holoparasites) and no other taxa within or outside Rafflesiaeaceae were included that would allow the root of the tree to be inferred.]

Mengesha, W.A., Menkir, A., Unakchukwu, N., Meseka, S., Farniola, A., Girma, G. and Gedil, M. 2017. Genetic diversity of tropical maize inbred lines combining resistance to Striga hermonthica with drought tolerance using SNP markers. Plant Breeding 136(3): 338-343. [Results from a study of 128 drought and Striga-resistant lines showed four distinct groups consistent with the pedigrees of the lines.]


Miyao, G. 2017. Egyptian broomrape eradication effort in California: a progress report on the joint effort of regulators, university, tomato growers and processors. Acta Horticulturae 1159: 139-142. [Following its first detection in 2014, the localised infestation of Phelipanche aegyptiaca has been treated with glyphosate, hand pulling, flaming and fumigation. No recurrence is apparent at the time of this report.]
environment. Antionie van Leeuwenhoek 110(6): 819-832. [Molecular analyses confirm two new species *Fusarium sudanense* and *F. terricola* in the *F. fujikuroi* species complex. One of these was isolated from *Striga herminthica* in Sudan but not clear which from the abstract.]

Mpika, J., Wahounou, P.J., Kossonou, K.A., Soumahin, E.F., Konan, E., Gnagne, M. and Obouayeba, S. 2017. Chemical control of *Phragmantonera capitata* in plantations of three clones (GT 1, PB 235 and PB 217) of *Hevea brasiliensis* (Euphorbiaceae) in Côte d’Ivoire. Journal of Animal and Plant Sciences (JAPS) 32(3): 5212-5222. [Noting that *P. capitata* may reduce rubber yields by 10% in Côte d’Ivoire. 10 ml glyphosate injected per tree at the base of the trunk provided 65 to 86% mortality of *P. capitata* and had no negative effect on rubber yield.]

Mudavath, C.N., Kailas, J.G., Salamma Sugali, Devender Ravula, Ramakrishna Hari and Boyina, R.P.R. 2017. The non-arboREAL diversity of the Andaman Islands, India, based on pollen analysis. Palynology 41(4): 41-461. [Among 118 species studied, only *Macrosolen cochin chinensis* has oblate pollen grains.]

Mulsw, K., Delebinski, C., Seifert, G. and Melzig, M.F. 2017. (Quantification of the mistletoe lectin I from pharmaceutical products.) (in German) Zeitschrift für Phytotherapie 38(4): 148-151. [Using two different ELISA (enzyme-linked immunosorbent assay) analyses to show that the levels of lectin I differed among the five commercial preparations available in Germany.]


*Nativ, N., Hacham, Y., Hershenhorn, J., Dor, E. and Amir, R. 2017. Metabolic investigation of *Phelipanche aegyptiaca* reveals significant changes during developmental stages and in its different organs. Frontiers in Plant Science 8(April): 491. (https://www.frontiersin.org/articles/10.3389/fpls.2017.00491/full) [The detailed results on a wide range of metabolites contribute to our knowledge of the metabolic behavior of parasites such as *P. aegyptiaca* that rely on their host for their basic nutrients.]*


Nickrent D.L. 2017. Status of the genera *Colpoon*, *Oxyris* and *Rhoaicarpus* in South Africa. Bothalia: African Biodiversity & Conservation 47(1):1-7. [Comparative morphology and phylogenetics were used to support the position that these three genera are distinct.]

Niikliefeld, H. 2016. (New floristic records from Austria (170-235).) (in German) Neireichia 8: 181-238. [Orobanche alsatica subsp. libanotidis (= *O. bartlingii*) is newly recorded in Upper Austria.]


*Oancea, F., Georgescu, E., Matusova, R., Georgescu, F., Nicolescu, A., Raut, I., Jecu, M.L., Vladulescu, M.C., Vladulescu, L. and Deleanu, C. 2017. New strigolactone mimics as exogenous signals for rhizosphere organisms. Molecules 22(6): 961. (http://www.mdpi.com/1420-3049/22/6/961/htm) [hree strigolactone mimics, pyrimidylphenoxy-, benzoisoquinolinolenedi, and naphthoquinolinolxy-D ring, were synthesized and examined for their activities on seed germination in different root parasites and radial growth and hyphal branching in pathogenic fungi. These mimics exhibited low to moderate stimulation effects on parasite seed germination and different potentials on growth and hyphal branching of pathogenic fungi.]

influencing host specificity in mistletoes based largely on South African species, with examples such as *Viscum rotundifolium* a generalist mistletoe species that parasitizes at least six tree species, *Agelanthus natalitius*, which has a limited number of host species and predominantly parasitizes *Acacia caffra*, *Viscum combrutum* mainly parasitizes *Combretum erythrophyllum* and rarely is found on *Dombeya rotundifolia* while *Tapinanthus rubromarginatus* parasitizes only *Protea caffra*.


*Olsen, S. and Krause, K. 2016. Activity of xyloglucan endotransglucosylases/hydrolases suggests a role during host invasion by the parasitic plant *Cuscuta reflexa*. PLoS ONE 12(4): e0176754. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0176754 ) [Showing that the level of xyloglucan endotransglucosylation (XET) activity was found to peak at the penetrating stage of *Cuscuta reflexa* on its host *Pelargonium zonale*. A known inhibitor of XET reduced the number of haustorial invasions.]


*Omoigui, L.O., Kamara, A.Y., Moukoumbi, Y.D., Ogunkammi, L.A. and Timko, M.P. 2017. Breeding cowpea for resistance to *Striga gesnerioides* in the Nigerian dry savannas using marker-assisted selection. Plant Breeding 136(3): 393-399. [The *Striga* resistance gene from the donor parent IT97K-499-35 was introduced into an elite farmer preferred cowpea cultivar ‘Borno Brown’. A number of desirable improved lines were selected, immune to *Striga*, and having local genetic background with higher yield than those of their parents and standard varieties.]

*Ongachi, W., Onwonga, R., Nyanganga, H. and Okry, F. 2016. Comparative analysis of Video Mediated Learning and Farmer Field School approach on adoption of *Striga* control technologies in Western Kenya. International Journal of Agricultural Extension 5(1): 1-10 . [Results indicated that Video Mediated Learning alone could be better than FFS in promoting *Striga*-control technologies, but best results can be expected from a combination of video and FFS as the two approaches complement each other.]


*Otto, R. and Verloove, F. 2016. New xenophytes from La Palma (Canary Islands, Spain), with emphasis on naturalized and (potentially) invasive species. Collectanea Botanica 35: pp.E001. (Phelipanche nana newly recorded on La Palma. Host not indicated.]

*Parker, T.J., Chambers, C.L. and Mathiasen, R.L. 2017. Dwarf mistletoe and breeding bird abundance in ponderosa pine forests. Western North American Naturalist 77(1): 40-50. [Finding that the density of breeding birds was not well correlated with density of *Arceuthobium vaginatum* but rather with ‘snag’ density, snags being a result of past rather than current parasite infection.]

*Perronne, R., Gibot-Leclerc, S., Dessaint, F., Reibel, C. and le Corre, V. 2016. (Differences in the germination abilities of two pathovars of branched broomrape on Brassicaceae and Fabaceae hosts.) (in French). In: Proceedings, 23e Conférence du COLUMA. Journées Internationales sur la Lutte contre les Mauvaises Herbes, Dijon, France, 6-8 décembre 2016: 48-57. (https://www.cabdirect.org/cabdirect/FullTextPDF/2017/20173254403.pdf) [Laboratory study comparing the germination of hemp and rape-seed pathovars of *Phelipanche ramosa* by 25 crop and weed species. Showing little difference between pathovars and wide differences between host species, the species causing highest germination (ca. 90%) being *Lotus corniculatus*, thus of potential interest as a trap crop.]

*Pointier, O., Gibot-Leclerc, S., Moreau, D. and Colbach, N. 2016. Modelling cropping system effects on branched broomrape dynamics in
interaction with weeds [Conference poster]. 23e Conférence du COLUMA. Journées Internationales sur la Lutte contre les Mauvaises Herbes, Dijon, France, 6-8 décembre 2016. (https://www.cabdirect.org/cabdirect/FullTextPDF/2017/20173254414.pdf) [Using a model PHERASYS to study the effects of cropping systems on *Phelipanche aegyptiaca* dynamics in interaction with weeds and crops. This simulated the complete life-cycle of the parasite, from seed dynamics in the soil to seed production. Interactions between the parasite and crops and weeds were characterized at the species level and at the plant scale. The effects of tillage, delayed sowing and catch crops are discussed.]

Punia, S.S., Anil Duhan, Yadav, D.B. and Sindhu, V.K. 2016. Use of herbicides against *Orobanche* in tomato and their residual effect on succeeding crop. Indian Journal of Weed Science 48(4): 404-409. [Noting that *Phelipanche aegyptiaca* is troublesome in tomato in Harayana, India and concluding that that post-emergence applications of ethoxysulfuron or sulfoxsulfuron at 30 and 60 days after transplanting provided 85-90% control without any adverse effect on the current or following crops and with yield increases of 46-58%.

Queijiero-Bolaños, M.E., González, E.J., Martorell, C. and Cano-Santana, Z. 2017. Competition and facilitation determine dwarf mistletoe infection dynamics. Journal of Ecology (Oxford) 105(3): 775-785. [Studying complex interactions between *Arceuthobium vaginatum* and *A. globosum* on the host *Pinus hartwegii* in Mexico. Self-limited population growth allowed mistletoe coexistence and intraguild mutualism was important for colonizing new host space.]

Qurashi, Y.A., Ganawa, E.S., Kheiralla, A.F. and Hassabala, A.A. 2017. Application of satellites imagery in detecting and mapping *Striga hermonthica* in a sugar cane field. Advances in Bioresearch 8(2):146-152. [Remote sensing was used to survey intensity of *S. hermonthica* in cane in SE Sudan. Most was detected in field borders. Losses due to *Striga* over 3 seasons was estimated at 150-200 tons over the studied fields.]

*Rabia Naz, Hafsa Ayub, Sayid Nawaz, Zia-ul-Islam, Tavyaba Yasmin, Ashhari Bano, Abdul Wakeel, Saqib Zia and Roberts, T.H. 2017. Antimicrobial activity, toxicity and anti-inflammatory potential of methanolic extracts of four ethnomedicinal plant species from Punjab, Pakistan. BMC Complementary and Alternative Medicine 17:302 (8 June 2017). (https://www.degruyter.com/downloadpdf/j/jppr.2017.57.issue-3/jppr-2017-0038/jppr-2017-0038.pdf) [A range of wild and cultivated wheat varieties were planted with canola (rapeseed) and *P. aegyptiaca* in pots. There were apparently significant but rather modest reductions in the parasite with some wheat varieties and allelopathy is claimed, but there are no data and no consideration of the possible effects via competition from the wheat on the canola host.]

Risnoveanu, L., Joita-Păcurareanu, M. and Anton, F.G. 2016. The virulence of broomrape (*Orobanche cumana* Wallr.) in sunflower crop in Braila area, in Romania. Helia 39(6): 189-196. [Noting that *O. cumana* was first recorded in Romania in 1940. This study determined that all races A to F are present in the country and some virulence greater than F, and the situation is changing annually.]


*Saraj, B.S., Kafaki, S.B., Kiadaliri, H. and Akhavan, R. 2017. (Classification of worldview 2 satellite image by using object-based technique to identifying the infection of Zagros forests by Loranthus europaeus.) (in Persian) Iranian Journal of Forest 8(4): e445-Pe457. (http://www.ijf-isaforestry.ir/article_46269_8a70ce07f0a4b9ba3b43de1c44ca22d2.pdf) [Concluding that Random Forest algorithm with 1000 trees was the best for indentifying the various intensities of infection by L. europaeus in forests in Zagros, Iran, with a reliability of 85-92%]

Saric-Krsmovic, M.M., Bozic, D.M., Radivojevic, L.M., Umljendic, J.S.G. and Vrbinacan, S.P. 2017. Effect of Cuscuta campestris parasitism on the physiological and anatomical changes in untreated and herbicide-treated sugar beet. Journal of Environmental Science and Health B. 52(11): 812-816. [C. campestris shown to cause 20-28% reductions in chlorophyll a and b and carotenoids in sugar beet. These reductions were only 2-5% in crop treated with propyzamide, suggesting it as ‘an adequate herbicide for control of field dodder at the stage of early infestation.’]

Sarić-Krsmović, M. and Vrbinčanin, S. 2017. Field dodder life cycle and interaction with host plants. Pesticides and Phytomedicine (Belgrade) 32(2): 95–103. [A general review, incidentally noting that about 10 Cuscuta species occur in Serbia, Cuscuta campestris being the most frequent.]

Sato, H.A. and Gonzalez, A.M. 2017. Embryogenesis, endospermogenesis and fruit development in Lophophyllum (Balanophoraceae): focus on endosperm and embryo initiation. Flora (Jena) 233: 79-89. [Endosperm forms without fertilization and first develops a coenocyte from the polar nuclei followed by the fusion of the endosperm nuclei resulting in a giant (120 X 60 μm) nucleus. Subsequent mitoses produce nuclei of equal dimensions and cytokinesis results in endosperm cells. The endosperm plus the undifferentiated mature embryo form the seed/fruit (achene).]


Sayad, E., Boshkar, E. and Gholami, S. 2017. Different role of host and habitat features in determining spatial distribution of mistletoe infection. Forest Ecology and Management 384: 323-330. [Loranthus europaeus causes significant damage to forests in western Iran. As part of a programme to understand the potential for its intensification under climate change, the pattern of its infection in tree canopies was studied. It was concluded that it establishes in the middle crown of the host, then develops downward into lower crown.]

Scalon, M.C. and Wright, I.J. 2017. Leaf trait adaptations of xylem-tapping mistletoes and their hosts in sites of contrasting aridity. Plant and Soil 415(1/2): 117-130. [Photosynthetic traits, leaf dark respiration, nutrient concentrations and specific leaf area (SLA) were measured on 42 mistletoe-host species-pairs sampled sampled from five sites in Australia and Brazil that vary widely in aridity. Concluding that the parasites exhibit trait responses and adaptations to site aridity in parallel and to approximately the same extent as their hosts.]

- Soil & Plant Science 67(9): 1-11. [Reviewing the methodology of breeding for resistance to S. asiatica in South Africa and promoting the use of integrated methods of Striga control including the use of Fusarium oxysporum f.sp. strigea.]


Sobeh, M., Mahmoud, M.F., Abdelfattah, M.A.O., El-Beshbishy, H.A., El-Shazly, A.M. and Wink, M. 2017. Hepatoprotective and hypoglycemic effects of a tannin rich extract from Ximenia americana var. caffra root. Phytomedicine 33: 36-42. [Results confirm a hepatoprotective potential for the root extract from X. americana var. caffra It can also mediate an antidiabetic effect by reducing elevated blood glucose and serum lipid peroxides levels and by increasing insulin in STZ-diabetic rats by -107%, -31.1% and +11.3%, respectively.]

Spallek, T., Melnyk, C.W., Wakatake, T., Zhang Jing, Sakamoto, Y., Kiba, T., Yoshida, S., Matsunaga, S., Sakakibara, H. and Shirasu, K. 2017. Interspecies hormonal control of host root morphology by parasitic plants. Proceedings of the National Academy of Sciences of the United States of America 114(20): 5283-5288. [The results demonstrate that the interspecies movement of cytokinin from the parasite, Phtheirospermum japonicum modified both host root morphology and fitness. Other microbial and animal plant pathogens use cytokinins during infections, highlighting the central role of this growth hormone during the establishment of plant diseases and revealing a common strategy for parasite infections of plants.]


*Steinborn, C. and 12 others. 2017. Viscum album neutralizes tumor-induced immunosuppression in a human in vitro cell model. PLoS ONE 12(7): e0181553. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0181553) [Two V. album extracts were tested for their effects on the maturation of human dendritic cells and on T cell function using flow cytometry, automated fluorescence microscopy and cytokine bead array assays, leading to their potential mode-of-action as an additive cancer therapy based on immunomodulatory effects.]

*Sun Ting, Renner, S.S., Xu YuXing, Qin Yan, Wu JianQiang and Sun GuiLing. 2016. Two hAT transposon genes were transferred from Brassicaceae to broomrapes and are actively expressed in some recipients. Scientific Reports 6: No.30192. (http://www.nature.com/articles/srep30192) [Concluding that the broomrape genera Phelipanche and Orobanche acquired two related nuclear genes (christened BO transposase genes), a new group of the hAT superfamily of class II transposons, from Asian Sisymbrieae or a closely related tribe of Brassicaceae, by horizontal gene transfer. The collinearity of the flanking genes, lack of a classic border structure, and low expression levels suggest that BO transposase genes cannot transpose in Brassicaceae, whereas they are highly expressed in P. aegyptiaca.]

Susatya A, Hidayati SN, Riki S. 2017. Rafflesia kemumu (Rafflesiaceae), a new species from Northern Bengkulu, Sumatra, Indonesia. Phytotaxa 326: 211-220. [A new species was named from plants occurring in two populations from the Palak Siring area of West Sumatra. that are sympatric with R. gadutensis. This taxon is morphologically very similar to R. gadutensis and sympatric with it, thus they may be conspecific (molecular data are needed).]


bidirectionally between parasite and host plants. The study was to investigate the miRNA of *S. hermonthica* and miRNA mediated regulation of the host plant *Oryza sativa* genes. Thirteen conserved miRNAs were identified in *S. hermonthica*, and showed homology with their host plants *O. sativa* and *Sorghum bicolor*. Out of the thirteen miRNAs, 12 miRNAs are predicted to regulate 185 target mRNA of *O. sativa.*

Talabi, A.O., Badu-Appru, B. and Fakorede, M.A.B. 2017. Genetic variances and relationship among traits of an early maturing maize population under drought-stress and low nitrogen environments. Crop Science 57(2): 681-692. [Studying genetic variances in a maize population which had undergone 4 cycles of selection for drought tolerance, and 4 cycles for resistance to *Striga hermonthica* and concluding that there was insufficient variation for further yield enhancement and there was a need to introgress new sources of favorable alleles for drought-stress and low N tolerance into the population.]


Tešitel, J., Mládek, J., Horník, J., Tešitelová, T., Adamec, V. and Tichý, L. 2017. Suppressing competitive dominants and community restoration with native parasitic plants using the hemiparasitic *Rhinanthus alectorolophus* and the dominant grass *Calamagrostis epigejos*. Journal of Applied Ecology 54(5): 1487-1495. [Demonstrating, in the Czech Republic, that *R. alectorolophus* is effective over 2 years, in biological control of the invasive *C. epigejos*, with a great potential to restore infested grassland vegetation.]

*Tilk, M., Tullus, T. and Ots, K. 2017. Effects of environmental factors on the species richness, composition and community horizontal structure of vascular plants in Scots pine forests on fixed sand dunes. Silva Fennica 51(3): article id 6986. (https://silvafennica.fi/article/6986) [Melampyrum pratense among the four most frequent species in the understory of *Pinus sylvestris*. The relative importance among species is influenced by elevation and aspect of the soil, nitrogen, potassium and phosphorus, pH, moisture conditions and thickness of the litter. No comment on possible hosts of the parasite.]

Tippe, D.E., Rodenburg, J., van Ast, A., Kayeke, J. and Bastiaans, L. 2017. Farmers' knowledge, use and preferences of parasitic weed management strategies in rain-fed rice production systems. Crop Protection 99: 93-107. [A valuable analysis of farmer reactions to *Rhamphicarpa fistulosa* in lowland rice and *Striga asiatica* in upland rice in Tanzania, and to the available control options. Concluding that the most favourable options for control of *R. fistulosa* were early crop establishment and use of the local variety Supa India. For *S. asiatica* late planting is preferred, requiring a short-duration variety such as NERICA-10. But emphasising the importance of farmer participation in technology testing and the need for improved credit and input supply.]

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Polysaccharide from *Cuscuta chinensis* can exert a protective effect on H$_2$O$_2$ injured SH-SY-5Y cells. This antioxidant effect could be related to increasing expression of PSD-95 and p-ERK.
HAUSTORIUM
Parasitic Plants Newsletter
ISSN 1944-6969
Official Organ of the International Parasitic Plant Society
(http://www.parasiticplants.org/)

July 2018                                                                             Number 73

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Dear IPPS members,

First, I would like to thank both Harro Bouwmeester and Philippe Simier for offering to host the next Parasitic Plant Congress in Amsterdam and Nantes respectively. I would also like to thank everyone who took part in the Doodle Poll to select the venue. Over 100 members voted showing the enthusiasm and support for the Parasitic Plant Congress and the excellent bids put forward by Harro and Philippe. The vote was extremely close but Amsterdam was selected as the next venue. As you will see below the dates for the next Congress are 30th June - 5th July 2019. Harro has provided a description of the venue, the cost of registration and options for accommodation. Further information will become available via a Congress website later in the year. Please put the dates in your diary!

Second, according to the schedule of elections to the IPPS Executive committee we are expected to elect a new Editor and Treasurer this year. Further details will be sent in a separate e-mail to all members of the society and I would like to encourage everyone to participate in the nomination and election process.

Finally, I hope everyone is having a good summer and that your parasitic plant research is going well!

With very best wishes

Julie
Julie Scholes, IPPS President
(j.scholes@sheffield.ac.uk)

AMSTERDAM CONGRESS

The 15th World Congress on Parasitic Plants, 30 June – 5 July 2019, Amsterdam, the Netherlands

On behalf of the International Parasitic Plant Society (IPPS), we invite you to the 15th World Congress on Parasitic Plants (WCPP15) to be held from Sunday June 30 (arrival and registration) until Friday July 5 (morning departure) 2019 in Amsterdam, the Netherlands. This meeting is organized by The University of Amsterdam in collaboration with the IPPS and the Working Group on Parasitic Weeds of European Weed Research Society (EWRS). WCPP15 will continue the long tradition of regular meetings of experts on parasitic plants from all over the world that started in 1973 in Malta. With these meetings we stimulate the exchange of information and ideas among researchers from around the world and working on a wide spectrum of disciplines and perspectives around the common theme of plant parasitism. Conference sessions will be designed to find common interests and create synergy among the different disciplines. They will include presentations on cutting edge parasitic plants research and will cover weedy and non-weedy species, management technologies, genomics, molecular biology, physiology and evolution of parasitic plants. We are looking forward to meeting researchers from all over the world for an exciting and varied scientific program. In addition to an engaging scientific program, there will be time for social events including a visit to beautiful Amsterdam. We hope you will attend the 15th World Congress on Parasitic Plants and mark the date in your calendar. On behalf of the Organizing Committee, and the IPPS and the EWRS Working Group on Parasitic Weeds, we are looking forward to meeting you in Amsterdam.

Local organising committee
Harro Bouwmeester, Teun Munnik, Laura Wind, Benjamin Thiombano, Mehran Rahimi, Jos Raaijmakers, Aimee Walmsley

Venue
The meeting will be held in Casa (https://hotelcasa.nl/), a hotel/conference centre with which the University of Amsterdam has a contract for reduced rates. All requirements for a scientific meeting, as well as optimal interaction between the participants are available under one roof: a meeting room, room for posters, a restaurant for dinner, a bar as well as comfortable hotel rooms. Casa is located close to one of the main train stations of Amsterdam (Amsterdam Amstel) and other public transport (bus and metro), about 13 minutes from the wonderful, historic, city centre (bus or metro) and about 30 min from Schiphol (by train) one of the major European airports that can be easily reached from all over the world. Consider spending some more time in Amsterdam before or after the meeting, as it is a fantastic city to visit. With its canals, its typical centuries-old houses, its museums, including the world-famous Van Gogh museum and Rijksmuseum, it is a must see (see for example https://www.iamsterdam.com/en/see-and-do/things-to-do/top-20-things-to-do-in-amsterdam).
Cost of the meeting
The registration fee will be approximately 570 euro - this includes coffee, tea, lunch and dinner, the conference dinner and a half-day excursion. The registration fee also includes two year’s membership of the International Parasitic Plant Society (60 euro). Registration will open September 2018. Rooms at Casa are available at a (discount) rate of 149 euro per night (5 nights = 745 euros). Rooms can be shared thus making the venue affordable for young scientists also. Alternatively, plentiful accommodation can be found in Amsterdam including youth hostels and AirBNB.

Harro Bouwmeester.

MEETING REPORT

The 18th European Weed Research Society Symposium, Ljubljana, Slovenia, 17 to 21 June 2018.

The 18th EWRS Symposium took place in Ljubljana (Slovenia) from 17 to 21 June 2018, at the GR-Ljubljana Exhibition and Convention Centre, organized by the Agricultural Institute of Slovenia (AIS). Over 260 participants from 40 countries attended this important symposium, submitting 240 scientific abstracts.

The programme was organized into 13 sessions with 76 oral presentations, 12 working group meetings, a poster section and a pre-symposium workshop. Although it was not possible to organize a whole session on parasitic weeds, because a more integrated programme was preferred, the subject proved to be still important among the scientific interests of the society.

Thus, fourteen abstracts having ‘parasitic weeds’ as main subject were submitted to the Symposium and accepted in five different sessions (see below), six of them as oral presentations (# 76, 174, 176, 178, 210, 270 in the list below).

Most of the abstracts had Phelipanche and Orobanche species as the parasitic weed subject, and P. ramosa was the preferred species. Different weed management practices for their control were reported, such as chemical on sunflower (71), integrated in tomato (210) or otherwise against P. ramosa (270, 278, 290). Other studies contributed to characterize the resistance of sunflower to its parasite (174), or to understand the interactions between host and parasite in carrot (182), or between soil fertility and Striga parasitism (176), or to decipher the differences between obligate and facultative parasites (178). Other studies focused on physiological properties of the parasitism, by considering the macromolecules translocated to the parasite from the host (191), or observing in vitro the germination of Striga hermonthica (187) or the synergy of stimulants, or by comparing hybrid populations of the parasite (196). Another abstract (76) considered a new methodology useful for the detection of the parasite in the field.

The Symposium was very intense, well organized, scientifically interesting and fruitfully interactive.

Chemical Weed Management
71. P. Vahamidis et al. - Sunflower broomrape occurrence under the use of Clearfield ExpressSun and technologies.

New Technologies
76. R. Lati et al. - 3D Morphological Crop Analysis - A New Methodology for Detection of Broomrape Parasitism.

Weed Biology
176. J. Rodenburg and L. Bastiaans – Are Striga spp. and low soil fertility, two sides of the same coin?
178. L. Bastiaans, A. et al. - Facultative or obligate parasitism - does it make a difference?
182. S. Emran - Metabolic and biochemical aspects of interaction between species of carrots to root parasite Orobanche.
187. Y. Krasylenko et al. - Purple witchweed (Striga hermonthica (Dellile) Benth.) in vitro germination and visualization of its cytoskeleton.
191. S. Marzouk and R. Aly - Translocation of macromolecules from tomato host plant to the parasitic weed Phelipanche aegyptiaca.
196. D. Plakhin et al. – Characterisation of a diverse hybrid population of Phelipanche ramosa and P. aegyptiaca.

Integrated Weed Management

Biologically Inspired Weed Management
E. Dor et al - Amino acid overproduction confers resistance to plants against Phelipanche and Orobanche spp.

S. Gibot-Leclerc et al - Biocontrol against the root parasitic plant species Phelipanche ramosa, branched broomrape of tobacco.

A. Boari et al - Effectiveness of a natural fertilizer in controlling the parasitic weed Phelipanche ramosa.

Maurizio Vurro.

ESSAY

Hit parasitic weeds hard with HIGS: they possibly can be transgenically controlled

Introduction

It was demonstrated in pioneering work over a decade ago, that transgenic plants could be engineered to produce double stranded RNA molecules that when entering a pest replicate themselves using the pest’s machinery while disseminating throughout the pest in a virus like manner. The double stranded RNA is processed in the pest into short usually 21-24 nucleotide long pieces. If these pieces are specially encoded to interact with pest mRNA, they interfere with pest mRNA function. Thus, the final processing product of the double stranded RNA is termed interference RNA (RNAi) and the interference it causes is termed Host-Induced Gene Silencing (HIGS). HIGS was first demonstrated to work two decades ago with nematode specific RNAi constructs, significantly inhibiting the development of the nematodes that attacked the transgenic plants (Huang et al. 2006). This major breakthrough was heralded as the new way to develop transgenic crops that could be thus rendered resistant to pests of all sorts. This could potentially augment or supplant pesticides (except for herbicides used on free-living weeds), as well as the need to genetically engineer crops with protein toxins such as Bt for insect control.

This realization that one could have an ‘in seed’ technology, any technology in or on the seed that obviates the need for an external input and where pest control is at no cost to the farmer except for seeds, caused many to try it. The results for the most part were ‘promising’, i.e. good enough for academic publication in a respectable journal. Recent reviews describe these endeavours to use HIGS against insects (Zotti et al. 2018), viruses (Tomar et al. 2018), and fungal pathogens (Sharma et al. 2018). One’s first worry with HIGS was that the RNAi made by the host will not get to its target in the pest. Indeed, some insect families seem to be impervious to the effects of crop engineered RNAi’s that are active in silencing of related families (Cooper et al. 2018). An RNAi ingested when a pest attacks a crop must be able to arrive intact at the target without being degraded. It was initially not known whether RNAi could travel from a crop into a parasitic weed. Over the past few years elegant experiments with parasitic plants have demonstrated that RNA can move both from host to parasite and parasite to host, and be expressed at the target (see recent excellent review by Westwood and Kim 2017), and RNA from the parasite can also negatively affect the host (Shahid et al. 2018). There were partial successes showing that Phelipanche aegyptiaca (Aly et al. 2009), as well as Cuscuta pentagona (Alakonya et al. 2012), could be suppressed by RNAi emanating from hosts, but unfortunately not to an extent that is sufficient to be of interest to a farmer. Only preliminary results were reported of a larger experiment with maize engineered with 13 RNAi constructs, each designed to interact with single sites on mRNA encoding key one of five key Striga asiatica metabolic enzymes (de Framond et al. 2007). The results were negative except for some slowing of Striga growth. Most RNAi researchers lost interest and went on to other things for nearly a decade.

A parallel system to HIGS where a virus is used instead of the crop plant to induce gene silencing has been used to vector RNAi into parasitic weeds (Dubey et al. 2017; Kirigia et al. 2014). While VIGS is an excellent system for studying general functional genomics of the parasitic weeds, it is the genes that are highly expressed during infection that are of interest in our context. Even if one were to be able to completely suppress a parasite with VIGS in the laboratory, it would not be a viable system for use with underground parasitic weeds in the field, except in the cases where a host-virus that lacks noticeable pathogenicity translocates and replicates in the parasite (Gal-On et al. 2009), and can possibly be used to vector RNAi.

In the past two years there have been significant advances leading to >99% suppression of genes in some cases e.g. (Gressel and Polturak 2018; Power et al. 2017; Sharma et al. 2018; Tomar et al. 2018). This has come from a better understanding of how to make more robust HIGS RNAi constructs, as well as the availability of better paradigms for the choice of pest-gene mRNAs to suppress. These successes could not have been possible without advances in gene isolation and sequencing as well as whole organism gene sequencing together with advances in bioinformatics. This confluence of new and needed information is now available for major parasitic weeds and their crop hosts. The possibility of having crops robustly resistant to parasitic weeds is probably well within our grasp in a relatively short
time period. This article with the suggestions below is only being written because the author has been retired for more than a decade. Under other circumstances, he himself would instead be following the suggestions below with students and colleagues. The suggestions are extrapolated from what has been learned about how best to use RNAi in other crop/pest systems. This article is written because the author would like others to follow this up, expand and refine the protocols, and release the world from the demon of parasitic weeds.

Choosing the target genes – genes the parasite expresses during attack
The initial attempts to use RNAi against parasitic weeds targeted major metabolic genes (Aly et al. 2009; de Framond et al. 2007). In retrospect, this may have been a mistake. They may not be heavily expressed during attack, and also, if inhibition is not complete, the parasite might be able to eke through. Those researchers had no choice and did what they could at that time. They were able to fish out the major metabolic genes from host and parasite using consensus sequences, and then finding stretches in the parasite sequences that were different from those of the host so that the RNAi would not cause a ‘self-goal’ in the host. It may have been a mistake to use a promoter from a leaf attacking virus in the maize/Striga attempt, with little evidence that it is expressed in maize roots (de Framond et al. 2007).

We now have available almost complete reference genomes for at least one crop attacked by Striga, Orobanche/Phelipanche as well as Cuscuta species. A draft quality Cuscuta campestris reference genome has been published (Shahid et al. 2018). According to J. H. Westwood (pers. comm.), there is a better genome posted of Cuscuta australis (Sun et al. 2018), and the reference genomes of Striga asiatica and Orobanche clymena are close to being published. These will allow a much better approach to choosing parasite specific genes to target. It is advised to choose sequenced parasite/host pairs, where parasite attack can be facilitated in an axenic system in order to eliminate transcripts emanating from crop- or parasite-associated microorganisms. It is not clear whether this has been done in previous transcriptomic analyses with parasitic weeds. The attack site - host and parasite together - should be excised at various stages after attachment and penetration, and the pieces subjected to expression profiling (transcriptomics). In the past, parasite tissue was either cut away from the host (Ranjan et al. 2014), or laser micro-dissected (Honaas et al. 2013), which as discussed below, may not have been necessary. The mRNAs being expressed at various stages of attack are transformed back to DNA using reverse transcriptase enzymes, which like so many molecular biology procedures, is performed with readily available commercial kits coupled with quantitative PCR (qRT-PCR), and the most amplified pieces are then subjected to sequencing. Assembling the transcriptome in a useful manner may require the assistance of a bioinformatician. There have been transcriptomic analyses of Cuscuta pentagona (Ranjan et al. 2014), but not using qRT-PCR, and thus all the transcripts are given equal weight, which does not tell us which are more likely to be the most important. A qRT-PCR analysis of housekeeping genes in Striga hermonthica has been published to serve as a reference (Fernandez-Aparicio et al. 2013). The concept of doing so was to have genes for normalization qRT-PCR during attack. A transcriptomics analysis of Striga hermonthica and Phelipanche aegytiaca gene sequences that are specifically expressed at various stages after host-parasite has also been published (Yang et al. 2015). Thus, it is now possible to qRT-PCR mRNA from both host and parasite at the point of contact and then compare the sequences of those mRNAs that are specifically expressed at the point of contact to the known sequences of the host and other non-parasitic plants using standard software. It is thus easy to ascertain which genes are highly expressed in the host, and which in the parasite at the time of parasite attack. The subjects of interest here are those only specifically expressed after there is a host parasite junction. If the parasite genes expressed at various stage of attack are RNAi silenced, attack should be aborted. An advantage to this approach is that one need not know the function of the genes being expressed, just that they are specifically expressed by the parasite during attack, presumably for an important function needed at that time.

The knowledge of the genes being highly expressed in the attacked host may also be of interest, not for their function per se, but for their promoters. These might be the best promoters to use to express the double stranded RNA, as well as for consideration in the future for upregulating host resistance genes, for another level of protection from attack.

Using multi-target constructs
The early attempts to suppress parasitic weeds (as well as other pests) all used constructs producing a single RNAi sequence targeting a single site on the mRNA targeted. We now know that this is insufficient to get the level of control needed. Even if it were, a single wobble base mutation in the 21-24 nucleotide sequence targeted would significantly destabilize the binding by the RNAi without affecting the amino-acid sequence of the targeted enzyme, at least partially obviating the silencing effect of the RNAi. Thus, pest resistance would be quick to evolve to RNAi, probably more quickly
than mutations conferring target-site resistance to pesticides, where wobble base changes cannot confer resistance.

The recent success with crop/pest pairs are all with constructs containing many RNAi encoding sequences. They encode sequences targeting many sites on one mRNA and/or many different mRNAs. Whether these suppressive effects are additive or synergistic is immaterial, suppression is often as complete as can be measured. This is not completely a wild shot-gun approach, as each RNAi is aimed specifically at a target. There is no great problem in putting many RNAi encoding sequences in a transformation construct, as they are quite short, tens can be included. Follow-up experiments show that for some unknown reasons, some of the RNAi sequences do not work, and some do (Power et al. 2017). More the reason for large numbers of RNAi encoding sequences, each under the control of a different promoter chosen to be active in the tissues and cells where needed.

Discussion and Conclusions

Regulatory issues

HIGS constructs do not encode for proteins, eliminating toxicological issues from the regulatory hoops that must be undertaken for transgenic crops that synthesize novel proteins. If the promoters used restrict expression to only tissues that are parasitized, there will not even be novel RNAi in edible part of the plant. A recent economic analysis of the actual costs of developing and registering a crop when it is a ‘public good’ (as in this case) and is done by the public sector come up with numbers more than two orders of magnitude less costly than industry claims (Schiek et al. 2016).

Resistance issues

In a situation where multiple targets are affected, it is hard to evolve target-site resistance, even if based on innocuous mutations in wobble bases. This does not mean that some other type of resistance may eventually evolve, and further thought will then be required on how to overcome it. As a pre-emptive starter, it would not be advisable to abandon the successful herbicide resistance (Ransom et al. 2012) and biocontrol (Nzioki et al. 2016) approaches to controlling parasitic weeds, but to integrate the RNAi approach into a system where all approaches are rotated.

Concluding challenge

The RNAi approach would have the lowest parasite-control economic input requirement for the grower, of all methodologies currently available. The evidence from other pest/crop systems, as well as with parasitic weeds, suggests that such an approach will succeed. As discussed above, much of the preparatory work has already been done. The time is ripe. Go for it – I wish I were in a position where I could.

References


Gressel J, Poultruk G (2018) Suppressing aflatoxin biosynthesis is not a breakthrough
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New Cuscuta interactions and genomes revealed

The first half of 2018 has brought a breakthrough in parasitic plant genomes as three new papers have released Cuscuta genome data (Shahid et al., 2018; Sun et al., 2018; Vogel et al., 2018). This is a remarkable advance. Even knowing that other
parasitic plant genomes are in various stages of sequencing, assembly, and annotation, it is momentous to have these genomes revealed in such rapid succession. It is also perhaps surprising that the first three parasitic plant genomes to be published are all Cuscuta species, with two dealing with C. campestris and one with C. australis.

The paper by Shahid et al. focuses on C. campestris and released a highly fragmented genome of this species as part of the supporting material for a study on small RNAs in parasite host interactions. The genomic sequences were used in identifying Cuscuta microRNAs (miRNAs) that are expressed in haustorial tissues in association with the host, Arabidopsis thaliana. The miRNAs appear to be mobile into host stems, where they result in production of small RNAs generated from the degradation of host target mRNAs. The parasite miRNAs have homology to host genes, so specifically bind to these targets to shut down their expression. Among the specific genes targeted for silencing are the sieve element occlusion protein SOER1 and three auxin receptors. Notably, parasites accumulated more biomass when grown on Arabidopsis hosts that were mutated in SOER1 or the auxin receptor AFB3. Taken together, these results make a strong case that C. campestris miRNAs function as trans-specific factors that facilitate parasitism. This is the first report of this type of interaction between parasitic plants.

Vogel et al. describe a more complete genome of C. campestris. For a parasitic plant, this species has a relatively compact genome, estimated at 556 Mbp per haploid genome, with a predicted 44,303 genes. Sun et al. report an even smaller genome for C. australis, estimating it at about half the size of C. campestris at 273 Mbp, with 19,671 predicted gene loci. Both papers describe insights from Cuscuta evolution, and although they ask slightly different questions, some common themes emerge. One of the more intriguing questions regarding parasite genomes is the extent to which the parasitic lifestyle has resulting in loss of unnecessary genes. This question can only be confidently addressed with a good quality genome in hand to provide certainty that genes are actually missing rather than just reduced in expression. For C. campestris, losses are reported for genes related to photosynthesis, metabolism, transport processes, and symbiotic interactions. This is similar to the situation in C. australis, in which lost genes relate to photosynthesis, chloroplast RNA processing, primary nutrient uptake from soil, and leaf and root development. All of these make sense for Cuscuta, which lacks functional leaves, roots and relies on host photosynthesis.

The genome papers diverge in other questions. Vogel et al. report evidence of 64 horizontal gene transfer events involving ancestral C. campestris acquisition of host genes. Sun et al. devote effort to analyzing regulation of gene expression, taking up the question of haustorium origin and concluding that haustoria in C. australis primarily use genes that are normally associated with root development in autotrophic species. These papers highlight the abundance of new data that is available and the types of questions that can be asked. Considering this along with a new aspect of parasitism involving RNAs as agents of cross-species gene silencing, these are indeed exciting times for parasitic plant research.


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‘VISCUM ALBUM’ IN WEST AFRICA

We have recently identified a considerable number of papers in which medicinal value has been studied or attributed to ‘Viscum album’ in West Africa (there are at least two in the Literature section below). As there is no reason to accept this identification as correct, as pointed out by Wahab et al., 2010. (TLC phytochemical screening in some Nigerian Loranthaceae. Journal of Pharmacognosy and Phytotherapy 2(5): 64–70.), we have contacted the authors of 14 publications, requesting them to try and confirm which mistletoe species is really the subject of their study. So far there has been no response. If any other reader can throw light on this unfortunate situation, do please let us know.
A link between climate change, a migratory bird and an abundance of mistletoe in Cambridge has been found. A study of the city's natural history has discovered the plant is present in unexpectedly large quantities. Blackcaps which feed on mistletoe are staying in the city instead of migrating and are spreading its seeds.

NatHistCam studied a five-mile by five-mile (8km by 8km) square of the city, roughly centred on Mill Road Cemetery, and discovered unexpected amounts of the plant and also blackcaps wintering in the area. The Cambridge survey was designed to create a snapshot of the flora and fauna of the city.

Researchers said the mystery of why it has so much mistletoe has been answered. The bird usually flies off as winter approaches, but in recent years has stayed in the city as the weather has become warmer. While feeding on mistletoe the birds smear seeds on to trees which helps spread the plant, the survey group said.

Bob Jarman of the Cambridge Bird club, who is researching overwintering blackcaps, said: ‘The blackcaps are traditionally migratory birds who are here for the summer and then head to warmer climes for the winter.’ The RSPB said that since the 1960s, more of them had started to winter here because of climate change.

BBC News 25 December, 2017

**Plant Palette: this parasite promotes kissing at the holidays**

No one gives much thought to mistletoe beyond the Holidays.

How in the world did a plant parasite become associated with kisses and Christmas? There are lots of legends told about mistletoe, but the familiar association with Christmas has its roots in Europe. The ancient Druids used a golden sickle to cut mistletoe from their most-revered tree, the oak, as part of ceremonies celebrating fertility that included human sacrifice. The Druids also celebrated the winter solstice which may explain part of mistletoe’s association with Christmas— but it’s a stretch.

Supposedly, a Norse myth explains mistletoe’s link to kissing. According to the myth, an arrow made from mistletoe killed Balder, son of Frigga, the goddess of love and beauty. The other gods resurrected Balder, and Frigga’s tears of joy formed the white berries produced by the common European mistletoe species, *Viscum album*. Legend says that the berries represent kisses bestowed by Frigga to people that meet under the mistletoe. Some say that a berry should be removed from the mistletoe for each kiss and that the mistletoe loses its "power" once all the berries are removed.

The name mistletoe comes from second-century Anglo-Saxon descriptions of the plants as ‘misteltan’, derived from the word ‘mistle’ meaning dung, and “tan” meaning twig. These early people associated the appearance of mistletoe with droppings from birds on tree branches. Not exactly the most romantic legend around, but they did think there was some magical process at hand that spontaneously generated the resulting mistletoe plants.

The French link mistletoe to Christmas through Christ’s crucifixion, using the fact that mistletoe is poisonous. According to a French legend, the original mistletoe plant grew on the tree that was made into the cross on which Jesus was crucified. This made the mistletoe cursed, causing it to be forever poisonous and a parasite, never allowed to grow independently on the ground.

Mistletoe may be poisonous, but at various times it has also been considered an aphrodisiac. Medically, it can be an abortifacient, meaning it will cause a miscarriage of pregnancy. Some writers suggest this is one reason mistletoe is linked with fertility, which in some cultures also meant uninhibited sexuality and promiscuity. In any case, ingestion of mistletoe is likely to cause severe cardiac, digestive, and neurological malfunction and death are likely. You’d be wise to search for aphrodisiacs elsewhere!

Another random fun fact: the mistletoe that started the kissing tradition according to European folklore is usually the species *Viscum album*. The mistletoe sold in the U.S. is an assortment of species from a different genus, *Phoradendron*. But regardless of the mistletoe species used, it really is an odd tradition when you stop to think about it!

‘How Maine’s red spruce forests are fighting for survival’

Philip Kiefer ’18, a member of the podcasting student team that produces ‘The Bowdoin Commons’, has made an audio story about the honors project of his friend Hanna Baldecchi ’18, who is researching the Eastern dwarf mistletoe. This mistletoe is a tiny parasitic plant that lives on the branches of spruce trees, stealing nutrients from and slowly killing its hosts.

With his recorder, Kiefer accompanied biology major Hanna Baldecchi ’18 on one of her data-collecting trips to the Maine island of Isleboro this winter. Driving up the coast and walking through the woods, Baldecchi explained her research into the mystery of why the mistletoe is affecting red and white spruces differently. The red spruce appears to be better at protecting itself from the mistletoe’s threat, but scientists are not sure why.

‘She is looking at something really cool. She is studying a predator-prey relationship in the forests of Maine. But not like wolves and deer or anything.’ Kiefer remarks early in his podcast. ‘The predator she is looking at is a plant, mistletoe, and the prey is the forest itself. When Hanna looks at the trees she doesn’t see a peaceful place; instead she sees a bunch of plants fighting for their lives.’

In his podcast, Kiefer enlivens the fatal, and quiet, process of the mistletoe’s scourage on white spruce trees, and the curious way red spruces are managing to defend themselves from what should be a mortal enemy. Along with audio effects, and some funny back-and-forth between him and Baldecchi, he includes original music by Sam Kyzivat ’18.

For the associated podcast go to: http://community.bowdoin.edu/news/2018/04/how-maine-s-red-spruce-forests-are-fighting-for-survival/

Philip Kiefer, 24th April, 2018.

‘Declining native mistletoe discovered in Upper Hutt taken to Zealandia for preservation’

A declining native mistletoe has been found in Upper Hutt, New Zealand, and conservationists are hurrying to save it. The mistletoe, known as *Ileostylus micranthus*, was unexpectedly found growing on a tree planted by Greater Wellington Regional Council to provide cover and shade for other native plants. The only problem is the tree is dying, which means the mistletoe will also die, so a plan was hatched to move the shrub to Wellington’s Zealandia ecosanctuary and nearby Otari-Wilton’s Bush.

Members of Ngā Manu Nature Reserve, Otari-Wilton’s Bush and Zealandia collected fruit from the mistletoe, before planting their seeds at Zealandia. The ‘host tree’, a lucerne planted next to State Highway 2 at River Rd, was not expected to survive until summer, so there was little time to act if the mistletoe was to be preserved.

*Ileostylus micranths* Photo Pieter Pelser

Hundreds of tiny fruit from the plants were taken from a tree they were growing on in Upper Hutt, with their seeds replanted at Zealandia. Zealandia conservation and research project leader Pascale Michel said while the plant species was not threatened, it was declining in Wellington. ‘We are on a bit of a rescue mission here to try to spread those plants throughout the Wellington region,’ Shanahan said.

‘They’re quite ripe so it’s a good time of the year to pick them. Usually birds will do that job, but
today it's us doing the job.' The bright orange fruit are a good source of food for birds and geckos.

Zealandia did not have the native species in its ecosanctuary, so it was hoping the propagation process would be successful. ‘It has been a bit of a rushed process because of the host tree dying. We had planned to do this next year but decided to rush it a little bit this year to try and establish here at Zealandia. ‘We'll most probably have another go next year as well.’

Zealandia manager of conservation and research Danielle Shanahan said the mistletoe plants played an important role in the ecosystem, as did all plants. ‘In this case, the mistletoe is an excellent food source for birds and geckos, and they are another structural element in the ecosystem. It's a super-connected system.’ Found in all parts of New Zealand and on Australia's Norfolk Island, the bushy, yellow-green shrub grows on other trees, producing clusters of tiny green flowers and orange fruit.

Damian George, 2nd May, 2018

‘Ahead of Ugadi, the curious case of the disappearing neem trees in Hyderabad’

Ugadi is not far away, and the special pachadi that is prepared on the New Year’s Day is something that most of us look forward to. However, one of the important ingredients of the recipe — the neem flower — is becoming increasingly hard to find. Once a common tree in households and road sides, the neem is fast disappearing from the landscape of Hyderabad. The neem flower, as a result, has become a rare commodity. Experts attribute the disappearance to a parasite called *Loranthus longiflorus* or honeysuckle mistletoe. The mistletoes anchor themselves onto the branches and suck water and nutrients directly. They engulf entire sections of the tree blocking the much-needed sunlight that is crucial for growth.

At the point of attachment, haustoria penetrate into the tissue of the host to absorb nutrients and water. The places at which the parasite is attached and where the haustoria penetrate often swell into tumours. When the tree is infested by the parasite, there will be a considerable reduction in the yield of fruit, and leaves wilt and show unhealthy green colour. Neem trees can be protected by removing the parasite in the early stages of its growth. Cutting the branch affected by *Loranthus* before it spreads to other branches will also help.


‘Mistletoe feared extinct found on Little Cayman’

An extremely rare endemic mistletoe species, which had not been seen since 1991 and was feared extinct, has been found on Little Cayman, paving the way for the Department of Environment to undertake a thorough survey of the plant for its future protection. The Terrestrial Research Unit at the DoE has been looking for this plant for many years, and according to a report in the latest edition of the DoE’s magazine, Flicker, the mysterious mistletoe species, *Dendropemon caymanensis*, was finally found quite by chance.

Stuart Mailer, the environmental programmes manager for the National Trust for the Cayman Islands, was on an altogether different mission in Little Cayman in January of this year, inspecting a network of trails that have recently been developed by a landowner on a large forested property on the island. Exploring what he said was a remote forest home to several rare plants and one of the places where the mistletoe was last seen, he spotted many ‘amazing’ plants and trees. But on higher ground, where the trees gave way to shrubs, he encountered several headache bushes, the primary host for the elusive *Dendropemon*.

According to Mailer, after some time, some scrambling around and careful concentration, he eventually spotted what he thought could be the elusive mistletoe, and after he and others in the party looked more closely, they were all reasonably convinced it was the mistletoe, even more so when they found more of the parasitic plant, which he was able to photograph close up.
for the record. Comparisons of Mailer’s pictures with George R. Proctor’s description of the various mistletoe species recorded in Cayman in his seminal work about local plants, based on the shape of the leaves and the berries, it seemed that Mailer had rediscovered the rare mistletoe.

Following his discovery, he sent his photos to the DoE, which passed them on to other international experts, who confirmed the identification. The TRU then conducted an initial search and identified another seven locations in the area where the plant was growing. As a result, a new survey will soon be underway to ensure the plant is preserved and to help researchers understand more about this plant.


(NB This species was the subject of a note in Haustorium 65 reporting that a project had been established to try and re-find the species – which apparently proved unsuccessful.)

‘MSU professors team up with African scientists to combat Striga’

Montana State University’s department of plant biology hosted scientists from twelve African countries as part of the toothpick project in hopes of teaching them good agricultural practices to combat Striga or witch-weed in Africa. The team hopes to use these skills to combat the issues that the weed causes to millions of African farmers and improve their livelihood.

Christopher Suh a scientist, from Cameroon, was one of the twelve investigating these Striga solutions. ‘Striga being the number one parasite weed affecting the entire continent, so if we succeed, then we’re going to improve the lives of 320 million people and give them a better future,’ Suh explained.

The scientists are grateful for the university’s willingness to help them improve farm life in Africa and hope for more universities around the world to open their doors to fight the problem.

Carson Vickroy - MTN News, 27th January, 2018

‘New striga resistant seeds boon for farmers’

Maseno University (Kenya) scholars say they have developed maize and millet seed varieties capable of resisting the notorious striga weed, promising hope to farmers who routinely lose out to the herb. Lead scientist Mathew Dida said the new seeds have a natural adaptation to fight off the destructive weed. ‘When you compare them with the normal seeds, ours have capacity to suppress the growth of the weed in maize plantations, for example,’ said Prof Dida.

A farmer uproots striga weeds from his farm. file photo | nmg

The researcher said their 16-year study has produced maize varieties Maseno EH10, EH11 and EH14 and finger millet variety 60D which can tolerate the weed and mature faster. The weed is a common parasite in sub-Saharan African countries including Kenya. It thrives by siphoning nutrients and water from host plants such as maize, sorghum and rice, weakening the crops. The scientists said the varieties can cushion farmers against losses occasioned by the parasitic weed, assuring them of improved harvests. ‘From the first day of planting to the harvest date takes about 120 days,’ he said. He said that the country suffers close to Sh6.7 billion losses as a result of the striga weed destruction.

Business Daily, 5th June 2018.

‘Kamuli COA asks Parliament to ban the smoking of Striga’

The Kamuli (Uganda) district deputy Chief Administrative Officer (CAO), Godfrey Aduma has asked the MPs committee of Agriculture to ban the smoking of Striga among locals. This follows the increased use of the weed among the youth in Busoga region. According to Aduma, Striga is a deadly weed known to affect someone mentally when taken. Aduma told the legislators during their over sight role to assess the impact Striga weed has caused in Busoga region on Tuesday. He added that youth tend to dry Striga
leaves and purple flowers, combine it with tobacco for smoking hence intoxicating their brain, which explains the increased crimes in the region.

‘Striga’ weeds are not on the list of banned narcotics in the country. ‘Apparently, it is difficult to prosecute people practicing the vice. Therefore, we implore you to ensure that smoking Striga is an offence,’ Aduma said. According to Aduma, over 60% of crimes committed in the region is done by youth who smoke Striga. ‘Over 200 drugs related cases have been registered at Bugembe Police station since the beginning of the year,’ he noted.

The Iganga district Senior Agricultural officer, Wilberforce Tibairira expressed fear that the weed may cause serious harm to the people’s lives who are smoking it since it causes serious damage to its host crop before emerging from the soil, by producing harmful phytotoxins to the host crop. ‘The host plant’s nutrients are depleted and energy is spent supporting the parasitic plant (Striga). Damage is severe under conditions of low rainfall and poor soil fertility,’ explained Tibairira.

‘Consumption of the deadly weed is common in peri-urban areas including Kamuli, Iganga, Bugiri, Mayuge, Jinja, Luuka, Kaliro districts he said the vice is rampant in Idudi, Busembatia, Bugembe, Kasambira town councils among others.’ The committee vice chairperson, Robert Migadde Ndugwa (Buvuma County MP, expressed fear that the youth may resort to planting the weed in hidden places, to avoid police. Meanwhile local governments in Busoga regions should agree to make and pass by-laws that prevent and control the smoking of the deadly weed,’ Migadde added.

Migadde said the committee will contact the Uganda National Crop Resources Research Institute-National Agricultural Research Organisation (NACRRRI-NARO) to carry out experiments to get herbicides that control the Striga weed. The Bududa woman MP, Nalongo Justine Khainza cautioned the farmers against selling off their land to opportunists who are threatening to buy them off because of the Striga weed. During their tour, the committee found over 200 acres of the maize, infested by the weed.

Sharon Muhwezi, the Uganda Government Relations analyst in charge of ‘One Acre Fund,’ a non-profit organisation serving smaller holders farmers in Busoga region said apparently there is no approved pesticides for controlling the weed, calling on Governments’ intervention. Muhwezi said they offer farmers with a package of farming inputs including fertilisers, Striga maize resistant seeds, solar lights and harvest drying sheets. the package is equivalent to a loan of sh 250,000. The revolving loan payable back within one year after the farmers have harvested their yields. Muhwezi warned; ‘Striga seeds are very small and mainly spread through the use of contaminated seed and equipment, surface run-off, eroded soil, wind, animals and people.

‘Uprooted Striga plants should be burned with fire to prevent spreads to other farms. Seeds may remain dormant in the soil for 15–20 years,’ he said.


(NB We had some suspicions that this was an example of ‘fake news’ but we have now learnt from local sources that Striga leaves are indeed being smoked by youths in Eastern Uganda as a substitute for marijuana, since the latter has been banned. We would welcome any further comments on the veracity (or otherwise) of this story. Eds.)

‘High-protein corn also resistant to parasitic weed’

The world produces more corn by weight than any other cereal crop. Corn, also known as maize, is a staple food in many countries. But farmers growing corn face many challenges, such as drought, diseases, and pests. For example, in sub-Saharan Africa, 20 to 80% of corn yields may be lost because of a semi-parasitic plant, Striga. In areas infested with Striga, farmers may even lose their entire crops.

Flowering witchweed (Striga asiatica) in a conventionally-ploughed maize field on sandy soils in Madziwa, Zimbabwe. Photo: Christian Thierfelder, CIMMYT
In a new study, researchers from southern Africa identified several varieties of corn resistant or tolerant to *Striga*. Importantly, these varieties also have improved nutritional content, particularly protein. The combination of *Striga* tolerance and improved nutrition is key. Farmers, as well as local populations, will benefit, says Peter Setimela, a study co-author. Setimela is a scientist at the International Maize and Wheat Improvement Centre in Harare, Zimbabwe.

*Striga* infestations can force small farmers in sub-Saharan and southern Africa to abandon their farms. *Striga* is known to affect fields that have poor soil fertility. Its seeds can stay in the soil for more than 15 years, ‘ says Setimela. ‘Many small farmers can’t afford to buy chemicals to control *Striga*. They may also be unable to buy chemical fertilizers.’ Having access to varieties of corn that can tolerate *Striga* will benefit these farmers. They will be able to continue farming and growing corn in areas with *Striga*. The improved nutritional content of these corn varieties will also help. The varieties have a wider variety of amino acids, the building blocks of protein.

‘Typically, corn is poor in essential amino acids. Human and animal bodies can’t make these amino acids. They have to be obtained from food,’ says Setimela. ‘Lack of essential amino acids can impair growth and development. It can also weaken the immune system’. Many rural populations depend on corn as a staple food. ‘But these populations often have limited access to protein sources, such as eggs, meat, and dairy products,’ says Setimela. ‘If varieties of corn can provide high-quality protein, these populations will benefit.’ Setimela and colleagues tested both typical and high-protein varieties of maize. They measured several plant characteristics, including yield, height, vigor, and kernel weight. Researchers found four varieties of high-protein corn that also showed high levels of *Striga* tolerance and high yields.

‘These varieties will provide options to farmers in areas with *Striga*,’ says Setimela. ‘They will improve food security and nutrition.’

EurekAlert, June 13, 2018, American Society of Agronomy

‘The flower that must not be named’

Some know the plant as naked broomrape. Others know it as flowered cancer root. There’s simply no way to talk about the beauty of *Orobanche uniflora* without raising a lot of eyebrows. The plant bears some of the least attractive common names in the plant kingdom: Some know it as naked broomrape. The alternate is no less unappealing: flowered cancer root. When you have to consider which of a plant’s common names is least offensive, you know you are facing a plant with a publicity problem, a plant badly in need of an image makeover.

Photo: David Taft

Probing naked broomrape’s common and Latin names rapidly leads down the rabbit hole of the arcane. The short version of the story is that ‘broomrape’ is the partially translated 16th-century name of a genus of plants, *Genista*: European plants called brooms. Likewise, rapum is the partially translated Latin for a cluster of tuberlike roots. Naked, though unfortunately suggestive in this context, probably simply refers to the plant’s leaflessness. Ferment these oral ingredients in the cask of time and the result is the hideous common name, naked broomrape. Though there are records of medieval medical uses of the plant as an astringent healer of ‘old green wounds’, whatever uses cancer root once
had for treating that disease have been lost to time.

Myths aside, flowered cancer root is a singular, fascinating plant to study in the field. It is an uncommon plant found in a fairly ordinary habitat, but without leaves or perennial stems, it is visible only when it flowers, and generally where few think to search. Luckily, even in New York City, old, un-mown fields are not hard to find. Cancer root is a parasite of such common plants as goldenrods, asters, saxifrages and sedums, and though I have seen these plants blooming in Brooklyn and Queens, the fields of Staten Island and the Bronx have real potential.

Superficially, cancer root appears like Indian pipe, a woodland dwelling saprophyte, a plant that feeds on decomposing plant matter. Though both plants are completely without chlorophyll, one-flowered cancer root grows in full sun, its 'haustoria' (specialized roots) piercing the roots of its victims, and deriving nutrition from them, without the need to wrest it from the soil.

One flowered cancer root can be found in all of the lower 48 states of the continental United States, as well as in Alaska. Within a range this large, the flowers will vary in color. Our local cancer root flowers are particularly beautiful, held singly on pinkish, hairy, upright stems, they are white with a bright yellow throat, but completely covered with short purple hairs that outline the flower with a supernaturally-looking halo. What is it that is so fascinating about parasites? Consider humanity’s endless flirtation with vampires, leeches, even mistletoe. Parasites are iconic, sometimes medically valuable, sometimes even erotic. Perhaps we are drawn to their otherworldly lifestyles. Perhaps, deep down, we’d all like to try to live as malevolently as Orobanche uniflora.


HAUSTORIUM SUPPLEMENT

Two years ago, Chris Parker was invited to present a paper at the Strigolactone meeting in Nitra, Slovakia. He chose to discuss the history of parasitic plants and their control, with some admitted emphasis on his own involvement. This paper was not published but it is felt it could be of some interest to readers of Haustorium. Too long to include in the newsletter, it will be distributed as a Haustorium Supplement – Issue 74 - in the near future, and will also be available via the IPPS website.

THESIS

Ecology and Systematics of Thonningia sanguinea Vahl. (Balanophoraceae) in Southern Nigeria. Oligie Imarhiagbe. PhD Thesis. Department of Biological Science, Edo University Iyamho, Edo State, Nigeria. (Supervisor E.I. Aigbokhan, Department of Plant Biology and Biotechnology, University of Benin, Benin City, Nigeria.)

Summary:

*Thonningia sanguinea* Vahl (Balanophoraceae) is a rare cryptic obligate holoparasitic plant endemic to tropical Africa. Apart from its recognition as a root parasite of forest trees, knowledge of its biology in Nigeria is scanty. To bridge the knowledge gap, this study aimed to address its ecology and systematics in Southern Nigeria.

To delineate its presence and current distribution range, reconnaissance surveys were conducted across selected forested areas across Southern Nigeria comprising; National Parks (Okomu and Cross River), Forest Reserves (Ofosu, Oba hills, Idanre and IITA), Plantation forest (RRIN, Iyanomo) and other community managed secondary forests (Ehor-Nu-Wire, Okour, Okokhuo). Historical records of *T. sanguinea* from literature and herbaria together with folk taxonomy and ethnobotanical information from oral interviews of indigenous people from eleven ethnic groups in Nigeria (Bini, Efik, Ejagham, Etulo, Hausa, Igbo, Igala, Ijaw, Tiv, and Yoruba) were used to complement records of areas harbouring populations of *T. sanguinea*. Host identity was determined from soil excavation where direct host-parasite connections to an emerged parasite were apparent. Assessments of degree of infestation per location were determined from number of inflorescence connected to each host. Habitat characteristics were inferred from vegetation and soil types while phenology and insect visitation regimes were monitored by bi-weekly visits to selected *T. sanguinea* stands. Genetic variability and structure of *T. sanguinea* populations in southern Nigeria were evaluated using random amplified polymorphic DNA (RAPD) profile analysis of 15 randomly distributed *T. sanguinea* samples across its distribution range. DNA bands generated were analysed for similarities from which the genetic population structure and
The phylogenetic relationship were inferred using PAST and GenALEx softwares.

The physical presence of *Thonningia* was observed in 25 locations but records from folk taxonomy suggest a wider distribution range. *T. sanguinea* showed a broad host range with special preference for native trees and members of the Euphorbiaceae and Urticaceae. Among the common hosts trees were: *Guarea cedrata* (Meliaceae), *Lophira alata* (Ochanaceae), *Musanga cecropiodes* (Urticaceae), *Myrianthus arboreus* (Urticaceae), and *Ricinodendron heudelotii* (Euphorbiaceae). *Only Hevea brasiliensis* and *Theobroma cacao* were of exotic origin. Phenologically, *T. sanguinea* flowers all year round with the peak during the raining season. Overall, incidence of female inflorescences surpassed male inflorescences by approximately a 2:1 ratio. Ants, *Technomyrmex* species, were the most common floral visitors, accounting for 55% frequency occurrence. Anatomically, the parasite-host interface was composed of a complex aggregate of composite bundles scattered within the haustorium matrix with no evidence of direct host-parasite vascular connectivity. Genetically, populations from Okuor forest were the most genetically diverse, while Cross River populations were most homogenous. Up to 82.3% variability could be explained by allelic variation within population. This demonstrates that *T. sanguinea* exhibits an out-crossing strategy which is expected in organisms with sexual breeding strategy. No IUCN red list category assessment is currently available for *T. sanguinea* but observations from this study suggests that *T. sanguinea* is therefore proposed to be Near Threatened (NT) category.

This study provides a comprehensive overview of the host and preference, habitat characteristics, phenology and some ecological interactions of *T. sanguinea* in Southern Nigeria. Its preference for disturbed areas of the forest, coupled with the fact that it is not found on all soil-types, especially those prone to leaching and erosion makes it a good bio-indicator for assessing the soil health status of a forest. *In situ* conservation *T. sanguinea* may be necessary.

**FORTHCOMING MEETINGS**

International Conference on Legume Genetics and Genomics, May 13-17, 2019 - Dijon, France. Contact ICLGG - C/O Vitagora - 67 rue des Godrans, 21000 DIJON, Tel.: +33 3 80 78 97 92. Email: conference@iclgg2019.com Includes a session on Biotic stress resistance.

The 15th World Congress on Parasitic Plants, 30 June – 5 July 2019, Amsterdam, the Netherlands (see above).

**GENERAL WEB SITES**

For individual web-site papers and reports see LITERATURE

* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: http://www.parasiticplants.org/

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

*For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see: http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For a description of the PROMISE project (Promoting Root Microbes for Integrated *Striga* Eradication), see: http://promise.nioo.knaw.nl/en/about

*For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/

For the Index of Orobanchaceae prepared by Óscar Sánchez Pedraja, Gerald Schneeweiss and others see: http://www.farmalierganes.com/Otropdf/publica/Orobanchaceae%20Index.htm

For the Annotated Checklist of Host Plants of Orobanchaceae, see: http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the *Desmodium* technique for *Striga* suppression, see: http://www.push-pull.net/
For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: [http://www.aatf-africa.org/]

*For Access Agriculture (click on cereals for videos on Striga) see: [http://www.accessagriculture.org/]

For information on future Mistel in derTumorthерапie Symposia see: [http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx]

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: [http://www.vfk.ch/informationen/literatursuch e] (in German but can be searched by inserting author name).

For the work of Forest Products Commission (FPC) on sandalwood, see: [http://www.fpc.wa.gov.au/sandalwood]

For 6th Mistletoe Symposium, Germany, November 2015 see: [http://www.sciencedirect.com/science/journal/09447113/22/supp/S1]

**LITERATURE**

*i*ndicates web-site reference only

**Items in bold selected for special interest**

**Items in blue relate to therapeutic uses of parasitic plants**


Akaogu, I.C., Badu-Apraku, B., Adetimirin, V.O. 2017. Combining ability and performance of extra-early maturing yellow maize inbreds in hybrid combinations under drought and rain-fed conditions. Journal of Agricultural Science 155(10): 1520-1540. [The drought-resistant hybrids TZEEI 81 × TZEEI 79, TZEEI 100 × TZEEI 63 and TZEEI 64 × TZEEI 79 were the highest-yielding and most stable across environments. They are also resistant to Striga hermonthica and have the potential to contribute to food security and increased incomes in sub-Saharan Africa.]


289-298. [C. campestris is one of the most important pests of tomato causing severe losses in yield. The inhibitory propeptide segment of cucusatin (a pre-pro-protein produced by dodder) was transferred into tomato and effectively interrupted cucusatin enzyme activity and haustoria development at the endophytic stage and reduced C. campestris vigour and fecundity.]

Andrade, C.G.C., da Silva, M.L., Torres, C.M.M.E., Ruschel, A.R., da Silva, L.F., de Andrade, D.F.C. and Reis, L.P. 2017. (Diametric growth and time of passage of Minquaria gianensis after logging at Tapajós National Forest, Brazil.) (in Portuguese) Pesquisa Florestal Brasileira 37(91): 299-309. [M. gianensis (Olacaceae) is a valued timber. Results of a 31-year study suggested that trees with DBH ≤50 cm have potential to be managed, due to the growth stagnation presented in larger diameter classes.]


Aytbeke, M. 2017. Fusarium infection causes phenolic accumulations and hormonal disorders in Orobanche spp. Indian Journal of Microbiology 57(4): 416-421. [It was concluded that Fusarium oxysporum causes heavy hormonal disorder, triggers only salicylic acid-mediated defence and induces intense accumulation of phenolic substances in an unidentified Orobanche species in Turkey.]


*Bao YaZhou Yao ZhaoQun, Cao XiaoLei, Peng JinFeng, Xu Ying, Chen MeiXiu and Zhao SiFeng. 2017. Transcriptome analysis of Phelipanche aegyptiaca seed germination mechanisms stimulated by fluridone, TIS108, and GR24. PLoS ONE 12(11): e0187539. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0187539) [Deep RNA sequencing was used to learn more about the mechanisms by which TIS108 and fluridone stimulate the germination of unconditioned P. aegyptiaca seeds. The results showed that only 119 differentially expressed genes were identified in the conditioned treatment vs TIS108 (strigolactone inhibitor) treatment. It was suggested that TIS108 and fluridone (an inhibitor of carotenoid-biosynthesis) +GA3 could be used to control P. aegyptiaca through suicidal germination.]

Barkman, T.J., Klooster, M.R., Gaddis, K.D., Franzone, B., Calhoun, S., Sugumaran Manickam, Vessabutr, S., Sasirat, S. and Davis, C.C. 2017. Reading between the vines: hosts as islands for extreme holoparasitic plants. American Journal of Botany 104(9): 1382-1389. [This is the second of two papers published this year on the population biology of Rafflesia (see also Pelser et al. 2017). Microsatellite markers were used to show that host vines can be infected by more than one Rafflesia individual, and that these are more closely related to each other than to other individuals in the population.]

Barkman, T.J., Repin, R. and Sugau, J.B. 2016. The parasitic plant families Loranthaceae and Viscaceae in Sabah, Malaysia. Sandakana 21: 131-169. [52 species of Loranthaceae and Viscaceae are recorded, including one new endemic Macrosolen sp. (not named in the abstract). Helixanthera pulchra, Korthalsella japonica and Viscum scurruolideum are recorded for the first time in Borneo.]


* Balasubramanian, V., Manohar, R., Sadasivam, K. and Jayaraman, P. 1992. Fractionation of crude extract of Haplophyllum obtusum with ethyl acetate and its various subfractions were subjected to TLC. Indian J Pharmacol 24: 142.

* Balasubramanian, V. and Manohar, R. 1992. The Ethyl acetate fraction of the crude extract of Haplophyllum obtusum was subjected to TLC to isolate the active principle. Indian J Pharmacol 24: 142.


Biegel, U., Stratmann, N., Knauf, Y., Ruess, K., Reif, M. and Wehrend, A. 2017. (Post)surgical adjuvant treatment with mistletoe extract (Viscum album ssp. album) in canine mammary tumors.) (in German) Complementary Medicine Research 24(6): 349-357. [Results suggest a lower though non-significant tumour-related death risk after postsurgical V. album therapy in female dogs suffering from canine mammary adenocarcinomas. The therapy was well tolerated by the patients.]


Boddey, R. M., Fosu, M., Atakora, W.K., Miranda, C.H.B., Boddey, L.H., Guimaraes, A.P. and Ahiabor, B.D.K. 2017. Cowpea (Vigna unguiculata) crops in Africa can respond to inoculation with rhizobium. Experimental Agriculture 53(4): 578-587. [Noting that where cowpea in Mozambique was infested by Alectra vogelii, inoculation with a Brazilian strain of Rhizobium, substantial yield increases were recorded, but not clear from the abstract whether Alectra was affected.]

Bodungen, U. von, Ruess, K., Reif, M. and Biegel, U. 2017. Combination therapy with radiation and adjuvant mistletoe extract (Viscum album L.) for the treatment of oral malignant melanoma in dogs: a retrospective study. Complementary Medicine Research 24(6): 358-363. [Results suggest that V. album extract is safe and seems to improve the survival time in dogs after radiation therapy for oral melanoma. However, the compared groups were small and a study with a larger population should be of interest.]

*Bolin, J.F., Lupton, D. and Musselman, L.J. 2018. Hydnora arabica (Aristolochiaceae), a new species from the Arabian Peninsula and a key to Hydnora. Phytotaxa 338. (https://biotaxa.org/Phytotaxa/article/view/phytotaxa.338.1.8) [Detailed morphological studies indicate that this taxon, previously called H. africana, is distinct. A key to the eight species of Hydnora is provided.]

Boydston, R.A. and Anderson, T.L. 2017. Field dodder (Cuscuta pentagona) control with flumioxazin. Weed Technology 31(6): 847-851. [The performance of flumioxazin 0.14 kg/ha in controlling C. pentagona (= C. campestris?) was equivalent to the standard pendimethalin at 2-4 kg/ha up to 4 weeks from application but somewhat less effective on later germinating parasite.]

Brand, J.E. and Norris, L.J. 2017. Variation in oil content and tree size between six geographically separate Santalum spicatum families, established near Narrogin, Western Australia. Australian Forestry 80(5): 294-298. [Discussing the variation in various parameters between 6 ‘families’ of S. spicatum, presumably from different sites.]

Brun, G., Braem, L., Thoiron, S., Gevaert, K., Goormachtig, S. and Delavault, P. 2018. Seed germination in parasitic plants: what insights can we expect from strigolactone research? Journal of Experimental Botany 69(9): 2265-2280. [The germination process of parasitic plants has probably undergone numerous selective pressure events in the course of evolution, in that the perception of host-derived molecules (such as strigolactones) is a necessary condition for seeds to germinate. In this review, the authors illustrate to what extent conclusions from research into strigolactones could be applied to better understand the biology of parasitic plants.]

Bruschi, P., Urso, V., Solazzo, D., Tonini, M. and Signorini, M.A. 2017. Traditional knowledge on ethno-veterinary and fodder plants in South Angola: an ethnobotanic field survey in Mopane woodlands in Bibala, Namibe province. Journal of Agriculture and Environment for International Development 111(1): 105-121. [Ximenia americana among the ten most commonly used species, for respiratory tract problems.]

Bulíř, P. 2017. Extent of infection by Viscum album L. and changes in its occurrence on ornamental woody species in the locality of Lednice (Czech Republic). Folia Horticulturae 29(2): 123-134. [V. album recorded in over 1300 trees, comprising 42 species, mainly in Acer campestris, A. platanoides, A. pseudoplatanus, Crataegus monogyna, Robinia pseudoacacia, Tilia cordata and T. platyphyllos, T. cordata being the most seriously affected. The number of host species had increased by 18 over a 20-year period, and included Aesculus × marylandica, Fraxinus bilimoreana, Magnolia hypoleuca × tripetala and Malus × moerlandii, perhaps for the first time.]

Bulut, G., Bozkurt, M.Z. and Tuzlaci, E. 2017. The preliminary ethnobotanical study of medicinal

Bulut, G., Haznedaroğlu, M.Z., Doğan, A., Koyu, H. and Tuzlacı, E. 2017. An ethnobotanical study of medicinal plants in Acipayam (Denizli-Turkey). Journal of Herbal Medicine 10: 64-81. [Also referring to *Viscum album* being among the more important plants used in traditional medicine.]

Bürzle, B., Schickhoff, U., Schwab, N., Oldeland, Burckhardt, D., Díaz, F. and Queiroz, D.L. 2017. Four new neotropical *Trioza* species associated with Loranthaceae (Santalales) and comments on mistletoe inhabiting psyllids (Hemiptera, Psyllidae). Alpine Entomology 1: 91-108. [Two of the new species occurring in Brazil and Chile are monophagous on *Struthanthus uraguenis* and *Tripodanthus acutilobus* respectively. A third is narrowly oligophagous on a *Tristerix* sp. Host plant and biogeographical patterns of mistletoe feeding psyllids around the world are briefly discussed.]


Chai, A.L., Li, P.L., Guo, W.T., Li, B.J. and Aisimutuola, P. 2018. First report of *Fusarium acuminatum* wilt in the broomrape parasite of processing tomato in China. Plant Disease 102 (3): 676-677. [*F. acuminatum* (also referred to as *Gibberella acuminata* in the abstract) reported infecting *Phelipanche aegyptiaca* on tomato in Xinjiang Province.]

Chen Jie, Ma YongQing and Xue QuanHong. 2018. (Use of microorganisms in controlling parasitic root weed *Orobanche spp.* (in Chinesea) Zhongguo Shengtai Nongye Xuebao / Chinese Journal of Eco-Agriculture 26(1): 49-56. [*Streptomyces amissocaesilis* controlled *O. cumana* in pot experiments, while *S. pactum* proved effective in both pot and field experiments against *Phelipanche aegyptiaca* resulting in increased yield of tomato.]


*Cheng Dan, Murtaza, G., Ma SuYa, Li Lingling, Li XinJie, Tian FangZe, Zheng JunChao and Lu Yi. 2017. In silico prediction of the anti-depression mechanism of a herbal formula (Tiansi Liquid) containing *Morinda officinalis* and *Cuscuta chinensis*. Molecules 22(10): 1614. (http://www.mdpi.com/1420-3049/22/10/1614) [Results support the use of *M. officinalis* and *C. chinensis* in the treatment of depression but the mechanism of action is uncertain.]

Chepchirchir, R.T., Macharia, I., Murage, A.W., Midega, C.A.O. and Khan, Z.R. 2017. Impact assessment of push-pull pest management on incomes, productivity and poverty among smallholder households in eastern Uganda. Food Security 9(6): 1359-1372. [A survey of 560 farms in several districts of Uganda found a good correlation between maize yields and prosperity level, and the degree of adoption of push-pull technology involving the use of *Desmodium spp.* for reduction of maize stalk borer and *Striga hermonthica* infestation. Conversely, the risk of being below the poverty line was reduced from 48% to 28%.]


Colbach, N., Bockstaller, C., Colas, F., Gibot-Lecler, S., Moreau, D., Pointurier, O. and Villerd, J. 2017. Assessing broomrape risk due to weeds in cropping systems with an indicator linked to a simulation model. Ecological Indicators 82: 280-292. [Parasite risk depended on crop rotation, sowing and harvest dates, tillage, herbicides and mechanical weeding. Early summer-emerging weed species increased parasite risk. No other notable correlations were found, indicating that parasite risk results from a...
weed community of interacting species, and not simply from individual weed species. An advice table was built to summarize and explain the effects of crop management practices on weed-mediated parasite risk.

Colwell, A.E.L., Watson, K.C. and Schneider, A.C. 2017. A new species of *Aphyllon* (Orobanchaceae) parasitic on *Galium* in the Western USA. Madroño 64(3): 99-107. [Describing *A. epigalium* distinguished by its host preference for *Galium*, by having 2-4 yellow flowers per stem, and pedicels longer than the stem. Two subspecies are described, differing from one another in flower size, corolla lobe shape, host preference, geographic range, and nuclear and plastid genetic markers.]

Cui, S., Wada, S., Tobimatsu, Y., Takeda, Y., Saucet, S.B., Takano, T., Umezawa, T., Shirasu, K. and Yoshida, S. 2018. Host lignin composition affects haustorium induction in the parasitic plants *Pitheirospernum japonicum* and *Striga hermonthica*. New Phytologist 218(2): 710-723. [The complex and elegant communication between host and parasite has received a great deal of study recently. This work reports that high concentrations of lignin polymers induced haustorium formation. Treatment with laccase, a lignin degradation enzyme, promoted haustorium formation at low concentrations.]

Czenze, Z.J. and Thurley, T. 2018. Weather and demographics affect *Dactylanthus* flower visitation by New Zealand lesser short-tailed bats. New Zealand Journal of Ecology 42(1): 80-84. [Studying the pattern of visits by the bat *Mystacina tuberculata* pollinating the threatened holoparasitic ‘wood rose’ *Dactylanthus taylorii* and finding that the majority of visits are by males and juveniles on warm nights.]

da Silva, F.P. and Fadini, R.F. 2017. Observational and experimental evaluation of hemiparasite resistance in trees in the urban afforestation of Santarém, Pará, Brazil. Acta Amazonica 47(4): 311-319. [*Passovia theloneura* was the most abundant mistletoe, parasitizing 59 individuals, while *Oryctanthus florulentus* was found on only 3 trees. The most abundant host and that most affected by *P. theloneura* was mango. Seed placement studies showed that the native *Handoanthus serratifolius* is relatively resistant.]

da Silva-Leite, K.E.S., Assreuy, A.M.S., Mendoça, L.F., Damasceno, L.E.A., de Queiroz, M.G.R., Mourão, P.A.S., Pires, A.F. and Pereira, M.G. 2017. Polysaccharide rich fractions from barks of *Ximenia americana* inhibit peripheral inflammatory nociception in mice: antinociceptive effect of *Ximenia americana* polysaccharide rich fractions. Revista Brasileira de Farmacognosia 27(3): 339-345. [Concluding that the polysaccharide rich fractions of *X. americana* bark inhibit peripheral inflammatory nociception and are well tolerated by animals.]


Dang Ngoc Quang and 11 others. 2018. Balanoclone, a new chalcone from *Balanophora laxiflora* HemsI. Natural Product Research 32(7): 767-772. [9 compounds identified in an extract from *B. laxiflora* in Vietnam including several with anti-cancer properties.]

Dénou, A., Koudouvo, K., Togola, A., Haïdara, M., Dembélé, S.M., Ballo, F.N., Sanogo, R., Diallo, D. and Gbeassor, M. 2017. (Traditional knowledge on antimalarial plants having analgesic properties, used in Bamako District (Mali).) (in French) Journal of Applied Biosciences 112: 10985-10995. [Among 54 species studied, *Cassytha filiformis* is noted to be threatened due to over-use for traditional medicinal purposes.]

*Dimitrijevic, A. and Horn, R. 2018. Sunflower hybrid breeding: from markers to genomic selection. Frontiers in Plant Science 17 January 2018. (https://www.frontiersin.org/articles/10.3389/fpls.2017.02238/full) [Advances in technologies and the availability of the sunflower genome sequence made novel approaches on the whole genome level possible, such as production of large amounts of SNP markers for high density maps and candidate gene based association studies. Genomic selection and integrative approaches can successfully address complex quantitative traits in sunflower and will help to speed up sunflower breeding programs in the future.]

diameter trees (<20 cm dbh) that had branch diameters 15-20 mm resulted in the greatest colonization success. But development is slow! - 100 days to germinate, 1.6 years for cotyledon emergence, and over 4.7 years to produce fruits.]


Ekawa, M. and Aoki, K. 2017. Phloem-conducting cells in haustoria of the root-parasitic plant Phelipanche aegyptiaca retain nuclei and are not mature sieve elements. Plants 6(4): 60. [Phloem-type cells in the haustoria of *P. aegyptiaca* contained nuclei but not callose-rich sieve plates, indicating that phloem-conducting cells in haustoria differ from conventional sieve elements. Further genetic study suggested that the formation of plasmodesmata with large size exclusion limits is independent of nuclear degradation and callose deposition.]

El-Refae, R., Rashwan, E. and Ramadan, E. 2017. Effect of dodder weed (*Cuscuta epilinum* L.) control on straw, seed and fiber yields of three varieties of flax *Linum usitatissimum* L.. In: Kovačević, D. (ed.) VIII International Scientific Agriculture Symposium, "Agrosym 2017", Jahorina, Bosnia and Herzegovina, October 2017. Book of Proceedings 2017: 221-231. [In field trials in Egypt, *C. epilinum* was selectively controlled in flax by clathodim and/or metsulam, also benzoic acid, applied 30 days after sowing and yields of stem and seed were significantly increased. Not clear whether control of other weeds might have contributed to the benefits. Hand weeding was slightly superior to the herbicide treatments.]


Erenturk, S. and Korkut, Ö. 2018. Effectiveness of activated mistalea (*Fiscum album L.*) as a heterogeneous catalyst for biodiesel partial hydrogenation. Renewable Energy 117: 374-379. [Even a small amount of activated *V. album* showed high catalytic activity for the partial hydrogenation reaction and can be recommended as a potential catalyst for the process.]

Fadini, R.F., Fischer, E., Castro, S.J., Araujo, A.C., Ornelas, J.F. and de Souza, P.R. 2018. Bat and bee pollination in *Psittacanthus* mistletoes, a genus regarded as exclusively hummingbird-pollinated. Ecology 99(5): 1239-1241. [Field studies in Brazil confirm that unlike other *Psittacanthus* spp., *P. acinarius* and *P. eucalyptifolius* are pollinated by the bats *Glossophaga soricina* and *Phyllostomus discolor* and by the several bee species, respectively.]

Fikriani, W.D., Mulyaningsih, T. and Aryanti, E. 2017. Study of mistletoe in Joben Resort forest Mount Rinjani Lombok. Biosaintifika: Journal of Biology & Biology Education 9(2): 304-310. [Recording *Amyema cuernosensis*, *A. tristis*, *A. enneantha*, *Macrosolen retusus* and *Scurrula atropurpurea* on 23 hosts species, the commonest being *Ficus septica*. *S. atropurpurea* the most aggressive.]


**hermonthica, S. aspera and S. forbesii** all had enlargements of their plastomes (chloroplast genomes), primarily caused by expansion within the large inverted repeats (IRs) that are a standard plastome feature.] Franke, A.C., van den Brand, G.J., Vanlauwe, B. and Giller, K.E. 2018. Sustainable intensification through rotations with grain legumes in sub-Saharan Africa: a review. Agriculture, Ecosystems & Environment 261: 172-185. [Reviewing 44 publications reporting comparisons of continuous cereal with a cereal/legume rotation, finding an overall benefit of 0.49 ton grain yield/ha, greatest in maize, less in sorghum or millet. Residual effects were greater after soyabean and groundnut than after cowpea. Other aspects are discussed.]


*Gaisberger, H. and 20 others. 2017. Spatially explicit multi-threat assessment of food tree species in Burkina Faso: a fine-scale approach. PLoS ONE 12(9) e0184457. ([http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0184457](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0184457)) [Assessing the threats to *Ximenia americana* and 15 other food tree species of overexploitation, overgrazing, fire, cotton production, mining and climate change. For *X. americana* the main threats are climate change, cotton production, fire and over-exploitation.]


Gisca, I., Joiţa-Pacureanu, M., Clapco, S. and Duca, M. 2017. Influence of broomrape on some productivity indices of sunflower. Lucrări Științifice, Universitatea de Stiinte Agricole Și Medicină Veterinară "Ion Ionescu de la Brad" Iaşi, Seria Agronomie 60(2): 97-102. [Many parameters studied in sunflower infected with *O. cumana*, the most significant being the head diameter and seeds per head.]


Goyet, V., Billard, E., Pouvreau, J.B., Lechat, M.M., Pelletier, S., Bahut, M., Monteu, F., Spichal, L., Delavault, P., Montiel, G. and Simier, P. 2017. Haustorium initiation in the obligate parasitic plant *Phelipanche ramosa* involves a host-exudated cytokinin signal. Journal of Experimental Botany 68(20): 5539-5552. [Root exudates from *Brassica napus* triggered the expression of cytokinin-responsive genes during early haustorium development in germinated seeds, and bio-guided UPLC-ESI(+)-. MS/MS analysis showed that these exudates contain a cytokinin with dihydrozeatin characteristics. The results suggest that cytokinins from host roots play a major role in haustorium formation and aggressiveness in *P. ramosa*.]


Guerra, T.J., Pizo, M.A. and Silva, W.R. 2018. Host specificity and aggregation for a widespread mistletoe in Campo Rupestre vegetation. Flora (Jena) 238: 148-154. [*Psittacanthus robustus* occurred on 8 hosts species but mainly on *Vochysiathyrsoides, Oualea cordata, Trembleya laniflora* and Miconia ferruginata and especially in taller host trees within rocky outcrop patches in *campo rupestre* in Brazil. Results of the survey are discussed in relation to plant-plant, bird-plant and fire-plant that might shape infection dynamics of this widespread species.]


Haan, N.L., Bakker, J.D. and Bowers, M.D. 2018. Hemiparasites can transmit indirect effects from their host plants to herbivores. Ecology 99(2): 399-410. [Showing that the host on which *Castilleja levิsica* was growing influenced the size and leaf N of the parasite, and this in turn influenced the size and success of the lepidopteran herbivore *Euphydryas editha*.]

Hailu, G., Khan, Z.R., Pittchar, J.O. and Ochatum, N. 2017. Impact of field days on farmers’ knowledge and intent to adopt push pull technology in Uganda. International Journal of Agricultural Extension 5(3): 31-143. [In a survey of 849 farmers over 75% cited push-pull technology as effective in controlling *Striga hermonthica* and stemborer, improving both soil fertility and yields of cereals, providing quality fodder. Adoption of the technique depended on farmers seeing the technique on demonstration plots rather than just being told about it.]


Halouzka, R., Tarkowski, P., Zwanenberg, B. and Zeljković, C.S. 2018. Stability of strigolactone analog GR24 toward nucleophiles. Pest Management Science 74(4): 896-904. [Stability of GR24 in the presence of different nucleophiles was examined. Results indicate that hydrolysis of GR24 proceeds via the Michael addition–elimination mechanism. This hydrolysis was found to occur rather rapidly in Tris-HCl and HEPES buffers and thus these buffers may be unsuitable for experiments with strigolactones. So far, hydrolysis experiments have been conducted at relatively high concentrations of strigolactones, in this case 33 mM, it may be useful to obtain data at biological concentrations at which strigolactones induce parasite seed germination – lower than µM levels.]

Harada, K. and 10 others. 2017. Enhanced production of nojirimycin via *Streptomyces ficellus* cultivation using marine broth and inhibitory activity of the culture for seeds of parasitic weeds. Journal of Pesticide Science 42(4): 166-171. [Describing techniques for enhancing the production of nojirimycin in a *S. ficellus* broth to the extent that it had activity equivalent to a ‘standard solution’ of nojirimycin for inhibiting the germination of *Orobanche minor, Striga hermonthica* and *S. gesnerioides*.]

Harmankaya, A. and Özcan, A. 2017. (Effect of different doses of mistletoe lectin-1 on the levels of tumor necrosis factor-α, nitric oxide, total antioxidant and oxidant capacity in rabbits.) (in Turkish) Van Veterinary Journal 28(1): 41-45. [Mistletoe lectin-1 caused alterations in the levels of tumour necrosis factor and nitric oxide and showed an acute antioxidant effect.]

Heer, N., Klimmek, F., Zwahlen, C., Fischer, M., Hözel, N., Klaus, V.H., Kleinebecker, T., Prati, D. and Boch, S. 2018. Hemiparasite-density effects on grassland plant diversity, composition and biomass. Perspectives in Plant Ecology, Evolution and Systematics 32: 22-29. [Studying different levels of *Rhinanthus electrophorus* in a grassland community. Species richness was greatest at 31% *R. electrophorus* but yield reduced by 26%. At over 60% *Rhinanthus*, species richness was even lower than in its absence. Increased Rhinanthus favoured smaller plant species.]

Hettenhausen, C. and 12 others. 2017. Stem parasitic plant *Cuscuta australis* (dodder) transfers herbivory-induced signals among plants. Proceedings of the National Academy of Sciences of the United States of America 114(32): E6703-E6709. (http://www.pnas.org/content/114/32/E6703) [An elegant study showing that *C. australis* can act as bridge between soyabean plants, effectively transferring signals which inhibit attack by *Spodoptera litura*. The link can be effective across several soyabean plants over at least 100 cm.]

Ho, A. and Costea, M. 2018. Diversity, evolution and taxonomic significance of fruit in *Cuscuta* (dodder, Convovulaceae); the evolutionary advantages of indehiscence. Perspectives in Plant Ecology, Evolution and Systematics 32: 1-17. [The fruit of dodder is a capsule. D dodders are one of the few genera to have both dehiscent and indehiscent modes. The authors show that the indehiscent mode has evolved several times from the dehiscent mode. They also postulate the role of flotation in indehiscent fruits, especially in the widespread *C. gronovii*, a species of wetlands in North America.]

Holá, E.; Kocková, J.; Tešitel, J. 2017. DNA barcoding as a tool for identification of host association of root-hemiparasitic plants. Folia Geobotanica 52(2): 227-238. [Identification of DNA retrieved from host root fragments attached to haustoria showed that *Rhinanthus major* and *R. minor* were mainly parasitic on grasses and legumes, while *Melampyrum nemorosum* was mainly parasitic on Rosaceae and Asteraceae.]
Holbrook-Smith, D. and McCourt, P. 2018. Chemical screening for strigolactone receptor antagonists using Arabidopsis thaliana. Methods in Molecular Biology 1795: 117-126. [Antagonists for strigolactone receptors serve as potentially important tools in understanding mechanisms of strigolactone perception from both the perspective of host plants and of their parasites. This document describes the procedures required to use phenotypic screening approaches to uncover likely strigolactone receptor antagonists.]

Hozumi, A., Bera, S., Fujiwara, D., Obayashi, T., Yokoyama, R., Nishitani, K. and Aoki, K. 2017. Arabinogalactan proteins accumulate in the cell walls of searching hyphae of the stem parasitic plants, Cuscuta campestris and Cuscuta japonica. Plant and Cell Physiology 58(11): 1868-1877. [Results from studies with C. campestris on Arabidopsis thaliana and C. japonica on soyabean, suggest that arabinogalactan proteins are involved in hyphal elongation and adhesion to host cells and in the adhesion between the epidermal tissues of Cuscuta and its host.]

*Hu GaoSheng, Wu TianRan, Chang Yue, Zhan XinYi and Jia JingMing. 2018. Wound stress, an unheeded factor for echinacoside accumulation in Cistanche deserticola Y.C. Ma. Molecules 23(4): 893. [http://www.mdpi.com/1420-3049/23/4/893/htm] [Results suggest that the richest source of echinacoside is in the scales and that content may be enhanced by scarification of the scales by wind-blown sand.]


Ivić, D. 2018. (Branched broomrape (Orobanche ramosa L.) - increasing problem in tomato production in Istria.) (in Croatian) Glasilo Biljne Zaštite 18(3): 337-340. [Reporting the increasing problem of O. ramosa in tomato in Croatia.]

Jamil, M. and 15 others. 2018. Methyl phelonactonoates are efficient strigolactone analogs with simple structure. Journal of Experimental Botany 69(9): 2319-2331. [A novel class of strigolactone mimics, methyl phenolactonoates (MPs), was developed based on the structure of non-canonical strigolactone, methyl carlactonoate. MP1 was more active than GR24 in modulating Arabidopsis root architecture and inhibiting rice tillering but slightly less active in Striga seed germination. The substituents on the benzene ring in MPs affect these biological activities to different extents.]

Jasiczek, N., Giertych, M.J. and Suszka, J. 2017. (Influence of mistletoe (Viscum album) on the quality of Scots pine (Pinus sylvestris) seeds.) (in Polish) Sylwan 161(7): 558-564. [Confirming that Viscum album has a small but significant negative impact on the size of seeds and cones of P. sylvestris and reduces seedling vigour.]

Jebri, M., Ben Khalifu, M., Fakhfakh, H., Perez-Vich, B. and Velasco, L. 2018. Genetic diversity and race composition of sunflower broomrape populations from Tunisia. Phytopathologia 56(3): 421-430. [O. cumana was first seen in Tunisia in 2010. It is believed that the first invasion was by race E but subsequently race G has been detected and is threatening to spread.]

Jia JianXin, Yan XuSheng, Cai ZhiPing, Song Wei, Huo DongSheng, Zhang BaiFeng, Wang He and Yang ZhanJun. 2017. The effects of phenylethanoid glycosides, derived from Herba cistanche, on cognitive deficits and antioxidant activities in male SAMP8 mice. Journal of Toxicology and Environmental Health. Part A 80(22): 1180-1186. [Results suggest that the ability of PhG to ameliorate cognitive deficits in SAMP8 mice may be related to promotion in synaptic plasticity involving antioxidant processes.]


Kaplan, Z. and 12 others. 2017. Biocontrol of broomrape using Fusarium oxysporum f. sp. orthoceras in tomato crops under field conditions. Biocontrol Science and Technology 27(12): 1435-1444. [In studies in Iran, high-concentration-root-dip inoculation of tomato with F. oxysporum decreased Phelipanche aegyptiaca biomass significantly by 58% and led to increased tomato yield. Good results were also obtained with sulfosulfuron, but details of the techniques not clear from abstract.]


*Kaštier, P., Krasylenko, Y.A., Martinčová, M., Kaplan, Z. and 12 others. 2017. Anti-fibrotic effects of Cuscuta chinensis [Results support the potential use of C. chinensis in treatment of hepatofibrosis].


Konaté, L., Baffour, B.A. and Traoré, D. 2017. Combining ability and heterotic grouping of early maturing provitamin A maize inbreds across Striga infested and optimal growing environments. Journal of Agriculture and Environment for International Development 111(1): 157-173. [The development, deployment and production of stress tolerant provitamin A maize is crucial to the fight against vitamin A deficiency in sub-Saharan Africa where maize is a major staple food crop. Maize hybrids were evaluated for yielding and stability across environments, and for Striga infestation.]


Krause, K., Johnsen, H.R., Pielach, A., Lund, L., Fischer, K. and Rose, J.K.C. 2018. Identification of tomato introgression lines with enhanced susceptibility or resistance to infection by parasitic giant dodder (Cuscuta reflexa). Physiologia Plantarum 162(2): 205-218. [Tomato, Solanum lycopersicum shows a hypersensitive response to C. reflexa, not shown by S. pennellii, even when grafted on to a tomato rootstock. Introggression lines involving both parents, however, show varied reaction, which could be valuable in tracing the genes involved.]

Kun-Peng Jia, Lina Baz and Salim Al-Babili. 2018. From carotenoids to strigolactones. Journal of Experimental Botany 69(9): 2189–2204. [Carotenogenesis is briefly described and an update on strigolactone biosynthesis is provided,
focusing on the substrate specificity and reactions catalyzed by the different biosynthetic enzymes.]


Larrieu, L., Sadjak, G., Cabanettes, A. and Dréno, C. 2018. (Decline of fir pectin: influences of diameter, mistletoe and local conditions.) (in French) Forêts-Entreprise 2017(240): 6-15. [This study fails to establish a clear correlation between infection by Viscum album and a decline in pectin thought to be responsible for decline in the health of the host Abies alba.]


Li JinQing, Su ZhiPing, Chen YanPing, Qi WeiZhen, Qi JiaLin, Duan XiaoHui, He LiNa and Lu Min. 2017. (Analysis on pests' intercepted situation in imported renewable resources at Shandong port during 2006-2016.) (in Chinese) Journal of Food Safety and Quality 8(11): 4120-4124. [Cuscuta australis among the top 5 species intercepted.]

*Li Qing, Yang ShiHua, Li YongQiang, Xue XiaoFeng, Huang YongHua, Luo HengGuo, Zhang YiMing and Lu ZhiChao. 2018. Comparative evaluation of soluble and insoluble-bound phenolics and antioxidant activity of two Chinese mistletoes Molecules 23(2): 359. [A study apparently involving a combination of Viscum articulatum and V. liquidambaricum (one may have been hyper-parasitic on the other?) from hosts Camellia assamica and Pyrus identified 18 phenolics. From either host the Viscum spp. showed potential value as a source of antioxidants, but especially those growing on Pyrus.]

*Li Xi, Hao BaoHai, Pan Da and Schneeweiss, G.M. 2017. Marker development for phylogenetics: the case of Orobanchaceae, a plant family with contrasting nutritional modes. Frontiers in Plant Science 8(16):PP.1973. [This study apparently involving a combination of Viscum articulatum and V. liquidambaricum (one may have been hyper-parasitic on the other?) from hosts Camellia assamica and Pyrus identified 18 phenolics. From either host the Viscum spp. showed potential value as a source of antioxidants, but especially those growing on Pyrus.]


Lin ChengWei, Lo ChiehWen, Tsai ChiaNi, Pan TingChun, Chen PinYin Yu MingJiun. 2018. Aeginetia indica decoction inhibits hepatitis C virus life cycle. International Journal of Molecular Sciences 19(1): 208.[A study apparently involving a combination of Viscum articulatum and V. liquidambaricum (one may have been hyper-parasitic on the other?) from hosts Camellia assamica and Pyrus identified 18 phenolics. From either host the Viscum spp. showed potential value as a source of antioxidants, but especially those growing on Pyrus.]

originated in Australasian Gondwana during the Paleocene to early Eocene and aerial parasites evolved ca. 50 Ma. Diversification of Loranthaceae occurred during a climatic optimum period that coincides with the dominance of tropical forests and the rapid radiation of many bird families.


*Liu YanYan, Taxipulati, T., Gong YanMing, Sui Liu Chang Anales del Jardín Botánico de Madrid 74(1): e051. (http://rjb.revistas.csic.es/index.php/rjb/article/view/460/490) [The fruit (pseudodrupe) morphology of *Jodina* has been variously interpreted. This study corrects previous work by showing that the fleshy layer of the pericarp is formed from the nectary disk whereas the stony layer is of mesocarp origin. The ovular integument disintegrates during development thus the seed is naked and the resulting structure is a pyrene.]

Malek, J., del Moral, L., Fernández-Escobar, J., Pérez-Vich, B. and Velasco, L. 2017. Racial characterization and genetic diversity of sunflower broomrape populations from Northern Spain. Phytopathologia Mediterranea 56(1): 70-76. [Of the 6 main populations of *O. cumana* occurring in Castella y León, 3 were found to be race F and 3 probably race E. Their likely origins, from Guadalquivir Valley and Cuenca, are discussed.]

Malik, C.P. and Dheera Sanadhya. 2018. Advances in plant science research. Journal of Plant Science Research 34(1): 81-91. [Including reference to the recent research showing that microRNAs from *Cuscuta* spp. can transfer into the host and silence the expression of host genes.]

Marin, M., Toorop, P., Powell, A.A. and Laverack, G. 2017. Tetrazolium staining predicts germination of commercial seed lots of European native species differing in seed quality. Seed Science and Technology 45(1): 151-166. [Among 112 species tested, *Rhinanthus minor* was found to respond only to cold stratification.]


Mellado, A. and Zamora, R. 2017. Parasites structuring ecological communities: the mistletoe footprint in Mediterranean pine forests. Functional Ecology 31(11): 2167-2176. [Concluding that V. album exerts a strong and lasting impact on the structure and dynamics of Pinus nigra forest, with parasitized trees acting as centres for the establishment and growth of fleshy-fruiting woody species, which, over the long term, promote vegetation shifts by limiting dominant pine trees and facilitating less represented fleshy-fruit shrubs.]


Mesfin Abate, Temam Hussien, Bayu, W. and Fasil Reda. 2017. Screening of Ethiopian sorghum (Sorghum bicolor) landraces for their performance under Striga hermonthica-infested conditions. Plant Breeding 136(5): 652-662. [Among 49 lines tested, ‘Birhan’, ‘Gubiye’, Wolegie, Zegerie, Nechmashila I, Woftel, Tetron and Eyssa were identified as promising based on grain yield and Striga-related traits, while Jamyo, Bobie, Gedido, Mankebar and Zengada had moderate Striga numbers with low relative yield loss compared with susceptible checks. The most promising, Zegerie, Mankebar and Zengada, out-yielded the standard resistant checks ‘Birhan’ and ‘Gubiye’ under Striga infestation.]


Mohemed, N., Charnikhova, T., Fradin, E.F., Rienstrasra, J., Babiker, A.G.T. and Bouwmeester, H.J. 2018. Genetic variation in Sorghum bicolor strigolactones and their role in resistance against Striga hermonthica. Journal of Experimental Botany 69(9): 2415-2430. [Strigolactones, are analyzed in the root exudates of 36 sorghum genotypes and S. hermonthica germination and infection are assessed. This study shows that the strigolactone profile in the root exudate of sorghum has a large impact on the level of Striga infection.]

Moreno Moral, G., Sánchez Pedraja, O. and Piwowarczyk, R. 2017. Contributions to the knowledge of Cistanche (Orobanchaceae) in the Western Palearctic. Phytom (Horn) 57(1/2): 19-36. [Cistanche contains ca. 18 species distributed from China to Europe and northern Africa. This work discusses the taxonomy of five species found in the western Mediterranean region (C. lutea, C. mauritanica, C. phelypaea, C. tinctoria and C. violacea) and provides a key to these species.]

Mourão, F.A., Pinheiro, R.B.P., Jacobi, C.M. and Figueira, J.E.C. 2017. Resource-directed foraging of the Neotropical mistletoe Struthanthus flexicaulis (Loranthaceae). Plant Biology 19(4): 592-598. [Studying the vegetative spread of S. flexicaulis on its host Mimosa calodendron. Spread towards, and attachment, occurred to both live host branches and to inert netting but was stronger to the former.]

Mousavi, E.A., Kalantari, K.M., Nasibi, F. and Olosmi, H. 2018. Effects of carrageenan as elicitor to stimulate defense responses of basil against Cucuta campestris Yunck. Acta Botanica Croatica 77(1): 62-69. [Three applications of carrageenan (an extract from the red seaweed, Chondrus crispus) before basil was exposed to C. campestris resulted in 26% reduction in the parasite and increased vigour of the basil, apparently associated with increased levels of PAL activity, phenols, antioxidant and lignin, associated with defence mechanisms.]

Mrema, E., Shimelis, H. and Laing, M. 2017. Genetic effect of Striga resistance in sorghum genotypes. Euphytica 213(12): 280. [Using crosses between 12 varieties of sorghum to study the relative importance of their agronomic characters in conjunction with the biocontrol agent Fusarium oxysporum for performance under Striga (hermonthica)? infestation in Tanzania and concluding that additive genes were predominantly responsible for the inheritance of Striga resistance.]


Piwowarczyk, R. 2017. Contributions to the taxonomy of five species found in the western Mediterranean region (C. lutea, C. mauritanica, C. phelypaea, C. tinctoria and C. violacea) and provides a key to these species.]

Mrema, E., Shimelis, H. and Laing, M. 2017. Genetic effect of Striga resistance in sorghum genotypes. Euphytica 213(12): 280. [Using crosses between 12 varieties of sorghum to study the relative importance of their agronomic characters in conjunction with the biocontrol agent Fusarium oxysporum for performance under Striga (hermonthica)? infestation in Tanzania and concluding that additive genes were predominantly responsible for the inheritance of Striga resistance.]

Mujezinović, O., Dautbašić, M., Mujčinović, A. and Zahirović, K. 2017. (Characteristics of mistletoe shrubs (Viscum album subsp. austriacum (Wiesb.) Vollmann (1914)) on black pine in Bosnia and Herzegovina.) (in Croatian) Šumarski List 141(9/10): 477-483. [Noting that V. album has relatively recently become more common and is causing significant damage and death of Pinus nigra and P. sylvestrica.]

Nabloussi, A., Velasco, L. and Assissel, N. 2018. First report of sunflower broomrape, Orobanche cumana Wallr., in Morocco. Plant Disease 102(2): 457. [A serious infestation of O. cumana in Kenitra Province, Morocco most closely matches race G but is thought to be somewhat distinct and is proposed to be defined as race G_KE.]

Noryškiewicz, A.M. and Noryškiewicz, B. 2017. Remarks on pollen representation of mistletoe (Viscum album L.). Ecological Questions 26: 19-26. [Discussing the significance of the presence of fossil V. album pollen in Holocene deposits in Poland, concluding that even a single grain could represent a substantial local population of the mistletoe.]

Ocaña-Moral, S., Gutiérrez, N., Torres, A.M. and Madrid, E. 2017. Saturation mapping of regions determining resistance to Ascochyta blight and broomrape in faba bean using transcriptome-based SNP genotyping. TAG Theoretical and Applied Genetics 130(11): 2271-2282. [A study of SNP markers revealed two QTLs for Orobanche crenata resistance (Oc7 and Oc8), Oc7 being located near to a QTL for A. fabae resistance suggested that these genomic regions might encode common resistance mechanisms and could be targets for selection strategies against both pathogens.]

Ogumefun, O.T., Fasola, T.R., Saba, A.B., Oridupa, O.A. and Adarabiyo, M.I. 2017. Haematology and serum biochemistry of alloxaninduced diabetic rats administered with extracts of Phragmanthera incana (Schum.) Balle. African Journal of Pharmacy and Pharmacology 11(43): 545-553. [A detailed study of the biochemical effects of an extract of P. incana (from cola and cocoa hosts), concluding that, regardless of the host, it decreased blood glucose and cholesterol levels and also alleviated other complications of diabetes such as liver and kidney injury and may possess a hepatoprotective effect.]

Ohikena, F.U., Wintola, O.A. and Afolayan, A.J. 2017. Proximate composition and mineral analysis of Phragmanthera capitata (Sprengel) Balle, a mistletoe growing on rubber tree. Research Journal of Botany 12(1): 23-31. [Conclusions from a study of the composition of leaves of P. capitata growing on rubber concluded that ‘P. capitata could serve as a source of essential nutrients which can go a long way in ameliorating most nutritional challenges and may contribute remarkably to the amount of nutrients in human.’ However the presence of ‘anti-nutrients’ is also mentioned and a pinch of salt might be needed?]


Omoigui, L.O., Kamara, A.Y., Ajeigbe, H.A., Akinwale, R.O., Timko, M.P., Oyekunle, M. and Bello, L.L. 2017. Performance of cowpea varieties under Striga gesnerioides (Willd.) Vatke infestation using biplot analysis. Euphytica 213(11): 244. [From a 3 year study over 3 sites in the dry savanna area of Nigeria, it was concluded that lines UAM09 1046-6-1 (V7), and UAM09 1046-6-2 (V8) gave best results over all sites.]

Patel, C.J., Gediya, K.M., Patel, H.K. and Patel, A R. 2017. Control of broomrape in Bidi tobacco by different management practices. Indian Journal of Weed Science 49(1): 67-69. [Methods to control Orobanche ramosa included herbicides glyphosate, isoproturon and pendimethalin applied ‘at emergence of Orobanche with irrigation’. These provided partial control and some increase in yield, but were inferior to hand weeding.]

Pavlenco, E.V. and Petrova, S.E. 2017. (Anatomy of the roots of some northern hemiparasites (Orobanchaceae).) (in Russian) Turczaninowia 20(1): 107-117. [The root structure and haustorial formation were studied in Bartsia alpina, Castilleja lapponica, Pedicularis s sceptrum-carolinum, P. lapponicus, Rhinanthus minor ssp. groenlandicus. A main precondition providing the possibility of rapid haustorium development is the long life of the primary outermost tissue of the root. Formation of haustorial hairs is one of the earliest structural events and the division and elongation of cells in the outer tissues play a major role in the early stages of endophyte development. The parasitic life-style influences the inner structure of the vascular cylinder including the reduction of phloem conductive elements and the accumulation of large amounts of starch in the xylem. It was found that the haustoria can penetrate rhizomes as well as roots.]
Germination of pathovars of *P. ramosa* from rapeseed and *Fabaceae* hosts was similar in response to *12 Fabaceae* spp. Phylogenetically related species showed more similar rates of induction of seed germination than species drawn at random from a phylogenetic tree. *Lotus corniculata* induced somewhat higher germination that other species and may be of value as a catch crop.

Pincovici, S., Cochavi, A., Karmieli, A., Ephrath, J. and Rachmilevitch, S. 2018. Source-sink relations of sunflower plants as affected by a parasite modifies carbon allocations and leaf traits. Plant Science 207: 100-107. [Parasitism of sunflower by *Orobanche cumana* results in depletion of carbohydrates, leading to thinner leaves, as under shade. Control of *O. cumana* by imazapic restored normal leaf mesophyll structure and carbon assimilation rates.]


Posz, E. 2017. *Euphrasia corcontica* (Orobanchaceae) - is it really extinct? Annales Botanici Fennici 54(1/3): 131-134. [Recording the rediscovery of *E. corcontica* in the Karkonosze National Park, Poland and

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Perronne, P.B., Nickrent, D.L., Gemmill, C.E.C. and Barcelona, J.F. 2017. Genetic diversity and structure in the Philippine *Rafflesia lagaescae* complex (Rafflesiaceae) inform its taxonomic delimitation and conservation. Systematic Botany 42:543-553. [This is the first of two papers published this year on the population biology of *Rafflesia* (see also Barkman et al. 2017). Microsatellite data showed that even small populations harbour moderate levels of genetic diversity with low levels of inbreeding. Staminate and pistillate flowers of *R. lagaescae* on the same host were genetically identical indicating the species is monoeocious.]

Pelser, P.B., Nickrent, D.L. and Barcelona, J.F. 2018. A conservation genetic study of *Rafflesia speciosa* (Rafflesiaceae, Philippines): patterns of genetic diversity and differentiation within and between islands. Blumea 63:93-101. [Microsatellites were used to study nine populations present on Panay and Negros islands. None of the populations showed evidence of inbreeding. Negros populations had lower genetic diversity and were genetically differentiated from Panay, thus suggesting sea straits impose reproductive barriers. Conservation implications are discussed.]
elaborating its distinction from *E. minima* and *E. micrantha*.]


Preeti Kumari, Tiwari, S.K. and Choudhary, A.K. 2017. Host range, anatomy, biochemistry and impacts of *Cuscuta reflexa* Roxb.: a case study from the Betla National Park, Jharkhand, India. Tropical Plant Research 4(1): 95-102. [A survey recorded *C. reflexa* on 33 host species in 23 families. Effects on the host included a consistent increase in protein especially in *Ziziphus maritiana*. Effects on community structure are discussed.]

Ramezani, S., Najafi, H., Nourmohammadi, G. and Meighani, F. 2018. Control of dodder (*Cuscuta campestris*) weed through integrated weed management system for higher sugar beet yield. Crop Research 53(1/2): 68-75. [Reporting significant increase in sugar beet from combinations of seed-bed preparation, date of sowing and application of propyzamide herbicide.]

Ramírez-Barahona, S., González, C., González-Rodriguez, A. and Ornelas, J. F. 2017. The influence of climatic niche preferences on the population genetic structure of a mistletoe species complex. New Phytologist 214(4): 1751-1761. [Concluding that environmental predictors appeared to be more important than host preferences to explain genetic structure of *Psittacanthus schiedeanus* in Mexico, suggesting that the occurrence of the parasite is determined more by its own climatic niche than by host specificity.]

Randrianjafizanaka, M.T., Authray, P., Andrianiaivo, A.P., Ramonta, I.R. and Rodenburg, J. 2018. Combined effects of cover crops, mulch, zero-tillage and resistant varieties on *Striga asiatica* (L.) Kuntze in rice-maize rotation systems. Agriculture, Ecosystems & Environment 256: 23-33. [Describing the results of a complex 4-year trial in Madagascar based on conservation agriculture (CA) principles. The best rest results involved rice varieties NERICA-9 and NERICA-4 and *Stylosanthes guianensis* cover crop but even the combination of zero-tillage, crop residue mulching, cover crops and resistant rice varieties does not entirely prevent *S. asiatica* parasitism and seed bank increase. Concluding other methods still needed. No mention of rice yields.]


Rocha, D., Ashokan, P.K., Santhoshkumar, A.V., Anoop, E.V. and Sureshkumar, P. 2017. Anatomy and functional status of haustoria in field grown sandalwood tree (*Santalum album* L.). Current Science 113(1): 130-133. [Study with multiple hosts revealed that the extent of translocation from hosts to *S. album* varied from 28.9% (coconut+*Casuarina*+rubber as host) to 78.5% (*Casuarina*+rubber as hosts). Reverse translocation of 32P from *S. album* to host was also observed. The study concludes that it is not necessary to plant the host along with the sandal as it is practiced presently. Noting that direct lumen-lumen xylem connections between *S. album* and host were absent.]

Ronald, M., Charles, M., Stanford, M. and Eddie, M. 2017. Predictions of the *Striga* scourge under new climate in Southern Africa: a perspective. Journal of Biological Sciences 17(5): 194-201. [Considering the effect of increased temperature on various factors influencing *Striga* spp. and concluding that infestations are likely to become worse in already affected areas and potentially move into new areas. Discussed primarily from a Southern Africa perspective, but apparently relevant to *S. hermonthica* as well as *S. asiatica*.]


Rubiales, D. 2018. Can we breed for durable resistance to broomrapes? Phytopathologia Mediterranea 57(1): 170−185. [Reviewing the current state of research in resistance breeding against *Orobanche* and *Phelipanche* spp, and incidentally emphasising the importance of avoiding human-driven seed dispersal.]

under the headings Diversity, Fecundity, Mobility, Coordinated, Dormancy, Manipulative and Mysterious! Also outlining emerging control options.

Safina, S.A. 2017. Effect of ridge width and cropping system on productivity and land use efficiency in faba bean-flax intercrops. 2017. Egyptian Journal of Agronomy 39(3): 357-381. [Comparing two faba bean varieties at two row widths in conjunction with interplanting with flax. Results from Giza-843 were superior in yield and in terms of Orobanche crenata to those from Giza-2 and best with flax interplanted on 120 cm ridges.]


Salifou, M., Tignegre, J.B.L.S., Tongoona, P., Offei, S., Ofori, K. and Danquah, E. 2017. Differential responses of 15 cowpea genotypes to three Striga hot spots in Niger. International Journal of Biological and Chemical Sciences 11(4): 1413-1423. [Screening of a range of cowpea varieties against S. gesnerioides suggest that other races occur, in addition to the predominant SG3. These include SG1 and what may be SG4Z or at least a more virulent form of SG3.]

Samejima, H. and Sugimoto, Y. 2018. Recent research progress in combatting root parasitic weeds. Biotechnology & Biotechnological Equipment 32(2): 221-240. [A wide range of potential control measures are usefully reviewed.]


Santos, M.O. and 10 others. 2017. The conservation of native priority medicinal plants in a Caatinga area in Ceará, northeastern Brazil. Anais da Academia Brasileira de Ciencias 89(4): 2675-2685. [Ximenia americana among 7 priority species for conservation.]}


Schad, F., Thronicke, A., Merkle, A., Matthes, H. and Steele, M.L. 2017. Immune-related and adverse drug reactions to low versus high initial doses of Viscum album L. in cancer patients. Phytomedicine 36: 54-58. [Over 1300 patients were given sub-cutaneous injections of a V. album product (specified in the abstract). A recommended low dose caused less than 1% adverse reaction. A higher dose caused a reaction in 20% of cases but these were always mild and often of a beneficial nature.]

Schad, F., Thronicke, A., Merkle, A., Steele, M.L., Kröz, M., Herbstritt, C. and Matthes, H. 2018. Implementation of an integrative oncological concept in the daily care of a German certified breast cancer center. Complementary Medicine Research 25(2): 85-91. [Concluding that integrated therapies involving Viscum album extracts have a satisfactory record but that further studies are required.]


Schneider, A.C. and Moore, A.J. 2017. Parallel Pleistocene amphitropical disjunctions of a parasitic plant and its host. American Journal of Botany 104(11): 1745-1755. [The genus Aphyllon is parasitic on Grindelia (Asteraceae) and both genera are disjunct between North and
South America. Chronograms for both genera and their relatives were constructed (from ITS and ETS rDNA sequences) that were calibrated with a horizontal gene transfer event. *Aphyllon* dispersed twice from North to South America recently (0.4 Ma) whereas *Grindelia* had a single dispersal.

Selvi, E.K., Turumtay, H., Demir, A. and Turumtay, E.A. 2018. Phytochemical profiling and evaluation of the hepatoprotective effect of *Cuscuta campestris* by high-performance liquid chromatography with diode array detection. Analytical Letters 51(10): 1464-1478. [The study suggested that isorhamnetin, kaempferol and quercetin were probably most responsible for the ant-cancer effects of *C. campestris* extracts.]


Shimada, H., Urabe, Y., Okamoto, Y., Li Zheng, Kawase, A., Morikawa, T., Tu PengFei, Muraoka, O. and Iwaki, M. 2017. Major constituents of *Cistanche tubulosa*, echinacoside and acteoside, inhibit sodium-dependent glucose cotransporter 1-mediated glucose uptake by intestinal epithelial cells. Journal of Functional Foods 39: 91-95. [This study suggested that the inhibitory effects of echinacoside and acteoside on sodium-dependent glucose cotransporter-mediated glucose uptake contribute to suppression of increased postprandial blood glucose level.]


*Shin, H.W. and Lee, N.S. 2018. Understanding plastome evolution in hemiparasitic Santalales: Complete chloroplast genomes of three species, *Dendrophthoe varians*, *Helixanthera parasitica*, and *Macrosolen cochinchinensis*. PLOS ONE. July 5, 2018. (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0200293) [Complete plastid genomes were reported and compared to other published sequences. These genomes were slightly or not reduced in size compared with other hemiparasites. These (and all examined Santalales) have experienced functional loss of ndh genes.]

Smith, R.S., Shiel, R.S., Millward, D. Simkin, J.M. 2017. Effects of sheep stocking on the plant community and agricultural characteristics of upland *Anthoxanthum odoratum-Geranium sylvaticum* meadow in northern England. Grass and Forage Science 72(3): 502-515. [Results support suggestions that recent reductions in the nature value of these grasslands, and specifically the proportion of *Rhinanthus minor* might be due to high stocking densities persisting until later in the spring, carried out during a 1-year period with warmer temperatures.] Sochor, M., Egertova, Z., Hrones, M. and Dancak, M. 2018. Rediscovery of *Thismia neptunis* (Thiimiaceae) after 151 years. Phytotaxa 340(1): 71-78. [Reporting the rediscovery of the mycoheterotroph *T. neptunis* from western Sarawak, Malaysia. This species has remarkable perianth lobes that are terminated by long, filiform, vertically oriented appendages. Detailed illustrations and photographs are provided.]

Solkin, 2017. Diversity of parasitic plants and their hosts in Kepala Jeri and Pemping agroforestry Batam Indonesia. Journal of Biological Researches / Berkala Penelitian Hayati 23(1): 45-52. [A survey showed *Cassystha filiformis* to be the commonest parasitic plant, followed by *Dendrophthoe pauciflora* each occurring on a relatively wide range of non-crop host species, while *Viscum stenocarpum* was rare and only occurred as a hyper-parasite on *D. pauciflora.*]

Souza, M.C., Scalon, M.C., Poschenrieder, C., Tolrà, R., Venâncio, T., Teixeira, S.P. and da Costa, F.B. 2018. Mechanisms of storage and detoxification of Al in two tropical mistletoes. Environmental and Experimental Botany 150: 37-45. [Concluding that *Passovia ovatus* and *Struthanthus polyanthus* growing on aluminium-accumulating trees tolerate high Al tissue levels
by allocating Al in phloem fibres and by its chelation with citrate.

Striegler, U. 2017. (The Upper Miocene flora of the leaf-bearing Wischgrund clay and other outcrops of the same age on the Klettwitz Plateau (Lower Lusatia, Brandenburg, Germany)) (in German). Peckiana 12: 151 pp. [Species of Loranthaceae and Santalaceae among fossil leaves identified.]


Sultan, A., Tate, J.A., de Lange, P.J., Glenny, D., Ladley, J.J., Heenan, P. and Robertson, A.W. 2018. Host range, host specificity, regional host preferences and genetic variability of Korthalsella Tiegh. (Viscaceae) mistletoes in New Zealand. New Zealand Journal of Botany 56(2):127-162. [Host breadth was documented for three endemic species of Korthalsella: K. clavata, K. lindsayi, and K. salicornioides. The first two are generalists (19 genera, 14 families) whereas Leptospermum scoparium is the primary host for the latter species. Shared cpDNA and ITS sequence types suggest hybridization between the first two species.]

Surabhi Gumber, Ashish Tewari and Beena Tewari. 2017. Loranthus (Taxillus vestitus) infestation in mixed oak forest sites in and around Nainital catchment of Central Himalayan region. Indian Forester 143(7): 671-675. [Surveying the occurrence of T. vestitus in Quercus leucotrichophora, Q. floribunda, Q. lanata and Populus ciliata. Q. floribunda had the highest infestations. Conifers were unaffected.]


Teppner, H. 2017. The first records of vibratory pollen-collection by bees. Phytón (Horn) 57(1/2): 129-135. [Tracing the first reliable literature on vibratory pollen collection (on Senna alata) to a paper by Lindman in 1902. Its occurrence on Melampryum pratense was reported by Meidell in 1944.]

*Thronicke, A., Steele, M.L., Grah, C., Matthes, B. and Schad, F. 2017. Clinical safety of combined therapy of immune checkpoint inhibitors and Viscum album L. therapy in patients with advanced or metastatic cancer. BMC Complementary and Alternative Medicine 17(53): No.534. (https://bmccomplementaltermmed.biomedcentral.com/track/pdf/10.1186/s12906-017-2045-0) [This preliminary study concluded that concomitant use of V. album therapy with the immune checkpoint inhibitors nivolumab (75%), ipilimumab (19%) or pembrolizumab (6%) did not result in increased ‘adverse events, but a larger study is required.]

Tian Xiao, Guo Sen, He Kan, Roller, M., Yang MeiQi, Liu QingChao, Zhang Li, Ho ChiTang and Bai NaiSheng. 2018. Qualitative and quantitative analysis of chemical constituents of Ptychopetalum olacoides Benth. Natural Product Research 32(3): 354-357. [14 compounds identified in extracts of P. olacoides (Olacaceae) among which alkaloids were thought to be the most important.]

Tong ZeYu and Huang ShuangQuan. 2018. Safe sites of pollen placement: a conflict of interest between plants and bees? Oecologia 186(1): 163-171. [Looking at the various sites on a bee’s body from which the bee can or cannot retrieve and utilise the pollen collected from 4 Pedicularis species (in China) and showing that the sites where most pollen was collected were favourable for both deposit on stigmas AND retrievable for the bee.]

Tsegay Gebreselassie, Atsba Gebreselassie and Hintsa Meresa. 2018. Enhancing sorghum productivity through demonstration of integrated striga management technologies and its partial budget analysis in Tanqua-Abergelle district, Central Zone of Tigray, Ethiopia. African Journal of Plant Science 12(1): 17-23. [The application of integrated Striga management technologies, including sorghum variety (Gobiye), tied-ridging/moisture conservation, row planting and fertilizer application on 10 farms resulted in a significant increase in grain yield, a moderate reduction in straw yield and a 36% increase in economic return.]

Tsuchiya, Y., Yoshimura, M. and Hagihara, S. 2018. The dynamics of strigolactone perception in Striga hermonthica: a working hypothesis. Journal of Experimental Botany 69(9): 2281-2290. [Recent advances in strigolactone research in parasitic plants are reviewed. A conceptual framework for the unique in planta dynamics of strigolactone perception is uncovered through the use of fluorescent probes for strigolactone receptors.]

Environment 639: 714-724. [Reporting the intriguing observation that O. lutea is particularly favoured when it occurs on Medicago falcata on industrial waste land contaminated with toxic metals (Zn, Cu and Pb). The parasite tends to lower the levels of metals in the host and increases its photosynthetic capacity, although reducing yield.]


Valcheva, E., Popov, V., Zorovski, P., Golubinova, I., Marinov-Serafimov, P., Velcheva, I. and Petrova, S. 2018. Allolepatic effect of dodder on different varieties of lucerne and bird’s foot-trefoil. Contemporary Agriculture 2018(1): 27-33. [Dried material of Cuscuta epythimum proved more inhibitory than fresh material to the germinations and growth of most varieties of lucerne and Lotus corniculatus but Medicago sativa var. multifoliolate and L. corniculatus var. Local population 1 and Local population 2 showed ‘significant tolerance’. Relevance not clear?]


Wang XiangPing and Huang ShuangQuan. 2017. Interspecific and intraspecific variation in corolla tube length in Pedicularis species achieved by both cell anisotropy and division. Journal of Systematics and Evolution 55(3): 208-214. [Results showed that intraspecific variation in corolla tube length in Pedicularis species was largely attributable to changes in cell anisotropy, but the evolutionary innovation underlying the rapid radiation of Pedicularis corolla tubes was attributable to both cell division and cell expansion.]


Wang YaJiao, Li LiJing, Li QuSheng, Chen LianFang, Xue GenSheh, Wang LianSheng and Kong LingXiao. 2017. (Control efficacy of microbial herbicide Br-2 against Orobanche
aegyptiaca.) (in Chinese) China Vegetables 2017(4): 65-68. [Noting the importance of O. aegyptiaca in tomato in northern China and the apparent success of the un-identified microbial agent ‘Br-2’ for its control when applied at 10 g per plant at time of transplanting.]

Wang, Yanting and Bouwmeester, H.J. 2018. Structural diversity in the strigolactones. Journal of Experimental Botany 69(9): 2219-2230. [This is a comprehensive review on structural diversity in the strigolactones in relation to their biosynthesis, biological relevance, and perception by receptors in plants and in other organisms. The distribution of strigolactones in different plant species listed in Table 1 is reliable and has eliminated ambiguous data. Please refer to this review for the distribution of strigolactones in the plant kingdom. This list shall be updated at least as often as annually.]

Wang Ye, Chen Lei, Bai Yun, Zhang Jun'e, Liu HongXia and Tian ChengMing. 2017. (Genetic diversity of Arceuthobium sichuanense revealed by ISSR markers.) (in Chinese) Acta Botanica Boreali-Occidentalia Sinica 37(11): 2153-2162. [Study of molecular markers from 100 specimens of A. sichuanense from 5 Picea species showed that they fell into 2 main groups according to host species, indicating that geographical isolation and host selection played an important part in the genetic diversity of A. sichuanense.]


Wehn, S. and Rønningen, K. 2017. (The "ENGKALL" (= Rhinanthus) project: optimised management of valuable hay meadows.) (in Norwegian) Blyttia 75(4): 209-216. [Studying the value of ‘Traditional Ecological Knowledge’ in the management of hay meadows and concluding that varying mowing time is preferable to any single fixed time, presumably for preserving populations of Rhinanthus spp.]

*Wen-Bin Yu, Randle, C.P., Lu Lu, Hong Wang, Jun-Bo Yang, de Pamphilis, C.W., Corlett, R.T and DeZhu Li. 2018. The hemiparasitic plant Phtheirospermum (Orobanchaceae) is polyporphic and contains cryptic species in the Hengduan Mountains of Southwest China. Frontiers in Plant Science 09 February 2018. (https://www.frontiersin.org/articles/10.3389/fpls.2018.00142/full) [Both nuclear and plastid data indicate P. japonicum is not part of the Pterygiella/Phtheirospermum clade. The authors discuss maintaining the name P. japonicum and transferring the remaining taxa to another genus.]

*Werthmann, P.G., Saltzwedel, G. and Kienle G.S. 2017. Minor regression and long-time survival (56 months) in a patient with malignant pleural mesothelioma under Viscum album and Helleborus niger extracts—a case report. Journal of Thoracic Research 9(12) e1064-e1070. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC575010/) [A rare case of an MPM patient not receiving any standard anticancer treatment but showing an extraordinary long survival and good performance status. It is presumed that the V. album and H. niger may have had an impact, deserving further investigation.]

Wiatrowska, B. 2017. (Rafflesia arnoldii - a plant with the largest flowers in the world.) (in Polish) Nauka Przyroda Technologie 11(4): 365-373. [A general review that is, for the most part, accurate but could have benefitted from accessing the now extensive literature on Philippine Rafflesia.]

Widener, L. and Fant, J.B. 2018. Genetic differentiation and diversity of two sympatric subspecies of Castilleja affinis; a comparison between the endangered serpentine endemic (spp. neglecta) and its widespread congener (ssp. affinis). Conservation Genetics 19(2): 365-381. [Confirming that there is little hybridisation between the endangered C. affinis ssp. neglecta and the commoner ssp. affinis but more strenuous conservation efforts are needed.]

Wójciak-Kosior, M., Sowa, I., Pucek, K., Szymczak, G., Kocjan, R. and Luchowski, P. 2017. Evaluation of seasonal changes of triterpenic acid contents in Viscum album from different host trees. Pharmaceutical Biology 55(1): 1-4. [Content of oleanoic acid was lowest in spring and highest in summer but the differences were not great.]

Wolfe, A.D. 2018. Hyobanche hanekomii (Orobanchaceae), a new species from the Western Cape of South Africa. Phytotaxa 340(1): 93-97. [Once thought to be a hybrid between H. atropurpurea and H. sanguinea, this taxon was shown to be distinct based on morphometrics and AFLP markers.]


Xiao Yan, Tian DaiKe, Zhang Cheng, Xiang ZuHeng, Zhang DaiGui and Fu NaiFeng. 2017. (Provincial new records of eight species of spermatophytes in northwestern Hu'nan

Yang, L., Yang, G-S., Ma, H-Y., Wang, Y-H. and Shen, S-K. 2018. Phylogenetic placement of Yunnanopilia (Opiliaceae) inferred from molecular and morphological data. Journal of Systematics and Evolution 56:48-55. [Morphological and molecular phylogenetic methods were employed to address the status of Y. longistaminea. The authors chose to recognize this taxon as a new genus, however, both types of data also support the original concept by Pierre and Li (1989) that this is another species of Melientha.]

YergIn-Ozkan, R. and Tepe, I. 2018. Emergence characteristics and germination physiology of smoothseed alfalfa dodder (Cuscuta approximata Bab.). Fresenius Environmental Bulletin 27(1): 104-109. [In a study in Turkey, seeds of C. approximata germinated between 10 and 30°C following stratification at 2°C. 50% germinated after 133 days. Maximum germination of 98% was obtained with 150 ppm gibberellic acid.]

Yousefabad, V., Alebrahim, M.T., Tuobe, A., Zand, E. and Abdollahian-Noghabi, M. 2017. Effect of seedling transplantation and post-emergence herbicides application on field dodder (Cuscuta campestris) control in sugar beet. Romanian Agricultural Research 34: 377-384. [Confirming that transplanting rather than direct sowing greatly reduced infection by C. campestris and increased sugar beet yield by 150%.]

Yule, K.M. and Bronstein, J.L. 2018. Reproductive ecology of a parasitic plant differs by host species: vector interactions and the maintenance of host races. Oecologia 186(2): 471-482. [Differences in several factors (reproductive phenology, pollinator reward, pollinator community, etc.) between Phoradendron californicum parasitizing mesquite (Prosopis) and acacia (Senegalia) were observed, but host was not associated with greater reproductive success in the mistletoe.]
activating dendritic cells via TLR4 signaling pathway.


Zlonis, K.J. and Gross, B.L. 2018. Genetic structure, diversity, and hybridization in populations of the rare arctic relict Euphrasia hudsoniana (Orobanchaceae) and its invasive congener Euphrasia stricta. Conservation Genetics 19(1): 43-55. [E. hudsoniana in Minnesota is at the southern edge of its range and is at risk from climate change and from hybridisation with the invasive E. stricta. Finding very little evidence of hybridisation but recommending further monitoring.]

Zoundji, G.C., Vodouhe, S.D., Okry, F., Bentley, J.W. and Tossou, R.C. 2018. Beyond striga management: learning videos enhanced farmers’ knowledge on climate-smart agriculture in Mali. Sustainable Agriculture Research 7(1): 80-91. [Ten videos describing techniques for reducing Striga hermonthica in maize, sorghum and millet contributed to significantly increased yields in villages where they were shown. Videos on other topics may also have contributed. The paper is available at https://www.cabdirect.org/cabdirect/FullTextPDF/2018/20183083144.pdf]

Zwanenburg, B. and Blanco-Ania, D. 2018. Strigolactones: new plant hormones in the spotlight. Journal of Experimental Botany 69(9): 2205–2218. [A historical review on stereochemical structures of natural strigolactones, structure-activity relationships, and designs and syntheses of strigolactone mimics. It may be better to use the terms of orobanchyl acetate (alectrol) for 4-O-acetyl orobanchol (alectrol) in Fig. 2 and 4-deoxyorobanchol for ent-2’-epi-(5)-deoxyxstrigol in Fig. 17. Carlactonic acid should be carlactonic acid.]
SPECIAL ISSUE

This special issue is primarily devoted to the paper ‘Parasitic plants and their control: a history’ by Chris Parker, based on the presentation he made at the Strigolactone meeting in Nitra, Slovakia in July 2106. See p. 2.

The opportunity is also taken here to provide a link to the website for the next, 15th, World Congress on Parasitic Plants to be held in Amsterdam in July 2019. The website is: https://www.wcpp2019.org

PARASITIC WEEEDS AND THEIR CONTROL – A HISTORY

Chris Parker, 5 Royal York Crescent, Bristol BS8 4JZ

Introduction
This special issue of Haustorium is devoted to a presentation given by Chris Parker at the Strigolactone meeting in Nitra, Slovakia, in July, 2016, which has not otherwise been previously published. Chris thanks his co-editors for allowing him this opportunity to share his thoughts and observations from a longish career in parasitic weeds.

This will be far from a complete history but a very selective one, looking at some of the key dates relating to major parasitic weed problems, especially *Orobanche cumana* in sunflower, *Striga* in cereals and in cowpea and *Orobanche crenata* in legumes, with admittedly personal reflections on my own involvement in each of these. There will also be a review of the wider development of literature and meetings on the topic.

Evolution:
To start at the beginning - i.e. some 100 millions of years ago. We know that the parasitic habit evolved independently many times. Certainly 11, maybe 12, according to Dan Nickrent to whom I am grateful for relevant advice in this sphere and particularly for referring me to the paper by Naumann et al, (2013) from which this information is drawn. Fig 1 suggests that Balanophoraceae and Loranthaceae both go back about 110 million years, *Cassytha* about 77 million, *Cuscuta* about 35 million and Orobanchaceae ‘only’ 32 million. These estimates are of course based on DNA rather than actual fossils. Apparently the only fossil record for Orobanchaceae is of pollen and the dating corresponds to that from DNA – this information from Muller, 1981.

<table>
<thead>
<tr>
<th>Family/genus</th>
<th>Million years BP</th>
</tr>
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<tbody>
<tr>
<td>Balanophoraceae</td>
<td>110</td>
</tr>
<tr>
<td>Loranthaceae</td>
<td>110</td>
</tr>
<tr>
<td>Hydnoraceae</td>
<td>101</td>
</tr>
<tr>
<td><em>Cassytha</em></td>
<td>77</td>
</tr>
<tr>
<td><em>Cuscuta</em></td>
<td>35</td>
</tr>
<tr>
<td>Orobanchaceae</td>
<td>32</td>
</tr>
<tr>
<td>From Naumann <em>et al.</em>, 2013; Muller, 1981</td>
<td></td>
</tr>
</tbody>
</table>

Fig 1.
The Greeks
The first we know of them in literature is that they were recognised as parasites by the Greeks. Theophrastus (c. 371-287 BC) apparently refers to an *Orobanche* species attached to and damaging fenugreek. Pliny and Dioscorides also commented – see Fig2 (all usefully reviewed by Zadoks in 2013). The Greeks also recognised these as ‘different’ and considered them useful as food or medicine. Ever since then, it seems that, because they are different, and damaging, parasitic plants are somehow expected to have healing or other magical properties, especially if they were particularly rare or unusual. And judging from the numbers of literature items that we scan for Haustorium (and print in blue) I get the impression that parasitic plants are still favoured as the source of traditional medicines. The Greeks felt that the mistletoe *Viscum album* had mystical powers and later in northern Europe, the pre-Christian druids maintained the legend of the ‘golden bough’, based on the relatively rare occurrence of mistletoe on oak. Pliny describes a Celtic *ritual sacrifice and banquet* at which a *druid* dressed in white would climb an oak tree to collect mistletoe using a *golden sickle* There is a lot more I could include about the history of the European mistletoe and its therapeutic uses in cancer treatment, but time does not allow, other than to say that the most recent reviews, including a meta-analysis by Cochrane suggest there are certainly benefits from use of mistletoe extracts in conjunction with conventional treatment (Horneber *et al.*, 2008). It can also be a significant weed problem, especially in forestry in the Balkan countries, but this is minor compared with others I shall be covering.

300 BC

Theophrastus (c.371-287 BC) – ‘On the Causes of Plants’. *Orobanche* attached to and damaging fenugreek. Mistletoe parasitic on trees and seeds transmitted by bird

Pliny (23-79 AD) – dodder on chickpea, bitter vetch and faba beans, mistletoes damaging trees, ritual use by Celts.

Dioscorides (c. To 90 AD) - ‘Materia medica’. *Orobanche* eaten as vegetable like asparagus, *Cuscuta* on thyme and *Satureja*, and used medicinally.

Zadoks, 2013.
I am skipping the mediaeval and later centuries which no doubt have many references to the characteristics and uses of parasitic plants but I am not aware of any major advances or developments of note.

**Sunflower**

My next significant date is 1866. In a recent excellent review, Molinero-Ruiz *et al.* (2015) describe how *Orobanche cumana* (Fig 3) was first recognised as a problem in sunflowers in Russia in 1866, and by the end of the century it had spread to Moldova and Romania. Pustovoit (1967;1976) describes how, in 1912, a resistance breeding programme was initiated (Fig 4). Cubero (1986, 1991) in valuable reviews describes how, by 1916, a range of material had been developed with complete resistance and by 1925, 95% of the sunflower crop grown in Pustovoit's region was based on these resistant lines. However, when they were distributed more widely in the following three years, the resistance failed. This failure was soon explained by the existence of different races of the parasite, the original being designated race A and the more virulent, race B. Unfortunately race B proved to be a complex of different sub-races, making it difficult for the breeders and in due course the resistance to race B was overcome in the 1970s, by race C. And so on until the current situation where we recognise races up to F, G and even H and the breeders are kept busy trying to keep one step ahead in many countries across southern and eastern Europe (Fig 5). I highly recommend the Molinero-Ruiz review which covers the history and the complexity of the topic in great detail. In most regions, resistance is available but the situation keeps changing, keeping the breeders on their toes.

![Orobanche cumana](image)

Fig 3.
Sunflower resistance breeding

1912 – First records of breeding sunflower for Orobanche-resistance
Pustovoit, 1967, 1976
1916 – First new virulence recorded, followed by further virulent races
Reviewed by:
Cubero 1986
Cubero 1991

Fig 4.

Races of O. cumana (Molinero-Ruiz et al., 2015)

<table>
<thead>
<tr>
<th>Country</th>
<th>Past</th>
<th>Present</th>
</tr>
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<tbody>
<tr>
<td>Bulgaria</td>
<td>A,B,C,D,E</td>
<td>E,F,G</td>
</tr>
<tr>
<td>China</td>
<td>A</td>
<td>A,B,C,D,E,F,G</td>
</tr>
<tr>
<td>Hungary</td>
<td>A,B,C,D</td>
<td>E,F</td>
</tr>
<tr>
<td>Romania</td>
<td>A,B,C,D,E</td>
<td>F,G</td>
</tr>
<tr>
<td>Russia</td>
<td>A,B,C,D</td>
<td>D,E,F,G,H</td>
</tr>
<tr>
<td>Spain</td>
<td>B,C,D,E</td>
<td>E,F</td>
</tr>
<tr>
<td>Turkey</td>
<td>?</td>
<td>F,G</td>
</tr>
<tr>
<td>Ukraine</td>
<td>A,B,C,D</td>
<td>E,F,G</td>
</tr>
</tbody>
</table>

Fig 5.

An alternative to Orobanche-resistant varieties is now the availability of naturally (not GM) herbicide-resistant varieties. But I am uncertain how widely they are being used. (On this as on all other topics I am not attempting to be completely up-to-date. I leave that to those still actively involved in the research.)

Striga
1955 - I am now jumping forward to 1955, when Striga asiatica (Fig 6) was first recognised in North and South Carolina in USA. It must have been there for decades already, to have spread, as it had, to nearly 200,000 ha. It is assumed to have come in accidentally in wool from South Africa. Farmers had been aware that they had some
sickness problem, in their maize/corn, but it took a visiting Indian student to recognise what it was.

Striga asiatica

Fig 6.

This was not the beginning of the *Striga* problem of course, nor of work on it, but the discovery in USA prompted the preparation of an invaluable bibliography prepared by McGrath *et al* in 1957, which provides a comprehensive record of research on *Striga* and related genera up to that time. It gives us all the early literature on *Striga* species, providing extremely detailed extended abstracts of each paper. The earliest reports of *Striga* as a weed problem are for *Striga asiatica* early in the 20th century, from India (e.g. Barber, 1904) and from southern Africa (Burtt-Davy, 1904). Earliest reports of work on these problems come from South Africa where Pearson (1914) showed the benefit of nitrogen fertilization and Saunders (1942) from 1926 onwards through to 1942, conducted a wide range of studies on biology and control, proposing a number of agronomic approaches and most importantly began the process of breeding and selection for resistance in sorghum, leading to release of the variety Radar. Timson worked on serious infestations of *S. asiatica* in maize in Rhodesia (Zimbabwe) from 1929 onwards. He promoted catch-cropping with sudan grass, together with phosphate fertilizer and crop rotation leading to over 3-fold yield increases in maize over a 4 year period (Timson 1945).

The problem from *S. hermonthica* (Fig 7) in the northern half of Africa did not appear to be recognised until somewhat later. I cannot explain this other than to assume that there was less pressure on land and it was traditionally suppressed by shifting cultivation. McDonald (1928) was one of the first to record it as a problem, on maize in Kenya. Andrews (1945) studied it as a problem in sorghum in Sudan while Portères (1948) documented it in rice and other crops in Senegal, West Africa. Doggett working in
Tanganyika (Tanzania) from 1952 to 1954 developed a number of resistant sorghum varieties, including Dobbs and others which provided the basis for the subsequent work of ICRISAT (Doggett, 1954). (I shall return to those more recent developments later).

Striga hermonthica

Fig 7.

The Witchweed Lab
Meanwhile, back to 1955 in USA, the fear was that it could spread to the corn belt of the mid-West, hence the establishment of the Witchweed Lab in Whiteville, North Carolina where Bob Eplee, from 1965, started to develop his various techniques for the study and eradication of Striga, involving quarantine, herbicides, methods for monitoring infestations by separation of seeds from the soil and the use of ethylene to stimulate suicidal germination (which sadly never really worked against S. hermonthica in Africa). Much of this work was summarised in the WSSA publication by Sand et al (1990) and by Eplee himself (Eplee, 1992). Wide-scale quarantine restrictions were finally lifted in 2009, and 50 years, and $250 million later, the infestation was finally reduced to a few hundred acres over 5 counties in the Carolinas (Tasker et al., 2012).

Oxford
1956 was significant as the year in which I myself first became familiar with Striga asiatica in South Africa, though I only began working on it in 1959 when I returned to the ARC Unit of Experimental Agronomy in Oxford and took over a programme that already included the testing of herbicides on Striga hermonthica. From then on I spent many years delving into its biology and control in the labs and glasshouses in Oxford and at Weed Research Organisation from 1966. We screened innumerable herbicides but found none sufficiently selective. We looked at the effects of nutrients on stimulant exudation in sorghum and confirmed the effect of nitrogen in reducing it and of
potassium in stimulating it. Curiously we failed to show the effect of phosphorus in reducing it, now well confirmed by others - and I still do not quite understand why we missed it. Now, it may be possible to exploit this beneficial effect of P very economically by ‘micro-dosing’ (Jamil et al., 2014).

We enjoyed demonstrating the profound inhibitory effect of *Striga* extremely early after attachment, such that, at 4 weeks, less than 1 mg of *Striga* seedlings a few mm long could cause 400 mg reduction in the total weight of the host, and at 5 weeks, 13.5 mg caused a total weight loss of 960 mg. (Parker 1984) (Fig 8). (Incidentally this phenomenon is not shown by *Orobanche* species, which in general reduce their host by very little more than their own dry weight). Furthermore, the shoot of *Striga* is disproportionately affected as a result of a significant shift in root:shoot balance (Fig 9). We also, in conjunction with ICRISAT, screened hundreds of sorghum varieties for their stimulant exudation, not realising at that time that the absence of stimulant might have a down-side.

### Early influence of *S. hermonthica* on host (low nitrogen)

<table>
<thead>
<tr>
<th></th>
<th>At 4 weeks</th>
<th>At 5 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Striga</em> dry wt.</td>
<td>0.3 mg</td>
<td>13.5 mg</td>
</tr>
<tr>
<td>Sorghum dry wt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no <em>Striga</em></td>
<td>2060 mg</td>
<td>3660 mg</td>
</tr>
<tr>
<td>+ <em>Striga</em></td>
<td>1650 mg</td>
<td>2600 mg</td>
</tr>
<tr>
<td>Sorghum dry wt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>loss</td>
<td>410 mg</td>
<td>960 mg</td>
</tr>
</tbody>
</table>

From Parker, 1984.

### Effect of *S. hermonthica* on root:shoot balance

<table>
<thead>
<tr>
<th></th>
<th>Root</th>
<th>Shoot</th>
<th>R:S ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum no <em>Striga</em></td>
<td>1.0</td>
<td>4.1</td>
<td>0.25</td>
</tr>
<tr>
<td>Sorghum + <em>Striga</em></td>
<td>1.6</td>
<td>2.5</td>
<td>0.61</td>
</tr>
<tr>
<td>Higher N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum no <em>Striga</em></td>
<td>2.0</td>
<td>9.9</td>
<td>0.21</td>
</tr>
<tr>
<td>Sorghum + <em>Striga</em></td>
<td>3.0</td>
<td>7.6</td>
<td>0.41</td>
</tr>
</tbody>
</table>

From Parker, 1984.
Strigolactones
1972 - A next significant date in the history of *Striga* is when Cook *et al.* (1972) were the first to describe the structure of a strigolactone – strigol, from the roots of cotton. This audience will hardly need to be reminded of the further history of strigolactones, including the discovery of their more primary involvements in controlling plant architecture and the growth of mycorrhizal fungi (Akiyami and Hyashi, 2006), but you may not be familiar with the history of the precursors of the very useful strigol analogues GR24 and Nijmegen-1. In 1975, my boss, John Fryer, director of the ARC Weed Research Organization attended an ARC (Agricultural Research Council) dinner and sat next to Prof. Alan Johnson, director of another ARC Unit - of Invertebrate Chemistry and Physiology at University of Sussex. Prof Johnson mentioned that he had a new post grad student from Canada working on the synthesis of simple strigol analogues and already had some products but had no idea how to test them for activity. John Fryer was able to say that I was doing that routinely with sorghum root exudates and would be able to be of service. A week later we had samples of GR2, GR3, GR4, GR5 and GR7 (Fig 10) and within days we had confirmed high activity from several of these (Fig 11). The later analogues, especially GR 24 and Nijmegen 1 are now immensely useful in research, but not so far as a means of control in the field? No doubt Binne Zwanenberg will bring us up to date on this later. It may not be generally realised that the prefix GR refers to Gerald Rosebery, the post-graduate student involved.

**The early GR compounds**

*From Johnson *et al.*, 1976

<table>
<thead>
<tr>
<th>Compound</th>
<th>mg/l</th>
<th>Germination %</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR2</td>
<td>0.1/1.0</td>
<td>0/0</td>
</tr>
<tr>
<td>GR3</td>
<td>0.1/1.0</td>
<td>0/0</td>
</tr>
<tr>
<td>GR4</td>
<td>0.1/1.0</td>
<td>0/0</td>
</tr>
<tr>
<td>GR5</td>
<td>0.1/1.0</td>
<td>2/56</td>
</tr>
<tr>
<td>GR7</td>
<td>0.00007/0.01</td>
<td>0/16</td>
</tr>
<tr>
<td>Sorghum exudate</td>
<td>50-70</td>
<td>60-70</td>
</tr>
<tr>
<td>Distilled water</td>
<td>0</td>
<td>2-20</td>
</tr>
</tbody>
</table>

*Based on Johnson *et al.*, 1976

**1976 – GR compounds**

**Alectra and Striga gesnerioides**

In 1985 I visited Charlie Riches in Botswana whose work there included the problem of *Alectra vogelii* (‘yellow witchweed’) in cowpea (Fig 12). By then he had identified a number of cowpea landraces with resistance to *Alectra* (Riches, 1976). I returned to UK with samples of ten of these and put them through a simple screen to look for possible co-resistance to *Striga gesnerioides* (cowpea witchweed) (Fig 13). Nine out of the ten showed no resistance but B.301 showed apparent immunity to at least one race of *S. gesnerioides*. As sunflower shows race-specific immunity to *Orobanche cumana*, so it soon proved that cowpea shows race-specific immunity to *S. gesnerioides*. In 1984, the variety Suvita-2 had been shown to resist *S. gesnerioides* in Burkina Faso, but it was soon shown that this line and another, 58-57 were not resistant in Mali, Niger or Nigeria (Aggarwal *et al.*, 1986). Our further work with B.301 showed that it was immune to the
races from all these countries and from Cameroon (Parier and Polniaszek, 1990). Only in 1993 was it found to be overcome by the ‘hyper-virulent’ Zakpota race from southern Benin (Lane et al., 1993). The recent situation is ably reviewed in the paper by Botanga and Timko (2006) (Fig 14) which includes this table showing that there have been other lines identified by the International Institute for the Semi-arid Tropics (IITA) with broad-spectrum resistance, including to the Zakpota race, but B.301 continues to be valuable to IITA in the development of cowpea lines with dual resistance to both Striga and Alectra (Poliaszek et al., 1991; Singh et al., 1997).

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>SU1 (Burkina Faso)</th>
<th>SU2 (Mali)</th>
<th>SU3 (Nigeria/Niger)</th>
<th>SU4 (Benin)</th>
<th>SU5 (Benin)</th>
<th>SU6 (Cameroon)</th>
<th>SU7 (Senegal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘IYK-5230’</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>‘Blackeye’</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>‘UVA-UCR1115’</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>‘S5-57’</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>‘Savita-2’</td>
<td>R</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>‘B301’</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>‘TB11D-994’</td>
<td>R</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>‘TB2D-049’</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>‘Tos.1d676’</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td>R</td>
<td>nt</td>
</tr>
<tr>
<td>‘TT93K-693-2’</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
</tbody>
</table>

Note: S, susceptible; R, resistant; nt, not tested; data from this study, Lane et al. (1996), and Singh and Enachebe (1997).
More on *Striga*

Returning to *Striga* in cereal crops - over the years there have been continued efforts to find resistance and/or tolerance to *Striga*, led, for sorghum, by ICRISAT who developed a number of valuable ‘SAR’ (*Striga asiatica*-resistant) lines which were later taken on and developed by Gebisa Ejeta in USA for release in Ethiopia and East Africa. For maize, IITA developed *Striga*-tolerant lines which have been released with considerable success in West Africa. In each case they have been exploited in conjunction with other, integrated approaches, in extensive projects funded by the Melinda and Bill Gates Foundation. I had hoped to have updates from the latter and from IITA but they have not been available, so I apologise once again for not being at all up-to-date. Also I am sure there are significant dates for developments and publications in the new fields of genomics and other molecular studies as they relate to parasitic weeds, but I am afraid I must leave that field for others to review.

Although in maize and sorghum there is nothing approaching immunity, in rice there has been more conspicuous success with the NERICA varieties developed by the Africa Rice Centre in East Africa. These involve crosses between *Oryza sativa* and the African *Oryza glaberrima*. These were not developed specifically for *Striga*-resistance but some are proving very effective (Rodenburg *et al*., 2015a).

1997 – a significant date in the control of *Striga* in cereals was when it was noticed, by a keen-eyed technician that in trials at the ICIPE station in Kenya, where *Desmodium uncinatum* was being tested as a means of repelling stalk-borer from maize plots, the *Striga hermonthica* was much reduced (Khan *et al*., 1997) (Fig 15). Hence in 2000 John Pickett, in conjunction with Dr Z.R. Khan of ICIPE was able to publish their findings that after just a few years of inter-planting maize between the rows of the perennial *D. uncinatum*, *S. hermonthica* was vastly reduced and the maize greatly invigorated by the additional nitrogen provided by the legume (Khan *et al*., 2000). This technique is now being widely used in East Africa, at least where there is not too long a dry season. ICIPE claim that over 100,000 farmers are already making use of the technique. Recent updates on the topic include those by Murage *et al*., 2015 and Midega *et al*., 2015.

![Effect of *Desmodium uncinatum*](image-url)
The other significant development in East Africa has been the treatment of naturally herbicide-resistant (non-GM) maize with imidazolinone herbicide. The seeds are coated with the herbicide before planting and good control of *Striga* has been achieved in wide-scale farmer trials. (Abayo et al., 1998; Kabambe et al. 2008; Mwangi et al., 2014; Makumbi et al., 2015).

Just one more development worth mention is the use of *Fusarium oxysporum* for biocontrol of *Striga*. There have been many attempts at exploiting this pathogen but the latest reports sound encouraging. David Sands of Montana State University reported to the Strigolactone meeting in Romania last year (2015) that isolate-treated toothpicks are distributed to farmers who culture it further on cooked rice and put some of the rice in the planting hole.

**Malta and *Orobanche crenata***

Going back now to another key date - 1972 - this date is when the EWRC (European Weed Research Council) Parasitic Weeds Research Group was established by myself and Dr Abdul Rahman Saghir of the American University of Beirut, Lebanon. We located just over 100 workers on parasitic weeds in 36 countries in Europe and beyond and invited them to attend the Symposium on Parasitic Weeds in Malta in April 1973. About 50 attended (Fig 16). This group photo includes myself and Lytton Musselman, also Jose Cubero and Job Kuijt but not many others that are still around or active. The Proceedings were published by EWRC (now EWRS) and I believe copies are still available. This meeting arose because of a UK-funded project on *Orobanche crenata* (Fig 17) which I had visited in Malta in 1970.
Fig 17.

I shall return to the Malta meeting as a starting point for other developments but will first use it as a prompt to talk about *Orobanche crenata*. This first picture was in fact taken at the time of that meeting in Malta and shows the devastating effect it can have, especially under dry conditions. Plenty of research had of course gone on before 1972, but the Malta Symposium was an opportunity for a pooling of available information on its distribution and biology, including physiology and germination and on resistance in faba bean, ably reviewed by Jose Cubero (1973), who concluded that there were resistance genes, especially in small-seeded varieties which tended to be dominant, but that they were greatly influenced by the environment. In the years since, there have been many further studies on all these but regrettably no major advance in control. From Egypt the variety Giza 402 showed promise but it was not a productive variety. It has been, however, the source of partial resistance in a number of newer varieties. Fast forward to 2013 and the latest workshop on the problem, held in Rabat, Morocco, which was organised in response to the continuation of its seriousness, not only on faba bean, but also on lentil, pea and other legumes across the Mediterranean region where the nutrition and economy of farmers and countries in the region are being seriously affected. One gleam of hope was the report of useful tolerance in the variety Misr-3 which suffers only 10% yield loss from heavy infestation. More recently the variety Baraca and derivatives from it have shown promise not only for *Orobanche crenata* but also for *Orobanche foetida* (Fig 18), the relatively new problem in Tunisia (Rubiales et al., 2014). And in Spain there has been success in developing resistant varieties of field pea. Otherwise, at the 2013 meeting (reviewed by myself and Donal O’Sullivan in Haustorium 64, 2013), there were novel suggestions for transfer of genes from *Desmodium* to faba-bean, and for creation of herbicide-resistant faba-bean, but without outcome as yet. Meanwhile some useful selectivity has been shown with glyphosate and imidazolinone herbicides which are, I believe, being used locally in Morocco and elsewhere. Biological control with the fly *Phytomyza orobanchia* has been explored repeatedly but never to any practical degree.
Meanwhile *O. crenata* is still spreading. It was first recorded in Ethiopia in 1989, since when it has spread rapidly to many of the important faba-bean growing areas of the country (Teklay Abebe *et al.*, 2013). And it even popped up in UK in 2013. Just in one or two fields in Kent but devastatingly damaging.

**Other Orobanche/Phelipanche species**
Just briefly to mention other problematic broomrape species. These include *Orobanche cernua* in Solanaceae, and *Phelipanche ramosa* (Fig 19), in Solanaceae and in Brassicaceae, including relatively new infestations in rape-seed in France. And *P. aegyptiaca* (Fig 20) mainly in Solanaceae and Cucurbitaceae. Control of all these depends mainly on herbicides – some treatments are particularly well developed in Israel (Fig 21..

**Orobanche foetida**

*Fig 18.*

**Phelipanche ramosa**

*Fig 19.*
Phelipanche aegyptiaca

Fig 20.

P. aegyptiaca on tomato

Control

Sulfosulfuron 2X50 g he
+ imazapic 2X20 ml he

Fig 21.
**Other genera**

I am not attempting to cover all the significant parasitic weeds but should briefly mention some of the more important, including *Rhamphicarpa fistulosa* (Fig 22), another root parasite in Orobanchaceae which is affecting rice widely across East and West Africa (Rodenburg *et al.*, 2015b).

![Rhamphicarpa fistulosa](image)

*Fig 22.*

Also the dodders, especially *Cuscuta campestris* (Fig 23), which can be severe locally on some crops especially when it is a contaminant of crop seed as in lucerne/alfalfa and in niger seed (*Guizotia abyssinica*), as here in Ethiopia (fig 24). Control depends almost completely on seed-cleaning and on herbicides.

![Cuscuta campestris](image)

*Fig 23.*

![Cuscuta campestris](image)

*Fig 24.*
The similar but unrelated *Cassytha filiformis* (Fig 25) can be a problem, so far without any developed control measures.

And the dwarf mistletoes, *Arceuthobium* species (Fig 26) have been described as the most serious disease problem in North American forestry. Control of these depends on cultural methods including fire and thinning.
Major meetings
Returning now to Malta and the EWRS Parasitic Weeds Research Group. In 1975 this was taken over by the newly formed European Weed Research Society (EWRS), but it was difficult to give adequate emphasis to Striga in a European context, so after a brief divorce it re-formed in 1979 as the International Parasitic Seed Plant Research Group which later still was taken under the wing of IPPS Lytton Musselman had been at the Malta meeting and in due course he arranged a Second International meeting in Raleigh, N. Carolina in 1979. These slides shows the full sequence of international meetings since then (including the latest in Asilomar in 2017) (Figs 27, 28).

Parasitic plant meetings (1)

1st Symposium – Malta, 1973
2nd Symposium – Raleigh, 1979
3rd Symposium – Aleppo, 1984
4th Symposium – Marburg, 1987
5th Symposium – Nairobi, 1991
6th Symposium – Cordoba, 1996
7th Symposium – Nantes, 2001

Parasitic plant meetings (2)

8th Symposium - Durban, 2005
9th World Congress – Charlottesville, 2007
10th World Congress – Kusadasi, 2009
11th World Congress – Martina Franca, 2011
12th World Congress – Sheffield, 2013
13th World Congress – Kunming, 2015
14th World Congress – Asilomar, 2017
Haustorium
There have also many other, more localised or specialised meetings in between those listed above, many of them very important and productive. They are not listed here but one is of particular importance to our story today – the *Striga* workshop arranged in Khartoum in 1978 by IDRC (International Development Research Center which funded a number of projects on parasitic weeds). It was here that Lytton and I first discussed the idea of a parasitic plants newsletter, resulting in the first issue of ‘Haustorium’ coming out in 1979. It started small and had some lapses and problems of funding documented in the item ‘How Haustorium Happens’ in our 50th issue, but fortunately it was able to continue and flourish and now endeavours to briefly note and summarise all new literature on parasitic plants (not just weeds) twice a year (Fig 29) Anyone not receiving it is welcome to let me know and be added to the mailing list which currently approaches 500 from some 60 or more countries.

![HAUSTORIUM](Khartoum Striga Workshop, 1978)
First issue December 1979
eds CP, Lytton Musselman et al.–
Issues 1-8 ’79-’81 (funded by ODU, Norfolk, VA)
Issues 9-14 ‘82-’85 (IPPC Corvallis)
Issues 15-16 ’85-’86 (Intsormil)
Issues 17-29 ’86-’94 (USAID + ODU)
Issues 32 ’97 (FAO) Issue 33-34 ’98 (LARS)
Issues 35-36 1999  (UK DFID)
Issues 37→ 2000→ (ODU) (for IPPS from 2001)
Issues 53 → 2018 → email only, no funding needed

Fig 29.

Publications
Now just one more thread, back-tracking to 1969 - when Job Kuijt published his masterly volume on The Biology of Parasitic Flowering Plants, the first to provide an overall survey of the subject. Since then some of the further major publications have included: Musselman, 1980, Visser, 1981, Parker and Riches, 1993, Press and Graves, 1995, Hawksworth and Wiens, 1996, Joel *et al.*, 2007, Heide-Jorgensen, 2008, Joel *et al.*, 2013 but there have been many others.
The future

We already have the relatively new problems which I have mentioned including *Rhamphicarpa fistulosa* in rice, *Orobanche foetida* in legumes in North Africa (Kherrat et al., 1992) and *Phelipanche ramosa* in rapeseed in France (Collin, 1999). Also the serious outbreak of *O. crenata* in Ethiopia. Publications emphasising the potential risks from further spread of parasitic weeds include those by Grenz and Sauerborn (2007) for *O. crenata* and by Mohamed *et al.* (2006) for a range of species (Figs 30, 31). These confirm the risks even without any climate change. That by Venette *et al.* (2013) makes predictions for the substantial spread northwards of *Arceuthobium* species in forestry in N. America, with global warming.

Fig 30.

Fig. 31.
Postscript
No attempt has been made to update this text in any way. Needless to say there have been many important developments in the subject published in the literature and presented at the 14th Parasitic Weed Congress in Asilomar in 2017. Many of these have involved cutting-edge genetic studies which in any case are beyond this author to interpret. May the good work continue!

Acknowledgement
I wish to thank IPPS and my co-editors, Lytton Musselman and Hinanit Koltai for permitting me the self indulgence of publishing in this way. I also wish to acknowledge the very generous support, help and advice that I have received from Lytton over the years and not least in the preparation of this paper.

References:


Sabah Attia, 2013. Misr 3 - a new Egyptian *Orobanche*-tolerant faba bean variety. Paper presented at the Workshop ‘Building a new research alliance to reclaim faba bean production area abandoned to *Orobanche.*’ Rabat, Morocco, 6-9 October, 2013. (Reviewed by Chris Parker and Donal O’Sullivan in Haustorium 64, December 2013.)


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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

I wish you all a very Happy New Year and lots of success with your parasitic plant research!

This year we have the 15th World Congress on Parasitic Plants, which will take place in Amsterdam from June 30th – July 5th. The venue looks fantastic and the meeting is a great opportunity to see friends and to network. Prof. Harro Bouwmeester is the local organizer and Registration and Abstract submission are now open on the WCPP-15 website (https://www.wcpp2019.org/program/). Please note that early registration at a reduced price is available until the 28th February so please register as soon as possible!

We have an exciting program of talks and poster presentations that cover different aspects of parasitic plant biology. There will be seven sessions including Host Plant Resistance, Genes and Genomes, Ecology, Phylogeny and Evolution, Molecules and Biochemistry, Control and Management, Parasitic Plant Biology and Parasitic plant-host interactions, so there’s something for everyone! There will also be a conference tour (to be announced) and conference dinner.

On other matters, we are due to elect a new Editor for the IPPS Executive committee shortly, as Prof. Hinanit Koltai has now completed four years as Editor. I would like to take this opportunity thank Hinanit very much, for all the work she has done on the committee on behalf of the IPPS, it is much appreciated. I will send information to all IPPS members about the election of a new Editor in the next few weeks.

I look forward to seeing everyone in Amsterdam in June.

Best wishes,

Julie Scholes, IPPS President
J.Scholes@Sheffield.ac.uk

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MEETING REPORTS

2nd International Congress on Strigolactones, Turin, Italy, 27th–31st March 2017

The Second International Congress on Strigolactones was held in Turin (Italy) on 27th-30th March 2017. The meeting was organized in the framework of the COST Action FA1206 ‘Strigolactones: biological roles and applications’. The meeting, organized by Prof Cristina Prandi, Chair of the Action FA1206 (University of Turin, Department of Chemistry) and Local Organizer, was held at Cavallerizza Reale in Turin.

The meeting was arranged into the following 7 sessions. Posters were displayed during the whole event.

Session 1. Strigolactones: perception and transport

In this session, new findings regarding Strigolactone signaling were presented, including new insight into D14 receptor, an ancestral role for, or D14 and KAI2 in signalling pathways, the activity and role of the Strigolactone transporter PDR1 under phosphate poor conditions, and new insight into the evolution of Strigolactone signaling.

Presentations:
Paola Bonfante, University of Torino, Italy - ‘Strigolactones cross the kingdoms: plants, mycorrhizal fungi and bacteria’
Daoxin Xie, Tsinghua University, China - ‘DWARF14 is a non-canonical hormone receptor for strigolactone’
Junko Kyozuka, Tohoku University, Japan - ‘Analysis of ancestral role of D14/KAI2 signaling pathway’
Lorenzo Borghi, University of Zurich, Switzerland - ‘The strigolactone transporter PDR1 regulates plant biomass production on phosphate-poor soil’
Tom Bennett, University of Leeds, UK - ‘The evolution of Strigolactone signalling’
Weiqiang Li - ‘OaMAX2 of Orobanche aegyptiaca and Arabidopsis AtMAX2 share conserved functions in both development and drought responses’
Kaori Yoneyama, RIKEN Center for Sustainable Resource Science, JAPAN - ‘Biochemical characterization of MAX1 orthologs involved in strigolactone biosynthesis’
Elena Sanchez, CSIC, Cordoba, Spain - ‘Control of DWARF14 stability in Arabidopsis thaliana’
Session 2. Strigolactones and microbiota
In this session new insight into the tight interactions between SLs released in the rhizosphere and their effects on the soil microbiota have been presented. A special focus was dedicated to the effects of SLs on AMF with emphasis on the recent progresses in the identification of SLs receptor in fungi.

Presentations:
Caroline Gutjahr, LMU Munich, Germany - ‘KARRIKIN signaling in arbuscular mycorrhiza development. Design and use of profluorescent probes’
Michael H. Walter, Leibniz Institute of Plant Biochemistry, Germany - ‘Strigolactone levels in mycorrhizal roots of dicots are determined by carotenoid pre-cursor supply driven by phytoene synthase 3’
Eloise Foo, University of Tasmania, AUSTRALIA - ‘Determining the site of action of Strigolactones during nodulation’
Juan Antonio López-Ráez, CSIC, Cordoba, Spain - ‘Role of strigolactones in the Rhizobium-legume symbiosis: effect on bacterial motility and regulation by nodulation’
Valentina Fiorilli, University of Torino, Italy – ‘Looking for genes encoding strigolactone receptors in fungi’
Rocio Pineda-Martos, University of Huelva, Spain - ‘Chemotropic sensing responses of fungal biocontrol agents to Strigolactones. The three-player system: host-parasite-Fusarium’
Piotr Rozpadek, Jagiellonian University, Poland - ‘Strigolactone is necessary for the establishment of a beneficial interaction between Arabidopsis thaliana and Mucor sp.’
In Sun Yoon, National Institute of Agricultural Sciences, Republic of Korea - ‘OsTCP6 is a positive regulator of tiller formation in rice and involved in the transcriptional activation of cell cycle genes’

Session 3. Strigolactones as plant hormones
In this session new insight into Strigolactone biosynthesis and transport were given. New biosynthesis components that result with different newly identified precursors and end products were presented, as well as new findings regarding the plasma membrane localization of a Strigolactone transporter.

Presentations:
Ottoline Leyser, University of Cambridge, UK - ‘Auxin, Strigolactone and the control of shoot branching’
Lam-Son Tran, RIKEN Center for Sustainable Resource Science, Japan - ‘Strigolactones: function and potential crosstalk with cytokinins in drought response’
Kaori Yoneyama, Utsunomiya University, Japan - ‘Biochemical characterization of lateral branching oxidoreductase involved in strigolactone biosynthesis’
Christine Beveridge, University of Queensland, Australia - ‘Shoot branching. Role of Strigolactones and interactions with other signals’
Markus Geisler, University of Fribourg, Switzerland - ‘TWISTED DWARF1 integrates auxin and strigolactone actions on plant development’
Guo-Wei Liu, University of Zurich, Switzerland - ‘The phytohormone strigolactone regulates the maintenance of hypodermal passage cells and Mg2+ uptake’
Francesca Cardinale, University of Turin, Italy - ‘Strigolactones are crucial for miR156 inducibility by drought in tomato’

Session 4. Chemistry of Strigolactones
This session was dedicated to new synthetic sequences leading to natural and synthetic Strigolactones. Impressive progresses have been made to enantioselective synthesis as enantiopure compounds are needed to evaluate biological effects directly related to Strigolactones and not to karrikins.

Presentations:
Tadao Asami, University of Tokyo - ‘Chemical regulation of strigolactone functions’
François-Didier Boyer, Institut Jean-Pierre Bourgin, INRA, France - ‘Mechanism of Strigolactone reception in vascular plants. Design and use of profluorescent probes’
Francisco Antonio Macias Dominguez, University of Cadiz, Spain - ‘Natural products as source for new Strigolactones mimics’
Salim Al Babili, King Abdullah University of Science and Technology, Saudi Arabia - ‘A negative regulator of Strigolactone biosynthesis and efficient Strigolactone analogs’
Christopher McErlean, University of Sidney, Australia - ‘Synthetic strategies to aryl Strigolactones’
José Maria González Molinillo, University of Cadiz, Spain - ‘Preparation and activity evaluation of Eudesmanestrigolactones from Costunolide’
Sofie Goormachtig, Ghent University, Belgium - ‘Strigolactone signaling through the eye of the mass spectrometer’

Carlos Rial Cumbra, University of Cadiz, Spain - ‘Evaluation of germination stimulant activity of the guaianolide Lappalone and its derivatives on parasitic weeds’

Salar Torabi, University of Munich, Germany - ‘Karrikin signaling in Lotus japonicas’

Session 5. Strigolactones: perception and signalling

In this session the role of SLs as seeds germination inducers of parasitic plants has been evaluated and new progresses in this field have been presented by the speakers. The exploitation of SLs as a tool to combat parasitic weeds infestation has been discussed.

Presentations:
Shinjiro Yamaguchi, Tohoku University, Japan - ‘Strigolactone biosynthesis and its regulation’

Sandrine Bonhomme, CNRS, Université Paris-Saclay, France - ‘Strigolactone signaling pathway evolution - inputs of Physcomitrella patens mutants’

Samy Carbonnel, LMU Munich, Germany - ‘Characterization of Karrikin and Strigolactone signaling in the legume Lotus japonicus’

Laura Ravazzolo, University of Padova - ‘Strigolactones involvement in maize root response to nitrate fluctuations’

Yuichiro Tsuchiya, Nagoya University, Japan - ‘Development of a germination stimulant for a parasitic plant Striga’

Attila Végh, Centre for Agricultural Research, Hungary - ‘Comprehensive analysis of DWARF14-LIKE2 (DLK2) reveals its role in seedling light responses’

Session 6. Strigolactones and germination

In this session, a number of speeches dealing with the roles of Strigolactones and related compounds on the germination processes of parasitic plants were grouped. (Many of the presentations in this and the following session which were included in Journal of Experimental Botany, are briefly reviewed in included in the Literature section below.)

Presentations:
David Nelson, University of California, USA - ‘Roles and regulation of the SMXL/D53 family’

Mark Waters, University of Western Australia - ‘Diversity in KARRIKIN receptor proteins. What can we learn beyond Arabidopsis?’

Steven M. Smith, University of Tasmania, Australia - ‘KARRIKIN signalling increases the sensitivity of Arabidopsis seed germination to osmotic stress’

Philippe Delavault, University of Nantes, France - ‘Parasitic and non-parasitic plants share a Strigolactone signaling pathway leading to seed germination through abscisic acid catabolism’

Harro Bouwmeester, University of Amsterdam, The Netherlands - ‘Structural diversity in Strigolactones: biosynthesis and significance’

Antonio Evidente, Università di Napoli Federico II, Italy - ‘Root plant and fungal metabolites to alternatively and biologically Lukas Braem - ‘A protein approach towards investigating parasitic plant germination’

Lukas Braem - VIB, Belgium – ‘A protein approach towards investigating parasitic plant germination’

Evgenia Dor - ‘Characterization of the Carotenoid Cleavage Dioxygenase 7 (CCD7) chickpea mutant’

Session 7. New challenges for Strigolactones

In this session, unforeseen and unprecedented SLs role and effects have been presented. Non canonical Strigolactones have been shown to be as effective as canonical SLs. Antitumoral activity of SLs analogues has been presented by Dr. Yarden, USA.

Presentations:
Koichi Yoneyama, Utsunomiya University, Japan - ‘Distribution of canonical and non-canonical strigolactones in the plant kingdom’

Claudio Screpanti, Syngenta Crop Protection, Switzerland - ‘Strigolactones and their potential role in modern agriculture’

Antonio Cala Peralta, University of Cadiz, Spain - ‘A Study on the germination activity of Dehydrocostuslactone derivatives on parasitic weeds’

Hailey Larose, Virginia Tech, USA - ‘The Orobanche camana x Orobanche cernua genetic system provides insight into the regulation of host specificity in a parasitic plant’

Ronit Yarden, Georgetown University, USA - ‘The anti-tumorigenic activities of Strigolactone analogs’

Closing lecture
Binne Zwanenburg, Radboud University, The Netherlands - ‘Strigolactones: new plant hormones on the move’
This symposium was the fourth specific symposium on broomrape in sunflower after those held in Turkey 2008, Moldova 2011 and Spain 2014. It was organized by the National Agricultural Research and Development Institute of Fundulea and the University of Agronomic Sciences and Veterinary Medicine of Bucharest, with the ISA, under the coordination of Maria Pacureanu, and attracted 203 participants from 17 countries including those most concerned by the infestations of *Orobanche cumana* on sunflower and/or research on this topics - Central and Eastern Europe, Spain, Turkey, Israel, Iran, Karakhan and China - were present. About two thirds of the participants were from private companies and one third from public research and universities, reflecting the importance of such events for the coordination of research and innovation.

27 oral presentations and 26 posters were presented, organized in the following four sessions, offering a quite complete overview of the diversity of the work on sunflower broomrape. The symposium ended with a workshop on the creation of an International Consortium on Sunflower broomrape resistance and was followed by a field trip to the Braila Research Station and Soare Constantin Society, in Constanța area.

**Biology and genetics of *Orobanche cumana***:

Philippe Delavault (University of Nantes) explained the interest of the focus on the germination process in the perspective to implement biocontrol methods of the *Orobanche*. Using a transcriptomic approach applied to *P. ramosa*, they showed that the germination stimulants produced by the host plant, induce a modification of only 28 transcripts out of 2500 and that 2 of them induce a gene active in ABA catabolism, producing an enzyme CYP707A involved in the control of seed dormancy and germination. They conclude that *P. ramosa* seeds germinate after the endogenous ABA content reaches a sufficiently low level through CYP707A dependent catabolism triggered by the germination stimulants. The work carried out at Nantes and Toulouse on *O. cumana* permitted to obtain a reference transcriptome of *O. cumana*, a transcriptomic profiling during the broomrape development and an annotation of the *O. cumana* genome sequence. Work is continuing with a PhD thesis (Sabrina Tourneur/ poster) and the project miPEPITO, aiming at identifying micropeptids involved in the regulation of specific target genes in *Orobanche* and sunflower, in order to implement biocontrol methods.

Maria Joita-Pacureanu (National Agricultural research and Development Institute Fundulea) presented the current global situation of the sunflower broomrape which concerns 70% of the world production area and 60% of the production; and the evolution of broomrape populations. The newest populations determined in some countries were called G, H and I, but there is a doubt in the description of races in different countries, especially for the recent ones. To facilitate communication and comparisons, proposals have been made for a universal adoption of the coded triplets system based on differential sets of sunflower lines, similarly to other plant pathogens. Sources of resistance to the races G and following have been identified in wild *Helianthus* species. The presentation concludes on the necessity to complexify the breeding strategy, using pyramiding of single dominant *Or* genes, and use of quantitative non-race-specific tolerance. Using resistance to the AHAS-inhibiting herbicides is part of the strategies.

(Sanrui Agri Tech) and Maria Duca (University of Academy of Science of Moldova) presented the status of *Orobanche* monitoring in China and Moldova respectively. In China, the results show a trend towards a higher pressure of broomrape. Hybrids resistant to races E and F were developed, but a race G is present already in Inner Mongolia and will probably increase. In Moldova, broomrape has a long history since 1935 with races A and B; the latest monitoring results show a rather unfavorable situation with a higher presence of the parasite in the south of the country, with more than 60% of infested lands, and a gradient from south to north, but the latest races F, G, H are present in all regions. Molecular studies and phylogenetics have been achieved, showing a pathogen-host co-evolution. Jian Wang (Zejiang University) detailed the situation and control techniques in Inner Mongolia, China: it seems that water soaking from irrigation can affect the vigor of *O. cumana* seeds and decrease their germination rate. Faisal Islam (Zejiang University) reviewed the possible management levers against *Orobanche*, including agronomic ones.
Resistance mechanisms in sunflower
Alberto Martin Sanz (Corteva) presented a complete review of the resistance mechanisms to *O. cumana* in sunflower, distinguishing pre-attachment and post-attachment phases, the latter being divided into pre-haustorial and post-haustorial, and describing the mechanisms identified in the literature. The action of some of the major resistance genes may be attributed to a dominant mechanism (e.g. pre-haustorial for *Or*7). Na Zhang et al (Zhejiang University) tested in controlled conditions a pre-treatment of sunflower seeds with brassinolide, revealing positive effects on sunflower growth and biomass. Mireille Chabaud (INRA) presented the phenotyping device used in Toulouse for the study of the resistance of sunflower to *Orobanchaceae* at early stages, in a rhizotron with automation of imaging and image analysis and optimization of the nutrient solution.

Genetic resistance
Leonardo Velasco (CSIC) introduced the session with a review of the recent developments of breeding for resistance against broomrape, pointing out a coexistence of more than one century between the crop and its parasite with a gene to gene resistance system, and a complexifying racial situation. The *Orobanchaceae* variability and increase in virulence is not due solely to mutations: recent studies in Spain have shown the existence of a certain level of cross-fertilization and genetic recombination between individuals of different gene pools. Also in Bulgaria it was found that there was a gene flow between populations parasitizing wild hosts and populations parasitizing sunflower. Velasco listed and commented on 5 complementary research strategies in a scenario of racial uncertainty: 1. Racial characterization of broomrape populations, 2. Discovery of new resistance genes, 3. Genetic and physiological characterization of resistance genes in sunflower, 4. Genetic and physiological characterization of avirulence genes in broomrape, 5. Developing diagnostic molecular markers for resistance and for avirulence genes.

Concerning the 3rd strategy, he insisted on the fact that genetic and physiological characterization of the resistance are equally important in the perspective to associate gene pyramiding with a physiology-based strategy. Stéphane Munos (INRA) presented the work carried out in the French-Spanish Helior project: observing that cell wall modifications seem to be involved in both compatible and incompatible attachments and that genes from both broomrape and sunflower are expressed in the attachments samples of the two categories, the team carried out transcriptomic studies to measures the gene expression from both *O. cumana* and sunflower during the early stages of the interaction. For this, they produced a complete sequence and first genetic map of *O. cumana* using the segregating populations of *O. cumana* identified in Spain. Work on transcriptomics is going on to annotate the two genomes.

Dragan Skoric reviewed the progress in sunflower breeding for the resistance to *Orobanchaceae* and observed that the permanent change in populations of *O. cumana* hinders the success of breeding for resistance and concludes on the pregnant need of methods to compare the results of different studies and to evaluate the resistances. Gerald Seiler (USDA) showed, based on literature reports, that sunflower is among the species for which the use of genetic resources from wild relatives is the most important, especially concerning resistances to biotic stresses. 37 sources of resistance to broomrape have been identified in wild relatives, 29 of them in perennials. Notably resistances to races E, F, G are available in several perennial *Helianthus*.

Herbicide tolerance and other control methods.
Johannes Bessai (BASF) highlighted the interest of imidazolinone herbicides and Clearfield system for completing the genetic control of *Orobanchaceae* specially in specific areas with a high pressure of *Orobanchaceae* and the presence of very virulent races. He also pointed out the risk of development of *Orobanchaceae* biotypes resistant to these herbicides as for any weed species, and concludes that a ‘golden standard’ for broomrape control would associate Clearfield sunflowers with the latest genetic broomrape resistance, that would also allow the genetic resistances to stay longer in the market and gain time for new breeding developments. Then he gave comparative information on the two imazamox systems Clearfield and Clearfield plus. Luis Carlos Alonso (Syngenta) reminded us of important basic elements of the biology of *Orobanchaceae*, conditioning the success of the control strategies: the fields are infested by mixtures of different races, the characterization of races by letters is not reliable when considering different countries, and the importance of the wind in the dispersal of the *Orobanchaceae* seeds seems to be quite relative. Strategies combining genetic, chemical control and agronomic practices including long rotations and trap crops seem to have shown the possibility to eradicate *Orobanchaceae* in one irrigated farm in
Spain, at the opposite of previous heavy eradication programs on parasitic plants in Australia and USA.

Call for collaboration

The last session of the symposium was devoted to a workshop on the constitution of an International consortium on Sunflower broomrape resistance, on a joint initiative of CSIC Cordoba, Spain and INRA France, whose purpose is to bring together a wide range of public and private partners working on the sunflower broomrape system to define and implement long-term research and control strategies. The operational objectives are a) to define a clear set of differential lines to universally classify broomrape races, b) to develop a collection of well-characterized broomrape populations based on their virulence degree, c) to use these collected genetic resources for molecular diversity, d) to progress on the functional characterization of the interaction at all stages (from seeds to flowering shoot). Open to public and private organisations, the funding would come from private companies and from public projects, on the principles of sharing the part of the results that fit the objectives.

NEW PROJECT

N₂AFRICA – new Striga project

N₂Africa is a large scale, science-based ‘research-in-development’ project focused on putting nitrogen fixation to work for smallholder farmers growing legume crops in Africa.

With funding from the Bill & Melinda Gates Foundation, N₂Africa has been active since 2013 in Ethiopia, Tanzania and Uganda, and since 2009 in DRCongo, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda and Zimbabwe. Focal legume crops are common bean, chickpea, cowpea, faba bean, groundnut and soyabean.

A recent review by Franke et al. (2018), noted below, looks at the benefits from inclusion of legumes in the rotation, particularly on the yield of cereal crops. This is mainly (but apparently not exclusively) due to the increase in N. Where Striga occurs there are two additional benefits as the N decreases the damaging effect on the crop while at the same time most legumes reduce the Striga seed bank via suicidal germination. Intercropping is not necessarily so beneficial. They refer to a paper by Rusinamhodzi et al. (2012) in which a study of the effect of legume rotation on cereal yield had to exclude one result where pigeonpea caused an 800% increase in maize, mainly due to reduction of Striga. (Rusinamhodzi, L., Corbeels, M., Nyamangara, J., Giller, K.E., 2012. Maize–grain legume intercropping is an attractive option for ecological intensification that reduces climatic risk for smallholder farmers in central Mozambique. Field Crop Res. 136, 12–22.)

The potential effects of legumes on Striga are now the subject of a new project being conducted under the programme by Dr Travis Goron at Wageningen. Dr Travis writes as follows:

‘My first set of experiments is being conducted in Western Kenya, in Bungoma, Busia, and Kakamega counties, areas known for their high infestation levels. My objectives are to quantify the Striga seed bank in maize fields of high and low infestation, correlate the seed bank and Striga emergence with soil physiochemical characteristics, and compare Striga emergence and seed bank between maize in monoculture or rotation with a legume crop.

This past June, I conducted a survey with help from IITA scientists, to identify farmers with maize fields of both high and low infestation levels. I asked these farmers questions regarding their management practices in the fields of both the high and low infestations, including fertilizer/manure input use, variety, and importantly, cropping history. At all of these fields, I also took soil samples which are currently being tested for percent clay, silt, and sand, available P and N, organic content, pH, macronutrients (K, Ca, Mg, Na), and micronutrients (Cu, Fe, Mn and Zn). Also, the Striga seed bank from these soil samples is being quantified by both microscopy.

During a future growing season, I will return to these farmers, and in each field two treatments of either legume or monoculture maize will be planted, with high/zero N fertilization treatments to disentangle the legume N₂-fixation benefit. Striga reduction in the subsequent maize crop will be compared between the cropping treatments with visual inspection, and analysis of the seed bank as described above. It is hypothesized that rotating maize with legumes will reduce the Striga seed bank and subsequent parasitism of a maize crop in a variety of environments?’

Travis Goron, Wageningen, The Netherlands
Taking the lead toward witchweed control

The first specific inhibitor for an uncontrollable plant pest, the witchweed *Striga hermonthica*, has been discovered through collaboration between two groups at KAUST, led by plant biochemist Salim Al-Babili and structural biologist Stefan Arold.

Witchweed is a parasitic plant that attaches to the roots of cereal plants, stealing their water and nutrients. It affects more than 60 percent of farmland in sub-Saharan Africa, and is spreading across other areas, including Asia, Southeast Europe and Saudi Arabia. Commercial losses for sub-Saharan Africa alone exceed 7 billion US dollars. *Striga* and related species have become one of the most serious threats to global food security,’ says Imran Haider, from KAUST. The magnitude of its destruction led the Bill & Melinda Gates Foundation to award substantial funding to Al-Babili, who teamed up with other researchers in the biological sciences and those from the Computational Bioscience Research Center and Core Labs units.

‘The breakthrough was fortuitous,’ says postdoc Umar Hameed, whose team was studying the molecular structure of a cell membrane receptor protein involved in the germination of *Striga* seeds. This protein, ShHTL7, must bind to natural plant compounds called strigolactones during seed germination. While working to determine the structure of ShHTL7, the researchers used the molecule Triton X-100 to assist preparation of samples of the protein. ‘We noticed that our ShHTL7 molecules always had Triton X-100 bound to them,’ says Hameed. The next crucial discovery was that this binding of Triton X-100 molecules inhibits the germination of the *Striga* seeds, acting as an antagonist by preventing the natural strigolactones from binding.

‘We soon realized that we had stumbled upon the first lead compound that could inhibit *Striga* seed germination without also affecting the host plant infected with *Striga*,’ says Haider. A lead compound demonstrates useful biological activity that can be refined by developing structurally similar, but more effective, compounds.

Hameed and Haider, together with Salim Al-Babili and Stefan Arold, are using their results as a stepping stone to develop more potent inhibitors that will bind more tightly and permanently to the site that Triton X-100 has identified.

The researchers believe that this success is a great demonstration of the power of structural analysis of proteins in identifying compounds that can selectively bind to proteins to inhibit their activities. They hope this approach can be applied more widely.

Another target on their radar is the *Orobanche* (broomrape) parasite that infests commercially significant crops, such as tomato and sunflower, in the northern hemisphere.

Reference:

NOTE

Mistletoe in pear

In the older literature there are mentioned among others as host for *Viscum album* in addition to the family/genus *Malus* also the genus *Pyrus*. *V. album* however very seldom grows on pear trees. Approx. 30 years ago I infected 40 young wild pears *Pyrus pyraster* with seeds of *V. album* - however with little success (either the seedlings became dry or the pear tree died below the infection). Only one infection was successful. Unfortunately, I'm not able to inform you about the further history of the pear mistletoe. It was handed over to an open-air museum where it disappeared (much to my regret!).

But 12 years ago my hometown Radevormwald established in Radevormwald-Herbeck an orchard with old varieties of fruit. This orchard is grazed extensively by sheep. There are also some beehives. Furthermore, perches for owls, kestrels and buzzards were installed. A hedge with various *Rosa canina*, *Corylus avellana*, *Viburnum opulus*, *Crataegus sp.*, *Prunus spinosa* was planted around the orchard. There is a great variety of insects. *V. album* is growing abundantly on a pear tree *Pyrus communis* of the old species ‘Gellert's Butterbirne’. Due to a very hot and long summer period the pear tree doesn't have any fruits, contrary to the other fruit trees of the orchard.
To Dr G.N. Dhanapal, congratulations on becoming a fellow of Indian Society of Weed at their Golden Jubilee International Conference held on 21st November, 2018.

REQUEST FOR SEEDS OF OROBANCHE CRENATA

Professor Gianniantonio Domina, University of Palermo, Italy, is launching a project to establish seed banks of Orobanche and Phelipanche samples from across Europe and the Mediterranean. He will appreciate offers of seed at gianniantonio.domina@unipa.it.

PRESS REPORTS

Sphinx molecule to rescue African farmers from witchweed: discovery of a hypersensitive suicide germination stimulant. (abridged)

An interdisciplinary team led by researchers at Nagoya University has discovered a highly potent and selective molecule, SPL7, that can lead seeds of the noxious parasitic weed Striga to suicide germination. Striga, also known as witchweed, has seriously affected millions of hectares of crop fields in Africa and poses a major threat to food security.

The molecular structure of a strigolactone (SL) is composed of an ABC-ring linked with a D-ring. Upon entering into the pocket of the SL receptor protein, SL is decomposed at the linker site. It has been thought that the structure of the D-ring is important, as it stays in the pocket to activate the receptor and lead Striga seeds to germinate. On the other hand, modifying the ABC-portion has been leading to the development of variable SL-like molecules. Nonetheless, the exact structure providing Striga-selectivity was still unknown. The plant biology team at the Institute of Transformative Bio-Molecules led by Yuichiro Tsuchiya initiated the search for a Striga-selective molecule from 12,000 synthetic molecules with random structures, and was able to identify a series of hit compounds (represented by a
A molecule called SAM690 that binds to an SL receptor in *Striga*, but not to that in the model plant Arabidopsis, and stimulates *Striga* seed germination with moderate activity (micromolar-range; 10-6 M).

The research went on with a serendipitous discovery of a highly active byproduct generated during the synthesis of hit molecules. The chemistry team led by Daisuke Uraguchi and Takashi Ooi isolated minuscule amount (0.01%) of the by-product from a crude mixture of a SAM compound and identified its structure as a hybrid of SAM690 and the D-ring component of SLs. The optimized molecule, which is called sphynolactone-7 (SPL7), stimulated *Striga* germination at femtomolar (10-15 M) range, yet only bound to the SL receptor in *Striga*. The potency is on a par with the natural strigolactone, 5-deoxystriogl (5DS), which is the strongest germination stimulant to *Striga* among all commercially available compounds. Named after sphinx (a mystical creature with the head of a lion and the body of a human), SPL7 appeared as a hybrid molecule which inherits *Striga*-selectivity from SAM690 and high potency from SLs.

As expected from the selective binding to the SL receptor in *Striga*, SPL7 did not show typical SL activity in *Arabidopsis*, such as reduction of the number of shoot branches or elongation of root hairs. Not only to *Arabidopsis*, but SPL7 also appeared to have a limited effect on the growth of AM-fungi, which is an agronomically important microbe. Finally, the research team confirmed that SPL7 did induce suicidal germination of *Striga* and protected maize plant from *Striga* parasitism in laboratory experiments. In conclusion, the team has proven that SPL7 is an effective *Striga*-selective suicide germination stimulant at least in laboratory experiments.

The report systematically analyzes the most significant details of the Global *Cuscuta* Seed Extract Market with the help of a thorough and specialized analysis. Characterized in a ground-up manner, the report presents an extensive synopsis of the market in view of the factors that are foreseen to have a considerable and measurable impact on the market’s developmental states over the conjecture time frame.

The prominent players in the global *Cuscuta* Seed Extract market are Active Herb Technology, Barlowe’s Herbal Elixirs, Bristol Botanicals, Stakich, Nutra Green Biotechnology. *Cuscuta* seed extract powder, liquid *Cuscuta* seed extract are used in medicines, food additives, dietary supplements.

Get a sample copy of this report at: https://www.marketinsightsreports.com/report-s/0905822138/global-Cuscuta-seed-extract-market-insights-forecast-to-
Biska - One of the smallest cities in the world specializes in mistletoe brandy.

According to the legend, the city of Hum, Croatia, was built by giants. One day long ago, the massive creatures were heaving rocks along the valley of the Mirna River to build their homes. After they’d finished, a few stones remained. To tidy up, the giants placed the leftover slabs upon the ridge above them and one of the smallest cities in the world was born.

Today, the city of Hum hovers around a population of 20 people, but with its surrounding walls, entrance gate, castle, and hospital, the area doesn’t lack for much, especially liquor.

Hum is located on the Istrian Peninsula, the stomping grounds for many a culture over the years. But the Celtic Druids are said to be the ones who left behind an original recipe for the mistletoe brandy known as biska 2,000 years ago. Hum has become famous for its production of the herb-infused brandy, which enjoys a special celebration at the end of October during the annual Rakija Festival. Although Hum offers its locally made biska throughout the year, at the festival people can find a host of the homemade batches that producers from throughout the region bring to be judged and, hopefully, awarded for their top-notch flavor. Attendees can also taste a bit of Istria while hearing poetry dedicated to brandy.

(It is a blend of apple distillate and carefully selected mistletoe leaves prepared according to a traditional recipe. Traditionally Biska is made in Istria, but the original recipe comes from the Celts who lived on the Istrian peninsula and is about two thousand years old. Bisca is the local name for mistletoe (Viscum album), whose healing force was already known in ancient times. It was highly esteemed by the Celtic druids, Greeks and Romans. Delikroat)

What does biska taste like? First, strong. Referred to as a type of rakija, biska is essentially a fruit brandy or grappa that has been infused with mistletoe and herbs. Mistletoe, actually a parasitic plant (known by some for dangerously dangling over door frames during Christmastime), gets gathered from local apple trees before being soaked in the distilled brandy. After one last distillation to remove impurities, the final, herbaceous brandy becomes, as one poet puts it, ‘the medicine whose drops warm our hearts.’

Need to Know - If you're keen on visiting Hum's Rakija Festival, stop by on the last Sunday in October.

Atlas Obscura.

Improved cowpea in the offing for Ghanaian smallholders

Accra. Ghanaian smallholders could by the end of this year get access to new, disease-resistant cowpea varieties that mature early and improve yields, says an expert who developed the varieties. According to researchers, cowpea is a major source of plant protein in the diet of Ghanaians but suffers up to 100 per cent yield losses from stress induced by drought, viruses and Striga gesnerioides also called cowpea witchweed. Examples of recipes in Ghana that include cowpeas are tuaani (steamed cowpea pudding) and waakye (rice and red or brown cowpeas cooked together).

‘The three newly developed cowpeas with resistant traits to all known races of Striga in West Africa were first to have been reported,’ says Aaron Asare, principal investigator of the project that developed the new varieties. ‘These novel cowpeas will sustain the cowpea industry and provide foundation for further breeding and improvement of the crop. ‘Cowpea seeds may be initially distributed free to farmers if funded and subsequently certified seeds will be produced by seed companies for farmers to buy from agro-shops and Ghana’s Ministry of Food and Agriculture.’

The new varieties require eight weeks to mature, have yield potential of almost four tonnes per hectare unlike existing yields with almost three tonnes per potential, and are highly tolerant to drought, rust and several viruses that attack cowpeas including cowpea severe mottle virus and cucumber mosaic virus. The new cowpea varieties are subject to approval by Ghana’s Ministry of Food and Agriculture based on recommendation by the National Varietal Release and Registration Committee, adds Asare, who is head of the Department of Molecular Biology and Biotechnology at Ghana’s University of Cape Coast.
During an inspection workshop which took place at the University of Cape Coast last month (18 September), Asare told SciDev.Net that the evaluation and selection of the cowpea varieties involved farmer and consumer participatory activities. The project, which began in April 2016 and is to end in April 2019, has partners including Ghana’s Council for Scientific and Industrial Research and US-based University of Virginia. The novel cowpeas were developed through classical breeding techniques involving genetic crosses of Striga-resistant parental donor with recipient parents.

Michael Timko, a professor of biology and public health at the University of Virginia, says that breeding improved cowpea varieties that are disease- and pest-resistant and can cope with climate change ensures future food security for people in Sub-Saharan Africa. ‘The lives and livelihoods of smallholders depend on their abilities to produce cowpea for food, forage and economic value, thus having improved varieties is essential,’ he explains.

Richard Akromah, an associate professor of crop science and plants breeding at Ghana’s Kwame Nkrumah University of Science and Technology, tells SciDev.Net that the varieties can benefit small-scale farmers who cannot afford irrigation and thus depend on rain-fed agriculture. ‘During the trials, whereas other varieties were failing due to erratic rainfall patterns, the new varieties were performing better, which would benefit Sub-Saharan Africa due to similar ecological conditions,’ explains Akromah, who is a member of Ghana’s National Varietal Release and Registration Committee.

Samuel Hinneh, SciDev.Net
4 August, 2018

Chinese Herbs Healing - Art of Herbal Remedies Revealed - Loranthus (Mulberry Mistletoe, Sang Ji Sheng)

Loranthus, also known as mulberry mistletoe or Sang Ji Sheng in mandarin, has long been characterized by increasing lifespan and preserving health in many medical classics. It was first mentioned as a medicine by Shen Nong Ben Cao Jing (the Divine Farmer’s Materia Medica). Medicinally people often confuse it with mistletoe (Viscum album). But it is generally accepted by doing so since they are quite similar in healing properties. In summary, Loranthus health benefits include lowering blood pressure, treating an abnormal heart rhythm, increasing coronary blood flow, improving coronary circulation, enhancing cardiac contractility, reducing myocardial oxygen consumption, inhibiting platelet aggregation, preventing thrombosis, promoting microcirculation, suppressing tumor growth, curing hepatitis, and so on.

As a matter of fact, Loranthus refers to a genus rather than a certain species. The typical Loranthus characteristic is that all of its plants are parasitic. That being said, Loranthus parasiticus (=Scurrula parasiticus) lives on other woody trees, apparently fed by directly robbing water and nutrients from the host. When it comes to such a mode of existence, Loranthus is not alone and actually it is just only one member in a bigger group – the showy mistletoe family (Loranthaceae), which consists of 73 genera and more than 900 species. Hence, Loranthaceae is also known as the largest family of mistletoes.

Medicinally it mainly refers to the dried aerial parts of Taxillus chinensis (DC.) Danser (Loranthus chinensis Dc.). But the fact is China’s ancient herbalists used to obtain it from several different genera in the family Loranthaceae, including Taxillus, Scurrula, and Viscum. To date Viscum coloratum (Komar.) Nakai is still mixed up with Taxillus chinensis even though it has been recorded separately in the ‘Chinese Pharmacopoeia.’ Besides, Taxillus sutchuenensis (Loranthus sutchuenensis Lecomte), Scurrula parasitica L., (Loranthus scurrula L.), Taxillus nigrans (Hance) Danser, and others are also used medicinally as Loranthus mulberry mistletoe. Therefore, other names of this herb include Mulberry Mistletoe Stem, Herba Taxilli, Loranthus stem, parasitizing Morus, Sangjisheng, Loranthus parasiticus, Loranthus rambus, and more. In China, it is mainly produced in Guangdong, Guangxi, and Yunnan. It is usually collected in winter and next spring. After the harvest, it needs to remove big stems, cut into sections, and then dry. Medicinally it is generally used raw and in thick slices.

Numerous clinical studies have shown that mistletoe has a certain effect on the treatment of angina pectoris, hyperlipidemia, acute and sequelae of poliomyelitis, arrhythmia, etc. In addition, the pharmacological studies have also shown that mistletoe preparations are anticancer while mistletoe extract has immunogenic
properties, which can be used as the adjuvant treatment of precancerous symptoms, prevention of the relapse after surgery, and advanced cancer.

(The report continues with a detailed description of *Taxillus chinensis*. Also further detail of uses and side effects, and specific Chinese preparations. For the full report see http://www.chineseherbshealing.com/loranthus-mistletoe/)

**New mistletoe species named after Pinay environmentalist**

A newly discovered mistletoe species has been named after a Filipina environmentalist, according to an article published in the scientific journal Phytotaxa.

The new species named *Amyema lisae*, was named after Lisa Paguntalan, Philippine Biodiversity Conservation Foundation Inc. (PBCFI) Executive Director, ‘a champion of biodiversity conservation in the Philippines.’

A graduate of Silliman University in Dumaguete City, Paguntalan has ventured into conservation right after taking BS Biology in 1996 and proceed to take a Master’s degree which she finished in 2002. In 2000, she received the BP Conservation Award in London for her work. The award, Paguntalan says, started her career in wildlife research and conservation science. She is known in Cebu for her work in the conservation of endemic bird species, the black shama or Siloy, Cebu flowerpecker, and the Cebu hawk owl, among others.

**BAP, GMA News**

September 25, 2018 11:51pm

**Rare native mistletoe blooming on Hutt tracks**

The rare native mistletoe (*Peraxilla tetrapetala*), known as beech mistletoe, has been spotted lately on a number of tracks in Kaitoke Regional Park and Pakuratahi Forest.

‘We are seeing more and more beech mistletoe blooms each year, which we believe is largely due to our possum control work in the area,’ says Barrett Pistoll, Senior Monitoring Environmental Officer at Greater Wellington Regional Council.

‘The best way to spot them is to look for a carpet of red petals on the ground. If you do, be sure to look up – they often grow quite high up.’

The Beech mistletoes are now becoming quite rare in New Zealand’s forests, especially in the North Island. This is mainly due to forest clearance, invasive predators, and the decline in native bird species that act as pollinators and seed-dispersers. ‘Possums love to browse the fleshy
leaves of these species. The presence of mistletoes still in our regional parks is a testament to our ongoing pest control efforts and forest management practices.’

Mistletoe is a famously romantic plant. According to Norse mythology, when the god Odin’s son Baldur was prophesied to die, his mother Frigg, the goddess of love, went to all the animals and plants of the natural world and asked them to promise not to harm him. But Frigg neglected to consult with the unassuming mistletoe, so the god Loki made an arrow from the plant, which was used to kill Baldur. According to happier versions of the myth, the gods were able to resurrect Baldur from the dead. Frigg declared mistletoe a symbol of love and promised a kiss to all who passed beneath it. This is the perfect time of year for a romantic stroll in the bush,’ says Mr Pistoll. ‘We encourage people to visit the area and enjoy these rare and beautiful flowers.’ Beech mistletoe has been monitored by members of Upper Hutt Forest and Bird for more than 10 years. Some key facts about beech mistletoes:

- The beech mistletoes in New Zealand are quite unique worldwide as they have a strong mutual relationship with their avian pollinators.
- Unlike some mistletoe species found in other countries, New Zealand mistletoes usually do not harm their hosts.
- Beech mistletoes are some of the few plants in the world with ‘explosive’ flowers. To be pollinated, these flowers must be twisted open by native birds such as tui and bellbirds. When twisted, the flower petals of the ripe buds spring open and spray the bird with pollen. This pollen can then be transferred to the next flower the bird visits, which allows that mistletoe plant to produce seeds. Amazingly, a tiny native bee only one-quarter the size of a red mistletoe bud can also pollinate this plant by twisting open flowers. No other plant in the world is known to have this unusual pollination system!
- Beech mistletoes provide native birds with a very important source of fruit and nectar, which are otherwise scarce in beech forests. Two of the beechn mistletoes have bright red flowers that appear around Christmas time and are often mistaken for rata.
- Beech mistletoes and native birds have developed a mutualism, which is a specialised relationship that benefits both species. Birds rely on the mistletoes for fruit and nectar, and mistletoes depend on birds for pollination and seed dispersal. This mutualism may be evolutionarily dangerous, because if either species declines then the other is in trouble.

Greater Wellington Regional Council
14 November 2018

THESIS

The role of strigolactones in resistance, tolerance and control of Striga infection in sorghum. Nasreldin Mohamed Ahmed. PhD Thesis, Wageningen University, The Netherlands. (Supervisors, Prof. Harro Bouwmeester, Amsterdam University and Prof. Abdel Gabar Babiker, National Research Centre, Kahhartoum, Sudan.)

Summary. Huge yield losses in important staple cereal crops including sorghum (Sorghum bicolor [L.] Moench) (Parker, 2009) are caused by infections by the root parasitic plant Striga hermonthica [Del.] Benth. (Striga) particularly in sub-Saharan Africa. Integrating host genetic resistance and tolerance with agricultural practices that reduce the Striga seed bank in the soil are deemed to be the best control strategy. Striga seeds can remain dormant in the soil for up to 20 years. They will germinate when they perceive specific germination inducing compounds that are secreted from the roots of its host and sometimes non-host into the rhizosphere. It was shown that strigolactones (SLs), are the most potent germination stimulants of Striga seed. Exudation of less active SLs in sorghum was shown to be associated with field resistance to Striga while in pearl millet the production of different SLs seems to make it resistant to the Striga that infects sorghum. In contrast, exudation of high amounts of active SLs by non-host intercrops is expected to results in higher suicidal germination and thus help in Striga control. In this study I used 36 sorghum genotypes, 2 pearl millets cultivars and 4 intercrop cultivars to investigate the role of variation in SL amount and profile in resistance and Striga control through intercropping and to
answer the question if they also play a role in tolerance. **In chapter 2** and **chapter 3** I focus on studying the role of strigolactones in resistance and tolerance to *Striga*. Hereto, I used statistical analysis on the combined results of strigolactones profiling, *in-vitro* germination bioassays, gene expression and molecular marker analysis, crop morphological and physiological traits, and photosynthesis measurements. This showed that the exudation of high amounts of orobanchol in combination with low amounts of 5-deoxystrigol and sorgomol by some sorghum genotypes is associated with low root exudate germination stimulatory activity and low *Striga* infection. Moreover, such genotypes had a higher tolerance to *Striga* and maintained higher photosynthetic capacity under *Striga* infection. All this suggests that selection/breeding for high orobanchol/low 5-deoxystrigol and sorgomol profiles will not only improve pre-attachment resistance but also improve tolerance to the *Striga* that can still attach.

**In chapter 4** I investigated the role of strigolactones in inter- and rotation crops. I showed that exudation of high amounts of orobanchyl acetate in the root exudate of pearl millet is associated with low germination stimulatory activity and low infection of a *Striga* sorghum ecotype, making pearl millet a suitable rotation crop. Vice versa exudation of high amounts of 5-deoxystrigol by sesame and groundnuts correlated with high (suicidal) germination stimulatory activity and low *Striga* infection when sorghum was intercropped with these intercrops. This knowledge enables a more targeted selection/breeding of resistant rotation crop cultivars or intercrop cultivars that induce more *Striga* suicidal germination. Knowledge on the sensitivity of the target *Striga* ecotype for certain strigolactones is important before a specific intercrop can be advised in the process of combating *Striga* in sorghum and other cereals.

**In chapter 5** a field experiment using 5 sorghum genotypes with different strigolactone profiles shows that the results from lab and greenhouse experiments can be translated to the field. For example, sorghum genotypes Fakimustahi and Wadfahel with high production of 5-deoxystrigol and sorgomol and relatively low orobanchol production exhibited high susceptibility to *Striga* in the field whereas Mogud and Wadbaco with much lower 5-deoxystrigol and sorgomol production and higher orobanchol exhibited field resistance.

**In chapter 6** I discuss the main highlights of the present thesis. I showed that there is a relationship between resistance/tolerance and the amount and identity of SL production. I hope that the knowledge generated in my thesis about the role of strigolactones in resistance and tolerance can help breeders with the selection of genotypes better equipped to withstand *Striga*. In addition I hope that the data generated by me can be used for the identification of the underlying genetic regions which would potentially allow the transfer of resistance and tolerance to elite but susceptible sorghum genotypes. The use of these traits in combination with post-attachment resistance mechanisms should result in a better and durable control of this parasite.

**CORRIGENDUM**


The structure of medicaol (Fig. 1, 22) should have a methyl on the D-ring and that of zealactone (Fig. 2, 24) should have a conjugated double bond as shown below. The error re zealactone also occurs in the paper by Uraguchi *et al.* 2018 – see both papers listed below.

**FORTHCOMING MEETINGS**


15th World Congress on Parasitic Plants.
Amsterdam, the Netherlands, 30th June – 5th July.


GENERAL WEB SITES
For individual web-site papers and reports see * these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: http://www.parasiticplants.org/
For the first circular, 15th World Congress on Parasitic Plants, Amsterdam. 2019, see: https://www.wcpp2019.org
For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/
*For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/
For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see: http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research
For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/
For a compilation of literature on *Viscum album* prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).
For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au/sandalwood
For 6th Mistletoe Symposium, Germany, November 2015 see: http://www.sciencedirect.com/science/journal/09447113/22/supp/S1

LITERATURE
*indicates web-site reference only
Items in bold selected for special interest
Items in blue relate to therapeutic uses of parasitic plants

Agyeno, O. E., Aigbokhan, E. I., Jayeola, A. A., Elisha, E. B., Dawurung, C. J., Gosomji, Y. J., and Oso, O. A. 2018. Incidence of *Hydnora* Thunb. in Nigeria: First report. Nigerian Field 83 (x) xx-xxx. [Records the first collection of *Hydnora abyssinica* in West Africa, a considerable range extension for this species. It is used in traditional medicine for digestive ailments as reported in eastern and southern Africa. The authors document numerous hosts, all legumes including the first report for parasitism of *Piliopstigma thonningii.*]

used traditionally in Nigeria to treat bowel ulcers, were shown to be quite safe in mice but have some toxic effect in rats.]


Akinnagbe, O.M., Adeniran, T. P. and Adeniran, A.A. 2018. Intra-household roles in cocoa production in Ondo State, Nigeria. Journal of Agricultural Extension 22(3): 77-86. [Recording that removal of (unspecified) mistletoe is predominantly done by men, but not quantifying how much time is required.]


Amin, M., Nabiabadi, H.S. Deljou, A. 2018. The role of cuscutain-propeptide inhibitor in haustoria parasitism and enhanced resistance to dodder in transgenic alfalfa expressing this propeptide. Plant Biotechnology Reports 12(3): 165-173. [Cuscutain is a cysteine protease produced by dodder essential for the development and penetration of the haustoria in host. Penetrating digitate cells of haustoria could not differentiate into the xylem and phloem hyphae when cuscutain was inhibited.]


Arti Rani, Meghana, R. and Anil Kush. 2018. Squalene production in the cell suspension cultures of Indian sandalwood (Santalum album L.) in shake flasks and air lift bioreactor. Plant Cell, Tissue and Organ Culture 135(1): 155-167. [Describing the generation of squalene, of value in a range of therapeutic uses including cancer, in cell suspensions of S. album as an alternative to the current source - shark liver oil.]

Ashwani Tapwal, Swedha Verma and Gunjan Thakur. 2017. In vitro evaluation of Trichoderma species and botanicals for the management of Lasiodiplodia theobromae. Indian Forester, Dehradun, India. Indian Forester 143(12): 1312-1317. [An extract of Santalum album was among the most effective treatments for the control of L. theobromae, the causal agent of bark cancer in a wide range of crops species.]

Aybeke, M. 2018. Transcriptomic effects of Aspergillus alliaceus on Orobanche during its pathogenesis. Journal of Plant Diseases and Protection 125(1): 33-39. [The pathogenicity of Aspergillus alliaceus (Aa), a fungal biocontrol agent, was tested for its effect on Orobanche transcriptomics. It was concluded that during Aa pathogenesis, (1) the increased SOD value was associated with ROS (reactive oxygen species) threats; (2) the fungus disturbed protein synthesis metabolism; (3) the inhibited antioxidant and apoptosis-based pathways compared to the control group.]


transformation factors provided a method for recovering transgenic roots from both parasitic plants and their hosts at high frequency.


Basso, A.A. and Mudi, S.Y. 2017. Evaluation of antulcer and psychochemical activities of leaf extracts from Tapinanthus dodoneifolius DC. (Loranthaceae) grown on Tamarindus indica tree. Bayero Journal of Pure and Applied Sciences 10(1): 392-396. [Results confirm that an aqueous extract from T. dodoneifolius growing on tamarind, reduced aspirin-induced ulceration in wistar rats for one week and showed no serious side effects.]


Boğa, M., Yaman, S., Doğan, S.C. and Burğut, A. 2018. (Determination of feed value of mistletoe collected in Niğde region by in vitro gas production technique.) (in Turkish) Turkish Journal of Agriculture - Food Science and Technology 6(8): 1051-1057. [Unspecified mistletoe (Viscum album or Loranthus europaeus) proved to be moderate in protein and in fibre and high in crude fat content compared with forages, and very good in metabolizable energy and net energy lactation values. Assuming its safety is confirmed in feeding trials, it has good potential as a feed ingredient in the diets of ruminants.]


*Bragard, C. and 20 others. 2018. Pest categorisation of Arceuthobium spp. (non-EU). EFSA Journal 16(7): e05384. (https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2018.5384) [Reviewing the dangers from introduction of exotic Arceuthobium species into Europe and concluding that ‘as a group of organisms, the criteria assessed by the Panel for consideration as a potential quarantine pest are met, while, for regulated non-quarantine pests, the criterion on the pest presence in the EU is not met.’ (clear?).]

Bromhead, L.J., Norman, A.R., Snowden, K.C., Janssen, B. and McErlean, C. 2018. Enantioselective total synthesis and biological evaluation of (−)-solanacol. Organic & Biomolecular Chemistry 16(30): 5500-5507. [Describing the third, shortest and efficient synthesis of optically pure natural solanacol in only 6-steps. Solanacol was confirmed to be far more active than GR24 in germination stimulation of O. minor seeds. Although solanacol was reported to be inactive in bud outgrowth inhibition of pea, differential scanning fluorimetry (DSF) demonstrated that it could interact with the strigolactone receptor DAD2.]

Brun, G., Braem, L., Thoiron, S., Gevaert, K., Goormachtig, S. and Delavault, P. 2018. Seed germination in parasitic plants: what insights can we expect from strigolactone research? Journal of Experimental Botany 69(9): 2265-2280. [Discussing strigolactone biosynthesis, perception, and signal pathways and the many questions remaining to be answered regarding the
germination process of parasitic plants, including how parasitic plants evolved to germinate in response to a wide variety of molecules, while autotrophic plants do not and what particular features are associated with their lack of spontaneous germination. Reviewing to what extent conclusions from research into strigolactones could be applied to better understand the biology of parasitic plants.


Celedon, J.M. and Bohlmann, J. 2018. An extended model of heartwood secondary metabolism informed by functional genomics. Tree Physiology 38(3): 311-319. [Studying the development and decay of heartwood in *Santalum album* and discussing a variation of existing models of hertwood formation, based on the recent discovery of specific transcriptome signatures of terpenoid biosynthesis.]

Chen, J., Wei, J., Gao, J.M., Ye, X.X., Meerlean, C.S.P. and Ma, Y.Q. 2017. Allelopathic inhibitory effects of *Penicillium griseofulvum* produced patulin on the seed germination of *Orobanche cumana* Wallr. and *Phelipanche aegyptiaca* Pers. Allelopathy Journal 41(1): 65-80. [Results confirmed complete inhibition of germination of *O. cumana* and *P. aegyptiaca* by dried *P. griseofulvum* and showed this was due to the active component, patulin, at 1 mg/l.]

Chen XianBing, Yang QingYu, Qin XiaoLi, Zhao FangYu, Tang XianE, Wang ZiLi, Chen ZongHai and Xiang JiaPeng. 2018. (Effect of *Balanophora polysaccharide* on expression of PPARγ, irisin and glucolipid metabolism in experimental diabetic rats.) (in Chinese) Chinese Journal of Pharmacology and Toxicology 32(5): 400-406. [Confirming that *Balanophora* polysaccharide can significantly reduce the blood glucose level in diabetic rats induced by STZ, enhance the antioxidant capacity, improve the abnormal blood lipid metabolism, can improve the irisin level and enhance the PPAR expression in the liver.]


Cheng Dan, Zheng JunChao, Ma SuYa, Murtaza, G., Wahab, A., Yu ChangYing, Liu JingWei and Lu Yi. 2107. Chemical constituents, and pharmacological and toxicological effects of *Cynomorium songaricum*; an overview. Tropical Journal of Pharmaceutical Research 16(11): 2689-2696. [Extracts of *C. songaricum* have promising pharmacological activities, due to the presence of various flavonoids, triterpenes and polysaccharides as well as promising effects against inflammation, aging, fatigue, viruses and cancer. No serious side effects have been seen but more testing is needed.]

Cheung WingLan and 9 others. 2018. *Gelsemium* poisoning mediated by the non-toxic plant *Cassyytha filiformis* parasitizing *Gelsemium elegans*. Toxicon 154: 42-49. [Confirming that *C. filiformis* can absorb the toxic alkaloids from *G. elegans* and cause acute poisoning in patients taking *C. filiformis* as a traditional medicine.]

Chiocchio, I., Mandrone, M., Sanna, C., Maxia, A., Tacchini, M. and Poli, F. 2018. Screening of a hundred plant extracts as tyrosinase and elastase inhibitors, two enzymatic targets of cosmetic
interest. Industrial Crops and Products 122: 498-505. [Cytinus hypocistis was among the most potent inhibitor of elastase while being low in inhibition of tyrosinase.]


De Moraes, P.L.R. 2018. (Flora of the canga of the Serra dos Carajás, Pará, Brazil: Lauraceae.) (in Portuguese) Rodriguesia 69(1): 81-117. [Cassutha filiformis among species recorded on iron-ore outcrops.]

De Souza, M.C., Scalon, M.C., Poschenrieder, C., Tolrà, R., Venâncio, T., Teixeira, S.P. and da Costa, F.B. 2018. Alumnium detoxification in facultative (Passovia ovata (Pohl ex DC.) Kuijt) and Struthanthus polyanthus Mart. - Loranthaceae) and dependent (Psittacanthus robustus (Mart.) Marloth - Loranthaceae) Al-accumulating mistletoe species from the Brazilian savanna. Phytochemistry 153: 58-63. [Describing how P. robustus parasitizes only Al-accumulating species (such as Miconia albicans) and protects itself from Al poisoning by chelation with oxalate, while P. ovata and S. polyanthus had higher citrate and phenolic concentrations.]

Dieni, Z., Tignere, J-B. de la Salle, Tongoona, P., Dzidzienyo, D., Asante, I.K. and Ofori, K. 2018. Identification of sources of resistance to Alectra vogelii in cowpea [Vigna unguiculata (L.) Walp.] germplasm from Burkina Faso. Euphytica 214: 234. [A. vogelii is serious problem on cowpea in Burkina Faso. Seven varieties shown to be resistant (immune?) three of which - Komcalle, IT99K-573-2-1 and IT98K-205-8 are improved varieties which can be recommended to farmers.]

*Disciglio, G. and 9 others. 2018. Effect of olive-mill wastewater application, organo-mineral fertilization, and transplanting date on the control of Phelipanche ramosa in open-field processing tomato crops. Agronomy 8(6): 92. (https://www.mdpi.com/2073-4395/8/6/92) [P. ramosa emergence was reduced and tomato yields significantly increased by delaying transplanting from April to May in southern Italy. Also by application of olive-mill waste water at 80m³/ha
40 days before planting, and by several organic fertilizer preparations.

Domina, G. 2018. Host-driven morphological variability in Orobanche crenata (Orobanchaceae) Turkish Journal of Botany 42(4): 502-509. [Recording that O. crenata was larger in various parameters on more vigorous hosts such as faba bean. The shape of the calyx and colour of corolla and stigma also showed significant variations according to the host – faba bean, pea, chickpea and vetch.]


Eizenberg, H. and Goldwasser, Y. 2018. Control of Egyptian broomrape in processing tomato: a summary of 20 years of research and successful implementation. Plant Disease 102(8): 1477-1488. [Describing the development of the PICKIT decision support system for application of sulfosulfuron and imazapic to control P. aegyptiaca in tomato and its successful use in Israel to increase tomato yields by 40 t/ha.]

Emiru Birhane, Kidu Gebremeskel, Tewodros Tadesse, Mengsteab Hailemariam, Kiroos Meles Hadgu, Norgrove, L. and Negussie, A. 2018. Integrating Faidherbia albida trees into a sorghum field reduces striga infestation and improves mycorrhiza spore density and colonization. Agroforestry Systems 92(3): 643-653. [Planting of the agroforestry tree F. albida in sorghum resulted in improved sorghum yield under the canopy, associated with increased fertility and increased AM fungi.]


Franke, A.C., van den Brand, G.J., Vanlauwe, B. and Giller, K.E. 2018. Sustainable intensification through rotations with grain legumes in Sub-Saharan Africa: A review. Agriculture, Ecosystems & Environment 261(1): 172-185. [As part of the N2Africa programme, funded by Gates Foundation, reviewing the influence of legumes on a range of factors, concluding that the only effect on weeds is on Striga spp., via suicidal germination or as a result of increased soil fertility.]

Freire, S.M.de F and 11 others. 2018. Protective effect of Struthanthus marginatus on ethanol-induced gastric damage in mice. Pharmacognosy Research10(2): 143-150. [The results show that S. marginatus is rich in flavonoids and that these compounds contribute directly to the gastroprotective and ulcer healing effects of this herb.]

Fu ZhiFei, Fan Xiang, Wang XiaoYing and Gao XiuMei. 2018. Cistanches Herba: an overview of its chemistry, pharmacology, and pharmacokinetics property. Journal of Ethnopharmacology 219: 233-247. [A wide-ranging review on the components, and activity of ‘Cistanche Herba’ (presumably based on Cistanches deserticola and/or C. tubulosa), concluding that the phenylethanoid glycosides, echinacoside and acteoside, have demonstrated wide pharmacological actions and have great clinical value if challenges such as poor bioavailability, fast and extensive metabolism are addressed. Other constituents, their pharmacological activities and underlying mechanisms, also deserve further study.]

Garba, Y., Abubakar, H.N. and Aliyu, I. 2017. Influence of inorganic fertilizer and spacing on growth and yield of two maize cultivars under Striga hermonthica infestation. Agro-Science 16(2): 38-45. [Nitrogen at 60, 120 and 180 kg/ha caused increasing reduction in S. hermonthica with resultant significant increases in yield. Spacing caused no significant differences.]

Gebauer, R., Volařík, D. and Urban, J. 2018. Seasonal variations of sulphur, phosphorus and magnesium in the leaves and current-year twigs of hemiparasitic mistletoe Loranthus europaeus Jacq. and its host Quercus pubescens Willd. Journal of Forest Science 64(2):66-73. [Levels of S, P and Mg in host and parasite varied greatly through the year but were generally higher in the L. europaeus than in the host].

Gonzalvez, J. and 10 others. 2017. The enriched proanthocyanidin extract of Ligraria cuneifolia shows a marked hypcholesterolemic effect in rats fed with cholesterol-enriched diet. Recent Patents on Endocrine, Metabolic & Immune Drug Discovery 11(1): 47-53. [Results with L. cuneifolia in Argentina.]


Halbritter, D.A., Willett, D.S., Gordon, J.M., Stelinski, L.L. and Daniels, J.C. 2018. Behavioral evidence for host transitions in plant, plant parasite, and insect interactions. Environmental Entomology 47(3): 646-653. [Neophasia butterflies were more frequent on ponderosa pines infected by Archeuthobium americanum probably due to the volatiles released by the mistletoe. Commenting that mistletoe is considered the butterflies' ancestral host, and the evolutionary transition to pine may have occurred recently in Arizona.]

*Hameed, U.S., Haider, I., Jamil, M., Kountche, B.A., Guo, X., Zaranb, R.A., Kim, D., Al-Babili, S. and Arolid, S.T. 2018. Structural basis for specific inhibition of the highly sensitive ShHTL7 receptor. EMBO Reports - advance online publication, 18 July 2018. (http://embor.embopress.org/content/early/2018/07/08/emb.0201745619) [[For germination, Striga seeds require host-released strigolactones that are perceived by the family of HYPOSENSITIVE to LIGHT (ShHTL) receptors. Broad specificity and high sensitivity of ShHTL7 was suggested. Strigolactones trigger structural changes in ShHTL7 and several lead compounds were suggested for the rational design of efficient Striga-specific herbicides targeting ShHTL And see project report above.]]


*Hasegawa, S. and 16 others. 2018. Low Infection of Phelipanche aegyptiaca in Micro-Tom Mutants Deficient in CAROTENOID CLEAVAGE DIOXYGENASE 8. International Journal of Molecular Sciences 19(9): 2645. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6163878/) [Showing that strigolactones were very low in exudates from ccd8-defective mutants of Micro-Tom tomato and caused very little germination of P. aegyptiaca.]

evidence supporting the hypothesis that the molecular developmental machinery used for lateral root formation in non-parasitic plants has been co-opted into the developmental reprogramming of haustorial formation in parasitic plants.


Jacobs, S.J., Kristofferson, C., Uribe-Convers, S., Latvis, M. and Tank, D.C. 2018. Incongruence in molecular species delimitation schemes: what to do when adding more data is difficult. Molecular Ecology 27(10): 2397-2413. [Incongruence between different molecular data sets is often dealt with whereas incongruence within a line of evidence must also be accounted for. Two molecular species delimitation approaches (Spedestem and BPP) were applied to the *Castilleja ambigua* (Orobanchaceae) species complex; the latter proved superior.]


Jamil, M. and 16 others. 2018. Methyl phenolactonates are efficient strigolactone analogs with simple structure. *Journal of Experimental Botany* 69(9): 2319-2331. [Describing the synthesis of methyl phenolactonates based on the structure of the non-canonical SL methyl carlactonoate, some of which stimulate germination of *Striga hermonthica* and outperform GR24 in some other types of activity. Small variations in structure cause changes in the spectrum of activity. MPI1 compared favourably with GR24 in a test for suicidal germination of *S. hermonthica* in soil.]

Kabiri, S., Rodenburg, J., van Ast, A. and Bastiaans, L. 2017. Slavery in plants: how the facultative hemi-parasitic plant *Rhamphicarpa fistulosa* can completely dominate its host. Annals of Applied Biology 171(3): 353-363. [Pot experiments demonstrated that *R. fistulosa* initially causes increased root:shoot ratio decreased host plant height, leaf area and tiller number. This may be followed by interference with light interception, leading to almost complete cessation of host growth, 22-71% reduction in biomass and up to 100% reduction in seed yield.]


Kanampiu, F., Makumbi, D., Mageto, E., Omany, G. Waruingi, S., Musyoka, P. and Ransom, J. 2018. Assessment of management options on *Striga* infestation and maize grain yield in Kenya. Weed Science 66(4): 516-524. [Three varieties of maize were grown as sole crop, inter-cropped with *Desmodium uncinatum* or groundnut or rotated with soya bean. Highest yields and least *Striga hermonthica* were recorded with *Striga*-resistant and herbicide-resistant varieties (with herbicide) intercropped with *Desmodium.*]


Kabiri, S., Rodenburg, J., van Ast, A. and Bastiaans, L. 2017. Slavery in plants: how the facultative hemi-parasitic plant *Rhamphicarpa fistulosa* can completely dominate its host. Annals of Applied Biology 171(3): 353-363. [Pot experiments demonstrated that *R. fistulosa* initially causes increased root:shoot ratio decreased host plant height, leaf area and tiller number. This may be followed by interference with light interception, leading to almost complete cessation of host growth, 22-71% reduction in biomass and up to 100% reduction in seed yield.]

Kaitera, J., Kalleinen, L., Mikkilä, J. and Hantula, J. 2017. *Cronartium flaccidum* sporulates on new *Euphrasia* species in natural habitats in Finland. Forest Pathology 47(5): e12349. [Natural sporulation of the pine rust, *C. flaccidum*, was confirmed on 6 species of *Melampyrum, Euphrasia* and *Pedicularis* but not on *Rhinanthus minor*.]


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HAUSTORIUM 75


Koca-Calliskan, U., Yilmaz, I., Taslidere, A., Yalcin, F.N., Akal, C. and Sekeroglu, N. 2018. *Cuscuta arvensis* Beyer "dodder": in vivo hepatoprotective effects against acetaminophen-induced hepatotoxicity in rats. Journal of Medicinal Food 21(6): 625-631. [Results of studies on the hepatoprotective activity of extracts of *C. arvensis* (=*C. campestris*) supported its use in traditional medicine. One of the active ingredients was identified as kaempferol-3-O-rhamnioside.]

Kokla, A and Melnyk, C. 2018. Developing a thief: haustoria formation in parasitic plants. Developmental Biology 442(1) 53-59. [Discussing the developmental basis for plant parasitism, focusing on haustorial initiation, penetration and vascular formation. Also reviewing the outstanding questions in this emerging field.]

Kollas, C., Gutsch, M., Hommel, R., Lasch-Born, P. and Suckow, F. 2018. Mistletoe-induced growth reductions at the forest stand scale. Tree Physiology 38(5): 735-744. [A model based on the tree’s water and carbon cycle was tested on a natural population of *Pinus sylvestris* in Germany and found to give good predictions of the losses in timber. Heavy infection by *Viscum album* caused 29% growth reduction over a 9 year period.]

Kountché, B.A., Novero, M., Jamil, M., Asami, T., Bonfante, P. and Al-Babili, S. 2018. The strigolactone analogs methyl phenlactonoates on spore germination and root colonization of arbuscular mycorrhizal fungi. *Heliyon* 4(11): e00936. (https://www.sciencedirect.com/science/article/pii/S2405844018326616) [Confirming that, although the strigolactone analogues MP1 and MP3 inhibit AMF spore germination, they promote the intra-radical root colonization, both more efficiently than GR24. These results indicate that field application of MP1 and MP3 does not have negative impact on mycorrhizal fungi, reinforcing their potential for controlling parasitic weeds. See also Jamil et al. above.]


Lan YueHui, Chi XiaoFeng, Zhou GuoYing and Zhao XiaoHui. 2018. Antioxidants from *Pedicularis longiflora var. tubiformis* (Klotzsch) P. C. Tsoong. Records of Natural Products 12(4): 332-339. [The results indicate that a combination of online HPLC-DPPH assay with HSCCC could be suitable for the screening and separation of antioxidant compounds from extracts of the Tibetan medicinal plant, *P. longiflora*.]

Leandre, S.P., Francis, K., Richard, A., Joseph, B., Baptiste, T.J., Ouedraogo, J.T., Patrick, A., Close, T.J. and Roberbs, P.A. 2018. Screening for resistance to *Striga gesnerioides* and estimation of yield loss among cowpea (*Vigna unguiculata* L.) progenies in the Upper East Region of Ghana. African Journal of Agricultural Research 13(28): 1430-1442. [251 inbred lines from a cross between IT97K 499-35 (resistant to *S. gesnerioides*) and Sanzi (susceptible) were screened and 27 found to be resistant. Yield loss of these was 3% or less compared to 28-58% in the susceptible lines.]

Liao PoLin, Li ChangHao, Tse LingShan, Kang JawJou and Cheng YuWen. Safety assessment of the *Cistanche tubulosa* health food product Memoregain®: genotoxicity and 28-day repeated dose toxicity test. 2018. Food and Chemical Toxicology 118: 581-588. [No adverse effects were recorded.]

Libiaková, D., Ruyter-Spira, C., Bouwmeester, H.J. and Matusova, R. 2018. *Agrobacterium rhizogenes* transformed calli of the holoparasitic plant *Phelipanche ramosa* maintain parasitic...


Mandumbu, R., Mutengwa, C.S., Mabasa, S. and Mweje, E. 2019. Challenges to the exploitation of host plant resistance for Siriga management in cereals and legumes by farmers in sub-Saharan Africa: a review. Acta Agriculturae Scandinavica, Section B - Soil & Plant Science 69: 82-88. [Reviewing the various mechanisms of resistance to Striga species and the problems involved in exploiting these, including genetic variation in the parasite allowing it to evolve virulence.]

Suggesting that different resistance mechanisms may need to be present in genetically heterogeneous varieties of cereals rotated in the same field. Also emphasising the problem of low soil fertility.]
HAUSTORIUM 75


Maul K., Krug M., Nickrent D.L., Muller K.F., Quandt D. and Wicke S. 2019. Morphology, geographic distribution and host preference are poor predictors of phylogenetic relatedness in the mistletoe genus Viscum L. Molecular Phylogenetics and Evolution 131:106-115. [Nuclear ITS and chloroplast rbcL and trnLF were used to generate a molecular phylogeny of 59 species of Viscum sampled from across its distribution. The genus originated in Africa and diversified mainly through geographic isolation (not host specialization). Reduction of leaves (evolution of scales) occurred multiple times independently.]


Menke, K., Schwermer, M., Felenda, J., Beckmann, C., Stintzing, F., Schramm, A. and Zuzak, T.J. 2018. Taraxacum officinale officinale extract shows antitumor effects on pediatric cancer cells and enhance mistletoe therapy. Complementary Therapies in Medicine 40: 158-164. [Showing that T. officinale extracts can have synergistic effects on cancer cells in combination with Viscum album preparations (Iscucin Tiliae and Isucin pini).]


Mohemed, N., Charnikhova, T., Fradin, E.F., Rienstra, J., Babiker, A.G.T. and Bouwmeester, H.J. 2018. Genetic variation in Sorghum bicolor strigolactones and their role in resistance against Striga hermonthica. Journal of Experimental Botany 69(9): 2415-2430. [Analysing the strigolactones in exudates from 36 sorghum genotypes and showing that high germination and susceptibility were associated with high exudation of 5-deoxystrigol and low germination and resistance with high levels of orobanchol.]


Moolayil, O. and Sreenivas, V.K. 2018. Striga musselmanii (Orobanchaceae): a new species of Striga from Western Ghats. Phytotaxa 375 (1): 099–103. [S. musselmanii is a newly described species, parasitic on Dactylolcentum aegyptium, Digitaria ciliaris and Perotis indica, based on a small number of specimens, distinct from S. angustifolia in having yellow flowers and different seed sculpturing. Distinction from S. asiatica (s.l) not so clear other than in having 15 calyx lobes.]


[Detailed genetic studies confirm that *E. azorica* is diploid while *E. grandiflora* is tetraploid. Eradication of invasive species and control of grazing will be fundamental to promote in situ restoration.]

Mousavi, E.A., Nasibi, F., Kalantari, K.M. and Oloumi, H. 2017. Stimulation effect of carrageenan on enzymatic defense system of sweet basil against *Cuscuta campestris* infection. Journal of Plant Interactions 12(1): 286-294. [Spraying basil plants with carrageenan 3 times before exposure to *C. campestris* reduced infestation by 26% and improved basil growth and identifying a range of metabolic changes which might be responsible.]

Mrema, E., Shimeles, H., Laing, M. and Mwadzingeni, L. 2018. Genetic analysis of the maximum germination distance of *Striga* under *Fusarium oxysporum* f. sp. *strigae* biocontrol in sorghum. Journal of Integrative Agriculture 17(7): 1585-1593. [Maximum germination distance (MGD) is an important component of *Striga* resistance in sorghum. The objective of this study was to determine gene action influencing MGD of *S. hermonthica* and *S. asiatica* among selected sorghum lines treated with a biocontrol agent, *F. oxysporum* f. sp. *strigae* (FOS). Breeding methods exploiting these genetic effects may provide enhanced response to selection for *Striga* resistance and FOS compatibility in integrated *Striga* management (ISM) programmes.]


Mujezinović, O., Treštić, T., Margaletić, J., Dautbašić, M., Zahirović, K., Ivojević, S. and Bakić, H.2018. (Effect of mistletoe (*Viscum album* L.) on radial growth of fir trees (*Abies alba* Mill.) in Bosnia and Herzegovina.) (in Croatian) Naše Šume 16(50/51): 34-40. [Describing the effects of *V. album* on fir trees, in relation to the 'opacity' (density?) of the crown. But is the opacity not influenced by the mistletoe?]

Mutinda, S.M., Masanga, J., Mutuku, J.M., Runo, S. and Alakonya, A. 2018. KSTP 94, an open-pollinated maize variety has postattachment resistance to purple witchweed (*Striga hermonthica*). Weed Science 66(4): 525-529. [Showing that the resistance of KSTP94, also known as Kakamega, is not only due to low production of sorgomol but also to the inability of the parasite to penetrate the endodermis resulting in greatly reduced size and numbers of attachments.]

Nagaratna Biradar, Nagar, R.P. and Vinod Kumar. 2018. Analysis of selected fodder ventures in southern and western India. Range Management and Agroforestry 39(1): 109-114. [Among the constraints identified for growers of fodder crops was the 'slow tedious process of cleaning *Cuscuta*-infested seed'.]

Ndagurwa, H.G.T., Maponga, T.S., Dube, B., Nzuma, T.M. and Muvengwi, J. 2018. Termitaria vs. mistletoe: effects on soil properties and plant structure in a semi-arid savanna. Acta Oecologica 91: 35-42. [Comparing the different benefits to soil properties from termite mound material and the leaf droppings from unidentified mistletoe in Zimbabwe and finding that soil under mistletoe-infested trees were associated with silt, organic matter, Na, P, Mg and nitrate, and encouraged the growth of *Securinega virosa* (Euphorbiaceae).]

Ndouyang, C and Noubissie Tchiagam, J.B. 2018. Genotypic response of *Sorghum bicolor* (L) Moench landraces to sodium carbonate Application in control of *Striga hermonthica* in the Sudano-Saharan zone of Cameroon. Haya: The Saudi Journal of Life Sciences August 3(8): 541-550. [Comparing 24 genotypes of sorghum for their resistance to *S. hermonthica* and reporting LMO-LT18, LMO-LT22, KW-CP09 and LMT-21 to be the least susceptible. Also showing that sodium carbonate at 75 kg/ha reduced *S. hermonthica* by 74% and increased sorghum yield by 91%.]


Nilsson, S.G. 2018. (Mowing and grazing in late summer - effects on herbs, especially orchids.) (in Swedish) Svensk Botanisk Tidskrift 112(3/4): 171-175. [Changing the management of grasslands to late summer mowing with aftermath grazing or only late summer grazing (previously grazed from spring to autumn for several decades) greatly increased the proportion of forbs including *Rhinanthus minor*.]

antimalarial activities of α-hydroxy diynes isolated from *Ongokea gore*. Planta Medica 84(1): 806-812. [Two of three α-hydroxy diynes isolated from *O. gore* (Oleaceae) proved to have anti-malarial activity equivalent to, or greater than, the standard quinine, and were found to be non-toxic.]


Orsenigo, S. and 14 others. 2018. Global and Regional IUCN red list assessments: 5. Italian Botanist 5: 83-99. [Providing a valuable description of *A. oxycedri* and its distribution in Europe, including good illustrations. Noting that it only occurs in a small area of Tuscany and Marche in Italy and is threatened by changes in agricultural practices and is to be regarded as ‘endangered’ at the regional level.]

Ortíz-Rodríguez, A.E., Guerrero, E.Y. and Ornelas, J.F. 2018. Phylogenetic position of Neotropical *Bursera*-specialist mistelotes: the evolution of deciduousness and succulent leaves in *Psittacanthus* (Loranthaceae). Botanical Sciences 96(3): 443-461. [Three species of *Psittacanthus* occur on *Bursera: P. palmeri*, *P. sonorae* and *P. nudus*. Concatenated nuclear ITS rDNA and chloroplast trnLF sequences showed the *Bursera* species to be monophyletic with the *P. nudus* (Honduras) clade being sister to one clade of *P. palmeri* (Mexico). Because *P. nudus* may be deciduous (not leafless), a feature also seen in *P. palmeri*, the two may be conspecific.]

*Osunlana, O.R.*, Bello, M.O. and Johnson, J.A. 2018. Nutritive values and bioactive compounds content of three commonly used blood pressure regulating plant leaves. Pharmacology Online 1: 128-136. (http://pharmacologyonline.silae.it/files/archives/2018/vol1/PhOL_2018_1_A014_Osunlana.pdf) [Suggesting caution in the consumption of *‘Viscum album’* growing on *Gmelina arborea* because of its oxalate content. N.B. Yet another example of the misuse of the name *Viscum album* for a mistletoe from West Africa.]

stimulating the germination of *S. hermonthica*, also that the stimulant involved appears to be identical to that from cowpea.


Özpınar, A., Polat, B., Şahİn, A.K. and Özpınar, S. 2017. (Determination of the relationship between *Orobanchaceae* and *Phytomyza orobanchia* Kaltenbach, (Diptera: Agromyzidae) on tomato areas of Çanakkale province.) (in Turkish) Journal of Tekirdag Agricultural Faculty 14(1): 48-53. [Surveys showed that 58% of tomato crops in this province are infested with *O. ramosa* and release of *P. orobanchia* at 3, 6 and 12 adults per tomato plant at least doubled infestation rate and resulted in 28, 56 and 60% reduction in parasite seed production respectively.]


Paporisch, A., Laor, Y., Rubin, B., Achi-dari, G and Eizenberg, H. 2018. Application timing and degradation rate of sulfsulfuron in soil co-aff ect control ef f icacy of Egyptian broomrape (*Phelipanche aegyptiaca*) in tomato. Weed Science 66(6): 780-788. [Describing the acceleration of the degradation rate of sulfsulfuron with increased temperature, which may result in reduced ef f icacy.]


*Patykowsk, J., Dell, M., Wevill, T. and Gibson, M. 2018. Rarity and nutrient acquisition relationships before and after prescribed burning in an Australian box-ironbark forest. AoB Plants 2018 Vol.10 No.3 pp.ply032 (https://academic.oup.com/aobpla/article/10/3/ply032/4996542) [Imcluding discussion of the important role of hemi-parasites *Amyema miquelii* and *Exocarpos cupressiformis* (Santalaceae) in the nutrient cycling in box-ironbark forest (mainly *Eucalyptus spp.*).]


*Pelser, P.B., Olimpos, S.M.B., O’Byrne, P. and Barcelona, J.F. 2018. A new species of *Amyema* (Loranthaceae) and a new *Gastrodia* (Orchidaceae) record for the Philippines from Negros Island. Phytotaxa 371(1): 3. (https://biotaxa.org/Phytotaxa/article/view/phytotaxa.371.1.3) [*Amyema lisae* differs from similar species with verticillate phyllotaxy and inflorescences of simple umbels by having relatively smaller leaves and 5-merous flowers that are yellow and tomentose. This new species is named in honor of Lisa J. Paguntalan, a champion of biodiversity conservation in the Philippines. See Press Report above ]

Pérez-Crespo, M.J., Ornelas, J.F., González-Rodriguez, A., Ruiz-Sanchez, E., Vásquez-Aguilar, A.A. and Ramírez-Barahona, S. 2017. Phylogeography and population differentiation in the *Psittacanthus calyculatus* (Loranthaceae) mistletoe: a complex scenario of climate-volcanism interaction along the Trans-Mexican Volcanic Belt. Journal of Biogeography 44(11): 2501-2514. [Bayesian analyses strongly supported a scenario of habitat isolation (glacial/interglacial cycles) and east to west invasion of the Trans-Mexican Volcanic Belt by *P. calyculatus* during the late-Pleistocene.]

of Strigolactones, not only in roots but also in specific effects of P deficiency and decisive role signaling pathway. The data show highly organ-specific hormonal cross-talk in phosphate deficiency. Environmental and Experimental Botany 153: 198-208. [P starvation was found to suppress phosphorus (P) uptake and growth in sorghum. In: Little, C.R. (Ed.) Volume 1: Genetics, breeding and production techniques. Burleigh Dodds Science Publishing Limited, Cambridge, UK, pp. 189-226. [A general review including some reference to Striga but no abstract available.]


Renna, M., Signore, A., Paradiso, V.M. and Santamaria, P. 2018. Faba greens, globe artichoke's offshoots, crenate broomrape and summer squash greens: unconventional vegetables of Puglia (Southern Italy) with good quality traits. Frontiers in Plant Science 9(March): 378. (https://www.frontiersin.org/articles/10.3389/fpls.2018.00378/full) [Noting that the shoots of faba bean are used as a vegetable, also Orobanche crenata, parasitizing the faba bean are used like asparagus in local cuisine. The faba bean shoots can be recommended as substitute for more nitrate-rich vegetables, while O. crenata is a good source of antioxidants and ‘may be considered as a very nutritious agri-food product.’]

Rial, C., Gómez, E., Varela, R.M., Molinillo, J.M.G. and Macias, F.A. 2018. Ecological relevance of the major allelochemicals in Lycopersicon esculentum roots and exudates. Journal of Agricultural and Food Chemistry 66(18): 4638-4644. [Exudates from tomato included α-tomatine which proves allelopathic against several species but also stimulates the germination of Phelipanche ramosa.]


*Schad, F., Thronicke, A., Steele, M.L., Merkle, A., Matthes, B., Grah, C. and Matthes, H. 2018. Overall survival of stage IV non-small cell lung cancer patients treated with *Viscum album*. In addition to chemotherapy, a real-world observational multicenter analysis. PLoS ONE 13(8): e0203058. (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0203058) [A study of survival rates of 158 patients, of whom 50 were receiving a *V. album* supplement in addition to chemotherapy showed that median survival was 17 months in the *V. album* group and 8 months in those receiving chemotherapy alone. There were also significant benefits in 1- and 3-year survival rates.]

[Recording effects of endophytic bacteria Burkholderia tropica and Herbaspirillum frisingense on sorghum – including increased biomass and a decrease in root diameter.]


Shimizu, K., Hozumi, A. and Aoki, K. 2018. Organization of vascular cells in the haustorium of the parasitic flowering plant Cuscuta japonica. Plant and Cell Physiology 59(4): 720-728. [Expression profiles of the regulatory genes, combined with those of cell type-specific marker genes, suggest that reprogramming of haustorial cells to vascular cells is regulated in a way that allows the immediate formation of xylem vessels by alleviating inhibition of xylem differentiation. (Could this explain the distinct cell-shape of xylem in the haustorial core of many parasites?)

Shin HyeWoo and Lee NamSook. 2018. Understanding plastome evolution in hemiparasitic Santalales: complete chloroplast genomes of three species, Dendrotrope varians, Helixanthera parasitica, and Macrosolen cochinchinensis. PLoS ONE 13(7): e0200293. [This study added three more plastome sequences to those in existence and compared the 11 datasets phylogenetically, size of the inverted repeat, and gene content. NADH dehydrogenases were lost in all sampled Santalales (no Olacaceae s. lat. sampled). No correlation was seen between gene content and type of parasitism.]


Shultz, L.M. and Smith, F.J. 2018. Novelties in Musineon (Apiaceae) and Orthocarpus (Orobanchaceae) in the northern Wasatch Mountains of Utah and Idaho. Madroño 65(1): 60-64. [Describing the new species Orthocarpus holmgienniorum, previously known as a subspecies of O. tolmielii.]

Simamora, J.M., Hikmat, A. and Zuhud, E.A.M. 2017. (The effect of biotic and physical environmental factors on total individual of Rafflesia meijerii in Batang Gadis National Park.) (in Indonesian) Media Konservasi 22(1): 35-41. [43 specimens of R. meijerii were found parasitising Tetrastigma papillosum. The various environmental factors studied did not significantly affect its occurrence.]

via suppressing the toll-like receptors 4-nuclear factor-κB pathway. Pharmacognosy Magazine 14(56): 383-389. [The protective effect of an extract from C. chinensis against lipopolysaccharide-induced acute kidney injury was at least partially associated with suppression of a TLR4-NF-κB signaling pathway, which provides evidence of the renal protective function of C. chinensis extract.]


Subramanian, D. 2017. Rare and new flowering plants of Cuddalore district, Tamil Nadu, India. Plant Archives 17(2): 1783-1789. [Noting the occurrence of Santalum album.]

Sultan, A., Tate, J.A., de Lange, P.J., Glenny, D., Ladley, J.J., and Heenan, P., Robertson A.W. 2018. Host range, host specificity, regional host preferences and genetic variability of Korthalsella Tiegh. (Viscaceae) mistletoes in New Zealand. New Zealand Journal of Botany 56:127-162. [The widespread Korthalsella salicornioides is the most host-specific, with 96% of the records from Leptospermum scoparium (Myrtaceae). For the rare K. clavata, Coprosma propinquua (Rubiaceae) and C. dumosa are the primary and secondary hosts. For K. lindsayi (also rare), Melicope simplex (Rutaceae) is the primary host (26% of records), whereas 4 other genera are secondary hosts. Very little host overlap occurs. Sequences of ITS and trnQ-rps16 sequencing showed that within-species genetic structure is geographic rather than host-based. Some evidence of introgressive hybridization exists between K. clavata and K. lindsayi.]

Susikumar Sundharamoorthy, Narunai Govindarajan, Arunachalam Chinnapillai and Ilavarasan Raja. 2018. Macro-microscopic atlas on heartwood of Santalum album L. (sandalwood). Pharmacognosy Journal 10(4): 730-733. [The present study is believed to be helpful in identifying the correct botanical source of the plant in crude form and also standardization of formulation containing S. album as ingredient.]

*Světlíková, P., Hájek, T. and Těšitel, J. 2018. Water-stress physiology of Rhinanthus alectorolophus, a root-hemiparasitic plant. PLoS ONE 13(8): e0200927. (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0200927) [Investigating the apparent paradox that success of hemi-parasites such as R. alectorolophus depend on generally extravagant transpiration, yet they are able to tolerate drought stress. Finding that stomata do close under those circumstances and commenting that climate change and more drought conditions may threaten their survival.]

Tadayon, A., Zafarian, M., Fallah, S. and Bazoubandi, M. 2018. Effects of arbuscular mycorrhizal fungal symbiosis for control of Egyptian broomrape (Orobanche aegyptiaca Pers.) in tomato (Lycopersicon esculentum L.) cultivation. Weed Biology and Management 18(3): 118-126. [Use of the AM fungi G. intraradices and G. mosseae at 200 and 300 kg/ha (!) decreased O. aegyptiaca seed germination, the number of nodules and the dry weight of the broomrape and increased root area and dry weight of the tomato plant compared to control treatments without broomrape. Yield of tomato was doubled by 300 kg/ha G. intraradices. In Iran.]

Takahashi, I. and Asami, T. 2018. Target-based selectivity of strigolactone agonists and antagonists in plants and their potential use in agriculture. Journal of Experimental Botany 69(9): 2241-2254. [A review, discussing the varied structure and functions of strigolactones, the antagonists of stigolactone receptors that have been developed, selectivity to their targets, and the possibilities for their use in agriculture.]


Tewari, V.P. and Diwakara, B.N. 2018. Development of a stand density management diagram for

Toscano, S., Romano, D., Tribulato, A. and Tivadar, B., Ildikó, V. and Miloš, P. 2017. (The Tivadar, B. harlandii was problem in B. fungosa mainly by drosophilid flies. Both species were pollinated mainly by wasps and B. fungosa mainly by drosophilid flies. Both species were pollinated also by harvestmen (Phalangidae).]

Tivadar, B., Ildikó, V. and Miloš, P. 2017. (The possibilities of visual evaluation process of infected trees by European mistletoe (Viscum album L.).) (in Hungarian) Erdészettudományi Közlemények 7(1/2) 43-58. [Discussing different methods of evaluation of V. album intensity; concluding that certain models are suitable but only feasible on the smaller scale of parks and urban areas.]


Tigay, K.I. and Gontcharov, S.V. 2018. (Development of new sunflower breeding material resistant to downy mildew and broomrape.) (in Russian) Agrarnyy nauchnyy zhurnal 8: 46-50. [Describing a breeding programme to develop varieties of confectionary sunflower with dual resistance to mildew and Orobanche cumana.]

Tsuchiya, Y., Yoshimura, M. and Hagiwara, S. 2018. The dynamics of strigolactone perception in Striga hermonthica: a working hypothesis. Journal of Experimental Botany 69(9): 2281-2290. [How perception relates to plant parasitism is still a mystery. In this review, the authors explore emerging questions by introducing recent advances in strigolactone research in parasitic plants and attempt to construct a conceptual framework for the unique aspects of plant dynamics in strigolactone perception.]


Thorogood, C. 2018. Hydnora: The strangest plant in the world? (http://orcid.org/0000-0002-2822-0182) A wonderfully detailed description of the genus and its 8 species; their evolution and life history, reproductive history, beatifully illustrated with photos and his own superb drawings.]


Uraguchi, D. and 13 others. 2018. A femtomolar-range suicide germination stimulant for the parasitic plant Striga hermonthica. Science 362(6420): 1301-1305. [Reporting the discovery of a strong suicidal germination stimulant that can potentially be used to control Striga. The compound, a hybrid molecule originated from chemical screening, that contains two functional modules derived from a synthetic scaffold and a core component of strigolactones - sphybolactone-7, is active at fmol levels. For the first time indications are obtained about the role of the rest of the strigolactone molecule (other than the D-ring) in receptor (D14) affinity.]

Ustuner, T. and Cakir, S. 2018. Dormancy breaking studies of dodder (Cuscuta spp.) was problem in greenhouse tomato. In: Proceedings, International Conference on Research in Education and Science. The Eurasia Proceedings of Science, Technology, Engineering & Mathematics (EPSTEM), 2018 2: 167-178. [Noting that C. campestris may cause 100% loss of tomato in greenhouses in Turkey. Dormancy could only be broken by 1% sulphuric acid for 3 minutes.]


Veysi Kamar, Dağalp, R. and Taştekin, M. 2018. Determination of heavy metals in almonds and mistletoe as a parasite growing on the almond tree using ICP-OES or ICP-MS. Biological Trace Element Research 185(1): 226-235. [Finding particularly high levels of K in V. album (used as a medicinal plant in Turkey) growing on almond. Levels of B, Ba, K, Mg, and Zn were also higher in the parasite than in the host, while Al, As, Ca, Cd, Cr, Cu, Fe, Mo, Ni, Sr, Pb, and Ti were higher in the lamond.]

Vislobokov, N.A. and Galinskaya, T.V. 2018. Pollination ecology of two co-occurring species of Balanophora: differences in range of visitors and pollinators. International Journal of Plant Sciences 179(5): 341-349. [Both species studied had a wide range of pollinators but B. harlandii was pollinated mainly by wasps and B. fungosa mainly by drosophilid flies. Both species were pollinated also by harvestmen (Phalangidae).]

*Wang XuMei, Gussarova, G., Ruhsam, M., de Vere, N. and Metherell, C. 2018. DNA barcoding a taxonomically complex hemiparasitic genus reveals deep divergence between ploidy levels but
lack of species-level resolution. AoB Plants 10(3): ply026. (https://academic.oup.com/aobpla/article/10/3/ply026/4983864) Sequences from nuclear ITS and three chloroplast spacers were used to study British Euphrasia (Orobanchaceae), a group with multiple ploidy levels, frequent self-fertilization, and widespread hybridization. Euphrasia has colonized Britain multiple times from mainland Europe. The species lack consistent sequence profiles (resulting in poor phylogenetic resolution) and ploidy level acts as a barrier to gene flow.

Wee SukLing, Tan ShwuBing and Jürgens, A. 2018. Pollinator specialization in the enigmatic Rafflesia cantleyi: a true carrion flower with species-specific and sex-biased blow pollinators. Phytochemistry 153: 120-128. Only the females of S capiliflorum flies were found on flowers of R. cantleyi, only one of which, Chrysoma chani, was an effective pollinator whereas 9 species were attracted to rotten meat. Analysis of volatiles identified dimethyl disulphide and dimethyl trisulphide which were shown to be specific female-attractants for C. chain.

Westerman, P.R., Hemerik, L., van der Werf, W. and Stomph, T.J. 2018. Density-independent reproductive success of the hemiparasitic plant Striga hermonthica, despite positive and negative density-dependent phases. Annals of Applied Biology 172(1): 74-87. Two sorghum varieties were exposed to various densities of S. hermonthica (in pots?). Biomass and numbers of parasite were negatively density dependent, but seed production was density-independent. It is suggested that maximum decline and long-term control of S. hermonthica was from increased shading and vigorous crop competition.


Wolfe A.D. 2018. Hyobanche hanekomii (Orobanchaceae), a new species from the Western Cape of South Africa. Phytotaxa 340: 93-97. This new species from the northwest part of the Western Cape is somewhat intermediate in appearance between H. sanguinea and H. atropurpurea, but can be distinguished from both in several morphological characters.

Xiao-yue Wang, Rong Xu, Jun Chen, Jing-yuan Song, Steven-G Newmaster, Jian-ping Han, Zheng Zhang and Shi-lin Chen. 2018. Detection of Cistanches Herba (Rou Cong Rong) medicinal products using species-specific nucleotide signatures. Frontiers in Plant Science 13 November 2018 (https://www.frontiersin.org/articles/10.3389/fpls.2018.01643/full?utm_source=F-AAE&utm_medium=EMLF&utm_campaign=MR_K_830687_66_PlantS_20181120_arts_A) Applying their analysis to 66 commercial products of Cistanche Herba which should be based on Cistanche deserticola or C. tubulosa and showing that over 50% were adulterated with C. sinensis, Boschniakia rossica or Cynomorium songaricum.

Xie YuLu, Li XiCan, Xu JieYing, Jiang Qian, Xie Hong, He JianFeng and Chen DongFeng. 2017. Two phenolic antioxidants in Suoyang enhance viability of .OH-damaged mesenchymal stem cells: comparison and mechanistic chemistry. Chemistry Central Journal 11: No.84 pp. Describing and comparing the protective effect of epicatechin and luteolin-7-O-β-D-glucoside, components of an aqueous extract from Cynomorium songaricum.


Yang, L., Yang, G.-S., Ma, H.-Y., Wang, Y.-H., and Shen, S.-K. 2018. Phylogenetic placement of Yumanopilia (Opiliaceae) inferred from molecular and morphological data. Journal of Systematics and Evolution 56:48-55. Molar and morphological data are presented that the authors claim justifies recognition of a new genus, Yumanopilia. The main difference between this taxon and Melientha suavis is that its flowers are bisexual (vs. unisexual, dioecious), otherwise morphologically very similar. Both taxa are sister with high support. The authors did not entertain the idea that this is simply a new species of Melientha. Over 1.5 years after publication, the gene sequences used in this paper are not available on Genbank.

alba among the 280 species recorded in the cemetery.


Yule, K.M. and Bronstein, J.L. 2018. Reproductive ecology of a parasitic plant differs by host species: vector interactions and the maintenance of host races. Oecologia 186: 471–482. [Phoradendron californicum (Viscaceae) has genetically distinct races that parasitize the hosts Prosopis (mesquite) and Senegalia (acacia). Differences in vector interactions were tested by quantifying pollinator visitation, floral reward, pollen receipt, and fruit consumption. Although the two races have distinct but overlapping pollinator communities, reproductive success and fruit set did not differ by host.]

Zhang YueYa, Yan HaiFeng, Niu MeiYun, Cheng QingWei, Zhang XinHua, da Silva, J.A.T. and Ma GuoHua. 2018. Multiple strategies for increasing yields of essential oil and obtaining sandalwood terpenoids by biotechnological methods in sandalwood. Trees: Structure and Function 32(1): 17-28. [Discussing the metabolic pathway of terpenoid biosynthesis in sandalwood (presumably Santalum album) and how to obtain these terpenoids or essential oils by chemical synthesis]

HAUSTORIUM 73
has been edited by Chris Parker, 5 Royal York Crescent, Bristol BS8 4JZ, UK (Email chrisparker5@compuserve.com), Lytton Musselman, Parasitic Plant Laboratory, Department of Biological Sciences, Old Dominion University, Norfolk Virginia 23529-0266, USA (fax 757 683 5283; Email lmusselm@odu.edu) and Hinanit Koltai, Dept of Ornamental Horticulture, Institute of Plant Sciences, ARO Volcani Center, Bet-Dagan 50250, Israel (hkoltai@agri.gov.il) with valued assistance from Koichi Yoneyama, Utsunomiya University, Japan, and from Dan Nickrent, Southern Illinois University, Carbondale, USA. It is produced and distributed by Chris Parker and published by Old Dominion University (ISSN 1944-6969).

Send material for publication to any of the editors.

NB. Haustorium is no longer distributed in hard-copy form. It is available by email free of charge – contact Chris Parker - and may also be downloaded from the IPPS web-site (see above).
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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS members,

I hope you have had a good summer.

The WCPP-15 meeting took place in Amsterdam, the Netherlands, from the 30th June to 5th July. Over 110 participants attended the meeting from different parts the world. The meeting was excellent both scientifically and socially; both the location and the weather were beautiful! I would like to thank Harro Bouwmeester and his team for their hospitality, their hard work and excellent organisation, before and during the meeting, which made it a great success.

I would also like to thank the scientific committee and the session organisers for their input into the scientific programme and the organisation of the individual sessions. We had excellent keynote, oral and poster presentations as described by Lytton Musselman and Nick Flanders in their meeting report below. I would particularly like to congratulate the students and young scientists on the exciting work they are doing.

I would like to update everyone on the proposed changes to the IPPS website and structure of the IPPS Executive Committee. As Harro and I explained at the end of the Congress, we would like to update and modernize the IPPS website so that it better serves the members of the Society. The new website will be more interactive and incorporate the websites for the biennial WCPP congresses within its structure. The website will also have a page for the society’s newsletter, Haustorium. Harro is currently exploring the possibility of employing the WCPP_15 website designer, to design the new structure of the IPPS website.

As part of these changes the role of the Editor and Members at Large will change. The Editor will have overall responsibility for the content and structure of the website, helped by the Members at Large. In addition to the current Member at Large (Prof Airong Li) a second Member at Large will be elected to help with the website and will also help Chris Parker put together Haustorium. At the conference we asked for nominations for the position of Editor and the new Member at Large. I am delighted to announce that Professor Susann Wicke has kindly agreed to take on the position of Editor. Susann is currently a Group Leader in Plant Evolutionary Genomics at the University of Munster and will bring a great deal of expertise to the Editor position. I have received two nominations for the new Member at Large position and I will shortly, via e-mail, organise the election for this position.

With very best wishes,

Julie

Julie Scholes, IPPS President
(j.scholes@sheffield.ac.uk)

THE FUTURE OF HAUSTORIUM

N.B. LITERATURE - Therapeutic uses. Chris Parker intends to continue assembling the Literature section with the help of colleagues. However he would like to reduce the work load by including only exceptionally interesting items on therapeutic uses. These amount to up to one third of all the items covered, yet he is not aware of any active interest in these. If anyone is really interested in these and/or wishes to help by covering them we could discuss how they access the relevant sources.

MEETING REPORT

15th World Congress on Parasitic Plants.
Amsterdam, the Netherlands, 30th June – 5th July.

I believe I was the only one at this congress who attended the first symposium on parasitic plants held in Malta in 1973 and organized by Chris Parker and the European Weed Research Council. With the perspective of the resident fossil, I was pleased to see the large number of young scientists eloquently displaying their research prowess. This bodes well for the future of our discipline. No doubt the availability of numerous financial awards encouraged the participation of early career scientists.

The progress made since Malta in understanding how parasitic plants function is astounding. Papers presented at the meeting in Amsterdam had enormous explanatory power that drew heavily upon the extensive genetic and genomic data created during the past decade.
Compared to earlier meetings there was more emphasis on *Cuscuta* and fewer presentations in posters and papers on mistletoes, Balanophoraceae, Rafflesiaaceae, Santalalean families, and nothing on *Cassytha*. But the data presented and the methods used have potential to answer questions in those groups.

This congress grew out of a series of earlier symposia where a major emphasis was on parasitic weeds of agricultural importance, especially *Striga* in Africa and *Orobanche* in the Middle East. Control of these devastating weeds was an overarching concern at those meetings. So the question can be asked, How has a more complete understanding of parasitic behavior, especially the elegant communication between host and parasite, affected the small holder farmer. In my view not much, an opinion shared by several colleagues at the meeting. The witchweed problem in Africa, for example, seems little mitigated since I lived in Sudan in the early 1980’s. Perhaps we need to devote time at the next congress to address the relationship of research to control.

The organization of the congress was superb. The selection and vetting of speakers ensured quality presentations with session chairs selected for their expertise evident in the way questions and discussions were handled. The quality of the papers was attested by the fact that almost all congress registrants were present at every session.

Posters were an important part of the congress. Ample, dedicated time was devoted to viewing the posters with the authors present. The poster sessions immediately followed the paper presentations ensuring good participation. Like similar meetings, one of the most important aspects was plenty of time for personal interaction.

Grateful thanks are due the organizing and scientific committees and especially to our Dutch hosts. Their efforts in the selection of the venue, arrangements for meals, coffee breaks, drinks at the poster sessions, projection quality, and all the other details requisite for a smooth running and profitable congress are commendable and much appreciated.

Lytton John Musselman,
Old Dominion University, Norfolk, Virginia
23529-0266 USA

**Oral presentations:**


**Host Plant Resistance**

Jiangqiang Wu – ‘The parasite *Cuscuta australis* with a streamlined genome mediates inter-plant systemic signals.’

Herbivory defense signals are transferred between plants by *C. australis*, even plants in different families; signals between hosts = ecological benefit of parasite. Also signals for N uptake and N itself moved through dodder from N rich host to N poor host. This *Cuscuta* species coordinates flowering with host species flowering

Michael Axtell - ‘*Cuscuta* microRNAs target host mRNAs involved in defence and vascular function.’

Regulatory RNAs are transported from *C. campestris* to host; microRNAs from *Cuscuta* target host mRNAs, down-regulating host mRNAs, helping the parasite. mRNA targets in the host help with resistance to *Cuscuta*, for instance clotting phloem at wound. Genome of *Cuscuta* with host genes that include introns confirms horizontal gene transfer; microRNAs transported by *Cuscuta* could come from host genes. Variation in microRNAs of *Cuscuta* match variation among mRNAs of different host species to ensure match; portions of host mRNAs that are conserved across host species thus conserved in *Cuscuta*.

Koh Aoki – ‘Interspecific long-distance movement of *Cuscuta* small RNAs control biological processes in host-parasitic plant complex.’

Small RNA’s from *Cuscuta* move long distance in the host (to apex); small RNAs from host move long distances in *Cuscuta* (*C. japonica* and *C. campestris*.)

Markus Albert – ‘A peptide motif of a parasitic plant cell wall protein is recognized by the receptor protein CuRe1 and induces defence in tomato.’

*Solanum lycopersicum* resistant to *Cuscuta reflexa* with insurmountable epidermis but not *S. pennellii*; *S. lycopersicum* with receptor for *Cuscuta* factor (a peptide), *S. pennellii* without receptor. This molecular signal is only responsible for partial resistance

Neelima Sinha – ‘Molecular basis for tomato resistance to the parasitic plant *Cuscuta*.’
Transcriptome of *Cuscuta campestris* during prehaustoria phase prompts hydrolase activity, penetration of stem. Host-induced gene silencing due to small RNA from host into *Cuscuta*; must have initial parasitism for *Cuscuta* to receive RNA from host, then subsequent haustoria are decreased. In resistant strains of tomato, after parasite detection, lignin genes are upregulated and cortical cell walls become lignified. Virus-based gene expression used in susceptible strain so cortex becomes lignified.

Dana Sisou – ‘Characterization of resistance to sunflower broomrape (*Orobanche cumana* [sic.]) insunflower (*Helianthus annuus* L.).’ Possible sunflower resistance mechanisms to *O. cumana*: 1) no root stimulant to cause germination; 2) prevention of the development of haustoria; 3) blocking nutrient flow to the parasite or poisoning it. Grafting experiment to show resistance in sunflower resistant variety EMEK3 is exclusive to root tissue. Lignification in host prevents penetration; *O. cumana* seeds germinate so resistance is pre-haustorial.

Stephane Munos and Begoña Pérez-Vich – ‘International consortium on sunflower broomrape resistance.’ Proposing the creation of an international group to study sunflower broomrape. Goals: to classify and standardize races for international use; develop seed bank for different populations and assess molecular diversity; characterize molecular interactions between parasite and host; 4-year long project with partners around the world.

**Ecology, Phylogeny, and Evolution**

Susan Wicke – ‘Eco-evolutionary causes and consequences of parasitism in plants.’ How does evolution of plastome reduction occur? Recreate ancestral genome and search for genes lost in a non-random way; transition to obligate parasitism from facultative leads to most molecular evolution. Evidence for DNA transfer in nuclear genome in *Orobanchaceae*. 2000 species in *Orobanchaceae* but only 30 species weedy, why these? Data gathered on ecology, geography, and hosts: before weediness, host switching and switching to rapid life history. Multiple transitions to weediness within *Phelipanche*. Possibly the opposite in *Striga* (non-weeds arising from weedy sp.).

Claude dePamphilis – ‘Novel genetic code and record-setting AT-richness in the highly reduced plastid genome of the holoparasitic plant *Balanophora*.’

Holoparasites: reduction in plastome without chlorophyll, plastome possibly lost in *Rafflesia*. 4 critical genes in plastome – if they are transferred or lost, plastome would be lost. *Balanophora* plastome with accelerated evolution + with extreme bias towards AT codons resulting in lots of stop codons but genes still transcribed; stop codons read as sense codons here? If genes with novel code were transferred to nuclear genome, they would not be transcribed making plastome non-removable.

Airong Li - ‘A neglected alliance in battles against parasitic plants: AM and rhizobial symbioses alleviate damage to a legume host by root hemiparasitic *Pedicularis* species.’ Parasitic plant can give non-host an advantage when competing with host species. Soil microbes help host plant achieve a more stable system, leading to more diversity? Field-level experiments with parasite + soil microbe removals: interactions between effects of parasites + microbes, e.g. if stressed for N due to *Pedicularis*, N-requiring AM fungi addition does not help host as much as addition in absence of parasite.

Peter Toth - ‘When the same is not the same.’ Phenotypic variation in volatile organic compounds (VOC’s) in *Orobanche flava* across different habitats in response to different pollinators? In habitat with only fly pollinators, VOC’s resemble aphids to attract flies?

Luyang Hu - ‘Genetic diversity of *Orobanche cumana* (sunflower broomrape) populations at the world level revealed by SSR markers.’ Analyzed genetic diversity in *O. cumana* across Europe and Asia: E. China with highest genetic diversity, either due to species originating there or faster evolution there.

Lammert Bastiaans – ‘Facultative parasitism: an evolutionary precursor of complete parasitism or an effective strategy in its own right?’ Facultative parasitism: habit representing transition to obligate parasitism, or superior strategy offering greater flexibility? *Rhamphicarpa* with higher seed bank turnover than obligate, but produces more seeds when attached to a host. Simulation study of equilibrium seed bank density: facultative better strategy than obligate with high seed mortality and low host plant abundance.

Renate Wesselingh – ‘Fitness of reciprocal F1 hybrids between *Rhinanthus minor* and *R. major*.’
Over time in mixed populations of Rhinanthus major and R. minor, most hybrids more like R. majo. Pollinator preference? Planted F1 hybrids and examined emergence rate; hybrid strain with poor germination in lab with equal emergence rate to other hybrids, why?

Genes
Kirsten Krause - 'Cuscuta campestris: A plant genome under the influence of a parasitic lifestyle. Cuscuta campestris has reduced CO₂ fixation, few stomata, uses recycled C instead of atmospheric? How is photosynthesis possible with RNA polymerase gene lost from plastid genome in Cuscuta? Protein transport from nucleus to plastid. Knocking out genes in Arabidopsis that have been lost in Cuscuta plastome allow functional photosynthesis but slower. Yellow color in Cuscuta are from carotenoids, providing protection in high light environments?

Satoko Yoshida - 'Genetic basis for host and parasitic plant communication. Striga asiatica genome: some gene families such as photosynthesis contracted but not lost; other families such as water transport, strigolactone receptors expanded/duplicated. Transcriptomics: lateral root development in Arabidopsis similar to haustorium development in Striga. Facultative Phtheirospermum has similar genes enriched as Striga; mutants with genes knocked out form fewer haustoria, not sure which genes yet.

Daniel Steele - ‘Exploring the evolutionary origin of haustorium development in root parasitic plants.’ Transcriptomics across haustorial development phases to identify genes involved in haustorium development in Triphysaria versicolor. Mapped promoter for regulation of these genes on phylogeny Found multiple hemiparasites in Orobancheaceae with promoter but not as much up-regulation in non-parasitic Lindenbergia.

Elizabeth Kelly - 'Where the action is: gene expression at the parasite-host interface.' Comparing, in Triphysaria versicolor, Striga hermonthica and Phelipanche aegyptiaca, gene expression in the parasite body, interface, and host body, distinct gene expression profiles in each tissue. Parasite tissues have upregulation of genes involved with cell wall, water transport, proteases, vs. host tissues with up-regulation of genes involved with water transport and stress. Some defense genes down-regulated in host, why? Controlled by parasite? Parasite transcripts in host and host transcripts in parasite.

Claude dePamphilis – ‘Convergent horizontal gene transfer and crosstalk of mobile nucleic acids in parasitic plants.’ Has horizontal gene transfer contributed to genes up-regulated in haustoria?. Identified HGT genes using gene trees; HGT genes expressed in haustoria approx. half of the time. Mobile RNAs in Cuscuta campestris from HGT? Yes, including genes for defense and cell wall modification. No HGTs from Poales in Cuscuta, but yes in Striga. HGT was transfer of DNA not RNA as introns included. HGTs interacting with small RNAs more than random genes, function as silencers of host defense?

James Bradley – ‘The identification of candidate pathogenicity-related genes from the genome of Striga hermonthica.’ Genes identified that allow Striga to overcome resistance in resistant strains of rice. Comparing proteins secreted by Striga and not by Mimulus to identify pathogenicity-related genes. Transcriptomics across life cycle of Striga on rice to identify upregulated genes, including those involved with cell wall modification.

Benjamin Anderson – ‘Lack of evidence for horizontally transferred genes in mitochondria of Cuscuta species.’ Parasites good candidates for HGT making it easy to identify as distantly related to host. Lots of HGT in mitochondria of Rafflesia, but not in mitochondria of Cuscuta.

Molecules and Biochemistry
Tadao Asami – ‘Chemicals that control Striga germination.’ Discussing control of Striga using strigolactone inhibitors in host, suicidal germination with synthetic strigolactones (such as ethylene mimics), or strigolactone receptor inhibitors. Host mutants with strigolactone inhibitors developed which show little change in host morphology.

Shelley Lumba - ‘Signaling pathways in Striga hermonthica germination.’ Testing genes for strigolactone receptors by putting in Arabidopsis mutants with germination defect to see if SLs rescue mutants and allow germination (assay). Construct protein similar to that transcribed by candidate gene on phylogeny protein in parasites and not elsewhere.

Salim Al-Babili – ‘Complementary hormone-based approaches for Striga control.’ Developing chemicals to mimic strigolactones to induce suicidal germination of Striga seeds but not affect host. Developing chemicals to down-
Regulate SL synthesis by host that also promote host growth.

Yuichiro Tsuchiya – ‘A femto-molar range suicide germination stimulant for the parasitic plant Striga hermonthica’.

Synthetic strigolactone must act only on Striga as natural SLs attract AM fungi to increase P uptake; must understand SL receptors on Striga to optimize selectivity of synthetic SL. Testing chemical that is cheap, active, and Striga-specific in field in Kenya.

Amir Arellano Sab – ‘Structural and biochemical characterization of strigolactone parasitic receptors, understanding their functionality and how to inhibit them.’

Striga with multiple strigolactone receptors: get structures; look at dynamics; make less sensitive structure more sensitive. Shows we can design Striga specific germination inhibitors.

Atsushi Okazawa - ‘Identification and characterization of α-galactosidase capable of hydrolyzing plantose in Orobanche minor as a target for control of root parasitic weeds.’

Can we target metabolism of plantose, used during germination of Orobanche minor, for control? Screening enzyme inhibitors for effect on O. minor germination gave some compounds which reduce radicle elongation.

Jean-Bernard Pouvreau – ‘Cannalactone: a new non-canonical strigolactone exuded by Cannabis sativa roots with a pivotal role in host specialization within French broomrape (Phelipanche ramosa) populations.’

Which stimulant from hemp required by Phelipanche ramosa to germinate? New strigolactone exuded by hemp called cannalactone described.

Control and Management

Damaris Odeny – ‘Striga research on finger millet: protocols, GWAS and RNA sequencing.’

Genotyped finger millet populations with 20K SNPs; looking at transcriptomics across Striga attachment and penetration in petri dish showing the upregulated genes include those involved in cell wall modification.

Hanan Eizenberg – ‘Parasitic weed management – opportunities and challenges.’

Multiple control methods needed with new infestations. Here focus on control using herbicides. New technologies for mapping infections post-emergence to be used in predicting control areas for subsequent years. Hyperspectral detection for pre-emergence detection based on changes in host leaf, optimized protocol for pre- and post-emergence control with herbicides.

Binne Zwanenburg – ‘Advances in parasitic weed control in the field’.

Natural stigolactone structure too complex/expensive to be used in weed control; need synthetic mimics that degrade in soil quickly as natural SLs do. Critical to time crop planting after suicidal germination of parasite. Alternative option to suicidal germination: use borax/thiourea to remove natural SLs from soil and reduce parasite germination.

Jonathan Gressel - Correctly multi-targeted Host-Induced Gene Silencing (HIGS) should allow full and sustainable control of parasitic weeds.’

Using Host-induced Gene Silencing with small interfering RNA’s targeting genes expressed at the parasite-host interface promising. Target multiple sites to delay resistance; trans-genic but no new proteins made; also expressed only in roots.

Boubacar Kountche – ‘Realizing the suicidal germination strategy to control Striga hermonthica in rain-fed agriculture of sub-Saharan Africa.’

Developed strigolactone analogs to induce suicidal germination in Striga to be used in rain-fed agriculture of sub-saharan Africa. Field trials reduced Striga seed bank and did not affect AM fungi. Need to optimize application timing.

Jonne Rodenburg – ‘How do fertilisers affect the facultative parasitic weed Rhamphicarpa fistulosa?’

Control of facultative parasite R. fistulosa includes herbicide, hand-weeding, use of resistant rice varieties, early sowing of rice. Could fertilizer help in the Rhamphicarpa/rice system as in Striga control?

Pot and field trials to look at effects of fertilizer on rice growth with or without parasite and on parasite growth with or without host. Fertilizer overall helps rice and parasite when grown together, but interaction exists: rice with fertilizer and parasite does worse than rice with fertilizer alone. Over time, R. fistulosa infestation may increase with fertilizer with more capsules produced each year.

Evgenia Dor – ‘Development of chickpea (Cicer arietinum L.) mutant resistant to imidazolinone herbicides for broomrape management.’

Developed chickpea line resistant to herbicide used to control broomrapes – Orobanche crenata and Phelipanche aegyptiaca; mutant not resistant to other herbicides. Testing with heterozygotes showed resistance is semi-dominant trait.
Parasitic Plant Biology

Julie Scholes – ‘Understanding the arms race: host resistance and parasite virulence in the Striga - cereal interaction.’

Striga hermonthica on rice: how does parasite overcome resistance? What about post-attachment defenses? Striga ecotypes vary in virulence; also need to study genes in resistant rice lines. Infect rice cultivars with Striga seedlings in rhizotron and collect parasite seedlings post-attachment. Look at transcription during attachment in host to identify candidate defense genes then use RNAi to test candidate genes by knocking them out in mutants + infecting with Striga. After RNAi, Striga biomass increases on mutant rice; but likely other genes involved in defense. Some Striga infections even with resistant lines. Identify genes involved in virulence: collect Striga seedlings that vary in virulence after growing on rice hence identify candidate genes based on big difference in allele frequency between Striga ecotypes. Some SNP differences non-synonymous, effecting genes for receptors, cell wall, proteases.

Jakub Tesitel – ‘Native parasitic plants: a solution of plant invasions worldwide?’

Problem of alien plant invasions, also native plants invading natural communities to detriment of biodiversity. Traits of worst invaders: tall plants, clonal, N-fixing. Among different control measures: biotic resistance - generalist enemy native to area that invader is impacting. Parasitic plant as biotic resistance. Generalist parasite should have stronger negative effect on invader than on native hosts to restore competitive balance. A few examples presented across world, including Rhinanthus to help control Calamagrostis in grasslands of central Europe. Most suitable - root hemiparasites, parasitic vines, mistletoes

Pradeepa Bandaranayake ‘Transcriptomics to farmer field: a system biology approach for commercializing root parasitic Santalum album (sandalwood).’

S. album in silviculture: fertilizer not needed, grows on marginal lands. Not popular in agriculture due to variation in yield, slow growth, and germination problems. Optimized seed germination and genotyped superior oil producing lines + optimized tissue culture of superior genotypes. Tested hosts for early growth, long term need to find optimal woody host.

Guilin Chen – ‘Reproductive biology and pollination of Cynomorium songaricum (Cynomoriaceae).’

C. songaricum of conservation concern. Mesh bag experiment showed insects responsible for most pollination, with most common pollinators determined to be from Diptera. Inflorescences increase in temperature to increase volatility of fly-attracting chemicals.

Yaxin Wang – ‘Triphysaria controls vegetative self-recognition by restricting release of HIFs in roots.’

Triphysaria with self-recognition: root exudates from Triphysaria do not induce haustoria; need to understand self-recognition to engineer crop plants invisible to parasitic weeds. Showed experimentally that exudate from T. roots does not inhibit germination. Need to know genes that produce host inducing factor, possibly DMPQ, to see if over-expressed in hosts.

Mamadou Cissoko – ‘Analysis of genetic variation in pre and post attachment resistance mechanisms in maize inbred lines to the parasitic weed Striga hermonthica; implications for control.’

Need to determine mechanism underlying maize resistance to Striga, including post-attachment defense. Post-attachment resistance in maize lines - Striga blocked in cortex. Variation in amount of strigolactone in root exudate from different maize lines. Variation in germination rate of Striga with root exudate from different maize lines but not correlated with SL%, need to identify SL’s most correlated with Striga germination.

Desalegn Etalo – ‘Impact of the soil microbiome on Striga -sorghum interaction.’

Does soil microbiome provide Striga suppression? Screening soil types from W. Europe for Striga activity gives large variation, due to microbes? Removing microbes using radiation leads to increase in Striga. What is mechanism for anti-Striga effect of soil microbes? Bacterial volatiles reduce Striga germination in presence of GR24; some fungi infect Striga. Microbiome as part of Integrated Management.

Parasitic Plant- Host Interaction

Mike Timko – ‘War and peace – the molecular dynamics of compatible and incompatible Striga -host plant associations.’

Heritable sources of monogenic resistance in dicot cowpea-Striga system; also genetic
variation in \textit{S. gesnerioides} infecting cowpea. Identified genes for resistance in cowpea using SSR's and SNPs across susceptible and resistant varieties showed 1 gene similar to more general defense gene, but is it responsible for resistance? RNAi to silence gene in resistant race - now susceptible. Overexpressed gene in susceptible race - now resistant. What is nature of resistance response? Look at gene expression across attack by \textit{Striga} in resistant vs. susceptible cowpea. Incompatible interaction: host root tissue killed off followed by cell wall construction later. Compatible: down-regulation of genes used by resistant strain; turned off by parasite? Whether to elicit or to suppress hypersensitive response in host, parasite must communicate with host. Look for differentially expressed genes between virulent and not virulent \textit{Striga} strains and use structural criteria to identify genes likely responsible for transported molecules. Found gene similar to cowpea gene and showed it is used by \textit{Striga} to suppress defensive response in host by applying to resistant cowpea to make susceptible. Multiple molecules involved in signaling response/lack of response.

**Thomas Spallek – ‘What model plants can tell us about parasitic plants.’**

Studied genes expressed in \textit{Phtheirospermum} early in haustorial development following cytokinin transfer to induce hypertrophy; genes identified using CRISPR mutants. Mutant hosts without hypertrophy had more haustorial attachments from \textit{Phtheirospermum}; hypertrophy function here may be increasing sink for nutrients/water from parasite to host. Next - investigate size variation in \textit{Phtheirospermum}, maybe xylem bridges w/o parasitism?

**James Westwood – ‘Message received: Evidence for translation of mobile mRNAs in \textit{Cuscuta} -host interactions.’**

Are mRNA’s transferred from host to parasite as food, for information, or both? Detected host proteins in parasite and vice versa; movement of large, membrane-associated proteins certainly as mRNA. \textit{Arabidopsis} mutants for genes of proteins transported by \textit{Cuscuta} in hosts affected in signaling pathway for defense mechanism hence \textit{Cuscuta} manipulating host with small molecule transfer likely.

**Songkui Cui - ‘The roles and functions of lignin in parasitic plant-host interaction.’**

Lignins as haustorium-inducing factor (HIF): shown for \textit{Striga} and \textit{Phtheirospermum}; \textit{Arabidopsis} mutants without lignin HIF had reduced parasitism, but not completely resistant. Lignins as resistance: resistant rice varieties with more lignin; remove ability to make lignin and susceptible rice strain now resistant. Tagged lignins shown to be taken in by parasite, used for strength as driving force for invasion by haustoria?

**Min-Yao Jhu – ‘A receptor and pathways discovered in the lignin-based resistance to \textit{Cuscuta campestris} in Heinz hybrid tomato cultivars.’**

Used RNAseq to identify few genes involved in tomato resistance to \textit{C. campestris}. 2 genes upregulated using virus-based gene expression hence increase lignin. Other genes for resistance apparently used to detect parasite identified using CRISPR mutants.

**Estelle Billard – ‘Cytokinins act as signaling molecules within the rhizosphere to trigger haustorium formation in the holoparasitic plant \textit{Phelipanche ramosa}’**

For holoparasites like \textit{Phelipanche ramosa} what is haustorial intitiation factor? Germinate with GR24 and add host + get haustoria, but what is the factor? Cytokinins induce haustoria, but are they from host or soil microbes? \textit{Arabidopsis} mutant without cytokinin production shows less haustoria from \textit{P. ramose}. But what is role of soil microbes? Cytokinins used to attract mycorrhizae.

**Luiza Teixeira-Costa – ‘Striking vegetative developmental convergence in endoparasitic angiosperms.’**

Endoparasitic habit now thought to have evolved independently in 4 lineages, morphological and anatomical examples of convergence shown here. Development: parasites get bigger after penetrating host xylem through rays, and establishment with xylem only with onset of flowering; host vessels diverging toward parasite flowers possibly due to reverse flux of auxins from parasite to host. Phloem-phloem connections in 2 of 4 lineages.

**Posters**

Abera, S. – ‘Deciphering the sorghum root microbiome for \textit{Striga}-suppressive bacteria.’

Adewale, S. – ‘Genome-wide association analysis of \textit{Striga} resistance in early maturing tropical maize, inbred lines.’

Bellis, E.S. – ‘Adaptation of sorghum landraces across gradients of \textit{Striga hermonthica} occurrence.’

Bernal-Galeano, V. – ‘\textit{Cuscuta campestris}: Transformation and other tools for parasitic plant research.’

Blanco-Ania, D. – ‘Hybrid-type strigolactone analogues and mimics derived from auxins.’
Ceccantini, G. – ‘Unfitting pipes! Patterns of connection between mistletoes and their hosts: anatomical and hydraulic consequences for angiosperms parasitizing conifers.’

Chabaud, M. – ‘Phenotyping of early stages of wild Helianthus species Orobanche cumana interaction towards the identification of new resistances.’

Cvejić, S. – ‘Breeding strategies for Orobanche cumana resistance in sunflower.’

Denysenko-Bennett, M. – ‘Duplicative horizontal gene transfer of mitochondrial atp8 gene observed in Cistanche armena (Orobanchaceae).’

Dor, E. – ‘Development of chickpea (Cicer arietinum L.) mutant resistant to imidazolinone herbicides for broomrape management.’

Edlund, M. – ‘How do shifts in parasitism affect chloroplast genomes in the Santalales?’

Emran, S. – ‘Metabolic and biochemical aspects of interaction between species of carrots to root parasite.’

Feng, Y. – ‘Holoparasitism breaks the evolutionary stasis of mitochondrial genome evolution in Orobanchaceae.’

Fischer, K. – ‘Element distribution at Cuscuta/host infection sites suggests the existence of selective mineral transport barriers.’

Flanders, N. – ‘Effects of environmental conditions on survival of a bird-dispersed mistletoe, Phoradendron leucarpum.’

Gedil, M. – ‘Identification of differentially expressed genes associated with tolerance to Striga hermonthica in tropical maize inbred lines.’

Haider, I. – ‘Structural basis for specific inhibition of the highly sensitive ShHTL7 receptor.’

Hudzik, C. – ‘Uncovering how and when Cuscuta campestris recognizes a host to produce interspecies miRNAs.’

Imarhiagbe, O. – ‘Studies on Thonningia sanguinea Vahl. (Balanophoraceae) in Southern Nigeria: I. Range and host preference.’

Imarhiagbe, O. – ‘Studies on Thonningia sanguinea Vahl. (Balanophoraceae): II. Reproductive phenology, sex ratio and insect pollinators at the Okomu National Park, Southern Nigeria.’

Imarhiagbe, O. – ‘Studies on Thonningia sanguinea Vahl. (Balanophoraceae) in Southern Nigeria: III. Distribution, habitat characteristics and phytosociology.’

Imarhiagbe, O. – ‘Studies on Thonningia sanguinea Vahl. (Balanophoraceae) In Southern Nigeria: IV. Patterns of genetic diversity and population structure within and between populations.’

Imerovski, I. – ‘Validation of broomrape resistance QTLs in sunflower line HA-267.’

Jamil, M. – ‘A new generation of methyl phenalectonate stirigolactone analogs with high efficiency and simple structure.’

Jhu, M-Y. – ‘A receptor and pathways discovered in the lignin-based resistance to Cuscuta campestris in Heinz hybrid tomato cultivars.’

Johnson, N. – ‘Sequence divergence among trans-species small RNAs in parasitic plant genus Cuscuta compensates for target-site diversity in hosts.’

Kibet, W. – ‘Finding a good decoy for Striga hermonthica suicidal germination.’

Kokla, A. – ‘The role of hormones in parasitic plant infection.’


Kunguni, J.S. – ‘Natural resistance to witchweed in cultivated and wild finger millet accessions.’

Li, C. – ‘Elucidating stirigolactone biosynthesis in Zea mays (maize).’

Libiakova, D. – ‘Transformation and regeneration protocol of parasitic plant Phelipanche ramosa.’

Lyko, P. – ‘Trophic specialization and host-related diversification in the Broomrape family (Orobanchaceae).’

Lyko, P. – ‘Genome sequencing of branched broomrape and reconstruction of the evolutionary history of the Phelipanche ramosa/P. aegyptiaca species complex.’

Mirzaei, K. – ‘Does introgression between two parasitic plants have local adaptation advantages for their offspring?’. 

Mitiku, K. – ‘Molecular detection of the Striga seedbank in Ethiopian soils.’

Park, S-Y. - ‘Ethylene-mediated host responses increase resistance to Phelipanche aegyptiaca.’

Park, S-Y. – ‘Cuscuta campestris Jasmonate-Induced Protein 23 (CcJIP23) is a functional mobile protein.’

Park, S-Y. – ‘Message received: evidence for translation of mobile mRNAs in Cuscuta-host interactions.’

Phon-or, N. – ‘Identification and characterization of QTL underlying resistance in rice to the parasitic weed, Striga asiatica.’

Rabeferaisana, J., - ‘Assessing the tolerance of the advanced putative mutant rice lines M5 generation (Oryza sativa) to Striga hermonthica attack.’

Rapley, D. – ‘Does silicon enhance rice resistance to the root parasitic weed, Striga hermonthica, and the Egyptian cotton leafworm, Spodoptera littoralis?’
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Sibinelli, V. – ‘Wood radial and axial variation of some gigantica Loranthaceae mistletoes.’
Sibinelli, V. – ‘Comparative wood anatomy of Brazilian mistletoes genera of Loranthaceae.’
Steele, D. – ‘Exploring the evolutionary origin of haustorium development in root parasitic plants.’
Sugimoto, Y. – ‘Aberrant protein phosphatase 2C leads to ABA insensitivity, high transpiration rate and sustenance of parasitism in Striga hermonthica.’
Takahashi, I. – ‘Development of propiconazole derivatives as strigolactone biosynthesis inhibitors.’
Teixeira-Costa, L. – ‘What's in a name? That which we call a haustorium by any other name would cause misunderstanding of parasitic plant biology.’
Tezemma, T. – ‘Scaling up of Integrated Striga Control in Sorghum in Ethiopia.’
Tourneur, S. – ‘miPEPs: new tools to study and control Orobanche cumana.’
von Muenchow, - ‘Lifecyle synchronization between parasitic plants and their hosts assessed by molecular evolutionary analysis and host-induced gene silencing.’
Wada, S. – ‘Structural and functional analysis of haustorium inducing factors for the parasitic plant Striga hermonthica.’
Wallach, A. – ‘Biology and management of P. aegyptiaca in cabbage.’
Wang, Yanting – ‘Transcriptional changes in tomato roots upon P starvation and the role of strigolactones in this response.’
Wang, Yaxin – ‘Triphysaria controls vegetative self-recognition by restricting release of HIFs in roots.’
Wicke, S. – ‘Eco-evolutionary causes and consequences of parasitism in plants.’
Yang, Beifen – ‘Inoculation of rhizobia enhanced the damage of holoparasitic plant on host plant which will not be affected by exogenous nitrogen.’
Yang, Chong – ‘Dual transcript profiling of plant-plant interaction between parasitic weed Orobanche cumana and sunflowers.’
Yoneyama, Kaori – ‘Characterization of germination stimulants for P. ramosa.’
Zhang, H. – ‘Phylogenetic and functional analyses of parasitism genes in haustorial formation and development.’

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MISTLETOE (VISCUM ALBUM) AND ITS HOSTS IN BRITAIN

Viscum album, the only native British mistletoe, is rich in associated folklore, and commercially important for the Christmas markets and its medicinal uses. Like all mistletoes, it is a hemiparasite, photosynthetic, and attached only to the host xylem, initial contact with which stimulates hypertrophy of the host tissue. It is hence a gall-causer, inducing variable but often marked and conspicuous swelling of the host.

Viscum album on branch of Malus ‘Golden Hornet’ at Chertsey, Surrey, 2019, showing marked swelling (photo: Graham Carey)

It occurs throughout Central Europe, N. Africa, and S.W. & E. Asia, and has been introduced to California and Vancouver Island (Briggs 2003). In Britain, it occurs mainly in the south, especially the south-west. Northwards, it is scarce or absent, though successfully introduced around Edinburgh, and in Ireland (Nelson 2007). It is the most plurivorous of all mistletoes, recorded worldwide on over 450 species in 44 families (Barney et al. 1998) and with over 200 hosts in Britain. National surveys were carried out by the Botanical Society of the British Isles (BSBI) in 1969 – 70 and by BSBI and Plantlife from 1994 - 96. Various other surveys are noted in Spooner (2018). These all record its common hosts as Malus domestica, Tilia x europaea, Robinia pseudoacacia, various Acer and
**Populus** taxa, and some other rosaceous genera, particularly *Crataegus* and *Sorbus*. Curiously, few of its hosts are native; Perring (1973), for example, notes ‘the amount growing on native trees in native situations is negligible’. Most hosts, then, are exotics, recorded mainly in arboreta and botanic gardens. At Oxford Botanic Garden, 20 hosts were documented in 1901 by T.E. Jefferies stating that it is ‘now on a greater number of different kinds of tree than could be seen in a similar area anywhere’ (Anon. 1901).

There are many host compilations for Britain, amongst the earliest those by Baxter (1834) and Jesse (1844) who recorded 38 hosts, including *Acer opalus* not subsequently reported in Britain. Bull (1907) documented 32 hosts from Herefordshire, and a survey in Britain by the *Quarterly Journal of Forestry* received records from 39 hosts (Somerville 1914). Later, Nicholson (1932) listed 164 hosts, including several exotic genera; and for *P. lanuginosa* and *P. lasiantha* only single early records exist. Notable is a recently discovered street tree of *P. ausica* at West Molesey, Surrey with a small bunch of mistletoe, apparently the first and only example of this as a host in Britain. For *Rosa* there are few reports, and on *Pyrus* it is also rare, due evidently to toxins in the berries which cause branch cankers generally preventing development of the mistletoe (Paine 1950). See also Fennel, *Haustorium* 75: 9.

Barriers to colonisation by mistletoe may also be chemical or mechanical. The latter involve thickness of the bark and lignified fibres, particularly effective for beech (*Fagus sylvatica*) on which mistletoe is virtually unknown.

*V. album* on Fagaceae in general is rare, and its occurrence on native oaks (*Quercus petraea*, *Q. robur*) has been venerated since the Druids. A survey of British mistletoe-oaks, recently updated by Box (2019), records just 13 extant trees only six of which are native taxa (*Q. robur*, 1 hybrid). However, a new record on *Q. rubra* from Petworth Park, Sussex was made in November 2017 (Spooner 2018), and there are two mistletoe-bearing *Q. palustris* at Valley Gardens (Spooner 2016), unknown to Box, so that ten examples of the red oak group are currently known in Britain. *Castanea sativa* is also virtually unknown as a host, with in Britain just one remarkable occurrence from Spalding (Lincolnshire) (Hodgson 1931).

Mistletoe resistance by oaks is genetically fixed by the host tree and involves structural elements of the bark. Differential production of polyphenols, stimulated by the mistletoe, may also be involved. Such chemical barriers linked to the genetics of the host trees produce some seeming anomalies. For example, mistletoe is common on hybrid black poplars (*P. × canadensis* agg.) but virtually absent on the parent *P. nigra* and its cultivars, due evidently to the production of flavonoids which accumulate during initial development of the haustorium and prevent penetration (Hariri et al. 1991; Sallé et al. 1994).

Scarc hosts in Britain include species of *Aesculus*, *Alnus*, *Betula*, *Carpinus*, *Corylus*, *Fraxinus*, and for *Ilex aquifolium*, *Laburnum* anagyroides, *Mespilus germanica*, *Ostrya carpinifolia*, *Platanus*, and *Ribes* only two or three records exist. *Juglans regia* and typical *J. nigra* have no recent records, except a notable occurrence on *J. nigra* ‘Alburiensis’, at Albury Park, Surrey, where the clone originated. *Rhamnus cathartica* is also a notable host, reported by Bull (1907) but unknown subsequently except for a remarkable occurrence at Box Hill, Surrey recently recorded by Ann Sankey (Surrey Botanical Society).

A few hosts occasionally reported on the Continent have only single records in Britain, including *Alnus maximowiczi* and *Diospyros virginiana* at Oxford, *Carya cordiformis*, species of *Davidia*, *Magnolia virginiana*, *Parrotia persica*, *Photinia serrulata*, and *Tamarix gallica*. Furthermore, a few hosts in England appear to be unique, including *Alnus maximoviczii* at Virginia Water, and *Hamamelis* ‘Red Glow’ (Mabey 1996), an otherwise unrecorded host genus. Others include *Acer macrophyllum*, *A. rubra*, *Arbutus* sp., *Catalpa bignonioides*, *Cladrastis tinctoria*, *Crataegus brainerdii*, *Cyclodon japonica*, *Gymnocladus dioica*, *Philadelphus coronarius*, *Rhododendron mollis*, *Robinia viscosa*, *Sorbus rondoensis*, *S. ferreri*, and *Symphoricarpos albus*. *Viburnum* seems to be an unrecorded host genus anywhere, though there is an unconfirmed report by Jefferies (in Anon. 1901) from Oxford Botanic Garden. Finally, *Pistacia terebinthus* was listed for Britain by Hawksworth (1974), but this appears to be an error (see Nicholson 1932).
Broadleaf taxa are all host to a single taxon, *V. album ssp. album*. However, two other subspecies, on conifers, occur in Europe: *V. album ssp. abietis* on *Abies*, and *V. album ssp. austriacum* on *Pinus, Picea*, and occasionally other genera. Neither is officially recognised from Britain. However, at least seven conifers have been reported as hosts in Britain, including *Taxus baccata*, *Abies alba*, *Cedrus libani*, *?Cupressus sp.*, *Larix decidua*, *Picea mariana* and *Pinus ?sylvestris*. Mostly, these are unverifiable early records; only ‘a cemetery cypress’ from Stratford-upon-Avon (Mabey 1996) is more recent and, if still extant, is certainly worth further attention. The major British floras make no mention of other subspecies of *Viscum*, although McClintock and Fitter (1956) state: ‘the others, very rare in Britain, grow respectively on pines and larches, and on firs’. The presence and status in Britain of these taxa would be worth clarifying.

For further discussion and fuller references see Spooner (2018).

References


Brian Spooner,
Chair, British Plant Gall Society

**Phelipanche aegyptiaca in Western Iran**

*Phelipanche aegyptiaca* (Pers.) Pomel (Egyptian broomrape) has recently become invasive in rapeseed/canola plantations in western Iran, after introduction of the crop to cultivation in the region. It is also an increasing threat for new rapeseed cultivations and other host crops limiting the choice of rotational crops. Rapeseed is grown as a winter crop in the region and there is a tendency among farmers for mono-cropping due to its economic value as an oil crop (Taab, personal observations). Recently, more than 3000 hectares of rapeseed were found to be infested by *P. aegyptiaca* in Ilam province, with similar infestations reported in some other provinces in Iran. The level of infestation is estimated to be between 10 to 80%. (Ilam Agricultural Organisation; personal communication).
Although the rapeseed yield loss due to \textit{P. aegyptiaca} in the infested fields in west of Iran has not yet been quantified, yield reductions of 65-70\% are expected.

Seed germination of \textit{P. aegyptiaca} up to 100\% can occur at temperatures ranging between 15 and 35°C. Thus, it is assumed that rising temperatures due to ongoing climate change could contribute to an increase of infestation.

\begin{figure}[h]
\centering
\includegraphics[width=0.45\textwidth]{infestation.jpg}
\caption{Infestation of \textit{Phelipanche aegyptiaca} on rapeseed in Dasht Abbas, Ilam, Iran. Photo Z. Nazari.}
\end{figure}

Broomrape species are difficult weeds to control and no control measures have been applied so far in this region, encouraging the further spread of the problem. Research is needed to survey the infested areas and to develop suitable control measures.

\textbf{Acknowledgment:}
I acknowledge the help of Chris Parker in identifying the species and Miss Z. Nazri for providing the plant samples.

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\section*{NEW AND CURRENT PROJECTS}
\textbf{Delivering high-yielding, disease-resistant finger millet to farmers.}

Farmers can soon access finger millet varieties that not only withstand drought but are also resistant to parasites and diseases. This is due to the boost received from a finger millet Crop Wild Relatives (CWR) pre-breeding project led by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and funded by the Crop Trust which ensures funding until 2020. Finger millet is highly valued for its nutritional qualities and recognized as a Smart Food; yet production of finger millet remains below its potential. Farmers claim that the two key constraints to increased production are the blast disease and a parasitic weed called \textit{Striga}. ‘Blast is the most destructive disease of finger millet,’ said Dr. Henry Ojulong, a cereals breeder at ICRISAT. ‘Blast can occur at all stages of plant growth and can affect the leaves, neck and fingers.’ In Kenya, blast can cause an estimated average yield loss of about 30 percent. Similarly, \textit{Striga}, a sap-sucking weed, can lead to a complete loss of crops and once it’s in a farmer’s field, it is nearly impossible to eradicate. ‘This project involves working with crop wild relatives (CWR) of finger millet since some of those have developed tolerance to either blast or \textit{Striga},’ reported ICRISAT’s Dr. Damaris Odeny, who is the principal investigator of the five-year CWR finger millet pre-breeding project.

‘We are delighted with the progress shown by the team during Phase 1,’ said Dr. Benjamin Kilian, the Crop Wild Relatives Pre-breeding Project Coordinator. ‘Thanks to the support from the Government of Norway, we will be supporting the project further. Our end goal is to raise finger millet production by providing farmers with access to varieties that not only withstand drought but are also resistant to blast and \textit{Striga}.’

The team started by collecting wild finger millet samples and screening them for resistance to blast and \textit{Striga}. ‘We used wild relatives of finger millet because we observed that some of them growing alongside cultivated finger millet on farmers’ fields were not affected by either \textit{Striga} or blast disease,’ explained Dr Odeny. The wild types, however, lack many traits that cultivated varieties may have, such as grain size and color, early maturation or high yield. During the first phase of the CWR project, the team, which included researchers not only from ICRISAT but also from the Kenya Agricultural and Livestock Research Organization (KALRO) – Kisii Center and Maseno University, was successful in identifying wild finger millet samples.
samples showing resistance to *Striga* and blast disease as well as drought tolerance. The team also identified finger millet qualities preferred by farmers and consumers so that the project would ensure that new varieties maintained these qualities.

‘In Phase 2 of the project (2018-2020), we will now introduce these unique characteristics into cultivated varieties with the support of the Crop Trust,’ said Dr. Odeny. The team will work toward releasing farmer-preferred varieties that have been improved using the superior traits from wild finger millets.

Christine Wangari, ICRISAT, Kenya

**N2AFRICA – new Striga project – update.**

Following the item in Haustorium 75 relating to the N2Africa Project, their Podcaster No. 54 (September 2018 - January 2019) includes detail of their *Striga* project in western Kenya:

Objectives will include:
1. Quantify *Striga* seed bank in maize fields of high and low infestation.
2. Correlate seed bank and *Striga* emergence with soil physiochemical characteristics.
3. Compare *Striga* emergence and seed bank between maize in monoculture or rotation with a legume crop.

‘This research will provide updated understanding of the degree by which *Striga* parasitism can be combated by legumes. Future work will include further characterization of the *Striga*-reducing benefit provided by legumes.’

**Striga asiatica Madagascar fieldwork summary 2019.**

For my first year of PhD studies I undertook fieldwork in Madagascar between February and March 2019, as part of a team from the University of Sheffield and CIRAD. The principal aim was to model the distribution and abundance of *Striga asiatica* across the middle-west region and to update information on *Striga* distribution. Available records are sparse, and no studies of distribution have been undertaken for over 20 years.

Fieldwork involved undertaking two long-distance, driven transects in which *Striga* abundance in fields adjacent to the road was obtained. These comprised a transect of 116km along RN34 (T1, n=153) and one of 70km along RN1 (T2, n=83). T1 was located between the towns of Betafo and Morafeno and T2 was located between 3km east of the Sakay and the outskirts of Tsiraoamandidy (see below).

One field on either side of the road was surveyed every kilometre. In the absence of fields in the immediate vicinity of the 1km sections, the next available field was located and surveyed. Fields almost exclusively comprised a main crop of either maize or rice, though a very small number of fields were surveyed with other main crops.

Fields were divided into quadrats, with two observers recording *Striga* density within up to three quadrats per field, measuring 10m wide by 20m in length. Where a field was over 1200m² in size, survey was limited to 3x200m² quadrats per observer. In each instance a field corner was randomly selected as the point to begin survey (Figure 2).

*Striga* density was estimated within quadrats using a six-point, density structured scale, ranging from absent (0) to very high (5). Based on available information, crop type, rice variety, companion crop, previous crop, estimated mean crop height, and percentage cover and data were collected. Information on fertiliser addition and any other pertinent information on the general area were recorded (where available). Photos of each field were also obtained. In addition, soil samples were collected from 104 fields and were analysed for NO3 and pH.

We are looking at whether the effects of rice variety had a significant effect on *Striga* density, as well as the effect of the spatial distribution of the weeds, and we hope to post results very soon!

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Pea (*Pisum sativum*) breeding for disease and pest resistance

The aim of this Project (AGL2017-82907, 2018-2020) is to provide a biotechnological support to disease and pest resistance breeding of pea (*Pisum sativum*) and grasspea (*Lathyrus sativus*) giving continuity to a long term research program. This is approached by a series of concatenated strategies: 1) Search for sources of resistance; 2) Use of identified resistances in breeding by crossing and selection; 3) Advanced QTL mapping for resistance and genome-enabled prediction; 4) Molecular characterization of plant/pathogen interaction; 5) Development of alternative control methods including allelopathy and bioprotection.

In the Mediterranean Basin broomrape (*Orobanche crenata*) is the major constraint for pea production, followed by ascochyta blight (*Didymella pinodes*), powdery mildew (*Erysiphe pisi*) and rust (*Uromyces pisi*). We started broomrape resistance research in pea in the frame of project 1FD97-0393 (1999-2001) in which, after a huge search we found that resistance was very scarce, with only some levels of incomplete resistance identified in a few accessions of *P. sativum* and in wild *Pisum* spp. These sources of resistance were successfully crossed with pea cultivars and introduced into our pea breeding program that already yielded the registration of the first pea cultivars resistant to broomrape (Fig. 1). Mechanisms of resistance have been characterized both in pea and in the model legume *Medicago truncatula*. Resistance available so far seems to be of complex inheritance, so in the frame of subsequent projects we approached the search for QTLs. These pea activities were complemented with work on faba bean (*Vicia faba*), crop in which we coordinated the European FP5 project EUFABA (2003-2005), getting expertise in resistance breeding. Contributing to the programs of other colleagues we covered also some small activities on vetch (*V. sativa*), chickpea (*Cicer arietinum*), lentil (*Lens culinaris*) and common bean (*Phaseolus vulgaris*).

Altogether, this enabled us to consolidate a pea program at Córdoba, that is the major target of our group. In the current project we give continuity to the breeding program with a major emphasis on combining existing levels of broomrape resistance with desirable agronomic traits and resistance to other pests and diseases. This is complemented with exhaustive phenotyping of large germplasm collections under controlled condition and in multi-environment field trials to enable Genome Wide Association studies and Genomic Selection. In addition to this contribution towards understanding plant/pathogen interaction, this project intends to provide applied solutions to farmers, delivering resistant germplasm together with alternative control strategies in integrated control packages covering a number of major pests (aphid and weevil) and diseases (powdery mildew, rust, ascochyta blight and fusarium wilt).

Diego Rubiales
Institute for Sustainable Agriculture, CSIC, Córdoba, Spain

REQUEST FOR SEEDS OF *OROBANCHE CRENATA*

I am happy to inform you that, thanks to an agreement between the Faculty of Agricultural, Food and Forest Sciences of the University of Palermo and the Experimental Zoo-prophylactic Institute of Sicily and the Biobank of the Mediterranean will host a section dedicated to the seeds of parasitic Orobanchaceae.

This core collection will give the opportunity to all of us interested in the study of this group to easily access to material of different origins. All of us are aware of the importance of the local
selection of parasites and hosts that exists in this group. Therefore the availability of seeds of different origins will allow the realization of more accurate experiments. Seed housed in the Biobank will be supplied to users representing recognised organisations, who make requests on behalf of that organisation. The contributors of the Core collection will have a privileged channel to request the supply of seeds.

In order to create this core collection I invite all of you to deposit samples in the Biobank and the spring that is about to begin can be a good time to make targeted collections of Orobancheaeae growing both on agricultural and natural environments.

Those interested can contact me for the instructions for seed collection.

Gianniantonio Domina,
University of Palermo, Sicily,
gianniantonio.domina@unipa.it

PRESS REPORTS

Metabolite stimulates a crop while suppressing a weed

Striga infestation (the smaller plants highlighted inside yellow boxes) in both control and in zaxinone-treated rice plants. Zaxinone limits the ability of Striga to take hold, allowing healthier plants to grow with improved yields. Credit: Salim Al-Babili

A newly discovered, naturally occurring metabolite that promotes growth in rice plants and thwarts infestation by a common parasitic plant could help improve global food security, say KAUST researchers. Plant scientists are working on methods for generating healthy, nutritious crops to feed the world's growing population. However, breeding strong plants that provide reliable, sustainable yields is beset with challenges, including battling parasitic infestations and plant infections.

Apocarotenoids are organic compounds found in the tissues of most living things; they can act as hormones and signaling molecules which, among other functions, stimulate metabolic processes. Scientists are just beginning to untangle the complex networks of these compounds in plants, with surprising results. Under the guidance of KAUST faculty Salim Al-Babili, Takashi Gojobori and Ikram Blilou, the KAUST team, together with scientists in Italy, have identified a novel apocarotenoid metabolite called zaxinone that is synthesized by a previously overlooked group of enzymes, carotenoid cleavage dioxygenases (CCDs), found in most plants. As well as promoting plant growth, zaxinone reduces infestation by the root parasite, Striga, also known as witchweed.

The first author of the paper Jian You Wang explains, Striga is a parasitic plant that infests cereals. Plant hormones called strigolactones are released by host plants into soil, and Striga seeds use this to germinate and build a structure that connects them to the host roots, where they siphon off nutrients, minerals and water. This strips the host of resources needed for its own growth, drastically reducing yields. Striga now affects more than 60 percent of farmland in sub-Saharan Africa and is spreading quickly; it is one of the seven major biotic threats to global food security.'

The team used sequence databases to analyze the distribution and activity of CCD genes across 69 different plant species, including rice. They identified a gene and its associated enzyme in one CCD subfamily that produces zaxinone. They investigated mutant rice plants with reduced zaxinone content to find that they had poor growth and elevated levels of strigolactones. ‘Next, we exposed mutant and wild-type plants to increased zaxinone levels,’ says Wang. ‘This treatment rescued the mutant plants and promoted the growth of wild-type plants. We were surprised to find that this metabolite regulates strigolactone levels with the knock-on effect of tackling Striga infestation.’

“We are very excited about zaxinone—it could be used to alleviate Striga infestation or as a bio-stimulant to accelerate plant growth,’ Al-Babili adds. ‘We’re currently performing metabolomics and transcriptomics studies to fully understand this growth regulator and how it functions.’
A tree in Wote town, Makueni County, invaded by dodder.

Kakamega Forest Senior Manager George Aimo said the dodder plant is a major threat to trees and crops. When Samuel Onyango, a smallholder farmer from Kisumu County, first noticed yellowish spaghetti-like leafless vines hanging loosely on his fence some three years ago, he did not bother about them. Little did he know that it was a killer weed that would end up strangling his crops and even trees.

The weed, known as field dodder or *Cuscuta japonica*, whose origin has been traced to North America, is a parasitic plant; meaning that it draws nutrients from host plants and trees — suffocating them, sometimes to death. ‘It is becoming a nightmare particularly in western Kenya, the Rift Valley and in parts of the Central region,’ said Dr Eston Mutitu, a Senior Entomologist and Chief Research Scientist at the Kenya Forest Research Institute (KeFRI). The dodder builds a canopy on the host plant and casts thousands of tendrils to form a dense spectacle before it strangles it. According to scientists, the weed spreads mainly through contaminated crop seed, although vegetative spread is also possible. ‘The biggest problem is that *Cuscuta* has hundreds of host plants, some of them are of great economic importance,’ said Dr Mutitu. ‘We have observed a huge impact on a wide range of plants and trees such as citrus, grevillea, euphorbia trees among many others,’ he told the *Nation*. The plant also affects crops such tomatoes, sweet potatoes, tea, and potatoes. According to scientists, the weed spreads mainly through contaminated crop seed, although vegetative spread is also possible.

Unlike root parasites such as *Striga* which require a germination stimulant provided by host root systems, scientists at the Centre for Agriculture and Bioscience International have observed that *Cuscuta* species have no specialised germination requirement. The weed is also said to be resilient to different climatic conditions and its seed can persist in dry soils for more than 10 years as it awaits a host.

‘I have tried different kinds of chemicals from local agrovets, but the weed has survived the onslaught, thriving and killing host plants,’ said Mr Onyango. Kakamega Forest Senior Manager George Aimo said the dodder plant is a major threat to trees and crops. ‘It has preference of certain species, though we cannot rule out that it can affect other trees species. Though it has not yet attacked any species in Kakamega Forest, it is present on the forest fence,’ said Mr Aimo. The forester said that despite its short lifespan, the parasitic weed can easily damage a forest if not dealt with in time.

Prof Matthew Dida, the Head of the Department of Agriculture at Maseno University, said that there are different kinds of dodder species which can affect indigenous vegetables and trees. ‘It is possible that the parasitic plant could evolve to affect other species that have not been under attack so far,’ said Prof Dida, pointing out that the most affected tree species in western Kenya are in the family of the yellow oleander, usually preferred for live fencing. According to Dr Mutitu, KeFRI has started analysing the weed to understand the biology of host plants among...
other issues, with a view of coming up with a mitigation strategy. ‘We are looking for a possibility of chemical control of the weed and in the long term biological control,’ said Dr Mutitu. ‘We are also exploring other avenues including positive uses of Cuscuta,’ he said, referring to a new study published in the American Journal of Agriculture and Forestry, which suggests that the weed could be an important source of medicine.

So far, farmers are using manual methods of control which include uprooting infested plants and burning them. However, in other areas people who are yet to understand the weed preserve it particularly on their fences confusing it is a flower. ‘There is need to sensitise the public on the impact of the dodder weed,’ said Ms Abigael Koech, a phytosanitary expert at the Kenya Plant Health Inspectorate. Dodder’s many other names include love vine, knot weed, strangle weed, strangle vine, angel’s hair, gold-thread, devil’s ringlet, hell-bind, hair weed, devil’s hair, hail weed and witches’ shoelaces.

Daily Nation
May 31 2019

(NB. There have been a number of press reports of new Cuscuta problems in Kenya over the past years. Our attempts to determine exactly which species have been involved have not been successful. It is almost certain that more than one species is involved, but the suggestion that this is C. japonica is alarming as this is a serious invasive species not previously recorded from Africa. It is an Asian species common in eastern Asia. It does not originate from North America as suggested, though it has been introduced to USA as a medicinal herb, and become invasive in parts of California (see Haustorium 51). Our enquiries continue.)

PhD SCHOLARSHIP OPPORTUNITY AT NRI

Innovative fertiliser solutions to combat Striga on smallholder sorghum farms in Africa. Two farmer-preferred Striga control technologies that potentially have the necessary synergy to be integrated are Striga-resistant/tolerant varieties and crop nutrition through fertilisers. A PhD project is offered by Natural Resources Institute (NRI), University of Greenwich, UK, in collaboration with Rothamsted Research, to investigate how this concept can be developed in the most effective and affordable technology for smallholder farming systems. The main supervisor from NRI will be Dr Jonne Rodenburg (j.rodenburg@gre.ac.uk); co-supervision will be provided by Dr Stephan Haefele of Rothamsted Research. Applications need to be made online via https://www.gre.ac.uk/research/study/apply/application-process. In the first part of the application select the following: Agriculture, Health and Environment (MPhil/PhD). The closing date for applications is midnight (UTC) on 31 October 2019. The scholarship must commence before 6 January 2020.

THESIS


Phelipanche ramosa, a.k.a. broomrape, is a parasitic plant of the Orobanchaceae family that infests numerous hosts in Europe and Mediterranean basin. It causes huge yield losses on various crops and especially on oilseed rape whose cultivation is threatened in western France. One of the special features of broomrape is its seed germination. Indeed, broomrape seeds cannot germinate without perceiving a germination stimulant (GS) exuded by its host. Two main types of growth stimulant have been identified hitherto: strigolactones and isothiocyanates. These molecules are known to be exuded by several crops but can also be modified or degraded by microorganisms. Additionally, three P. ramosa genotypes have been distinguished with specific preferential hosts: oilseed rape for genotype 1, hemp for genotype 2a and tobacco for genotype 2b. This study is based on seed samples that cover this genetic diversity. Herein, we observed that seeds coming from different hosts had different sensitivities to growth stimulants.

Concomitantly, we described the bacterial and fungal communities associated with P. ramosa seeds and observed that the originating host of the parasitic seeds was the most influential factor shaping the seed microbiome. We also noticed a terroir effect, especially on fungal communities. Furthermore, we characterize the P. ramosa seed
core microbiome. Thus, this study continues the research effort on broomrape host specialization and highlights the growing evidence of the key role of microbiome in host plant – parasitic plant interactions.

**BOOK REVIEW**

**Strigolactones – Biology and Applications.**

This is an excellent textbook on strigolactones (SLs) for graduate students, postdoctoral fellows, teachers and all scientists who would like to better understand SLs.

SLs were originally identified as germination stimulants for root parasitic weeds and thus, I think, have been well-known chemicals (only?) among IPPS members. In the first decade of this century, SLs have been shown to be not detrimental but beneficial metabolites to plants themselves as they function as rhizosphere signals for symbionts in particular arbuscular mycorrhizal fungi (AMF), and in addition, as a novel class of plant hormones regulating plant architecture and response to abiotic stresses. In the last two decades, biosynthesis, perception, and signal transduction of SLs have been extensively studied but not yet fully characterized.

This book, the fruit of the COST action FA1206 “Strigolactones: biological roles and applications”, contains 6 chapters which were written by experts in each research field.

Chapter 1: Strigolactone Biosynthesis and Signal Transduction
Chapter 2: Strigolactones as Plant Hormones
Chapter 3: Strigolactones and Parasitic Plants
Chapter 4: The Role of Strigolactones in Plant–Microbe Interactions
Chapter 5: Evolution of Strigolactone Biosynthesis and Signalling
Chapter 6: The Chemistry of Strigolactones

In general, all chapters are written carefully in plain English and Figures, Glossaries, and Synopses help readers to understand each topic. As the Editors explain in ‘Introduction’, each chapter starts with a general introduction which enables readers to look deeply into the specific aspects addressed by every single chapter. I strongly recommend this book to all IPPS members who are interested in the biology, genetics, and chemistry of SLs.

I noticed that in most experiments rac-GR24 was used as a standard SL. However, it is a mixture of enantiomers that have different affinities to the receptors, D14 and KAI2. Therefore, optically pure isomer or natural SLs should be used from now on. It is rather easy to separate enantiomer of rac-GR24 for us chemists and thus I encourage biologists to ask chemists for optically pure SLs. Of course, it is preferable to use natural SLs in any experiments. It may be possible to establish plant cell cultures or in vitro cell-free systems for the production of natural SLs. Furthermore, as plants produce and release not a single but a mixture of SLs, effect of different SL mixtures on various biological functions need to be examined in the future.

I noticed some minor mistakes and typos:
- Page 22, Fig. 1.9; The structure of heliolactone needs to be corrected (see Fig. 1.3). MeCLA+18 should be MeCLA+16, conversion of CLA to MeCLA is not catalyzed by MAX1 but by a methyltransferase.
- Page 22, line 4; The enzyme LATERAL…..(LBO) should not be in italic.
- Page 101, Fig. 3.5; The structures of sorgomol and heliolactone should be corrected (see Fig. 6.2 and Fig. 1.3, respectively)
- Page 102, line 4 from the bottom; CCD8 should be in italic.
- Page 104, line 4; ent-2'-epi-orobanchol should be orobanchol to avoid possible confusion.
- Page 105, line 5 from the bottom; physic should be physical
- Page 127, line 2; Kaori et al. 2008 should be Yoneyama et al. 2008 (see Page 140).
- Page 130, 133; diastereoisomers should be stereoisomers (enantiomers); rac-GR24 is a mixture of enantiomers but not of diastereo(iso)mers. See Glossary in Chapter 6.

Page 174, line 2; ‘form’ should read ‘from’??

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**FORTHCOMING MEETINGS**

http://www.iufro2019.com  
Or contact: David Shaw, Oregon State University, dave.shaw@oregonstate.edu

**World Oilseed Congress (WOS)**, Lviv, Ukraine November 6-7, 2019. https://worldoilseed.org/

**International Biological, Agricultural and Life Science Congress (BIALIC)**, Lviv, Ukraine, November 7-8, 2019. https://bialic.org/

**BELATED ACKNOWLEDGEMENT**

For many years I have worked with CABInternational (CABI), writing and editing data sheets on weeds, originally for their Plant Protection CD, later available on line, and then on a broader range of plant species for their Invasive Species Compendium (https://www.cabdirect.org/?target=%2fcabdirect%2fsearch%2f%3fsearchtype%3dadvance-search%26q%3d). For this work I have had access to their very comprehensive database, CAB Direct, ‘the most thorough and extensive source of reference in the applied life sciences’, covering plants generally and not just weeds.

I have always felt that this invaluable source should be acknowledged in Haustorium, but I was anxious that I might be contravening some prohibition against distillation of this sort. I was worried I would be found out and banned from using it any longer!

As my work for CABI had dwindled, my access finally expired and I have had to come clean. Fortunately they have very generously renewed my access to their very comprehensive database, CAB Direct, ‘the most thorough and extensive source of reference in the applied life sciences’, covering plants generally and not just weeds.

Chris Parker.

**GENERAL WEB SITES**

For individual web-site papers and reports see LITERATURE

* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: http://www.parasiticplants.org/

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/

*For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see: http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research

For information on the EU COST 849 Project (now completed) and reports of its meetings see: http://cost849.ba.cnr.it/

For a description of the PROMISE project (Promoting Root Microbes for Integrated Striga Eradication), see: http://promise.nioo.knaw.nl/en/about

*For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/

For the Index of Orobanchaceae prepared by Óscar Sánchez Pedraja, Gerald Schneeweiss and others (updated December 2018), see: http://www.farmalierganes.com/Otrospdf/publica/Orobanchaceae%20Index.htm

For the Annotated Checklist of Host Plants of Orobanchaceae, see: 
http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checlist.htm

For information on the EWRS Working Group ‘Parasitic weeds’ see: http://www.ewrs.org/parasitic_weeds.asp

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/

*For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

For information on future Mistel in derTumortherapie Symposia see:
For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see:
http://www.vfk.ch/informationen/literatursuche
(in German but can be searched by inserting author name).

For the work of Forest Products Commission (FPC) on sandalwood, see:

For 6th Mistletoe Symposium, Germany, November 2015 see:
http://www.sciencedirect.com/science/journal/094447113/22/supp/S1

LITERATURE

*indicates web-site reference only

Items in bold selected for special interest
Items in blue relate to therapeutic uses of parasitic plants

h20) [Intercropping with T. foenum-gracum reduced emergence and underground numbers of O. foetida on both susceptible variety Badi and resistant Najeh, and increase seed yield, particularly in Najeh.]

Abdelhalim, T.S., Babiker, A.G.T. and Finckh. 2019. Effects of powder and aqueous extracts of Euphorbia hirta on Phelipanche ramosa germination and haustorium initiation. Archives of Phytopathology and Plant Protection 51(17-18): 979-992. [Dried powder or aqueous extracts of E. hirta increased germination of P. ramosa and reduced haustorial initiation, suggesting that they could also be used as ‘spot treatments to induce suicidal germination of Striga hermonthica.’]

Abiola, O.A. 2018. Ethnobotanical study of medicinal plants in southwestern Nigeria and traditional healers’ perception of indigenous knowledge digitisation. Inkanyiso: The Journal of Humanities and Social Sciences 10(1): 90-102. [A survey of 18 traditional healers found that Phragmanthera capitata was among the most favoured sources.]

Akhil Saxena, Dwarki Prasad and Rajesh Haldhar. 2018. Investigation of corrosion inhibition effect and adsorption activities of Cuscuta reflexa extract for mild steel in 0.5 M H2SO4. Bioelectrochemistry 124: 156-164. [C. reflexa extract contains 3-methoxy-3,4,5,7-tetrahydroxy flavone, which decreases the corrosion rate of mild steel in acidic medium. The maximum corrosion inhibition efficiency was observed at 500 mg/L inhibitor concentration.]


Akhter, G. and Khan, T.A. 2018. Screening of brinjal (Solanum melongena L.) varieties against obligate root parasite, Orobanche aegyptiaca. Journal of Crop and Weed 14(3): 203-208. [Noting that brinjal is seriously damaged by O. aegyptiaca in Uttar Pradesh, India and reporting that of 30 varieties compared for their susceptibility, only 3 (Mahy 112, Mahy 80 and Nagina) were tolerant, and only one, Mahy Ruby was moderately resistant. None was fully resistant.]


Al-Gburi, B.K.H., Al-Sahaf, F.H., Al-Fadhal, F.A. and del Monte, J.P. 2019. Detection of phytochemical compounds and pigments in seeds and shoots of Cuscuta campestris parasitizing on eggplant. Physiology and Molecular Biology of Plants 25(1): 253-261. [Studying the different content of protein, total phenolic, total soluble carbohydrates, plant hormones and pigments in seeds, and in shoots (flower and filament). ABA content was particularly high in the seeds.]

infected field. BIORXIV pre-print (https://www.biorxiv.org/content/10.1101/602284v2) [Describing a DNA technique for detecting, and distinguishing between, the seeds or other material of Orobanche crenata, O. cumana and Phelipanche aegyptiaca in soil.]

*Aly, R., Lati, R., Abu Nassar, J., Ziadna, H., Achnadari, H., von Münchow, C.S., Wicke, S., Bari, V.K. and Eizenberg, H. 2019. The weedy parasite Phelipanche aegyptiaca attacks Brassica rapa var. rapa L. for the first time in Israel. Plant Disease 103(7): (https://apsjournals.apsnet.org/doi/pdf/10.1094/PDIS-02-19-0285-PDN) [Noting that P. aegyptiaca is the most serious and extensive parasitic weed in Israel and for the first time was found in white turnip as the winter crop following summer tomatoes which were infested with this weed. And using mitochondrial DNA to confirm its distinction from P. ramosa, P. mutelii or P. nana.]


Anusorn, K. and Intanon, S. 2019. Flowering phenology of common Chinese mistletoe (Macrosolex cochinchinensis) and its infestation of jackfruit (Artocarpus heterophyllus).] (in Thai) Kaen Kaset = Khon Kaen Agriculture Journal 47(Suppl.1): 1431-1436. [M. cochinchinensis flowered 2-3 times in 6 months and was continuously flowering and fruiting on jackfruit, A. heterophyllus. There was significant reduction of lead mass in the host.

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_Badu-Apraku, B., Talabi, A.O., Fakorede, M.A.B., Annor, B. Babita Mishra, Sandeep, C., Sushant Arade._

*Germination is best at the alternating temperatures of 20-30°C for _P. pyrifolia_ and _P. mucronatum_ and at a constant 20°C for _S. marginatus_ (parasitising _Citrus sinensis_ and _Annona squamosa_ in Brazil). Light reduced the germination of _P. mucronatum_ and _S. marginatus_ but not _P. pyrifolia_. Germination of all three was improved when the epicarp was removed._

_Badu-Apraku, B., Fakorede, M.A.B., Annor, B. and Talabi, A.O._

*Improvement in grain yield and low-nitrogen tolerance in maize cultivars of three eras. Experimental Agriculture 54(6): 805-823._ [Describing a three-stage breeding programme aimed at resistance to drought, low soil fertility and _Striga hermonthica_. Maize line 2009 TZEE-OR: STR was the most stable, with competitive yield across environments, while 2004 TZEE-W Pop STR C2, and TZEE-W STR 104, TZEE-W STR 108 and 2012 TZEE-W DT STR C2 were high yielding but ‘less stable’.]

_Badu-Apraku, B., Talabi, A.O., Fakorede, M.A.B., Fasanmade, Y., Gedil, M., Magorokosho, C. and Asiedu, R._

*Yield gains and associated changes in an early yellow bi-parental maize population following genomic selection for _Striga_ resistance and drought tolerance. BMC Plant Biology.19(129): 05 April 2019._ [This study demonstrated that genomic selection was effective for yield improvement in the bi-parental maize population under _Striga_-infested environments and resulted in concomitant yield gains under optimal environments. However, due to low genetic variability of most traits in the population, progress from further genomic selection could only be guaranteed if new sources of genes for _Striga_ resistance and drought tolerance are introgressed into the population.]

_Bhat, N.A., Licha Jeri, Yogendra Kumar and Mir, A.H._

*First observation of field dodder and its host range in Meghalaya. Indian Journal of Weed Science 50(2): 192-194._ [ _Cuscuta campestris_ newly recorded from, mainly, _Mikania micrantha_, _Parthenium hysterophorus_ and _Duranta erecta_.]

_Bilas Singh, Singh, G. and Rathore, T.S._

*The effects of woody hosts on _Santalum album_ L. tree growth under agroforestry in semi-arid north Gujarat, India._ Indian Forester 144(5): 424-430.

* Bilgen, B.B., Baru, A.K. and Demirbas, S._

*Genetic characterization of _Orobanche cumana_ populations from the Thrace region of Turkey using microsatellite markers._ Turkish Journal of Botany 43(1): 38-47. [Six populations of _O. cumana_ were found to fall into 2 main clusters. Most variation was within populations.]

_Bradley, L.E., Kelly, C.A. and Bowers, M.D._

*Host plant suitability in a specialist herbivore, _Euphydryas anicia_ (Nymphalidae): preference, performance and sequestration._ Journal of Chemical Ecology 44(11): 1051-1057. [ _E. anicia_ feeds on _Castilleja integra_ in the lab but in the field _mucn prefers Penstemon glabra_ (Plantaginaceae), perhaps due to the presence of the iridoid glycoside macfadienoside in the former.]

_Brotherton, S.J., Joyce, C.B., Berg, M.J. and Awcock, G.J._

*Immediate and lag effects of hydrological change on floodplain grassland plants._ Plant Ecology 220(3): 345-359. [ _Rhinanthus minor_ was soon lost under wetter conditions.]

_Burgess, T.I., Howard, K., Steel, E. and Barbour, E.L._

*To prune or not to prune; pruning induced decay in tropical sandalwood._ Forest Ecology and Management 430: 204-218. [Identifying a wide range of rot fungi in heartwood of _Santalum album_, and recommending pruning when trees are young, preferably at the beginning of the dry season, to decrease the amount of potential decay.]


*STMS (sequence tagged microsatellite site) molecular markers as a valuable tool to confirm controlled crosses in chickpea (_Cicer arietinum_ L.) breeding programs._ Euphytica 214(12): 231. [The technique is being used in_
the search for various disease resistance and for resistance to *Orobanche foetida*.


Chabra, A., Monadi, T., Azadbakht, M. and Haerizadeh, S.I. 2019. Ethnopharmacology of *Cuscuta epithymum*: a comprehensive review on ethnobotany, phytochemistry, pharmacology and toxicity. Journal of Ethnopharmacology 231: 555-569. [A wide-ranging review covering the traditional uses of *C. epithymum* by rural people as a geriatric drug, detergent, purgative, treatment for melancholic humor, joint, kidney, urinary tract, gastrointestinal system, nervous system, *etc*. In modern medicine, the extract shows anti-microbial, cytotoxic, anti-convulsant, anti-urease, immune stimulatory, hepatoprotective effect, and antioxidant activity.]


Chávez-Salcedo, L.F., Queijeiro-Bolaños, M.E., López-Gómez, V., Cano-Santana, Z., Mejía-Recamier, B.E. and Mojica-Guzmán, A. 2018. Contrasting arthropod communities associated with dwarf mistletoes *Arceuthobium globosum* and *A. vaginatum* and their host *Pinus hartwegii*. Journal of Forestry Research 29(5): 1351-1364. [Species richness, abundance and diversity in Central Mexico were significantly different for the three studied plants, as well as sampling month and the interaction of these two factors (except for diversity). The results suggest that the canopy of *P. hartwegii* is an important element in the ecosystem, providing a mosaic of resources and conditions to the associated fauna. It is also proposed that mistletoes are key species within the forest canopy, as they greatly influence the establishment of diverse organisms, particularly arthropods.]

Cheng QingWei and 12 others. 2010. Callus of East Indian sandalwood co-cultured with fungus *Colletotrichum gloeosporioides* accumulates santalenes and bisabolene. Molecules 24(6): 1111. [Callus of *Santalum album* was co-cultured with fungi *C. gloeosporioides*. Analysis of the solvent extract showed the presence of santalenes and bisabolene, precursors of santalol. Another fungus, *Penidiella kurandae*, did not induce santalenes or bisabolene. This study provides an opportunity to further studies on the santanol biosynthetic pathway and the fungal endophyte-plant interaction in sandalwood.]


Chen ZhuLin, Wang XueFeng and Sun HanZhong. 2019. (Diagnosis of total phosphorus content in young sandalwood based on visible light and near infrared images.) (in Chinese) Journal of Beijing Forestry University 41(2): 88-96. [Describing techniques for diagnosis of total P in young sandalwood (*Santalum album*?) helping optimise the use of P fertilizer and avoiding the ecological problems such as groundwater pollution caused by excessive fertilization.]

Chikoye, D., Ekeleme, F., Hauser, S., Menkir, A., Kamara, A.Y., Neuenschwander, P., Ajuonu, O. and Ajeigbe, H.A. 2019. Weeds affecting field crops and water bodies in Africa. In: Neuenschwander, P. and Tamò, M. (eds) Critical issues in plant health: 50 years of research in African agriculture: 365-396. [This IITA publication includes a section on *Striga hermonthica* in maize describing the available methods of control; rotation with legumes including soyabean and cowpea; application of inorganic and organic nitrogen; resistant and tolerant varieties; herbicide-treated seed of herbicide-resistant maize varieties. Some integration of different methods has proved successful but the overall conclusion is that the problem is far from solved. Adoption and integration of available methods is often limited by biophysical and socio-economic factors and there is a pressing need for further research.]

Čiča, K.H. and 7 others. 2019. Characterisation of flavour compounds in Biska - a herbal spirit produced with mistletoe. Journal of the Institute of Brewing 125(1): 143-154. [Detecting 166 aromatic compounds in the spirit distilled from Viscum album known as 'Biska' in Croatia. Major components were ethyl esters (medium and long chain fatty acids), fatty alcohols, isopropyl myristate, aldehyde decanal and some terpenes.]

Cirocco, R.M., Facelli, J.M. and Watling, J.R. 2018. A native parasitic plant affects the performance of an introduced host regardless of environmental variation across field sites. Functional Plant Biology 45(11): 1128-1137. [Results suggest that the native Cassytha pubescens has negative effects on Ulex europaeus in the field in Australia.]


*Clermont K., Yaxin Wang, Siming Liu, Zhenzhen Yang, dePamphilis, C.W., Yoder, J.I., Collakova, E., Westwood, J.H. 2019. Comparative metabolomics of early development of the parasitic plants Phelipanche aegyptiaca and Triphysaria versicolor. Metabolites 2019(9): [A study of amino acid and central carbon metabolites in two parasite species and their hosts over the course of early development from seedlings through host-attached parasites. P. aegyptiaca and T. versicolor differ substantially from each other, likely reflecting different host dependencies.]

Cochavi, A., Ephrath, J., Eizenberg, H. and Rachmilevitch, S. 2018. Phelipanche aegyptiaca parasitism impairs salinity tolerance in young leaves of tomato. Physiologia Plantarum 164(2): 191-203. [Concluding that P. aegyptiaca parasitism reduced the salt tolerance of tomato plants by promoting the accumulation of salts from the rhizosphere and impairing the host's osmotic adjustment ability.]

Coelho, R.P., Feksa, D.L., Oliveira, P.M., Güllich, A.A.daC., Pilar, B.C., Piccoli, J.daC.E. and Manfredini, V. 2018. Protective effect of the hydroalcoholic extract of Tripodanthus acutilifolius in hypercholesterolemic Wistar rats. Biomedicine & Pharmacotherapy 97: 300-309. [Regarding oxidative damage to biomolecules, T. acutilifolius showed a protective effect on lipids, proteins and DNA. Histological analysis of the aortic artery showed that treatment was able to decrease aortic vasculature. Hence, T. acutilifolius is rich in antioxidant compounds and may be an alternative for the treatment of hypercholesterolemia.]


Cui XiangDan, He Xin, Zhu JieBo, Liu LiYuan, Quan JiShu and Yin XueZhe. 2018. (Inhibition of Boschniakia rossica polysaccharides on oxidative stress-induced apoptosis in vascular endothelial cells.) (in Chinese) Shipin Kexue / Food Science 39(9): 127-133. [Polysaccharides from B. rossica had an inhibitory effect on oxidative stress-induced apoptosis in human vascular endothelial cells in vitro, likely through inhibiting mitochondrial apoptosis and death receptor pathways.]

De Novais, L.M.R. and 12 others. 2019. 4′-hydroxy-6,7-methylenedioxy-3-methoxyflavone: a novel flavonoid from Dulacia egleri with potential inhibitory activity against cathepsins B and L. Fitoterapia 132: 26-29. [This flavonoid found to inhibit activity of cathepsins, involved in some types pf cancer.]


Confirming the effectiveness of an ‘electronic tongue’ for discriminating between populations of *C. songaricum* from different parts of the country.


Eom, J. and 9 others. 2018. Pleurodesis using mistletoe extract delivered via a spray catheter during semirigid pleuroscopy for managing symptomatic malignant pleural effusion. Respiration 95(3): 177-181. [Pleurodesis with mistletoe (*Viscum album*) extract delivered via a spray catheter during semirigid pleuroscopy is a safe and effective procedure for managing symptomatic malignant pleural effusion.]

Fadini, R.F., Fischer, E., Castro, S.J., Araujo, A.C., Ornelas, J.F. and de Souza, P.R. 2018. Bat and bee pollination in *Psittacanthus* mistletoes, a genus regarded as exclusively hummingbird-pollinated. Ecology 99(5): 1239-1241. [*P. acinarius* and *P. eucalyptifolius* found to be bat (*Glossophaga soricina* and *Phyllostomus discolor*), and bee (*Centris* and *Neoxylocopa* spp.)-pollinated, respectively, in Brazil.]


Fatima, T., Srivastava, A., Hanur, V.S., Somashekar, P.V. and Rao, M.S. 2019. Genetic diversity estimates of *Santalum album* L. through microsatellite markers: implications on conservation. American Journal of Plant Sciences 10(3): 462-485. [Genetic diversity within and among 14 populations of sandalwood from three states was determined. 97% of the variation was within population and clustering methods gave three groups with admixtures of alleles from different states. It is suggested that populations with high genetic diversity be
conserved to counter genetic erosion owing to harvesting.
Felenda, J.E., Turek, C. and Stintzing, F.C. 2019. Antiproliferative potential from aqueous *Viscum album* L. preparations and their main constituents in comparison with ricin and purothionin on human cancer cells. Journal of Ethnopharmacology 236: 100-107. [Phenolic compounds found in all ‘Iscucin’ (*V. album*) preparations may contribute to the cytotoxic activity of the component ML-1 by antioxidative action. However, further studies are necessary to evaluate the role of another component, VT-A, and possible synergistic actions to the antiproliferative effect of aqueous *V. album* extracts.]
Feng BingWei, Song YongGui, Xu QingMing, Xu PengFei, Zeng Qiang, Shan BaiXi, Liu KuangYi and Su Dan. 2018. Simultaneous determination of savaside A, acteoside, and isoacteoside in rat plasma by UHPLC-MS/MS: comparative pharmacokinetic and bioavailability characteristics of *Monochasma savatieri* via different routes of administration. Journal of Separation Science 41(24): 4408-4418. [Comparing different methods of extraction and application of *M. savatieri* (Orobanchaceae) as a traditional medicine in China.]
Fjordheim, K., Moen, A., Hjelle, K., Bjune, A.E. and Birks, H.H. 2018. Modern pollen-vegetation relationships in traditionally mown and unmanaged boreal rich-fen communities in central Norway. Review of Palaeobotany and Palynology 251: 14-27. [Proposing that the presence of ‘*Pedicularis*-type’ pollen suggests that the site had been subject to mowing in the past.]
Fontúrbel, F.E., Bruford, M.W., Salazar, D.A., Cortés-Miranda, J. and Vega-Retter, C. 2019. The hidden costs of living in a transformed habitat: ecological and evolutionary consequences in a tripartite mutualistic system with a keystone mistletoe. Science of the Total Environment 651(2): 2740-2748. [Studying the variability in the mistletoe *Tristerix corymbosus*, its pollinator (*Sephanoides sephaniodes*) and its seed disperser (*Dromiciops gliroides*) in a ‘transformed habitat’ and finding that the mistletoe may be resilient but its highly specialized interactions along with changes in its spatial configuration depict a more complex scenario, which probably impose a cost in terms of lower genetic diversity and increased relatedness that might compromise its long-term viability.]
Interestingly, both rhizobium inoculation and N addition significantly increased biomass of C. australis, and both parasitism by C. australis and N addition significantly reduced biomass of rhizobia. Therefore, parasitic plants can benefit from rhizobia and N addition via improved host (soyabean) growth. Rhizobia suffer from parasitic plants by competing with them for photosynthetic carbon from the host, and from high N supply likely because high N reduces their affinity for symbiotic partnerships with the host. Our results highlight the complex cascading effects of biotic and abiotic interactions via host plants.

Göl, Ç., Serdar, B., Öztürk, M., Coşkuner, K.A. and Bİlgİlİ, E. 2018. (The effect of pine mistletoe (Viscum album L. subsp. austriacum (Wiesb.) Vollman) on wood anatomy of Scots pine (Pinus sylvestris L.).) (in Turkish) Düzce Üniversitesi Bilim ve Teknoloji Dergisi / Duzce University Journal of Science & Technology 6(4): 1354-1363. [Certain parameters of the wood structure of P. sylvestris were found to be reduced by up to 80% by V. album.]


Guo YuanHeng, Cao LiLi, Zhao Bing, Zhao QingSheng, Huang YuanRong and Xiao ChuanMing. 2018. Hepatoprotective effect of phenylethanoid glycosides from Cistanche deserticola against chronic hepatic injury induced by alcohol. Shipin Kexue / Food Science 39(13): 176-183. [Results indicate that the glycosides from C. deserticola possess hepatoprotective properties against chronic alcohol-induced liver injury, the mechanisms involving the modulation of related enzyme (including superoxide dismutase, glutathione S-transferase, glutathione peroxidase) activities and the reduction of lipid peroxidation products such as malondialdehyde.]

Hagos Kidane and Tsehayehu Brhanie. 2018. Improving faba bean production of smallholder farmers’ through on-farm popularization of Orobanche crenata tolerant variety in southern Tigray, north Ethiopia. International Journal of Agriculture and Biosciences 7(4): 229-235. [Commenting that the relatively newly-introduced O. crenata is now ‘the main constraint of faba bean production in the highland areas of southern Tigray, and can cause up to 100% yield loss.’ Trials over two seasons, with the tolerant variety ‘Hashenge’ (previously known as ILB4358) gave substantially higher yields than local varieties and was favoured by a large majority of farmers on most of its characteristics, other than being late maturing and not having good flavour in the local ‘wat’ dishes.]

*Heidari, M. and Bayat, M. 2018. (Investigating the oak trees with different dimensions contaminated by Loranthus europaeus in the middle Zagros (case study: Gilan-e Gharb, Kermanshah).) (in Persian) Iranian Journal of Forest and Range Protection Research 16(1): Pe35-Pe46. (http://ijfrpr.areeo.ac.ir/article_117131_f44168dc4e1c620ebd2559001ed942.pdf) [A survey of 9 tree species, dominated by Quercus brantii, concluding that the level of infection by L. europaeus was closely correlated with tree size.]

Herawan, T. and Putri, A.I. 2018. (Influence of arbuscular mycorrhiza and Portulaca sp. host to acclimatization of cendana (Santalum album L.) plantlets.) (in Indonesian) Jurnal Pemuliaan Tanaman Hutan 12(2): 157-165. [Showing that mycorrhiza are important to prevent mortality of S. album plantlets on P. oleracea.]

Hödär, J.A., Lázaro-González, A. ad Zamora, R. 2018. Beneath the mistletoe: parasitized trees host a more diverse herbaceous vegetation and are more visited by rabbits. Annals of Forest Science 75(3): 77. [A study in SE Spain, concluding that parasitism by Viscum album, by creating patches of greater nutrient availability under the host canopy, extends its effects beyond the host tree to other members of the forest community, which in turn contributes to environmental heterogeneity with their activity.]

Honsa, Z.L., Mashtoubabc, S., Howarthabd, G.S., Honsab, L.C.C., Simsone, L., Cheahbf, K.Y. and Bastianf, S.E.P. 2018. Comparative effects of mistletoe extracts in combination with 5-Fluorouracil on viability of IEC-6 and Caco-2 intestinal epithelial cells. Australian Journal of Herbal and Naturopathic Medicine 30(4): 174-179. [Extracts of Viscum album from three different hosts were compared. Those from Fraxinus were most potent in reducing colon cancer cell viability. Those from Malus were least effective and those from Quercus were intermediate. Some activation was apparent in combination with 5-fluorouracil.]


Huish, R. and Klopf, R. 2018. Environmental correlates to population structure and health of the rare piratebush (Buckleya distichophylla) within Poor Mountain Natural Area Preserve, Virginia. Natural Areas Journal 38(2): 148-153. [Concluding that successful sexual reproduction within this piratebush population may be rare, and establishing a detailed baseline assessment of the largest extant piratebush population, enabling future study of factors relevant to the long-term viability of this species.]

Imerovski, I., Dedić, B., Cvejić, S., Miladinović, D., Jocić, S., Owens, G.L., Tubić, N.K. and Rieseberg, L.H. 2019. BSA-seq mapping reveals major QTL for broomrape resistance in four sunflower lines. Molecular Breeding 39(March 2019): 41. (https://link.springer.com/article/10.1007%2Fs11032-019-0948-9) [Four F3 families of sunflower from Serbia, Spain, Romania and Romania were phenotyped for resistance to Orobanche cumana race G. Resistance was polygenic and numerous QTLs were identified, including a new QTL or3.2 on chromosome 3 which was found to be consistently associated with resistance to race G.]


*Jamili, M. and 13 others including Al-Babili, S. 2019. Methylation at the C-3' in D-ring of strigolactone analogs reduces biological
activity in root parasitic plants and rice. Frontiers in Plant Science 2 April 2019. (https://www.frontiersin.org/articles/10.3389/fpls.2019.00353/full) [Describing the greatly increased activity of previously published strigolactone analogues, AR8 and AR36 after de-methylation, yielding MP13 and MP26 respectively which showed enhanced promise as triggers for suicidal germination of Striga hermonthica.]

Jia Dan, Xu Shuo, Sun Jie, Zhang ChuanBo, Li DasHuai and Lu WenYu. 2019. Yarrowia lipolytica construction for heterologous synthesis of α-santalene and fermentation optimization. Applied Microbiology and Biotechnology 103(8): 3511-3520. [Describing the synthesis of ɑ-santalene by Yarrowia lipolytica, an oleaginous yeast, which has been metabolically engineered to produce valuable compounds such as terpenoids and biofuel.]


Keskln, D. and Ceyhan-Guvensen, N. 2018. Determination of bioactive components and antimicrobial activity of methanolic extracts of mistletoe leaves (Viscum album L. subsp. album L.). Fresenius Environmental Bulletin 27(12): 7991-7996. [Ethanol, methanol, hexane, chloroform, isopropanol and water extracts of leaves of V. album were compared for their antimicrobial activity against 11 bacteria and one yeast. The methanolic extract was the most effective against Streptococcus faecalis and Bacillus subtilis.]

*Kim EunSun, Zaya, D.N., Fant, J.B. and Ashley, M.V. 2019. Reproductive trade-offs maintain bract color polymorphism in scarlet Indian paintbrush (Castilleja coccinea). PLoS ONE 14(1): e0209176. (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0209176) [Results indicate that the red-bract form has higher seed set when cross-pollinated, but the yellow-bract form has higher seed set when not self-pollinated. Such reproductive assurance, which would be important for fluctuations in pollinator abundance or colonizing new areas, may act as a selective agent to maintain such polymorphisms.]

Kim YoungHoon, Kim InBo, Park ChoonHo and Kim JongBae. 2018. Korean mistletoe lectin enhances natural killer cell cytotoxicity via upregulation of perforin expression. Asian Pacific Journal of Allergy and Immunology 36(3):175-183. [Demonstrating that the signal transduction controlling NK lymphocyte cytotoxicity was mediated by upregulation of the NKGD2 receptor and expression of a cytotoxic effector molecule. These results suggested that lectin from Viscum album coloratum possessed immunological activity, mediated by NK cell activation.]

Klutsch, J.G. and Erbilgin, N. 2018. Dwarf mistletoe infection in jack pine alters growth-defense relationships. Tree Physiology 38(10):1538-1547. [Studying the defence reactions of Pinus banksiana to infection by Arceuthobium americanum shows the long term affect on phloem resistance and radial growth. Resource allocation by the host is long lasting and will affect later infections.]
(https://royalsocietypublishing.org/doi/full/10.1098/rsbl.2018.0240) [Coming to the slightly surprising conclusion that there were no detrimental effects of Phoradendron villosum on Quercus douglasii, Quercus kelloggii or Quercus lobata. This species therefore resembles an epiphyte more than a parasite - and provides important ecosystem services.]

Kong ZweiLing, Johnson, A., Ko FanChi, He JiaLing and Cheng ShuChunL. 2018. Effect of Cistanche tubulosa extracts on male reproductive function in streptozotocin-nicotinamide-induced diabetic rats. Nutrients 10(10): 1562. [The presence of echinacoside in extracts of C. tubulosa is known to improve memory and sexual ability, reduce impotence, and minimize constipation. This study confirmed that it also has antioxidant, anti-inflammatory, and steroidogenesis effects.]

* Kountche, B.A., Jamil, M., Yonli, D., Nikiema, M.P., Blanco-Ania, D., Asami, T., Zwanenburg, B. and Al-Babili, S. 2019. Suicidal germination as a control strategy for Striga hermonthica (Benth.) in smallholder farms of sub-Saharan Africa. People, Plants, Planet 1(2): 107-118. (https://nph.onlinelibrary.wiley.com/doi/10.1002/ppp3.32) [Pot and field experiments, conducted with the stimulants, Nijmegen-1, GR24, MP1 and MP2 gave varying results, affected by soil type and crop (sorghum or millet). But up to 60% reduction in emergence of S. hermonthica was achieved in best conditions. MP1 gave the best results. Overall they confirm that the technique is worth further development.]


* Kovar, L. and 12 others. 2018. PacBio-based mitochondrial genome assembly of Leucaena trichandra (Leguminosae) and an intrageneric assessment of mitochondrial RNA editing. Genome Biology and Evolution 10(9): 2501-2517. (https://academic.oup.com/gbe/article/10/9/2501/5076815) [The mitochondrial genome of Leucaena was compared to those from 7 other legumes, 8 diverse angiosperms, and Lophophyllum mirabile (Balanophoraceae). It was previously shown (Sanchez-Puerta et al. 2017) that for the latter, 80% of its protein coding genes are derived from its legume host through horizontal gene transfer.]

Krishnakumar, N. and Parthiban, K.T. 2018. Comparison of phytochemical constituents of the identified sandalwood (Santalum album L.) genetic resources in India. Journal of Essential Oil-Bearing Plants 21(3): 658-666. [Forty-five constituents of the oil from S. album were identified, α and β-santalol being the most important for quality. Identifying the regions of India with the highest santalol content.]

* Krupp, A., Heller, A. and Spring, H. 2019. Development of phloem connection between the parasitic plant Orobanche cumana and its host sunflower. Protoplasma 13 pp. (https://link.springer.com/article/10.1007/s00709-019-01393-z) [Describing the ultrastructure of the phloem elements, very intermixed in the haustorium, but the sieve-element plastsids of the O. cumana were larger, often irregular in shape and contained few, small starch inclusions, while those of the host were significantly smaller, always roundish with more and larger starch inclusions. This made it possible to trace the exact contact site of host and parasite sieve elements to show a direct symplastic phloem connection between the two species. Also showing that undifferentiated cells of the parasite could connect to fully differentiated sieve elements of the host.]

Kubiczek, J., Špinlerová, Z., Michalko, R., Vrška, T. and Matula, R. 2018. Temporal dynamics and size effects of mistletoe (Loranthus europaeus Jacq.) infection in an oak forest. Austrian Journal of Forest Science/Centralblatt für das gesamte Forstwesen 135(2): [Studying the development of L. europaeus on Quercus petraea with time and the size of the host in the Podyji National Park, Czech Republic, concluding that the rate of infestation was rapid in young trees and declined with host age.]

small mammals predated a flower bud of \textit{R. patma} in West Java, Indonesia, one of which has not previously been identified as a predator of \textit{Rafflesia} flowers. Also detected was a wasp infection in \textit{R. rochussenii} and predation by another animal on \textit{R. zollingeriana}. Overall, flower bud predation by animals damaged up to 10\% of the surveyed flowers.

\textbf{Lans, C.} 2019. Do recent research studies validate the medicinal plants used in British Columbia, Canada for pet diseases and wild animals taken into temporary care? Journal of Ethnopharmacology 236: 366-392. [\textit{Viscum album} among plants used to treat heart problems in pets.]

\textbf{Lázaro-González, A., Hódar, J.A. and Zamora, R.} 2019. Mistletoe versus host pine: does increased parasite load alter the host chemical profile? Journal of Chemical Ecology 45(1): 95-105. [Assessing needles of \textit{Pinus nigra} subsp. \textit{salzmannii} for changes induced by infection with \textit{Viscum album} ssp. \textit{austriacum} and finding the content of monoterpenes to increase with level of parasitism while content of N decreased. These changes corresponded with the effects of other stresses. Low levels induced reactions resembling those against drought while medium and high parasitism elicited responses comparable to those against burning and defoliation.]

\textbf{Li MengJiao, Chen Qing, Li Ting, Ye WanHui and Shen Hao.} 2018. (Influence of parasitic plant \textit{Cuscuta campestris} on leaf chlorophyll fluorescence parameters of five mangrove species.) (in Chinese) Guangxi Zhiwu / Guihaia 38(10): 1261-1266. [Confirming that \textit{C. campestris} was unable to establish on mangrove species (\textit{Acanthus ilicifolius}, \textit{Bruguiera gymnorrhiza} and \textit{Kandelia candel}) or on associated species \textit{Cerbera manghas} and \textit{Heritiera littoralis}. Hence it was safe to use \textit{C. campestris} to control \textit{Mikania micrantha} (in China).]

\textbf{Chen Xin-lian, Cui Ying-xian, Xu Zhi-chao, Li Yong-hua, Song Jing-yuan, Duan Bao-zhong and Yao Hui.} 2017. Gene losses and partial deletion of small single-copy regions of the chloroplast genomes of two hemiparasitic \textit{Taxillus} species. Scientific Reports 7, 12834. (https://www.nature.com/articles/s41598-017-13401-4) [The complete chloroplast genomes of two \textit{Taxillus} species, \textit{T. chinensis} and \textit{T. sutchuenensis}, are reported (first for Loranthaceae) that are 121-122 kb in size, smaller than relatives owing to the loss of all \textit{ndh} genes, ribosomal protein genes, \textit{trnA} genes, \textit{ycf} genes, and the \textit{infA} gene.]

\textbf{Lin MingKuem, Lee MengShiou, Huang HuiChi, Cheng TunJen, Cheng YihDih and Wu ChiRei.} 2018. \textit{Cuscuta chinensis} and \textit{C. campestris} attenuate scopolamine-induced memory deficit and oxidative damage in mice. Molecules 23(12): 3060. (https://www.mdpi.com/1420-3049/23/12/3060/htm) [Demonstrating that both \textit{Cuscuta} species exhibited a protective activity against SCOP-induced memory deficit, cholinergic dysfunction, oxidative damage and neuro-inflammation in
mice. *C. campestris* showed better potential than *C. chinensis.*

Liu XiaoJin, Xu DaPing, Yang ZengJiang, Zhang NingNan and Pan LiJun. 2018. Investigation of exogenous benzyladenine on growth, biochemical composition, photosynthesis and antioxidant activity of Indian sandalwood (*Santalum album* L.) seedlings. Journal of Plant Growth Regulation 37(4): 1148-1158. [Results suggest that suggested that leaf application of 1 mg L$^{-1}$ benzyladenine was the most suitable concentration for enhancing seedling quality during the nursery period.]


Lombo, O., Lykke, A.M., Lankoandé, B. and Ouédraogo, A. 2018. Influence of climate on fruit production of the yellow plum, *Ximenia americana*, in Burkina Faso, West Africa. Journal of Horticulture and Forestry 10(4): 36-42. [Determining that the optimum climate for *X. americana* was in the south-Sudanian phytogeographic zone, with a mean fruit weight per tree of 1.49±0.26 kg while the lowest value was observed in the sub-Sahel zone, with 0.67±0.11 kg.]


*López-Rodríguez, R., Herrera-Ruiz, M., Trejo-Tapia, G., Dominguez-Mendoza, B.E., González-Cortazar, M. and Zamilpa, A. 2019. In vivo gastroprotective and antidepressant effects of iridoids, verbascoside and tenuifloroside from *Castilleja tenuiflora* Benth. Molecules 24(7): 1292. (https://www.mdpi.com/1420-3049/24/7/1292/htm) [Finding that verbascoside, tenuifloroside and mixture geniposide/musseanoside all displayed gastroprotective effects and antidepressant activity and were likely to be the active ingredients of *C. tenuifolia*, used medicinally in Mexico.]

Ma XueQin, Liu JingJing, Yang LingLing, Zhang Bo, Dong YanHong and Zhao QiPeng. 2018. *Cynomorium songaricum* prevents bone resorption in ovariectomized rats through RANKL/RANK/TRAF6 mediated suppression of PI3K/AKT and NF-κB pathways. Life Sciences 209:140-148. [*C. songaricum* exhibited potential therapeutic effect on bone metabolism of ovariectomized rats, and this effect was possibly exerted by RANKL/RANK/TRAF6 mediated down-regulation of NF-κB and PI3K/AKT pathways.]

*McKibben, M. and Henning, J.A. 2018. Hemiparasitic plants increase alpine plant richness and evenness but reduce arbuscular mycorrhizal fungal colonization in dominant plant species. PeerJ 6: 5682. (https://peerj.com/articles/5682/) [Finding that the presence of *Castilleja* spp. (*C. angustifolia*, *C. miniata* and/or *C. sulphurea*) was associated with an 11% increase in plant richness and a 5% increase in plant evenness, regardless of elevation; also that it reduced mycorrhizal fungal colonization within dominant plant species by ~20%, regardless of elevation (in California).]

and Steppe, K. 2018. Can UAV-based infrared thermography be used to study plant-parasite interactions between mistletoe and eucalypt trees? Remote Sensing 10(12): 2062. (https://www.mdpi.com/2072-4292/10/12/2062/htm) [Using thermal imagery to confirm that mistletoes (apparently several species but none named) have significantly lower temperature by 0.2-0.3°C and can confirm their presence in the canopies of Eucalyptus fibrosa and E. moluccana with infection rates of 69-75%.]

*Maisetta, G., Batoni, G., Caboni, P., Esin, S., Rinaldi, A.C. and Zucca, P. 2019. Tannin profile, antioxidant properties, and antimicrobial activity of extracts from two Mediterranean species of parasitic plant Cytinus. BMC Complementary and Alternative Medicine 19(82): 5 April 2019. (https://link.springer.com/article/10.1186/s12887-019-1740-z) [The profiles of C. hypocistis and C. ruber revealed significant amounts of gallotannins, in particular 1-O-galloyl-β-D-glucose. In addition, pentagalloyl-O-β-D-glucose was present in all extracts. These are likely to be the active compounds contributing to their antioxidant and antimicrobial activities.]


Mao ChangLi, Wu Yu, Zhang FengLiang and He MeiYing. 2019. (Genetic diversity of Scleropyrum wallichianum based on AFLP markers.) (in Chinese) Journal of Tropical and Subtropical Botany 27(1): 29-35. [Scleropyrum wallichianum (= S. pentandrum) is a root parasitic tree in Cervantesiaceae. Genetic diversity was assessed using AFLP markers obtained from seven populations from Yunnan Province. 88.5% of the variation existed within populations, thus in situ and ex situ protections were proposed to increase genetic diversity.]

Mao JiHua, Jia DaiShun, Chen Fu, Jing YueBo, Li RongBo, Li YongPeng, Chen ZhongHua and Li Jiang. 2018. (Hypocotyle grafting techniques of rare and endangered plant Malania oleifera.) (in Chinese) Journal of West China Forestry Science 47(5): 39-45. [Optimum grafting techniques for the ‘rare and endangered’ M. oleifera (Olacaceae) were: grafting in early June, cut-grafting, semi-lignified scion, retaining half a leaf, grafting at 6 cm height of hypocotyle, covering the grafting part with grafting membrane, growing the grafted plantlet with medium formula of 50% yellow sub-soil+20% +10% vermiculite +10% perlite +10% calcium magnesium phosphate fertilizer, and shading with 60% shade net.]


Maul. K., Krug, M., Nickrent, D.L., Müller, K.F., Quandt, D. and Wicke S. 2019. Morphology, geographic distribution and host preference are poor predictors of phylogenetic relatedness in the mistletoe genus Viscum L. Molecular Phylogenetics and Evolution 131:106-115. [Nuclear ITS and chloroplast markers were used to generate a molecular phylogeny for 59 (of the ca. 120 species). Viscum originated in Africa and diversified via geographic isolation following long-distance dispersal to continental Asia and Australia. Multiple
switches from ancestral dioecy to monoecy occurred as well as multiple cases of the evolution of scale leaves.]

Mejri, S., Mabrouk, Y., Belhadj, O. and Saidi, M. 2018. Orobanche foetida resistance in two new faba bean genotypes produced by radiation mutagenesis. International Journal of Radiation Biology 94(7): 671-677. [Confirming that low induction of seed germination is a major component of resistance to O. foetida in the resistant variety Badi and two mutant lines P2 M3 and P7 M3. A parallel reduction in infection was accompanied by the continuous enhancement of the peroxidase activity, the polyphenol oxidase activity and the phenylalanine ammonia lyase activity in faba bean roots.]

*Misse, P.T.E. 2019. Development project to allay poverty and food insecurity in the north and far-north regions of Cameroon. SSRN Electronic Journal: 12 pp. (https://ssrn.com/abstract=3328098) [Describing a project aiming to overcome constraints on productivity in N. Cameroon. with particular emphasis on Striga hermonthica. Proposing three strategies: increased soil organic matter, legume rotations or intercrops, and growing Striga trap crops or non-host crops.]


Mursidawati, S., Wicaksono, A. and Teixeira da Silva J.A. 2019. Development of the endophytic parasite, Rafflesia patma Blume, among host plant (Tetrastigma leucostaphylum (Dennst.) Alston) vascular cambium tissue. South African Journal of Botany 123: 382-386. [An anatomical study that confirms previous observations (e.g. Nikolov et al. 2014 Annals of Botany 114:233). [The authors indicate that the endophyte spreads within the host vascular cambium in a linear manner, but not as a continuous strand.]

Mutuku, J.M. and eleven others. 209. The structural integrity of lignin is crucial for resistance against Striga hermonthica parasitism in rice. Plant Physiology 179(4): 1796-1809. [The results demonstrate that enhanced lignin deposition and maintenance of the structural integrity of lignin polymers deposited at the infection site are crucial for the post-attachment resistance of rice variety Nipponbare against S. hermonthica.]

Nadİroğlu, M., Behçet, L. and Çakılcıoğlu, U. 2019. An ethnobotanical survey of medicinal plants in Karlıova (Bingöl-Turkey). Indian Journal of Traditional Knowledge 18(1): 76-87. [Rhinanthus serotinus ssp. aestivalis among species not previously recorded locally as medicinal herbs.]

Nave, L.E., Heckman, K.A., Muñoz, A.B. and Swanston, C.W. 2018. Radiocarbon suggests the hemiparasitic annual Melampyrum lineare Desr. may acquire carbon from stressed hosts. Radiocarbon 60(1): 269-281. [By girdling host trees and comparing the parasites response to non-girdled the authors indicate that the parasite takes more carbon and nitrogen from stressed trees.]

Ortiz, S., Lecsö-Bornet, M., Bonnal, C., Houze, S., Michel, S., Grougnet, R. and Boutefnouchet, S. 2019. Bioguided identification of triterpenoids and neolignans as bioactive compounds from anti-infectious medicinal plants of the Taira Atacama’s community (Calama, Chile). Journal of Ethnopharmacology 231: 217-229. [Gram positive strains of clinical interest were highly sensitive to *Krameria lappacea*. A bioguided approach led to identification of conocarpan as the main bioactive compound.]

Osunlana, O.R., Bello, M.O., Johnson, J.A. and Afolabi, O.B. 2018. Antioxidant, compositional evaluation and blood pressure modulating potentials of *Bryophyllum pinnatum* (Lam.), *Viscum album* (L.) and *Artocarpus altilis* (Parkinson) leave extracts. Potravinárstvo: Slovak Journal of Food Sciences 12(1): 422-430. [Antioxidant activity of *V. album* was intermediate between that of the other two species. All considered to be of value in treatment of high blood pressure.]

Öztürk, L., Sİvrİ, N., Şİn, B. and Kadıoglu, İ. 2018. Host range and distribution of European mistletoe *Viscum album* in Northwestern Marmara, Turkey. IX International Scientific Agriculture Symposium "AGROSYM 2018", Jahorina, Bosnia and Herzegovina, 4-7 October 2018. Book of Proceedings, 1075-1080. [A survey confirmed occurrence of *V. album* on wild pear, pear, almond, plum, apricot, oak, spruce tree, willow, and poplar trees in Edirne, Kırklareli and Tekirdağ provinces. Cherry and pear were the most seriously damaged, to the point of tree death under the most dense infestations.]

Park InKyu, Yang SungYu, Kim WookJin, Noh PuReum, Lee HyunOh and Moon ByeongCheol. 2018. The complete plastome of *Cuscuta pentagona* Engelm. Mitochondrial DNA Part B 3(2): 523-524. [Complete chloroplast genome sequences for seven taxa exist in Genbank: *C. campestris* (not *C. gronovii*), *C. chinensis*, *C. exaltata*, *C. japonica*, *C. obtusiflora*, *C. “pentagona”*, and *C. reflexa*. As pointed out by Costea and Stefanović in Haustorium 68, *C. pentagona* is often confused with *C. campestris*. The size of the plastome reported here is 86.38 kb whereas the previously misidentified one is 86.74. The voucher specimen should be checked.]

Park JongHeum, Kim YoNa, Kim JaeKyung, Park HaYoung and Song BeomSeok. 2019. Viscothionin purified from mistletoe (*Viscum album var. coloratum* Ohwi) induces insulin secretion from pancreatic beta cells. Journal of Ethnopharmacology 234: 172-179. [The study indicates that the hypoglycemic effect of *V. album* is mediated by its insulinotropic action and α-glucosidase inhibitory activity, and the effect is due to viscothionin, one of its major bioactive constituents.]


Pei WenJing, Guo RuiLi, Zhang JinLi and Li XueQin. 2019. Extraction of phenylethanoid glycosides from *Cistanche tubulosa* by high-speed shearing homogenization extraction. Journal of AOAC International 102(1): 63-68. [Describing an improved method for extraction of echinacoside and acteoside themain active ingredients in *C. tubulosa*.]

Petersen, G., Zervas, A., Pedersen, HÆ. and Seberg, O. 2018. Genome Reports: Contracted genes and dwarfed plastome in mycoheterotrophic *Sciaphila thaidanica* (Triuridaceae, Pandanales). Genome Biology and Evolution 10: 976–981. [The mycoheterotrophic plant *Sciaphila thaidanica* has a tiny plastome, only 12.7 kb in size and it contains only 20 potentially functional housekeeping genes.]


Putri, A.I. and Herawan, T. 2018. (Rooting regeneration of in vitro and ex vitro plantlets of cendana (Santalum album Linn.) tissue culture.) (in Indonesian) Jurnal Pemuliaan Tanaman Hutan 12(2): 147-155. [Comparing two clones and finding significant differences in the root regeneration of plantlets of S. album, one showing much stronger secondary root regeneration, favourable for success in acclimatisation.]

*Quintana-Rodríguez, E., Ramírez-Rodriguez, A.G., Ramírez-Chávez, E., Molina-Torres, J., Camacho-Coronel, X., Espanza-Claudio, J., Heil, M. and Orona-Tamayo, D. 2108. Biochemical traits in the flower lifetime of a Mexican mistletoe parasitizing mesquite biomass. Frontiers in Plant Science 2018(9): 1031. (https://www.frontiersin.org/articles/10.3389/fpls.2018.01031/full) [Studying, in impressive detail, the sequence of events in production and quality of nectar in Psittacanthus calycatus over a mainly 3-day period. Although it refers to nectar secretion as “the only” reward to engage flower visitors (mainly humming birds), it also refers to volatiles, the most important of which was β-ocimene.]

Rai, I.D., Manish Bhardwaj, Gautam Talukdar, Rawat, G.S. and Sambandham Sathyakumar. 2018. Large scale infestation of Blue pine by Himalayan dwarf mistletoe in the Gangotri National Park, Western Himalaya. Tropical Ecology 59(1): 157-161. [Recording extensive infestation of Pinus wallichiana by Arceuthobium minutissimum in N. India, not previously reported. It is possibly being supported by climate change.]


Ribeiro, D.A. and 9 others. 2019. Conservation priorities for medicinal woody species in a cerrado area in the Chapada do Araripe, northeastern Brazil. Environment, Development and Sustainability 21(1) 61-77. [Including Ximenia americana among ‘priority species’.]

Risberg, B. 2019. (Flora in Altai and northwestern Mongolia.) (in Swedish) Svensk Botanisk Tidskrift 113(2): 127-133. [Calling for help in identifying Pedicularis spp. which are well represented in this region.]

Rodriguez-Mendieta, S., Lara, C. and Ornelas, J.F. 2018. Unravelling host-mediated effects on hemiparasitic Mexican mistletoe Psittacanthus calycatus (DC.) G. Don traits linked to mutualisms with pollinators and seed dispersers. Journal of Plant Ecology 11(6): 827-842. [Studying the flower morphology, nectar production, pollinator visitation rate and female reproductive fitness of P. calycatus populations on cultivated host species Crataegus mexicana and native hosts Quercus cerris and Prunus serotina at three different locations. Hummingbird visitation and pollen production were highest when host was C. mexicana while there were larger flowers, fruits and seeds on the other hosts. The effects of host species, study site and floral trait covariates significantly affected all fitness measures, indicating that the reproductive fitness of the mistletoe is affected differently depending on the host species and their site of occurrence.]
Ronald, M., Charles, M., Stanford, M. and Eddie, M. 2019. Mulching offers protection from *Striga asiatica* L. Kutnze parasitism in sorghum genotypes. Acta Agriculturæ Scandinavica, Section B - Soil & Plant Science 69(2):167-173. [Assessing the susceptibility of 10 sorghum genotypes to *S. asiatica* at two levels of mulching in pots in South Africa. Genotypes Mukadziusaende, Chiredhi and Hlubi were able to maintain height despite infestation by *Striga*. Mulching was beneficial in most cases. *S. arundinaceum* was highly susceptible.]


Schneider, A.C., Braukmann, T., Arjan Banerjee and Stefanović, S. 2018. Convergent plastome evolution and gene loss in holoparasitic Lennoaceae. Genome Biology and Evolution 10(10): 2663-2670. [The plastomes of two species, *Lennoa madreporoides* and *Pholisma arenarium*, are 83.6 and 81.2 kb in size, respectively. Some genes are under relaxed selection (e.g. many associated with photosynthesis) whereas others appear to be under purifying selection, e.g. *rbcL*, suggesting a nonphotosynthetic function.]

Schöfferl, S., Huber, S.M., Lentzen, H., Mittelbronn, M. and Naumann, U. 2018. Adjuvant therapy using mistletoe containing drugs boosts the T-cell-mediated killing of glioma cells and prolongs the survival of glioma bearing mice. Evidence-based Complementary and Alternative Medicine 2018: ID 3928572. [Treatment of glioblastoma cells with ISCADOR Qu that contains a high mistletoe (*Viscum album*) lectin concentration, but also viscontoxins and other compounds, as well as with Aviscumine or...]


[Concluding from studies of the mycoheterotrophic orchids *Epipogium aphyllum* and *E. roseum* and *Hypopitys monotropa* (Ericaceae) that full heterotrophy leads to profound changes in nuclear gene content. The observed increase in the rate of nucleotide substitutions is lineage specific, rather than a universal phenomenon among non-photosynthetic plants.]


Schneider, A.C., Braukmann, T., Arjan Banerjee and Stefanović, S. 2018. Convergent plastome evolution and gene loss in holoparasitic Lennoaceae. Genome Biology and Evolution 10(10): 2663-2670. [The plastomes of two species, *Lennoa madreporoides* and *Pholisma arenarium*, are 83.6 and 81.2 kb in size, respectively. Some genes are under relaxed selection (e.g. many associated with photosynthesis) whereas others appear to be under purifying selection, e.g. *rbcL*, suggesting a nonphotosynthetic function.]

*Schöfferl, S., Huber, S.M., Lentzen, H., Mittelbronn, M. and Naumann, U. 2018. Adjuvant therapy using mistletoe containing drugs boosts the T-cell-mediated killing of glioma cells and prolongs the survival of glioma bearing mice. Evidence-based Complementary and Alternative Medicine 2018: ID 3928572. ([https://www.hindawi.com/journals/ecam/2018/3928572/][2]) [Treatment of glioblastoma cells with ISCADOR Qu that contains a high mistletoe (*Viscum album*) lectin concentration, but also viscontoxins and other compounds, as well as with Aviscumine or...]
native ML-1, enhanced the expansion of cancer cell-specific T-cells as well as T-cell-mediated tumor cell lysis. They further modulated the expression of immune response associated genes, such that in vivo, subcutaneous ISCADOR Qu injections at increasing concentration induced cytokine release in immunocompetent VM/Dk-mice. Finally, ISCADOR Qu, if applied in combination with tumor irradiation and TMZ, further prolonged the survival of glioma mice.

Schweiger, J.M I., Kemnade, C., Bidartondo, M.I. and Gebauer, G. 2019. Light limitation and partial mycoheterotrophy in rhizoctonia-associated orchids. Oecologia 189(2): 375-383. [Concluding that both Neottia ovata and Ophrys insectivora can be considered as partially mycoheterotrophic and at least in O. insectifera, the degree of partial metrotrophy can be fine-tuned according to light availability. However, exploitation of mycorrhizal fungi appears less flexible in saprotroph-associated orchids than in orchids associated with ectomycorrhizal fungi.]

Sdiri, M., Li XiangMin, Du, W.W., El-Bok, S., Xie YiZhen, Ben-Attia, M. and Yang, B.B. 2018. Anticancer activity of Cynomorium coccineum. Cancers 10(10): 35. [Treatment of mice with murine cancer cell line B16, followed by peritoneal injection of the water extract prolonged mouse survival significantly apparently due to down-regulation of c-myc expression. Further investigation showed that treatment with C. coccineum induced the overexpression of the tumor suppressor Foxo3 and other molecules involved in inducing autophagy and exerts its antiproliferative activity through the induction of cell death pathway. C. songaricum was less active.]

Sequeira, A.S., Rocamundi, N., Ferrer, M.S., Baranzelli, M.C. and Marvaldi, A.E. 2018. Unveiling the history of a peculiar weevil-plant interaction in South America: a phylogeographic approach to Hydnorobius hydnorae (belidae) associated with Prosopanche americana (Aristolochiaceae). Diversity 10(2): 33. [After studying 18 sites where H. hydnorae occurred in Chaco Province, Argentina results indicated ‘a long trajectory of host-tracking through space and time, where the weevil has expanded its geographic range following its host plant, without significant demographic growth’.

Shayanowako, A.I.T., Shimelis, H., Laing, M.D. and Mwadzingeni, L. 2018. Genetic diversity of maize genotypes with variable resistance to Striga asiatica based on SSR markers. Cereal Research Communications 46(4): 668-678. [The extent of genetic diversity among 37 diverse maize genotypes was determined using simple sequence repeat (SSR) markers. The maize genotypes were selected based on their variable resistance to S. asiatica. A total of 191 alleles were detected and the number of effective alleles varied from 2 to 21 per locus with a mean of 11. Based on this analysis several open pollinated varieties were selected from different clusters for breeding.]


Shi BiXian, Xu DongSheng, Wu YuanZhu, Lei ZhongHua, Lai ChengXia and Zhao Jun. 2018. (Effect of soil conditions on sunflower broomrape parasitism.) (in Chinese) Acta Botanica Boreali-Occidentalia Sinica 38(9): 1717-1721. [Finding that sandy loam soil was much more favourable than loam or clay to the growth and development of Orobanche cumana on sunflower. Further, a temperature of 25-30°C, soil moisture of 60%-70% and soil pH 8 were optimal for the parasite.]


Smith, D.R. 2018. Plastid genomes hit the big time. New Phytologist 219: 491-495. [A short but information packed review of variation in plastomes, which is more than you might...
currently think. Covers green and red algae as well as nonphotosynthetic species.] Solomon Assefa Derese, Shimelis, H., Laing, M. and Fentahun Mengistu. 2018. The impact of drought on sorghum production, and farmer's varietal and trait preferences, in the north eastern Ethiopia: implications for breeding. Acta Agriculturae Scandinavica, Section B - Soil & Plant Science 68(5): 424-436. [Concluding that overall, sorghum breeding programmes should be directed at developing farmers' ideal sorghum varieties with high grain and biomass yield, adequate level of drought and Striga tolerance. In addition, development of farmer preferred medium-maturing sorghum varieties suitable for April planting would strengthen its productivity and increase varietal adoption rate in the area.]

Song DeZhi, Cao Zhen, Liu ZaiBing, Tickner, J., Qiu Heng, Wang Chao, Chen Kai, Wang ZiYi, Dong ShiWu and Xu JiaKe. 2018. Cistanche deserticola polysaccharide attenuates osteoclastogenesis and bone resorption via inhibiting RANKL signaling and reactive oxygen species production. Journal of Cellular Physiology 233(12): 9674-9684. [C. deserticola polysaccharide (CDP) is already known to have antitumour, anti-inflammatory, and antioxidant activity. This study confirmed that CDP may also represent a candidate drug for the treatment of osteoporosis caused by excessive osteoclast activity.]

Song Xue, Jiang Lu, Guo Qiang, Sun YanJun and Zan QiJie. 2018. Effect of other plants by applying Cuscuta campestris Yuncker to control Mikania micrantha H. B. K. Journal of Guangxi Normal University - Natural Science Edition 36(4): 139-150. [Recording the successful use of C. campestris as a biological control to reduce Mikania micrantha in forest parks in China. Among other plants incidentally parasitised, 15 were unharmed. 138 other species were affected to varying degrees but none were killed.]

*Su, H-J., Barkman, T.J, Hao, W., Jones, S.S., Naumann, J., Skippington, E., Wafula, E.K., Hu, J-M., Palmer, J.D. and dePamphilis, C.W. 2019. Novel genetic code and record-setting AT-richness in the highly reduced plastid genome of the holoparasitic plant Balanophora. Proceedings of the National Academy of Sciences 116: 934-943. (https://www.pnas.org/content/116/3/934) [Truly one of the most remarkable plastomes yet seen among holoparasitic angiosperms, not only because it is tiny (15.5 kb) but also because it has 88% AT and apparently remains functional with biased codon usage by using a novel genetic code.]
Suetsugu, K., Ohta, T. and Tayasu, I. 2018. Partial mycoheterotrophy in the leafless orchid Cymbidium macrorhizon. American Journal of Botany 105(9): 1595-1600. [Concluding that despite its leafless status, fruiting plants of C. macrorhizon were capable of fixing significant quantities of carbon. Considering the autotrophic carbon gain increases during the fruiting season, its photosynthetic ability may contribute to fruit and seed production that C. macrorhizon should, therefore, be considered a partially mycoheterotrophic species rather than fully mycoheterotrophic, at least during the fruiting stage.]


Tănase, M. 2018. Cuscuta epithymum L. (Convolvulaceae), the most widespread species in Southern Transylvania, Romania. Scientific Papers Series - Management, Economic Engineering in Agriculture and Rural Development 18(4): 369-374. [Noting that C. epithymum is the most widespread Cuscuta species in Romania affecting more crops than other species, especially the perennial legumes alfalfa, sainfoin, clovers and bird’s foot trefoil. Other hosts mentioned include Rhinanthus serotinus, C. campestris, C. europaea and C. lupuliformis also occur.]


Tao Yi, Gu XiangHui, Li WeiDong and Cai BaoChang. 2018. Fabrication and evaluation of magnetic phosphodiesterase-5 linked nanoparticles as adsorbent for magnetic dispersive solid-phase extraction of inhibitors from Chinese herbal medicine prior to ultra-high performance liquid chromatography-quadrupole time-of-flight mass spectrometry analysis. Journal of Chromatography, A 1532: 58-67. [Reporting the successful use of this technique in the extraction and purification of the active ingredient echinacoside from Cistanche tubulosa.]

Tong ZeYu, Wang XiangPing, Wu LingYun and Huang ShuangQuan. 2019. Nectar supplementation changes pollinator behaviour and pollination mode in Pedicularis dichotoma: implications for evolutionary transitions. Annals of Botany 123(2): 373-380. [P. dichotoma typically produces very little nectar and visiting been collect only pollen, resulting in sternotribic (ventral) pollination. When a sugar solution was added to mimic nectar, the bees switched to foraging for nectar resulting in nototribic (dorsal) pollination.]

Trần H.D., Lưu H.T., Nguyễn Q.D., Nguyễn H.C., Athen P., and Wong K.M. 2018. Identification, sexual dimorphism and aspects of the natural history of Sapria himalayana (Rafflesiaeaceae) on Vietnam’s Lang Biang Plateau. Botanical Studies 59:29. [This species, first seen in Vietnam in 1959, was rediscovered in 2017. Eight populations were studied and detailed descriptions of the male and female flower morphology were made. These data extend knowledge of the natural history of this plant. These populations in the Lâm Đồng Province are being designated as Protected Research Reserves.]

Tsiftsis, S., Djordjević, V. and Tsiripidis, I. 2019. Neottia cordata (Orchidaceae) at its southernmost distribution border in Europe: threat status and effectiveness of Natura 2000 Network for its conservation. Journal for Nature Conservation 48: 27-35. [A survey of the ‘vulnerable’ N. cordata in forests of Pinus sylvestris and Picea abies showed that the latter was more favourable to its conservation and the most appropriate management measure is the maintenance of the tree layer canopy closed.]

Turnau, K., Jędrzejczyk, R., Domka, A., Anielska, T. and Piwowarczyk, R. 2018. Expansion of a holoparasitic plant, Orobanche lutea (Orobanchaceae), in post-industrial areas - a possible Zn effect. Science of the Total Environment 639: 714-724. [The data presented support the hypothesis that the expansion of O. lutea on Medicago sativa is most likely supported by the increased
concentrations of Zn and Cd in areas connected with industrial waste. Although, on industrial wastes the host yield was decreased in the parasite presence, its photosynthetic capacity was even increased.

*Vogel, A. and 13 others. Footprints of parasitism in the genome of the parasitic flowering plant *Cuscuta campestris*. Nature Communications 9(6): 2515. (https://www.nature.com/articles/s41467-018-04344-z) [Genes needed for high photosynthetic activity are shown to be lost, explaining the low photosynthesis rates displayed by the parasite. Also, several genes involved in nutrient uptake processes from the soil are lost. On the other hand, evidence for horizontal gene transfer by way of genomic DNA integration from the parasite's hosts is also found.]

Vurro, M., Boari, A., Thiomiano, B and Bouwmeester, H. Strigolactones and Parasitic Plants. 2019. in: Koltai, C and Prandi, C. (eds) Strigolactones - biology and applications: pp. 89-120. [Reviewing the role of strigolactones in the germination of *Orobanche, Philipanche* and *Striga* species, covering their distribution, agricultural importance and life cycle, and the role of strigolactones in seed germination, parasite development, host specificity, plant nutrition and microbiome composition. Also, some weed control approaches involving strigolactones are discussed. See Book Review above for listing of other chapters.]

*Wada, S., Songkui Cui and Yoshida, S. 2019. Reactive oxygen species (ROS) generation is indispensable for haustorium formation of the root parasitic plant *Striga hermonthica*. Frontiers in Plant Science 22 March 2019. (https://www.frontiersin.org/articles/10.3389/fpls.2019.00328/full) [Exploring the role of reactive oxygen species (ROS) in activation of haustorial initiation in *S. hermonthica*, as in the oxidation of syringic acid to produce DMBQ in sorghum roots; and confirming from results with NADPH oxidases and peroxidases that that ROS and ROS-regulating enzymes are indeed indispensable in downstream signaling of haustorium-inducing factors for haustorium formation.]


[Concluding that the invasive *Lespedeza cuneata* (in USA) could be reduced by increasing soil fertility and by shading but not by sowing of *Pedicularis canadensis*.]

Wang GuoYan, Baskin, C.C., Baskin, J.M., Yang XueJun, Liu GuoFang, Ye XueHua, Zhang XinShi and Huang ZhenYing. 2018. Effects of climate warming and prolonged snow cover on phenology of the early life history stages of four alpine herbs on the southeastern Tibetan Plateau. American Journal of Botany 105(6): 967-976. [Assessing the impact of changes in climate on 4 species on the Tibetan plateau, including *Pedicularis fletcheri*. Both warming and alteration of the snow cover regime can influence plant recruitment by affecting seedling phenology, growth, and survival, but prolonged snow cover would partly mediate the effects of warming on *P. fletcheri*.]

*Wang, JianYou and 18 others including Muhammad Jalil and Al. Babili, S. 2019. The apocarotenoid metabolite zaxinone regulates growth and strigolactone biosynthesis in rice. Nature Communications 10, 1–9. (https://www.nature.com/articles/s41467-019-08461-1) [The authors through a survey of grass Carotenoid Cleavage Dioxxygenases (CCDs) identified a clade named Zaxinone Synthase (ZAS) which is widely distributed in the plant kingdom. Its product zaxinone is required for normal growth and development of rice plants and is a negative regulator of strigolactone biosynthesis and release. Chemical modification of zaxinone may afford practical compounds applicable to agricultural production for promoting plant growth and development and for combating root parasitic weeds.]

Wang, W.B., An, M.N., Feng, Y.L. and Qu, B. 2019. First report of dodder (*Cuscuta australis*) on the invasive weed *Xanthium strumarium* var. *canadense* in China. Plant Disease 103(3): 591. [C. *australis* caused wilting, senescence and stunted growth in X. *strumarium*, and few or no fruit were produced.]

Sixty-six different sources of Cistanches Herba which should only contain *Cistanche deserticola* and *C. tubulosa*, were studied and 36.4% adulteration was found. 19.7% involved adulteration with *Cynomorium songaricum* or *Cistanche sinensis*, and 16.7% involved substitution with *C. songaricum*, *C. sinensis*, or *Boschniakia rossica*.

Wang Yue, Ye XiaoXin, Wang Kai, Li PuFang, Guo ZhenGuo, Chen FangJie and Ma YongQing. 2018. (Effect of maize and gibberellic acid on sunflower broomrape germination, control and growth in sunflower field.) (in Chinese) Zhongguo Shengtai Nongye Xuebao / Chinese Journal of Eco-Agriculture 26(11): 1672-1681. [In a pot experiment growing maize reduced emergence of *Orobanche cumana* in sunflower the following year. Application of GA$_3$ to the maize 20 and 40 days after emergence further reduced *O. cumana* emergence and increased sunflower head size.]

Wei YingQin, Sun ManMan and Fang HaiYan. 2019. Dienzyme-assisted salting-out extraction of flavonoids from the seeds of *Cuscuta chinensis* Lam. Industrial Crops and Products 127: 232-236. [Describing a technique for enhancing the extraction of anti-oxidant flavonoids, particularly 1,1-diphenyl-2-picrylhydrazyl, from seeds of *C. chinensis*.]


*Werthmann, P.G., Kempenich, R., Lang-Avérous, G. and Kienle, G.S. 2018. Long-term survival of a patient with advanced pancreatic cancer under adjunct treatment with *Viscum album* extracts: a case report. World Journal of Gastroenterology 25(12): 1524-1530. [Presenting the case of a patient with pancreatic cancer with R1-resection with development of liver metastasis during the course of treatment who showed an overall survival of 63 months and a relapse-free survival of 39 months under increasing supplementary *V. album*. The possible synergistic effect on tumor control of radiofrequency ablation treatment and immune-stimulatory effects of *V. album* extract should be further investigated.]

*Wicke, S. and Naumann, J. 2018. Molecular evolution of plastid genomes in parasitic flowering plants. Advances in Botanical Research 85: 315-347. [This is an excellent review of the state of affairs with parasitic angiosperm plastomes up to that point in time (not including the Su et al. 2019 study of *Balanophora*). Provides a model for plastome degradation and much more about the molecular evolution of this organelle.]

Wilson, A.B. and Musselman, L.J. 2018. *Agalinis* - a root parasite on loblolly pine. In: General Technical Report - Southern Research Station, USDA Forest Service 2018 No. SRS-234 Proceedings pp. 49-50. [Noting that loblolly pine (*Pinus taeda* is the most widely planted pine species in the Southern United States and that as well as increasing damage from of *Seymeria cassioides* (Orobanchaceae), the trees are now being damaged by *Agalinis fasciculata*. Providing information on its identification, distribution and impact.]

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According to this study, ML1 protein has ribosome inactivating properties and STxB has adjuvant and carrier functions, therefore, this recombinant protein can be a candidate vaccine against ML-1 toxin of Shigella dysentery, which its antibody can be used as identifier.

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Zhao Shuyi, Li Jialiang, Ma Rui, Miao Ning, Mao Qiyun and Mao Kangshan. 2019. Characterization of the complete chloroplast genome of *Taxillus nigrans*. Mitochondrial DNA Part B 4: 472-473. [Yet another short paper reporting on the plastome of yet another species of *Taxillus* which is 121.4 kb in size. See also Li et al. (2017).]
HAUSTORIUM
Parasitic Plants Newsletter
ISSN 1944-6969
Official Organ of the International Parasitic Plant Society
(http://www.parasiticplants.org/)

December 2019 Number 77

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MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS members,

I hope you all had a very enjoyable Christmas break.

In my last message I talked about some of the changes we are making to the IPPS website and structure of the Executive Committee, including the election of a New Member at Large to help Chris Parker with the production of Haustorium and Susann Wicke with the new website.

Firstly, I would like to thank Luiza Teixeira-Costa and Evgenia Dor for their interest in this position. The vote was very close but Luiza has been elected as the New Member at Large.

Luiza is currently a Postdoctoral Fellow at Department of Organismic & Evolutionary Biology, Harvard University Herbaria. Luiza’s research in parasitic plant biology encompasses a broad diversity of plants, from mistletoes, to the cryptic Rafflesiaceae, and the widely known Cuscuta. Using a variety of methods, from plant morphology and physiology, to phylogenetic analyses, she investigates haustorium development and evolution across the different clades among which parasitic plants have evolved. She is also interested in host-plant specificity in different parasites, trying to understand what mechanisms could govern the process of host selection. As a new Member at Large beginning this year, Luiza hopes to help the IPPS in elaborating and improving the Haustorium newsletter.

Secondly, Harro Bouwmeester has been working very hard on the design and production of the new IPPS website with Susann and the website manager. I have recently seen the website and it is looking very impressive. The website is at an advanced stage of development and will be available very soon. Look out for a message from Harro in the next week or two!

Finally, there are two bids to host the next World Congress on Parasitic plants (WCPP-16) in 2021. The first is from Hanan Eizenberg who proposes to hold the Congress in Jerusalem, Israel. The second is from Steven Runo and Damaris Odeny who propose Nairobi, Kenya as the venue for the Congress. Both bids are in the final stages of preparation and I will shortly contact everyone with details of the bids and organise a Google Poll so that everyone can vote for the venue for the 2021 Congress.

I wish everyone a very happy and successful Year.
Best wishes
Julie Scholes

MEETING REPORT


The IUFRO 7.02.11, Parasitic Flowering Plants in Forests technical working group, had a poster session, oral session and field trip at the World Congress of the International Union of Forest Research Organizations (IUFRO) in Curitiba, Brazil 29 September - 5 October, 2019 attended by scientists from Australia, Brazil, USA, Nigeria, Chile and Ukraine (Crimea, but now in Czech Republic).

Perhaps the iconic mistletoe of this congress should be Struthanthus martianus, which was common all over Curitiba (Figure 1). This loranthaceous mistletoe establishes in the tree via bird dispersal, then can form very large shrubby plants perhaps due to its ability to ‘walk’ down the branch forming epicortical roots.

Luiza Teixeira (Harvard Herbarium), her students (University of São Paulo), as well as Rodrigo Fadini (Federal University of Western Pará, Brazil) participated from Brazil.
field trip was led by Luiza and her students and focused on parks in Curitiba. We observed 6 species of mistletoe including Viscaceae (*Phoradendron*) and Loranthaceae (*Struthanthus, Tripodanthus*) and Santalaceae (*Eubrachion ambiguum*). Perhaps the highlight of the day was observing a *Euphonia* feeding on *Phoradendron dipterum* berries! What a sight to observe this spectacularly beautiful bird hopping/flying about the plant grabbing fruit.

Figure 1. *Struthanthus martianus*, with pendulous branches, in an urban tree in Curitiba, Brazil. Note the mistletoe now dominates the foliage of the canopy of this tree.

We also observed epiparasitism! A *P. dipterum* on a *Salix babylonica* (weeping willow) was parasitized by *Struthanthus martianus*! An excellent publication by the Universidade Federal do Rio Grande do Sul on Southern Brazilian Mistletoes (Dettke, G.A. and Waechter, J.L. - https://fieldguides.fieldmuseum.org/sites/default/files/rapid-color-guides-pdfs/493.pdf) is a great mistletoe reference for the region. The poster, oral session and field trip were very diverse and truly fit the theme of our session: Complex Interactions of Mistletoe, Ecosystems and People. The abstracts for all these talks will be published with the entire set of IUFRO abstracts.

Also a special issue of the journal Botany on mistletoes will include most of the following papers, and others. Due out in May.

Species observed:

- *Eubrachion ambiguum* Santalaceae
- *Struthanthus martianus* Loranthaceae
- *S. polyrhizus* Loranthaceae
- *S. uraguensis* Loranthaceae
- *Tripodanthus acutifolius* Loranthaceae
- *Phoradendron dipterum* Viscaceae

Relevant papers presented:

- Francisco Fonturbel *et al.* - The cascade impacts of climate change could threaten key ecological interactions: insights from a keystone mistletoe
- Ekeoba Matthew Isikhuemen *et al.* - The African Mistletoe: from noxious weed to cure-all medicine: a synthesis of experience from empirical and indigenous knowledge domains
- Victor Sibinelli *et al.* - Comparative wood anatomy of Brazilian mistletoes genera of Loranthaceae
- Luiza Teixeira-Costa *et al.* - Morphogenesis and evolution of mistletoes’ haustoria
- David Watson *et al.* - Urban mistletoe: The final frontier in ecological restoration?
- Melinda Cook *et al.* - Mistletoe dispersing birds rely on spatial-memory and established search images to find fruiting mistletoes.
- David Watson - Did mammals bring the first mistletoes into the tree-tops?
- David Shaw *et al.* - The European mistletoe in Sonoma County California, USA
- Yuliya Krasylenko *et al.* - Hosts and distribution range of juniper dwarf mistletoe (*Arceuthobium oxycedri*) in the Crimea Peninsula

David Shaw.

**LITERATURE HIGHLIGHT**

**New potential for control of *Striga* by synthetic strigolactones?**

Suicidal germination—induction of seed germination in the absence of their hosts—has been regarded as a promising strategy for root
parasitic weed management. Indeed, in the US, *S. asiatica* infestation has been mostly eradicated, but not completely, by inducing germination of the seeds by extensive ethylene gas fumigations (Eplee 1975; Tasker and Westwood 2012). This is the only one success story of suicidal germination in weedy root parasite management. Sadly it has proved less effective and in any case uneconomic for control of *S. hermonthica* in Africa (Ransom and Njoroge, 1991).

Recently, several ‘novel’ approaches to *Striga* control by suicidal germination have been reported. Herein I would like to summarize these recent approaches and discuss whether it is a reality or if more studies are needed to adopt this strategy in parasitic weed management. (refer to earlier work with GR24 and Nijmegen1 and problem of lability in soil?)

In 2016, Samejima *et al.* reported that application of a chemical stimulant T-010 (Kondo *et al.* 2007) at 1 kg ai/ha could effectively reduce *S. hermonthica* infection by 33% in sorghum field trials irrigated for the distribution of the applied chemical (Samejima *et al.* 2016). The research group led by Yukihiro Sugimoto (Kobe University) and A.G.T. Babiker (Sudan University of Science and Technology) also pointed out the importance of developing more potent stimulants, effective formulations, and application protocols.

In 2018, Uraguchi *et al.* developed a highly potent germination stimulant, sphynolactone-7 (SPL7), which is more active than synthetic strigolactone (SL) standard (+)-GR24 and as active as 5-deoxyxystroigol (5DS), the most active SL, in germination stimulation of *S. hermonthica* seeds (Bouwmeester 2018; Uraguchi *et al.* 2018). Although natural SLs so far characterized, and synthetic analogs including GR24, also induce arbuscular mycorrhizal (AM) fungi hyphal branching (and thus promote AM colonization) and inhibit shoot branching as a novel class of plant hormones, both typical SL activities, SPL7 is only weakly active on AM fungi and is inactive in shoot branching. Therefore, SPL7 can be applied as a suicidal germinator for *Striga* seeds without affecting AM colonization or plant growth and development. This is due to SPL7 being a highly specific ligand to the receptor ShHTL7 in *S. hermonthica*, and its affinities to D14, the receptor for SL as a plant hormone, and to unknown receptor(s) in AM fungi, seem to be low. In pot experiments, SPL7 at 100 pM applied a week before planting of maize could inhibit *S. hermonthica* infestation while GR24 required 10 nM for a similar effect. The research group at Nagoya University represented by Yuichiro Tsuchiya has started field trials in Kenya to assess if SPL7 can be applied as a suicidal germinator for *S. hermonthica* in maize.

The third group working on *Striga* control by suicidal germination is led by Salim Al-Babili (KAUST, Saudi Arabia) in collaboration with Tadao Asami (The University of Tokyo, Japan) and Binne Zwanenburg (Radboud University, The Netherlands), and the project is supported by The Bill & Melinda Gates Foundation. They have developed a new class of synthetic SLs, methyl phenlactonoates (Jamil *et al.* 2018), and selected MP1 and MP3 for further study. These compounds did not affect AM colonization (Kountche *et al.* 2018). They evaluated effectiveness of the phenlactonoates MP1 and MP3 along with the synthetic SL analog Nijmegen-1 (Nefkens *et al.* 1997), in rain-fed sorghum and pearl millet fields in Burkina Faso (Kountche *et al.* 2019). Treatment with these compounds resulted in up to 55–65% reduction of *Striga* emergence in these rain-fed fields, demonstrating that these synthetic SLs can reduce *Striga* infection through induction of suicidal germination in typical African small-holder farms.

These three groups have clearly demonstrated that suicidal germination is one of the promising strategies for parasitic weed management, especially for *Striga*. However, as Kountche *et al.* described in their recent paper, 50–60% reduction of *Striga* emergence may not be enough for *Striga* control because only a few seedlings per square meter may maintain the *Striga* seedbank. Therefore, to reduce *Striga* seedbank effectively, *Striga* seed germination should also be induced in the absence of host crops.
Suicidal germination strategy can be applied for other root parasitic weeds, broomrapes (Orobanche and Phelipanche spp.) and Alectra spp. Indeed, Zwanenburg et al. (2016) reported effectiveness of this strategy for P. ramosa control in tobacco. They pointed out that the timing of the wet conditioning period, the actual application of stimulants, and the planting of the crop are very critical. If the stimulants are applied at the incorrect time, they may promote parasitism due to the increased number of germinating parasite seeds. This may be one of reasons why this strategy has yet to be widely adopted in crops susceptible to root parasitic weeds. In addition, species-specific stimulants like SPL.7 may need to be developed for each broomrape and Alectra species.

All plant species produce and release SLs, and therefore, suicidal germination occurs if there is other vegetation in the field. In fact, cotton and groundnut have been planted as trap crops for S. hermonthica as they induce suicidal germination of Striga seeds. However, weedy parasites quickly attack their hosts when the host crops return to the infested field even after several decades. It is likely that at least some of weedy the parasitic species can distinguish SL profiles of preferable hosts from those of non-host plants, and their seeds may not respond well to SL profiles of non-hosts.

Accordingly, suicidal germination strategy should be combined with other methods including resistant cultivars, intercropping with non-hosts (Push-Pull), crop-rotation, and so on. To eradicate the parasite seedbank, suicidal germination should be induced in the absence of host crops and be continued for at least several cropping seasons.

There are some new options arising for chemical management of root parasitic weeds. For example, inhibitors of SL biosynthesis and perception can inhibit parasitism effectively (Yoneyama et al. 2019). Further studies are necessary to introduce these chemicals in the battles with root parasitic weeds in the field.

References:


Koichi Yoneyama, Ehime University, Japan yoneyama.koichi.ll@ehime-u.ac.jp

(Editors’ Note: We would welcome comment on the prospects/difficulties in commercialisation of strigolactones for practical use. Registering new products for the market is notoriously expensive. Although there is little further research needed to establish efficacy, there are the costs of toxicological work which could be highly significant. What cost of product would be acceptable for the parasitic weed market? These issues have been discussed by Vurro et al. 2016. Strigolactones: how far is their commercial use for agricultural purposes? (https://onlinelibrary.wiley.com/doi/abs/10.1002/ps.4254). We would welcome comments on this important question.)

**PROJECT UPDATE**

**Striga Smart Sorghum Solutions for Smallholders in East Africa**  
(A new Global Challenges Research Fund project between NRI and Kenyatta University, funded by the Royal Society)

December 2019 marks the start of a new GCRF - Royal Society (UK) funded project entitled, part of an International Collaborations Award, granted to Jonne Rodenburg of the Natural Resources Institute (NRI), part of the University of Greenwich in the UK, and Steven Runo of the Kenyatta University in Kenya.

Sustainable intensification of sorghum production, an indispensable crop for millions of poor families, is key to ensuring food security and improving livelihoods in sub-Saharan Africa (SSA). Sorghum is relatively drought and heat tolerant and therefore a strategic crop for the continued production of food, fodder and biomass in a changing climate. Major production constraints to sorghum in SSA are the parasitic weeds of the *Striga* genus (*S. asiatica* and *S. hermonthica*) and poor soil fertility. These constraints are intertwined as crops seem more susceptible and sensitive to *Striga* infections when grown under nutrient-deficiencies. This could partly be due to reduced effectiveness of host plant resistance and tolerance, but much of this is still unknown. Understanding this interaction is essential as host plant resistance and tolerance and fertilisers are key elements of integrated *Striga* management. This project will explore these two elements and produce the knowledge, materials and tools for synergetic integration.

Jonne Rodenburg

**PRESS AND OTHER REPORTS**

**Nuclear techniques help develop new sorghum lines resistant to the parasitic weed Striga**

Farmers in Africa will soon benefit from new sorghum varieties resistant to *Striga* — one of the most devastating parasitic weeds that impact crop yields on the continent. Improved sorghum lines with resistance to *Striga* have been developed using gamma ray irradiation, with the support of the IAEA and the Food and Agriculture Organization of the United Nations (FAO). ‘This important achievement is of great significance, especially as we prepare for the International Year of Plant Health 2020,’ said Qu Liang, Director of the FAO/IAEA Division of Nuclear Techniques in Food and Agriculture. ‘For African farmers, the availability of *Striga*-resistant sorghum varieties will be a major breakthrough: it will improve livelihoods for rural communities and contribute to food security,’ said Abdelbagi Ghanim, a plant breeder and geneticist at the Joint FAO/IAEA Division. *Striga* infestation is a scourge that continues to pose a huge challenge for crop productivity, reducing national and regional capacity for food production, he added. *Striga* is present in parts of Africa, Asia, and Australia, with the greatest crop losses in Africa’s savannahs. FAO estimates that annual crop loss due to *Striga* across Africa exceeds US $7 billion, impacting over 300 million people. Up to 50 million hectares of crop land are *Striga*-infested, Ghanim said. ‘*Striga* is a major biological constraint to cereal production in most of sub-
SAHARAN AFRICA AND SEMI-ARID TROPICAL REGIONS OF ASIA. CROPS SUCH AS SORGHUM, MILLET, MAIZE AND UPLAND RICE FACE THE BIGGEST THREAT FROM THIS PARASITIC WEED.

THE TWO MOST Destructive STRIGA strains are STRIGA HERMONTIICA AND STRIGA ASIATICA, Ghanim said. To combat Striga, new varieties of sorghum have been developed using irradiation, in a technique known as plant mutation breeding. "Thanks to glass-house and field trials, we succeeded in the selection of improved lines, and we expect that new resistant varieties developed from these lines will be released to farmers within the next two years, in some of the participating countries."

In plant breeding programmes, the primary challenge is to identify new and improved lines, with desired traits, before they can be developed into varieties that can be cultivated by farmers. The ongoing research and development using irradiation has identified such lines with proven resistance to *Striga*, and these are being developed into varieties that can be disseminated to farmers in the near term.

PHILIPPE NIKIEMA, A researcher at Burkina Faso's Environmental Institute of Agricultural Research points to the impressive difference between wild and newly developed sorghum mutants under artificial infestation with *Striga* seeds. (Photo: A. Ghanim/IAEA)

'I am so excited to see the power of nuclear technology applications for mutation breeding: I hope the varieties developed from the improved sorghum lines selected in this project will finally restore production of cereals in the heavily *Striga* infested areas in Africa,' said Phillipe Nikiema, a researcher at Burkina Faso's Environmental Institute of Agricultural Research and a participant of an IAEA Striga coordinated research project. The results originating from this project focus specifically on understanding and developing solutions for resistance to *Striga* in cereal crops, involving experts from twelve countries.

‘The affected African countries, including my own, Burkina Faso, will benefit from new improved sorghum lines and varieties developed through this project. Results of the project will also help to understand the physiological and molecular bases of host-parasite interaction to enable the development of further solutions to restore cereals production and boost food security in Africa,’ he added. ‘*Striga* threatens food security in rural areas where it has been expanding and taking over millions of hectares, including those owned by of poor farmers.' Experts are now analysing the induced resistance in different sorghum varieties to enable combining more than one defense mechanism and produce even more resistant sorghum varieties to restore production and ensure food security and the livelihoods of farmers.

AABHA DIXIT, IAEA OFFICE OF PUBLIC INFORMATION AND COMMUNICATION
5 SEPTEMBER, 2019

**Helixanthera cylindrica** – a mistletoe on mango in Kuala Trengganu, Malaysia

A visit to Cambodia near Sihanoukeville in May 2014, the writer spotted a colourful mistletoe on a mango plant which Dr Don Kirkup identified as *Helixanthera cylindrica* (HAUSTORIUM 65 July 2014 page 5). The writer has not been seen *H. cylindrica* on mango plant in many places on west coast of Peninsular Malaysia. The common mistletoes found growing on mango plants in west coast areas are *Dendrophthoe pentandra* and *Scurrula ferruginea*.

Recently (last week of July 2019), the writer saw the same mistletoe on many mango plants in Kuala Trengganu (GPS Coordinates: 5.3296 degree N, 103.1370 degree E), on the east coast of Peninsular Malaysia. See pictures of *H. cylindrica* growing on mango branch (Fig 1) and a close up view of red flower (Fig 2) taken in Kuala Trengganu.

Fig 1. *H. cylindrica* growing on mango branch
The Banded Matchflower

This is the 40th in an ongoing series that highlights the riches of Pigeon Valley, the urban nature reserve in the heart of Glenwood, Natal. The focus of this article will be on the Banded Matchflower, *Oncocalyx quinquenervius*. This striking flower is that of a seldom encountered mistletoe. A couple of years ago I was investigating a sewage leak on the northern fence of Pigeon Valley next to a large Natal Elm when I realised that the ground was covered in flowers different from the prevailing local mistletoe (*Erianthemum dregei*). Looking up, I could see large areas of the tree covered in mistletoe. Later I found evidence that there are small patches elsewhere in Pigeon Valley on other Natal Elms or Thorny Elms.

The riches of Pigeon Valley Nature Reserve explained by Glenwood resident and chair of the Friends of Pigeon Valley who undertake clearing of alien plants, keep records of bird and mammal sightings and alert management to any problems.

Crispin Hemson
October 27, 2019.

Grasspea and finger millet pre-breeding get a boost

Plant breeders need genetic diversity in order to improve the yield and nutritional quality of crops and adapt them to changing climatic conditions. But that diversity is limited in cultivated grasspea and finger millet. However, in recent years, pre-breeders working on the Crop Trust’s Crop Wild Relatives Project have expanded that diversity by tapping into wild and ancient domesticated forms of the two crops.

This new project, funded by the Templeton World Charity Foundation, Inc., will allow pre-breeders to continue their work and ultimately contribute to food security, human health, income for rural poor, while protecting the environment.

Ridding grasspea of toxins
‘Grasspea is a nutritious crop which is heat- and drought-tolerant and often survives when other crops fail, thus gaining a reputation as a “famine crop”,’ said Shiv Agrawal, a legume breeder with the International Center for Agricultural Research in the Dry Areas (ICARDA), who will spearhead the work on grasspea in the new project. The problem with the crop is that it contains a toxin that can cause paralysis if people eat too much of it as a sole food source. By mapping the genome sequence of both cultivated grasspea and its closest wild relatives, Shiv’s team can accelerate the pace of breeding by ‘tagging’ those genes in the wild species which he wishes to transfer to the cultivated crop.

Developing a Striga-resistant finger millet
Finger millet is also a highly nutritious, drought-tolerant crop, but one that still doesn’t get the research attention it deserves. ‘We have the potential to significantly increase yields in East Africa, where finger millet is an important subsistence crop for small-scale farmers, particularly women,’ said Damaris Odeny, a molecular geneticist with the International Crops Research Institute for Semi-Arid Tropics (ICRISAT) in Nairobi, who led the Crop Wild Relatives Project finger millet pre-breeding work.
Finger millet yields are stagnating in part due to a sap-sucking plant parasite known as *Striga* and blast disease. Damaris’s national partners in Kenya have succeeded in developing crosses between wild relatives of finger millet and its cultivated varieties that show promise for *Striga* and blast resistance, as well as tolerance to drought. Several superior crosses have already been identified and crossed again with varieties preferred by farmers in the country. Some of these are currently undergoing adaptation trials and will subsequently be released in Kenya for use by farmers.

‘The Templeton-Crop Trust project will now help us make this newly developed breeding material available to other countries in East Africa,’ said Damaris. ‘Our objective is to develop successful and well-integrated pre-breeding programs in Ethiopia, Uganda and Tanzania, as well as Kenya, so that we can capitalize on the rich genetic diversity that exists in these centers of finger millet diversity.’

International Center for Agricultural Research in the Dry Areas
6 October, 2019

**New flowerpecker species described from Borneo**

An international team of ornithologists, led by the Smithsonian Institutions National Museum of Natural History, has scientifically described a new species of flowerpecker from the island of Borneo. The species, which has been named Spectacled Flowerpecker, belongs to a family of small, fruit-eating passerines found throughout tropical southern Asia, Australia and nearby islands. Spectacled Flowerpecker resides in lowland forests and was first recorded in the Danum Valley of Sabah, in north-eastern Malaysian Borneo, in 2009.

‘This bird is totally unique,’ said Dr Christopher Milensky, collections manager for the Division of Birds at the Smithsonian National Museum of Natural History. ‘It’s unlike anything else, and it is the latest example of the rich biodiversity that can be found in this region.’ Ten years after it was initially discovered, in March 2019, Dr Milensky and his colleagues managed to capture a female of the species and examine it closely. They analysed its external features and compared its DNA to that of other flowerpeckers. Surprisingly, they found that Spectacled Flowerpecker is quite distinct and is not closely related to any other known flowerpecker species. ‘It isn’t related to any of the other flowerpeckers all that closely. Its a whole new species that distinctly stands out,’ said Dr Jacob Saucier, also from the Smithsonian National Museum of Natural History.

The researchers also analysed the bird’s diet and found that it eats the berries of mistletoe, a parasitic plant that grows high in the forest canopy. Through DNA analysis and close inspection of seeds from the birds gut, the team was able to identify the type of mistletoe that Spectacled Flowerpecker eats. ‘We hope this discovery will bring attention to the unexplored diversity that remains in the forests of Borneo — and the importance of conserving these threatened ecosystems,’ the team said. ‘Protecting the regions natural resources from logging, palm plantations and other sources of deforestation is critical to preserve endemic species, as well as the homes and livelihoods of the islands indigenous people.’ Dr Saucier said.

‘The scientific name that we chose for Spectacled Flowerpecker, *Dicaeum dayakorum*, honours the Dayaks, the people who live in and are working to protect the islands forests.’


Bird Guides
October 24th 2019.
Kissing under the mistletoe

It is believed the first people to become aware of mistletoe’s romantic powers were the Druids who wandered Europe in the 1st Century A.D. They believed that ‘mistletoe, taken in drink, will impart fecundity to all animals that are barren.’ Druids would reportedly hang the plant over their doors for luck. Historians learned about mistletoe’s romantic reputation through Pliny the Elder, one of the world’s first known naturalists. He thought the Druids’ beliefs about mistletoe were silly, but the reputation stuck thanks in part to a Norse myth.

The story involved Frigga, the goddess of love and marriage, who loved her son Baldur so much that she and Baldur’s wife teamed up to make all the world’s plants and animals to promise not to hurt him. Well, they got all the plants, except mistletoe. Loki, the god of mischief who Marvel fans will recognize as Thor’s pesky brother, realized the mistake and made a spear out of mistletoe and killed Baldur. If it ended there, it wouldn’t be a particularly sweet story, but in some versions of the tale, as Frigga cried over the loss of her son, her motherly tears turned into mistletoe berries. Those berries somehow brought Baldur back to life, so Frigga declared mistletoe to be a symbol of love. According to The Smithsonian magazine, ‘Mistletoe would come to hang over our doors as a reminder to never forget. We kiss beneath it to remember what Baldur’s wife and mother forgot.’

The Striga from ‘The Witcher’ – the monster & curse explained
(extract from item by Luke Alphonso)

(NB Now we know what we are up against!)

The Witcher series is a Polish and literary phenomenon written by Andrzej Sapkowski. Here’s a little background; a Striga, from what we know, is a woman that’s been cursed to transform into a horrid creature at night. From what we can also tell, this happens with corpses as well, as the main Striga we know of, Princess Adda, fell to the curse when she and her mother died during childbirth. Accordingly, Striga are known to be immense creatures, lopsided and horribly disfigured. Geralt describes the one that he fought as having a disproportionately large head on a short neck, and a ‘tangled, curly halo of reddish hair.’ The creature is shown to have immense, jagged teeth set in its maw, and long talons that can rend most flesh into chunks with one swipe.

Andy Chalk, PC Gamer
11 November, 2019.

Plants in ancient Antalya sites to be taken under protection

Ancient cities in the southern province of Antalya, which host millions of tourists every year, constitute a living space for endemic plants. Within the scope of a project under the Civil Society Dialogue V Program and funded by the European Union, five endemic plants in five ancient cities along with the reliefs in archaeological remains - *Lathyrus phaselitanus* of the ancient city of Phaselis, *Alkanna macrophylla* of Perge, *Orobanche sideana* of Side, *Himantoglossum montis-tauri* of Aspendos and *Colchicum baytopiorum* of Termessos, which grow only in these areas in the world, will be taken under protection.

Turkey is home to 10,000 plant species and about one-third of them are endemic plant species. While 800 of these plants are in Antalya and 70-80 species of Antalya’s endemic plants are in critical danger of extinction. The project, called ‘Endemic Flowers, Ancient Cities from Apollo from Athena,’ aims to protect these five endemic plants growing only in five ancient cities of Antalya and will continue for 15 months. For the project, brochures prepared for the conservation of endemic species threatened by touristic visits and unconscious tourism activities are distributed to eco-tourism guides and seminars are organized on the subject. Also, the distribution of the species is modeled on a digital map, and seed transfers are made to the most suitable environments in the ancient cities depending on the threat factors.

Within the scope of the project, in cooperation with archaeologists who carry out archaeological studies in ancient cities, trainings are also provided for university students in these ancient cities. The project
The aim of this study was to simultaneously explore biocontrol options by bio-prospecting bacterial and fungal descriptors identified in isolates from the biocontrol frontier, bacterial and fungal genes from Medicago truncatula and corn, as well as their ability to induce cellular enzymes and antibiotic compounds as well as enhancing P efficient Purple Acid Phosphatase (PAP) of ecologically adapted maize genotypes with availability to maize by genetic transformation against the effectiveness of culturable microbes.

Exploring biological control and transgenic weed management approaches against infestation by Striga hermonthica in maize.

Abstract (omitting some introduction)

The aim of this study was to simultaneously explore biocontrol options by bio-prospecting the effectiveness of culturable microbes against S. hermonthica as well as enhancing P availability to maize by genetic transformation of ecologically adapted maize genotypes with P efficient Purple Acid Phosphatase (PAP) genes from Lupinus albus (LaPAP) and Medicago truncatula (MtPAP). To explore the biocontrol frontier, bacterial and fungal isolates from Striga suppressive soils were assayed for their ability to produce extracellular enzymes and antibiotic compounds as well as their ability to induce S. hermonthica seed decay and later genotyped using 16S rRNA and 18S rRNA genes, respectively. In order to develop transgenic maize plants expressing target PAP genes, a regeneration protocol with an assortment of callus induction and callus maturation/shoot induction media were evaluated. Further, the transformability of target maize varieties was assessed via histochemical analysis of β-glucuronidase (GUS) reporter gene. Finally, Agrobacterium tumefaciens-mediated transformation of the maize varieties over-expressing PAP gene cassette was achieved and transgenic lines evaluated using S. hermonthica-host plant infection assays in vitro and in potted experiments. The morphometric analysis of bacterial and fungal descriptors identified bacterial isolates that displayed array of enzymatic and antibiosis properties and also that had ability to cause Striga seed decay. For instance isolate SM5ISS (KY041696) with 99% genetic affiliation to Bacillus recorded high antibiosis (8cm) and extra cellular enzymatic values (2.5±0.03) and also recorded the highest number of S. hermonthica page 16xvseed decay (45±0.23%). This bio-prospection study summarily identified candidate isolates that caused S. hermonthica seed decay. The regeneration study revealed that Namba nane, KSTP’94 and CML144 varieties recorded a regeneration frequency of 26.1±1.11%, 32.1±1.28% and 35.4±1.24%, respectively, while their corresponding GUS transformability efficiency values were 0.8±0.03%, 1.4±0.19% and 2.1±0.20%, respectively. Transformation of Namba nane with LaPAP and MtPAP gene construct recorded a transformation efficiency of 0.33±0.03% and 0.36±0.04%, respectively, while the corresponding values for LaPAP and MtPAP gene constructs in KSTP’94 were 0.69±0.05% and 0.37±0.03%, respectively. Transformation of CML144 with LaPAP and MtPAP gene construct recorded a transformation efficiency of 0.65±0.03% and 0.34±0.03%, respectively. These results demonstrated that the target maize germplasm was transformable. Over-expression of LaPAP and MtPAP in the selected maize genotypes resulted in low numbers of S. hermonthica colonizing transgenic maize in comparison to wild type maize. For instance, in Namba nane the average number of Striga plants colonizing individual wild maize plant in both rhizotron and bucket experiments were 9 and 4 while the corresponding numbers for LaPAP and MtPAP transgenic were 4, 1 and 5, 2, respectively. For KSTP’94 the average number of Striga plants colonizing individual wild maize plants in both rhizotron and bucket experiments were 4 and 3 while the corresponding numbers for LaPAP and MtPAP transgenic was 3, 1 and 3, 1, respectively. In the case of CML144 the average number of Striga plants colonizing individual wild maize plant in both rhizotron and bucket experiments were 12 and 7 while the corresponding numbers for LaPAP and MtPAP transgenic plants was 6, 2 and 8, 3,
respectively. Analysis of the ability of root exudate to induce *S. hermonthica* seed germination was higher in wild type than transgenic maize. For instance, the average number of *Striga* seeds stimulated to germinate in Namba nane under treatments; wilt-type, LaPAP and MiPAP was 7, 4 and 6, respectively. In KSTP’94, the average number of *Striga* seeds stimulated to germinate in Namba nane under treatments; wild-type, LaPAP and MiPAP was 5, 2 and 3, respectively. Lastly, in CML144 the average number of *Striga* seeds stimulated to germinate in Namba nane under treatments; wild-type, LaPAP and MiPAP was 5, 2 and 3, respectively.

Summarily, this study identified microbes that were potent against *S. hermonthica* and proposes their use in reduction of *S. hermonthica* seed bank in infested soils. Further, it was demonstrated that indeed over-expression of PAP genes in maize results in less *S. hermonthica* infestation. The use of the two approaches is therefore recommended in an integrated *S. hermonthica* management package that would be able to impede the parasite in infested and low P soils especially in western Kenya.

**FORTHCOMING MEETING(S)**


There will be a session on parasitic and invasive plants.


**GENERAL WEB SITES**

For individual web-site papers and reports see LITERATURE

* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: [http://www.parasiticplants.siu.edu/](http://www.parasiticplants.siu.edu/) (in the course of reconstruction)

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: [http://www.parasiticplants.siu.edu/](http://www.parasiticplants.siu.edu/)

*For the Parasitic Plant Genome Project (PPGP) see: [http://ppgp.buck.psu.edu/](http://ppgp.buck.psu.edu/)


For information on the EU COST 849 Project (now completed) and reports of its meetings see: [http://cost849.ba.cnr.it/](http://cost849.ba.cnr.it/)

For a description of the PROMISE project (Promoting Root Microbes for Integrated *Striga* Eradication), see: [http://promise.nioo.knaw.nl/en/about](http://promise.nioo.knaw.nl/en/about)


For the Annotated Checklist of Host Plants of Orobanchaceae, see: [http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm](http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm)

For a description and other information about the *Desmodium* technique for *Striga* suppression, see: [http://www.push-pull.net/](http://www.push-pull.net/)

For information on the work of the African Agricultural Technology Foundation (AATF) on *Striga* control in Kenya, including periodical ‘Strides in *Striga* Management’ and ‘Partnerships’ newsletters, see: [http://www.aatf-africa.org/](http://www.aatf-africa.org/)

*For Access Agriculture (click on cereals for videos on *Striga*) see: [http://www.accessagriculture.org/](http://www.accessagriculture.org/)

For information on future Mistel in der Tumortherapie Symposia see: [http://www.mistelsymposium.de/deutsch-mistelsymposien.aspx](http://www.mistelsymposium.de/deutsch-mistelsymposien.aspx)

For a compilation of literature on *Viscum album* prepared by Institute Hiscia in Arlesheim, Switzerland, see: [http://www.vfk.ch/informationen/literatursuche](http://www.vfk.ch/informationen/literatursuche) (in German but can be searched by inserting author name).


For 6th Mistletoe Symposium, Germany, November 2015 see: [http://www.sciedirect.com/science/journal/09447113/22/supp/S1](http://www.sciedirect.com/science/journal/09447113/22/supp/S1)
LITERATURE

*indicates web-site reference only
Items in bold selected for special interest
Items in blue relate to therapeutic uses of parasitic plants

Abdelhalim, T., Jannoura, R. and Joergensen, R.G. 2019. Mycorrhiza response and phosphorus acquisition efficiency of sorghum cultivars differing in strigolactone composition. Plant and Soil 437(12): 55-63. [Comparing two Striga-resistant varieties (orobanchol-secreting) and two susceptible (5-deoxystrigol-secreting) for their P-acquisition and mycorrhizal development. Strigolactone type did not significantly affect growth, but one of the orobanchol-secreting varieties, IS9380, showed high P acquisition and greatest root growth leaf area and shoot dry weight]

Akbah, I.Z., Dewi, F.R.P. and Setiawan, B. 2019. *In silico* interaction of the active compounds of *scurrula atropurpurea* with the RANK/RANKL/OPG system in diabetoporosis. Acta Informatica Medica 27(1): 8-11. [Studying the activity of 9 components of *S. atropurpurea* on diabetes-related osteoporosis in Indonesia. Conclusions not clear (to me) from the abstract.]

Akbulut, S., Karakose, M. and Özkan, Z.C. 2019. Traditional uses of some wild plants in Kâle and Acıpayam provinces in Denizli. Kastamonu Üniversitesi Orman Fakültesi Dergisi 19(1): 72-81. [Reviewing the range plants used medicinally in this region of Turkey, and noting the newly recorded use of *Viscum album ssp. austriacum* as a vasodilatory drug.]


Amer, A., Taha, H., Ammar, N., Salama, M. and El-Alfy, T. 2018. Applicability of different molecular markers techniques for genetic distinguish between two genera *Cressa* Linn. and *Cuscuta* Yunck. family Convolvulaceae. Pakistan Journal of Biological Sciences 21(4): 179-186. [Concluding that the SCoT molecular technique (PCR based DNA fingerprint) is superior for distinguishing the two genera.]


Andiego, K.P., Dangasuk, O.G., Odee, D.W., Omondi, F.S., Otieno, D.F. and Balozi, B.K. 2019. Genetic diversity of endangered sandalwood (*Osyris lanceolata*) populations in Kenya using ISSR molecular markers. East African Agricultural and Forestry Journal 83(2): 80-93. [Showing that a Baringo population of *O. lanceolata* is genetically distinct from 2 other populations in Kenya, but that there was much variation within each and all require conservation after excessive exploitation for cosmetic and pharmaceutical uses.]

Including reference to strigolactones and parasitic plants.

Armağan, M. 2018. Pedicularis munzurdaghensis (Orobanchaceae), a new species from Turkey. Phytotaxa 333(1): 124-130. [Describing P. munzurdaghensis, morphologically close to, P. cadmea, P. arguteserrata, and P. anthemifolia, occurring in rocky limestone in eastern Turkey.]

Azami-Sardooei, Z., Shahreyarinejad, S., Rouzkhosht, M. and Fekrat, F. 2018. The first report on feeding of Oxycarenus hyalinipennis and Aphis fabae on dodder Cuscuta campestris in Iran. Journal of Crop Protection 7(1): 121-124. [Reporting the occurrence of O. hyalinipennis (Hemiptera) feeding on capsules of C. campestris parasitising Ziziphus spin-christi; and Aphis fabae, causing severe damage to stems of C. campestris on Dodonaea viscosa.]

Badu-Apraku, B. and Akinwale, R.O. 2019. Biplot analysis of line × tester data of maize (Zea mays L.) inbred lines under stress and nonstress environments. Cereal Research Communications 47(3): 518-530. [Using a GGE biplot technique to identify tester lines TZEEI 13, TZEEI 21 and TZEEI 29 as the most efficient across stress environments (including Striga infestation).]


Bascos, E.M.A., Rodriguez, L.J.V., Duya, M.V., Fernando, E.S. and Ong, P.S. 2019. Philippine *Rafflesia*: emerging patterns in floral morphology and distribution. Flora (Jena) 257: 151409. [A key to Philippine *Rafflesia* species, as was presented by Barcelona et al. in 2011, is presented that now includes the two new species *R. mixta* and *R. consueloae.*]

Bashar K.H. Al-Gburi1, Fadhil H. Al-Sahaf1, Del-Monte2, J.P., Fadhal A. Al-Fadhal1 and Akeel E. Mohammed. 2019. The effect of *Cuscuta campestris* filaments and seeds on the virulence of *Arceuthobium tsugense* on eggplant. [Comparing the anti-oxidant qualities of *Cynomorium coccineum* from Tunisia and southern Italy: effect of environmental stress. Diversity 10(3): 53. [Comparing the anti-oxidant qualities of *C. coccineum* from Tunisia and southern Italy and finding significant differences presumed due to differences in climate.]

Bilgen, B.B., Daneshvar, S., Evci, G., Pekcan, V., Yilmaz, M.I and; Kaya, Y. 2018. Determination of high oleic type and broomrape resistant sunflower hybrids by DNA markers. EKIN, Journal of Crop Breeding and Genetics (4): 22-30. [Identifying SCAR markers (RTS28, RTS29, RTS40 and RTS41) and SSR markers (ORS1036 and ORS1040) as being linked to the Or5 gene, providing resistance to all five races (A-E) of *Orobanche cumana.*]


Blanco-Ania, D., Mateuman, J.J., Hýlová, A., Spichal, L., Debie, L.M. and Zwanenburg, B. 2019. Hybrid-type strigolactone analogues derived from auxins. Pest Management Science 75(11): .3113-3121. [8 new compounds synthesised and tested for germination of *S. hermonithica, Orobanche minor* and *Phelipanche ramosa*. Those with with a natural monomethylated D-ring had appreciable to good activity towards the three species and were the most active, while derivatives with the trimethylated D-ring showed no activity and the dimethylated derivatives (2,4-dimethyl and 3,4-dimethyl) were slightly active, especially towards *P. ramosa.*]


Borzouei, S., Sharifi, R. and Moarrefzadeh, N. 2019. Induction of systemic resistance in tomato against broomrape (*Phelipanche aegyptiaca*). Journal of Phytopathology 167(10): 567-575. [Concluding that it was possible to use a mixture of rhizobacteria including *Bacillus pumilis* INR7 and *Lysinibacillus boronitolerans* B124, and defence inducers such as biogenic volatiles as a promising approach in the management of *P. aegyptiaca.*]

Bouwmeester, H. 2018. Can witchweed be wiped out? Science (Washington) 362(6420): 1248-1249. [Referring to the paper by Uraguchi et al. (see below) and the discovery of highly potent...
germination stimulants, and discussing the possibility of their use to eradicate parasitic weeds of the Orobanchaceae. See Literature Highlight above.

Briache, F.Z. and 9 others. 2019. Field and controlled conditions screenings of some faba bean (Vicia faba L.) genotypes for resistance to the parasitic plant Orobanche crenata Forsk. and investigation of involved resistance mechanisms. Journal of Plant Diseases and Protection 126(3): 211-224. [Of 6 genotypes tested, Giza 843, Misr1, and Misr3 genotypes showed moderate resistance to O. crenata and 2-4-fold yield increase compared with the susceptible standards thanks to combinations of lower host root density, reduced attachment on host roots and delayed development of infection.]


Brun, G., Thoiron, S., Braem, L., Pouvreau, J.B., Montiel, G., Lechat, M.M., Simier, P., Gevaert, K., Goormachtig, S. and Delavault, P. 2019. CYP707As are effectors of karrinik and strigolactone signalling pathways in Arabidopsis thaliana and parasitic plants. Plant, Cell and Environment 42(9): 2612-2626. [In Phelipanche ramosa, strigolactone-induced germination was shown to require one of the CYP707A proteins involved in abscisic acid catabolism suggesting that the lack of host-independent germination in obligate parasites is associated with an exacerbated CYP707A induction and that CYP707As and WRKY33 are new players involved in a variety of strigolactone/karrinik responses.]


Bulti Merga and Abdulatif Ahmed. 2019. A review on agricultural problems and their management in Ethiopia. Turkish Journal of Agriculture - Food Science and Technology 7(8): 1189-1202. [Noting that a considerable loss in growth and yield of many food and fodder crops are caused by Striga hermonthica and Orobanche spp. in Ethiopia.]

Busch, K.B. 2018. Respiration: life without Complex I. Current Biology 28(1): R616-R618. ['Eukaryotic life has developed a fascinating and highly optimized system for energy transduction: the mitochondrial respiratory chain. Typically composed of five core protein complexes, we now learn from two studies (see items by Senkler et al. and Maclean et al. – see below) that plant hemi-parasites of the Viscum album type cope without Complex I, the entry point of the classical respiratory system.]


Camarero, J.J., González de Andrés, E., Sangüesa-Barreda, G., Rita, A. and Colangelo, M. 2019. Long- and short-term impacts of a defoliating moth plus mistletoe on tree growth, wood anatomy and water-use efficiency. Dendrochronologia 56; 125598. [Concluding that defoliation by nun moth (Lymnantria dispar) disposed Pinus sylvestris to infection by Viscum album ssp. austriacum, the combination leading to severe reduction in tree growth (in Spain).]

Camel, V., Arizapana-Almonacid, M., Pyles, M., Galeano, E., Quispe-Melgar, H.R., Ninanya-Parra, Z., Ames-Martínez, F.N., Requena-Rojas, E. and Kessler, M. 2019. Using dendrochronology to trace the impact of the hemiparasite Tristerix chodatianus on Andean Polylepis trees. Plant Ecology 220(9): 873-886. [In the high Andean forests of Peru, analysis of wood anatomy was used to show that T. chodatianus causes a reduction in the vessel density, and an increase in the vessel diameter leading to vulnerability of the parasitized branches to embolisms and cavitation, thus leading to progressive death of the tree crown.]
Caraballo-Ortiz, M.A, and Acevedo-Rodríguez, P. 2019. Clarifying the identity of the enigmatic mistletoe Cladocolea biflora (Loranthaceae). Harvard Papers in Botany 24: 119-120. [Based on morphological assessment, the specimen from which C. biflora was described is not a mistletoe but instead the hemiparasitic tree Schoepfia schreberi (Schoepfiaceae). The taxonomic implications are discussed, and synonymizing C. biflora under S. schreberi is proposed.]

Cardoso, L.J.T., de Smidt, E. and Braga, J.M.A. 2018/ Reinterpretation of the nomenclatural type of Archimeda pyramidalis (Balanophoraceae) with new combination to Lophophytum. Phytotaxa 345(3): 279-285. [A reinterpretation of the nomenclatural type of Archimeda pyramidalis (Balanophoraceae) is presented that results in the synonymization of Lophophytum leandrii. This lectotype is designated and a new combination, L. pyramidalis, is proposed.]

Cardoso, L.J.T. and Braga, J.M.A. 2018/ Typifications and nomenclatural notes on Neotropical Balanophoraceae. Phytotaxa 340(3): 263-270. [Nomenclatural types for nine names of Neotropical Balanophoraceae are designated or clarified here, involving the genera Helosis, Langsдорffia, Lathrophytum, and Scybalium.]

Carmona Gallego, I., Murillo Serna, J.S., Rincón Barón, E.J. and Alzate Guarín, F.A. 2018. (Comparative leaf anatomy of Gaiadendron punctatum and Tripodanthes belmirensis (Loranthaceae).) (in Spanish) Acta Biológica Colombiana 23(1): 66-72. [A few leaf anatomical differences, such as idioblasts in Tripodanthes, were detected that would allow one to distinguish between these two species.]


Castillo-Sánchez, I.L. and Figueroa-Castro, D.M. 2019. Intra-inflorescence variation in reproductive traits of Conopholis alpina (Orobanchaceae): effect of flower maturation pattern and resource competition. Plant Ecology 220(7/8): 721-729. [Detailed study of numerous parameters of structural detail in the upper, middle and lower inflorescence showed reproductive traits had the highest values in the middle region of the inflorescence, which is also the first to reach maturity. The results provide strong support towards the existence of differential resource availability among regions within the inflorescence as an explanation to the pattern of intra-inflorescence variation detected.]

Chai YangYang, Kan LianBao and Zhao Min. 2019. Enzymatic extraction optimization, anti-HBV and antioxidant activities of polysaccharides from Viscum coloratum (Kom.) Nakai. International Journal of Biological Macromolecules 134: 588-594. [Describing extraction methods and suggesting that V. coloratum could be a good potential natural antiviral agent and antioxidant.]

Chen, X., Wicke, S., and 22 others. 2019. Comparative plastome analysis of root- and stem-feeding parasites of Santalales untangle the footprints of feeding mode and lifestyle transitions. Genome Biology and Evolution 12(1): 3663–3676. https://doi.org/10.1093/gbe/evz271. [Covers the trajectory of heterotrophy-related reduction of plastid genomes in different families of the sandalwood order. Phylogenomic-comparative methods reveal the series of genes losses across the order, elevations of substitutions rates, and increasing biases of DNA composition. The study shows that the independent transitions to a mistletoe habit within Santalales coincides with an apparent parasitic specialization, pronounced as increased dependency on host photosynthates].

modelling monogastrics. Pakistan Journal of Biological Sciences 21(7): 314-322. [Concluding that *X. caffra* meal could be a substitute for soya bean meal, but may be toxic at high levels.]


**Clarke, C.R., Timko, M.P., Yoder, J.I., Axtell, M.J. and Westwood, J.H. 2019. Molecular dialog between parasitic plants and their hosts.** Annual Review of Phytopathology 57: 279-299. [Reviewing the current knowledge of how parasitic plants (*Striga, Orobanche* and *Phelipanche* spp.) sense host plants, germinate, form haustoria, and suppress host plant immune responses, and whether parasitic plants fit within the current paradigms used to understand the molecular mechanisms of microbial plant–pathogen interactions. Also discussing challenges facing parasitic plant research and proposing the most urgent questions that need to be answered to advance our understanding of plant parasitism.]

**Cui HongLiang, Dong PanPan Chen Bin. 2019. Effect of total flavonoids of *Cuscuta chinensis* Lam. (Convolvulaceae) on oxidative stress injury in mouse testis and epididymis, and on serum levels of reproductive hormones in oligoasthenospermia mice model.** Tropical Journal of Pharmaceutical Research 18(6): 1253-1258. [Results suggest that extracts of *C. chinensis* effectively improve sperm quality and reduce oxidative damage in testes and epididymis of mice with oligoasthenospermia via a mechanism involving the regulation of serum levels of reproductive hormones.]


**Cusimano, N. and Renner, S.S. 2019. Sequential horizontal gene transfers from different hosts in a widespread Eurasian parasitic plant, *Cynomorium coccineum*.** American Journal of Botany 106(5): 679-689. [Transfer of multiple genes from various host species to the widespread *Cynomorium coccineum* reveals a degree of host specialization and a directionality in the expansion of parasite’s distribution range.]


**da Silva-Leite, K.E.S. and 10 others. 2018. *Ximenia americana* heteropolysaccharides ameliorate inflammation and visceral hypernociception in murine caerulein-induced acute pancreatitis: involvement of CB2 receptors.** Biomedicine & Pharmacotherapy 106: 1317-1324. [Showing that the polysaccharides in *X. americana* contain heteropolysaccharides that inhibit inflammation and hypernociception in mice with caerulein-induced acute pancreatitis by a mechanism involving type 2 cannabinoid receptors.]


**Dafaalah, A.B 2020. Variability and host specificity of *Striga hermonthica* (Del.) Benth. in response to in-situ root exudates**
of *sorghum bicolor* (L.) Moench. Journal of Research in Weed Science 3(2): 238-253. [Confirming that different populations of *S. hermonthica* in Sudan are specific either to sorghum or to millet. Among sorghum varieties, Abu-70 and Wad Ahmed were most susceptible while the least susceptible was Hakika.]


de Menezes, I.R.A. and 12 others, 2019. *Ximenia americana* L. enhances the antibiotic activity and inhibit the development of kinetoplastid parasites. Comparative Immunology, Microbiology & Infectious Diseases 64: 40-46. [‘The low cytotoxic and biological potential against *Staphylococcus aureus* open therapeutic perspectives against leishmaniosis and bacterial infections.]

Dieni, Z., Batieno, T.B.J., Barro, A., Zida, F.M.W.S., Tignegre, J.B.delaS. and Dzidzienyo, D. 2019. Diallel analysis of cowpea [*Vigna unguiculata* (L.) Walp.] for seed size, and resistance to *Alectra vogelii* Benth. International Journal of Biological and Chemical Sciences 13(3): 1496-1509. [Both additive and non-additive gene actions were operative for the investigated characters, seed size and resistance to *A. vogelii*. Additive gene effects were more important, resulting in high narrow sense heritability inferring that breeding progress can be achieved through backcross or single seed descent method.]

Dieni, Z. and 10 others. 2019. Farmers' perception of the parasitic weed *Alectra vogelii* Benth. and their cowpea varietal preferences in Burkina Faso. Journal of Agricultural Research 14(31): 1390-1399. [*A. vogelii* causes up to 100% yield loss in some areas. Farmers' preferred traits where it occurs is for short-season cowpea varieties with large size, rough and white grain. However, erect varieties were selected in Koupela and Tenkodogo districts; prostrate varieties were preferred in Toussiana district. *Striga gesnerioides* also occurs.]

Drabo, I., Zangre, R.G., Danquah, E.Y.; Ofori, K., Witcombe, J.R. and Hash, C.T. 2019. Identifying farmers' preferences and constraints to pearl millet production in the Sahel and North-Sudan zones of Burkina Faso. Experimental Agriculture 55(5): 765-775. [A detailed survey noting that the major constraints for farmers include *Striga hermonthica*, second only to drought. Other important preferences in relation to e.g. crop head type were also noted which all need to be considered in any breeding programme for *Striga* resistance.]


Duriez, P. and 18 others. 2019. A receptor-like kinase enhances sunflower resistance to *Orobanche cumana*. Nature Plants 5(12): 1211–1215. (https://doi.org/10.1038/s41477-019-0556-z) [Quantitative genetics and mapping in sunflower identified one resistance gene named HaOr7. It is a membrane receptor-like kinase that prevents attachment of *O. cumana* to the sunflower roots and confers resistance to race F.]

strigolactone mimics were highly active on *P. ramosa* but not on *Striga hermonthica.*]  

*Dyankova, S., Doneva, M., Solak, A. and Metodieva, P.* 2018. Comparative analysis of extracts from some medicinal plants used in traditional Bulgarian medicine. Journal of Mountain Agriculture on the Balkans 21(3): 172-183. [Including *Viscum album.* The amount of extracted substances in the samples depends on the type of raw material and the ethanol concentration.]


*Fang YanYan, Liu Jian, Wan Lei, Xin Ling, Dong WenZhe and Wen JianTing.* 2019. Chinese herbs for Pi invigorating, dampness resolving, Shen benefiting, and...
collaterals dredging treated 323 ankylosing spondylitis patients: a cohort study. Chinese Journal of Integrated Traditional and Western Medicine 39(5): 553-556. [Taxillus chinensis could reduce the occurrence of endpoint events in ankylosing spondylitis patients.]

Farrokhi, Z., Alizadeh, H. and Alizadeh, H. 2019. Developmental patterns of enzyme activity, gene expression, and sugar content in sucrose metabolism of two broomrape species. Plant Physiology and Biochemistry 142: 8-14. [Pre and post emergence states of both Egyptian and branched broomrape species were analyzed for their metabolism, providing new perspectives for management strategies.]


Fathin, A.N. and Ratnaningrum, Y.W.N. 2018. The differences in floral structures of three sandalwood variants in one of Gunung Sewu (Indonesia) population, and their consequences on visitor diversity and visitation rate. Biodiversitas: Journal of Biological Diversity 19(3): 1097-1101. [Describing 3 sandalwood landraces varying in flower colour ('yellow big flower’ YBF; ‘red big flower’ RF; and ‘red small flower’ RSF.) YBF was visited more by coleopterans and hemipterans, while both RF and RSF were visited more by hymenopterans. The dipterans and lepidopterans visited both yellow and red flowers at a similar rate. The bigger flowers of RF and YBF received more visits than RSF.]


French, K.E., Harvey, J. and McCullagh, J.S.O. 2018. Targeted and untargeted metabolic profiling of wild grassland plants identifies antibiotic and anthelmintic compounds targeting pathogen physiology, metabolism and reproduction. Scientific Reports 8(1): 1695. [Recording the compounds benzoic acid, myricetin, p-coumaric acid, rhamnetin, and rosmarinic acid, having antimicrobial/anthelmintic properties in a range of species including *Rhinanthus minor*.]


Response of IITA maize inbred lines bred for Striga hermonthica resistance to Striga asiatica and associated resistance mechanisms in southern Africa. Euphytica 215(10): 151. [Identifying a number of the IITA-selected Striga-resistant lines with potential value for breeding maize with resistance to S. asiatica in Zimbabwe.]

Gebauer, R., Albrechtová, P., Plichta, R. and Han XiaoXu and 9 others. 2019. Protective effects of Astragalus on spermatogenesis in streptozotocin-induced diabetes in male mice by improving antioxidant activity and inhibiting inflammation. Biomedicine & Pharmacotherapy 110: 561-570. [Concluding that astragalin from Cuscuta chinensis is a potential beneficial agent to protect diabetic-induced spermatogenic dysfunction in male mice by increasing antioxidant activities and inhibiting inflammation.]

Hargreaves, A.L. and Eckert, C.G. 2019. Local adaptation primes cold-edge populations for range expansion but not warming-induced range shifts. Ecology Letters 22(1): 78-88. [Based on studies with Rhinanthus minor in Canada. [Authors have used Rhinanthus minor populations to test two contrasting predictions concerning the parasite's distribution range under scenarios influenced by climate change]


Hýlová, A., Pospíšil, T., Spichal, L., Mateman, J.J., Blanco-Ania, D. and Zwanenburg, B. 2019. New hybrid type strigolactone mimics derived from plant growth regulator auxin. Conference paper : New Biotechnology 48: 76-82. [Auxins were coupled with the butenolide D-ring, with or without an extra methyl group in the vicinal C2 or C3 positions. Those without the methyl groups showed good activity and it is suggested could be of value for stimulating suicidal germination if the field.]


Jia JianXin, Yan XuSheng, Song Wei, Fang Xin, Cai ZhiPing, Huo DongSheng, Wang He and Yang ZhanJun. 2018. The protective mechanism underlying phenylethanoid glycosides (PHG) actions on synaptic plasticity in rat Alzheimers disease model induced by beta amyloid 1-42. Journal of Toxicology and Environmental Health. Part A 81(21): 1098-1107. [Data suggest that the protective effects of PHG on synaptic plasticity may involve inhibition of cytotoxicity-mediated by Aβ 1-42 administration and reduction of oxidant stress.]

Jiang ZhiHui, Zhou Bo, Li XinPing, Kirby, G.M. and Zhang XiaoYing. 2018. Echinacoside increases sperm quantity in rats by targeting the hypothalamic androgen receptor. Scientific Reports 8(1) 3839. [Results demonstrate that echinacoside (from Cistanche spp.) blocks androgen receptor activity in the hypothalamus to increase the quantity of sperm and protect against oligoasthenospermia in rats.]

Johnson, N.R.and Axtell, M.J. 2019. Small RNA warfare: exploring origins and function of trans-species microRNAs from the parasitic plant Cuscuta. Current Opinion in Plant Biology 50: 76-81. [Showing that an unspecified Cuscuta sp. exchanges diverse macromolecules with its hosts. Also that trans-species microRNAs from Cuscuta regulate host genes. The genes encoding these microRNAs could originate from horizontal-gene transfer events. Extracellular vesicles are one possible mechanism for how trans-species microRNAs are delivered to the host.]

Jokinen, J.I. and Irving, L.J. 2019. Effects of light level and nitrogen supply on the red clover-Orobanche minor host-parasite interaction. Plants 8(6): 146. [Parasitism by O. minor caused reductions in host leaf mass, area, photosynthetic rates and shoot N concentration, but did not affect starch accumulation.]

and Tapinanthus preussii on Dacryodesedulis and other forest tree species. 34 other ant species were also identified. They forage during the mistletoes’ flowering and fruiting and ‘participate in the flowers fall’.

Jung SeHui, Kim JaeHyun, Eum JuneYong, Choe JungWon, Kim HakHyun, Kee Yun, Lee KooYeon. 2019. Velutin, an aglycone extracted from Korean mistletoe, with improved inhibitory activity against melanin biosynthesis. Molecules 24(14): 2549. [Confirming that the natural compound velutin, extracted from Viscum album coloratum improved the efficacy of melanin biosynthesis inhibition with little toxicity.]


Khound, N.J. and Bharali, R.K. 2018. Biosorption of fluoride from aqueous medium by Indian sandalwood (Santalum album) leaf powder. Journal of Environmental Chemical Engineering 6(2): 1726-1735. [Results indicated that S. album leaf powder might be an effective adsorbent for treatment of water contaminated with fluoride.]


Kim, H.T.; Shin ChangHo, Sun Hang and Kim JooHwan. 2018. Sequencing of the plastome in the leafless green mycoheterotroph Cymbidium macrorhizum helps us to understand an early stage of fully mycoheterotrophic plastome structure. Plant Systematics and Evolution 304(2): 245-258. [Plastome of four species of the mycoheterotroph orchid genus Cymbidium have been sequenced and compared, suggesting no direct evidence of functionality loss in photosynthesis related genes.]

Kirilova, I., Hristeva, T., Bozhinova, R., Denev, I., Docheva, M. and Yonchev, Y. 2018. Molecular detection of beneficial hyphal soil-borne microorganisms in different soil types in areas infested with parasitic broomrapes - Orobanche cumana Wallr. and Phelipanche ramosa L. in Bulgaria. Journal of BioScience and Biotechnology 7(2/3): 63-71. [The soils at numerous sites infested by O. cumana or P. ramosa were found by molecular detection to be populated most commonly by Glomus intraradices and G. mosseae. Five Streptomyces spp. were also identified, namely S. ambifaciens, S. aureocirculatus, S. carnosus, S. fasiculatus and S. griseorubens. Other genera included Penicillium, Trichoderma, Fusarium and Mucor. The results could contribute to a new strategy for using beneficial hyphal microorganisms to control parasitic weeds.]

Kitis, Y.E., Grenz, J.H. and , J. 2019. Effects of some cereal root exudates on germination of broomrapes (Orobanche spp. and Phelipanche spp.) Mediterranean Agricultural Sciences 32(2): 145-150. [A range of cereal species were tested for their ability to stimulate Orobanche crenata, O. cumana and Phelipanche ramosa. Maize
(var. Amadeo) was the most active and *P. ramosa* the most sensitive to stimulation. Oat was also quite active on *P. ramosa*, while wheat, barley, rye, rice, sorghum and pearl millet (single varieties in each case.) were least effective.]

Kleszken, E., Laslo, V. and Vicaș, S.I. 2019. Spectrophotometric quantification of green pigments and total carotenoids from mistletoe grown on different host trees. Natural Resources and Sustainable Development 9(1): 27-33. [Showing significant variations in chlorophyll and carotenoids in *Viscum album* growing on 4 hosts, apricot, hawthorn, willow and *Rubus*, and between spring and winter, in Romania.]

*Konarska, A. and Chmiellewski, P. 2019. Taxonomic traits in the microstructure of flowers of parasitic *Orobanche picridis* with particular emphasis on secretory structures. Protoplasma 2019: 1-19 (https://doi.org/10.1007/s00709-019-01438-3) [A very detailed study of the sepals, petals, stamens and pistils and the ultra-structure of nectaries and glandular trichomes of *O. picridis* in Poland. Also identifying the metabolites including polyphenols, lipids, polysaccharides and alkaloids.]*


Lallemand, F., Martin-Magniette, M.L., Gilard, F., Gakière, B., Launay-Avon, A., Delannoy, É. and Selosse, M.A. 2019. In situ transcriptomic and metabolomic study of the loss of photosynthesis in the leaves of mixotrophic plants exploiting fungi. Plant Journal 98(5): 826-841. [Rather than decisive metabolic innovations, it is suggested that the evolution towards mycoheterotrophy in orchids is more likely to be reliant on the versatility of plant metabolism and an ability to exploit fungal organic resources, especially amino acids, to replace missing photosynthates.]


Le ChiToan, Liu Bing, Barrett, R.L., Lu LiMin, Wen Jun and Chen ZhiDuan. 2018. Phylogeny and a new tribal classification of Opiliaceae (Santalales) based on molecular and morphological evidence. Journal of Systematics and Evolution 56(1): 56-66. [This molecular phylogenetic study recovered essentially the same relationships as already published previously (Su et al. 2015). 24 morphological characters were mapped onto this tree, a new tribal classification was proposed, and a key to all genera was provided.]


Lee ShiouYih, Dhilia Udie Lamasudin and Rozi Mohamed. 2019. Rapid detection of several endangered agarwood-producing Aquilaria species and their potential adulterants using plant DNA barcodes coupled with high-resolution melting (BarHRM) analysis. Holzforschung 73(5): 435-444. [Noting *Santalam album* among several species as a potential adulterant detected by DNA barcoding with high-resolution melting analysis.]

Lee YunGyoo, Jung InNa, Koo DongHoe, Kang DuYoung, Oh TaeYoon, Oh SukJoong and Lee SeungSei. 2019. Efficacy and safety of *Viscum album* extract (Helixor-M) to treat malignant pleural effusion in patients with lung cancer. Supportive Care in Cancer 27(5): 1945-1949. [Concluding that a pleurodesis with *V. album* extract was an effective and tolerable procedure for

Li EnLiang, Mao YunLing, Zhou Jiang, Liu YongGuo, Chang EnFu, Li Ya, Li YongPeng and Jing YueBo. 2019. (Physical-chemical properties of different growing media and its effects on seedling emergency percentage of Melientha longistaminaea.) (in Chinese) Journal of West China Forestry Science 48(3): 127-132. [Describing the optimal ratio of coffee compost, forest compost and forest humus for the germknation and establishment of M. longistaminea (Opiliaceae).]

Li JuanJuan, Yang Chong, Liu Hui, Cao MengTing, Yan GuiJun, Si Ping, Zhou WeiJun and Xu Ling. 2019. 5-aminoolevolinic acid enhances sunflower resistance to Orobanche cumana (broomrape). Industrial Crops and Products 140: 111467. [5-aminoolevolinic acid enhanced sunflower resistance to O. cumana by promoting antioxidant defence systems, reducing ROS levels, decreasing cellular damage and regulating the expressions of stress related genes.]


*Li Xi, Feng Tao, Randle, C. and Schneeweiss, G.M. 2019. Phylogenetic relationships in Orobanchaceae inferred from low-copy nuclear genes: consolidation of major clades and identification of a novel position of the non-photosynthetic Orobanche clade sister to all other parasitic Orobanchaceae. Frontiers in Plant Science 10(July): 902. (https://www.frontiersin.org/articles/10.3389/fpls.2019.00902/full) [56 taxa (in 30 genera) were analyzed using nuclear ITS, PHYA, PHYB, chloroplast matK and rps2, three low-copy nuclear genes and two pentatricopeptide repeat genes. There was considerable incongruence between the newly and previously generated markers. Unlike previous studies where the Cymbaria-Siphonostegia clade was sister to all parasites in the family, this study places this clade internally with the hemiparasites. This shift in position then places the Orobanche clade as sister to the remaining members of Orobanchaceae.]

Li Ya, Li EnLiang, Mao YunLing, Zhou Jiang, Liu YongGuo, Chang EnFu, Li YongPeng and Jing YueBo. 2019. (Effects of growing media on seedling performance of Melientha longistaminaea.) (in Chinese) Journal of Northeast Forestry University 47(3): 8-11. [M. longistaminaea (= Champereia manillana) (Opiliaceae) is valued as a food and as a medicine in E. Asia. Identifying the optimum combinations of coffee husk, humus and forest soil for its growth.]

Li Yang, Peng Ying, Ma Ping, Wang MengYue, Peng ChongSheng, Tu PengFei and Li XiaoBo. 2019. In vitro and in vivo metabolism of Cistanche tubulosa extract in normal and chronic unpredictable stress-induced depressive rats. Journal of Chromatography, B 1125: 121728, (https://www.sciencedirect.com/science/article/pii/S1570023218318324) [The results of this study laid the foundation for understanding the metabolic process and therapeutic mechanism of C. tubulosa’s antidepressant property.]


Li YongPeng, Jing YueBo, Mao JiHua, Li RongBo and Li SunLing. 2019. (Root hemiparasitic characteristics of Malania oleifera.) (in Chinese) Journal of West China Forestry Science 48(4): 1-6. [M. oleifera (Olapaceae), an endangered endemic in China, can survive without a host but grows poorly. Showing that Chlorophytum comosum is a suitable host on which it can grow more vigorously.]

*Li ZiYan, Zhang ChunHong, Ren GuanYao, Yang Min, Zhu ShouDong and Li MinHui. 2019. Ecological modeling of Cistanche deserticola Y.C. Ma in Alxa, China. Scientific Reports 9(1): 13134. (https://www.nature.com/articles/s41598-019-48397-6.pdf) [Determining the climatic and soil characteristics optimal for the content of the most important composition of C. deserticola for medicinal use.]

Lindman, L.Y., Remm, J., Meister, H. and Tammaru, T. 2018. Host plant and habitat preference of the endangered *Euphydryas maturna* (Lepidoptera: Nymphalidae): evidence from northern Europe. *Ecological Entomology* 43(1): 102-113. [This butterfly species is threatened due to the disease threat to its main host, *Fraxinus excelsior*. Confirming that this butterfly may lay eggs on *Melampyrum pratense* but that this host may be less important in Estonia than in Finland.]


Liu Bing, Chi Toan Le, Barrett, R.L., Nickrent, D.L., Chen ZhiDuan, Lu LiMin and Vidal-Russell, R. 2018. Historical biogeography of Loranthaceae (Santalales): diversification agrees with emergence of tropical forests and radiation of songbirds. *Molecular Phylogenetics and Evolution* 124: 199-212. [Nuclear and chloroplast gene data were used to address divergence times and ancestral area reconstruction for Loranthaceae whose crown group originated in Australasian Gondwana during the Paleocene to early Eocene (53–66 Ma). Aerial parasitism evolved from root parasitism ca. 50 Ma during the Eocene climatic optimum. Subsequently, Loranthaceae were widespread in Australasia and South America; the African and European members being derived later from Asiatic lineages. The burst of diversification of Loranthaceae can be correlated with climatic optima that coincide with the dominance of tropical forests and the rapid radiation of many bird families.]

Liu Jing, Yang Yang, Wei HaiYan, Zhang QuanZhong, Zhang XuHui, Zhang XiaoYan and Gu Wei. 2019. Assessing habitat suitability of parasitic plant *Cistanche deserticola* in Northwest China under future climate scenarios. *Forests* 10(9): 823. [Studying the climatic factors affecting the distribution of *C. deserticola* and its main host *Haloxylon ammodendron*.]


Lobulu, J., Shimelis, H., Laing, M. and Mushongi, A.A. 2019. Maize production constraints, traits preference and current *Striga* control options in western Tanzania: farmers’ consultation and implications for breeding. *Acta Agriculturae Scandinavica, Section B - Soil & Plant Science* 69(8): 734-746. [Noting that 93% of farmers in the surveyed areas name *Striga* as a major constraint, either *S. hermonthica* or *S. asiatica* or both, yet there are few effective control methods in use. Recommending that crop breeding for *Striga* resistance should take into consideration the full range of the farmers’ requirements including drought and insect resistance.]

Lonardi, S. and 22 others. 2019. The genome of cowpea (*Vigna unguiculata* [L.] Walp.). *Plant Journal* 98(5): 767-782. [A comprehensive description of the genome of *V. unguiculata*, noting the identification of an inversion of 4.2 Mb among landraces and cultivars, which includes a gene that has been associated in other plants with interactions with the parasitic weed *Striga gesnerioides*.]

Lopez, L., Bellis, E.S., Wafula, E., Hearne, S.J., Honaas, L., Ralph, P.E., Timko, M.P., Unachukwu, N., de Pamphilis, C.W. and Lasky, J.R. 2019. Transcriptomics of host-specific interactions in natural populations of the parasitic plant purple witchweed (*Striga hermonthica*). *Weed Science* 67(4) 397-411. [Despite low levels of host-based genome-wide differentiation in *S. hermonthica* infesting sorghum and maize in Nigeria, a set of parasite transcripts were

Mamudu, A.Y., Baiyeri, K.P. and Echezona, B.C. 2019. Effect of cropping system, seed treatment and planting date on *Striga hermonthica* infestation and growth and yield of sorghum. African Journal of Agricultural Research 14(29): 1254-1261. [The results from trials in Nigeria showed that *S. hermonthica* emergence was significantly delayed in sorghum variety ICSV1002, sorghum intercropped with soyabean and sorghum soaked with 66 g/L *Parkia* concentrate compared to other treatments.]


Manyasi, C.N., Ochieno, D.M.W., Muyekho, F.N., Muoma, J.V.O., Pamela, M.M. and Naluyange, V. 2018. Soil maize cultivar-related challenges on *Striga hermonthica* infested fields in Western Kenya. Journal of Plant Studies 7(2): 41-48. [Lowest *Striga* numbers and highest yields were associated with white-seed commercial variety Duma, and with DAP + CAN fertilizer. Water hyacinth compost containing Effective Microbes™ (HEM) allowed high *Striga* emergence but gave higher yields than cattle manure.]

Mapunda, E.P. and Mligo, C. 2019. Nutritional content and antioxidant properties of edible indigenous wild fruits from Miombo woodlands in Tanzania. International Journal of Biological and Chemical Sciences 13(2): 849-860. [Concluding that the local fruits studied, including those from *Ximenia caffra* could be be used as valuable sources of nutrients and vital natural antioxidant to human diets.]

Martínčová, M., Kaštner, P., Krasylenko, Y.A., Gajdoš, P., Čertík, M., Matušková, I. and Blehová, A. 2019. Species-specific differences in architecture and chemical composition of dodder seeds. Flora (Jena) 256: 61-68. [Showing that *Cuscuta europaea* and *C. monogyna* each have special endosperm architecture and different seed coat thickness.]

identified specifically associated with each host. Parasite genes in several different functional categories implicated as important in host-parasite interactions differed in expression level and allele on different hosts, including genes involved in nutrient transport, defense and pathogenesis, and plant hormone response.]

López-Ortega, M., Pérez-Rodríguez, P., Pérez-Staples, D. and Díaz-Fleischer, F. 2019. Patterns of oviposition and feeding in the monophagous fly *Anastrepha spatulata* (Diptera: Tephritidae) on its larval host plant *Schoepfia schreberi*. Environmental Entomology 48(5): 1178-1186. [Results indicate that female *A. spatulata* use different foraging tactics during the fruiting season and confirm that, in this case, the host plant *S. schreberi* (Schoafiaceae/Olacaceae) is not the center of activity.

Lukacova, Z., Svubova, R., Janikovicova, S., Volajova, Z. and Lux, A. 2019. Tobacco plants (*Nicotiana benthamiana*) were influenced by silicon and were not infected by dodder (*Cuscuta europaea*). Plant Physiology and Biochemistry 139: 179-190. [Silicon applied as a seed priming, applied to the soil, or to the foliage almost completely prevented *C. europaea* infestation on tobacco, presumably due to changes in cell wall properties in epidermis and cortex. Tobacco growth was enhanced in some seed priming and soil treatments but reduced in foliar treatments.]

Luo YaTing, Qiu QiWei and Cui XianLiang. 2019. (Effects of light quality and seed size on fourteen species of plants in Puer region.) (in Chinese) Guangxi Zhiwu / Guihaia 39(7): 959-966. [The germination percentage of *Oxysir quadrirpartita* was highest and fastest in white or red light and least in blue light or dark.]

Maclean, A.E., Hurtle, A.P., Ligas, J., Bock, R., Balk, J. and Meyer, E.H. 2018. Absence of complex I is associated with diminished respiratory chain function in European mistletoe. Current Biology 28(10): 1614-1619. [Showing that oxidative phosphorylation in *Viscum album*, is highly diminished. Complex I activity and protein subunits of complex I could not be detected. The levels of complex IV and ATP synthase were at least 5-fold lower than in a non-parasitic plant whereas alternative dehydrogenases and oxidases were higher in abundance.]

Histochemical staining also revealed peculiar storage compounds composition and localisation in seeds. Starch deposits occurred directly beneath *C. europaea* testa, while only in the embryo in *C. monogyna.*

Masi, M., Fernández-Aparicio, M., Zatout, R., Boari, A., Cimmino, A. and Evidente, A. 2019. Inuloxin E, a new seco-eudesmanolide isolated from *Dictytrichia viscosa*, stimulating *Orobanche cumana* seed germination. Molecules 19: 3479. (https://www.mdpi.com/.../pdf ) [Both inuloxins D and E induced germination of *O. cumana*, but were inactive on *O. minor* and *Phelipanche ramosa*. The germination activity of some hemisynthetic esters of inuloxin D was also investigated.]

*Mathiasen, R.L. 2019. Susceptibility of red fir and white fir to fir dwarf mistletoe (*Arceuthobium abietinum*) in California. Forest Pathology 49(3): e12516 (https://doi.org/10.1111/efp.12516). [A careful study confirming that the forms of *A. abietinum* f. *sp. magnifica* and *concoloris* are highly specific to red fir and white fir respectively.]

Mathiasen, R.L. 2019. Susceptibility of Coulter pine (*Pinus coulteri*) to western dwarf mistletoe (*Arceuthobium campylopodum*) in southern California. Forest Pathology 49(5): e12543. (The results indicate that Coulter pine should be classified as a principal host of *A. campylopodum* and not as a secondary host as previously reported.)

Mbasani-Mansi, J., Briache, F.Z., Ennami, M., Gaboun, F., Benbrahim, N., Triqui, Z.E.A. and Mentag, R. 2019. Resistance of Moroccan lentil genotypes to *Orobanche crenata* infestation. Journal of Crop Improvement 33(3): 306-326. [Among 17 genotypes, VO8 was the most susceptible and LR9 and VO8 were the most resistant, but how resistant, not clear from abstract.]


Menkir, A. and Meseka, S. 2019. Genetic improvement in resistance to *Striga* in tropical maize hybrids. Crop Science, 59(6): 2484-2497. (https://dl.sciencesocieties.org/publications/cs/abstracts/59/6/2484) [Reviewing the performance of maize hybrids from before the 1990s and since the 1990s when breeding for polygenic resistance to *S. hermonthica* had resulted in 64% higher yields, 61% less *Striga.*]


Mohapatra, S.R., Bhol, N. and Nayak, R.K. 2019. Standardization of nursery media and sowing time for germination of sandalwood...
(Santalum album L.) seed. Indian Forester 145(8): 752-756. [Describing results from 8 different sowing media, with seeds with and without seed coats.]


Moon JeongMin, Chung YounJee, Chae Boah, Kang HeeJin, Cho HyunHee, Kim JangHeub and Kim MeeRan. 2018. Effect of mistletoe on endometrial stromal cell survival and vascular endothelial growth factor expression in patients with endometriosis. International Journal of Medical Sciences (Sydney) 15(13): 1530-1536. [Concluding that extracts of mistletoe have anti-angiogenic activity on endometrial stromal cells and thus have potential for the treatment of endometriosis. Extraordinarily, the full paper makes no attempt to identify the species, but references suggest it was referring to Viscum album.]


Morimoto, M. 2019. Chemical defense against insects in Heterotheca subaxillaris and three Orobanchaceae species using exudates from trichomes. Pest Management Science 75(9): 2474-2481. [Glandular trichomes of Parentucellia viscosa showed insect antifeedant activity. Non-biologically active secondary metabolites produced by P. latifolia and Bellardia trixago were presumed to act as physical defenses due to their viscosity.]


Muhammad Qaiser and Anjum Perveen. 2019. Pollen morphology of the genus Pedicularis L. Orobanchaceae from Pakistan and Kashmir and its taxonomic implications. Pakistan Journal of Botany 51(5): 1809-1818. [On the basis of exine ornamentation four distinct pollen types viz., P. albida-type, P. oederi-type, P. bicorruita-type, and Pedicularis roylei-type were recognized but little correlation was found between the infrageneric classification and the pollen type.]

Muniyandi Kasipandi, Ayyapan Manikandan, Sreeja, P.S., Thamburaj Suman, Sathyanarayanan Saikumar, Sivaraj Dhiyva and Thangaraj Parimelazhagan. 2019. Effects of in vitro simulated gastrointestinal digestion on the antioxidant, α-glucosidase and α-amylase inhibitory activities of water-soluble polysaccharides from Opilia amentacea roxb fruit. LWT - Food Science and Technology 111: 774-781. [Concluding that the bioactive potential of O. amentacea (used as a traditional medicine in West Africa) as an antioxidant and antihyperglycemic, which could be considered as a promising candidate for functional foods.]

Murage, A.W., Pitchar, J.O., Midega, C.A.O., Onyango, C.O., Pickett, J.A. and Khan, Z.R. 2019. Gender appropriateness of field days in knowledge generation and adoption of push-pull technology in eastern Africa. East African Agricultural and Forestry Journal 83(4): 289-306. [Concluding that women were more receptive than men to training in the push-pull technique for control of Striga.]

Nabiabad, H.S., Amini, M. and Kianersi, F. 2019. Ipomoea batatas: papain propeptide inhibits cysteine protease in main plant parasites and enhances resistance of transgenic tomato to parasites. Physiology and Molecular Biology of Plants 25(4): 933-943. [Transgenic tomato containing an inhibitory propeptide derived from sweet potato and some other sources were found to be relatively resistant to Orobanche cernua and Cuscuta chinensis due to defective haustorial connections.]

Ng, F.S P. 2019. Is Rafflesia an angiosperm? Journal of Tropical Forest Science 31(3): 286-297. [This sad paper attempts to make the case that Rafflesia is not an angiosperm by comparing various morphological features (androecium, gynoecium, fruit, seed) to “typical” flowering plants and then, given their unusual nature, stating that those features are not homologous. All
of this flies in the face of molecular and
developmental work that clearly shows
Rafflesiaceae is part of Malpighiales. Some
of that literature is cited but apparently
discounted.]
Nge, F.J., Ranathunge, K., Kotula, L.,
Strong host specificity of a root hemi-
parasite (Santalum acuminatum) limits its
local distribution: beggars can be choosers.
Plant and Soil 437(1/2): 159-177. [S.
acuminatum showed much stronger growth
in association with Acacia saligna than
with 17 other potential hosts.] 
Feeding patterns of Indian Giant Flying
Squirrel (Petaurista philippensis, Elliot
1839) with reference to seasonal variation
in Central Gujarat, India. Journal of
[Identifying Dendrophthoe falcata as a
secondary food source for P. philippensis.]
Nsor, C.A., Godsoe, W. and Chapman, H.M.
2019. Promiscuous pollinators - evidence
from an Afromontane sunbird-plant pollen
transport network. Biotropica 51(4): 538-
548. [Noting the dependence of
Globimetula braunii on sunbirds for
pollination.]
preparation procedure for laser
microdissection-mediated harvest of plant
tissues for gene expression analysis. Plant
Methods 15(88): (02 August 2019).
[https://plantmethods.biomedcentral.com/ar-
ticles/10.1186/s13007-019-0471-3] 
[Cuscuta reflexa growing on its compatible
host plant Pelargonium zonale were
sectioned using a vibratome and dried on
glass slides at 4°C before laser
microdissection. The expression levels of
two parasite genes previously found to be
highly expressed during host plant
infection were shown to differ individually
between specific regions of the infection
site. By drying plant sections under low
pressure to reduce the dehydration the
induced expression of two wound-related
genes during preparation was avoided.] 
Osathanunkul, M. 2019. eDNA-based
monitoring of parasitic plant (Sapria
himalayana). Scientific Reports 9(9161):1-
5. [Environmental DNA (eDNA) was used
to monitor for the presence of this rare
Sapria species from soil samples. Species
specific primers and qPCR was used and
Sapria DNA was detected in all sites where
the parasite was known to occur and none
of the sites where it was not known. This
technique could have use in conservation
management.] 
Ouattara, Z.A., Sangaré, N., Mamyrbekova-
Bekro, A.J., Bekro, Y.A., Tomi, P., Paoli,
Composition and chemical variability of
essential oils isolated from aerial parts of
Cassycha filiformis from Côte d’Ivoire.
Natural Product Communications 13(2):
217-218. [Determining various compounds
in C. filiformis, mainly sesquiterpenes.] 
Ozturk, M., Coskuner, K.A., Usta, Y., Serdar,
B. and Bilgili, E. 2019. The effect of
mistletoe (Viscum album) on branch wood
and needle anatomy of Scots pine (Pinus
[V. album ssp. austriacum caused major
reductions in the double wall thickness,
lumen area, tangential lumen area and
radial lumen area of the tracheids in the
wood and a decrease in vascular area in the
needles.] 
*Pan Da, Schönswetter, P., Moser, T., Vitek,
E. and Schneeweis, G.M. 2019. Ancestral
remnants or peripheral segregates?
Phylogenetic relationships of two narrowly
endemic Euphrasia species
(Orobanchaceae) from the eastern
European Alps. AoB Plants 11(2) plz007.
[https://academic.oup.com/aobpl/article/11/
2/plz007/5345136] [The diploid
autogamous species Euphrasia inopinata
and E. sinuata are morphologically similar
to allopolyploid E. minima. ITS and AFLP
analysis, however, shows they are
peripheral segregates of the widespread
diploid allogamous E. alpina.] 
Park InKyu, Song JunHo, Yang SungYu, Kim
WookJin, Choi GoYa and Moon
ByeongCheol. 2019. Cuscuta species
identification based on the morphology of
reproductive organs and complete
chloroplast genome sequences.
International Journal of Molecular Sciences
20(11): 2726. 
[https://www.mdpi.com/1422-
0067/20/11/2726/htm] [Dried seeds from
some Cuscuta species are used in Korean
traditional medicine, hence means to
distinguish C. japonica from C. chinesis
morphologically is given. The complete
plastome sequences of these species is also
given and compared to other dodder
plastomes.] 
Parul Bhargava, Ravindra, N. and Gyan Singh.
2018. A modified and improved protocol
development for in vitro clonal propagation
of Santalum album L. from internodal
explants. Tropical Plant Research 5(2):
193-199.
Pelzer, F. and Tröger, W. 2018. *Viscum articulatum* Burm. f.: a review on its phytochemistry, pharmacology and traditional uses. Journal of Pharmacy and Pharmacology 70(2): 159-177. [Reviewing the traditional uses of *V. articulatum* in Chinese and Ayurvedic medicine against hypertension, ulcer, epilepsy, inflammation, wound nephrotoxicity. Major bioactive phytochemicals include oleanolic acid, betulinic acid, eriodictyol, naringenin, β-amyrin acetate and visartisides.]

Pelzer, F. and Tröger, W. 2018. Complementary treatment with mistletoe extracts during chemotherapy: safety, neutropenia, fever, and quality of life assessed in a randomized study. Journal of Alternative and Complementary Medicine 24(9/10): 954-961. [Confirming that extracts of *Viscum album* used in conjunction with chemotherapy had no adverse effects and alleviated some of the symptoms from the chemotherapy.]


Pointurier, O., Gibot-Leclerc , S., Le Corre, V., Reibvel, C., Srubik, F. and Colbach, N. 2019. Intraspecific seasonal variation of dormancy and mortality of *Phelipanche ramosa* seeds. Weed Research 59(6):407-418. [Samples of *O. ramosa* from a rapseed host and from hemp were buried 30cm deep and sampled at 6 week intervals over 2 years. When retrieved and tested with GR24 they showed variation in germination over the season with maximum around the time of crop sowing and least towards harvest time. Spontaneous germination (without stimulant) was high for samples from hemp but very low for those from rapseed. Viability declined by only 4-7% per year.]

Pompermaier, L., Schwaiger, S., Mawunu, M., Lautenschlaeger, T. and Stuppern, H. 2019. Development and validation of a UHPLC-DAD method for the quantitative analysis of major dihydrochalcone glucosides from *Thomningia sanguinea* VAHL. Planta Medica 85(11/12): 911-916. [Confirming high contents of dihydrochalcone glucosides, including the two bioactive constituents thonningianin A and B, presumed to be responsible for the antidiabetic use of *T. sanguinea* in Angola.]

Potapov, G.S. and Kolosova, Yu.S. 2018. Distribution and habitat preference of *Bombus (Kallobombus) soroeensis* (Fabricius, 1777) on the territory of Arkhangelsk Region. Arctic Environmental Research 18(2): 66-70. [Recording *B. soroeensis* on *Rhinanthus minor*.]


Qasem, J.R. 2019. Branched broomrape (*Orobanche ramosa* L.) control in tomato (*Lycopersicon esculentum* Mill.) by trap crops and other plant species in rotation. Crop Protection 120: 75-83. 44 species tested as trap crops to reduce *O. ramosa* in glasshouse-grown tomatoes. *Ecballium elaterium* reduced *O. ramosa* by 56% and improved crop dry weight by 126%. From the average of two experiments, high tomato growth and best parasite control (73% reduction) were obtained after *Vigna sinensis*.]

Qasem, J.R. 2019. Weed seed dormancy: the ecophysiology and survival strategies. In: Dormancy and Germination. DOI: 10.5772/intechopen.88015 [Including quite detailed sections on germination of stimulants, and inhibitors, of parasitic weeds *Striga, Orobanche* etc.]

Qu, X.-J., Fan, S.-J., Wicke, S., and Yi T. S. 2019. Plastome reduction in the only parasitic gymnosperm *Parasitaxus* is due to...
losses of photosynthesis but not housekeeping genes and apparently involves the secondary gain of a large inverted repeat. Genome Biology and Evolution 11(10): 2789–96. https://doi.org/10.1093/gbe/evz187. [Provides DNA sequence data for Parasitaxus and shows that the trajectory of heterotrophy-related reduction of its plastid differs from known patterns of parasitic flowering plants]

Rabiu, A. 2018. Use of cassia (Cassia obtusifolia) green manure and nitrogen rates for striga (Striga hermonthica Del Benth) management in sorghum (Sorghum bicolor (L) Moench) in Sudan savanna, Nigeria. International Journal for Research in Applied Science and Engineering Technology 6(8): 401-407. [Comparing 0, 40 and 80 kg N/ha with and without two levels of C. obtusifolia green manure. Highest yields and least S. hermonthica recorded at 80 kg N. Green manure apparently gave little benefit but abstract not clear.]


Ravazzolo, L., Trevisan, S., Manoli, A., Boutet-Mercy, S., Perreau, F. and Quaggiotti, S. 21209. The control of zealactone biosynthesis and exudation is involved in the response to nitrogen in maize root. Plant and Cell Physiology 60(9): 2100-2112. [Showing that the inhibition of zealactone production observed in response to nitrate and ammonium would contribute to the regulation of lateral root development as well as to increased germination of Phelipanche ramosa.]

*Rehberg, N. and 9 others. 2019. 3-0-Methylalkylgallates inhibit fatty acid desaturation in Mycobacterium tuberculosis. Antimicrobial Agents and Chemotherapy 63(9): pp.e00136. [Confirming moderate bactericidal effect of 3-0-methylbutylgallate from 'Loranthus micranthus' (=Englerina gabonensis = L. micrantherus) against M. tuberculosis acting synergistically with isoniazid leading to sterilization in liquid culture.]

*Rezanejad, A., Ravanbakhsh, H. and Kartoolinejad, D. 2019. (Relationship between abundance/infection intensity of dwarf mistletoe (Arceuthobium oxycedri (DC.) M. Bieb.) and qualitative and quantitative characteristics of the host tree, physiographic conditions, and soil erosion.) (in Persian) Iranian Journal of Forest and Poplar Research 27(1): Pe64-Pe75. (http://ijfpr.areeo.ac.ir/article_119182_8394a04181f05104138d8e2f505acada.pdf) [Results suggest that Juniperus excelsa with broader canopy, higher collar diameter, and taller height are more prone to parasitism by A. oxycedri in Iran.]

Řezanka, T., Kolouchová, I., Nedbalová, L. and Sigler, K. 2018. Enantiomeric separation of triacylglycerols containing very long chain fatty acids. Journal of Chromatography, A 1557: 9-19. [Describing the extraction and identification of TAGs from various sources including from Ximenia americana and discussing possible biosynthetic pathways.]

Ricco, M. V. And 10 others. 2019. Establishment of callus-cultures of the Argentinean mistletoe, Ligaria cuneifolia (R. et P.) Tiegh (Loranthaceae) and screening of their polyphenolic content. Plant Cell, Tissue and Organ Culture 138(1): 167-180. [Confirming the presence of quercetin glycosides and phenolic acids in the methanolic extracts of L. cuneifolia and the callus obtained from embryo culture. L. cuneifolia extracts are claimed to have hypolipemic, antioxidant, antibacterial, and immunomodulatory effects.]

Rim ChaiHong, Koun SooNil, Park HaeChul, Lee Suk and Kim ChulYong. 2019. Radioprotective effects of mistletoe extract in zebrafish embryos in vivo. International Journal of Radiation Biology 95(8): 1150-1159. [Concluding that ‘Abnoba Viscum Q’ (an extract from Viscum album on oak?) might be a new candidate radioprotectant to enhance cancer radiotherapy efficacy.]

Scharenberg, F., Stegemann, T., Çiçek, S.S.

Saucier, J, Milensky, C M, Caraballo-Ortiz, M


Sanni, O., Erukainure, O.L., Oyebode, O.A., Koobanally, N.A. and Islam, M.S. 2018. Concentrated hot water-infusion of Phragmanthera incana improves muscle glucose uptake, inhibits carbohydrate digesting enzymes and abates Fe2+-induced oxidative stress in hepatic tissues. Biomedicine & Pharmacotherapy 108: 417-423. [The results suggest that the observed antioxidative and antiinflammatory potentials of P. incana could be attributed to 2-methoxythiazole; 1-cysteine; nicotinic acid; S-methyl-1-cysteine; isoquinoline; 1-methyl-; and 1H-indole-2,3-dione; 5-methyl, supporting folkloric medicinal use of this plant in southern Africa.]

Sardesai, M.M., Gaikwad, S.P and Yadav, S.R. 2019. Viscum sahyadricum (Viscaceae), a new species from the Western Ghats of India. Edinburgh Journal of Botany 76(3): 369-376. [This new species is described, illustrated, and compared to similar Viscum species.]


Scharenberg, F., Stegemann, T., Ciçek, S.S. and Zidorn, C. 2019. Sequestration of pyridine alkaloids anabasine and nicotine from Nicotiana (Solanaceae) by Orobanche ramosa (Orobanchaceae). Biochemical Systematics and Ecology. 86: 103908. [O. ramosa is not able to synthesize pyridine alkaloids anabasine and nicotine itself. The present study proves the sequestration of pyridine alkaloids by O. ramosa from four investigated Nicotiana host species, including tobacco.]

Scheiterle, L., Häring, V., Birner, R. and Bosch, C. 2019. Soil, Striga, or subsidies? Determinants of maize productivity in northern Ghana. Agricultural Economics 50(4): 479-494. [Exploring the reasons for the relative failure of the fertilizer subsidy programme in Ghana, and the need for investment in capacity building and extension services to address the site-specific problems through comprehensive soil fertility management techniques and weed control. Promoting soil carbon management, minimum mechanical stress, crop rotation, and permanent soil cover should be further investigated as options for the region.]

Seiler, G.J. 2019. Genetic resources of the sunflower crop wild relatives for resistance to sunflower broomrape. Helia (https://doi.org/10.1515/helia-2019-0012) [Noting that resistance to Orobanche cumana has been reported in 7 annual and 32 perennial wild sunflower relatives and referring to the USDA National Plant Germplasm System collection of 2,519 accessions from 14 annual and 39 perennial species; but not clear from the abstract whether or how that collection is being used.]

Senkler, J., Rugen, N., Eubel, H., Hegermann, J. and Braun, H.P. 2018. Absence of complex I implicates rearrangement of the respiratory chain in European mistletoe. Current Biology 28(10): 1606-1613. [Results demonstrate that, in the context of parasitism, multicellular life can cope with lack of one of the OXPHOS complexes and give new insights into the life strategy of Viscum album and other mistletoe species.]

Seran, Y.N., Sudarto, Hakim, L. and Arisoesilaningsih, E. 2018. Sandalwood (Santalum album) growth and farming success strengthen its natural conservation in the Timor Island, Indonesia. Biodiversitas: Journal of Biological Diversity 19(4): 1586-1592. [Studying S. album across Timor and identifying those districts with the highest quality and noting that farmers had a significant role in strengthening sandalwood conservation in their districts as shown by their successful farming and tree growth quality that was similar to that in the forest.]

Shalini, K.S., Omita Yengkhom, Subramani, P.A. and Michael, R.D. 2019. Polysaccharide fraction from the Indian...
mistletoe, *Dendrophthoe falcata* (L.f.) Eittingsh enhances innate immunity and disease resistance in *Oreochromis niloticus* (Linn.). Fish & Shellfish Immunology 88: 407–414. [A polysaccharide extract from *D. falcata* led to Nile tilapia provided substantial protection against the bacterium *Aeromonas hydrophila*, apparently via an immunostimulatory action.]


*Shao MingHui, Dai Wei, Yuan SiWen, Lu Shankar, M.and Devakumar, A.S. 2018. Effect of pre-sowing treatments on seed germination and seedling qualities of sandalwood (*Santalum album* L.). Mysore Journal of Agricultural Sciences 52(4): 732-737. [Finding that GA3 500 ppm for 24 hours is the best pre-sowing treatment to obtain maximum planting material.]


Shivaprakash and Hiremath, S.M. 2018. Studies on wild edible fruit yielding plants used by local communities in Dakshina Kannada District, Karnataka (India). International Journal of Forest Usufructs Management 19: 24-31. [Including reference to the use of *Scleroxyrum* spp. (Santalaceae) for cooking oil.]


Sotero-García, A.L., Arteaga-Reyes, T.T., Martínez-Campos, A.R. and Bunge-Vivier, V. 2018. (Local knowledge of *Arceuthobium* genus in a Natural Protected Area of the centre of Mexico.) (in Spanish) Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas 17(2): 120-129. [Noting that *A. vaginatum* and *A. globosum* are recorded locally. They are not generally recognised as being damaging for the forest but are used for making toys(?) and ink, and medicinally for respiratory and nervous complaints.]


Suetsugu, K. 2018. Independent recruitment of a novel seed dispersal system by camel crickets in achlorophyllous plants. New Phytologist 217(2): 828-835. [Confirming that camel crickets are the main means of...
seed dispersal in *Phacellanthus tubiflorus* (Orobanchaceae), associated with the occurrence of this species in dense forest vegetation where wind dispersal would be inefficient.] Sullivan, E.R., Barker, C., Powell, I. and Ashton, P.A. 2019. Genetic diversity and connectivity in fragmented populations of *Rhinanthus minor* in two regions with contrasting land-use. Biodiversity and Conservation 28(12): 3159-3181. [Finding little difference in the genetic diversity within populations of *R. minor* from extensively managed upland and intensively managed lowland but recommending that conservation strategies should aim to maintain large populations in meadows to enhance genetic diversity.] Sultan, A., Tate, J.A., de Lange, P.J., Glenny, D., Ladley, J.J., Heenan, P. and Robertson, A.W. 2018. Host range, host specificity, regional host preferences and genetic variability of *Korthalsella* Tiegh. (Viscaceae) mistletoes in New Zealand. New Zealand Journal of Botany 56(2): 127-162. [Describing in detail the host ranges and distribution of *K. salicornioides*, *K. clavata* and *K. lindsayi* in New Zealand. *K. salicornioides* is the most widespread and also the most host specific, mainly on *Leptospermum* *scoarium*. The others are less host specific but *K. clavata* occurs mostly on *Coprosma* *propinqua* and *K. lindsayi* mostly on *Melicope simplex*.]

*Sun GuiLing and 13 others. 208. Large-scale propinqua in New Zealand. Variability of regional host preferences and genetic A.W. 2018. Host range, host specificity, most widespread and also the most host specific, mainly on *Leptospermum scoarium*. The others are less host specific but *K. clavata* occurs mostly on *Coprosma* *propinqua* and *K. lindsayi* mostly on *Melicope simplex*.]


Szmidla, H., Tkaczyk, M., Plewa, R., Tarwacki, G. and Sierota, Z. 2019. Impact of common mistletoe (*Viscum album* L.), on Scots pine forests - a call for action. Forests 10(10): 847. [*V. album* has been causing increasing damage to Scots pine in recent years and is now estimated to infest over 70,000 ha of forest in Poland. The paper reviews its impact on tree breeding traits and raw material losses as well as current options for its prevention and eradication.]

Tui, B.H, and 10 others. 2019. Three new constituents from the parasitic plant *Balanophora laxiflora*. Natural Product Communications 14:1-6. [The new compounds included an iridoid, a rare natural occurring 1-hydroxy-1,3-diarylpropan-2-one glucoside, and an aryltetralin lignan glucoside. The isolated compounds weakly inhibited both NO production and COX-2 mRNA expression in RAW264.7 macrophages.]


Usman, I., Daniya, E. and Kolo, M.G.M. 2018. *Aeschynomone histrix* (joint vetch) fallow and nitrogen fertilizer effects on *Striga hermonthica* infestation and maize (*Zea mays*) productivity in southern Guinea savanna of Nigeria. Agro-Science 17(3): 1-6. [Recording benefits from fallowing with *A. histrix* fallow (compared with natural fallow) and from N in reduction of *S. hermonthica* and improved crop yield. Apparently no comparison with continuous cropping and no economic analysis (e.g. *A. histrix* fallow had to be weeded).]

Van Halder, I., Castagneyrol, B., Ordoñez, C., Bravo, F., del Rio, M., Perrot, L. and Jacel, H. 2029. Tree diversity reduces pine infestation by mistletoe. Forest Ecology and Management 449: 17470. [Comparing the occurrence of *V. album* ssp. *austriacum* in *Pinus sylvestris* and in *P. pinaster*. Occurrence was higher in taller trees, but was also less in mixed than in pure stands, perhaps because of difference in dispersal of seed by birds.]

Wahid, H.A., Barozai, M.Y.K. and Muhammad Din. 2019. Identification and characterization of dwarf mistletoe responding genes in Ziarat juniper tree (*Juniperus excelsa* M. Bieb) through suppression subtractive hybridization and deep sequencing. Trees: Structure and Function 33(4): 1027-1039. [Identifying 985 genes differentially expressed in shoots of *J. excelsa*, infected and non-infected by *Archeuthobium oxycedri* in Pakistan. The responding genes are observed to be involved stress, transcription factor, signaling pathway and structural proteins. The results will be useful in preparing the juniper trees against dwarf mistletoe and other stresses.]

Wang Han, Snapp, S.S., Fisher, M. and Viens, F. 2019. A Bayesian analysis of longitudinal farm surveys in Central Malawi reveals yield determinants and site-specific management strategies. PLoS ONE 14(8): e0219296. (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0219296) [Striga asiatica infestation was the factor most consistently associated with lower yields in Central Malawi, and concluding that enhancing nitrogen fertility will lead to higher maize yields. To improve plant nitrogen status, fertilizer was effective at higher productivity sites, whereas soil carbon and organic inputs were important at marginal sites.]

Waweru, D.N., Kuria, E.K., Bradley, J.M., Scholes, J.D. and Runo, S. 2019. Tissue culture protocols for the obligate parasitic plant *Striga hermonthica* and implications for host-parasite co-cultivation. Plant Cell, Tissue and Organ Culture 138(2): 247-256. [Finding the best auxin and cytokinin concentrations to be: 10.7 µM naphthaleneacetic acid (NAA) and 2.2 µM 6-benzylaminopurine (BAP) for embryogenic regeneration and 1.1-4.4 µM BAP without NAA for shoot multiplication. Callus generated from seedling shoot and leaf tissue but not from seedling radicles. The techniques described...
in this study will enhance further understanding of Striga-host interactions.]


Wieczorek, A., Lysek-Gladysinska, M., Krol, T., Kordos, K., Kosińska, K., Atanasov, A.G., Strzalkowska, N., Jozwik, A. 2019. Biochemical and morphological changes in mouse liver induced by mistletoe toxins. Food and Chemical Toxicology 129: 229-238. [Microscopic examinations revealed that hepatocyte mitochondria were enlarged and increased in number, whereas the surface of the rough endoplasmic reticulum was decreased significantly.]


Wu AiPing, Zhong Wen, Yuan JinRui, Qi LiangYu, Chen FaLin, Liang YunShan, He FeiFei and Wang YanHong. 2019. The factors affecting a native obligate parasite, Cuscuta australis, in selecting an exotic weed, Humulus scandens, as its host. Scientific Reports 9(1): 511. [Concluding that C. australis may be useful for biological control of H. scandens where it is dominant, but would also damage native species in a mixed vegetation.]

Xia Zhi, Wen Jun and Gao ZhiMing. 2019. Does the enigmatic Wightia belong to Paulowniaceae (Lamiales)? Frontiers in Plant Science 10(April): pp.528. (https://www.frontiersin.org/articles/10.3389/fpls.2019.00528/full) [The familial placement of Wightia has been controversial, including near Paulownia (Paulowniaceae) and Brandesia (Orobanchaceae). Nuclear ITS data suggest a sister relationship to Paulownia, thus it may represent a hybrid between early lineages of Phrymaceae and Paulowniaceae.]

Xu YuQun and 11 others. 2018. Structural analysis of HTL and D14 proteins reveals the basis for ligand selectivity in Striga. Nature Communications 9(9): 3947. (https://www.nature.com/articles/s41467-018-06452-2) [Analysis of karrin and strigolactone perception mediators provide insight into how these hormones are perceived by Striga hermonthica.]

Yan HaiFeng and 11 others. 2018. Selection and validation of novel RT-qPCR reference genes under hormonal stimuli and in different tissues of Santalum album. Scientific Reports 8(1): 17511. [The results should improve the accuracy of RT-qPCR analysis and benefit S. album functional in different tissues and under hormone stimuli in the future.]


Yang Liu, Yang GuanSong, Ma HaiYang, Wang YueHua and Shen ShiKang. 2018. Phylogenetic placement of Yunnanopilia (Opliaceae) inferred from molecular and morphological data. Journal of Systematics and Evolution 56(1): 48-55. [The authors conducted a molecular analysis and compared the morphology of this taxon with Melientha suavis and Champerea manillana. Molecular data place all Yunnanopilia accessions in a clade with Melientha. The authors considered the morphological differences to be sufficient to recognize a new genus, however, the idea that it is simply another species of Melientha was not entertained.]

Yao RuiFeng; and Chen Li; Xie DaoXin. 2018. Irreversible strigolactone recognition: a non-canonical mechanism for hormone perception. Current Opinion in Plant Biology 45(A): 155-161. [Review that discusses recent advances in the newly described irreversible mechanism for strigolactone perception.]

Yapa, S.S., Mohotti, A.J., Seneviratne, M.A.P.K., Peiris, B.L. and Tennakoon, K.U. 2018. Prevalence of mistletoes in fruit and timber trees in the wet and intermediate zone of Sri Lanka. Tropical Agricultural Research 29(4): 330-340. [Dendrophthoe falcata, D. neilgerrensis, Scurrula cordifolia, Viscum articulatum, Taxillus incanus, and V. orientale were the mistletoes species infested in fruit trees; while D. falcata, D. neilgerrensis, S. cordifolia, S. parasitica, V. articulatum and V. orientale were found in timber species.]
D. falcata was the most predominant parasitic plant in both fruit and timber trees. *Mangifera indica* and *Albizia* were the most susceptible host fruit and timber species, respectively.

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PRESIDENT’S MESSAGE

Dear IPPS members

I hope you are all keeping well and managing to continue your research in these difficult times.

As you will see, the new IPPS website is going from strength to strength, thanks to the efforts of Harro, Susann and Luiza. I would like to encourage everyone to look at and interact with the website, as it is continually updated with new information about members, the society, publications and news items. Two important news items I would like to bring to your attention are the venue for the 16th World Congress on Parasitic Plants and the current round of IPPS elections.

As outlined in the last issue of Haustorium, we had two excellent offers to host the 16th World Congress on Parasitic Plants, from Steven Runo and Damaris Odeny (Nairobi, Kenya) and Hannan and colleagues (Jerusalem, Israel). Both venues were very popular but the next meeting will be held in Nairobi, Kenya in July 2021, if conditions allow. The date of the congress will be reviewed towards the end of the year, if COVID-19 is still widespread.

It is also time for election of a new Vice President and Secretary. All the positions on the Executive Committee are four-year positions which are staggered so that different officers are elected every two years to provide continuity. However, the Vice President position is different as the Vice President will automatically become the next President of the Society, so it is an eight year commitment.

We have excellent candidates for both the Vice President and Secretary positions. For Vice President the candidates are Professor Markus Albert, Dr Steven Runo, Dr Jonne Rodenburg, Dr Satoko Yoshida and Dr Chris Thorogood. Candidates for Secretary of the society are: Professor Airong Li, Professor Ahmet Auludag and Dr Dr Mónica Fernández-Aparicio. Biographies of all the candidates are available on the IPPS website, so please have a look at these.

The link to the Election Google Poll for Vice President is (https://forms.gle/kjukWEqFuHqvTXfX6) and for Secretary of the Society the link is (https://forms.gle/kjukWEqFuHqvTXfX6). Again, these links can also be accessed from the website. Please note the closing date for both polls is Wednesday 12th August.

I would like to take this opportunity to thank Maurizio Vurro (Secretary), Airong Li (Member at Large) and Harro Bouwmeester (Vice President) for all the hard work they have done for the Society over the last four years.

Harro is now taking over as President, so this is my last President’s message. It has been a great pleasure and an honour to serve as Vice President and President of this Society over the last eight years. I would like to thank everyone who has contributed to the society, including members of the Executive committee, organisers of the WCPP Congresses and members of the society. I feel that parasitic plant research is becoming more mainstream with increasing numbers of young researchers interested in parasitic plants, which bodes well for the future of the Society. I look forward to maintaining links with the society and to meeting everyone at the next Congress in Nairobi, hopefully in 2021.

With very best wishes

Julie Scholes

IPPS President

INVITATION: GENERAL ASSEMBLY INTERNATIONAL PARASITIC PLANT SOCIETY 25 AUGUST 2020 3.00-4.30 pm cet (on-line)

Dear IPPS member,

We want to invite you to the first online General Assembly of the IPPS on Tuesday 25 August 2020 3.00-4.30 pm cet. As the Executive Committee, we have decided that it would be good to organize our General Assembly more regularly, as indicated on the IPPS Constitution. Therefore, we will organize an online General Assembly meeting every two years, alternated with the occurrence of in-person General Assembly meetings during the World Congress of Parasitic Plants (WCPP).
For our first online meeting this year, we would like to update you and get your opinion on a number of IPPS matters:
- The new IPPS website
- The new IPPS Executive Committee, results of the elections
- Changes to the Society’s Constitution
- Membership and membership fee payment
- Installation IPPS Advisory Board

We hope to see all of you on Tuesday 25 August 2020 3.00-4.30 pm CET on https://uva-live.zoom.us/j/91346420541

The current IPPS Executive Committee (Julie Scholes, Harro Bouwmeester, Maurizio Vurro, Philippe Simier, Susann Wicke, Airong Li, Luiza Teixeira-Costa)

NB You can only attend the General Assembly if you are a member of the IPPS. All who attended the WCPP in Amsterdam are current members. However, we are inviting everyone who is interested in the IPPS to become a member free of charge until June 2021 (see Society news in Haustorium and at www.parasiticplants.org). If you would like to become a member, please send an email to secretary@parasiticplants.org.

FREE MEMBERSHIP OF THE INTERNATIONAL PARASITIC PLANT SOCIETY UNTIL JUNE 2021

Membership of the International Parasitic Plant Society (IPPS) is traditionally associated with participation in the World Congress on Parasitic Plants (WCPP), as the registration for these events includes the IPPS membership fee. Formally, this implies that only the attendants of the most recent WCPP are members of the IPPS. Taking advantage of recent changes in the IPPS Constitution and Executive Committee, we have decided to establish a more constant form of membership. Membership registration and fee payment will still be coupled to the WCPP, but members who do not attend the WCPP will be enabled to continue their membership by paying a membership fee via the IPPS website. To facilitate this transition, we are offering anyone who is interested in becoming a member of the IPPS free membership until June 2021.

In June 2021 we will have the next WCPP, in Nairobi, and you will be able to pay your membership fee either through your attendance at the WCPP or via the IPPS website. If you would like to become a member, please send an email to secretary@parasiticplants.org. You will receive an email inviting you to confirm your membership by logging in on the IPPS website member area. After doing so, we kindly ask you to update your member profile on the website with a short description of your scientific interest and a picture of yourself as well as an image representing your institution. Through the website member area, you can also post news and vacancies, access high-resolution pictures of parasitic plants, and communicate with other members.

I hope that many of you use this opportunity to become a member and support our society!

Julie Scholes, president of the IPPS

STUDENT PROJECT

Impact of soil microorganisms on the seedbank of the plant parasitic weed Striga hermonthica.
Getahun Mitiku (PhD candidate) and collaborators:
Department of Microbial Ecology, Netherlands Institute of Ecology, Netherlands
Ethiopian Institute of Agricultural Research, Ethiopia
Institute of Biology, Leiden University, Netherlands

Control of S. hermonthica remains challenging due to the enormous amounts of seeds produced per plant and high seed survival rates in soils. To date, few efforts have been made to explore the functional potential of the soil and sorghum root microbiome as a complementary strategy to reduce the Striga seedbank and Striga infections of the host plants. Hence, the overall aims of my PhD study are i) to investigate the importance of soil microbes in diminishing the S. hermonthica seedbank and ii) to unravel the relationship between soil physicochemical properties, soil microbiome composition, Striga seedbank and Striga incidence in sorghum-growing agroecological zones of Ethiopia.

The availability of fast, high-throughput and robust techniques for the in-situ detection and quantification of Striga seeds in agricultural soils is a crucial step for investigating the impact of edaphic factors on Striga seedbank dynamics. Hence, we developed a new qPCR-based
detection and quantification of Striga seeds in agricultural field soils. The efficiency of the technique was also assessed in proof-of-principle experiment involving introduction of known numbers of Striga seeds in two Striga-free Dutch agricultural soils. By integrating density-based extraction, size-dependent sieving approach and DNA extraction, our results showed that very few Striga seeds could be recovered, detected and quantified. This new integrated detection method was also deployed for the detection and quantification of Striga seeds in a total of approximately 50 naturally infested soils from sorghum-growing areas of Ethiopia. Multivariate analyses were performed to establish the relationship between Striga incidence monitored in the field, Striga seedbank, soil physicochemical characteristics and microbial composition in the same areas of the country. We are currently investigating the survival rates of Striga seeds in these ±50 field soils with the goal to identify and characterize the microorganisms that trigger suicidal germination of Striga seeds or affect their viability in agricultural soils.

PROJECT UPDATES

PROMISE: promoting root microbes for integrated Striga eradication

The PROMISE project funded by the Bill & Melinda Gates Foundation aims to harness soil and root microbiomes to control Striga infection of sorghum and other crop species. To this end a multidisciplinary team with expertise in agronomy, microbiology, mycology, plant chemistry, plant development, molecular biology and bioinformatics were brought together to develop new complementary approaches to control this devastating parasitic weed.

Microbes can directly and indirectly interfere with the Striga life-cycle, either by deterring the parasite or by triggering processes that impair infection of the host roots (Masteling et al., 2019). Direct modes of action include i) pathogenicity towards Striga, ii) antagonism via secondary metabolites or volatile organic compounds, and iii) interference with host-Striga signalling. Indirect modes of action by which microbes could suppress Striga include a) enhancement of nutrient (P, N) acquisition by the host, b) induced systemic resistance (ISR), and c) alteration of root exudation or root architecture (Masteling et al., 2019). To date, most studies on microbe-mediated suppression of Striga and other root parasitic weeds have focused on the activities of single microbial species, mostly fungi and bacteria. In the PROMISE project, the ultimate goal is to design synthetic microbial communities (SynComs) or identify microbial metabolites that consistently suppress Striga infections or trigger suicidal germination of the Striga seed bank. The design of SynComs should involve microbes with complementary modes of action that act together or synergistically, and preferably at different stages of the parasite’s life cycle. This reinforces the need to understand the taxonomic and functional diversity of the sorghum root microbiome and the dynamic changes in the microbiome during plant and parasite development as well as their interaction. Moreover, a microbiome-mediated strategy for Striga control should take into account how each microbial member of the consortium behaves across different soil conditions, how their activities are influenced by the genotypic diversity of the host and parasite as well as by other commonly used agricultural practices used to control Striga (e.g. crop rotation, trap/catch crop).

Figure 1: a sorghum field site in Ethiopia sampled in the PROMISE project to map the Striga seedbank and to characterize the soil and sorghum root microbiome (photo courtesy: Dr. Taye Tessema, EIAR).

In the past 2-3 years of the PROMISE project, we have developed a highly sensitive molecular detection method that allows accurate quantification of Striga seeds in field soils. This technique is now applied in the project to i) quantitatively map the geographic distribution of the Striga seedbank in soils from Ethiopia and other sub-Saharan countries, ii) assess the relation between Striga seedbank and incidence in sorghum fields across different agro-ecologies in Ethiopia, and iii) investigate the impact of existing and new (microbiome-based) approaches that
target the Striga seedbank. To identify Striga-antagonistic microbes or microbial metabolites, we developed an automated computer vision tool for image analysis and high-throughput bioassays. To isolate potential members of a microbial SynCom, we determined the core and accessory root microbiome of sorghum. Defining the core microbiome allows us to target microorganisms and traits that are consistently associated with roots of different sorghum genotypes growing in soils from different agroecological zones. To identify specific microbial genera that interfere with the Striga lifecycle we are screening a well-characterized and sequenced bacterial culture collection representing multiple phyla, genera and species. We also established and characterized a large fungal isolate collection (approximately 4,000 isolates) from Ethiopian field soils, sorghum roots and Striga seeds. Several of these significantly interfere with Striga seed germination. Similarly, we established a large collection of P-solubilizing bacteria which are being tested for their abilities to affect the strigolactone-based signalling between host and parasite.

In the context of host-parasite signalling, we identified new putative mechanisms by which the root microbiome can exert a suppressive effect on Striga root infection by manipulation of the host (sorghum) physiology, host-Striga signalling and root cellular traits. These mechanisms are being further explored in the coming year. In this context, we also initiated collaborations with two other projects funded by the Bill & Melinda Gates Foundation, i.e. N2-Africa and ENSA. Together with team members of N2-Africa, experiments on Striga seed bank detection in selected Kenyan soils were initiated. For ENSA, experiments were conducted to evaluate the impact of specific plant genes on root microbiome assembly and Striga infection.

PROMISE consists of the following institutes and PI’s:
- Ethiopian Institute of Agricultural Research (EIAR) – Dr. Taye Tessema
- University of California, Davis – Prof. Siobhan Brady
- University of Amsterdam – Prof. Harro Bouwmeester
- Westerdijk Fungal Biodiversity Institute – Prof. Pedro Crous
- AgBiome, Research Triangle Park, NC – Dr. Tracy Raines
- Netherlands Institute of Ecology – Prof. Jos Raaijmakers

For more detailed information on the team members, objectives and accomplishments, please visit the PROMISE website: https://www.promise.nioo.knaw.nl

Reference

PARASITES OF PARASITES – THE TOOTHPICK PROJECT

Plant pathogens have been studied for their possible use in weed control. However, most pathogens of weeds are not useful in their wild form because they are not sufficiently host-specific and/or virulent enough. In short, they have evolved a sort of ‘pathosymbiosis’ or controlled coexistence with their host. A mere 40% damage isn’t enough if they are to compete against chemical herbicides. Through our project, demonstrated in Kenya on Striga, we see that these barriers can be overcome.

Research out of the David Sands Lab at Montana State University has focused on the inhibitory effects of certain amino acids on the growth and development of specific plants. Pathogens that overproduce these chosen amino acids can be easily selected from a pool of spontaneous mutants. Such mutants can have increased pathogenicity to their target weed and enhanced field performance as biocontrol agents. Enhancement of biocontrol efficacy in pathogen–host systems can lead to obtaining biocontrol agents capable of producing inhibitory levels of selected amino acids in situ.

The target we chose was Striga hermonthica, which continues to be a major parasite of maize, sorghum, millet, rice and now wheat, grown by 40 million subsistence farmers in Sub-Saharan Africa. The pathogen should be endemic, and safe in its host specificity. It must be delivered to ‘that last mile’ all the way to subsistence farmers where they can see a solid return on their investment. To overcome these problems of cost, efficacy and
safety we embarked on a decade long saga to develop a solution to the *Striga* problem.

The *Fusarium oxysporum* f.sp. *strigae* strains that we have selected are affordably delivered to the village level on a toothpick (hence the name The Toothpick Project) and then grown into a live, fresh inoculum by each farmer or as a group at the village level. In over 1000 paired-plot trials, crop yield has increased 42-56%. A social enterprise is now fully commercializing this innovation in Kenya, subject to completion of necessary regulation for a biocontrol product which should be completed shortly after 5 years, sadly interrupted by the COVID-19 outbreak. This should then serve as a scale-up model for *Striga* and other weeds beyond that one country.

In parallel to the Kenya enterprise, we are focusing on capacity-building in twelve other African countries by setting up and training a team of scientists from these countries. With cultivation by the Toothpick Project, bioherbicides are a growth industry primed for international collaboration, using the team’s expertise to explore other methods of disbursement and distribution, expansion to other weeds, and commercialization innovations. Please visit www.toothpickproject.org for more information and to potentially get involved.

Dr. David Sands and Claire Baker

**PROFILE**

*Archeuthobium oxi-cedri* – juniper dwarf mistletoe

*Archeuthobium oxi-cedri* is the one European species of this vastly important and damaging genus. Like so many species in the genus, it has a narrow host specificity parasitizing just certain Cupressaceae, mainly juniper species, and most notably *Juniperus oxy-cedrus*, which is a source of cade oil, used in cosmetics and traditional medicine, but is otherwise relatively unimportant economically.

*A. oxy-cedri* is one of only three mistletoe species in Europe. As such, I had always wished to see it. I had always been familiar with *Viscum album* and had eventually seen *Loranthus europaeus* when on a camping holiday in Italy. The latter we had also seen during a field trip organised during the 10th Parasitic Plant Congress in Kusadasi, in 2009.

Before going to Turkey (for my first time) I had checked and found that *A. oxy-cedri* occurred on Mt Sypilos (Mt Spil) some 100km N. of Kusadasi. Having a few extra days there after the Congress I persuaded Lytton Musselman and Jay Bolin to join me on an expedition to find it. We hired a vehicle and set out having to ask our way several times but eventually winding our way up to an elevation of about 1000m.

Towards the end of the first day we had made several stops where we looked at junipers a number of times but without success. In the evening at our hotel overnight Lytton confessed that he had been guiding us to look at the wrong species of juniper. Hence the next morning we very soon found *J. oxy-cedrus* on a steep rocky slope infested quite heavily by *A. oxy-cedri*.

This species is distributed from Spain and Morocco, to Lebanon and Syria, reaching Kurdistan in Iran, Iraq and the Caucasus mountains. Also the Himalayas in Pakistan, India, and China. *A. oxycedri* differs from the North American species in having junipers as host plants, and in its wide geographical distribution, mainly at moderate altitude, and in a relatively mild Mediterranean climate. It is greener than most *Arceuthobium* spp. but is still largely dependent on the host and has a debilitating effect.

In common with other *Arceuthobium* spp. *A. oxycedri* is dioecious, the male flowers 1.5-2 mm across, perianth mostly 3-merous. The mature fruit is about 3 mm long and 1.5-2 mm wide. Pollination appears to be predominantly due to insects, especially ants and flies, but may also
occur by wind (Hawksworth and Wiens, 1996). In *A. oxycedri*, anthesis occurs mostly in September-October (August - September in China). Following fertilization of the 'ovule', the fruit matures 13 months later in October - November of the following year.

No true seed is formed, as there is no testa, but the embryo is embedded in chlorophyllous endosperm, referred to as a seed for convenience, surrounded by viscin. The embryo is green, a few millimetres long, and has a meristematic radicular apex without a root cap. Dispersal of the seed is exceptional, involving a hydrostatic, explosive process which expels the seed at least 10 m (CABI, 2020). It is included in this Invasive Species Compendium due to its potential, if introduced, to damage North American species of economic value.

References:


Chris Parker – with warm thanks to Lytton and Jay for their companionship on this memorable trip, and for assistance in preparing this article.

OPEN SESAME

While conducting field work on *Hydnora* in northwestern Namibia we happened upon a population of a distinctive shrub, *Sesamothamnus guerichii* with the descriptive common name of Herero sesame bush. It grows almost exclusively in the region of the Herero peoples in Namibia and is in the same family, Pedaliaceae, as the familiar sesame plant, *Sesamum indicum* the source of sesame seeds. What caught our eye was nothing familiar, however.

At the base of the shrub we found what looked like *Orobanche* shoots. As we continued our search for *Hydnora* the next few days we came upon a few additional populations of *Sesamothamnus* and examined them for the parasite and found some just coming into flower. It obviously was not a species of *Orobanche* but rather in the genus *Alectra*. Host selection cannot be assumed by proximity of the parasite to a
potential host as we have learned from decades of field work, but excavation showed a connection between roots.

_Alectra orobanchoides_ (photo Lytton Musselman)

Plants were not mature so we had difficulty determining which species of the parasite it might be. A web search was not helpful nor was a search of herbarium specimens for potential helpful label data. In fact, there appear to be very few herbarium specimens of _S. guerichii_. However, Visser in his 1982 classic South African Parasitic Flowering Plants (page 156) notes _Sesamothamnus_, without giving the species, as a host for _Alectra orobanchoides_. Interestingly, he does not record the parasite in his distribution map for Namibia. He does, however, list sesame as a host though we have found no documentation of the parasite on this crop.

_Alectra orobanchoides_ has the broadest host range reported in the genus and its presence in the region should be noted in the unlikely spread to an agronomic host.

Lytton John Musselman, Old Dominion University
Erica Maass, University of Namibia
Jay Bolin, Catawba College.

PRESS REPORTS

Some sorghum can ‘hide’ from witchweed

Sorghum crops in areas where the agricultural parasite _striga_, also known as witchweed, is common are more likely to have genetic adaptations to help them resist the parasite, researchers say. Witchweed, one of the greatest threats to food security in Africa, causes billions of dollars in crop losses annually and has a variety of hosts, including sorghum, the world’s fifth most important cereal crop.

Changes to the LGS1 gene affect some of the crop’s hormones, making it harder for parasites to find in the soil, at least in some regions. The changes, however, may come at a cost, affecting photosynthesis-related systems and perhaps growth.

The new study in the Proceedings of the National Academy of Sciences may eventually inform strategies for managing the parasite. ‘We wanted to know if sorghum plants in areas with high parasite prevalence were locally adapted by having LGS1 mutations,’ says Jesse Lasky, assistant professor of biology at Penn State and senior author of the paper. ‘We often think about local adaptation of agricultural crops with regard to factors like temperature, drought, or salinity. For example, if plants in a particularly dry region were locally adapted to have genes associated with drought-tolerance, we could potentially breed plants with those genes to resist drought. We wanted to know if you could see this same kind of local adaptation to something biotic, like a parasite.’

Gail McCormick-Penn State.
February 12th, 2020

CRISPR replicates the mutations

The researchers modeled the prevalence of witchweed across Africa and compared the presence of LGS1 mutations thought to confer some resistance in sorghum. They found that these mutations were more common in areas with high parasite prevalence, suggesting that sorghum plants in those areas may locally adapt to deal with the parasite. ‘The LGS1 mutations were widespread across Africa where parasites were most common, which suggests they are beneficial,’ says first author Emily Bellis, postdoctoral researcher at Penn State at the time of the study and now an assistant professor of bioinformatics at Arkansas State University. ‘But these mutations were not very common, and nearly absent outside of parasite-prone regions. This indicates that there may also be a cost, or tradeoff, to having these mutations.’

To better understand the effects of the LGS1 mutations, members of the research team at Corteva Agriscience used CRISPR-Cas9 gene-editing technology to replicate the mutations in...
the lab. The loss of LGS1 function did appear to confer resistance to witchweed in their experiments, as parasites had low or even zero germination rates, suggesting the parasites were not as successful at finding the crop to reproduce. But parasites collected from different geographic locations in Africa responded in different ways. ‘Germination of parasites from a population in West Africa was effectively shut down in both nutrient-rich and nutrient-poor conditions, but we still saw germination up to about 10% for a population in East Africa when nutrients were limited,’ Bellis says. ‘That is definitely an improvement, but there can be thousands of parasites in the soil, so even 10% germination can be problematic, especially in the smallholder farms where these crops are predominantly grown.’

Hiding from parasites:

Researchers know that LGS1 mutations affect strigolactone hormones that sorghum releases from its roots. Because the parasite uses these hormones to find sorghum, altering the hormones makes the plant mostly invisible to the parasite. But strigolactones are also important for communication with mycorrhizal fungi, which play an important role in the plant’s acquisition of nutrients. The new study shows that loss of LGS1 function in the modified plants also affects systems related to photosynthesis and subtly affects growth. ‘It may be that plants with LGS1 mutations are better at hiding from the parasites, but are less productive,’ Lasky says. ‘This potential tradeoff might explain the relatively low prevalence of these mutations in sorghum across Africa.’

The researchers also identified several mutations in other genes related to parasite prevalence, which might reflect local adaptation. The researchers plan to investigate these genes—some of which are involved in cell-wall strengthening, to see if they may also confer resistance to the parasite. ‘We eventually would like to look at other agriculturally important host plants of striga in Africa to ask similar questions,’ says Lasky. ‘If we do indeed see local adaptation to the parasite and find genes that confer resistance with few tradeoffs, we may be able to capitalize on that from a management perspective.’

The National Science Foundation, the Advanced Research Projects Agency-Energy, and the US Department of Energy funded the work.

Original study: DOI: 10.1073/pnas.1908707117
Additional researchers are from Penn State; Corteva Agriscience; Sorbonne Université in France; the Royal Botanic Gardens Kew in the United Kingdom; the University of Texas; Kansas State University; Uppsala University in Sweden; the University of Virginia; the International Crops Research Institute for the Semi-Arid Tropics in Mali; and Kenyatta University in Kenya.

Penn State

Unique centromere type discovered in the European dodder

The holocentric european dodder (Cuscuta europaea) entwines a nettle. Photo: Jiri Macas

Whenever the European dodder, Cuscuta europaea, is under scientific scrutiny, it usually is due to its lack of chloroplasts and its concomitant parasitic lifestyle. However, since the beginning of this year its chromosomes became the new centre of attention, when researchers discovered a new type of centromere inherent to C. europaea. Whilst the positioning of the centromeres on the chromosome is normally determined by the locations of CENH3 histones, the centromeres of C. europaea were positioned in some chromosomal regions also independently from the plant's occurrence of CENH3.

C. europaea is mainly known as a parasitic plant - instead of doing photosynthesis, it grows on other plants and lives off their products. In some cases, it even lives as an epiparasite, living off related plant species. When looking into the plants' cytogenetics, researchers from the Biology Centre of the Czech Academy of Sciences in České Budejovice, in collaboration with researchers from the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), recently discovered
that *C. europaea* showcases a unique kind of centromere.

The centromere is a region on a chromosome, at which the kinetochore assembles. This, in turn, guides the attachment of the microtubules of the spindle apparatus during the cellular processes mitosis and meiosis. In most eukaryotic species, the positioning of the centromere is determined by a centromere-specific histone H3 variant called CENH3, which also plays an essential role in the formation and function of kinetochores. Based on the distribution of centromeres on the chromosome, species are thought of as having either monocentric or holocentric centromere types. In monocentric species, CENH3 and thus centromere activity is confined to a single region per chromosome, whilst in holocentric species, both are found along the entire length of the chromosome.

In order to investigate traits associated with the transition from monocentric to holocentric chromosome organisation, researchers compare the phylogenetics of related species with differing centromere types. Species of the genus *Cuscuta* are already well documented. However, when investigating *C. europaea* as an additional representative holocentric species, the scientists came across unexpected discrepancies. Instead of creating the expected signals along the entire chromosome, in situ immunodetection patterns showed that CENH3 occurred in up to three distinct regions per chromosome. Later, super-resolution microscopy revealed that the centromeres still showed typical holocentric activity, apparently independent of the unusual CENH3 distribution, proving that a new type of centromere had been found.

To date, only few species showing no correlation between CENH3 and kinetochore functionality, mainly holocentric insects which are lacking CENH3 genes, have been found. But through the discovery of *C. europaea*’s unique centromere type, this short list has now been extended by one already rather exceptional parasitic plant, which will continue to inspire further research.

Leibniz Institute of Plant Genetics and Crop Plant Research

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**Action is needed to preserve a rare species of mistletoe in Dunedin’s Town Belt, a botany student says.**

University of Otago student Zoe Lunniss, who is nearing completion of her master’s thesis, said change was needed to conserve the *Tupeia antarctica* species.

![Tupeia antarctica Photo: Chris Ecroyd](image)

It did not quite look like it should in the Dunedin Town Belt, because of possums grazing and a lack of light beneath the canopy, she said. Miss Lunniss has studied growths of the parasite on host trees and placed collars on the trees to hinder possum access. The mistletoe growths were still not fruiting, however. They were alive but not flourishing. Otago was once a stronghold for the species but the region was down to three populations, she said. The others were at Tavora Reserve, near Palmerston, and in the Catlins.

Miss Lunniss has a bachelor of science degree and has run experiments and examined *T. antarctica* closely for almost two years. One curious characteristic was that it grew on different hosts, depending on their location, she said. ‘It’s cool to have it here in the Town Belt. It’s really rare. ‘Something needs to happen now, for the conservation of the species.’
This species, endemic to New Zealand, will on occasion extend into beech forest where it has been found parasitic on red mistletoe (*Peraxilla tetrapetala*). Favoured indigenous hosts include *Pseudopanax arboreus*, *Carpodetus serratus*, *Nestegis cunninghamii*, *Pittosporum eugenioides*, *P. tenuifolium*, and *Coprosma* spp. At present the species has been recorded from 48 hosts (11 exotic) spread through 32 genera and 20 families (from de Lange et al. 1997, though this figure needs revision as since that time many more hosts have been reported. de Lange, P.J. 2020. *Tupeia antarctica* Fact Sheet. New Zealand Plant Conservation Network. [https://www.nzpcn.org.nz/flora/species/tupeia-antarctica](https://www.nzpcn.org.nz/flora/species/tupeia-antarctica))

**THESIS**


Plants of the genus *Cuscuta* or dodder belonging to the morning glory family (Convolvulaceae) are obligate parasitic plants, so-called holoparasites, meaning that they are fully host-dependent. Only few plants can successfully resist a dodder attack. The cultivated tomato (*Solanum lycopersicum*) however is among the resistant plants. It can successfully persist an attack of giant dodder (*Cuscuta reflexa*). In this work the perception system of tomato and its corresponding elicitor from giant dodder is investigated. Cultivated tomato has many wild relatives and is with most of them intercrossable, which gives researchers an excellent opportunity for genetic investigations. It shows a violent reaction when attacked by giant dodder. Thus the immune system of tomato is able to perceive a molecular pattern from giant dodder (*Cuscuta reflexa*). In this work the perception system of tomato and its corresponding elicitor from giant dodder is investigated. Cultivated tomato has many wild relatives and is with most of them intercrossable, which gives researchers an excellent opportunity for genetic investigations. It shows a violent reaction when attacked by giant dodder. Thus the immune system of tomato is able to perceive a molecular pattern from giant dodder, whereas some wild tomatoes cannot, which makes them susceptible. This unknown molecular pattern was characterized and an identification process began, and in addition the corresponding receptor was found. It was furthermore revealed how the findings of the interaction between dodder and tomato can be used for plant protection.

**MEETING REPORT**

**Mistletoe in Tumour Therapy:** Basic Research and Clinical Practice. 7th. Mistletoe Symposium, 7–9 November 2019, Europäisches Bildungszentrum Otzenhausen D-66620 Nonnweiler.

Lucie Schröder, *et al.* - Special features of cellular respiration in *Viscum album*.

Uwe Pfüller and Udo Schumacher - Lectins, viscotoxins and low molecular weight active components of mistletoe plants.

Gero Leneweit *et al.* - Colloidal formulation of mistletoe extracts in a pharmaceutical flow process for targeted cancer therapy.

Tim Jäger *et al.* - Metabolic profiling as a tool for differentiating *Viscum album* ssp. album plants growing on various host trees.


Marcus Reif *et al.* - Association between fatigue and laboratory parameters in a longitudinal randomized controlled mistletoe trial in breast cancer patients.

Gunver S. Kienle - Current developments of clinical research on mistletoe therapy in cancer care.

Kathrin Wode *et al.* - Mistletoe therapy in primary and recurrent inoperable pancreatic cancer. A phase III prospective, randomized, double blinded, multicenter, parallel group, placebo controlled clinical trial on overall survival and health-related quality of life (MISTRAL).

André-Michael Beer - Do world history and history of naturopathy influence the history of phytotherapy?

Sonja Schötterl *et al.* - Mistletoe lectin I reduces glioma cell motility by changing mainly the expression of genes associated to TGF-β signaling.

Katrin Menke *et al.* - Preclinical study on the significance of mistletoe preparations in the therapy of urological tumors.

Eva Jüngel *et al.* - Preclinical studies on the significance of mistletoe preparations in the therapy of urological tumors.

Amy Marisa Zimmermann-Klemd *et al.* - Does Mistletoe Interact with Tumor Immune-Escape Mechanisms?

Catharina Delebinski *et al.* - Overview of viscumTT.

André-Michael Bee *et al.* - On-site Integrative Oncology: The Bochum/Hattinger Model.
Daniel Galun et al. - The impact of fever on overall survival after trans-catheter hepatic mistletoe therapy of patients with primary liver cancer.
Theo Dingermann - Checkpoint inhibitors: A starter.
Ulrike Weissenstein - *Viscum album* and Immunotherapy.
Harald Matthes - Reviews: Status of mistletoe therapy for breast and lung cancer.
Christian Grah et al. - First prospective study of a combined immune therapy of checkpoint inhibitors ± CTX plus *Viscum album* L. in non-small cell lung cancer (NSCLC) in UICC stage III B-IV B.
Burkhard Matthes et al. - Prolonged overall survival in patients with metastasized non-small cell lung carcinoma after combined treatment of chemotherapy and *Viscum album* L. versus chemotherapy alone, a cancer registry analysis.
Friedemann Schad et al. - Psychosocial, cognitive, and physical impact of Elaborate Consultation and Life Review in Female Patients with Non-Metastasized Breast Cancer.
Anja Thronicke et al. - Financial burden of all-stage lung and breast cancer patients as an early indicator for emotional and physical burden.
Harald Matthes - Psycho-oncology today: The same approach for all patients? Or an organ-specific approach?
Christian Grah - Psycho-oncological care in lung cancer: are there site-specific features?
Martin Flür et al. - A Single-Case Series on the Tolerability of Targeted Therapy and Concomitant Mistletoe Therapy in the Treatment of Oncological Patients
Karl Rüdiger Wiebelitz and André-Michael Beer - Intratumoral, intrapleural and intraperitoneal mistletoe therapy. Effects and adverse reactions.
Gil Bar-Sela - Intravenous application of mistletoe extract: review of the reported data and outline of a planned study with Iscador.
Alessandra Longhi et al. - Long term results in osteosarcoma patients treated with *Viscum album* Fermentatum P versus Etoposide as maintenance therapy after second relapse.
Frank Meyer- Sources of Integrative Medicine.
Marcus Reif et al. - Pain and use of analgesics in a randomized study of metastasized or locally advanced pancreatic carcinoma (MAPAC).
Thomas Ostermann et al. - A Systematic Review and Meta-Analysis on the Survival of Cancer Patients Treated with a Fermented *Viscum album* L. Extract (Iscador) – an Update of Findings.

**FUTURE MEETINGS**

**16th World Congress on Parasitic plants - Nairobi, Kenya. July 2021 (to be confirmed).**

**Symposium on Holoparasites. Namibia, September 2022.**

We are writing to inform you of plans to hold a symposium on holoparasites in Namibia in September 2022. The emphasis will be on African holoparasites but anyone working on holoparasitic angiosperms is welcome. This is a very preliminary announcement based on our recent meeting in Windhoek earlier this month but we wanted to gauge interest before further planning. The symposium will be sponsored by the University of Namibia, Old Dominion University, and Catawba College. A three-day meeting is planned with additional opportunity for field trips to see some of the most bizarre parasites in the world.

We are seeking funds to help subvent the cost of the meeting and it is anticipated that funds will also be available to support travel, especially students and African colleagues.

If you are interested and would like to receive additional announcements, please respond to Lytton Musselman at lmusselm@odu.edu

Comments and suggestions are encouraged.

Jay F Bolin, Catawba College
Erika Maass, University of Namibia
Lytton J Musselman, Old Dominion University

**Virtual Agbiol Conference 1-3 September 2020, Edirne, Turkey focusing on Agriculture, Biology and Life Sciences topics.**

For more information:

**GENERAL WEB SITES**

For individual web-site papers and reports see LITERATURE

* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see:
For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/
*For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/
For Old Dominion University Haustorium site see: https://ww2.odu.edu/~lmusselm/haustorium/index.shtml
For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see: http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research
For a description of the PROMISE project (Promoting Root Microbes for Integrated Striga Eradication), see: http://promise.nioo.knaw.nl/en/about
For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/
For the Toothpick Project – see https://www.toothpickproject.org/
For the Annotated Checklist of Host Plants of Orobanchaceae, see: http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm
For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/
For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/
For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/
*For information on future Mistel in derTumortherapie Symposia see: http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx (NB see above re 7th Symposium)
For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).
For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au/sandalwood

LITERATURE

*indicates web-site reference only
Items in bold selected for special interest


Abbes, Z., Trabelsi, I., Kharrat, M. and Amri, M. 2019. Intercropping with fenugreek (Trigonella foenum-graecum) enhanced seed yield and reduced Orobanche foetida infestation in faba bean (Vicia faba). Biological Agriculture & Horticulture 35(4): 238-247. [Confirming reduced infestation by O. foetida and increased yield of faba bean as a result of intercropping with fenugreek, presumably as result of allopathic effects but these not confirmed in this study.]


*Ayybeke, M. 2020. Aspergillus alliaceus infection fatally shifts Orobanche hormones and phenolic metabolism. Brazilian Journal of Microbiology. (https://doi.org/10.1007/s42770-020-00283-4) [Concluding that A. alliaceus infection reduces the effect of defence hormones (jasmonic acid, ABA and salicylic acid) leading to slow death of Orobanche (not specified in abstract).]


Hungarian) Erdészettudományi Közlemények 29(1/2): 69-85. [A study involving Viscum album on Acer, Crataegus, Juglans, Robinia and Tilia spp. Establishing that as the infection intensity increases, the relationship between the height and DBH decreases proportionally. However, the exact modelling of this relationship is more complicated, because the negative effect of mistletoe may differ within host species.]


Banerjee, A. 2020. Inter-plant communication via parasitic bridging. Journal of Experimental Botany 71(3): 749-750. [Commenting on the paper by Li ShaLan et al. – see below.]

Banerjee, A. and Stefanović, S. 2019. Caught in action: fine-scale plastome evolution in the parasitic plants of Cuscuta section Ceratophorae (Convolvulaceae). Plant Molecular Biology 100(6): 621-634. [Complete plastome sequences reveals exactly which genes have been lost and pseudogenized in members of this section. Three species, C. boldinghii, C. erosa, and C. strobilacea, have the smallest plastomes and are holoparasites.]

Bayé-Nivah, C., Hamawa, Y., Loura, B.B., Fawa, G. and Mapongmetsem, P.M. 2019. (Production of litter and supply of bioelements from four local fruit species of the high Guinean savannas of Cameroon.) (in French) Journal of Animal and Plant Sciences (JAPS) 42(1): 7162-7174. [Ximenia americana was the richest species in bio elements with 2378.12 mg/100 g of dry matter. X. americana and Parakia biglobosa were the richest species in nutrient with 666 mg/100 g and 354 mg/100 g of dry matter respectively. These results show that these species of fruit trees produce a fertilizing foliar litter and their integration in agro systems could contribute to soil restoration.]

Bellis, E.S. and 17 others. 2020. Genomics of sorghum local adaptation to a parasitic plant. Proceedings of the National Academy of Science 117(8): 4243-4251. [Exploring the variations in gene LGSI (low germination stimulant 1) and finding their frequency greater in sorghum populations subject to high intensity of infestation by Striga hermonthica. See also Press Reports above.]


Bokov, D.O. and 13 others. 2020. Lathraea squamaria L. (Orobanchaceae): a review of its botany, phytochemistry, traditional uses and pharmacology. Pharmacognosy Journal 12(3): 667-673. [L. squamaria is apparently used in antitumoral, biligenic, infertility-treatment and diuretic drugs in Russia. A range of chemical components are identified, with possible roles in their therapeutic effects.]

Borkowski, J., Machlanka, A., Dyki, B., Kowalczyk, W. and Felczyńska, A. 2018. (The influence of branched broomrape on growth and yielding of tomato 'Growdena F1') (in Polish) Zeszyty Naukowe Instytutu Ogrodnictwa 26: 119-126. [An inconclusive study as the control plants (in pots) were affected by blossom-end rot.]


Bumsick, M., and 11 others. 2020. SMXI-dependent seed germination bypasses GA signalling in Arabidopsis and Striga. Nature Plants 6, 646–652. (https://www.nature.com/articles/s41477-020-0653-3) [GA acts as the dominant hormone for stimulation of non-parasitic plants by inhibiting a set of DELLA repressors. In parasitic plants strigolactone receptors circumvent the GA requirement. The receptors co-opt and enhance signalling through the
HYPOSENSITIVE TO LIGHT/KARRIKIN INSENSITIVE2 (AHKT/KAI2) pathway, which normally plays only a rudimentary role in Arabidopsis seed germination. tHTL/KAI2 negatively controls the SUPPRESSOR OF MAX2 1 (SMAX1) protein, and loss of SMAX1 function allows germination in the presence of DELLA repressors. The data suggest that ligand-dependent inactivation of SMAX1 in Striga and Arabidopsis can bypass GA-dependent germination in these species.

Bürger, M. and Chory, J. 2020. The many models of strigolactone signaling. Trends in Plant Science 25(4): 395-405. [Reviewing recent developments in the strigolactone field and the crystal structures that gave rise to various models of receptor activation. Also highlighting the increasing number of discovered molecules with activity in varying contexts.]

CAB International, Wallingford, UK. 2019. Managing Striga weed poster. Miscellaneous Leaflet, CABI, 1p. [Illustrating S. hermonthica, describing how it is spread, by wind, rain water, implements and contaminated crop seed; and how it may be controlled, by rotation, intercropping with legumes and using herbicide-resistant varieties Longe 7H-IR, NARO Maize 58-IR, NARO Maize 59-IR and NARO Maize 60-IR in combination with herbicide. Also by preventing seeding.]

Canelón, D.S., Niño, S.M., Dorr, L.J. and Caraballo-Ortiz, M.A. 2020. Two new species of Dendrophthora (Viscaceae) from the Venezuelan Andes. PhytoKeys 140: 1-10. [Describing D. apiculata and D. coronata are described. Confined to subpáramo and páramo ecosystems of the Venezuelan Andes, they are at present, only known from Guaramacal National Park. Ecological aspects and possible taxonomic affinities are discussed.]


Chen Jie, Ma YongQing, Guo ZhenGuo and Xue QuanHong. 2019. (Effect of Penicillium griseofulvum on control of Orobanche aegyptiaca and microorganisms in rhizosphere soils of tomato.) (in Chinese) Zhongguo Shengtai Nongye Xuebao / Chinese Journal of Eco-Agriculture 27(5): 766-773. [Results suggest that a cell-free extract of P. griseofulvum inhibited growth of O. aegyptiaca and full inoculum applied in pot experiments reduced parasite infestation by 76% and increased tomato fruit yield by 50%].

*Chen Jie, Xue QuanHong, Ma YongQing, Chen LianFang and Tan XinYu. 2020. Streptomyces pactum may control Phelipanche aegyptiaca in tomato. Applied Soil Ecology 146: pp.103369. (https://www.sciencedirect.com/science/article/abs/pii/S0929139319302185?via%3Dihub) [From 88 actinobacterial strains, assayed for their effects on germination of P. aegyptiaca seeds, Streptomyces pactum Act12 was selected for detailed laboratory, greenhouse and field studies. A cell-free culture filtrate inhibited seed germination and germ tube elongation of P. aegyptiaca by 94% and 97%, respectively. In potted plants S. pactum reduced P. aegyptiaca emergence and dry weight by 86% and 55%, respectively and increased tomato biomass. In the field it decreased P. aegyptiaca emergence by 32% and increased tomato fruit yield by 57%].

*Chen JingFang, Yu RunXian, Dai JInHong, Liu Ying and Zhou RenChao. 2020. The loss of photosynthesis pathway and genomic locations of the lost plastid genes in a holoparasitic plant Aeginetia indica. BMC Plant Biology 20(199): (https://bmcplantbiol.biomedcentral.com/articles/10.1186/s12870-020-02415-2) [The study suggests the loss of photosynthesis-related functions in A. indica in both the nuclear and plastid genomes. The lost plastid genes are transferred into its nuclear and/or mitochondrial genomes, and exist in very small fragments with no expression and are thus non-functional. The A. indica plastome also provides a resource for comparative studies on the repeated evolution of holoparasitism in Orobancheaceae.]

*Chen LanLan, Zhu ZaiBiao, Guo QiaoSheng, Guo Jun, Huang ZhiGang, Shi YongTao and Wen ZhenCui. 2020. Effects of one
haustorium-inducing quinone DMBQ on growth and development of root hemiparasitic plant *Monochasma savatieri*. Ciência Rural 50(3): [Showing that DMBQ increased haustorium formation in *M. savatieri* in the absence of a host; also increased density of planting. Of interest for the cultivation of this species as a traditional medicine in China.]


*Clarke, C.R., So-Yon Park. Tuosto, R., Xiaoyan Jia, Yoder, A., Van Mullekom, J. and Westwood, J. 2020. Multiple immunity-related genes control susceptibility of Arabidopsis thaliana to the parasitic weed *Phelipanche aegyptiaca*. Peer Journal 8(5423): e9268. [In a study of 46 mutant lines of *A. thaliana*, host plants with mutations in genes involved in jasmonic acid biosynthesis/signaling or the negative regulation of plant immunity were less susceptible to *P. aegyptiaca* parasitization. In contrast, *A. thaliana* plants with a mutant allele of the putative immunity hub gene *Pfd6* were more susceptible to parasitization. While most tested *A. thaliana* lines were fully susceptible to *P. aegyptiaca* parasitization, this work revealed several host genes essential for full susceptibility or resistance to parasitism.]*


Danil, S, Pacureanu-Joita, M., Anton, F.G. and Dan, M. 2019. Sunflower hybrids with resistance at sulfonilureea herbicide and at imidazolinone herbicide created at NARDI Fundulea. Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series 49(1): 138-142. [Cataloguing the sunflower hybrids developed and released by NARDI Fundulea in Romania, FD15CL44, FD16CL50 and FD18CL58, resistant to imidazolone herbicide, and FD15E27 and FD18E41, resistant to sulfonylurea herbicides, listing their oil content period to maturity, ideal planting density, and range of *O. cumana* races to which they are resistant.]


*de Saint Germain, A., Jacobs, A. and 15 others. 2020. A *Phelipanche ramosa* KA12 protein perceives enzymatically strigolactones and isothiocyanates. bioRxiv June 2020; preprint (10.1101/2020.06.09.136473) [Identifying five putative SL receptors in *P. ramosa*, of which PrKA12d3 is involved in seed germination stimulation. PrKA12d3 enzymatic activity confers hypersensitivity to strigolactones. Additionally, demonstrating that methylbutenolide-OH binds PrKA12d3 and stimulates *P. ramosa* germination with a bioactivity comparable to that of ITCs. All suggesting that *P. ramosa* has extended its signal perception system during evolution, a fact to be considered in the development of specific and efficient bio-control methods.]*

Delavault, P. 2020. Are root parasitic plants like any other plant pathogens? New Phytologist 226(3): 641-643. (https://doi.org/10.1111/nph.16504) [A detailed commentary on the article by Su et al. (see below), emphasising how that study demonstrates clear parallels between parasitic plants and other plant pathogens and the ways in which they can evolve to overcome resistance.]

Đokić, D., Stanisavljević, R., Terzić, D., Milenković, J., Jevtić, G., Srbanović, R. and Koprivica, R. 2019. The influence of different purity of natural alfalfa seeds on the processing efficiency. AGROFOR International Journal 4(2): 5-11. [Unspecified Cuscuta sp. seeds were found in 8 of 10 samples of alfalfa seed in Serbia. Treatment by mixing with Nutra Fine RS steel powder and passing through a magnetic separator serves to eliminate Cuscuta seed from the alfalfa.]

Domina, G., Scafidi, F. and Gargano, M.L. 2018. Typification of the name Orobanche ebuli Huter & Rigo (Orobanchaceae) and its taxonomic implications. Phytotaxa 344(2): 198-200. [Orobanche ebuli is an Italian endemic, exclusive to Lazio and Abruzzo. It grows on the edge of beech woods at 1200-1300 m, host Sambucus ebulus. ‘This name, as far as we are aware, is not yet typified.’]

Dor, E., Plakhine, D., Joel D.M. and Larose, H. 2020. A new race of sunflower broomrape (Orobanche cumana) with a wider host range due to changes in seed response to strigolactones. Weed Science 68(2): 132-142. [Identifying a new race of O. cumana with ability to attack tomato and tobacco as well as sunflower, being able to respond to strigolactones and dehydrocostus lactone while most O. cumana only responds to the latter and O. cernua only to strigolactones. It is ‘currently spreading and posing a threat to processing tomato in Israel’.]

El-Fatah, B.E.S.A. and Nassef, D.M.T. 2020. Inheritance of faba bean resistance to broomrape, genetic diversity and QTL mapping analysis. Molecular Biology Reports 47(1): 11-32. [Six faba bean parents and their F1 and F2 generations were used to study the genetic system controlling resistance of faba bean (Vicia faba L.) to Orobanche crenata. The population P2 × P8 (Assiut 125 × Romy 12) gave the highest value of relative yield and tolerance index.]


*Emnami, M., Mbasani-Mansi, J., Briache, F.Z., Ouissible, N., Gaboun, F., Ghaouti, L., Belqadi, L., Ghanem, M.E., Aberkani, K., Westwood, J. and Mentag, R. 2020. Growth-defense tradeoffs and source-sink relationship during both faba bean and lentil interactions with Orobanche crenata Forsk. Crop Protection 127: pp.104924. (https://www.sciencedirect.com/science/article/pii/S0261219419302704) [During the first stage of infection, reductions in host biomass were observed on susceptible and resistant faba bean cultivars (54 and 27%, respectively for Lobab and Misr 3) and on susceptible lentil cultivar (Zaaria). Considering biomass partitioning over the various host parts, O. crenata parasitism on susceptible faba bean and lentil cultivars greatly increased host root dry matter, but delayed and reduced host reproduction. Source-sink relationships explained the dry weight diversion from host to parasite during the last phases of the interaction.]


Psittacanthus plagiophyllus constituted less than 0.15% (0.5-2.2 kg ha\(^{-1}\)) of the total above-ground biomass, suggesting that this life-form is irrelevant to the local biomass stock despite its unequivocal biological importance.

*Ferrenberg, S. 2020. Dwarf mistletoe infection interacts with tree growth rate to produce opposing direct and indirect effects on resin duct defenses in lodgepole pine. Forests 11(2): (https://www.mdpi.com/1999-4907/11/2/222) [A study aiming to disentangle the influences of tree age, growth rate, and *Arceuthobium americanum* infection on resin duct defenses in lodgepole pine, *Pinus contorta*, concluding that there was an increase in resin duct formation only partially offset by the negative effect of the mistletoe on overall growth. And discussing the potential influence of this on susceptibility to natural enemies.]

Flores-Sánchez, I.J. and Garza-Ortiz, A. 2019. Is there a secondary/specialized metabolism in the genus *Cuscuta* and which is the role of the host plant? Phytochemistry Reviews 18(5): 1299-1335. ['This review attempts to discuss the hosts' plants' influence on the phytochemistry and pharmacology of parasitic plants like *Cuscuta*, from the evidence that has been published until recent years in specialized literature'. Not altogether clear how successful that attempt has been.]


Gholizadeh, R. and Hemmati, R. 2019. Occurrence and pathogenicity of some fungal species on broomrape. Iranian Journal of Plant Pathology 55(1): Fa83-Fa86. [46 fungal isolates from unhealthy *Phelipanche ramosa* were studied. These included *Aspergillus ochraceus* and *F. fujikuroi* recorded for the first time on broomrape. Also *Macrophomina phaseolina*, *F. acuminatum* and *F. equiseti* for the first time in Iran. *F. acuminatum*, *F. fujikuroi* and *F. proliferatum* caused the most disease severity on tubercles.]


Haan, N.L., Bakker, J.D., Dunwiddie, P.W. and Linders, M.J. 2018. Instar-specific effects of host plants on survival of endangered butterfly larvae. Ecological Entomology 43(6): 742-753. [Survival of *Euphydryas editha* (Taylor's checkerspot) was lower on *Castilleja levisecta* and *C. hispida* than on *Plantago lanceolata.*]

cultivars, Wad Ahmed, Tabat, Butana and Arfagadamek-8 as recurrent parents. Resistance to *S. hermonthica* in the crosses varied from 12% to 89%.

*Hamad, M.A., Babiker, A.G.T. and Mohamed Osman A.A. 2019. Yield adaptability and stability of grain sorghum crosses across environments under *S. hermonthica* infestation in Sudan. Journal of Agricultural and Veterinary Sciences 20(2): (http://repository.sustech.edu/handle/123456789/24358) [Studying the genetic x environment interaction in a range of crosses. Based on Additive Main Effect and Multiplicative Interaction (AMMI) analysis the crosses Framida x AG-8, PQ-34 x BU, ICSV006 x BU, ICSV007 x BU, SAR33 x BU, SAR33 x TA, P402 x TA, P-Q-34 x WA, P405 x WA, P401 x WA, Framida x WA, SAR33 x WA and Brhan x WA were identified as the most stable, endowed with *S. hermonthica* resistance and/or tolerance and high grain yield (1139-1548 kg ha⁻¹).


*Imarhiagbe, O. and Aigbokhan, E. I. 2019. Studies on Thonningia sanguinea Vahl. (Balanophoraceae) in Southern Nigeria. Range and host preference. International Journal of Conservation Science 10(4): 721-732. [A paper based on the senior author’s PhD thesis – see Haustorium 73 – recording the hosts of *T. sanguinea* which include the native *Guarea cedrata, Lophira alata, Musanga cecropiodes, Myrianthus arboreus* and *Ricinodendron heudelotii*, and the introduced rubber and cacao. *L. alata* was the most susceptible host, while *M. cecropiodes* had the highest percentage occurrence with 32%. This species is currently ‘Not Evaluated’ by IUCN, but conservation is recommended.]


Jiang Di, Ma Rui, Li JiaLiang, Mao QiYun, Miao Ning and Mao KangShan. 2019. Characterization of the complete chloroplast genome of *Scurrula parasitica*. Mitochondrial DNA Part B 4(1): 247-248. [The genome contains 106 genes, including 66 protein-coding genes, 28 tRNA genes, 8 ribosomal RNA genes and 4 pseudogenes. Phylogenetic analysis revealed that *S. parasitica* is closely related to *Taxillus* (3 spp.), with strong support values.]


*Julio, E., Malpica, A., Cotucheau, J., Bachet, S., Volpatti, R., Decors, C. and de Borne, F.D. 2020. RNA-Seq analysis of *Orobanche* resistance in *Nicotiana tabacum*: development of molecular markers for breeding recessive tolerance from 'Wika' tobacco variety. Euphytica 216(1): pp.6. (https://link.springer.com/article/10.1007%2Fs10681-019-2544-9) [The tobacco variety 'Wika' induces lower or delayed germination of *Phelipanche ramosa* seeds, thanks to a single recessive gene. An F2 population segregating for 'Wika' recessive tolerance was then used for marker validation and mapping. All candidates were situated on chromosome 14. Other potential tolerant lines were then identified and markers for conventional gel electrophoresis are now available facilitating the transfer of 'Wika' recessive tolerance into elite lines.]

*Kaga, Y., Yokoyama, R., Sano, R., Ohtani, M., Demura, T., Kuroha, T., Shinohara, N. and
Nishitani, K. 2020. Interspecific signaling between the parasitic plant and the host plants regulate xylem vessel cell differentiation in haustoria of Cuscuta campestris. Frontiers in Plant Science 11(March): (https://www.frontiersin.org/articles/10.3389/fpls.2020.00193/full) [Findings suggest the involvement of host-derived signals in the regulation of non-autonomous xylem vessel differentiation in C. campestris and suggest that its connection to the Arabidopsis host xylem during haustorium development activates a set of key genes for differentiation into xylem vessel cells.]


*Kamara, A.Y., Menkir, A., Chikoye, D., Solomon, R., Tofa, A.I. and Omoigui, L.O. 2020. Seed dressing maize with imazapyr to control Striga hermonthica in farmers' fields in the savannas of Nigeria. Agriculture 10(3): 257-368. [Noting that its connection to the host plant and the host plants, and that it is mostly a relic of cultivation in Neotropical Balanophoraceae.]

Kaplan, Z. and 11 others. 2019. Distributions of ancient grasslands in Central Europe and distinguishing them, Noting that identifying the few species which can play an essential role in regulation of plant growth. It is thought that XTHs play an integral role in the way the parasitic vine plant Cuscuta is able to penetrate host plant cell walls. Another study to synthesise analogues of the triphenylmethyl food colorant Brilliant Blue R250 with increased activity – see Petersen, 2019 below.]


Kosonen, Juho Aleksi. 2019. Structure activity survey for new hosts of Helicanthes elastica. Phelipanche mutelii and Orobanche cumana in the soils from different agricultural regions in Bulgaria by molecular markers. Biotechnology & Biotechnological Equipment 33(1): 520-528. [56 soil samples were assayed using PCR-based assay for detection of broomrape seeds with methods to distinguish species based on nuclear ITS sequences. 22 contained O. cumana and 6 contained P. ramosa. The analyses surprisingly revealed that the isolated sequences from supposedly P. mutelii seeds diverge from those annotated by other authors on 16 different nucleotide positions and were almost identical with P. rosmarina. It is hypothesized that P. mutelii/P. rosmarina populations are in a period of active expansion]

Kosonen, Juho Aleksi. 2019. Structure activity investigations of XTH inhibitors. MSc, Universitetet i Tromsø. Advisor: Tore Lejon. http://hdl.handle.net/10037/16067) [XTHs regulate xyloglucan cross-linking in cell walls and play an essential role in regulation of plant growth. It is thought that XTHs play an integral role in the way the parasitic vine plant Cuscuta is able to penetrate host plant cell walls. Another study to synthesise analogues of the triphenylmethyl food colorant Brilliant Blue R250 with increased activity – see Petersen, 2019 below.]

Kumar, T.G.A. and Mathew, L. 2020. A short survey for new hosts of Helicanthes elastica...
(Desr.) Danser and its morphological diversity on selected hosts. Indian Forester 146(2): 143-147. [Noting that H. elastica (Loranthaceae) occurs on a wide range of hosts including some gymnosperms (un-specified in abstract). Its host selection is influenced by bark characteristics and peripheral tissue system of hosts. The host may also influence the spreading of epicortical runners, branching of haustoria and their penetration into the host.]


Lech, P., Żółciak, A. and Hildebrand, R. 2020. Floral anatomy of Tristerix longebracteatus (Loranthaceae). Revista de Biología Tropical 68(1): 87-97. [*The gynoecium with a single ovarian cavity and central mamelon is a condition shared by Tristerix (subtribe Ligarinae) and all the genera of the subtribe Psittacanthinae, except Tripodanthus. The base of the style forms a nectary similar to that found in the sister genus Ligaria. This type of stalar nectary is of taxonomic value for grouping species of the subtribe Ligarinae and differs from the annular nectary of subtribe Psittacanthinae.*]

Lamilla, L.A., Robayo, C.A., Castaño, F., Marquinez, X. and Raz, L. 2020. Floral anatomy of Tristerix longebracteatus (Loranthaceae). Revista de Biología Tropical. 68(1): 87-97. [*The gynoecium with a single ovarian cavity and central mamelon is a condition shared by Tristerix (subtribe Ligarinae) and all the genera of the subtribe Psittacanthinae, except Tripodanthus. The base of the style forms a nectary similar to that found in the sister genus Ligaria. This type of stalar nectary is of taxonomic value for grouping species of the subtribe Ligarinae and differs from the annular nectary of subtribe Psittacanthinae.*]


Letemariam Desta, Ibrahim Fitiw, Alemu Araya and Dawit Fisseha. 2020. Chlorsulfuron and nitrogen rates effect on striga and sorghum varieties yield at Humera, North West Ethiopia. International Journal of Agriculture and Biosciences 9(2): 74-82. [Providing results of an elaborate split plot experiment involving 4 levels of N, 4 levels of herbicide and 3 sorghum varieties. Yields were highest with var. Deber, treated with chlorsulfuron at rates of 10-20 g/ha and with added N at 23 kg/ha. Striga hermonthica numbers were least on the relatively resistant variety Brihan, but yields were lower with this local variety as also with var. wediaker. An integrated approach was best for control of Striga and for optimum yield, using N fertilizer, herbicide, and variety.]


Li ManRu and Zhang Ling. 2019. (Reproductive phenological characteristics and impact factors of Macrosolen cochinchenensis in Xishuangbanna.) (in Chinese) Guangxi Zhiwu / Guiaha 39(9): 1252-1260. [Finding that the flowering period of M. cochinchenensis and its host Schima superba were closely correlated and overlapped in time. In light of other findings it is concluded that ‘the reproductive phenological characteristics of mistletoe species may be influenced by many factors, and it is essential to consider comprehensively combination of multiple factors such as many...
biotic and abiotic factors to understand the reproductive phenological characteristics of those hemiparasite mistletoes in the ecosystem."

Li ShalAn, Zhang JingXiong, Liu Hui, Liu Nian, Shen Guojing, Zhuang HuiFu and Wu JianQiang. 2020. Dodder-transmitted mobile signals prime host plants for enhanced salt tolerance. Journal of Experimental Botany 71(3): 1171-1184. [Transcriptomic analysis indicated that 24 h after salt treatment of one cucumber, the transcriptome of another Cuscuta-connected cucumber largely resembled that of the salt-treated one, which showed reduced leaf withering and cell death in response to subsequent salt stress. Salt treatment of one of the cucumbers also induced physiological changes, including altered proline contents, stomatal conductance, and photosynthetic rates, in both of the dodder-connected cucumbers.]

Li WenJun, Guan KaiYun, Abduraimov, O. and Feng Ying. 202. Pedicularis multicolor (Orobanchaceae), a new replacement name for the Pedicularis inconspicua. Phytotaxa 437(2): 118-118. [Concluding that P. inconspicua is an invalid name for the plant described from Uzbekistan and correcting it to P. multicolour.]

Li YuanJie and Zhang Ling. 2019. (Preliminary studies on effects of host functional traits on host specificity of mistletoe species.) (in Chinese) Journal of Tropical and Subtropical Botany 27(2): 187-195. [Surveying the occurrence of mistletoes Dendrophthoe pentandra, Scurrella chingii var. yunnanensis, S. chingii, Helixanthera parasitica, Macrosolen cochinchinensis, Viscum monoicum and V. ovalifolium in monocultures of citrus, mango and Pouteria australis and in mixed forest in a Yunnan botanical garden. D. pentandra had the highest number of different hosts (258) while the Viscum spp. had only 4 or 5.]

Licona-Vera, Y., Ortiz-Rodriguez, A.E. Vázquez-Aguilar, A.A. and Ornelas, J.F. 2018. Lay mistletoes on the Yucatán Peninsula: post-glacial expansion and genetic differentiation of Psittacanthus mayanus (Loranthaceae). Botanical Journal of the Linnaean Society 186(3): 334-360. [Results from ecological niche modelling (ENM) and approximate Bayesian computation (ABC) highlight the influence of Pleistocene events in shaping the geographical distribution of genetic variation in Neotropical lowland forest. The phylogeographic and environmental patterns in P. mayanus provide an opportunity to investigate further the evolution of Mexican lowland forest biodiversity.]

Liu Nian and 10 others. 2020. Extensive inter-plant protein transfer between Cuscuta parasites and their host plants. Molecular Plant 13(4): 573-585. [More than 1500 proteins are shown to be transferred between Cuscuta and hosts Arabidopsis and soybean. Such an intensive protein traffic may play an important role in host-parasite interactions.]


 Lobachev, Y.V., Kudryashov, S.P., Kurasova, L.G. and Bandurina, Y.Y. 2020. (The source material for the selection of decorative sunflower.) (in Russian) Agrarnyy nauchnyy zhurnal 2020(4): 28-30. [Seven lines of decorative sunflowers derived from YuV-28B with different coloured leaves were assessed and all found to be resistant to local races of Orobanche camuna in SE Russia.]

Madany, M.M.Y., Obaid, W.A., Wael Hozien, AbdElgawad, H., Hamed, B.A. Saleh, A.M. 2020. Salicylic acid confers resistance against broomrape in tomato through modulation of C and N metabolism. Plant Physiology and Biochemistry 147: 322-335. [Concluding that salicylic acid-induced resistance against unspecified Orobanche/Phelipanche sp. relies on the rational utilization of C and N assimilates in a manner that disturbs the sink strength of the parasite and/or activates the defence pool of the host.]

Malagon, M.delP, Mendoza-Cifuentes, H., Gómez-Parra, S. and Uribe-Convers, S. 2019. Neobartsia matuy (Orobanchaceae), a new species from the Colombian Andes. Phytotaxa 424(2): 87-96. [Describing N. matuy, from the an elevation of c. 3500 m., belonging to section Orthocarpiflorae and morphologically characterized by floral bracts light green with glandular hairs, corolla yellowish green, the galea cucullate, longer than the lip, retrorsely glandular-puberulous, the lip three-lobed, glabrous and the corolla tube cured.]
**Lathraea squamaria.** Biochemical Systematics and Ecology 86: pp.103928. (https://www.sciencedirect.com/science/article/pii/S0305197819302601) [Two epimeric pairs of iridoid aglycones isolated and their structures confirmed from *L. squamaria.* The chemophenetic significance and possible reasons for the occurrence of such iridoid aglycones in holoparasitic plants are discussed.]


Mude, B.T., Dube, T., Niassy, S., Kimathi, E., Landmann, T., Khan, Z. and Abdel-Rahman, E.M. 2019. Is it possible to discern striga weed (*Striga hermonthica*) infestation...
levels in maize agro-ecological systems using in-situ spectroscopy? International Journal of Applied Earth Observation and Geoinformation 8: (https://www.sciencedirect.com/science/article/pii/S0303243419305689?via%3Dihub) [Using in-situ FieldSpec® Handheld 2™ analytical spectral device to discriminate among different levels of S. hermonithica infestations in maize fields in western Kenya. The ‘random forest’ algorithm was superior to others. Discussing many other details and results but concluding that there is potential for use of hyperspectral, resampled Sentinel-2 multispectral datasets and machine learning discriminant algorithms as a tool to accurately discern Striga.]


*Nickrent, D.L. 2020. Parasitic angiosperms: How often and how many? Taxon (https://doi.org/10.1002/tax.12195) [Haustorial angiosperm parasites evolved 12 times resulting in over 290 genera and 4700 species. This comprehensive review summarizes the molecular phylogenetic information available for all 12 clades.]

Nickrent, D.L. 2020. Gymnosiphon syceorosensis (Burmanniaceae), the second new species for the Philippines. PhytoKeys 146: 71-87. [This new mycoheterotrophic plant is described from Mt. Hamiguitan on the island of Mindanao. Its morphology suggests an alliance with Gymnosiphon hiliar region morphology, from which an anthoclorid species is prepared.

Nie LiPing, Cui YingXian, Wu LiWei, Zhou JianGuo, Xu ZhiChao, Li YongHua, Li XiWen, Wang Yu and Yao Hui. 2019. Gene losses and variations in chloroplast genome of parasitic plant Macrosolen and phylogenetic relationships within Santalales. International Journal of Molecular Sciences 20(22): pp.5812. (https://www.mdpi.com/.../pdf) [In this study, the complete chloroplast genome sequences of M. cochinchinesis, M. tricolor and M. bibracteolatus are reported.]


Ohlson, E.W. and Timko, M.P. 2020. Race structure of cowpea witchweed (Striga gesnerioides) in West Africa and its implications for Striga resistance breeding of cowpea. Weed Science 68(2): 125-133. [A study of the virulence of 58 populations of S. gesnerioides on 7 varieties of cowpea revealed 6 races of the parasite. No cowpea line was resistant to all; and none of the S. gesnerioides races was able to overcome the resistance of all 7 varieties. A novel race SG6 from Kudu, Nigeria, was found to overcome more cowpea resistance than any previously reported race. Proposing the need to stack multiple resistance genes.]


Olszewski, Magdalena. 2019. Diversity and evolution of seeds in Cuscuta (dodders, Convolvulaceae): morphology and structure. MSc, Wilfrid Laurier University, Ontario, Canada. Advisor: Dr. Mihai Costea (https://scholars.wlu.ca/etd/2186) [A study of 104 species of Cuscuta, looking at seed coat morphology, embryo shape, mechanism of water entry, seed size, seeds per capsule and hilar region morphology, from which an identification key for 16 species present and of concern in Canada is prepared.]

Oltra Benavent, J. E. and Navarro Peris, A. 2020. (Some new vascular plants from La Safor (Valencia, Spain).) (in Spanish) Flora Montiberica 76: 139-146. [Recording localities for Parentucellia viscosa.]

Onisan, E., Petrescu, I. and Sarac, I. 2019. The development of new sunflower varieties resistant to O. cumana has become more difficult because the interaction of the female line with the genes from the
restore line must fit perfectly in order to have a complete resistance to the parasite, due to the very fast development of new and more virulent races. Commenting that ‘there are also reported two dominant genes, one recessive gene, double dominant epistasis and dominant recessive epistasis, leading to the conclusion that resistance must be incorporated into both parental lines for developing resistant hybrid’. The paper presents some strategic conclusions from the past 5 year of their sunflower breeding program in Romania.

Pan Da, Hülber, K., Willner, W. and Schneeweiss, G.M. 2020. An explicit test of Pleistocene survival in peripheral versus nunatak refugia in two high mountain plant species. Molecular Ecology 29(1): 172-183. [In Pedicularis asplenifolia the peripheral plus nunatak survival hypothesis was supported by Bayes factors, consistent with current habitat preferences.]

*Pelser, P.B., Nickrent, D.L., van Ee, B.W. and Barcelona, J.F. 2020. A phylogenetic and biogeographic study of Rafflesia (Rafflesiaceae) in the Philippines: limited dispersal and high island endemism. Molecular Phylogenetics and Evolution 139: 106555. (https://doi.org/10.1016/j.ympev.2019.106555) [These analyses indicate that dispersal between islands is rare resulting in high island endemism. BioGeoBEARS analyses suggest Borneo as the ancestral range of the genus and that diversifications occurred earlier than previously assumed.]

*Pettersen, Martin. 2019. Synthesis of XTH inhibitors. PhD, Universitetet i Tromsø. Advisor: Prof. Tore Lejo. (http://hdl.handle.net/10037/16065) [XTHs (xyloglucan endotransglucosylase/hydrolases) are a group of enzymes possibly involved in the infection of tomato plants by Cuscuta spp. This study shows that Brilliant Blue R250 works as a good inhibitor for these enzymes, and attempts to synthesise structurally similar molecules to potentially increase water solubility and inhibitor activity. Compounds with sulfonate groups replaced with phosphonate showed desired activity.]

*Pointurier, O., 2019. (Modelling cropping system effects on branched broomrape dynamics in interaction with weeds.) (in French) Doctorat de Sciences agronomiques, Université de Bourgogne, Dijon, France. (http://www.theses.fr/2019UBFC058) [The model allowed identification of promising combinations of techniques to control both Phelipanche ramosa and other weeds, and revealed that weeds may regulate broomrape. See also Haustorium 77: Pointurier et al. 2019.]

*Qasem, J.R. 2020. Control of branched broomrape (Orobanche ramosa L.) in tomato (Lycopersicon esculentum Mill.) by olive cake and olive mill waste water. Crop Protection 129: pp.105021. (https://www.sciencedirect.com/science/article/abs/pii/S0261219419303679?via%3Dihub) [Olive mill waste water at 400 ml per pot reduced shoot number and dry weight of O. ramosa by 70% and 74%. It was more selective and effective against O. ramosa than olive cake and of a ‘high potential use for parasite control in tomato.’]

*Queijeiro-Bolaños, M.E., Malda-Barrera, G.X., Carrillo-Angeles, I.G. and Suzán-Azpiri, H. 2020. Contrasting gas exchange effects on the interactions of two mistletoe species and their host Acacia schaffneri. Journal of Arid Environments 173: pp.104041. (https://www.sciencedirect.com/science/article/abs/pii/S0140196318319037) [This study evaluated gas exchange (photosynthetic net rate (A), stomatal conductance (G) and intrinsic water use efficiency (iWUE)) of uninfected A. schaffneri trees, compared to trees infected by two mistletoe species, Psittacanthus calyculatus and Phoradendron brachystachyum, in a semi-arid zone in central Mexico. Stomatal conductance in trees infected with P. brachystachyum was significantly lower, particularly on severely infected trees. But results suggest that overall, seasonality effect is more important than mistletoe infection in the physiological performance of the host.]

*Qin Yan, Zhang JingXiong, Hettenhausen, C., Liu Hui, Li ShaLan, Shen uoJing, Cao GuoYan and Wu JianQiang. 2019. The host jasmonic acid pathway regulates the transcriptomic changes of dodder and host plant under the scenario of caterpillar feeding on dodder. BMC Plant Biology 19(No.540). (https://bmcplantbiol.biomedcentral.com/articles/10.1186/s12870-019-2161-8) [Finding that during caterpillar attack on C. campestris, the JA pathway of the tobacco host plant is required for the proper transcriptomic responses of both dodder and host. This study highlights the importance of the host JA pathway in regulating the inter-plant systemic signaling between dodder and hosts.]
Radu, I., Manole, D., Gurau, L.R. and Jinga, V. 2019. Phytosanitary status and yield capacity of some sunflower hybrids in south Dobrogea. Romanian Journal for Plant Protection 12: 61-66. [Noting that sunflower is an immensely important crop in Romania. Twenty hybrids were screened for resistance to several pathogens. Hybrids Aurimii, Centros and Rubisol proved susceptible to *Orobanchus cumana* (race unspecified), but a number of others showed excellent resistance.]

*Rafferty, N.E., Agnew, L. and Nabity, P.D. 2019. Parasitism modifies the direct effects of warming on a hemiparasite and its host. PLoS ONE 14(10): e0224482. (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0224482) [In studies with *Castilleja sulphurea* and its host *Bouteloua gracilis*, the host produced more root biomass relative to shoot biomass when grown with a parasite and when warmed (without parasite). Warmed parasite had lower root:shoot ratios but only when grown with a host. Under elevated temperatures, *C. sulphurea* aboveground biomass was marginally greater, and plants produced significantly more haustoria.]

Ramarumo, L.J., Maroyi, A. and Tshisikhawe, M.P. 2020. Plant species used for birdlime-making in South Africa. Bangladesh Journal of Botany 49(1): 117-124. [The fruits of *Erianthemum dregei*, *E. ngamicum*, *Tapinanthus forbesii* and *T. rubromarginatus* were all recorded being used for making birdlime but were not among the most favoured.]

Randle, C.P. and 10 others. 2018. Host cues mediate growth and establishment of oak mistletoe (*Phoradendron leucarpum*, Viscaceae), an aerial parasitic plant. Castanea 83(2): 249-262. [Studies to determine why *P. leucarpum* favours *Quercus nigra* and certain other species as hosts demonstrated that light, host physiochemistry, and volatiles released from potential host trees serve as cues affecting the viability and establishment of mistletoe seedlings. In particular, 3 common monoterpenes, limonene, β-myrcene, and β-phellandrene induce a positive growth response of *P. leucarpum* radicles.]

*Ren ZiChun, Zagortchev, L., Ma JunXia, Yan Ming and Li JunMin. 2020. Predicting the potential distribution of the parasitic *Cuscuta chinensis* under global warming. BMC Ecology 20(28): (09 May 2020). (https://bmcecol.biomedcentral.com/articles/10.1186/s12898-020-00295-6) [Concluding that global warming may tend to decrease the distribution of *C. chinensis* in China, both through direct effects on the parasite and through adverse effects on the main host soyabean.]

Ripoche, A. Autfray, P. and Marnotte, P. 2019. (Control of *Striga asiatica* using 2-4-d in rainfed rice in middle-western Madagascar.) (in French) 24e Conférence du COLUMA : Journées internationales sur la lutte contre les mauvaises herbes, Orleans, France, 3, 4 et 5 décembre 2019. [Noting that *S. asiatica* can cause severe crop loss in rain-fed rice in Madagascar and that pre-emergence 2,4-D had proved helpful elsewhere for control of *S. hermonthica*, 2,4-D was applied at 4 stages, at 30 days after planting (prior to *S. asiatica* emergence) and at 45, 60 and 75 days after planting. The two earliest applications reduced *Striga* emergence by 80 and 50% respectively and provided significant increases in yields.]

Robayo, C., Marquina, X. and Nickrent, D. L. 2020. Floral anatomy of the plant *Psittacanthus schiedeanus* (Loranthaceae). Revista de Biología Tropical 68(1): 1-11. [The floral anatomy is generally like that of other Psittacanthus. The morphological comparison of pedicel, bracteole and calyculus provides support for the interpretation of the calyculus as a reduced calyx. The sepal locules of the anther are here considered an adaptation for releasing pollen over an extended time period.]

Runo, S. 2019. Modern breeding approaches for durable resistance against the parasitic plant *Striga*. Afrika Focus 32(2): 109-115. (https://ojs.ugent.be/AF/article/view/15770/13336) [Reviewing technologies for a new approach to *Striga* resistance breeding that incorporates host resistance breeding while taking account of the tendency for *Striga* to evolve virulence – by genotyping the parasite in different eco-geographical regions and identifying fingerprints unique to these regions and subsequently linking that to genetic markers.]

natural regeneration is the best way to reduce future losses. Also discussing the possible effects of climate change.]


Sangare, S., Coulibaly, M., Doumbia, I., Sanogo, O., Kwadwo, O. and Gracen, V. 2020. Breeding opportunities and varietal preferences as per farmers' perceptions for development of striga (*Striga hermonthica*) resistant varieties and hybrids in maize. Journal of Genetics, Genomics and Plant Breeding 4(1): 37-46. [Surveys in Mali show that farmers are all too aware of the danger from *S. hermonthica* and its association with low soil fertility, but high cost limits the use of fertilizer. They mostly grow local landraces of maize which are chosen for their taste and maturity. *Striga* is removed by hand. Emphasising the need for the breeding of resistant varieties of maize.]

*Sawadogo, M., Batieno, T.B.J., Dieni, Z., Sawadogo, N., Ouedraogo, T.J. and Sawadogo, M. 2020. Geographical distribution and alternate hosts of *Striga gesnerioides* (Willd.) Vatke in Burkina Faso. Journal of Applied Biosciences 145: 14955 – 14964. (https://doi.org/10.35759/JABs.v145.10) [Cassia mimosoides, Alysicarpus ovalifolius, Ipomea eriocarpa, Ipomea sp. and Tephrosia pedicellata were identified as hosts of *S. gesnerioides* in addition to cowpea. Four morphotypes were also distinguished, but the host range of the different populations was not determined.]


*Sarfoawaa, Adwoa. 2019. Activity of xyloglucan endotransglucosylases/hydrolases XTHs during host plant infection by the parasitic plant *Cuscuta*. MSc, Universitetet i Tromso. Supervisors: Prof. Kirsten Krause and Dr. Stian Olsen (http://hdl.handle.net/10037/15947) [The action of XTHs in haustoria formation, previously observed in *Cuscuta reflexa* was studied in *C. campestris* and *C. platyloba* infecting *Pelargonium zonale*. The expression of Cp-XTH1 was well regulated in the haustoria of *C. platyloba*, but not in *C. campestris*, while the expression of Cc-XTH2 was greatly regulated in *C. campestris* but not in *C. platyloba*. Concluding that the high levels of XTHs, xyloglucan endotransglycosylase enzymes (XET) and xyloglucan work synergistically to modify the parasitic plant leading to the formation of the specialized structures called haustoria.]

(Rafflesiaceae): a new record to Kalimantan, Indonesia. Reinwardtia 18(2): 65-70. [R. hasseltii recorded for the first time from Sambas District, West Kalimantan and describing the detailed characteristics of the flowers.]

Saric-Krsmanovic, M., Uludag, A., Bozic, D., Radivojevic, L., Gajic-Umiljendic, J. and Vrnicanin, S. 2020. The effect of glyphosate on anatomical and physiological features of alfalfa infested with field dodder (Cuscuta campestris Yunck.). Tarim Bilimleri Dergisi 26(2): 181-189. [Showing that glyphosate at 288 and 360 g/ha caused recovery of the harmful effects of C. campestris on alfalfa, confirming that glyphosate can control field dodder at early stages of infestation on alfalfa.]


Sharma, R., Amarjeet and Punia, S.S. 2019. Response of various chemicals, neem cake and hand pulling on growth and development of Egyptian broomrape (Phelipanche aegyptiaca) in Indian mustard. Journal of Crop and Weed 15(2): 126-131. [Application of recommended doses of fertilizer (N and P), plus foliar sprays of glyphosate at 25 and 50 g/ha, plus 1.0% solution of ammonium sulphate at 25 and 55 DAS, reduced the infestation of P. aegyptiaca significantly throughout the growing season and proved best in increasing yield as well as oil content in Indian mustard. Neem cake, pendimethalin and metalaxyl, alone or in combination with glyphosate, exhibited control of P. aegyptiaca at early growth stages only.]

*Shimels, Mahdere Z. 2019. The mechanism underlying strigolactone diversification in sorghum and its role in resistance against the parasitic weed Striga hermonthica. PhD, Wageningen University. Advisors: H.J. Bouwmeester, C.P. Ruyter-Spira. (http://library.wur.nl/WebQuery/wurpubs/554879) [Sorghum lines with high Striga germination stimulant activity predominantly produce 5-deoxyxestril while the low germination stimulant lines produce orobanchol. Evidence is provided for the functional loss of an enzyme annotated as a sulfotransferase (Sobic.005G213600, SbSOT4A) and it is hypothesized that it is responsible for the stereospecific difference of strigolactones between low- and high-germination stimulant sorghum lines. It is thus concluded that in high germination stimulant lines, SbSOT4A is intact; after sulfation of C18-hydroxycarotene it is further oxidized at the C19 position to form a carboxy group and upon the loss of the sulfate group ring closure occurs which results in the formation of 5-deoxyxestril. Also studying the synthesis and role of sorgomol.]

*Silberg, T.R., Richardson, R.B. and Lopez, M.C. 2020. Maize farmer preferences for intercropping systems to reduce Striga in Malawi. Food Security (https://doi.org/10.1007/s12571-020-01013-2) [Noting that repeated droughts have exacerbated the problem of S. asiatica in southern Africa, affecting 80% farmers in Malawi. This paper discusses the potential benefits from inter-cropping with legumes and reports on a survey to establish the extent to which farmers are prepared to sacrifice some yield of maize for suppression of Striga. Noting differences between male and female farmers.]

Şın, B., Öztürk, L., Şivrî, N., Avci, G.G. and Kadioğlu, İ. 2019. Weed flora of cherry, walnut, apple, almond and pear orchards in northwestern Marmara region of Turkey. Turkish Journal of Agriculture - Food Science and Technology 7(12): 2252-2258. [Viscum album was widespread among pear trees while
Cuscuta campestris was detected only on emerged suckers in apple and cherry orchards.

Singh, P., Těšítel, J., Plesková, Z., Peterka, T., Hájková, P., Ditě, D., Pawlikowski, P. and Hájek, M. 2019. The ratio between bryophyte functional groups impacts vascular plants in rich fens. Applied Vegetation Science 22(4): 494-507. [Although non-sphagnumous bryophytes, especially so-called brown mosses, prevail over sphagna under alkaline conditions, in sub-alpine conditions, rich fens allow the co-occurrence of both these functional groups. Then sphagna tend to be dominant over the brown mosses and over seedlings of vascular plants. Hence the importance of brown mosses in the preservation of endangered species including Pedicularis palustris.]

*Skrypnik, L., Maslennikov, P., Feduraev, P., Pungin, A. and Belov, N. 2020. Ecological and landscape factors affecting the spread of European mistletoe (Viscum album L.) in urban areas (a case study of the Kaliningrad city, Russia). Plants 9(3): (https://www.mdpi.com/2223-7747/9/3/394) [The commonest hosts of V. album in Kaliningrad were Tilia cordata, Acer platanoides, and Populus nigra with up to 10 parasites per tree, but those with the heaviest infestations, up to 50 per tree were Populus × berolinensis, Populus nigra, and Acer saccharinum. Levels of infestation were not correlated with soil or air pollution, but were with tree age.]


Su, Chun, Hai Liu, Wafula, E.K., Honaas, L., de Stešević, D., Küzmič, F., Stanišić-Vujačić, M. and *Skrypnik, L., Maslennikov, P., Feduraev, P., Singh, P., Těšítel, J., Plesková, Z., Peterka, T., Pungin, A. and Belov, N. 2020. Ecological and landscape factors affecting the spread of European mistletoe (Viscum album L.) in urban areas (a case study of the Kaliningrad city, Russia). Plants 9(3): (https://www.mdpi.com/2223-7747/9/3/394) [The commonest hosts of V. album in Kaliningrad were Tilia cordata, Acer platanoides, and Populus nigra with up to 10 parasites per tree, but those with the heaviest infestations, up to 50 per tree were Populus × berolinensis, Populus nigra, and Acer saccharinum. Levels of infestation were not correlated with soil or air pollution, but were with tree age.]


Sultan, A., Robertson, A.W., Callmander, M.W., Phillipson, P.B., Meyer, J-Y. and Tate, J.A. 2019. Widespread morphological parallelism in Korthalsella (Santalaceae, tribe Viscceae): A molecular phylogenetic perspective. Taxon 68:1204-1218. [Nuclear ribosomal ITS and plastid trnL-F phylogenies show that historical sectional classifications based on morphology are not supported and that geographical distribution is a better indicator of relationships in these mistletoes.]


Suatuya, A. 20120. The growth of flower bud, life history, and population structure of Rafflesia arnoldii (Rafflesiaeaceae) in Bengkulu, Sumatra, Indonesia. Biodiversitas: Journal of Biological Diversity 21(2): 792-798. [Measurements were made on 17 flowers from two host vines and the growth rates calculated. Despite the title, little information is given on actual population structure and life history of this holoparasite (e.g. nothing about host infection.]


phosphorus in branches and leaves of *Loranthus delavayi* and *Taxillus delavayi* and their hosts, providing data for the study of nutrient utilization strategies in these parasites]


Tigist Beyene and Meseret Chimdessa Egigu. 2020. *Striga hermonthica* (Del.) Benth has dual negative effect on its host *Sorghum bicolor* (L.) Moench. Turkish Journal of Agriculture - Food Science and Technology 8(1): 165-170. [Suggesting that extracts of leaf and flower of *S. hermonthica* could cause reductions in germination and early root growth of sorghum in petri dishes, but subject to the usual doubts surrounding studies of allelopathy.]

Tilal, S.A., Babiker, A.G.T. and Finckh, M.R. 2019. Effects of powder and aqueous extracts of *Euphorbia hirta* on *Phelipanche ramosa* germination and haustorium initiation. Archives of Phytopathology and Plant Protection 51(17-18): 1-14. [Confirming that both dried powder and aqueous extracts of *E. hirta* stimulated germination of *P. ramosa* and also suppressed haustorium initiation when applied during conditioning. They also ‘have potential as spot treatments also for control of *Striga hermonthica*.’]

*Tippe, Dennis Erro. 2019. Developing parasitic weed control strategies for rainfed rice production environments. PhD, Wageningen University. Supervisors: N.P.R. Anten, L. Bastiaans and J. Rodenburg. (https://library.wur.nl/WebQuery/wurpubs/55308) [Studying three options for control of *Striga asiatica* and *Rhamphicarpa fistulosa* in rain-fed rice in Tanzania – delayed sowing, short-duration cultivars and fertilizer. Delayed sowing reduced infection by *S. asiatica*, especially when combined with a short-duration rice variety, but increased that by *R. fistulosa*. Application of fertilizer showed only a small and inconsistent benefit. Farmers’ experience indicated that the early sowing time under lowland conditions favoured the traditional late maturing rice variety. Under upland conditions, farmers were more impressed with a newly developed, early maturing, resistant rice variety. Organic fertilizers, particularly rice husks, in combination with mineral fertilizers were the preferred soil amendment. Conclusion – no simple solutions! (See also papers by Tippe et al. 2017 in Haustorium 72.)]


Üstüner, T. 2020. (The effect of field dodder (*Cuscuta campestris* Yunck.) on the phenological and pomological characteristics of Dila pepper (*Capsicum annuum* L.)) (in... )
A very dense infestation of *C. campestris* shown to cause 17% yield loss in Dila pepper in Turkey.


*Wang Dan, Cui BoChao, Duan SuSu, Chen JiJun, Fan Hong, Lu BinBin and Zheng JiangHua. 2019. Moving north in China: the habitat of *Pedicularis kansuensis* in the context of climate change. Science of the Total Environment 697: pp.133979. (https://www.sciencedirect.com/science/article/pii/S004896971933949X?via%3Dihub) Modelling the potential of climate change to affect the distribution of *P. kansuensis* and concluding that increased populations to the north by 2070 would only amount to about 0.5%.

*Wang JianYou, Salim Al-Babili and 16 others. 2019. The apocarotenoid metabolite zaxinone regulates growth and strigolactone biosynthesis in rice. Nature Communications 10(2): pp.810. (https://www.nature.com/articles/s41467-019-08461-1) [Mutants (zas) containing less zaxinone, exhibit retarded growth and show elevated levels of strigolactones, confirming that zaxinone is a key regulator of rice development and biotic interactions and has potential for increasing crop growth and combating *Striga*.]

*Wang XiangTao, Niu Ben, Zhang XianZhou, He YongTao, Shi PeiLi, Miao YanJun, Cao YaNan, Li Meng and Wang ZhiPeng 2020. Seed germination in alpine meadow Steppe plants from central Tibet in response to experimental warming. Sustainability 12(5): 1884. (https://doi.org/10.3390/su12051884) Finding that germination of *Pedicularis kansuensis* would be higher (but slightly slower) with increased temperatures of 3°C.


Wimolsakcharoen, W., Dumrongrojwatthana, P. and Trébuil, G. 2020. Production of non-timber forest products (NTFPS) and diversity of harvesters' practices and decision-making processes in northern Thailand community forests. Bois et Forêts des Tropiques 343: 39-52. [Young shoots of *Melientha suavis* (Opiliaceae), were found to be one of the three main non-timber forest products collected, with productivity of 2 kg/ha/year.]

Wolfe, A.D. 2018. *Hyobanche hanekomii* (Orobanchaceae), a new species from the Western Cape of South Africa. Phytotaxa 340(1): 93-97. [*H. hanekomii* is described and illustrated, somewhat intermediate in appearance between *H. sanguinea* and *H. atropurpurea*. It occurs in the Cape Fold Belt Mountains of the northwest part of the Western Cape. Host not identified in the abstract.]


*Yakubu, Mohammed Nuru. 2019. Physiological and genetic study of the three-way interactions between rice, arbuscular mycorrhizal fungi and the parasitic weed *Striga*. PhD, University of Aberdeen. Advisors: Adam Price, Ahmad Abdulhameed. (https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.794127) [This study screened diverse rice cultivars for *Striga* resistance, evaluating the influence and nature of mycorrhizal (*Rhizophagus intraradices*)-induced protection
against *S. hermonthica* using a split-root technique, assessing activity on *Striga* seed germination, and examining evidence that variation in the presence or absence of the MAX1 ortholog gene is implicated in resistance.

Yan JiaKun, Zhang NingNing and Duan YiZhong. 2019. The complete chloroplast genome sequence of *Tribulus terrestris*, an important traditional Chinese medicine. Mitochondrial DNA Part B 4(2): 3108-3109. [A total of 129 genes were annotated, including 37 tRNA, 8 rRNA, and 84 protein-coding genes. Phylogenetic analysis showed *T. terrestris* clustered with *Krameria lanceolata* and *Krameria bicolor.*]

Yanev, M. and Kalinova, S. 2019. Influence of glyphosate on leaf gas exchange and photosynthetic pigments of broomrape-infested tobacco plants. Bulgarian Journal of Agricultural Science 26(2): 435-440. [Glyphosate is used for partial control of *Phelipanche ramosa* and *P. mutelii* in tobacco in Bulgaria, but has to be applied at the precise dose of 144 g/ha and only to the lower leaves if the yield is not be adversely affected. This study confirms that application to the upper leaves reduces photosynthesis via a reduction in chlorophylls while application to the lower leaves does not.]


Yıldız, Ü.C., Kılıç, C., Gürgen, A. and Yıldız, S. 2020. Possibility of using lichen and mistletoe extracts as potential natural wood preservative. Maderas: Ciencia y Tecnologia 22(2): 179-188. [Extraction of *Viscum album* in water or methanol has good potential to prevent fungal rotting of wood.]

*Yoneyama, K. 2020. Recent progress in the chemistry and biochemistry of strigolactones. Journal of Pesticide Science (10.1584/jpestics.D19-084) [Reviewing the subject 50 years since the identification of strigol and summarising the recent advances in chemistry and biology of the strigolactones.*]

Yu RunXian, Zhou SongYan, Zhou QiuJie, Liu Ying and Zhou RenChao. 2019. The complete chloroplast genome of a hemiparasitic plant *Tolypanthus maclurei* (Loranthaceae). Mitochondrial DNA Part B 4(1): 207-208. [All the *ndh* genes except *ndhB* are lost and five protein-coding genes are pseudogenized. Phylogenetic analysis shows that *Tolypanthus* is sister to *Macrosolen* within Loranthaceae.*]


Zázvorka, J., Sánchez Pedraja, Ó., Moreno Moral, G., Carlón Ruiz, L., Domina, G., Lainz Gallo, M. and Piwowarczyk, R. 2019. *Orobanche crenata* Bertol. the correct name for *O. kochii* F.W. Schultz (*Orobanchaceae*). Flora Montiberica 75: 52-56. [Concluding, after comparison with *O. kochii* and other specimens, that *O. crenata* Bertol. is the correct name for the plant parasitizing *Centaurea paniculata* in the Czech Republic.]

Zeid, M.M. and Hemeid, M.M. 2019. Effect of glyphosate on performance of faba bean varieties under heavy infestation of *Orobanche crenata*. Alexandria Science Exchange 40(1): 169-176. [Field trials with glyphosate sprays at 86 g/ha in Morocco reduced *O. crenata* but failed to increase faba bean yield and is not recommended. Variety Misr 3 was seen as the most promising variety combining generally good yield and low number of emerged *O. crenata* compared to older varieties Giza 843 and Misr 1.*]
Zeid, M.M. and Komeil, D.A. 2019. Same-hill intercropping of different plant species with faba bean for control of *Orobanche crenata*. Alexandria Science Exchange 40(2): 228-238. [Radish interfered with *O. crenata* germination, fenugreek had a small effect and fennel, none. Interplanted in the field, fenugreek reduced the crop when in the same hill but sometimes reduced *O. crenata* when planted separately in the ridge. Effects in heavily infested fields were generally disappointing.]

Zhang YingYing, Wang DaWei, Shen YueQuan and Xi Zhen. 2020. Crystal structure and biochemical characterization of *Striga hermonthica* HYPO-SENSITIVE TO LIGHT 8 (ShHTL8) in strigolactone signaling pathway. Biochemical and Biophysical Research Communications 523(4): 1040-1045. [ShHTL8 has eleven different kinds of ShHTL hydrolases. The study indicates that on ShHTL8, L125, M147, M154 and I1194 are important binding sites, and of which L125 be especially important. The corresponding residue, Y124 of ShHTL1 and F135 of ShHTL2 may also play a significant role.]

Zhang YingYing, Wang DaWei, Shen YueQuan and Xi Zhen. 2020. Crystal structure and biochemical characterization of *Striga hermonthica* HYPO-SENSITIVE TO LIGHT 8 (ShHTL8) in strigolactone signaling pathway. Biochemical and Biophysical Research Communications 523(4): 1040-1045. [Determination of the crystal structure of a *Striga* hydrolase, a protein that responds to the presence of strigolactones in the soil. The work shows specific structural residues that play a role in substrate recognition.]

*Zhou Nong. 2019. Characterization of the complete chloroplast genome of *Boschniakia himalaica* J. D. Hooker & Thomson (Orobanchaceae), a medicinal species in southwest China. Mitochondrial DNA Part B 4 No.2(2) pp.3064-3065. (https://www.tandfonline.com/doi/full/10.1080/23802359.2019.1664952) [The chloroplast genome contained 84 genes, including 50 protein-coding genes, 30 tRNA genes, and 4 rRNA genes. The phylogenetic analysis indicated *B. himalaica* was closely related to *Cistanche deserticola*.

*Zhou Tao, Ruhsam, M., Wang Jian, Zhu HongHong, Li WenLi, Zhang Xiao, Xu YuCan, Xu FuSheng and Wang XuMei. 2019. The complete chloroplast genome of *Euphrasia regeltii*, pseudogenization of *ndh* genes and the phylogenetic relationships within Orobanchaceae. Frontiers in Genetics 10(May): pp.444. (https://www.frontiersin.org/articles/10.3389/fgene.2019.00444/full) [First complete chloroplast genome of *E. regeltii*, which is more conserved when compared to other hemiparasitic Orobanchaceae genera. Structural rearrangements or gene losses were not detected.]

Zhuo Zhou, Jin-Jin Hu, Jun Wen and Hang Sun. 2019. Morphometric, phylogenetic and biogeographic analyses of *Pyrularia* (Santalales), a parasitic disjunct lineage between eastern Asia and eastern North America. Taxon 68: 47-71. [ *Pyrularia* is a small genus that displays the well-known intercontinental disjunct distribution between eastern Asia and eastern North America. Molecular phylogenetics and dating indicate there are two species in the genus that diverged in the late Miocene.]
Parasitic Plants Newsletter
ISSN 1944-6969
Official Organ of the International Parasitic Plant Society
(http://www.parasiticplants.org/)

December 2020                                                                                              Number 79

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Dear IPPS members

I hope you are all OK. We are going through some rough times and it is difficult to meet other people. Fortunately, we have electronic means of communication and the IPPS General Assembly that we held on Zoom on 25 August showed that for meetings like that this is a viable option. And we have our newsletter, Haustorium, to stay in touch. But we have probably also all experienced that the real exchange of ideas and creation of new plans and collaborations very much needs live interaction. Let’s hope that we will be able to have our 16th WCPP on location in Nairobi 4-10 July 2021, as planned. We will keep you updated on developments.

This is my first ‘Message of the President’ in Haustorium. I want to use this opportunity to thank my predecessor, Julie Scholes, for the great job she did over the last 8 years as Vice-President and President of the IPPS. She organized a WCPP in Sheffield and has supervised a number of transitions in the IPPS, such as the creation of a new website, an update of the constitution and the creation of an IPPS bank account, thus preparing the Society for the future. Thanks for all your hard work Julie!

The new website came right in time, helping us, as members of the IPPS, to stay in touch despite the difficult time. In contrast to the old one, the new site is interactive and alive. Through the website you can reach out to other members should you have specific questions or if you are looking for a collaborator. The website is alive because the members can, themselves, post news and vacancies. I invite you to use this opportunity to reach out to other IPPS members and the society at large: login into the member area and post news and vacancies. I invite you to use this opportunity to post your news on your most recent paper or project funding or your vacancies.

With the help of you, our members, the Executive Committee is nominating the IPPS Advisory Board, consisting of Julie Scholes, Neelima Sinha, Koichi Yoneyama and Jim Westwood. The Advisory Board will advise the Society on matters of strategic importance and monitor the Society’s finance. We ask the members to give their opinion on this nomination; on the Society’s website you will be able to cast your vote, see IPPS News.

While you are at our website to cast your vote, I would like to encourage you to look at and interact with the website. Please log in to the Member area and update your profile with your picture and that of your institution as well as some personal information. You may want to add some expertise keywords as the member list is searchable, allowing others to find you based on your expertise. And post news on your most recent paper or project funding or your vacancies.

I would like to end with wishing you all Happy holidays and a great, healthy and hopefully interactive 2021.

Harro Bouwmeester
IPPS President

FREE MEMBERSHIP OF THE INTERNATIONAL PARASITIC PLANT SOCIETY UNTIL JULY 2021

Membership of the International Parasitic Plant Society (IPPS) is traditionally associated with participation in the World Congress on Parasitic Plants (WCPP), as the registration for these events includes the IPPS membership fee.
Formally, this implies that only the attendants of the most recent WCPP are members of the IPPS. Taking advantage of recent changes in the IPPS Constitution and Executive Committee, we have decided to establish a more constant form of membership. Membership registration and fee payment will still be coupled to the WCPP, but members who do not attend the WCPP will be enabled to continue their membership by paying a membership fee via the IPPS website. To facilitate this transition, we are offering anyone who is interested in becoming a member of the IPPS free membership until July 2021. In July 2021 we will have the next WCPP, in Nairobi, and you will be able to pay your membership fee either through your attendance at the WCPP or via the IPPS website. If you would like to become a member, please send an email to secretary@parasiticplants.org. You will receive an email inviting you to confirm your membership by logging in on the IPPS website member area. After doing so, we kindly ask you to update your member profile on the website with a short description of your scientific interest and a picture of yourself as well as an image representing your institution. Through the website member area, you can also post news and vacancies, access high-resolution pictures of parasitic plants, and communicate with other members. I hope that many of you use this opportunity to become a member and support our society!

Harro Bouwmeester, president of the IPPS

IPPS NEWS

The International Parasitic Plant Society (IPPS) aims to involve its members in decision-making regarding general society matters. To simplify this process, the Executive Committee has established dedicated web pages at https://www.parasiticplants.org/. In the Members-only area, IPPS members can access general Society Documents like the Constitution of the IPPS and a record of the last General Assembly, including the president’s presentation. Members can now vote on Society matters through the IPPS website directly. For example, active IPPS members can decide on the next meeting venue or new Executive Committee officers at https://www.parasiticplants.org/members-only-area/society-documents/polls/. In the future, the Executive Committee will announce elections online and in Haustorium.

IPPS Advisory Board

Following the Executive Committee’s call for nominations, members named Koichi Yoneyama (Ehime University, Japan), Neelima Sinha (UC Davis, USA), Julie Scholes (The University of Sheffield, UK), and Jim Westwood (Virginia Tech, USA) to form the IPPS Advisory Board. The Executive committee now asks IPPS members to take part in an online vote by January 20, 2021. Specifically, members need to confirm the Advisory Board in its current personnel composition. Comprehensive biographies of each of the Advisory Board members are available on the polling page of the IPPS website (see above).

Election of an IPPS Treasurer

Three experienced IPPS members put themselves up for Treasurer: Rosemary Ahom (Nigeria), Ahmed Uludag (Turkey), and Prof. Renate Wesselingh (Belgium). Therefore, the Executive Committee now asks all members to vote online by January 20, 2021 at the IPPS website. Short profiles of each of the nominees are accessible on the polling page in the Members-only area of the IPPS website, which members can access using their login credentials.

Susann Wicke

PROFILE

*Santalum acuminatum* (Santalaceae) – quandong

*Santalum acuminatum* or more commonly known as quandong, is a close relative to sandalwood, and is a hemi-parasitic Australian plant. It belongs to the family Santalaceae, many members of which are also parasites (Der and Nickrent, 2008). Quandong has a widespread distribution across Australia, with a distributional range that extends from the mesic southern temperate to central arid regions of the continent, growing in a wide range of soil types and conditions. The plant’s edible fruit (Fig.1) is an important food source for the indigenous people of Australia and has also been utilised for medicinal purposes in some indigenous local communities.
Most studies on the genus *Santalum* have focused on the sandalwood species and how to increase their yield either through suitable host trials or other environmental field experiments. Though looking at host preferences for *Santalum* in an ecological context has been lacking.

Our recent study looked at the host preferences of quandong by growing it with a range of different potential hosts (native Australian plant species) that are known to co-occur with it in its natural habitat (Nge et al., 2019). Out of the eighteen species that we included in the study, quandong grown with *N₂*-fixing hosts (Fabaceae) showed the highest growth in biomass, whereas the quandong grown with other species were suppressed, compared to the controls (grown without a host or with another quandong). Preference for *N₂*-fixing hosts supports findings on other parasitic plants that display higher yields or biomass growth when paired with these hosts due to the higher nitrogen content in their xylem (Fig. 2). Interestingly, the quandong strongly preferred only one of the three *N₂*-fixing Fabaceae hosts (*Acacia saligna*) in our study; those grown with the other two Fabaceae host pairs had even lower biomass than the controls. These findings indicate that this parasitic plant has a strong host specificity and this may partly explain why it is present in some areas and not in others, in a local scale throughout Australia (Nge et al., 2019).

Due to a combination of strong host specificity, rare local establishment, and the slow growing nature of this species, there has been no incentive and indeed little purpose for the control of this parasite in terms of its management. This is in stark contrast to other more invasive herbaceous parasites commonly found in the Northern Hemisphere (e.g. *Striga*). The Australian large flightless emu bird is a well known seed dispersal agent of quandong. Getting quandong seeds to germinate is difficult in horticulture, and is said to be significantly aided by feeding them to an emu and collecting the remains of their scat after, with the kernels digested but seed intact. Quandong is slow growing and once established, will persist in the landscape for many years (50–100 years or more), often growing into large shrubs. On some occasions I have seen them as tall trees though this is rare, and these are found in areas that get higher rainfall than in more arid parts of its distribution (Fig. 3).

I have also seen some quandong being parasitised by other parasitic plants or even on themselves (self-parasitism). An unusual example includes a native Australian mistletoe...
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growing on a quandong, an example of hyper-parasitism (Fig. 4).

Figure 3. Quandong trees up to 3 m in height and are still relatively young of age, growing in an open clearing surrounded by Wandoo (Eucalyptus) woodland (photo: Francis Nge)

Figure 4. Quandong being parasitised by another plant parasite – an Australian mistletoe species (Amyema) (photo Francis Nge)

References:

Francis J Nge, The University of Adelaide and State Herbarium of South Australia

INTERNATIONAL YEAR OF PLANT HEALTH: PLANT OF THE MONTH - SEPTEMBER – STRIGA

Artist Libby Walker is an illustrator and maker based in Glasgow.
https://libbywalker.co.uk/

Why did we pick it?
*Striga* is a devastating parasitic weed that attacks food crops in sub-Saharan Africa such as rice, sorghum and millet. It affects 40% of Africa’s arable savanna region, and is a major cause of food insecurity and poverty. Tackling the plant health problems experienced by rural subsistence farmers requires an extra level of local collaboration and ingenuity, to ensure that solutions are locally appropriate and meet the needs of these communities.


*A MILLION WORDS*

About a million words have been published in the 78 previous editions of Haustorium. After extracting the text from the original PDF and other files, we can, with the help of the ‘tidytext’ package of statistics software R, identify the most common words. Disregarding short and common words, the top five emerge: *Striga* (over 4,300 mentions), plant, parasitic, species and host. *Orobanche* and mistletoe are not far behind. This graphic (offered just for decorative purposes) shows the 150 most frequent words with the font sized according to how often they appear. The colours are randomly applied in four shades approximating the *Striga hermonthica* flower.
How often and how many?

The review published by Daniel L. Nickrent in Taxon (Parasitic angiosperms: How often and how many? Taxon 69(1): 5-27. 2020) (noted briefly in Haustorium 78) is a helpful summary of the phylogeny of parasitic angiosperms that will be of broad interest to botanists, and of particular regard to those of us working with parasitic angiosperms. Nickrent is one of the leading researchers of parasitic angiosperm phylogeny especially in the Santalales, which includes sandalwood making him ideally suited to prepare this overview.

His definition of parasitic flowering plants is plants that attach to host plants by means of haustoria. They are heterotrophic. Mycoheterotrophs, plants that derive nutrients from other plants via fungal connections to host plants, are also heterotrophic and could be considered parasites in a different way. They are termed ‘ectomycorhizal epiparasites’. This review covers only angiosperms with haustoria.

He provides careful documentation of evolutionary research, including much of his own, confidently showing that parasitism has evolved twelve times in the angiosperms. He states ‘it is no exaggeration to say that these methods (molecular phylogenetic) have revolutionized our understanding of parasitic plant relationships’.

The review includes discussion of each of the twelve orders that contain parasites. These treatments are helpful summaries of the history of evolutionary studies, representative genera, fossil evidence (there is not a fossil record for many of the orders), unresolved phylogenies, and more. The greatest generic diversity is in the Santalales which the order with the highest number of species is the Orobanchaceae. In fact, five clades of the Orobanchaceae are covered in greater detail, more than any other group. This is because, as the author explains, this family contains the notorious parasites *Striga* and *Orobanche* which have received so much attention because of the devastation they cause to crops.

Based on his extensive research and familiarity with parasites around the world, Nickrent suggests evolutionary trends. For example, there are strong evolutionary forces for a trend to holoparasitism. Once parasitism has evolved in a group, there is no going back to the autotrophic condition.

This is a capstone paper from a researcher who has advanced our understanding of parasites markedly. It is certain to be widely cited.

Lytton. J. Musselman

**STUDENT PROJECT**

Estimating the relative influences of local environmental conditions and disperser behavior on the distribution of the oak mistletoe (*Phoradendron leucarpum*)

The high visibility of oak mistletoe (*Phoradendron leucarpum*) and its dependence on birds for seed dispersal beyond the host tree of origin make it a nice system for investigating general questions about the role of dispersal in determining plant distributions. Such information about the distribution of oak mistletoe in the southeastern United States could also have conservation implications. Mistletoes in general can be considered keystone resources, and in addition to being food resources for fruit-eating birds in forested wetlands and urban areas of the region the species serves as the sole larval
host-plant for the great purple hairstreak butterfly (*Atlides halesus*).

We used a seed sowing experiment to quantify the roles of light availability and flood regime in determining the initial survival of oak mistletoe (*Phoradendron leucarpum*). During winters (Jan-Mar) 2016-2018 we planted 1000 oak mistletoe seeds across 50 plots in forested wetlands in southeastern Virginia on a variety of potential host tree species. In winter 2018 we planted 580 oak mistletoe seeds on potted red maple (*Acer rubrum*) saplings under a range of light availability and flood regime treatments using a split plot design. Mistletoe seedling survival and establishment data were analyzed using generalized linear models and the results suggest that light availability has a significant effect on seedling establishment. This information will be coupled with results from a regional co-occurrence study using presence-absence data on both oak mistletoe and avian frugivores to determine the relative influences of environmental conditions and seed disperser behavior on oak mistletoe habitat relationships. Cryptic habitat specificity could exist in the foraging behavior of unmarked avian seed dispersers detected in the region. We are using population genetics analyses and microsatellite marker data from mistletoe samples from across the region to test for the presence of patterns indicative of such disperser.

Established oak mistletoe (*Phoradendron leucarpum*) seedlings as evidenced by the presence of leafy stems.

Nicholas Flanders

**PRESS REPORTS**

**Plants communicate at a molecular level - biologists identify a protein which recognizes *Cuscuta* as a parasite.**

Working together with researchers from the University of Tübingen, the University of Tromsø, the UC Davis and the Sainsbury Laboratory in Norwich, biologists from FAU have discovered how tomato plants identify *Cuscuta* as a parasite. The plant has a protein in its cell walls that is identified as 'foreign' by a receptor in the tomato. *Cuscuta* spp., also known as dodder, is a parasitic vine which grafts to the host plant using special suckers to obtain water, minerals and carbohydrates. The parasite also attacks and damages crops such as oilseed rape, sweetcorn, soy, flax or clover. Although the infection generally goes undetected by the host, some species of tomato actively defend themselves by forming wooden tissue which prevents the suckers from penetrating the plant. In earlier research, the biologists at FAU discovered that these tomatoes possess a special receptor, the *Cuscuta* receptor 1 (CuRe1), which triggers the defence mechanism. However, until now it was unclear how the receptor recognises the danger posed by the dodder.

The researchers have now succeeded in answering this question: the dodder possesses a specific marker in its cellular wall, a glycine-rich protein (GRP). Using its receptor CuRe1, the tomato is able to recognise the molecular pattern of the GRP and identify the dodder as a pathogen, and triggers the immune reaction as a result. The new findings concerning the molecular dialogue between the *Cuscuta* marker and the tomato receptor may help to increase the resistance of crop plants against parasitic plants.

Journal Reference:

Volker Hegenauer et al. 2020. The tomato receptor CuRe1 senses a cell wall protein to identify *Cuscuta* as a pathogen. Nature Communications 11(1): DOI: 10.1038/s41467-020-19147-4

Parasitic plants attack crops when defending themselves from microbes.

Researchers at the RIKEN Center for Sustainable Resource Science (CSRS) in Japan have discovered a link between defensive responses in plants and the beautiful but devastating crop parasite witchweed. Published in Nature, the new study shows that both parasitic and non-parasitic plants can detect and react to a class of organic compounds called quinones. While parasitic plants sense quinones in their prey and use it to invade, quinones trigger defensive responses in non-parasitic plants that can protect them from bacteria and other microbes.

All varieties of the witchweed parasite (genus *Striga*) sense the quinone DMBQ in other plants such as maize, sugarcane, and sorghum, and then build appendage-like organs that they use to invade the host. Once they invade, they steal water and nutrients, affecting crop growth and production. Annual worldwide losses to *Striga* parasites are well over a billion USD. Ken Shirasu and his group at CSRS want to find ways to prevent these kinds of losses by developing effective treatments or *Striga*-resistant crops. To do this, they need to understand all the molecular events that happen in the parasitic plants in response to quinones. But first says Shirasu, ‘we needed to answer a more basic question: What are quinones doing in non-parasitic plants in the first place?’ Surprisingly, no one had ever tested whether non-parasitic plants respond to quinones. The answer is that they do.

The researchers found that the commonly used research plant *Arabidopsis* responded to quinones by producing a calcium signal. They then examined 50,000 mutagenized seedlings and found 11 mutants in which this response was absent. This is a common technique used to find genes responsible for biological chains of events. In this case, all 11 mutants showed mutations in the same gene, which the researchers named CARD1 (*CAnnot Respond to DMBQ*).

Next, the researchers asked what happens after a non-parasitic plant detects DMBQ. A genetic analysis showed that biological chain of events after quinones activate the CARD1 protein involve responses to wounds and stress. The team then tested the hypothesis that quinone signaling is related to immune responses. They found that compared with wildtype plants, the card1 mutants were more easily infected by the *Pseudomonas syringae* bacteria—a common bacterium that affects *Arabidopsis* and many other plants such as tomatoes. One typical immune response in plants is the closing of pores in the leaves to prevent pathogens from entering. A deeper analysis showed that these stomatal pores failed to close in the mutant plants because the plants could not respond to quinones. This likely led to the increased susceptibility to infection. Another test showed that pre-treating plants with DMBQ increased resistance to bacterial infection via the CARD1 signaling pathway.

Satisfied that the CARD1 protein is essential for immune-related responses to quinones in non-parasitic plants, the team wondered if quinone signaling in parasitic plants was related to a similar gene. They looked for and found CARD1-like proteins in the model parasitic plant *Phtheirospermum japonicum*, which were expressed in the roots and also involved in DMBQ-induced calcium increase.

Understanding plant quinone signaling should provide targets for combatting parasitic plants, as well as rule out other targets. As Shirasu explains, ‘our current research shows that if we simply target quinones, it will likely have the unwanted side effect of making crops more susceptible to bacterial infection. Another approach could be to create crops that do not produce quinones, but can still initiate the downstream responses that provide protection from microbial infection, perhaps with treatment.’

One of the next steps is to figure out how exactly quinone production is triggered in non-parasitic plants, and if the chain of events can be initiated downstream when quinones are missing.

Reference
Laohavisit et al. (2020) Quinone perception in plants via leucine-rich repeat receptor-like kinases. Nature. DOI: 10.1038/s41586-020-2655-4

New pests: resistant maize to the rescue.

Maize is a staple food crop for many subsistence farmers. Destructive pests have emerged causing crop losses. The cheering news is that scientists have developed disease-resistant varieties of
maize. Farmers in Akwa Ibom State are benefiting from it, reports.

New threats are emerging in the production of maize. They are in form of newer pests, some of them voracious crop-destroyers that can reduce farm production and farmers’ incomes. Among a flood of new pests that has emerged over a couple of years, is the fall armyworm. The worm has a voracious appetite for crops. According to the Food and Agriculture Organisation (FAO), it has spread to more than 30 countries since being discovered, potentially destroying $5 billion worth of maize, its favourite snack. Another pest is Striga. It currently remains the biggest threat to maize production.

With Striga-related losses estimated at $1 billion per year, a number of research bodies in Africa, including the International Institute of Tropical Agriculture (IITA), the International Centre for Insect Physiology and Ecology (ICIPE), International Wheat and Maize Improvement Center (CIMMYT) and the African Agriculture Technology Foundation, launched in 2009 a concerted effort to tame the weed.

Nigeria produces over 12 million metric tonnes of maize annually and it is a major source of farm income. Farmers have been applying maize crops resistant to the widespread Striga plant parasite. The crops were developed at IITA. According to IITA, the varieties dramatically cut maize losses from the root-infecting Striga, or witchweed, during two years of trial cultivation by farmers in Borno State. In support of this, the Institute for Agricultural Research has begun distributing the new parasite-resistant maize seeds.

The varieties, known as Sammaz 15 and 16, contain genes that diminish the growth of parasitic flowering plants such as Striga, which attaches to the maize root. Both Sammaz varieties tolerate heavy Striga infestations without suffering. Sammaz 16 is a late-maturing variety requiring 110 to 120 days of growth, whereas Sammaz 15 can often be harvested at 100 days and is more suitable for regions with short growing periods or unpredictable water supplies. Other maize varieties that will be able to resist Striga and pests and confer resistance are being bred in partnership with IITA.


Secrets of mistletoe to be uncovered by Scottish scientists

It has been a frivolous part of Christmas festivities for centuries, but now scientists sense that untangling mistletoe’s complex make-up could lead to lasting benefits. Edinburgh scientists are set to be the first to sequence mistletoe’s genome – the sum total of its entire DNA – which is more than 40 times the size of the human genome.

The mistletoe genome will contribute to the Darwin Tree of Life Project, which aims to sequence the genomes of over 60,000 British and Irish species within the next 10 years. The research is pioneering the use of ground-breaking gene sequencing technology, that could also be used to better understand diseases and cancers in humans and animals.

Researchers at the University’s Edinburgh Genomics facility will be one of the first in Europe to use the PacBio Sequel IIe System, which is designed to read long fragments of DNA from virtually any species, with extremely high accuracy. The system produces eight-times more data than earlier sequencers, making sequencing complex genomes more affordable. Experts will use the technology to rapidly decode the mistletoe’s entire DNA.

Mistletoe is a hemi (partial) parasite which attaches to a tree via suckers roots and absorbs some water and nutrients from its host plant. However, it also produces some of its own food via photosynthesis in its green leaves. It can be found in the UK on a variety of host plants including apple, lime, poplar, sycamore, ash and hawthorn. However it is rarely found on oak.

The results from the study could reveal how mistletoe has evolved to become a parasite in the first instance. Project partners, the Royal Botanic Garden Edinburgh, will provide the mistletoe sample, collected from near the Scottish Gallery of Modern Art. Dr Javier Santoyo-Lopez, Service Manager at Edinburgh Genomics sequencing facility, said: ‘PacBio’s Sequel IIe System is a very powerful addition to our battery of sequencers at Edinburgh Genomics, enhancing the sequencing services we provide to researchers at the University at the same time as reducing costs. Its capability to
accurately read large fragments of DNA will allow us to fully characterize the genetic information of many organisms, such as the mistletoe, as well as detect complex genomic alterations that could be the cause of rare diseases or cancers.’

Dr Alex Twyford, Lecturer in Botany at the School of Biological Sciences and Darwin Tree of Life University lead, said: ‘We’re excited to be the first to attempt to sequence the complex genome of the mistletoe, using the new PacBio Sequel Ile System. The results will become part of the Darwin Tree of Life Project, to sequence the genomes of all 60,000 British and Irish species within the next ten years. Jonas Korlach, PhD, Chief Scientific Officer of PacBio, said: ‘We are proud to support the Darwin Tree of Life project and excited to see the complexity of a festive holiday plant like mistletoe revealed with HiFi reads. Projects and initiatives such as these are vital to generating complete reference genomes that advance research focused on understanding and preserving Earth’s biodiversity.’

This equipment was funded by a grant from the Biotechnology and Biological Sciences Research Council (BBSRC). The Darwin Tree of Life project is funded by Wellcome.

By Iain Pope, The Scotsman
17th December 2020

Unique parasitic plant returns to Wellington for the first time in many years

A weird and wonderful plant is making its return to Wellington today, with seeds harvested by careful hands from Pureora Forest Park, gifted to their new caretakers in a tearful ceremony, and planted in the cool earth at Zealandia.

_Dactylanthus taylorii_ or _Pua o te Rēinga_, meaning ‘flower of the underworld’ is New Zealand’s only native parasitic plant. On Friday morning, representatives from six iwi, Wellington City Council, and conservation workers gathered on the lawn outside the Zealandia visitor centre for a short ceremony, before zigzagging through the reserve to the first planting site. It was truly Wellington on a good day. The sun beamed down, Mayor Andy Foster was there, and only one person slipped down a hill. The plant has not grown in the Wellington region for many years, due to predation by introduced mammals, and destruction of their habitat.

![Wellington Mayor Andy Foster planting some of the seeds deep in the Zealandia bush, which would take a minimum of five years to sprout.](image)

The seeds were collected three days ago from Pureora Forest, washed, and readied for planting at Zealandia, and another batch at Otari-Wilton’s Bush. Zealandia director Danielle Shanahan said this was the first time all six iwi had worked together. Representatives from each iwi sang a _waiata_, specially composed to mark the occasion. Then another representative, tears on her cheeks and sobs wracking her body, knelt in the centre, took each seed packet from a woven purse, and placed them gently on the grass. They were collected up again, one by one to be taken to the planting site, a symbolic gesture of the seeds changing hands.

David Mudge, a passionate advocate for _pua o te Rēinga_ and a member of the group from Pureora Forest Park which launched the endeavour, was fascinated by the plant. ‘Each seed is a treasure, more precious than gold, each a small capsule of genetic information.’ A parasitic plant is one that gets its nutrients from another plant, instead of from the earth and the sun. _Pua o te Rēinga_ does this by putting roots into another plant, tapping its resource supply and leaving beautiful, flared, rose-shaped scars on the roots, popular with collectors. These never seemed to heal, Mudge said, implying there was some kind of chemical released by the tubers which left permanent damage. The plant, when it grew from the tubers and appeared above ground, had no leaves or stems, didn’t photosynthesise to produce energy from sunlight, and survived entirely through the connection to the host plant - hence its status as a parasite.
Wood rose, caused by the parasitic plant Pua o te Rēinga, meaning 'flower of the underworld'.

In nearby locations like Pureora Forest Park, they tended to flower around March. Mudge estimated a group of 30 or so flowers, each with a lifespan of only 7-10 days, would produce collectively 0.5mL of nectar in that time. But flowers were something that wouldn’t be seen for at least five years, as the plant was slow to germinate and start growing – if they grew at all.

The three planting sites were carefully chosen; one at the head of a river, to encourage the spread of seeds downstream; one just off the trail in the cool, moist earth of the bush; and one where there was a small population of mice, to see if their presence affected its growth. The flowers would hopefully provide a rich food source for nectar feeding animals, and it would be interesting to see which animals became the main clientele.

The Tenbury Wells Mistletoe Festival, which celebrates the town's connection to the sale of holly and mistletoe – and goes back more than a hundred years – has also had to be cancelled.

A spokesperson for the Tenbury Wells Mistletoe Association said: ‘It is with sadness, however not surprising, we are not holding the Mistletoe Festival this year due to the ongoing Corona Virus Pandemic. ‘We hope to return bigger and better in December 2021. Until then, stay safe. Look out for updates for our return.’

Charlotte Bentley, South ShropshireFarming. Nov 24, 2020

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Nga Manu/Supplied

The flower of Dactylanthus taylorii.

The plant was unique in another way – it was the only ground flower in the world to be pollinated by bats, in particular the New Zealand short-tailed bat. The introduction to Zealandia, where there were no bats, was an opportunity to explore the relationships between the plant and different hosts and pollinating species. Zealandia staff hoped the hihi, also known as the stitchbird, might step into that role.

The foundations were laid, and only time would tell.

Kate Green, Wellington Reporter

**Tenbury mistletoe auction cancelled for first time in more than 150 years.**

A famous mistletoe auction has been cancelled this year for the first time in 160 years.

The Tenbury Wells Mistletoe Festival, which celebrates the town's connection to the sale of holly and mistletoe – and goes back more than a hundred years – has also had to be cancelled. A spokesperson for the Tenbury Wells Mistletoe Association said: ‘It is with sadness, however not surprising, we are not holding the Mistletoe Festival this year due to the ongoing Corona Virus Pandemic. ‘We hope to return bigger and better in December 2021. Until then, stay safe. Look out for updates for our return.’

Charlotte Bentley, South ShropshireFarming. Nov 24, 2020

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**CHRIS THOROGOOD**

**IN THE NEWS!**

Dr Thorogood, Head of Science and Public Engagement for Oxford Botanic Garden & Arboretum researches the evolutionary genetics of plants, plant taxonomy and biodiversity hotspots. Specifically he is interested in speciation and adaptive radiations in poorly known parasitic and carnivorous plant groups, and also in taxonomic diversity in biodiversity hotspots including the Mediterranean Basin region and Japan. He is based at the University of Oxford Botanic Garden and works in close collaboration with other scientists at University
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of Oxford Department of Plant Sciences. He is also interested in identifying novel and effective routes to public engagement with research, as Head of Science & Public Engagement at the Botanic Garden.

Expertise

- Botany
- Plant sciences
- Plant evolution
- Rare plants
- Parasitic plants
- Carnivorous plants
- Mediterranean plants

Oxford University

NB. For full item including interview on BBC Breakfast show, see: https://www.ox.ac.uk/news-and-events/find-an-expert/dr-chris-thorogood

See also:
https://www.oxfordsparks.ox.ac.uk/content/facebook-live-worlds-largest-flower

Abstract

Sunflower broomrape, *Orobanche cumana* WALLR., is a root parasitic plant causing considerable yield losses in sunflower cultivation in Europe, North Africa and Asia. Comprehensive knowledge about early interaction stages between host and parasite is necessary to find new ways of controlling this weed. In this thesis, three aspects regarding the biology of *O. cumana* were studied: 1) the chemotropism of *O. cumana* germtubes which bend towards the host root, 2) the development of *O. cumana* on resistant and susceptible sunflower lines and 3) the development of the phloem connection between the *O. cumana* haustorium and the sunflower host root. Sesquiterpene lactones in sunflower root exudates act as germination stimulants for *O. cumana*. As sesquiterpene lactones are known inhibitors of plant elongation growth and seem to play a role in the phototropic curvature of sunflower hypocotyls, a chemotropism bioassay on water agar was established to test if they also serve as chemotropic signals for the host-finding of *O. cumana* germtubes. When sesquiterpene lactone containing sunflower root exudate, sunflower seed oil extract or the sesquiterpene lactone reference costunolide were applied on filter discs, 70% of the germtubes showed orientation towards them. The artificial strigolactone GR24, however, did not induce chemotropism. A concentration gradient of sesquiterpene lactones exudated from the host root is likely to be responsible for a stronger inhibition of elongation growth on the host-facing flank of the germtube. This would confer a double role of sesquiterpene lactones from root exudates in the sunflower-broomrape-interaction, namely as germination stimulants and as chemotropic signals. One way of controlling *O. cumana* is the cultivation of resistant sunflower lines. However, this resistance is rapidly overcome by more aggressive pathotypes of the parasite. Therefore, the resistance or tolerance reaction of the sunflower genotype T35001 was investigated in comparison to six other sunflower genotypes with different resistance characteristics. The development of *O. cumana* was monitored in a root chamber system which allowed permanent assessment of germination, attachment and tubercle formation in the different host-parasite-combinations. All seven tested sunflower lines induced germination and attachment of *O. cumana*, independent of the expected resistance or susceptibility of the host.

THESIS


Painting by Chris Thorogood of *Cistanche fissa* in Israel.
A difference between compatibility or incompatibility of the interactions was only observed at the tubercle stage. On T35001, tubercles never occurred, neither in root chamber nor in pot experiments. To find out why the development stopped before the tubercle stage, samples of sunflower roots with attached *O. cumana* seedlings were analysed by bright field-, fluorescence- and transmission electron microscopy. Histological studies revealed that *O. cumana* penetrated the host root, but never reached the host’s vascular bundle. The root cortex cells surrounding the *Orobanche* haustorium showed no ultrastructural changes such as cell wall thickening. Fluorescence microscopy revealed no callose depositions or signs of phytoalexin release. However, ultrastructural examination of the host-parasite interface showed degeneration processes in both cortex and haustorial cells. Cortex cells were flooded with bacteria, haustorium cells showed degeneration of cytoplasm and nuclei. The resistance mechanism that prevented further development of the *O. cumana* haustorium did not express itself in a histologically visible way. As holoparasite, *O. cumana* acquires its entire demand for water, minerals and organic nutrients from the host’s vascular system. The development of the xylem connection between *O. cumana* and sunflower had previously been reported, but the phloem connection is far more relevant for the parasite in terms of organic nutrients. Accordingly, the ultrastructure of the phloem connection between the haustorium of young *O. cumana* tubercles and the sunflower root was examined. Parasite and host tissues were intermingled at the contact site and difficult to distinguish, but sieve-tube elements of *O. cumana* and sunflower could be differentiated according to their plastid ultrastructure. While sieve-element plastsids of *O. cumana* were larger, often irregular in shape and contained few, small starch inclusions, sieve-element plastids of the host were significantly smaller, always round with more and larger starch inclusions. This made it possible to trace the exact contact site of host and parasite sieve elements to show a direct symplastic phloem connection between the two species. The interspecific sieve plate showed more callose on the host side. This allowed detection of newly formed plasmodesmata between host sieve-tube elements and parenchymatic parasite cells, thus showing that undifferentiated cells of the parasite can connect to fully differentiated sieve elements of sunflower.

**LITERATURE**

We thank CAB Direct for access to their abstract data base.


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(https://doi.org/10.3390/agronomy10081168) 
[194 F2,3 families of TZEEI 79 × TzdEEI 11 were screened and 12 minor and major QTLs were identified for Striga resistance/tolerance adaptive traits.]

(https://doi.org/10.3390/agronomy10081188) 
[54 early maturing maize hybrids were evaluated and TzdEEI 352 × TZEEI 355, TzdEEI 378 × TZEEI 173, and TZEEI 173 × TZdEEI 352 were outstanding in grain yield and stability in Striga-infested environments.]

[Hybrids TZEEIOR 202 and TZEEIOR 205 found to combine combination of high provitamin-A with satisfactory performance under low-N, Striga hermonthica-infested conditions.]

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[Adding Pedicularis suteica ssp. albolabiata.]

Bilgen, B.B., Barut, A.K. and Demirbaş, S. 2019. Genetic characterization of Orobanche cumana populations from the Thrace region of Turkey using microsatellite markers. Turkish Journal of Botany 43(1): 38-47. [66% of the genetic variation was within-population and 34% due to among-population variations. Analysis showed 1 cluster had 3 groups containing 4 populations from the Kırklareli and Edirne regions. Two populations from Tekirdağ were in cluster II.]

Billard, E., Goyet, V., Delavault, P., Simier, P. and Montiel, G. 2020. Cytokinin treated microcalli of Phelipanche ramosa: an efficient model for studying haustorium formation in holoparasitic plants. Plant Cell, Tissue and Organ Culture 141(3): 543-553. [A study aimed at improving the ability of P. ramosa calli to attach to a host plant and develop to maturity, which can be useful as an efficient genetic transformation system for future studies.]

Borzooie, S., Sharifi, R and Moarrefzadeh, N. 2020. Induction of systemic resistance in tomato against broomrape. Journal of Phytopathology 167(10): 1-9. [10 of 15 plant growth-promoting rhizobacteria reduced growth of Phelipanche aegyptiaca. Lysinibacillus boronitolerans B124 reduced the dry weight by 80%; Bacillus pumilus INR7 reduced the number of tubercles by 90%, and number of emerged parasites by 87%, while the lowest dry weight of the parasite was observed with methyl jasmonate treatment.]

Bran, A., Ion, V., Joïta-Pâcureanu, M., Prodan, T., Rişnoveanu, L., Dan, M. and Sava, E. 2020. Sunflower hybrids with high genetic potential for the seed yield, in different environmental conditions. Romanian Agricultural Research 37: 81-88. [18 varieties tested at four locations over 2 years including one with serious Orobanchaceae infestations where two varieties showed zero infection. Very varied results.]


hybrids, seed-treated with herbicide yielded 60% more than those not treated with herbicide.]

**Clark, N.F., McComb, J.A. and Taylor-Robinson, A.W. 2020. Host species of mistletoes (Loranthaceae and Viscaceae) in Australia. Australian Journal of Botany 68(1): 1-13. file:///C:/Users/chris/AppData/Local/Temp/BT19137_Clark_et_al_2020.pdf** [An extremely comprehensive documentation of the hosts of Australia’s 90 mistletoe species, adding 317 species to those 338 previously known. 36 species are recorded as hyper-parasites on 37 different host mistletoes. 63% of all Australian mistletoes parasite either Eucalyptus or Acacia species, or both these genera.]

Cocoletzi, E., Angeles, G.; Briones, O., Ceccantini, G. and Ornelas, J.F. 2020. The ecophysiology of a neotropical mistletoe depends on the leaf phenology of its tree hosts. American Journal of Botany 107(9): 1225-1237. [Showing that Psittacanthus schiedeanus growing on Liquidambar styraciflua (deciduous) and Quercus germana (evergreen) host trees in eastern Mexico takes up water and xylem nutrients from both deciduous and evergreen host trees, suggesting the ability to modify its physiology according to the availability of host resources, benefiting the early growth of the parasite.]

Coutinho, A.P., Silveira, P.C.da, Portugal, A., Albuquerque, J.I. and Pujadas-Salvà, A.J. 2019. Contribution to the knowledge of the pollen morphology in the tribe Orobancheae Lam. & DC. (Orobanchaceae). Grana 58(1): 14-44. [A very detailed study of 53 species of Orobanche, Phelipanche and Cistanche. 6 pollen groups are described. Light microscopy is apparently more useful than SEM, although information from SEM is clearly relevant as a complement.]


Dawood, E.M., Zein, A.A., Soliman, I.E., Hamza, A.M. and Sharshar, A.A.H. 2019. Irrigation periods, broomrape control treatments and the growth performance of pea (Pisum sativum). Indian Journal of Agricultural Sciences 89(11): 1948-1952. [In soil heavily infested by Orobanche crenata best results were obtained from irrigation at 14 days interval and glyphosate sprayed twice at 6.5 g/ha. This increased pea seed yield without any residues in pea seeds at harvest.]

De Campos, B.H., Dalbeto, A, C, Francisco, B.dosS., Romanelli, J.P., Munis, R.A., Engel, V.L. and Durigan, G. 2020. Root parasitism by Scybalium fungiforme Schott & Endl. is not random among host species in seasonal tropical forest. Acta Botanica Brasilica 34(1): 149-154. [Among the hosts of S. fungiforme (Balanophoraceae), Croton floribundus was apparently preferred (68% of parasitized plants), while four liana species were complementary hosts (32%).]


Ding HongBo, Yang Bin, Zhou ShiShun, Maw MyaBhone, Maung KyawWin and Tan YunHong. 2019. New contributions to the flora of Myanmar I. Plant Diversity 41(3): 135-152. [Christistonia siamensis recorded for the first time.]

Dipankar Borah, Neelam Gap and Singh, R.K. 2020. Pedicularis koiyangii (Orobanchaceae), a new species from the Eastern Himalaya, India. Phytotaxa 430(4): 287-293. [P. koiyangii D. Borah & R.Kr. Singh belongs to Pedicularis series Rudes Prain and is closely related to P. prainiana, but differs in many morphological details including size – it is the tallest species of Pedicularis recorded so far from India.]

Farfán, J., Lamas, G. and Cerdeña, J. 2020. A new Faradonbeh, N.H., Darbandi, E.I., Karimmojeni, H. Emran, S., Nawade, B., Yahyaa, M., Nassar, J.A., Duca, M., Joița-Păcureanu, M., Port, A., Martea, R., Fernández-Aparicio, M., Delavault, P. and \['New understanding of the physiological and molecular mechanisms behind the processes of germination and haustorium development, and behind the crop resistant response, in addition to the discovery of new targets for herbicides and bioherbicides will guide researchers on the design of modern agricultural strategies for more effective, durable, and health-compatible parasitic weed control.' We hope!\] Ghaemnavi, M., Kazemeini, S.A. and Naderi, R. 2019. Effects of N fertilizer and a bioherbicide on Egyptian broomrape (Orobanche aegyptiaca) in a tomato field. Iran Agricultural Research 38(1): 9-13. [200 kg ha\(^{-1}\) ammonium nitrate reduced \(O. aegyptiaca\) height and biomass up to 18.7 and 33.7\%, respectively and increased tomato yield up to 27%.]


Gonzalez-Verdejo, C.A., Fernández- Aparicio , M., Córdoba, E.M. and Nadal, S. 2020. Identification of Vicia ervilia germplasm resistant to Orobanche crenata. Plants 9(11): 1568. [Screening102 bitter vetch accessions for resistance to \(O. crenata\) revealed 16 accessions with low levels of \(O. crenata\) infection. Resistance in Ve.055 and Ve.155 was associated with low stimulant, while others had two forms of post-germination resistance.]


Guojing Shen, Jingxiang Zhang, Baldwin, T. and Jianqiang Wu. 2020. Cuscuta australis (dodder) parasite eavesdrops on the host plants’ FT signals to flower. PNAS 117(37): 23125-23130. [Showing that FLOWERING LOCUS T (FT) protein is synthesized in the leaves of the host,
increase the productivity of maize in Striga-infested fields in the Nigerian savannas.]

Kamara, A.Y., Ajeigbe, H.A., Ndagu, N., Kamsang, L., Ademulegun, T. and Solomon, R. 2019. Using a participatory approach and legume integration to increase the productivity of early maturing maize in the Nigerian Sudan savannas. International Journal of Agronomy 2019: No.5154943. (https://www.hindawi.com/journals/ija/2019/5154943) [Striga hermonthica-tolerant and early-maturing maize varieties with legume rotation reduced Striga infestation by 46-100% when cowpea was rotated with maize, 80-97% with groundnut 59-94% with soybean. 99EVT-D-W-STR C0 was the most popular maize because it is early maturing, Striga-resistant, and drought-tolerant.]


Konarska, A. and Chmielewski, P. 2019. Taxonomic traits in the microstructure of flowers of parasitic Orobanche picridis with particular emphasis on secretory structures. Protoplasma 257(1): 299-317. [The micromorphology of sepals, petals, stamens, and pistils of O. picridis are described in great detail. Also the ultrastructure of nectaries and glandular trichomes.]

Krupp, A., Heller, A. and Spring, O. 2019. Development of phloem connection between the parasitic plant Orobanche cumana and its host sunflower. Protoplasma 256(5): 1385-1397. [Describing detection of newly formed plasmodesmata between host sieve-tube elements and parenchymatic parasite cells, showing that undifferentiated cells of the parasite could connect to fully differentiated sieve elements of sunflower. More detail of the phloem development in the O. cumana tubercle are also described.]


Li AiRong, Mao Ping asnd Li YunJu. 2019. Root hemiparasitism in Malania oleifera (Olacaceae), a neglected aspect in research of the highly valued tree species. Plant Diversity 41(5): 347-351. [Confirming the presence of parasitic haustoria of M. oleifera (Olacaceae), attached to a wide range of host species, including trees and grasses; also self-parasitism. In Yunnan, China.]

Li JunMin, Oduor, A.M.O., Yu FeiHai and Dong Ming. 2019. A native parasitic plant and soil microorganisms facilitate a native plant co-occurrence with an invasive plant. Ecology and Evolution 9(15): 8652-8663. [Results suggest that parasitism by Cuscuta campestris on the invasive Mikania diminishes the competitive ability of invasive plants and facilitates the native Coix lacryma-jobi. Effects of the parasite are enhanced as a result of suppression of favourable fungi in favour of pathogenic bacteria.]

Ma Rui, Miaojing, Zhang HuaXia, Tao WenJing, Mao KangShan, Moermond, T.C. 2020. Generalist mistletoes and their hosts and potential hosts in an urban area in southwest China. Urban Forestry & Urban Greening 53: 126717. (https://doi.org/10.1016/j.ufug.2020.126717) [Hosts of Taxillus nigrans and Scurrula parasitica included 41 species, 54% of infections occurring on 4 species - Platanus acerifolia (85%), Robinia pseudoacacia (65%), Metasequoia glyptostroboides (45%), and Broussonetia papyrifera (42%).]


Marin, M., Laverack, G., Matthews, S. and Powell, A.A. 2019. Germination characteristics of *Rhinanthus minor* influence field emergence, competitiveness and potential use in restoration projects. Plant Biology 21(3): 470-479. [Seed quality of *R. minor* is discussed as a key factor to consider when predicting the impact of the hemi-parasite on community productivity and diversity.]

Martin-Sanz, A., Pérez-Vich, B., Rueda, S., Fernández-Martínez, J.M. and Velasco, L.. 2020. Characterization of post-haustorial resistance to sunflower broomrape. Crop Science 60(3): 1188-1198. [Resistance to *Orobanche cumana* in sunflower inbred line PHSC1102, which was consistently resistant against races F and G, was observed at a late stage (i.e., after tubercle development) and was associated with the production of phenolic compounds, which were hypothesized to restrict the parasite's growth.]


Mellado, A. and Zamora, R. 2020. Ecological consequences of parasite host shifts under changing environments: more than a change of partner. Journal of Ecology (Oxford) 108(2): 788-796. [Discussing the apparent shift in host attack by *Viscum album* from *Pinus nigra* to *P. sylvestris* ssp. *nevadensis*, the contrasting effects on the two hosts – mainly a reduction in growth in *P. nigra* as opposed to a reduction in reproductive capacity in *P. sylvestris* and the importance of considering the specific effects of newly established interactions when predicting future species assemblages.]

Menkir, A. and Meseka, S. 2019. Genetic improvement in resistance to *Striga* in tropical maize hybrids. Crop Science 59(6): 2484-2497. [Studying genetic gain in grain yield and other traits in 32 maize hybrids developed over three breeding periods under artificial *Striga hermonthica*-infested and non-infested conditions for 4 years and finding a yield gain of 3.2% with a mean increase of 94 kg ha⁻¹ yr⁻¹ under *Striga* infestation, associated with 5.5% yr⁻¹ reduction in the number of emerged parasites at 10 wk after planting.]

Miyakawa, T., Xu, Y. and Tanokura, M. 2020. Molecular basis of strigolactone perception in root-parasitic plants: aiming to control its germination with strigolactone agonists/antagonists. Cellular and Molecular Life Sciences 77(6): 1103-1113. [A review outlining recent findings on the strigolactone perception mechanism in *Striga hermonthica*, including the finding that HTL/KAI2 homologs have been identified as strigolactone receptors in the process of *Striga* seed germination.]


Science and Technology 13(27): 2747-2754. [Using PCR amplification to distinguish *Phelipanche ramosa* from *P. purpurea*.]


Ndayisaba, P.C., Kuyah, S., Midega, C.A.O., Mwangi, P.N. and Khan, Z.R. 2020. Push-pull technology improves maize grain yield and total aboveground biomass in maize-based systems in western Kenya. Field Crops Research 256: 107911. (https://doi.org/10.1016/j.fcr.2020.107911) [Finding that push-pull is similar or superior to other maize farming systems in terms of maize grain and biomass production; and that while its performance is influenced by agro-ecological conditions, its efficacy in controlling *Striga hermonthica* increases over time, and its productivity is not compromised over time on the same farm.]

Nosrati, I., Sabeti, P., Chaghahmirzaee, G. and Heidari, H. 2020. Weed problems, challenges, and opportunities in Iran. Crop Protection 134: 04371. (https://doi.org/10.1016/j.cropro.2017.10.007) [*Cuscuta campestris* among the most important weed species that compete with major crops in Iran.]


Orchard, A., Vuuren, S. F. van and Viljoen, A. M. 2019. Commercial essential oil combinations against topical fungal pathogens. Natural Product Communications 14(1): 151-158. [Of 128 combinations, those containing *Santalum austrocaledonicum* displayed the strongest anti-fungal activity with MIC values as low as 0.06 mg/mL.]

Oyetunde, O. A., Badu-Apraku, B., Ariyo, O. J. and Alake, C. O. 2020. Efficiencies of heterotic grouping methods for classifying early maturing maize inbred lines. Agronomy 10(8): 1198. (https://doi.org/10.3390/agronomy10081198) [256 maize hybrids, were grown under *Striga hermonthica* infestation, drought, and optimal conditions to determine the combining abilities of the parental inbreds. HSGCA and SCA methods were the most efficient for grouping in all test conditions. For practical breeding purposes, the HGCAMT (general combining ability effects of multiple traits) method was recommended for *Striga* infestation.]


Piwowarczyk, R., Mielczarek, Ł., Panek-Wójcicka, M. and Ruraż, K. 2020. First report of *Melanagromyza cuscutae* (Diptera: Agromyzidae) from Poland. Florida Entomologist. 103(1): 124-126. [30-60% of *Cuscuta lupuliformis* plants were found to be infested by *M. cuscutae*, causing reduced vigour and seed production.]
Piwowarczyk, R., Ruraź, K., Krasyleanko, Y., Kasinska, J. and Pedraja, O.S. 2020. Seed micromorphology of representatives of holoparasitic Orobanchaceae genera from the Caucasus region and its taxonomic significance. Phytotaxa 432(3): 233-251. [Seeds of 43 holoparasitic species from the Cistanche, Diphelypaea, Orobanche and Phelipanche were subjected to micromorphological analysis. Three types of periclinal wall ornamentation were: (1) clearly pitted sculpturing in all Cistanche, Diphelypaea, and most Orobanche seeds; (2) fibrillar and veined sculpturing in Phelipanche seeds; and (3) smooth, granular or rugged (very rarely visibly pitted) outer periclinal wall in O. coerulescens and O. colorata.]


Punia, S.S., Vinod Maun, Yadav, D.B., Manjeet and Todarmal Punia. 2020. Effectiveness of different methods for controlling Orobanche in mustard. Indian Journal of Weed Science 52(1): 43-46. [Applications of neem cake or soil drenching of metalaxyl were ineffective. Post emergence glyphosate at 25 or 50 g/ha plus ammonium sulphate gave up to 90% control of unspecified Orobanche. No reference to yields/crop damage in abstract.]

Qasem, J.R. 2020. Osyris (Osyris alba L.) updates, the illustrated threatening parasite to fruit and forestry trees in Jordan. Pakistan Journal of Botany 52(1): 251-256. [O. alba recorded on olive, grape, almond, figs, plum, cypress, orange wattle, Aleppo pine, Palestine buckthorn and wild pistachio; also on wild thorny burnet and spiny broom. Olive, almond and grapes were the most severely affected.]


Rohani, S., Ai Lim Teh and Salam, M.R. 2019. Parasitic plants at the coastal of Setiu, Terengganu: distribution and its association with host trees. In: Mohd Tajuddin Abdullah et al. (eds) Greater Kenyir Landscapes. Springer. Pp. 91-100. [7 parasitic species recorded in this region of Malaysia including Cassytha filiformis (most frequent at both coastal and inland sites), Deudrotrophe varians, D. pentandra, Scurrula , Viscum articulatum, Macrosolen cochinchinensis and M. retusus. Syzygium zeylanicum the host tree most highly parasitized.]

Roulet, M.E., Garcia, L.E., Gandini, C., Sato, H., Ponce, G. and Sanchez-Puerta, M.V. 2020. Multichromosomal structure and foreign tracts in the Ombrophylum subterraneum (Balanophoraceae) mitochondrial genome. Plant Molecular Biology 103(65): 623-638. [Analysis of horizontal gene transfer from Asteraceae host to O. subterraneum compared to other cases of gene transfer among Balanophoraceae species, leading to an evolutionary hypothesis involving ancient transfers from legume hosts to ancestral parasite species.]

Rubiales, D. 2020. Broomrape threat to agriculture. Outlooks on Pest Management 31(3): 141-145. [A general review, emphasising that in spite of a wide range of control efforts, the threat from Orobanche and Phelipanche species is increasing, not only extending to new suitable areas but also adapting genetically to infect new crops and to develop increased virulence.]

Rubiales, D. and Emeran, A.A. 2020. Adaptation of grass pea (Lathyrus sativus) to Mediterranean environments. Agronomy 10(9): 1295. [Orobanche crenata noted to be the major limiting factor in both Spain and Egypt, favoured by moderate temperatures at crop flowering and rain and humidity after flowering. The most interesting accessions of 16 breeding lines studied, those with high yield and low broomrape infection, were lines Ls10, Ls11 and Ls18.]


dodder (Cuscuta campestris Yunck.) parasitism: a physiological and anatomical approach. Canadian Journal of Plant Science 99(2): 199-209. [Cuscuta campestris caused a reduction in pigment content in alfalfa (15%-68%) and sugar beet (1%-54%). It had a strong effect on stem and leaf of alfalfa and leaf and petiole of sugar beet. It also increased the contents of N, P₂O₅, K₂O, and organic nutrients in alfalfa while infested sugar beet had higher contents of N and organic nutrients.]

Sawadogo, P., Batieno, T.B.J., Dieni, Z., Sawadogo, N., Ouedraogo, T.J. and Sawadogo, M. 2020. Geographical distribution and alternate hosts of Striga gesnerioides (Willd.) Vatke in Burkina Faso. Journal of Applied Biosciences 145: 14955-14964. [Alternative hosts of S. gesnerioides were Cassia mimosoides, Alysicarpus ovatifolius, Ipomea eriocarpa, Ipomea sp. and Tephrosia pedicellata. In addition, 4 morphotypes of S. gesnerioides were all found to be parasitizing both wild plants and cowpea.]

Sáenz-Romero, C. and 11 others. 2020. Recent evidence of Mexican temperate forest decline and the need for ex situ conservation, assisted migration, and translocation of species ensembles as adaptive management to face projected climatic change impacts in a megadiverse country. Canadian Journal of Forest Research 50(9): 843-854. [Recording massive infestations of Pinus hartwegii by Arceuthobium globosum and A. vaginatum and other problems apparently due to climate change. Discussing possible options for management.]


Seiler, G.J. 2019. Genetic resources of the sunflower crop wild relatives for resistance. Helia 42(71): 127-143. [The USDA-ARS, National Plant Germplasm collection of wild, relatives of sunflower containing 2,519 accessions of 53 species with 14 annual species (1641 accessions) and 39 perennial species (878 accessions) is found to have a number with resistance to Orobanche cumana races F, G, and H, in 7 annual and 32 perennial species.]


Shi RuYu, Zhang ChunHong, Gong Xue, Yang Min, Ji MingYue, Jiang LinLin, Leonti Marco, Yao RuYu and Li MinHui. 2020. The genus Orobanche as food and medicine: an ethnopharmacological review. Journal of Ethnopharmacology 263: 113154. [A substantial review based on 74 references. Orobanche spp. (s.l.) are much used in China as health foods and food supplements, with potential to be developed into herbal medicines for tonifying the kidney, against impotence and spermatorrhoea, dermatological problems and wounds, as well as infantile diarrhoea. However, the basis for their activity is not yet explained.]

Singh, S.P., Yadav, R.S., Godara, A.S. and Bairwa, R.C. 2020. Screening of herbicides for broomrape (Orobanche) control in mustard. Indian Journal of Weed Science 52(1): 99-101. [Glyphosate at 25 g/ha + 50 g/ha at 25 and 55 DAS controlled unspecified Phelipanche sp. effectively with nil phytotoxicity and produced significantly the highest seed yield in mustard during both the years over other herbicidal treatments.]

Sofi Mursidawati, Adhityo Wicaksono and da Siva, J.A.T. 2020. Rafflesia patma Blume flower organs: histology of the epidermis and vascular structures, and a search for stomata. Planta 251(6): 112. [Studying vascular and epidermal tissue of R. patma flowers during anthesis. The adaxial epidermis had papillate cells, perhaps assisting the emission of odor through chemical evaporation. The abaxial epidermis had flattened cells providing a stiffer outer protective barrier for the flower. No stomata were found in this tissue.]
Sokat, Y. and Çatikkaş, U. 2019. (Weed species in almond areas in Akhisar-Kula (Manisa) and Daçta (Muğla).) (in Turkish) Turkish Journal of Weed Science 22(1): 121-126. [Viscum album recorded as a minor weed of almond.]


Tang GuangDa, Liu JunFang, Huang Lin, Zhu ChuMeng, Liu LiHua, Randle, C.P. and Yu WenBin. 2019. Molecular and morphological analyses support the transfer of Gleadovia kwangtungensis to Christisonia (Orobanchaceae). Systematic Botany 44(1): 4-82. [Supporting the creation of Christisonia kwangtungensis, differing from C. sinensis and C. siamensis in the length and colour of the corolla.]

Tippe, D.E., Bastiaans, L., van Ast, A., Dieng, I., Cisso, M., Kayeke, J., Makokha, D.W. and Rodenburg, J. 2020. Fertilisers differentially affect facultative and obligate parasitic weeds of rice and only occasionally improve yields in infested fields. Field Crops Research 254: 10785. (https://doi.org/10.1016/j.fcr.2020.107845) [Rice husks alone and rice husks or manure combined with DAP and urea increased yields and soil fertility most. Striga asiatica in upland rice in Tanzania was moderately reduced, however infestation of Ramphicarpa fistulosa in lowland rice was increased.]


Asghar Ali. 2020. Floristic configuration and ecological characteristics of plants of Koh-

Striga hermonthica and increased yields of millet.)

Üder, F. and Demirbaş, S. 2019. (Comparing different samples of O. cumana for their germination and damaging effects on sunflower. Samples from 2006 were still viable.)

Vélez-Gavilán, J. 2020. Aeginetia indica (forest ghost flower). Compendium Datasheet : Invasive Species Compendium 2020: 40110039. [Possible distribution models for A. indica show that the species has a broad invasive potential in tropical and subtropical areas of all continents where potential host crops are grown.]

Vera, A., Maldonado, R., Socorro, Y. and Martinez, M. 2020. (Interaction pattern of Struthanthus dichotrianthus in the xerophytic scrubland, wildlife reserve Cienaga de La Palmita and Isla de Pajaros, Zulia state.) (in Spanish) Revista de la Facultad de Agronomía, Universidad del Zulia 37(Suppl.1) 52-58. [S. dichotrianthus has a wide range of hosts in this region of Venezuela, with some degree of preference for Pithecellobium dulce. Other common hosts include Quadrella odoratissima and Ruprechtia ramiflora.]


Wang JianYou and14 others. 2020. Efficient mimics for elucidating zaxinone biology and promoting agricultural applications. Molecular Plant 13(11): 1654-1661. [Describing the development of easy-to-synthesize and highly efficient mimics of zaxinone easy-to-synthesize and highly efficient mimics of zaxinone. MiZax3 and MiZax5 exert zaxinone activity in reducing strigolactone content and are at least as efficient as zaxinone in alleviating Striga hermonthica infestation under greenhouse conditions without negatively impact mycorrhization.]


Xiaoxin Ye, Meng Zhang, Manyun Zhang and Yongqing Ma. 2020. Assessing the performance of maize (Zea mays L.) as trap crops for the management of sunflower broomrape (Orobanche cumana Wallr.). Agronomy 10(1): 100. [Confirming maize, specially var N214, to be a useful trap crop for reduction of O. cumana sunflower in China.]

Yanev, M., Mikov, A., Neshez, N. and Tonev, T. 2020. Broomrape (Phelipanche ramosa (L.) Pomel) control in winter oilseed rape with imazamox-containing herbicide products. International Journal of Innovative Approaches in Agricultural Research 4(2): 251-258. [Best herbicide treatments on imidazolinone-resistant rape were 25 g/ha imazamox and metazachlor 750 g + imazamox 35 g/ha, both providing over 90% control.]

Plant and Soil 450 (1/2): 303-321. [Infection of *O. cumana* triggered insufficient defense responses in a susceptible cultivar compared to a resistant one, presumably due to a failure to fully recognize parasite effectors. Secretome prediction enabled identification of 180 proteins associated with *O. cumana* penetration and infection. They were associated with cell wall degradation, nutrient acquisition and pathogenesis.]

Yang DeJun, Qiu Qiong, Xu LinHong, Xu YuMei and Wang Yi. 2020. The complete chloroplast genome sequence of *Santalum album*. Mitochondrial DNA Part B.5(1): 406-407. [A phylogenomic analysis also showed that *S. album* and *Osyris alba* clustered in a clade in the Santalales order.]

Yolcu, S., Ozberk, I. and Ozberk, F. 2020. Orobanche (Orobanche spp.) in lentil (Lens culinaris Medic.): how huge are the losses of yield, quality, marketing prices and profitability? Journal of Agricultural Sciences, Belgrade 65(2): 151-161. [Infestation by 0 to 15 m\(^{-2}\) broomrape (mainly *Phelipanche aegyptiaca* and *P. ramosa*) reduced the grain yield by 59%. Variety Firat-87 was found to be higher yielding than Yerli Kirmizi.]

Yoneyama, K., Xie XiaoNan, Nomura, T. and Yoneyama, K. 2020. Do phosphate and cytokinin interact to regulate strigolactone biosynthesis or act independently? Frontiers in Plant Science 11: 438. ([https://doi.org/10.3389/fpls.2020.00438](https://doi.org/10.3389/fpls.2020.00438)) [Cytokinins applied to hydroponic culture media significantly suppressed the strigolactone levels in both the root exudates and the root tissues of rice plants grown under P deficiency. In a split-root system, cytokinin suppressed strigolactone production locally, while P affected it systemically, suggesting that they act on its production independently.]

Zamora, R. and Mellado, A. 2019. Identifying the abiotic and biotic drivers behind the elevational distribution shift of a parasitic plant. Plant Biology 21(2): 307-317. [Discussing the population dynamics of *Viscum album* subsp. *austriacum*, occurring on *Pinus halepensis*, *P. nigra* and *P. sylvestris* var. *nevadensis* in a Spanish mountain region. With warming temperatures, the mistletoe currently has a window of opportunity to expand its distribution to higher elevations.]

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PRESIDENT’S MESSAGE

Dear IPPS members

I hope you are all OK. We are still going through rough times and it is difficult to meet other people. Fortunately, we have electronic means of communication and the large attendance of the online IPPS seminars shows that there is a great need for this. And we have our newsletter, Haustorium, to stay in touch, with a wonderful selection again of parasitic plant related news.

Of course, as you have probably all experienced, the real exchange of ideas and creation of new plans and collaborations very much needs live interaction. I am therefore happy to announce that our 16th WCPP is going to be held in Nairobi in Summer 2022. The meeting will be held on location, offering the possibility of online attendance in case someone is not able to attend in person. Please keep an eye on our website, www.parasiticplants.org, for updates.

In the meantime we will continue to host the online IPPS seminars, every first Wednesday of the month, at 3:00 PM GMT (i.e., 8:00 AM Los Angeles, 10:00 AM Bogota/Brasilia, 11:00 AM New York/Santiago, 4:00 PM Abuja/London, 5:00 PM Amsterdam/Berlin/Cape Town, 6:00 PM Nairobi/Tel Aviv, 11:00 PM Beijing, next day 12:00 AM Tokyo, next day 01:00 AM Canberra). The latest seminar was on 4 August with Francisco Fontúrbel (Pontificia Universidad Católica de Valparaíso) – ‘Cascade impacts of climate change on ecological interactions: lessons from a keystone mistletoe’ and Min-Yao Jhu (University of California, Davis) – ‘CcLBD25 functions as a key regulator of haustorium development in Cuscuta campestris’. See www.parasiticplants.org for the complete programme; we will post the abstracts of the talks on the Society page in the week before the seminar.

With regard to our website, I want to mention a change that we have implemented in the past half year: we now have a membership fee payment plug-in, which allows you to pay your IPPS membership fee in a super easy way. For the year 2021-2022 we have a reduced fee of 20 euro for regular members because we had to postpone the WCPP. For students we waive this year’s membership fee. We use these fees to run the society and to support the organization of the WCPP and its attendance by young researchers, so please pay yours, if you did not already do so.

I want to invite you to also use the other possibilities of our website and reach out to other IPPS members and the society at large: login into the member area and post news, for example on your most recent paper or project funding. I would also greatly appreciate your updating, your profile as much as possible, with your picture and that of your institution and with a short description of your research area. You may want to add some expertise keywords as the member list is searchable, allowing others to find you based on your expertise. I also encourage you to check out the News and Society pages regularly, for member and society news. Also check out the homepage where we have two continuously refreshed feeds, from Google Scholar and Scopus, showing the most recent papers on parasitic plants, as well as a Twitter feed showing Tweets on parasitic plants; I encourage you to use the #parasiticplants hashtag if you Tweet then it will show up on our home page.

I would like to end with wishing you all a great summer.

Harrow Bouwmeester
IPPS President

THE FUTURE OF HAUSTORIUM

Haustorium is undergoing a change, reflective of increased interest in parasites and by the efforts of the International Parasitic Plant Society IPPS) and by the retirement of Lytton Musselman from his university position in 2022. Issues number 9-14 were published by the International Plant Protection Service at Oregon University. Issues 15 and 16 were published by INTSORMIL, all other issues, 17-80 up to the present, have been published by Old Dominion University. Publication will now come under the aegis of IPPS who will hold the ISSN number.

Secondly, on the occasion of a somewhat significant birthday, Chris Parker is considering easing up a little. After assisting Lytton in the establishment of the newsletter in 1978, Chris has been involved in the editing, production and distribution of the newsletter and has aimed to provide an increasingly comprehensive Literature section over the past 20 -25 years. He has recently reduced the range somewhat by (regrettably)
excluding most purely therapeutical items, but is now having to consider cutting back further. **Any assistance in helping to maintain this service will be warmly welcomed.**

**RESEARCH NOTE**

Aspects of the biology of the root holoparasite *Cynomorium coccineum* L.

The genus *Cynomorium* belongs to the monogeneric family Cynomoriaceae, which includes a single species *Cynomorium coccineum*. Sometimes *C. coccineum* is subdivided into two species or subspecies [ssp. *coccineum* L. and ssp. *songaricum* (Rupr.) Léonard]. The geographical distribution of *C. coccineum* depends upon the range of its hosts, which extend from the west in the Mediterranean salt marshes of the Middle East and Southern Europe and, to the east in Afghanistan, Mongolia/China (Leonti et al., 2020).

*C. coccineum* consists of a perennial subterranean branched fleshy rhizome which, during April and May sends several annual aboveground club-shaped inflorescences (Photo) bearing delicate tiny female, male, and bisexual flowers. The parasite is deep purple due to its rich contents of anthocyanins, and the red pigment cyanidin 3-O-glucoside (chrysanthemin), which is present in the flowers and bracts of the inflorescence and absent in its inner fleshy white tissues (Zucca et al., 2013). The rhizome carries several secondary lateral haustoria (Fahmy and Hassan, 2021), which infect the roots of a wide range of host plants belonging to the Chenopodiaceae, Frankeniaceae, Plumbaginaceae and Zygophyllaceae.

Extensive research has dealt with the chemical composition, bioactive compounds, antimicrobial activities, and pharmacological effects of *Cynomorium* (see Leonti et al., 2020; Patočka and Navátilová, 2020). The anatomical and ecophysiological relationships of the target parasite to its hosts, have received relatively little attention. For example, Fahmy and Hassan (2021) described for the first time the anatomy and ultrastructure of the haustoria of *C. coccineum* infecting two halophytes.

I have investigated *C. coccineum* and its hosts in two geographically distinct habitats, firstly in a salt marsh in North Africa in Egypt in the Western Mediterranean coastal zone which has an attenuated sub desertic climate, and secondly in Asia in the inland desert of the state of Qatar, which has an extremely arid climate. The following points summarize my published and the unpublished research on the parasite-host relationships.

Ecophysiological aspects: The diurnal transpiration rate of the inflorescence of the parasite [expressed as mg H$_2$O kg$^{-1}$ fresh mass s$^{-1}$] is low (5.3 mg) in comparison to its halophytic hosts Limonium delicatum (21.9 mg) and Arthrocnemum glaucum.
(12.8 mg), and the non-infected plants (Fahmy, 1993). The water potential and the osmotic potential of the underground rhizome of the parasite are significantly lower (more negative) than those in the host roots (Fahmy, unpublished data). These gradients facilitate the transport of water and solutes in the direction of the parasite. The high ratio of potassium/calcium in *C. coccineum* implies that it is a phloem-feeding parasite.

Anatomical and ultrastructural aspects: Many stomata are present on the perianth segments and bracts of the inflorescence of *C. coccineum* (Fahmy, 1986). The guard cells seem to be non-functioning since they are devoid of chloroplasts and potassium ions but contain starch grains. The haustorium of *C. coccineum* penetrates the tissues of the host root *Atriplex portulacoides* by exerting a mechanical pressure (Fahmy and Hassan, 2021). The ultrastructural studies indicated that connections are not present between the sieve elements of the host *Atriplex* and parasite, while xylem (parasite)-to-xylem (host) contacts are either direct luminal or by their common walls.

References:


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NEW PROJECT

Project to determine the extent of parasitic weed problems

Dear colleagues, I am a senior research associate in Joanne Chory’s lab at the Salk Institute in La Jolla, California. I would like to work on an update of the data concerning crop damage caused by *Striga* and *Orobanche* on a global scale, and possibly correlate such data with available climate records. Since sources about the spread of *Striga* and *Orobanche*, yield losses, economic impact, etc. are often limited and sometimes rough estimates, I would like to gather ideas from the parasitic plant community about the best ways to pursue such a project, e.g., using surveys, satellite data, or herbarium records. Any input will be greatly appreciated. I would like to make sure that I don’t miss anything before I get started on this. If you wish to share your thoughts with me, please feel free to write to me: mburger@salk.edu.

Marco Burger

STUDENT PROJECT

Artificial hosts: a novel tool for research on the parasitic plant *Cuscuta campestris*

*Cuscuta campestris*, an obligate parasite, relies on a host to complete its life cycle. *Cuscuta* may be grown in tissue culture but does not develop typical parasite growth patterns or seeds under such conditions. To better study parasite growth and biology without a plant host, we developed an axenic system to grow *C. campestris* on an inert, fibrous stick that mimics a host stem, wicking water and nutrients to the parasite. *Cuscuta* growing in this artificial host system (AHS) displays all the stages typical of the parasite life cycle, including production of flowers and viable seeds. The most important components of the AHS are a solid support with capillarity capacity, a
HAUSTORIUM 80

closed sterile container, exposure to far-red light to induce coiling and haustoria, and a liquid media with proper nutrients and phytohormones. Inclusion of an auxin and a cytokinin in the media increased parasite fresh weight and biomass, and media containing cytokinin increased parasite shoot length. Transcriptomic analysis comparing haustorial regions and new shoots of parasites growing in the AHS, independent of any interaction with a plant host, showed that haustorial regions present an enrichment in biological process related to circadian rhythm; metabolic and catabolic processes; lignin biosynthetic and xylem development; transport; response to abiotic and chemical stress, and defense response. On the other hand, stems present enrichment in gravitropism, cuticle and cell wall-related biosynthetic processes, organ morphogenesis, stomatal morphogenesis, among others.

C. campestris growing in an AHS

The AHS is a methodological improvement for studying Cuscuta biology because it avoids effects imposed by the host, and opens possibilities to new ways of experimentation.

Our findings prove the generalist nature of C. campestris given its ability to grow and display all its lifecycle stages on an artificial host, including production of viable new shoots and seeds.

For more information visit: https://doi.org/10.1101/2021.06.21.449293

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PROJECT UPDATE

Toothpicks – Kenya approves Kichawi Kill™ an important weed bioherbicide to combat Striga.

Kenya has become the first country in the world to commercialize a weed bio-herbicide technology, Kichawi Kill™ to combat Striga hermonthica (commonly known as Striga, Kayongo or witchweed), one of the worst threats to food security in Sub-Saharan Africa.

Striga is a destructive invasive parasitic weed that can cause up to 100% yield losses by attacking the roots of staple crops such as maize, sorghum, millet, cowpea and upland rice resulting in food insecurity and lack of income. It affects about 50 million hectares of African croplands, causing $9 billion in crop loss annually. In addition, approximately 40 million farms and 300 million people across Sub Saharan Africa are affected.

In Kenya, in western region alone, Striga has infested over 217,000 ha of crop land, resulting in maize yield losses of up to 182,227 tons per year valued at USD 53 million. Conversely, research has shown that over 70% of maize smallholder farmers in Kenya are women, making Striga a gender-sensitive food security problem.

Although there are Striga-management technologies that exist, they have not been widely adopted by farmers due to mismatches between technologies, socio-economic conditions, effectiveness and availability. However, farmers and consumers have two concerns, one, the potential poisoning of food and the environment arising from chemicals currently used to manage pests. Secondly, weeds are increasingly becoming resistant to herbicides which is also a global concern. This is because Striga attacks the roots of the crop within 48 hours of planting, which means by the time weeding is done whether by hand or by using chemical herbicides it is too late to reverse the damage. Chemical coated hybrid maize seeds (such as with imazapyr) have not been proven safe and effective on Striga control. At farm level, Striga-tolerant crop cultivars, push-pull technology, and soil fertility improvement can improve crop yields but do not restore full yields or address the soil’s Striga seed bank. Moreover, current costs of managing the pests often exceed the farmers’ economic means.

Kenya Pest Control Products Board (PCPB) last week granted registration status of the bio-
herbicide with the Kenya Agricultural and Livestock Research Organization (KALRO) as the registrant, paving the way for its unhindered use in Kenya. The registration and commercialization of *Kichawi Kill*™ follows a decade long collaborative research between KALRO and Montana State University (MSU - USA) that began in 2008. The bio-herbicide research focused on *Striga hermonthica*.

KALRO scientists led by Henry Sila Nzioki, utilized an innovative biocontrol technique developed by MSU’s Professor David Sands to isolate a fungal pathogen from a wilted *Striga* plant. The fungal strains were selected for increased virulence through their overproduction of specific amino acids that harm the weed and not the crop. The research team also developed a unique distribution system which involved growing the selected fungal strains on toothpicks. These were then transported to the village, where the researchers worked with a team of Village Inoculum Producers (VIPs) to make a fresh, live inoculum by cultivating the toothpicks in cooked rice for several days. During planting, a capful (cap of a bottle) of the inoculated rice was placed (paired up) with each maize seed. Paired-plot trials took place on 500 farms in 2014-2015 with funding by Gates Foundation. The trials showed 42-56% increase in crop yield, with similar results showing in the regulatory trials. While there have been other attempts at biological control of weeds, this is the first commercialized bio-herbicide to control *Striga*, and the first in the world to utilize this technological advancement.

‘This is a major milestone for agricultural research in the country. Now that this biocontrol product is approved for use after meeting stringent standards of safety and efficacy, we expect that its rapid adoption will help us to reduce the negative impact of *Striga* and improve food security for the country. This project is an excellent example of a Public Private Partnership.’ Dr Eliud Kireger; Director General, KALRO.

A social enterprise based in Kakamega, Toothpick Company Ltd (TCL) was incorporated in 2018 to undertake a successful commercialization of *Kichawi Kill*™, with guidance from an NGO partner, Welthungerhilfe (WHH). After a long and rigorous regulatory process, TCL hosted demonstration plots on nearly 1,000 farms and trained over forty (40) Village Inoculum Producers (VIPs) who will set up their own micro-enterprises. As Kenya enters the long rains season, these producers are currently taking *Kichawi Kill*™, orders from farmers for the inaugural commercial season. TCL will be using this season to work closely with VIPs to reach as many farmers as possible and to plan for expansion in future seasons.

‘We are excited to be part of a process that places more ugali on the tables of households in the Western Kenya, and together we can win this fight against *Striga* weed.’ Newton Kisala Chamwama, General Manager, Toothpick Co. Ltd.

‘This development demonstrates a global sea change for bio-herbicides. Kenya is the forefront of this global advancement, ahead of the US, EU, and Asia. This home-grown solution will enhance foreign exchange for Kenya and elevate research opportunities. The product offers a safe, effective, and affordable solution to a devastating weed and is a positive alternative to synthetic herbicides. We celebrate the commitment to advance this innovation.’ Claire Baker, Director TCL and Toothpick Project (international).

Mr. Nzioki who is a plant pathologist from KALRO-Katumani is continuing to work on the technology, including alternative application methods of the inoculum, and trials of *Striga* in sorghum. He is also part of the team training international scientists from research organizations in twelve other countries to adopt Kenya’s model to identify their own locally-sourced fungal strains and to expedite regulatory processes.


**Also see/hear:**
Promotional video - [https://www.youtube.com/watch?v=YD38kJJqvi E&feature=youtu.be](https://www.youtube.com/watch?v=YD38kJJqvi E&feature=youtu.be)
Sands’ interview with the BBC - [https://www.bbc.co.uk/sounds/play/p09crtqg](https://www.bbc.co.uk/sounds/play/p09crtqg).
Dear Colleagues at the IPPS,

To date, few journals accept video articles for submission/publication in our field, despite this type of article being very engaging and useful for sharing new techniques and approaches. For this reason, under an invitation from the Journal of Visualized Experiments (JoVE), I decided to serve as guest editor for a Collection titled ‘Methods and applications in parasitic plant research’.

The purpose of the Collection is to offer a comprehensive overview of new and adapted techniques and approaches used in parasitic plant research. In this context, this collection invites researchers to submit method papers related to the multiple areas of Plant Science that converge into the study of parasitic plants. Contributions are expected from, but not limited to, developmental biology, ecology, evolution, physiology, and weed management.

The most recent Impact Factor for JoVE (ISSN 1940-087X) is 1.2, according to the 2019 Journal Citation Reports released by Clarivate Analytics. The Journal is currently indexed in the major databases, including PubMed, EMBASE, Scopus and Web of Science.

After submission, each manuscript will be editorially and peer reviewed, which is typically a 2-month process. JoVE is currently publishing text manuscripts after acceptance and will be filming and adding videos when university laboratories reopen. When filming is able to resume, JoVE will generate a script and schedule a filming date. A videographer will be sent to the authors’ site to film the procedure.

If you are interested, either message me (lteixeiracosta@fas.harvard.edu) or submit an abstract on the Collection website (https://www.jove.com/methods-collections/1036).

I look forward to building a strong methods Collection and to receiving contributions from IPPS members.

Luiza Teixeira-Costa

LITERATURE HIGHLIGHT


Pardon a personal recollection. Almost fifty years ago, I studied the anatomy and development of haustoria of this family using the classic paraffin method to produce thousands of sections from which I attempted to reconstruct the development and structure of the parasitic organ. The paper by Masumoto et al. presents elegant data I sought and would never have dreamed possible! Using sophisticated software that concatenates microtomed sections, the authors provide striking three-dimensional images of the two main types of haustoria in the family. *Striga hermonthica*, an obligate root parasite, produces haustoria from the root tip, termed primary haustoria and is also able to produce lateral haustoria on their adventitious roots. The other parasite is *Phtheirospermum japonicum*, a facultative parasite increasingly popular with researchers, does not form primary haustoria, only lateral haustoria. Despite the difference in ontogeny, the primary and lateral haustoria have a similar anatomy at maturity. Regions of the haustorium and their purported function are described; intriguingly, the phloemotracheids, so prominent in haustoria from diverse families including the Orobanchaceae are absent in both species. The developmental stages from initiation to maturation as well as descriptions of the various regions of the adult haustorium are wonderfully displayed in the fifty or so images that enrich the paper.

Lytton J. Musselman
A series of monthly webinars has been arranged by IPPS. The first three of which are reviewed here.

12 May 2021.
**Julie Scholes** - Can Receptor-Like Protein (RLP) resistance genes in rice provide protection against *Striga hermonthica?* [Abstract not available]

**Harro Bouwmeester** - The role of rhizosphere signaling in the host-parasitic plant interaction. [Using a metabolomic approach for further study of the root exudates of 59 sorghum genotypes, identifying a number of new, bioactive, metabolites that had so far not been implicated in *Striga* infection processes, including new putative germination stimulants and inhibitors and haustorial initiation factors. Findings include that while 5-deoxystrigol promotes germination of *Striga*, orobanchol is inhibitory (contributing to the resistance in var. SRN39). Discussing how the multiple roles of strigolactones could have contributed to their diversity. Also identifying a cytochromeP450 in *Nicotiana benthamiana* that catalyses the first step in conversion of orobanchol to solanocol in tomato; and demonstrating how Virus Induced Gene Silencing can be used to alter the balance of strigolactoners in root exudate.]

2 June 2021
**Jianqiang Wu** - Interactions between hosts and parasitic plant *Cuscuta* (dodder). [It was previously known that the *C. australis* genome had lost many flowering regulatory genes and thus not able to flower autonomously. Biochemical and genetical analyses indicates that among the interplant mobile proteins, the host-produced florigen protein, named FT, which can be transferred to the parasite where it interacts with *Cuscuta* FD transcription factor to activate flowering thus allowing *C. australis* to synchronize its flowering with that of its host.]

**Songkui Cui** - Host infection is mediated by ethylene signaling in the parasitic plant *P. japonicum*. [Using whole genome sequencing-based SNP analysis the responsible genes were identified that encode an ethylene receptor ETHYLENE RESPONSE1 (ETR1) and ethylene signaling mediator ETHYLENE INSENSITIVE 2 (EIN2), respectively. Further analysis reveals that ethylene signaling is crucial for parasitic plants to infect host by regulating haustorium development via cell division and differentiation at the haustorial apex region.]

7 July, 2021.
**Vivian Bernal-Galeano, Jim Westwood and Natalia Pabón-Mora** - An artificial host system for growing and studying *Cuscuta.* [See STUDENT PROJECT above.]

**Natalia Pabón-Mora** - Natural history and genomics in *Pilostyles* (Apodanthaceae), the smallest endoholo-parasitic plants on Earth. (Abstract included in full because of its novelty) ABSTRACT: The Apodanthaceae comprises two genera and eleven endoholoparasitic species. The exclusively New World, monospecific *Apodanthes* parasitizes various Salicaceae, whereas the 10 species of the widespread *Pilostyles* parasiitize a broad range of legumes. All Apodanthaceae are achlorophyllous and have undergone extreme morphological reduction resulting in the lack of root and shoot apical meristems, stems, and leaves. Their vegetative phase is reduced to a mycelium-like endophyte formed by strands of parenchymatous cells that are in close contact to the host vasculature. Floral development occurs entirely inside the host stems. The Apodanthaceae become apparent only when their tiny gregarious, mostly unisexual, flowers emerge breaking through the host cortex. Our case study, *Pilostyles boyacensis*, has been chosen as a representative species of the genus, in order to study a number of structural traits and genomic fingerprints that help us to better understand its holoparasitic lifestyle; the species is found in dry inter-Andean valleys parasitizing *Dalea cuatrecasasii* (Fabaceae). We have sequenced both its genome and representative transcriptomes from the endophytic tissue of *P. boyacensis* growing inside the *D. cuatrecasasii* host stem, in mixed (PbE+D) host-parasite samples, as well as individual emerging preanthetic flowers (PbFl) and fruits (PbFr) of *P. boyacensis*. In this talk we will: (1) present genome content and structure, especially that corresponding to the highly reduced plastome, with some insights into the nuclear genome; (2) assess the evolution of shoot apical meristem (SAM)-related genes in the absence of a typical vegetative SAM; and (3) assess the evolution of flowering integrators and floral organ...
identity genes in this endoholoparasitic plant with intact floral transition. So far, our results have confirmed extreme plastome reduction, both in size and gene content, without broad scale changes in the mitogenome or the nuclear genome. Plastome reduction is highly conserved in African and Australian Pilostyles spp., which strongly suggests that the legume-Pilostyles endoholoparasitism was already in place before the Gondwana split. In addition, the endoparasitic lifestyle of Apodanthaceae appears to correlate with a substantial reduction in the transcriptomic machinery linked to initiation and maintenance of SAMs, whereas the genes involved in flower fate have remained intact. Finally, we have preliminary data that suggest the recruitment of host flowering signals to activate endogenous floral organ identity genes, similar to what has been observed in other parasitic plants. Additional studies are underway to address the same questions in Apodanthes casearieae in order to test common and convergent features during the evolution of the two members of the family Apodanthaceae, which has taken place in two unrelated hosts.

EWRS

Parasitic Weeds: know the enemy to combat it. June 29th, 2021.

This very successful International Webinar was jointly organized by Maurizio Vurro (CNR-ISPA) and Alessandro Nicolia (CREA-OF), with the support of the BIOTECH project (Mipaaf) and the sponsorship of the European Weed Research Society (EWRS) - Working Group ‘Parasitic Weeds’, was to make a general overview of the research on parasitic weeds, a very serious and often underestimated problem in many countries all over the world, being responsible for serious qualitative and quantitative damages to numerous crops.

The webinar was opened by the welcome of the Organizers, and of the Institutional representatives, namely:

Dr. Jukka Salonen, President of the European Weed Research Society (EWRS)

Dr. Antonio Logrieco, Director of the Institute of Sciences of Food Production (ISPA), National Research Council (CNR)

Dr. Teodoro Cardi, Director of the Council for Agricultural Research and Economics, Research Centre for Vegetable and Ornamental Crops (CREA-OF)

Dr. Luigi Cattivelli, Director of CREA-GB e Coordinator Project BIOTECH

The morning session consisted in four lectures held by eminent and internationally renowned experts who covered various topics concerning parasitic plants, such as strigolactones, physiology, biology and management, interactions with the host, genetics improvement, and crop resistance, namely:

Koichi Yoneyama - Strigolactones as germination stimulants for root parasitic weeds. [Referring to 30 structurally different strigolactones. Typical or canonical SLs contain the ABCD ring system but non-canonicals lack A, B, or C ring. Maize, wild oat, and sunflower produce only non-canonicals. Discussing their biosynthesis and the influence of phosphate. And questioning the reason for their wide diversity, their evolution and their original function and how more information could lead to improved parasite management.]

Harro Bouwmeester - The role of chemical communication in parasitic plant infection and its prevention [Describing the range of compounds involved in the interaction between Striga and other parasitic plants, and their hosts, including the strigolactones (commenting on their diverse structure and roles) and hasutorial initiation factors. Using a metabolomics approach in sorghum to find some new putative germination stimulants, inhibitors and HIFs.]

Julie Scholes - Identification of resistance genes for smart breeding of durable defence against Striga hermonthica. [Abstract not available]

Hanan Eizenberg - The use of multi-spectral sensors and modeling approach for early broomrape detection and management. [Abstract not available]

PRESS REPORTS

A weird underground plant has been rediscovered after 151 years

A peculiar plant has been found in the rainforests of Borneo after having been lost for over 150 years. Thismia neptunis was discovered in 1866 by the Italian botanist Odoardo Beccari in the Gunung Matang massif in western Sarawak, Malaysia. He formally described it a few years later. There are no records of anyone seeing it since, so it was
assumed extinct. But in January 2017, Michal Sochor of the Crop Research Institute in Olomouc, Czech Republic and his colleagues found a few specimens in the same area and photographed them for the first time.

*T. neptunis* belongs to a group of plants that shun the light. Instead, they live underground and steal food from fungi. This behaviour has evolved independently about 40 times. There are around 500 species of ‘underground plant’, says Vincent Merckx of the Naturalis Biodiversity Center in the Netherlands, who studies these ‘mycoheterotrophs’. They have lost their leaves and chlorophyll, and cannot photosynthesize like normal green plants. ‘They completely rely on fungi,’ Merckx says. The fungi in question are called mycorrhiza. They have symbiotic relationships with plants, helping them get water and nutrients in exchange for food. So mycoheterotrophs like *T. neptunis* ultimately get their food from other plants. It’s assumed the fungi the mycoheterotrophs take food from don’t benefit, meaning the plants are parasites, says Merckx. However, no one has demonstrated this.

Journal reference: Phytotaxa, DOI: 10.11646/phytotaxa.340.1.5

Michael Le Page, New Scientist 2 March 2018

**Secrets of mistletoe to be uncovered by Scottish scientists**

It has been a frivolous part of Christmas festivities for centuries, but now scientists sense that untangling mistletoe’s complex make-up could lead to lasting benefits. Edinburgh scientists are set to be the first to sequence mistletoe (*Viscum album*)’s genome – the sum total of its entire DNA – which is more than 40 times the size of the human genome. The mistletoe genome will contribute to the Darwin Tree of Life Project, which aims to sequence the genomes of over 60,000 British and Irish species within the next 10 years.

The research is pioneering the use of ground-breaking gene sequencing technology that could also be used to better understand diseases and cancers in humans and animals. Researchers at the University’s Edinburgh Genomics facility will be one of the first in Europe to use the PacBio Sequel Ile System, which is designed to read long fragments of DNA from virtually any species, with extremely high accuracy. The system produces eight-times more data than earlier sequencers, making sequencing complex genomes more affordable. Experts will use the technology to rapidly decode the mistletoe’s entire DNA.

Mistletoe is a hemi (partial) parasite which attaches to a tree via suckers roots and absorbs some water and nutrients from its host plant. However, it also produces some of its own food via photosynthesis in its green leaves. It can be found in the UK on a variety of host plants including apple, lime, poplar, sycamore, ash and hawthorn. However, it is rarely found on oak. The results from the study could reveal how mistletoe has evolved to become a parasite in the first instance. Project partners, the Royal Botanic Garden Edinburgh, will provide the mistletoe sample, collected from near the Scottish Gallery of Modern Art. Dr Javier Santoyo-Lopez, Service Manager at Edinburgh Genomics sequencing facility, said: ‘PacBio’s Sequel Ile System is a very powerful addition to our battery of sequencers at Edinburgh Genomics, enhancing the sequencing services we provide to researchers at the University at the same time as reducing costs. Its capability to accurately read large fragments of DNA will allow us to fully characterize the genetic information of many organisms, such as the mistletoe, as well as detect complex genomic alterations that could be the cause of rare diseases or cancers.’

Dr Alex Twyford, Lecturer in Botany at the School of Biological Sciences and Darwin Tree of Life University lead, said: ‘We’re excited to be the first to attempt to sequence the complex genome of the mistletoe, using the new PacBio Sequel Ile System. The results will become part of the Darwin Tree of Life Project, to sequence the genomes of all 60,000 British and Irish species within the next ten years. Jonas Korlach, PhD, Chief Scientific Officer of PacBio, said: ‘We are proud to support the Darwin Tree of Life project
and excited to see the complexity of a festive holiday plant like mistletoe revealed with HiFi reads. Projects and initiatives such as these are vital to generating complete reference genomes that advance research focused on understanding and preserving Earth’s biodiversity.

This equipment was funded by a grant from the Biotechnology and Biological Sciences Research Council (BBSRC). The Darwin Tree of Life project is funded by Wellcome.

Iain Pope, The Scotsman
17th December 2020

Kenya looks to gene editing to grow its key food crops

Kenya’s agriculture is set to benefit from several gene-editing projects that target some of the country’s key food crops and livestock. Farmers raising sorghum, maize, bananas, pigs and cattle can expect good news from ongoing research projects that aim to improve disease resistance and build more robust crop and animal varieties.

Gene editing, also known as genome editing, is a set of advanced plant and animal breeding techniques that can help to produce crops and livestock that can thrive in diverse ecological settings. Genome editing comprises a group of technologies that give scientists the ability to change an organism’s DNA. The technologies allow the addition, removal or alteration of genetic material at specific locations in the genome.

Kenya is a market leader among African countries in this area of biotechnology. The country has begun drafting guidelines to regulate gene-edited products, applying procedures that have been formulated in Argentina. A report produced by the International Service for the Acquisition of Agri-biotech Applications (ISAAA AfriCenter) and titled ‘Genome Editing in Africa’s Agriculture 2021: An Early Take-off,’ details some of the gene editing projects underway in Africa.

Kenya is among three countries in the eastern African region that have ongoing projects in genome editing in agriculture, with eight scientists working on various projects. Uganda and Ethiopia are the other two. One of Kenya’s gene editing projects seeks to build resistance in the sorghum plant against the parasitic weed. The project is by Prof. Steven Runo, a professor of molecular biology at Kenyatta University. The project is evaluating knocking out the LGS1 gene to confer Striga resistance in sorghum. Striga is a huge constraint to the production of sorghum and other cereal crops. Most cultivated cereals, including maize, millet, sorghum and rice, are parasitized by at least one Striga species, leading to enormous economic losses. Sorghum is an important crop in Kenya that is in high local demand not only for food and fodder, but also in the brewing industry, which requires over 30,000 metric tonnes of white sorghum.

Joseph Maina | Cornell Alliance for Science | May 19, 2021

Pilbara mistletoes face sub-regional extinction

A new study from the Department of Environment and Conservation suggests long-term modern fire regimes could pose a threat to Western Australia mistletoes (Loranthaceae sp). Single fires ignited by lightning, arson or by prescribed burning often destroy thousands of hectares in the region. This scale of damage poses a problem for mistletoe species because of their physical vulnerability and regeneration methods.

Across species, mistletoe foliage and fresh seed are killed when scorched. As none have a mechanism of long-term in situ seed storage and limited capacity for long-distance seed dispersal, they are highly dependent on seed being imported and deposited in burnt areas by avian populations. Given the increasingly vast range of fire damage, regeneration is at risk.

According to study author Dr. A.N. Start, ‘when pastoralists settled the area little more than a century ago, radical changes were imposed on land tenure...’ ‘Former fire regimes were abandoned and fire was used for novel purposes, including the manipulation of pastures. Anthropogenic fire is still common across northern and central Australia where the trend has been to hotter and more extensive burns.’

Dr. Start notes that concern about the environmental effects of long-term, modern fire regimes has been present since the 1980s and mistletoes appear to be one group adversely affected. Mistletoe varieties comprise a key component of Pilbara biodiversity, with many
insects dependant on them for larval food, including butterfly genera *Ogyris* (Lycenidae) and *Delias* (Pieridae). Mistletoes also support the highly adapted mistletoebird (*Dicaeum hiundinaceum*) as well as spiny-cheeked and grey honeyeaters, important pollinators within the region.

Though there’s no evidence of an extinction threat at the bioregional or national level, there has been sub-regional contraction, especially where modern fire regimes for highly flammable hummock grasslands exist. ‘The outlook is bleak for mistletoes growing in areas dominated by hummock grasslands,’ Dr. Start says. ‘Sub-regional extinction is likely and there are broader implications for biodiversity.’ The study found that mistletoes have adapted to fire risk in various and imperfect ways.

Twelve taxa reduce risk by favoring hosts that grow in fire-sheltered sites. However, when host stems are killed, the length of host reestablishment often appears prohibitive to mistletoe regeneration. Two species have very low host specificity, which increases the likelihood that imported seed can be deposited on suitable hosts, allowing for faster regeneration following fire. However, these species are located in hummock grasslands, bringing the issues of fire frequency and seed replacement distances into play.

Rob Payne, ScienceNetwork, Western Australia, December 19, 2011

**An unexpected consequence of climate change: heat-waves kill plant pests and save our favorite giant trees.**

Australia is sweltering through another heatwave, and there will be more in the near future as climate change brings hotter, drier weather. In some parts of Australia, the number of days above 40°C will double by 2090, and with it the tragedy of more heat-related deaths. In the complex world of plant ecology, however, heatwaves aren’t always a bad thing. Rolling days of scorching temperatures can kill off plant pests, such as elm beetles and mistletoe, and even keep their numbers down for years. This is what we saw after the 2009 heatwave that reached a record 46.4°C in Melbourne and culminated in the catastrophic Black Saturday bushfires. Years later, the trees under threat from the pest species were thriving. Here are a few of our observations.

In the days following Black Saturday, botanists, horticulturists and arborists noticed a curious heatwave side-effect: the foliage of native Australian mistletoes (*Amyema miquelii* and *A. pendula*) growing on river red gums lost their green colour and turned grey. The two species of mistletoe are important in the ecology of plant communities and to native bird and insect species. But infestation on older trees can lead to their deaths, particularly in drought years.

Australian mistletoe is not related to the northern hemisphere mistletoes of Christmas kissing fame. They are water and nutrient parasites on their host tree and can kill host tissues through excessive water loss. Often mistletoes go largely unnoticed, only becoming obvious when they flower. This is because many have evolved foliage with a superficial resemblance to the host species, a phenomenon known as host mimicry or ‘crypsis.’

During the Black Saturday heatwave, many mistletoes growing on river red gums died. The gums not only survived, but when record rains came in 2010, they thrived. A decade on, the mistletoe numbers are gradually increasing, but they’re still not high enough to threaten the survival of older, significant red gums. We want both mistletoes and red gums to persist. But often the old red gums are last survivors of larger populations that have been cleared—a seed source for future regeneration.

Gregory Moore, The Conversation, Feb 1 2021.

**Native trees play host to rare plant species in North Canterbury (New Zealand) bush**

Tiromoana Bush at Kate Valley is home to three different mistletoe plants, including the rare dwarf mistletoe, which grows on kānuka (*Kunzea ericoides*) in this area. New Zealand’s rarest mistletoe species are making a comeback thanks to a regeneration project at Tiromoana Bush in North Canterbury. The native forest, owned and funded by Transwaste Canterbury, is the result of 15 years of work to restore the area, which also boasts a 12-hectare wetland, supporting a range of flora and fauna. More than 200 native species are now growing in the bush, including matai, whekī and titoki, the mistletoes are an extraordinary part of the regenerating native bush. Rarest of all is the dwarf mistletoe (*Korthalsella salicornioides*),...
which occurs on kānuka (also on *Leptospermum scoparium*).  

![Korthalsella salicornioides](Photo Delbert Wiens)

White mistletoe or tāpia (*Tupeia antarctica*), which grows on five-finger, and green mistletoe or pikirangi (*Ileostylus micranthus*), which is found on mingimingi, matagouri and a few other hosts, are also growing in the area. Professor David Norton, from the University of Canterbury’s Te Kura Ngahere/School of Forestry and author of *The Tiromoana Bush Restoration Management Plan*, said considering the exacting conditions required for their growth it was pretty special to have three mistletoe species in Tiromoana Bush. ‘So many factors have to come together to enable our rare native mistletoes to survive,’ he said. ‘Birds are required to spread their seeds, and deposit them accurately onto specific native hosts for them to establish and grow’. ‘Dwarf mistletoe only grows on kānuka here making it incredibly rare, yet a significant number are growing in Tiromoana Bush.’

Mistletoe varieties are unusual as they are arboreal parasites – instead of germinating on the ground they require a host species to live on. *K. salicornioides* is ranked nationally critical, the highest threat level in New Zealand, because of concerns its main host species kānuka might be affected by myrtle rust. *T. antarctica* is ranked as at risk - declining nationally, and is also quite sparse in many areas of New Zealand, whereas *I. micranthus* is widely distributed nationally and the only mistletoe not threatened or at risk.

Tiromoana Bush and the native forest restoration project are owned and funded by Transwaste Canterbury, which owns and operates the adjacent Kate Valley Landfill in Waipara.


**Oxford (New Zealand) wetland to be protected.**

The Waimakariri Water Zone Committee is supporting biodiversity funding of NZ$23,600 to restore approximately two hectares of remnant podocarp forest, wetland and a stream located near Oxford. Environment Canterbury and the QEII Trust are working together with the landowner to assist with land retirement, fencing, weed control and planting to enhance this important ecological habitat. The landowner will also contribute to funding the project, which has a total cost of $35,400.

The project aims to protect several types of flora including two species of pygmy mistletoe (*Korthalsella clavata* and *Korthalsella lindsayi*), along with two critically endangered species of evergreen myrtle/ rōhutu (*Lophomyrtus obcordate*) and (*Neomyrtus pedunculata*). Myrtle/ rōhutu bark and berries have anti-inflammatory antioxidant properties and are used in traditional Māori medicines/ rongoā.

The bush also contains mānuka (*K. clavata*) which is classified as a species in decline across New Zealand.

![A pygmy mistletoe (*Korthalsella lindsayi*) growing on weeping matipo (*Myrsine divaricata*) in the forest block.](Photo Delbert Wiens)

The regenerated forest block will provide an ideal environment for native birds, while fencing to remove stock access to the stream will provide a suitable habitat for the vulnerable Canterbury mudfish/kowaro which prefer swampy lowland habitats such as wetlands and swamp forests.

Environment Canterbury Biodiversity Officer Zipporah Ploeg said the project had a high ecological score and would allow the landowners
to continue their positive work to improve the environment and waterways. ‘One of the areas of bushland was retired from farming and turned into a QEII covenant several decades ago and the funding will enable further protection works to enhance existing biodiversity values,’ she said. Waimakariri Water Zone Committee Chair Michael Blackwell said the restoration project tied in well with the growing understanding of the importance of protecting biodiversity in the local community. ‘Wetlands and native forests are the organs of our land and deserve to be protected and enhanced so that we can improve the overall health of our waterways,’ he said. ‘Being able to help landowners to carry out further environmental initiatives to improve biodiversity is a vital part of the one Committee’s work.’

NZHerald, 26 May, 2021

New mistletoe species found in Davao Oriental’s Mt. Hamiguitan

A new species of a mistletoe, was discovered in Mt. Hamiguitan Range Wildlife Sanctuary in Davao Oriental by researchers from the National Museum and Central Mindanao University in Bukidnon. A statement released by the Department of Environment and Natural Resources (DENR)-Davao on Saturday, June 5, World Environment Day, said the new floral species called *Amylotheca cleofei* Tandang, Galindon, & A.S.Rob. belongs to the family Loranthaceae. It said this new plant species was the first of this genus of mistletoe to be recorded in the Philippines and the fifth in the world. The plant, first documented in 2019, is endemic to Mt. Hamiguitan.

Ugadi pachadi half-done as Hyderabad runs low on neem flowers

Until a few years ago, neem - an evergreen tree species known for its medicinal properties - was available all over the city. ‘Ugadi pachadi’ is a popular dish consumed in every Telugu household on Ugadi, or the Telugu New Year’s Day, which is just three days away. Prepared using raw mango, tamarind and jaggery, the recipe’s chief ingredient is quite special - flowers from the neem tree. Unfortunately, for many Telugus in Hyderabad, finding a neem tree, that too one bearing flowers, is an arduous task.

One reason behind the decline in the number of neem trees, apart from deforestation, is the infestation of a parasite creeper called loranthus or Honey Suckle Mistletoe (*Dendrophthoe falcata*), as per officials of the Greater Hyderabad Municipal Corporation dealing with urban biodiversity. The parasitic creeper anchors itself onto the branches of neem trees and sucks water and nutrients directly from them, weakening the host.
To protect the neem tree, control measures against the parasite are imperative. The creepers must be removed in the early stages of infestation, or they should be sawn off from the branches of its host. Officials admit that the dwindling number of neem trees in the city is a cause of concern and they, along with the HMDA, are taking up plantation of neem saplings as part of the Telangana Ku Haritha Haram programme.


BOOK REVIEWS


Both authors have extensive experience with the broomrapes and the family as a whole in the field and in the herbarium and share this through lucid text and a wonderful array of well-reproduced colour images of all species as well as Thorogood’s incomparable drawings. Features of the corolla are important for species determination, features that are very difficult to determine from herbarium specimens.

The book begins with an introduction to the family Orobanchaceae and a lucid discussion of the complex life cycle of broomrapes, Orobanche and Phelipanche. There are sections also on the related Lathraea species and on other non-photosynthetic plants that could be confused with broomrapes—plants like dodders (species of Cuscuta in the Convolvulaceae); pine drops (species of Hypopitys of the Ericaceae); and achlorophyllous orchids (species in the genera Neottia and Corallorhiza). This is followed by terse but informative information on ecology. Many broomrapes are endangered in Britain and Ireland. Particularly helpful is the section ‘Identification’ which provides the user with the criteria for distinguishing species. A short section on taxonomic history is especially germane for this genus which has suffered by fragmentation through splitting but is now receiving attention through careful field studies coupled with molecular studies. Yet the authors state—with British understatement-- that until further studies occur ‘taxonomy in the genus is likely to remain in a state of some flux.’

The bulk of the book is made up of species accounts following the format of the Botanical Society of Britain and Ireland’s (BSBI) handbooks. In addition to conservation status, description with key characters, there is information on the hosts, colour photographs of plants and their habitats as well as exceptional line drawings for each of the fourteen species. The requisite BSBI maps with grids are included for each of the species, subspecies, and varieties. The parasite distribution is helpfully mapped along with the distribution of the hosts.

Orobanche minor receives special attention because of difficulty, as noted earlier, separating it from distinct but similar appearing species. No doubt Broomrapes of Britain and Ireland will be used to correct determinations in herbaria. The four sub-specific taxa of O. minor are treated in detail. This will be of potential value to weed scientists dealing with this widely spread parasite reported from North America and Australia and perhaps elsewhere where crop and forage plants are damaged. Do some of the invasions of this parasitic weed involve distinct varieties?

A helpful glossary and references cited conclude what will undoubtedly be the ‘go to’ reference for anyone interested in these beautiful and fascinating plants. As the back cover states: ‘It is hoped that
this book will stimulate interest in broomrapes broadly, and promote their much-needed conservation focus in the region.’ It will accomplish that for users in Britain and Ireland and regions far beyond.

Lytton Musselman and Chris Parker


Oncology is changing rapidly and new successful therapies are raising hopes. As oncology is changing, the contribution of mistletoe therapy must evolve and redefine its place. For this reason, the role of mistletoe in tumour therapy is scientifically re-examined at regular intervals in the so-called Mistletoe Symposia, which have been held since 1995 (www.mistelsymposium.de), and subsequently presented in a book. The new book in this series contains 49 contributions from the fields of biology, pharmacy and pharmacology, preclinical and clinical studies with findings from therapeutic experience and clinical trials, as well as reviews presented at the 7th Mistletoe Symposium in November 2019. The clinical part of the symposium is focussed on bronchial and breast carcinoma: What is the potential of conventional tumour therapy, what contribution does mistletoe make, e.g., in different dosages and forms of application, and how does mistletoe therapy also help patients in the psychological dimension? A further focus is on checkpoint inhibitors and modern immunological therapies with which mistletoe is used. The abstracts in German and English preceding each article provide a good overview of the respective topic.

All contributions are vividly supplemented with graphics, diagrams and photos. Detailed reference lists and correspondence addresses facilitate further, more in-depth work. The book is a contribution to integrative oncology, the medicine of the future. Like its 6 predecessor volumes, it is an important reference work for all those who wish to inform themselves about the state of theoretical and practical knowledge and clinical evidence of mistletoe therapy.

Dr Rainer Scheer, Carl Gustav Carus-Institut, Germany

CABI INVASIVE SPECIES COMPENDIUM

Readers may wish to be aware of this valuable resource, providing detailed data sheets on virtually all the significant parasitic weed species in Orobanchaceae, Visaceae, Loranthaceae, Convolvulaceae and Lauraceae. Each data sheet includes comprehensive coverage of distribution, host range, biology, ecology, taxonomy, control, together with photos. https://www.cabi.org/ISC

COMPOSITE FILES

All issues of Haustorium are available in two PDF documents, ‘Haustorium1-48’ and ‘Haustorium49-79’ (shortly to be amended to 49-80) on Lytton Musselman’s Haustorium website https://ww2.odu.edu/~lmusselm/haustorium/index.shtml - these can be searched for species, author etc.

FORTHCOMING MEETINGS

The 16th WCPP will be held in Nairobi in Summer 2022. Further details will appear on the ipps website (http://www.parasiticplants.org/)


Agribalkan 2021 III Balkan Agricultural Congress. August 29th - September 1st, 2021, Edirne, Turkey www.agribalkan.net

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE
* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: http://www.parasiticplants.org/
For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/
For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/
For Old Dominion University Haustorium site: see 
https://ww2.odu.edu/~lmusselm/haustorium/index.shtml
For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see: 
http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research
For a description of the PROMISE project (Promoting Root Microbes for Integrated Striga Eradication), see: 
http://promise.nioo.knaw.nl/en/about
*For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/
For the Toothpick Project – see 
https://www.toothpickproject.org/
For the Annotated Checklist of Host Plants of Orobancheaceae, see: 
http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checlist.htm
For a description and other information about the Desmodium technique for Striga suppression, see: 
http://www.push-pull.net/
For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/
For Access Agriculture (click on cereals for videos on Striga) see: 
http://www.accessagriculture.org/
*For information on future Mistel in derTumortherapie Symposia see: 
http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx (NB see above re 7th Symposium)
For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: 
http://www.vfk.ch/inneninformationen/literatursuche (in German but can be searched by inserting author name).
For an excellent publication by the Universidade Federal do Rio Grande do Sul on Southern Brazilian Mistletoes (Dettke, G.A. and Waechter, J.L. 2013) see: 
For the work of Forest Products Commission (FPC) on sandalwood, see: 

LITERATURE

We thank CAB Direct for access to their abstract data base.


*Abdel-Wahab, S.I. and Abdel-Wahab, E.M. 2021. Cropping systems of fenugreek with faba bean to reduce broomrape infestation. Legume Research LR621. (https://www.arccjournals.com/journal/legume-research-an-international-journal/LR-621) [Testing various combinations of fenugreek and faba bean and concluding that growing two rows of faba bean in both sides of 120 cm wide ridges with four rows of fenugreek in the middle of the ridge could be an integrated control strategy to increase faba bean productivity, land usage and economic return under heavy infestations of Orobanche crenata.]


(https://www.mdpi.com/2073-4395/10/10/1478) [The study provided an opportunity for selecting divergent parents for tagging candidate genes and quantitative trait loci for marker-assisted introgression of *Striga* resistance genes into early maturing tropical maize breeding populations. The most reliable secondary trait for indirect selection for grain yield under *Striga* infestation was the ear aspect.]


Amani M.H. Abu-Shall. 2021. Effect of infestation density with *Phelipanche aegyptiaca* on the efficiency of bio-agent, *Phytomyza orobanchia* and infestation by *Tuta absoluta* on tomato crop at El-Beheira Governorate, Egypt. Alexandria Science Exchange Journal 18(42):445-452. [Infestation of tomato with *P. aegyptiaca* had no influence on infestation by *P. orobanchoides*. But moderately infested plants with 11-20 parasites per host resulted in lower infestation by the leaf miner, *T. absoluta*, and significantly increased yields compared with less infested tomato with 1-10 parasites per host.]


*Anteyi, W.O. and Rasche, F. 2021. Role and in vivo localization of *Fusarium oxysporum* f. sp. *strigae* and *Bacillus subtilis* in an integrated *Striga hermonthica* biocontrol system. Phytofrontiers (https://apsjournals.apsnet.org/doi/10.1094/PHYTOFR-08-20-0011-R) [Various combinations of *F. oxysporum* f. sp. *strigae* and rhizobacterium, *Bacillus subtilis* increased sorghum biomass, but inclusion of the rhizobacterium did not improve suppression of *S. hermonthica* attachment.]


normally favours the growth of its host, *Stipa purpurea* was found to also favour its growth when parasitised by *P. kansuenis*.


*Bonanomi, G., Salvatori, N., Zotti, M., Motti, R., Idbella, M., Carteni, F., Mazzoleni, S. and Giannino, F. 2020. Parasitic plant causes an ephemeral "rainbow" pattern in a reservoir bank. Journal of Vegetation Science 32(1): (https://onlinelibrary.wiley.com/doi/epdf/10.1111/jevs.12931) [As a reservoir level fell, the newly exposed soil was dominated by pure *Xanthium italicum*; above that band it was yellow with infestation of *Cuscuta campestris*; above that band was brown where the *Xanthium* had died.]

*Boukari, O., Abberton, M., Oyatomi, O., Togola, A. Tripathi, L. and Fatokun, C. 2020. Introggression breeding in cowpea [*Vigna unguiculata* (L.) Walp.]. Frontiers in Plant Science 11: (https://doi.org/10.3389/fpls.2020.567425) [*Vigna vexillata* lines were resistant to *Striga gesnerioides* but are cross-incompatible with cultivated cowpea.]


1292-1308. [A comprehensive review of the different classes of germination stimulants, how they are produced and their role in host specificity, and how this knowledge may contribute to improved control methods.]

Briache, F.Z., Ennami, M., Mbasani-Mansi, J., Lozzi, A., Abousalim, A., El-Rodeny, W., Amri, M., Triqui, Z.E.A. and Mentag, R. 2020. Effects of salicylic acid and indole acetic acid exogenous applications on induction of faba bean resistance against *Orobanche crenata*. Plant Pathology Journal 36(5): 476-490. [Reporting significant protection of faba bean against *O. crenata* infestation from seed soaking with salicylic acid or IAA. Foliar sprays were not effective.]


*Cai HongYue, Lu HongFang, Tian Yang, Liu ZhanFeng, Huang Yao and Jian ShuGuang. 2020. Effects of invasive plants on the health of forest ecosystems on small tropical Coral Islands. Ecological Indicators 117: (https://doi.org/10.1016/j.ecolind.2020.106656) [Discussing the impact of *Cassysta filiformis* on Chinese off-shore islands.]

Caires, C.S. and Dettke, G.A. 2021. *Passovia bracteata*, a new species of Loranthaceae endemic to the Brazilian Amazon. Phytotaxa 490(1): 114-117. [Describing *P. bracteata* characterized by its terete stems, ovate leaves, racemose inflorescences and pedunculate triads with a long-foliaceous bract subtending the median flower of the triad and/or the whole triad.]

*Calkins, S.J., Shaw, D.C. and LanYung-Hsiang. 2020. Transformation of western hemlock (*Tsuga heterophylla*) tree crowns by dwarf mistletoe (*Arceuthobium tsugense*, Viscaceae). Forest Pathology 51(1): (https://publons.com/publon/10.1111/efp.12664/) [Noting that over 10% of all western hemlock trees in Oregon are infected by *A. tsugense*. Heavy infestation could involve over 3000 individuals per tree. Finding that infections tended to reduce branch foliage and lead to increased proportion of foliage distal to the infection.]

Chileen, B.V., McLauchlan, K.K, Higuera, P.E., *Chen Po-Hao, Chung An-Ching, and Yang Chandrashekar Sandeep, Amit Kumar, Rodrigues, Chandrashekharaiah P.S., Paul, V., Kushwaha, S., Casadesús, A. and Munné-Bosch, S. 2021. the past 2500 years to from pollen preserved in a vegetation change in a Rocky Mountain lodgepole pine forest over the past 2500 years. Holocene 30(11): 1493-1503. 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Di Na, Ju XiangYu, Han HaiJun, Wang Jing, Cui Chao and Zheng XiQing. 2020. Effects of preculture conditions on the germination of sunflower broomrape seeds. (in Chinese) Chinese Journal of Oil Crop Sciences 42(3): 486-492. [Finding the optimal pre-culture conditions were a temperature of 25°C, pre-culture time 7 days, osmotic potential at 0 MPa, pH 7.0, and concentration of gibberellins of 30 mg/mL]


Duca, M., Clapco, S., Boicu, A., and Port, A. 2020. Morphological variability of broomrape’s seeds collected from different host plants. Journal of Botany X11 NR. 2(21): 13. [Studies of seed morphology in samples of Orobanche cumana in Moldova, where the species has occurred for over 50 years, found no variation in length:width ratio in races occurring on sunflower over time (from 1921). But there were significant differences in seed from Artemisia and Matricaria spp.]

Ellis, J., Ellis, B., Velez-Estevez, A., Rweichel, M.P. and Cobo, M.J. 2020. 30 years of parasitology research analysed by text mining. Parasitology 147(14): 1-58. [A broad review covering all aspects of parasitology, noting that the major research themes are dynamic and continually changing with time.]

*Elsakhawy, T., Alkahtani, M.D.F., Sharshar, A.A.H., Attia, K.A., Hafez, Y.M. and Abdelaal, K.A.A. 2020. Efficacy of mushroom metabolites (Pleurotus ostreatus) as a natural product for the suppression of broomrape growth (Orobanche crenata Forsk) in faba bean plants. Plants 9(10): (https://www.mdpi.com/2223-7747/9/10/1265) [Recording good suppression of O. crenata and increase in faba bean yield from application of a ten-fold dilution of 10% (w/v) spent mushroom substrate extract (SMSE) of Pleurotus ostreatus and the same dilution of culture filtrate of mushroom (MCF) grown in potato dextrose broth (PDB) at a rate of 48 l hectare\(^{-1}\).]

*Elsakhawy, T., Alkahtani, M.D.F., Sharshar, A.A.H., Attia, K.A., Hafez, Y.M. and Abdelaal, K.A.A. 2020. Efficacy of mushroom metabolites (Pleurotus ostreatus) as a natural product for the suppression of broomrape growth (Orobanche crenata Forsk) in faba bean plants. Plants 9(10): (https://www.mdpi.com/2223-7747/9/10/1265) [Recording good suppression of O. crenata and increase in faba bean yield from application of a ten-fold dilution of 10% (w/v) spent mushroom substrate extract (SMSE) of Pleurotus ostreatus and the same dilution of culture filtrate of mushroom (MCF) grown in potato dextrose broth (PDB) at a rate of 48 l hectare\(^{-1}\).]


Fang-Lei Gao, Alpert, P. and Fei-Hai Yu. 2020. Parasitism induces negative effects of physiological integration in a clonal plant. New Phytologist 229:585-592. [(An advantage clonal plants have is sharing of resources so that when one ramet is growing in unfavorable conditions, resources can be shut off to that ramet. Studies indicated that cutting these ramets benefitted the clone. Using two species]
of *Sphagneticola* (Asteraceae) the authors applied *Cuscuta australis* (dodder) to test the effect of parasitism on biomass. The overall biomass of *S. calendulacea* was not reduced while the connected ramet was reduced by 60%. Dodder biomass increased by 50%. Intriguingly, no effect on either dodder or *S. trilobata* was seen.

Farrokhi, Z., Alizadeh, H. and Alizadeh, H. 2021. Egyptian broomrape sucrose metabolism in response to different host plants. Weed Research (Oxford) 61(2): 137-145. [Investigation of developmental patterns of enzymes involved in the osmoregulation of *Phelipanche aegyptiaca* showing differences in sugar metabolism according to different host species.]

*Feleke, G. and Addisu, S. 2021. Distribution and importance of *Cuscuta campestris* on lentil growing areas: a preliminary survey from Ethiopia. International Journal of Agriculture and Biosciences 10(1): 60-64. (http://www.jiagbio.com/_660-64.pdf) [Noting that *C. campestris* mostly parasitizes noug (nigerseed), linseed, some vegetable crops and coffee trees in Ethiopia, but now occurs on lentil especially in Shewa province causing up to 15% yield loss. Local control methods include crop rotation and deep ploughing.]

*Fernández-Aparicio, M., Cimmino, A., Vilariño, S. and Evidente, A. 2021. Allelopathic effect of quercetin, a flavonoid from *Fagopyrum esculentum* roots in the radicle growth of *Phelipanche ramosa*: quercetin natural and semisynthetic analogues were used for a structure-activity relationship investigation. Plants 10(3): 543. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8001586/) [Results indicated quercetin was tenfold more active than DMBQ in stimulating haustorial initiation in *P. ramosa.*]

*Fernández-Aparicio, M., Masi, M., Cimmino, A. and Evidente, A. 2021. Allelopathic effect of quercetin, a flavonoid from *Fagopyrum esculentum* roots in the radicle growth of *Phelipanche ramosa*: quercetin natural and semisynthetic analogues were used for a structure-activity relationship investigation. Plants 10(4): 746. (https://pubmed.ncbi.nlm.nih.gov/33920368/) (Confirming the activity of *p*-benzoquinone and 2,6-dimethoxy-*p*-benzoquinone (BQ and DMBQ) on radicles of *Orobanche cumana, O. minor* and *Phelipanche ramosa.*]

*Fernández-Aparicio, M., Masi, M., Cimmino, A., Vilariño, S. and Evidente, A. 2021. Allelopathic effect of quercetin, a flavonoid from *Fagopyrum esculentum* roots in the radicle growth of *Phelipanche ramosa*: quercetin natural and semisynthetic analogues were used for a structure-activity relationship investigation. Plants 10(3): (https://doi.org/10.3390/plants10030543) [Showing that quercetin, exuded from the roots of buckwheat reduced radicle growth and induced haustorium formation in *P. ramosa*, showing 10 times the activity of DMBQ.]


Gebrekidan Feleke and Shugute Addisu. 2021. Importance of *Cuscuta campestris* on lentil growing areas: a preliminary survey from Ethiopia. International Journal of Agriculture and Biosciences 10(1) 60-64. [Noting that *C. campestris* is well-established in several parts of Ethiopia on noug, linseed, some vegetable crops
and coffee trees. In Oromia, a survey recorded up to 96% of lentil fields infested, causing up to 30% yield loss. Hand weeding, crop rotation and deep ploughing are considered the most important control measures.]


[Testing the influence of herbicide imazapic on P. aegyptiaca and tomato plants, as well as a method of herbicide application via irrigation systems. Results show that imazapic does not prevent P. aegyptiaca seed germination and that in tomato roots inoculated with the parasite seeds, P. aegyptiaca is killed only after its attachment to the host]

*Gonzalez-Verdejo, C.I., Fernández-Aparicio, M., Córdoba, E.M. and Nadal, S. 2020. Identification of Vicia ervilia germplasm resistant to Orobanche crenata. Plants 9(11): (https://doi.org/10.3390/plants9111568) [From 102 accessions screened, 16 selected with lower susceptibility to O. crenata. See also the following.]


Gowda, M., Makumbi, D., Das, B., Nyaga, C., Kosgei, T., Crossa, J., Beyene, Y., Montesinos-López, O.A., Olsen, M.S. and Prasanna, B.M. 2021. Genetic dissection of Striga hermonthica (Del.) Benth. resistance via genome-wide association and genomic prediction in tropical maize germplasm. TAG Theoretical and Applied Genetics 134(3): 941-958. [Results demonstrated the polygenic nature of resistance to S. hermonthica, and that implementation of genomic prediction in Striga resistance breeding could potentially aid in increasing genetic gain for this important trait.]


*Guo XiaoRong, Zhang GuangFei, Fan LinYuan, Liu ChangKun and Ji YunHeng. 2021. Highly degenerate plastomes in two hemiparasitic dwarf mistletoes: Arceuthobium chinsense and A. pini (Viscaceae). Planta 253(6): (https://doi.org/10.1007/s00425-021-03643-y) [The plastid genomes of A. chinsense and A. pini were shown to be much reduced and unexpectedly, several essential housekeeping genes (rpoA, rpoB, rpoC1, and rpoC2) and some core photosynthetic genes (psbZ and petL), as well as the rpl33 gene, indispensable for plants under stress conditions, were deleted or pseudogenized.]

*Guzmán-Rodríguez, L.F., Cortés-Cruz, M.A., Rodriguez-Carpena, J.G., Coria-Ávalos, V.M. and Muñoz-Flores, H.G. 2020. Biochemical profile of avocado (Persea americana Mill) foliar tissue and its relationship with susceptibility to mistletoe (Family Loranthaceae). Revista Bio Ciencias 7: (https://doi.org/10.15741/revbio.07.e492) [Assessing the secondary metabolites in avocado ‘drymifolia’ which is sensitive to the attack of mistletoe (presumably Psittacanthus calyculatus) and in ‘Hass’ and ‘Mendez’ varieties which exhibit tolerance. A number of compounds were found in the latter varieties and not in ‘drymifolia’, presumably explaining the difference in susceptibility.]


Horbelt, N., Eder, M., Bertinetti,, L., Fratzl, P., and Harrington, M.J., 2019. Unraveling the rapid assembly process of stiff cellulosic fibers from mistletoe berries. *Biomacromolecules* 20: 3094-3103. doi: 10.1021/acs.biomac.9b00648 [This paper examines in detail the structure of *Viscum album* viscin fibers demonstrating their amazing physical properties]

Hounbedji, T., Dessaint, F., Nicolardot, B., Perronne, R. and Gibot-Leclerc, S. 2020. Abundance of *Rhamphicarpa fistulosa* in rainfed lowland rice fields in the savannah region of Togo: moderate influence of physico-chemical characteristics of soils. *Weed Research (Oxford)* 60(6): 385-391. [Finding that the increasing problem of *R. fistulosa* in northern Togo is associated with coarser soil texture, higher K and higher pH, and little by organic C or N. As these factors are difficult to change, early sowing and selection of variety are suggested.]

Hu Lei and Wu XinWei. 2020. The difference in pollen harvest between *Apis mellifera* and *Apis cerana* in a Tibetan alpine meadow. *Journal of Mountain Science* 16(7): 1598-1605. [The native *A. cerana* foraged more on *Pedicularis longiflora* than the exotic western honey bee.]


Iszkol, G., Armatsys, L., Dering, M., Ksepko, M., Tomaszewski, D., W azna, A. and Giertych, M.J. 2020. (Mistletoe as a threat to the health state of coniferous forest.) (in Polish) Sylwan 164(3): 226-236. [Noting an increase in *Viscum album* infection in European forests in recent years, the worst affected being Scots pine and *Abies alba*, and discussing control options.]


JieChen, QuanhongXue, YongqingMa, Jang SeJi and Kuk YongIn. 2020. Growth seed germination of the broomrapes than the them displayed a higher potential toward the dihydroflavonoids as potent seed germinators of strigolactone analogues derived from Glycine max fields. Research on Crops 21(3): 480-486. [Recording an increase in C. pentagona (C. campestris?) in southern S. Korea, and studying its optimum germination conditions.]

Kabambe, V.H. and Bokosi, J.M. 2020. Role of variety and fertilizer practices on cowpeas (Vigna unguiculata) yield and field incidence of the parasitic weed Actea vogelii (Benth) in central Malawi. Journal of Agricultural Science (Toronto) 12(11): 200-208. [Noting the immunity of cowpea variety Mkanakaufti to A. vogelii, but its poor yield performance. Application of cattle manure to more susceptible varieties reduced emergence of A. vogelii but gave little benefit in crop yield.]


Kang YunYao, Pang ZhiLi, Xu NiNiu, Chen FangJie, Jin Zhong and Xu XiaoHua. 2020. Strigolactone analogues derived from dihydrolavonoids as potent seed germinators for the broomrapes. Journal of Agricultural and Food Chemistry.68(40): 11077-11087. [Describing the development of a novel class of strigolactone analogues derived from dihydrolavonoids as potent seed germinators of Orobanche spp. It was shown that one of them displayed a higher potential toward the seed germination of the broomrapes than the positive control GR24. Structure—activity relationship of these analogues was further validated on the basis of binding affinity.]
determine the land suitability class for sandalwood in Sumba Island.


Lerner, F., Pfennig, M., Picard, L., Lerchl, J. and Hollenbach, E. 2020. Prohexadione calcium is herbicidal to the sunflower root parasite *Orobanche cumana*. Pest Management Science 77(4): 1893-1902. [Showing that prohexadione is an inhibitor of *O. cumana* germination and that it is found in sunflower roots shortly after application and is apparently excreted in sufficient amounts to have a direct impact on *O. cumana* germination.]

Li JuanJuan and 9 Others. 2021. Genome-wide investigation and expression analysis of membrane-bound fatty acid desaturase genes under different biotic and abiotic stresses in sunflower (*Helianthus annuus* L.). International Journal of Biological Macromolecules 175: 188-198. [Identifying 40 putative *FAD* genes in sunflower and noting significant changes in their expression in response to stresses including *Orobanche cumana*. Up-regulated genes such as *HaFAD3.2, HaADS8, HaFAD2.1*, and *HaADS9* would be the potential candidate genes for the sunflower tolerance breeding programme.]

Liu Cheng, Ya JiDong, Guo YongJie, Cai Jie and Zhang Ting. 2020. (Newly recorded species of seed plants from Xizang, China.) (in Chinese) Biodiversity Science 28 (1): 1238-1245. [Recording *Alectra arvensis*.]


*Liu Ye, Liu LiNa, Zhao WenQian, Guan ZhiYong, Jiang JiaFu, Fang WeiMin and Chen FaDi. 2021. A transcriptional response atlas of *Chrysanthemum morifolium* to dodder invasion. Environmental and Experimental Botany 181: (https://doi.org/10.1016/j.envexpbot.2020.104272) [Finding that over 20,000 genes were differentially expressed in *C. morifolium*, infected by unspecified *Cuscuta* sp. Resulting in stimulation of reactive oxygen species, calcium, and MAPK-related pathways. A series of defence genes were also up-regulated.]


Speculating what drives the evolution of virulence effectors in parasitic plants by considering concepts from similar studies of plant–microbe interaction, and discussing CRISPR/Cas9-mediated genome editing and RNAi silencing that could contribute to the development of novel strategies for control.]


*Monteiro, G.F., Novais, S., Barbosa, M., Antonini, Y., Passos, M.F.deO. and Fernandes, G.W. 2020. The mistletoe Struthanthus flexicaulis reduces dominance and increases diversity of plants in campo rupestre. Flora (Jena) 271 October 2020, 151690. (https://doi.org/10.1016/j.flora.2020.151690) [Showing that parasitism by S. flexicaulis had an important role in reducing the vigour of susceptible species and thus changing the structure of the plant community in the campo rupestre ecosystem in Brazil.]

based invasion risk modeling of Striga (*Striga asiatica*) in Zimbabwe. GIScience and Remote Sensing 57(4): 553-571. [Six machine learning modeling techniques and the ensemble model were evaluated for their suitability to predict current and future *S. asiatica* abundance. Results showed that the ensemble model had the strongest predictive power. Temperature seasonality, the maximum temperature of the warmest month and precipitation seasonality were determined to be the most dominant bioclimatic variables influencing *Striga* occurrence.]

*Mudereri, B.T., Abdel-Rahman, E. M., Dube, T., Niassy, S., Khan, Z., Tonnang, H.E.Z. and Landmann, T. 2021. A two-step approach for detecting *Striga* in a complex agroecological system using Sentinel-2 data. Science of the Total Environment 762: (https://www.sciencedirect.com/science/article/abs/pii/S004896972036681X?via%3Dihub) [To detect *S. hermonthica* in croplands in Rongo, Kenya, firstly, Sentinel-2 data (2017 to 2018) were utilized to map cropland and non-cropland areas using the Google Earth Engine. The cropland area was then used in a multiple end-member spectral mixture analysis (MESMA) to detect *Striga* occurrence and infestation using end-members obtained from the in-situ hyperspectral data.]


*Ndayisaba, P.C., Kuyah, S., Midega, C.A.O., Mwangi, P.N. and Khan, Z.R. 2021. Intercropping desmodium and maize improves nitrogen and phosphorus availability and performance of maize in Kenya. Field Crops Research 263: (https://doi.org/10.1016/j.fcr.2021.108067) [Comparing the effects of various intercrops grown with maize over 15 years, only *Desmodium intortum* increased yield of *Striga hermonthica*-infested maize in the final 3 years. Levels of both N and P in the soil were also increased.]

Neumann, P. and 9 others. 2021. Impact of parasitic lifestyle and different types of centromere organization on chromosome and genome evolution in the plant genus *Cuscuta*. New Phytologist.229(4): 2365-2377. [A remarkable 102-fold variation in genome sizes (342-34 734 Mbp/1C) was detected for monocentric *Cuscuta* species, while genomes of holocentric species were of moderate sizes (533-1545 Mbp/1C). The genome size variation was primarily driven by the differential accumulation of LTR-retrotransposons and satellite DNA. Demonstrating that the transition to holocentricity in *Cuscuta* was accompanied by significant changes in epigenetic marks, chromosome number and the repetitive DNA sequence composition.]


Nikiëma, M.P. and 11 others 2020. Induced resistance to *Striga hermonthica* in sorghum by gamma irradiation. American Journal of Plant Sciences 11(10): 1545-1561. [Dry seeds of three sorghum varieties; *Grinkan*, ICV1049 and Sarios14 subjected to gamma-irradiation up to 500 Gy yielded 7 mutant families showed no emergence of *S. hermonthica* from Burkina Faso, and 2 of these, SA38M5 and IC47M5 showed resistance also to a Sudanese ecotype.]


Noshad, Q., Ajaib, M. and Kiran, A. 2020. Comparative investigation of palynological characters of *Cuscuta reflexa* and few members of
Convolvulaceae. JAPS, Journal of Animal and Plant Sciences 30(5): 1215-1223. [Detailed study of pollen morphology concludes that pollen of C. reflexa is ‘exactly similar’ to that of Ipomoea arachnoidea.]


Ogawa, S. and 10 others. 2021. Subtilase activity in intrusive cells mediates haustorium maturation in parasitic plants. Plant Physiology 185(4):1381-1394. [Using promoter analyses to identify genes that are specifically induced in intrusive cells, and promoter fusions with genes encoding fluorescent proteins to develop intrusive cell-specific markers. Four of the identified intrusive cell-specific genes encode subtilisin-like serine proteases, suggesting that subtilasde activity plays an important role in haustorium development in Phtheirospermum japonicum.]

*Okazawa, A. and 8 others. 2021. Localization of protease activity in intrusive cells mediates haustorium maturation in parasitic plants. Plant Physiology https://doi.org/10.1101/2021.06.16.448768 [Protease acts as a storage carbohydrate in seeds of O. minor and its hydrolysis (releasing hexoses for embryo growth) is activated by α-galactosidase family member, OmAGAL2. This enzyme could thus be a target for control.]

*Okazawa, A. and 8 others. 2021. Localization of planteose hydrolysis during seed germination of Orobanche minor. BioRxiv June 2021. [Protease acts as a storage carbohydrate in seeds of O. minor and its hydrolysis (releasing hexoses for embryo growth) is activates by α-galactosidase family member, OmAGAL2. This enzyme could thus be a target for control.]

Ogawa, S. and 10 others. 2021. Subtilase activity in intrusive cells mediates haustorium maturation in parasitic plants. Plant Physiology 185(4): 1381-1394. [Using promoter analyses to identify genes that are specifically induced in intrusive cells, and promoter fusions with genes encoding fluorescent proteins to develop intrusive cell-specific markers. Four of the identified intrusive cell-specific genes encode subtilisin-like serine proteases, suggesting that subtilasde activity plays an important role in haustorium development in Phtheirospermum japonicum.]


Orumwense, K.O., Koriecha, J.N., Ehis-Iyoha, E., Adindu, G.A. and Omozusi, J.E. 2020. Nigerian Agricultural Journal 51(2): 195-198. [Four clones of rubber compared for their resistance to unspecified mistletoe spp. (perhaps Phragmanthera capitata and/or Agelanthus brunneus) and finding these two indigenous clones to be twice as susceptible as the exotic clones.]

*Oula, D.A., Nyongesah, J.M., Odhiambo, G. and Wagaii, S. 2020. The effectiveness of local strains of Fusarium oxysporum f. sp. strigae to control Striga hermonthica on local maize in western Kenya. Food Science and Nutrition 8(8): 4352-4360. (https://onlinelibrary.wiley.com/doi/epdf/10.1002/fsn3.1732) [Among 5 isolates of F. oxysporum tested at 3 sites, FK1 and 2 had least virulence on S. hermonthica and FK5 the greatest, and gave the highest improvement in maize yield, but there was some evidence that the ideal isolate might differ from site to site.]

Oveis, Ojaghi, A., Mashhadi, H.R., Muller-Scharer, H., Yazdi, K.R., Kaleibar, B.P. and Soltani, E. 2021. Potential for endozoochorous seed dispersal by sheep and goats: risk of weed seed transport via animal faeces. Weed Research (Oxford) 61(1): 1-12. [Cuscuta campestris was the most persistent survivor of passage through sheep. Recommending that sheep be kept corralled for 96 hours to minimize dispersal of viable seeds.]

Oyekale, S.A., Badu-Apraku, B. and Adetimirin, V.O. 2020. Combining ability of extra-early biofortified maize inbreds under Striga infestation and low soil nitrogen. Crop Science 60(4): 1925-1945. [Studying 150 hybrids and concluding that additive and non-additive genetic effects controlled the inheritance of traits under low N. Hybrids TZEEIORQ 55 × TZEEIORQ 26, TZEEIORQ 49 × TZEEIORQ 75, and TZEEIORQ 52 × TZEEIORQ 43 were high yielding and stable across environments and have potential for improving nutrition and maize yields.]
Özen, H.Ç., Savaşı, S., Surmuş Asan, H. and Kizmaz, V. 2020. The effect of *Cuscuta babylonica* Acher on chemical compounds of lice tomato. KSÜ Tarım ve Doga Dergisi 23(6): 1483-1488. [The study revealed that the amount of fatty acids, Ca²⁺, and phenolic compounds chlorogenic acid, hyperoside, rutin, quercetin and salicylic acid increased in tomato leaves that were infected by *C. babylonica* suggesting the variety grown in the Lice district of Turkey has developed some resistance.]

Pan LiMei and 9 others. 2021. Comparative proteomic analysis of parasitic loranthus seeds exposed to dehydration stress. Plant Biotechnology Reports 15(1): 95-108. [The results suggest that the efficient removal of excessive reactive oxygen species may be crucial for the germination of *Taxillus chinensis*.]

Pang ZhiLi, Zhang Xu, Ma FuLei, Liu JunLiang, Zhang Hang, Wang Jing, Wen Xin and Xi Zhen. 2020. Comparative studies of potential binding pocket residues reveal the molecular basis of ShHTL receptors in the perception of GR24 in *Striga*. Journal of Agricultural and Food Chemistry 68(45): 12729-12737.

Paporiisch, A., Laor, Y., Rubin, B. and Eizenberg, H. 2020. Simulating sulfofuranate fate in soil under different weather scenarios to support weed management decisions. Pest Management Science 77(1): 253-263. [Showing that 10-20 mm rain in 2 weeks after application may reduce the performance of sulfofuranate on *Phelipanche aegyptiaca* in tomato.]


(https://doi.org/10.1016/j.eja.2021.126318) [Describing PHERASYS which combines 1) a demographic submodel to predict *Phelipanche ramosa* seed bank dynamics, 2) a trophic-relationships submodel to predict the effect of parasitism on crops and weeds, and 3) a submodel of weed dynamics in agroecosystems to predict the growth of crops and weeds from cropping techniques and pedoclimate, a tool to test management strategies including crop mixes and relying on biological regulations by weeds.]

Pratap, A and Gupta, S. (eds.) 2021. The Beans and the Peas: from Orphan to Mainstream Crops. Elsevier 362 pp. [Containing 12 chapters on different pea and bean crops, including faba bean (including reference to *Orobanche crenata*) and cowpea (with reference to *Striga gesnerioides* and *Alectra vogelli*).]


Rubiales, D., Fondevilla, S. and Fernández-Rubiales, D., Emeran, A.A. and Flores, F. 2020. Multichromosomal structure and foreign tracts in the Ombrophytum subterreaneum (Balanophoraceae) mitochondrial genome. Plant Molecular Biology 103(6): 623-638. [Like Lophophytum mirabile, the O. subterreaneum mitochondrial (mt) genome contains 54 circular chromosomes, but only 20% of that DNA is shared. Ombrophytum has 43% native, 15% Fabaceae, 14% Asteraceae and 27% DNA of unknown origin. The authors favour a hypothesis where the common ancestor of the two parasites experienced mt to nt horizontal gene transfer from a legume host. The Asteraceae (and other angiosperm families) DNA in Ombrophytum was acquired after it split from Lophophytum.]

Rubiales, D., Barilli, E. and Flores, F. 2020. Broomrape as a major constraint for grass pea (Lathyrus sativus) production in Mediterranean rain-fed environments. Agronomy 10(12): (https://doi.org/10.3390/agronomy10121931) [Exploring a range of lines with varying resistance to O. crenata under different soil and climatic conditions: concluding that short season varieties were preferable where the parasite was most abundant and long season varieties yielded best where broomrape was less abundant.]

Rubiales, D., Emeran, A.A. and Flores, F. 2020. Adaptation of grass pea (Lathyrus sativus) to Mediterranean environments. Agronomy. 10(9):1295 (https://doi.org/10.3390/agronomy10091295) [Orobanche crenata reported to be the main limiting factor for the grass pea in both Spain and Egypt. Varieties Ls10, Ls11 and Ls18 proved to have the most favorable combination of yield and broomrape resistance.]


Roulet, M.E., Garcia, L.E., Gandini, C.L., Sato, H., Ponce, G. and Sanchez-Puerta, M.V. 2020. Adaptation of grass pea (Striga gesnerioides) to Mediterranean environments. Varieties Ls10, Ls11 and Ls18 were preferable where the parasite was most abundant and long season varieties yielded 63% respectively. Essential oil content was slightly increased in peppermint but decreased by 63%, respectively. Essential oil content was by 25% and 7747/9/10/1286 confirmed their useful performance in field trials.]


Sarić-Krsmanović, M., Dragumilo, A., Umiljendić, J.G., Radivojević, L., Šantrić, L. and Đurović-Pejić, R. 2020. Infestation of field dodder (Cuscuta campestris) promotes changes in host dry weight and essential oil production in two aromatic plants, peppermint and chamomile. Plants 9(10): (https://www.mdpi.com/2223-7747/9/10/1286) [C. campestris reduced dry matter of peppermint and chamomile plants by 25% and 63%, respectively. Essential oil content was slightly increased in peppermint but decreased by 60% in chamomile. There were also changes in the oil profiles.]

B301, IT93K-693-2 and IT82D-849 were immune to all ecotypes of *S. gesnerioides* from across Burkina Faso. Varieties Tiligré, 524B, local Gorom and Niziwé, varied in response, indicating the presence of 5 biotypes, SG1, SG5 and SG Kp and 2 further unidentified biotypes.


Scott., D., Scholes, J.D., Randrianjafizana, M.T., Randriamampianina, J.A., Autfray, P and Freckleton, R.P. 2021. Mapping the drivers of parasitic weed abundance at a national scale: a new approach applied to *Striga asiatica* in the mid-west of Madagascar. Weed Research 60(5): 3234-333. [Demonstrating that one can capture distribution and management data for *Striga* density at a landscape scale and use this to understand the ecological and agronomic drivers of abundance. The importance of crop varieties and cropping patterns is significant, and has the potential to be promoted as readily available control options, rather than novel technologies requiring introduction.]


*Silberg, T.R., Renker, K., Olabisi, L.S., Richardson, R.B., Chimonyo, V.G.P., Uriona-Maldonado, M., Basso, B.B. and Mwale, C. 2021. Modeling smallholder agricultural systems to manage *Striga* in the semi-arid tropics. Agricultural Systems 187: (https://www.sciencedirect.com/science/article/abs/pii/S0308521X20308696?via%3Dihub) [Model simulations in Malawi indicate that while a combination *S. asiatica* control practices are necessary to manage the weed, future research should focus on developing smallholder-adapted practices that address the attachment stage of the weed's lifecycle (e.g., timely manure application) rather than its germination, emergence or flowering stages.]

Silva, M.C., Guimarães, A.F., Teodoro, G.S., Bastos, S.S., de Castro, E.M. and van den Berg, E. 2021. The enemy within: the effects of mistletoe parasitism on infected and uninfected host branches. Plant Ecology 222(5): 639-645. [Finding that the damaging effects of *Phoradendron crassifolium* on *Eremanthus erythropappus* and of *Psittacanthus robustus* on *Vochysia thyrsoida* in the Brazilian savannah are not confined to the infected branches, but also affect neighbouring branches.]

Şin, B., Öztürk, L., Sivri, N., Avci, G.G. and Kadioğlu, I. 2020. Weed hosts of field dodder (*Cuscuta campestris* Yunck.) in northwestern Marmara Region of Turkey. Anadolu 30(1): 80-86. [Infection intensity was highest in *Lactuca serriola*, *Convolvulus arvensis*, *Portulaca oleracea*, *Tribulus terrestris*, *Echallium elaterium*, *Rumex crispus* and *Polygonum aviculare*.]

Singh, L. J., Ranjan, V., Rasingam, L. and Swamy, l.. 2020. A new species of genus *Dendrophthoe* Mart. (Loranthaeae-Loranthaceae) from the Peninsular India. Journal of Asia-Pacific Biodiversity: (https://doi.org/10.1016/j.japb.2020.03.017) [Describing *D. gamblei*, a new species from the Eastern Ghats that is similar to *D. memecylifolia*.]

floral tube conferring a zygomorphic symmetry to the flower, as in *T. labiata.*]

*Skay, R., Windmuller-Campione, M.A., Russell, M.B. and Reuling, L.F. 2021. Influence of eastern spruce dwarf mistletoe on stand structure and composition in northern Minnesota. Forest Ecology and Management 481: (https://doi.org/10.1016/j.foreco.2020.118712) [Noting that infestation by *Arceuthobium pusillum* was most severe in black spruce (*Picea mariana*) and was likely to kill the host trees within 17 years.]

*Soma Mondal, Ramachandran Sundararaj and Rao, H.C.Y. 2020. A critical appraisal on the recurrence of sandalwood spike disease and its management practices. Forest Pathology 50:6 (https://doi.org/10.1111/efp.12648) [Refining the identification of the causal phytoplasma. Using tissue culture to create disease-free clones, but suggesting that breeding resistant varieties may be the more realistic solution.]

*Stanley, A., Menkir, A., Paterne, A., Ifie, B., Tongoona, P., Unachukwu, N., Meseka, S., Mengesha, W. and Gedil, M. 2020. [Genetic diversity and population structure of maize inbred lines with varying levels of resistance to *Striga hermonthica* using agronomic trait-based and SNP markers. Plants 9(9): (https://www.mdpi.com/2223-7747/9/9/1223) [Results indicate wide genetic variability among 150 inbred lines, and the joint diversity analysis can be utilized to reliably assign the inbred lines into heterotic groups and also to enhance the level of resistance to *Striga* in new maize varieties.]

*Suetsugu, K. 2020. A specialized avian seed dispersal system in a dry-fruited nonphotosynthetic plant, *Balanophora yakushimensis*. Ecology 101(11): (https://doi.org/10.1002/ecy.3129) [Camera traps were used to record visitors to *Balanophora* infructescences. Pale thrust and Red-flanked bluetail birds were seen feeding on the fruits, likely attracted to the bright red claviform bodies. Fecal pellets from the birds contained *Balanophora* seeds that had the same viability as those directly from the plant. The migratory nature of these birds could explain the widespread and scattered populations of the parasite.]


Těšitel, J., Cirocco, R.M., Facelli, J.M. and Watling, J. R. 2020. Native parasitic plants: biological control for plant invasions? Applied Vegetation Science 23(3): 464-469. [Referring to examples of the use of parasitic plants to suppress invasive species. In Europe, *Rinanthus alectrolophus* is being used in the Czech Republic to control the invasive grass *Calamagrostis epigeos*, while in Australia *Cassytha pubescens* can control *Ulex europaeus* and *Cytisus scoparius* and in China, *Cuscuta australis* suppresses *Mikania micrantha.*]

Botanical Society of Britain & Ireland. 150 pp. [see Book Review above.]

* Tikkanen, O.P. and 11 others. 2021. Freezing tolerance of seeds can explain differences in the distribution of two widespread mistletoe subspecies in Europe. Forest Ecology and Management 482: [https://www.sciencedirect.com/science/article/abs/pii/S0378112720315759?via%3Dihub] [Seeds of Viscum album ssp. album collected in Sweden, Poland and Switzerland proved more tolerant of temperatures below -15°C than V. album ssp. austriacum. A warming climate is likely to see spread of both species to higher altitudes and latitudes.]


* Wang YaXin, Murdock, M., Lai, S.W.T., Steele, D.B. and Yoder, J.I. 2020. Kin recognition in the parasitic plant Triphysaria versicolor is mediated through root exudates. Frontiers in Plant Science 11: [https://doi.org/10.3389] [Results indicate that kin recognition in Triphysaria is associated with the lack of active haustorium-inducing factor in their root exudates.]

* Watson, D.M. 2020. Did mammals bring the first mistletoes into the treetops? The American Naturalist 196(6): 769-774. [Noting that the evolution of mistletoes predated that of mistletoe-feeding birds, establishing that they could have been dispersed by Cretaceous primates (e.g., Purgatorius) and, in the Eocene, by ancestors of today’s mistletoe-dispersing marsupials, Dromiciops.]


Wójcik, R., Wikaliński, M. and Kędziora, W. 2021. (Mistletoe (Viscum album L.) inventory on the Scots pine (Pinus sylvestris L.) in the Kozienice forest district.) (in Polish) Sylwan 165(1): 3-8. [Noting an increase in V. album on Scots pine since recent droughts. Survey of 1500 trees showed 31% of trees infected by V. album. More than 35% of the infected trees were damaged heavily by more than 6 specimens per tree.]

* Xiong DianGuang, Huang HuaYi, Wang ZeZhong, Li ZhouYuan and Tian ChengMing. 2021. Assessment of dwarf mistletoe (Arceuthobium sichuanense) infection in spruce trees by using hyperspectral data. Forest Pathology 51(2): [https://doi.org/10.1111/efp.12669] [A study of the changes in leaf reflectance of Picea crassifolia, infected by A. sichuanense with ground-based hyperspectral technology. Infection resulted in an increase of leaf reflectance which should be usable with remote sensing on a landscape scale to survey infection intensity.]

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Yamamoto, S., Atarashi, T., Kuse, M., Sugimoto, Y. and Takikawa, H. 2020. Concise synthesis of heliolactone, a non-canonical strigolactone isolated from sunflower. Bioscience, Biotechnology and Biochemistry 84(6): 1113-1118. [Synthesis was achieved by employing Knoevenagel-type condensation and semi-reduction of a malonate intermediate as the key steps. A racemic and diastereomeric mixture of heliolactone was obtained.]


*Yuan YongGe, Kleunen, M. van and Li JunMin. 2021. A parasite indirectly affects nutrient distribution by common mycorrhizal networks between host and neighboring plants. Ecology 102 No. (https://doi.org/10.1002/ecy.3339) [Results indicate that when Trifolium pratense was parasitized by Cuscuta australis, common mycorrhizal networks preferentially distributed more mineral nutrients to the nonparasitized neighboring T. pratense plant, and that this had a negative feedback on the growth of the parasite.]


*Zagorchev, L., Pachedjieva, K., Tosheva, A., Li JunMin, Teofanova, D. and Atanasova, A. 2021. Salinity effect on germination and further development of parasitic Cuscuta spp. and related non-parasitic vines. Plants 10(3): (https://doi.org/10.3390/plants10030438) [Showing that Cuscuta spp. are highly sensitive to NaCl concentration within the range of 200 mM. Germination was delayed and reduced by nearly 70%, accompanied by decrease in further seedling growth, ability to infect host plants, and growth rate of established parasites.]


*Zebire, D., Menkir, A., Adetimirin, V., Mengesha, W., Meseka, S. and Gedil, M. 2020. Effectiveness of yellow maize testers with varying resistance reactions to Striga hermonthica for evaluating the combining ability of maize inbred lines. Agronomy 10 (9): (https://doi.org/10.3390/agronomy10091276) [Concluding that testers with a high frequency of desirable alleles were superior to the tester with a low frequency of favorable alleles in hybrid breeding programs for resistance to S. hermonthica.]

*Zhang RuiTing, Xu Bei, Li JianFang, Zhao Zhe, Han Jie, Lei YunJing, Yang Qian, Peng FangFang and Liu ZhanLin. 2020. Transit from autotrophism to heterotrophism: sequence variation and evolution of chloroplast genomes in Orobanchezaceae species. Frontiers in Genetics 11: (https://doi.org/10.3389/fgene.2020.542017) [Comparison among 50 complete chloroplast genomes from Orobanchezaceae species of different feeding types reveals important differences in gene content and structural variation. Codon usage patterns are discussed to be shaped by selective pressures and mutational biases.]
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has been edited by Chris Parker, 6 Royal York Crescent, Bristol BS8 4JZ, UK (Email chrisparker5@compuserve.com ), Lytton Musselman, Parasitic Plant Laboratory, Department of Biological Sciences, Old Dominion University, Norfolk Virginia 23529-0266, USA (fax 757 683 5283; Email lmusselm@odu.edu) and Luiza Teixeira-Costa, Department of Organismic & Evolutionary Biology, Harvard University Herbaria, USA. (luiza.teixeirac@gmail.com). It has been produced and distributed by Chris Parker and published by IPPS (ISSN 1944-6969).

Send material for publication to any of the editors.
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PRESIDENT'S MESSAGE

Dear IPPS members

I wish you all a healthy, happy and successful 2022, hopefully with less restrictions than in the past, almost two, years. We are still experiencing a difficult time and meeting other people, especially internationally is virtually impossible. That is a real pity, as I experienced during the short relief in the travel restrictions, in a couple of face to face meetings that gave so much more energy than online. Nevertheless, fortunately we have the online possibilities and I personally greatly enjoy the online IPPS seminars, which are a great success. And of course we have our newsletter, Haustorium, to stay connected. Also this issue again has a great selection of parasitic plant related news.

In 2022 we will continue to host the online IPPS seminars from February thru April, then have a 5-months break around the World Congress on Parasitic Plants, where the real exchange of ideas and creation of new plans and collaborations can take place. The 16th WCPP is going to be held in Nairobi in July 2022 with hybrid, on site and online, participation. Please keep an eye on our website, for updates. The IPPS seminars will be held on the first Wednesday of the month at 3:00 PM GMT. See the programme and the announcements with the exact time in the different time zones and the zoom link (accessible for members only). Group leaders can share the zoom link with their students.

You may have noticed the change in the Twitter feed on our website, which is more professional now, allows for more search terms and generally also shows the pictures in the original tweets. I want to invite you to contribute to that Twitter feed by using the hashtag #Parasiticplants. Please also use the other possibilities of our website and reach out to other IPPS members and the society at large: login into the member area and post news, for example on your most recent paper or project funding, and job vacancies. I would also greatly appreciate if you keep your profile up to date, with your picture and that of your institution and with a short description of your research area. You may want to add some expertise keywords as the member list is searchable, allowing others to find you based on your expertise. I also encourage you to check out the News and Society pages regularly, for member and society news, and the homepage where we have two continuously refreshed feeds, from Google Scholar and Scopus, showing the most recent papers on parasitic plants, as well as the Twitter feed.

If you are reading Haustorium but are not an IPPS member yet, consider to become a member. For the year 2021-2022 we have a reduced fee of 20 euro for regular members; for students we waive this year’s membership fee. We use these fees to run the society and to support the organization of the WCPP and its attendance by young researchers. If you are a member but did not pay your membership fee, please do so here. I would like to end with wishing you all a great 2022.

Harro Bouwmeester
IPPS President

MEETING REPORT

XI Weed Science Congress and Symposium on Herbicides and Growth Regulators. Palić, Serbia, 20th to 23rd of September 2021

The Eleventh Serbian Weed Science Congress was planned for the year 2020, just 40 years after the first. However, the COVID-19 pandemic led to its postponement to 2021,

National and eminent international lecturers presented oral and poster presentations, describing the most important results of scientific research done in the field of weed science for the last five years. For the first time the programme included a Symposium on Herbicides and Growth Regulators, to encourage better communication and cooperation between colleagues working in primary production, scientific institutions, pesticide industry, and all other fields which share the common interest in the study and control of weeds.

A total of 90 papers were presented, 16 of which were by invited speakers (including prof. dr Ahmet Uludag, prof. dr Husrev Mennan, prof. dr Stevan Knezevic, prof. dr Heinz Müller-Schärer and prof. dr Mostafa Oveisi) presenting a broad picture of developments, newest contributions, and a vision of future research in the field. Of 33 oral papers 3 involved parasitic plants as follows:

Marija Sarić-Krsmanović et al. - Field dodder: the old problem looking for a new approach (in Serbian).
About 10 *Cuscuta* species are known in Serbia. The most frequent, *Cuscuta campestris*, may be a problem in tomato, sweet pepper, potato and cabbage and recently in sugar beet; also in other crops grown in plastic greenhouses. However, it is most devastating in newly-established alfalfa, clover, etc. Successful requires an integrated approach involving crop rotation, use of pure seeding material, physical removal by mowing, hand weeding or flaming, the use of tolerant cultivars and biological agents, as well as treatments with herbicides when the problem cannot be solved any other way.

Lyuben Zagorchev et al. - Response of field dodder (*Cuscuta campestris* Yunck.) to salinity independence of the host plants (in English).

Being a stem parasite, *Cuscuta campestris*, once attached to its host is not directly exposed to abiotic stress factors such as drought and high soil salinity. However, germination and early growth are shown to be seriously affected by salinity. After attachment to the host its success depends on that of the host. Host susceptibility was increased in some species but notably reduced in *Capsicum album*.

Sandra Cvejić et al. - Genetic control of broomrape in sunflower (in English). Reviewing the problems from development of new races of *Orobanche cumana* and emphasising the need for pyramiding of resistance genes from different sources into a single genotype. Noting the value of new techniques using maker analyses for identifying and mapping resistance genes.

Marija Sarić-Krsmanović

**PROFILE**

**THISMIACEAE**

**Introduction**

Heterotrophic plants come in two flavors: holoparasitic plants make a physical connection to a host plant to obtain carbon, while mycoheterotrophic plants use root-associated fungi as carbon source. The latter mode of life has evolved over 40 times in plant evolution and includes over 550 species broadly distributed through the world’s forest ecosystems. Due to their rarity and unusual appearance the species in the plant family Thismiaceae are among the most intriguing mycoheterotrophic plants. Here I provide an overview of the diversity, evolution, and ecology of these remarkable plants and I discus their apparent rarity.

**Diversity, and distribution**

Thismiaceae comprise five genera and c. 100 species, all of which have a fully mycoheterotrophic mode of life (Merckx et al. 2013; Yudina et al. 2021; Fig. 1). The family has a pantropical distribution; and occurs throughout the rainforests of South and Middle America, Africa, western India, Southeast Asia, and Australasia, although it is notably absent from Madagascar and tropical oceanic islands (Fig. 2). The distribution extends into subtropical and even temperate regions in the USA, China, Japan, Australia, and New Zealand (see *Thismia*; Merckx et al. 2013).

![Figure 1. A: Afrothismia winkleri, pictured at Mount Kupe, Cameroon. B: Thismia tentaculata, Hong Kong, China. C: Thismia clavarioides at Moreton National Park, NSW, Australia. D: Thismia rodwayi, Tasmania, Australia. E: Thismia hillii, Mount Pirongia, New Zealand. All photos by Vincent Merckx.](image-url)
The second largest genus of the family, *Afrothismia*, contains over 10 species which are all known from tropical Africa (excluding Madagascar). The little-known genus *Oxygyne* comprises 6 species, of which 3 are described from a single collection in tropical West Africa. The other 3 species occur in subtropical regions in Japan (Cheek et al. 2018). Finally, of both genera *Haplothismia* and *Tiputinia* only a single species is known, from India and Ecuador respectively (Merckx et al. 2013).

**Figure 2.** Global distribution map of Thismiaceae. Adapted from Merckx & Smets (2014)

**Classification**
Due to the strong reduction of vegetative organs and the rarity of most species involved, Thismiaceae taxonomy has been the subject of much debate. Most classifications included Thismiaceae, as a subtribe “Thismieae,” in a broadly defined Burmanniaceae (Miers 1847; Schlechter 1921; Jonker 1938; Maas et al. 1986; Maas-van de Kamer 1998; Caddick et al. 2002; APG 2009) while other authors favored the recognition of a separate family of Thismiaceae closely related to the mycoheterotrophic Burmanniaceae (Hutchinson 1934, 1959; Dahlgren et al. 1985; Takhtajan 1997; APG 1998). Thismiaceae or Burmanniaceae (including Thismieae) on their part were linked to various other families, including other mycoheterotrophic groups such as Triuridaceae, Geosiridaceae, Corsiaceae, and Orchidaceae (see Maas et al. 1986 for an overview). However, these relationships are now completely discredited based on convergence of character states involved, due to their mycoheterotrophic mode of life (Soltis et al. 2005). DNA-based phylogenetic analyses place Thismiaceae in Dioscoreales (Caddick et al. 2002; Davis et al. 2004), but outside Burmanniaceae (Merckx et al. 2006, 2009; Lam et al. 2018). Nuclear and mitochondrial DNA data suggest that Thismiaceae are paraphyletic, due to the inclusion of *Tacca* (Merckx et al. 2009), but these relationships remain unclear.

**Evolution**
The potential inclusion of the genus *Tacca* within Thismiaceae (see Classification) suggests that a mycoheterotrophic mode of life has evolved independently in *Afrothismia* and in the common ancestor of the remaining Thismiaceae (Merckx et al. 2009). Thismiaceae are absent from the fossil record but according to molecular clock estimates both lineages originated during the Cretaceous (Merckx et al. 2010), which makes it one of the oldest known extant lineages of mycoheterotrophic plants known. The loss of photosynthesis has led to pronounced gene-loss in the chloroplast genome; the chloroplast genomes of *Thismia* species are among the smallest known in plants (Lim et al. 2016; Yudina 2021).

**Figure 3.** Detail of a cluster of root tubercles of *Afrothismia foertheriana*. Photo by Vincent Merckx

**Ecology**
Morphological observations indicate that species of Thismiaceae grow on arbuscular mycorrhizal fungi (Glomeromycotina), which are the most common mycorrhizal associates of plants. In fact, they obtain carbon from surrounding plants through these shared fungi (Gomes et al. 2020). DNA sequencing of several species of *Thismia* and *Afrothismia* indicate that their interactions with these fungi are very specific, often associating with a single narrow fungal lineage (Merckx & Bidartondo 2008; Merckx et al. 2017; Guo et al. 2019), particularly in relation to surrounding green plants (Gomes et al. 2017). In
Afrothismia the fungi housed are in highly specialized root tubercles (Fig. 3).

Pollination is poorly studied in Thismiaceae, but because many species have showy flowers with a conspicuously pigmented corolla, a trap-like perianth tube, long tepal appendages, and nectaries. These specializations are highly variable between species and suggest cross-pollination; it is likely that genera such as Thismia are either xenogamous or maintain a mixed selfing–outcrossing reproductive strategy (Vogel 1962; Stone 1980; Maas et al. 1986). The particular floral morphology and odor of Tiputinia points to sapromyophily (Woodward et al. 2007). Recently, the pollination of Thismia tentaculata was studied in detail demonstrating that the flowers are pollinated by a single species of fungus gnats (Corynoptera, Sciaridae), which are attracted by the yellow pigments and are temporarily restrained within the perianth chamber before departing via apertures between the anthers. The plants are self-compatible but predominantly xenogamous (Guo et al. 2019). Similar observations have been made for T. hongkongensis (Mar & Saunders 2015).

The seed dispersal mechanism of Thismiaceae species is poorly-studied, but the cup-shaped fruit of Thismia species points towards dispersal by rain splash (Mar & Saunders 2015; Coehlo et al. 2021).

Rarity
A remarkable common feature of most Thismiaceae is their apparent rarity (Stone 1980; Maas et al. 1986; Franke 2004). The majority of species are known exclusively from the type collection, which in some cases was made more than a century ago (Stone 1980; Maas et al. 1986). However, our knowledge about the occurrence of Thismiaceae may be considerably biased by the plants’ ability to remain unnoticed by collectors. Most species are only known from remote areas where botanical inventories have yet to be carried out. Moreover, mycoheterotrophic plants can only be spotted when they are flowering or fruiting, mostly for a short period of time only and often in the wet season, when few botanists are eager or able to enter the forest. The rest of the year, they remain underground hiding from discovery (Fig. 4), and they may not even flower each year. Even when flowering, many species of Thismia may fail to protrude above the dense leaf litter and remain covered by fallen leaves. It is little wonder that these mycoheterotrophs are often spotted by mushroom hunters or by a botanist during a sanitary break; some species may be more abundant than we assume because we just fail to find them even when actively looking for them. The fact that new species are constantly being described and thus escaped discovery for a long time illustrates the secret nature of Thismiaceae species. Notorious is the discovery of two new Afrothismia species in Korup Forest Dynamic Plot in Cameroon (Sainge and Franke 2005; Sainge et al. 2005). This 50-ha plot was established in 1994 and is frequently monitored, yet two Afrothismia species escaped discovery for almost a decade, despite the fact that a path through the plot was also going through one of the Afrothismia populations (Franke 2007). Similarly, Tiputinia foetida, with a flower of 5 cm in diameter, was discovered in 2005 in a biological station in Ecuador growing within a meter of the path linking the station’s dining hall to the laboratory (Woodward et al. 2007).

Figure 4. Root of Thismia hillii at Mount Pirongia, New Zealand. Photo by Vincent Merckx.

The influence of collection effort has been addressed for the once-rare species Thismia rodwayi (Roberts et al. 2003; Wapstra et al. 2005). From its discovery in 1890 until 2002, there were only five records of T. rodwayi in Tasmania (Roberts et al. 2003). Since the discovery of two specimens at a new site in Tasmania, subsequent searches on this and other sites with similar habitat characteristics revealed several additional population and sites, and T. rodwayi is now known from at least 26 sites from 7 disparate locations in Tasmania (Wapstra et al. 2005). During searches in 2012 the plant was observed in high numbers at several sites.
throughout Tasmania, and appears to be a relatively common species of wet sclerophyll forest (Merckx & Wapstra 2013). Removing leaf litter at sites with suitable vegetation, it would usually take less than 5 minutes to locate specimens of *T. rodwayi* (pers. observ.; Fig. 5). As standard biological inventories fail to encounter species like *T. rodwayi* (Roberts et al. 2003), another conclusion that can be drawn from this study is that this species, and other inconspicuous Thismiaceae, can only be reliably recorded by targeted surveys. Because very few botanists search tropical rainforests specifically for mycoheterotrophic plants, the majority of collections result from chance encounters, hence explaining the lack of collections for so many Thismiaceae species and other mycoheterotrophic plants. The few intensive searches for mycoheterotrophic plants that have been carried out, in many cases, to the discovery of unexpected mycoheterotrophic plant diversity or even to the discovery of undescribed taxa (e.g., Franke 2007).

**Figure 5.** Flowers of *Thismia* (red dots) appearing after removal of the leaf litter. Blue Mountains, NSW, Australia. Photo by Vincent Merckx.

Since many mycoheterotrophic species, particularly those occurring in tropical rainforests, grow in inaccessible areas and are extremely difficult to spot (see above), it is impossible to declare any mycoheterotrophic species as extinct with confidence. Even when the type locality is destroyed and a species has not been seen for many decades, it is still possible that other populations escaped discovery. Sometimes species have been rediscovered after a notably long hiatus. *Haplothismia exannulata* was rediscovered at its type locality in India in 2000, 49 years after its discovery and only a few years after being declared “extinct” (Sasidharan and Sujanapal 2000). The second collection of *Thismia clavigera* (Thismiaceae) was made 115 years after the first and over 1,000 km from the type locality (Stone 1980). Similarly, 151 years passed between the first and second collection of *Thismia neptunis* in western Sarawak on Borneo (Sochor et al. 2018).

In other cases, however, chances for survival of the species seem grim because the type locality and surrounding habitat has been destroyed. One of the most famous, now destroyed, localities is the “Alto Macahé” near Nova Friburgo (Rio de Janeiro), which is part of the coastal rainforest of southeast Brazil. In the nineteenth century, John Miers and Auguste Glaziou collected many remarkable mycoheterotrophic plants at this location. As a result, Alto Macahé is the type locality of *Thismia fungiformis*, *T. caudata*, *T. macahensis*, *T. janeirensis*, and *T. glaziovii*. Of these species, only *Thismia janeirensis* and *T. glaziovii* were later collected at another location. All other species have not been recorded since the type collection, and because 95% of the original Mata Atlântica rainforest has been replaced by farmland (Prance et al. 2000; Murray-Smith et al. 2009), little hope remains that these species escaped extinction (Maas et al. 1986). A similar fate was suffered by the endemic Thismiaceae of Mount Cameroon, where most of the forest has been replaced by farmland, thereby destroying the type localities of *Oxygyne triandra*, *Afrothismia pachyantha*, and *A. winkleri* (Schlechter 1906, 1921). The latter species was later found at another nearby location (Mount Kupe), but *Oxygyne triandra* and *Afrothismia pachyantha* have not been collected for more than 100 years and may be extinct.

Arguably, the most mysterious of all Thismiaceae species is *Thismia americana*. This tiny species was discovered in August 1912 by Norma E. Pfeiffer in a low prairie near Chicago Illinois (USA) (Pfeiffer 1914; Fig. 6). *Thismia americana* was observed at this locality for several subsequent summers and was probably the type locality of *Thismia americana* has been replaced by an industrial complex, and numerous attempts to relocate this enigmatic species have been unsuccessful. Therefore, the species is currently listed as “possibly extinct” (Lewis 2002) last seen in 1916 (Merckx & Smets 2014),
While *Thismia* has a widespread distribution and covers a considerable variety of forest habitats, the occurrence of a *Thismia* species in a prairie in temperate North America, more than 3,500 km from the nearest *Thismia* site (southern Costa Rica), is truly remarkable. The average temperature in the Chicago area lowers to −5°C during winter, by far the lowest temperature for any *Thismiaceae* site. This led Pfeiffer (1914) to the suggestion that the plant was perennial and that the underground parts of the plant were able to hibernate. Based on morphological similarities, it has been suggested that the closest known relative of *T. americana* is *T. rodwayi* from Australia and New Zealand (Jonker 1938; Maas et al. 1986), forming one of the “most anomalous disjunctions known in flowering plants” (Thorne 1972, p. 407). However, this affinity is questionable, and most likely *T. americana* is most closely related to *Thismia* species from eastern Asia (Merckx & Smets 2014). Was this *Thismia* population the result of a human introduction, a recent long-distance dispersal, or the last remnant of an ancient boreotropical *Thismia* distribution? Unless the plant is rediscovered, this mystery will remain unsolved. Many people assume that the species is still present in the area. The only certainty is that if *T. americana* still exists, it is extremely difficult to find. In a letter to Prof. Warren H. Wagner in 1956, Pfeiffer recalled that it took her 3 h to relocate the plants when she returned to the exact same spot shortly after her first discovery.

**Figure 6.** *Thismia americana.* Redrawn from Pfeiffer (1914).

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ZOOMINARS

IPPS Seminar series

August 4th, 2021

**Francisco E. Fontúrbel - Cascade impacts of climate change on ecological interactions: lessons from a keystone mistletoe.**

Climate change is triggering ecological responses all over the world as a result of frequent, prolonged droughts. It could also affect ecological interactions, particularly pollination and seed dispersal, which play a key role in plant reproduction. We used a tripartite interaction with a mistletoe, its pollinator, and its disperser animals to gain insight into this issue. We studied flower and fruit production, and visitation rates during average (2012) and dry (2015) austral summers. Drought in our study area affected precipitation and soil water availability. Although pollinator visits did not significantly differ in these summers, during the dry summer flower and fruit production experienced an important decline, as did seed disperser visits. Also, mistletoe mortality increased from 12% in 2012 to 23% in 2015. This empirical evidence suggests that the cascade effects of climate change may indirectly be hindering ecological interactions in the Valdivian temperate rainforest ecosystem we studied. Long-term research is essential to provide the knowledge necessary to understand how key ecological processes may be affected in a changing world.

**Min-Yao Jhu - CcLBD25 functions as a key regulator of haustorium development in Cuscuta campestris**

*Cuscuta campestris* is a stem parasite that attaches to its host, using haustoria to extract nutrients and water. We analyzed the transcriptome of six *C. campestris* tissue types and identified a key gene, LATERAL ORGAN BOUNDARIES DOMAIN 25 (CcLBD25), as highly expressed in prehaustoria and haustoria. Gene co-expression networks indicated that CcLBD25 could be essential for regulating cell wall loosening and organogenesis. We employed host-induced gene silencing by generating transgenic tomatoes expressing hairpin RNAs to down-regulate CcLBD25 in the parasite. Our results showed that *C. campestris* growing on CcLBD25 RNAi transgenic tomatoes transited to the flowering stage earlier and had reduced biomass compared with *C. campestris* growing on wild-type hosts, suggesting that parasites growing on transgenic plants were stressed due to insufficient nutrient acquisition. With our in vitro haustorium system, we found that *C. campestris* grown on RNAi tomatoes produced fewer prehaustoria than those grown on wild-type tomatoes, indicating that down-regulating CcLBD25 may affect haustorium initiation. *C. campestris* haustoria growing on RNAi tomatoes exhibited reduced pectin digestion and lacked searching hyphae, interfered with haustorium penetration and formation of vascular connections. The results of this study elucidate the role of CcLBD25 in haustorium development and might contribute to developing parasite-resistant crops.
HAUSTORIUM 81

September 1st, 2021

Soyon Park - Functional study of a mobile protein; Jasmonate-Induced Protein 23 (JIP23)
Abstract: We are increasingly aware of the exchange of macromolecules such as RNAs between Cuscuta and their hosts, but the functional significance of such transfer remains unclear. Recognizing that proteins are important functional molecules regardless of their site of synthesis, we sought to investigate mobile proteins in the parasite-host interaction. We explored the Cuscuta campestris / Arabidopsis thaliana system using liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS) to analyze total protein extracts from host and parasite stems near the haustorium region. We identified 97 mobile Cuscuta proteins in Arabidopsis stems and 447 mobile Arabidopsis proteins in Cuscuta stems. Among the most highly abundant Cuscuta mobile proteins found in the host was a 23 kDa Cuscuta Jasmonate-induced protein (CcJIP23). The mRNA encoding this protein was found in previous transcriptome analyses as mobile from Cuscuta to Arabidopsis and tomato hosts (Kim et al., 2014). JIP23 has not been well characterized in other plant species, so we set out to identify the CcJIP23 function using various molecular techniques. Y2H screening revealed that CcJIP23 interacts to Arabidopsis l-3-ketoacyl CoA thiolase (AtKAT2) which is involved in the jasmonate synthesis pathway. Arabidopsis transgenic plants over-expressing CcJIP23 (35S::CcJIP23) had no JA-Ile induction under wounding stress. In sum, we hypothesize that Cuscuta produces CcJIP23, which may be mobile as a transcript, protein, or both, and once in the host acts to regulate the jasmonate pathway of the host plant, resulting in suppressed defense response against Cuscuta.

Damaris A. Odeny - What we know about sorghum-Striga interactions
Sorghum (Sorghum bicolor L.) is a diploid (2n=2x=20) drought tolerant cereal crop native to Africa. Among the many biotic challenges affecting successful production of sorghum in Africa is a parasitic weed, Striga hermonthica, which can result in up to 100% yield loss. Traditionally, farmers have managed Striga in sorghum fields using cultural and mechanical methods. There are now various recommended scientific methods for studying Striga both in the field and under contained conditions that have led to the identification of several Striga resistant/tolerant varieties. The reported mechanisms of resistance to Striga range from low germination stimulants to the creation of mechanical barriers. Despite the significant knowledge generated to enhance our understanding of sorghum-Striga interactions, Striga continues to destroy farmers’ crops, suggesting there are still no lasting solutions to this obnoxious weed. We will provide an overview of studies done so far, covering the screening and gene discovery methods, mechanisms of resistance, sources of resistance and some candidate genes studied so far.

October 6th, 2021

Thomas Spallek - Signaling between Phtheirospermum and Arabidopsis.
I will present our ongoing work on the molecular communication between root parasitic plants of the Orobanchaceae family and their hosts. We mainly work with Phtheirospermum japonicum (Phtheirospermum), a euphytoid parasite, and its host Arabidopsis thaliana (Arabidopsis) - two model species that allow in-depth analysis of plant parasitism. In my talk, I will give an overview of how studying Phtheirospermum and Arabidopsis can help us to understand related crop-parasitizing species. I will present our recent work on potential substrates of subtilases expressed during infection. Subtilases are a class of proteases with diverse functions in plants. Subtilases are also required for the efficient maturation of the Phtheirospermum haustorium (Ogawa et al., 2021). Our data suggest that some of these subtilases process precursors of peptide hormones. The bio-active peptide is perceived by the parasite and may also play a role in host-parasite communication. Homologs are also present in parasitic weeds Striga hermonthica and Striga asiatica.

Immaculate Mwangangi - Enhancing sorghum post-attachment resistance against Striga by improved host nutrition
The use of Striga resistant cultivars is considered to be a crucial component in integrated Striga management. Studies also show that fertilizers may play a key role in the reduction of Striga infection levels and crop performance. The combination of Striga resistant germplasm and targeted host-plant nutrition is therefore proposed to be a feasible and effective integrated Striga management. To date, most research has focused on the role (macro-) nutrients play in pre-germination Striga resistance. Our understanding of the effect of host-plant nutrition on post-
germination. In this study, we used rhizotron assays to determine the interaction between post-germination resistance and host-plant nutrition. Three sorghum genotypes were selected based on their mechanistic post-attachment resistance (i.e., N13: mechanical barriers, Framida: hypersensitive response, IS9830: incompatibility reaction) and these were compared to a susceptible check (i.e., Ochuti). These four genotypes were subjected to four different nutrient treatments (F1: control, F2: macronutrients, F3: micronutrients and F4: macro and micronutrients). Our findings show that recommended levels of macronutrients, alone or in combination with micronutrients, generally increase post-germination resistance whereas the application of only micronutrients has a weaker and more inconsistent effect on post-germination resistance. While these findings are awaiting confirmation, we are currently investigating their mechanistic explanation and also studying the nutritional effects on host-plant tolerance. This research project will enhance our understanding of the interaction between host-plant defense mechanisms and nutrition, which should ultimately lead to tailored management recommendations for Striga-affected smallholders in Africa.

November 3rd, 2021

Salim Al-Babili - Harnessing hormones and signaling molecules for combating Striga.

The root parasitic plant Striga hermonthica is one of the major threats to global food security and is a severe agricultural problem, particularly in sub-Saharan Africa. The dependency of Striga seed germination on host-released strigolactones (SLs), opens up different combating possibilities, including the suicidal germination strategy, which refers to application of SL analogs/mimics in host’s absence, application of Striga-specific SL antagonists that inhibit Striga germination host’s presence, and reducing the release of SLs. In the last years, we have explored, together with our collaborators, the potential of these hormone-based possibilities. We have developed SL analogs and tested their efficiency in inducing Striga seed germination in lab, greenhouse, and in infested farmer’s fields in Burkina Faso. For this purpose, we have established an application protocol for rain-fed agriculture, which makes the suicidal germination strategy applicable in sub-Saharan Africa. Indeed, our field trials show clear reduction in Striga infestation. Following serendipity discovery that unraveled the detergent Triton X-100 as a tightly binding ligand of the Striga SL receptor ShHTL7, we combined structural elements of Triton X-100 with those of trisole ureas known to inhibit SL perception in host plants and developed Striga specific seed germination inhibitors. Greenhouse tests confirmed the inhibition activity of the developed compounds, which provides a basis for further developments. Finally, we synthesized mimics of the regulatory, carotenoid-derived metabolite zaxinone that promotes growth and inhibits SL biosynthesis and release in rice. Greenhouse tests confirmed the activity of zaxinone and its mimics in promoting growth and alleviating Striga infestation.

Stéphane Muños - Use of the genetic diversity within Helianthus for the resistance to sunflower broomrape.

The sunflower broomrape (Orobanche cumana) is an obligate parasitic plant that attaches to the sunflower roots. These very small seeds (approx. 200 µm) remain dormant in the soil until a molecule produced by sunflower root exudates is detected and induces its germination. Once connected to the vascular system of the sunflower root, it will uptake water and nutrients from the host to develop an underground tubercle before a flower shoot emerges from the ground. O. cumana populations are found from southern Spain to China. They differ in their genetic diversity, their level of virulence and aggressiveness. While most cultivated sunflowers are susceptible to broomrape, there are many resistance mechanisms among the 52 wild Helianthus species. I will present how these resistances are used to improve the resistance of the cultivated sunflower varieties and how they can provide a better understanding of the interaction mechanism.

December 1st, 2021

Kateřina Knotková - Interactions between and parasitic plants and invasive hosts: the experimental evidence.

Plant invasions are a component of global change that threatens biodiversity and impacts ecosystems worldwide. The main concerns of traditional invasion biology were exclusively alien invaders, but expansions of native species (native invaders) have recently been shown to have comparable effects on biota. Preventing further invasion, reducing invasive species, and
restoring the original diversity represent a major global challenge.

Biological control represents a significant component of plant invasion management. Parasitic plants may be used within the Biotic Resistance Hypothesis framework, which relies on antagonistic ecological interactions between the invader and its generalist native enemy. Therefore the recent experience suggests mainly root hemiparasites and parasitic vines (Cuscuta, Cassytha) with relatively wide host ranges as potential biocontrol agents.

Our recent project focuses on gathering systematic empirical evidence on the interactions between alien and native invasive plants and root-hemiparasites in the Czech Republic. We have conducted an extensive pot experiment testing parasite-invader combinations. Pilot field trials were consequently established for the promising associations. Among all the candidate invader-hemiparasite pairs, we identified Melampyrum arvense and Odontites vernus as hemiparasites, which may suppress alien invaders Solidago gigantea, and Symphyotrichum lanceolatum. For these, we established detailed field experiments. Just after one year, Melampyrum proved to be highly successful against Solidago and moderately against Symphyotrichum. With Odontites, we encountered issues with its establishment, which we hope to overcome next year. Additional hemiparasite-host combinations still wait to be tested.

Emily Bellis - Evolution of parasitic plant-host interactions from gene to continent scales
Understanding how species interactions evolve across diverse environments is a key question for evolutionary ecology. This talk presents the results of our recent work demonstrating that patterns of adaptation to local host communities emerge at broad scale in the parasitic plant Striga hermonthica, and follow up work investigating the genetic mechanisms of parasite specialization to different cereal hosts.

YOUR EDITOR AT 90
I recently enjoyed celebrating my 90th birthday, but hope to continue helping to produce Haustorium for some time yet. Co-incidentally around that time I was honoured with an invitation to contribute to the new (virtual) issue of Plants journal as a ‘tribal elder’ in the subject of Parasitic Weeds and their Control and my ‘Personal history’ is listed below. I am indebted to Coby Goldwasser and Evgenia Dor for the invitation and for their patience in the process of its editing, and to Lytton Musselman for his help and support in its preparation. I have also to acknowledge Lytton’s help and encouragement over a period of nearly 50 years since we met at the first international meeting in Malta in 1973. Most of the developments in which I have been involved, including Haustorium would not have happened without his energy and initiative.

And the Parker involvement may continue beyond my eventual departure. Grandson Adam is pursuing a PhD at Sheffield University and has recently authored a detailed review ‘Epigenetics: a catalyst of plant immunity against pathogens’ (https://nph.onlinelibrary.wiley.com/doi/full/10.1111/nph.17699?af=R) There is no mention of parasitic plants, but some of our readers may find it of interest. Long live Lamarck!

Chris Parker

PRESS REPORTS

Does mistletoe help treat cancer? An evidence-based look
Mistletoe extracts are commonly prescribed to people with cancer in some European countries. Prescription mistletoe products are usually injected under the skin and are typically used in
combination with traditional cancer treatments such as chemotherapy. Mistletoe extract contains a variety of biologically active compounds that have powerful immune-modulating effects, which may be effective in cancer treatment. Some research suggests that mistletoe extract may be beneficial in improving quality of life, survival, and symptoms in people with cancer. However, researchers have voiced concerns about the reliability and mixed results of existing studies.

Study results suggest that prescription mistletoe products are generally safe. However, if you have cancer, discuss any medication or supplement changes with your oncology team to ensure safety.

**NB** This is a heavily abridged version of the full report which can be found at: [https://www.healthline.com/nutrition/mistletoe-and-cancer](https://www.healthline.com/nutrition/mistletoe-and-cancer)

(See also Loef and Walach, 2020, below.)

**An app to help African farmers defeat crop pests (abridged)**

African smallholder farmers face major challenges from weeds such as *Striga* and insect pests such as fall armyworm. Fall armyworm is a serious threat to food security and livelihoods. But a solution exists – ‘push-pull technology’ – and it avoids the need to use harmful and expensive chemical pesticides. Push-pull technology is a scientific method of planting crops such as maize and sorghum alongside particular species of forage grasses and legumes, which repel pests and suppress weeds. The method was developed by scientists at the International Centre of Insect Physiology and Ecology (icipe) in Kenya with partners and is designed to protect the plants against devastating pests like the fall armyworm and the *Striga* weed, with the companion plants also improving soil fertility.

But a major challenge is how to communicate advice and information about this crop management technique to millions of smallholder farmers in sub-Saharan Africa. To help address this challenge, a new mobile phone app – called ‘Push-Pull’ – has been launched by Agape Innovations Ltd, in collaboration with a team of scientists from the University of Leeds, Keele University and icipe. The app is part of a larger project called ‘Scaling up Biocontrol Innovations in Africa’ funded by the Global Challenges Research Fund (GCRF), which seeks to understand how biocontrol methods have been used across Africa and to encourage their uptake. The project involves a cluster of previous GCRF-funded research programmes, including the Leeds-led AFRICAP project ([https://africap.info/](https://africap.info/)).

Principal Investigator Dr Steve Sait, from Leeds’ School of Biology, said: ‘The push-pull method of pest control is decades old and is used successfully by thousands of smallholder farmers across Africa. ‘We hope that this collaboration, and this new app, can help us extend knowledge of this technique to potentially millions of other farmers who could be benefitting from it. Compared to chemical pesticides, push-pull costs less money to the farmer, results in less damage to their crops, and it avoids harming other insect species that play valuable roles in the ecosystem. The Push-Pull app, which has launched today, is available on Android phones. It has been designed to work on the basic smartphones that are being increasingly used by smallholder farmers in Africa. It gives farmers information they need to get started with push-pull farming, and is not only free but will work offline, meaning a lack of internet connection in rural regions will not affect its function. ’At Agape, we built the Push-Pull app as a global tool to equip a farmer with all that is needed for a successful push-pull garden. Embedded with audio, visual and graphical expressions we are certain that the Push-Pull app will be relevant to maize and sorghum farmers worldwide for both today and tomorrow in controlling fall armyworm, *Striga* and maize stalk borer.’

The Push-Pull app can be downloaded on the [Google Play website](https://play.google.com/store/apps). Environment news 11 August 2021

**Botanists name astonishing new species of ‘fairy lantern’ from Malaysian rainforests**

Oxford University scientist, Dr Chris Thorogood, from Oxford Botanic Garden teamed up with Siti-Munirah at the Forest Research Institute Malaysia, and local explorer, Dome Nikong, to describe a strange plant from the depths of the Malaysian rainforest.
So-called ‘fairy lanterns’ (genus *Thismia*) are among the most extraordinary-looking of all flowering plants. These curious, leafless plants grow in the darkest depths of remote rainforests where they are seldom seen. There are some 90 species worldwide, distributed across the forests of Asia, Australasia, South America, and the USA. They all lack true leaves and chlorophyll, obtaining their food from root-associated fungi shared with other green plants. Their mysterious flowers emerge just briefly, and often under leaf litter, so few people are lucky enough to encounter them.

Scientists at Oxford and in Malaysia have just described a species of fairy lantern completely new to science. It was first discovered by rainforest explorer Dome Nikong in 2019 who, astonishingly, found the plant growing along a popular tourist track on Gunung Sarut, a mountain located in the Hulu Nerus Forest Reserve in the state of Terengganu. In February 2020, Dome Nikong was joined by a team of botanists including researcher Siti-Munirah. To their dismay, the only known ‘fairy lantern’ plants had been destroyed by wild boars except for a single fruiting specimen.

Examining the little material collected from the two trips, Siti-Munirah and Dr Chris Thorogood, who is Deputy Director and Head of Science for Oxford Botanic Garden and Arboretum and lecturer at the Department of Plant Sciences, were able to describe and illustrate the new species. They examined the architecture of the flower – its shape, colour and surface characteristics. They found that it has a unique and peculiar orange, lantern-like flower with pillars holding up a so-called ‘mitre’ – an umbrella-like structure, the function of which is a mystery.

Together, the scientists named the plant *Thismia sitimeriamiae* after Dome’s mother Siti Meriam, honouring the support she has given his life’s dedication to conservation work in Terengganu, Malaysia. The plant’s unique and remarkable ‘mitre’, colour and surface texture make *Thismia sitimeriamiae* among the most eye-catching plants ever described from Peninsular Malaysia. Dr Chris Thorogood says, ‘The extraordinary architecture of the flower raises interesting questions about how it is pollinated’.

See also: [https://www.sciencealert.com/enchantingly-strange-fairy-lanterns-discovered-growing-in-a-malaysian-rainforest](https://www.sciencealert.com/enchantingly-strange-fairy-lanterns-discovered-growing-in-a-malaysian-rainforest)

**THESIS**


**Abstract**

In this thesis, a study is made of the different roles that the European mistletoe (*Viscum album subsp. austriacum*) can play simultaneously in a Mediterranean pine forest, and their ecological consequences generating multiple plant–plant and plant–animal interactions in their ecosystem. Due to their hemiparasitic nature, the mistletoe has been traditionally regarded as a host pathogen, causing detrimental effects on growth, morphology, and reproduction. However, recently other ecological interactions that mistletoe establishes in the forest ecosystem have been found to be noteworthy, not only with its host but also with the rest of the community where they live. Consequently, the presence of mistletoe in the forest canopy can cause direct and indirect effects in their ecosystem through trophic and non– trophic relationships, favoring the restructure of community composition. Therefore, this thesis has been split into three main parts examining the role of mistletoe: 1) as a keystone resource for its associated arthropods
(Chapters 1–3); II) as direct competitor with its host (Chapters 4–5); and III) as indirect competitor with host–feeding herbivores (Chapter 6) and facilitator for the herbaceous community (Chapter 7). From a holistic view, it is concluded that mistletoes are keystone species that trigger a series of interactions with important ecological consequences at the community level, causing direct and indirect effects at different trophic levels. This has profound implications for the dynamics of the forest ecosystem, restructuring the entire community, from nutrient dynamics and herbaceous community to primary and secondary consumers. Thus, by simultaneously providing new resources while acting as a competitor and facilitator, mistletoes become ecosystem engineers, building an additional level of heterogeneity to the forest canopy and amplifying biodiversity and complexity in their ecosystem.

ANNUAL REPORT

Annual Report 2019-2020. Society for Cancer Research, Arlesheim, Switzerland: 44pp. Contents include a brief chapter by F. Pelzer on Viscum album therapy for relieving fatigue in cancer, and one by H. Rahm on Christoph Surbeck’s role in cultivating V. album in his apple orchard, specifically for therapeutic research and use, before he died of cancer. Also a look back at Rudolf Steiner’s role in promoting mistletoe use, and a look in to the future of the subject.

COMPOSITE FILES

All issues of Haustorium are available in two PDF documents, ‘Haustorium1-48’ and ‘Haustorium49-80 (shortly to be amended to 49-81) on Lytton Musselman’s Haustorium website - https://ww2.odu.edu/~lmusselm/haustorium/index.shtml - these can be searched for species, author etc.

FORTHCOMING MEETINGS


Bioherbicides 2021 – Overcoming the barriers to adoption of microbial bioherbicides.


GENERAL WEB SITES

For individual web-site papers and reports see: (some websites may need copy and paste.)

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: http://www.parasiticplants.org/
For Dan Nickrent’s ‘The Parasitic Plant Connection’ see: http://www.parasiticplants.siu.edu/
For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/ (may be temporarily unavailable)?
For Old Dominion University Haustorium site: see https://ww2.odu.edu/~lmusselm/haustorium/index.shtml
For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see: http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research
For a description of the PROMISE project (Promoting Root Microbes for Integrated Striga Eradication), see: http://promise.nioo.knaw.nl/en/about
For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/
For the Toothpick Project – see https://www.toothpickproject.org/
For the Annotated Checklist of Host Plants of Orobanchaceae, see: http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm
For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/
For information on the work of the African Agricultural Technology Foundation (AATF) on
Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: [http://www.aatf-africa.org/](http://www.aatf-africa.org/)

For Access Agriculture (click on cereals for videos on Striga) see: [http://www.accessagriculture.org/](http://www.accessagriculture.org/)

For information on future Mistel in der Tumortherapie Symposia see: [http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx](http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx) (NB see above re 7th Symposium)

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: [http://www.vfk.ch/informationen/literatursuche](http://www.vfk.ch/informationen/literatursuche) (in German but can be searched by inserting author name).


**LITERATURE**


Acharya, B.D., Bista, A., Jyawali, S. and Darai, N.K. 2021. Evaluation of non-host crops as trap crops to reduce Orobanche seed bank in tomato fields. Journal of Research in Weed Science 4(3): 210-217. [Capsicum frutescens, Cicer arietinum, Lens culinaris and Vicia faba were classified as highly potential trap crops and reduced seed bank of Phelipanche aegyptiaca by at least 50%]

Adhityo Wicaksono, Sofi Mursidawati and Molina, J. 2020 A plant within a plant: insights on the development of the Rafflesia endophyte within its host. Botanical Review 87(2): 233-242. [Post-germination, the Rafflesia endophyte, within its Tetrastigma host, forms a clonal network of vegetative meristematic cells separated by the dividing host tissue; each meristematic cell cluster eventually developing into the primordial floral bud or protocorm.]

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Aleksandrov, V.V., Aleksandrov, T.B., Cruzado, L.L. and Escamilla, R.J.A. 2021. Controlled transition in a model of biomass dynamics of root hemiparasitic plants. Moscow University Mechanics Bulletin 76: 111–117. [https://doi.org/10.3103/S0027133021040026](https://doi.org/10.3103/S0027133021040026) [‘Showing the possibility of solving the problem of the transition between periodic and point attractors in the bistable Rosenzweig–MacArthur model with modifications for the dynamics of root hemiparasitic plants and their hosts.]

evolutionary relationship of Krameriaeae inferred from phylotranscriptomic analysis. Bangladesh Journal of Plant Taxonomy 27(2): 427-433. [Phylotranscriptomic analyses infer evolutionary relationships of Krameria lanceolata with Tribulus eichleriannus and Larrea tridentata in the family Zygophyllaceae.]


Anton, F.G. and Rîsnoveanu, L., 2020. Sunflower genotypes from Nardi fundulea in field infestation with broomrape in Braiila area, in year 2019. “Ion Ionescu de la Brad”, Romania, 63(1): 91-94. [Identifying sunflower hybrid H19 as the most resistant to Orobanche cumana races G and H at the National Agricultural Research and Development Institute, Fundulea, Romania.]


Asodewine, P.A., Lamptey, S. and Dzomeku, I.K. 2021. Pearl millet-cowpea intercrop effect on Striga hermonthica and grain yield. Indian Journal of Weed Science 53(2): 146-152. [Varieties Akadkom and Naad-kohblug show some tolerance of S. hermonthica and are recommended as sole crops or intercropped with cowpea (1:1) in NE Ghana.]


Atencio, N.O., Vidal-Russell, R., Chackoff, N. and Amico, G.C. 2021. Host range dynamics at different scales: host use by a hemiparasite across its geographic distribution. Plant Biology 23(4): 612-620. [Tristerix corymbosus was studied across 22 localities in Chilean matorral and temperate forest. Aristotelia chilensis was the most parasitized in the temperate forest, with Populus sp. the most in the matorral.]


*Badu-Apraku, B., Obisesan, O., Olumide, O.B. and Toyinbo, J. 2021. Gene action, heterotic patterns, and inter-trait relationships of early maturing pro-vitamin A maize inbred lines and performance of test crosses under contrasting environments. Agronomy 11(7): (https://doi.org/10.3390/agronomy11071371) [Hybrids TZEIOR 4 × TZEIOR 158 and TZEIOR 119 × TZEIOR 158 were outstanding in performance and show promise for possible commercialization to combat malnutrition with tolerance of Striga hermonthica.]
Bandaoud, F., Kim, G., Larose H., Westwood, J., Zermene, N. and Haak, D. 2021. GBS analysis of Orobanche crenata populations in Algeria supports local adaptation and host-specialization. [Authorea: 2021] (DOI: 10.22541/au.163245464.46250620/v1) [Using Genotyping-By-Sequence to study variation across 10 populations of O. crenata and finding some variation according to distance but more pronounced differences across the 5 main hosts, with pea having an SNP profile distinct from faba bean, chickpeas, carrot and tomato.]

Bao GenSheng, Song MeiLing, Wang YuQin, Liu Jing and Wang HongSheng. 2020. (Interactive effects of different densities of Pedicularis kansuensis parasitism and Epichloë endophyte infection on the endogenous hormone levels and alkaloid contents of Stipa purpurea.) (in Chinese) Acta Prataculturae Sinica 29(4): 147-156. [Confirming that infection by the endophyte significantly reduced the damage caused to S. purpurea and could therefore have potential to assist recovery of degraded grassland in the Qinghai Tibet Plateau where P. kansuensis is widely distributed.]

Baráth, K. 2021. Effect of species environment on host preference of Cuscuta campestris. Plant Ecology 222(9): 1023-1032. [The frequency and intensity of C. campestris infestations varied greatly amongst 174 detected host species in Hungary. Frequently parasitized hosts are not necessarily preferred. Most host species have infestations of varying intensity in different species environments.]


*Bascos, E.M.A., Fernando, E.S., Duya, M.V. and Rodriguez, L.J.V. 2021. Beginnings of a plant parasite: early development of Rafflesia consueloeae inside its Tetrastigma host. Planta 254(3): (https://doi.org/10.1007/s00425-021-03710-4) [Infection begins within the vascular cambium where the endophyte appears to initially reside prior to their radial spread to the vascular tissues. The parasite may persist in the host tissues for prolonged periods as small cell clusters without transitioning to the reproductive stage. However, floral shoots may develop in scarcely infected host tissues indicating that extensive endophyte growth within the host is not a prerequisite to the onset of reproductive development.]

Becher, H., Powell, R.F., Brown, M.R., Metherell, C., Pellicer, J., Leitch, I.J. and Twyford, A.D. 2021. The nature of intraspecific and interspecific genome size variation in taxonomically complex eyebrights. Annals of Botany 128(5): 639-651. [Studying genome size in 192 individuals of Euphrasia spp., concluding that there was considerable variation intra- as well as inter-specifically. Diploids varied according to isolation-by-distance, while in tetraploids size increased with latitude in outcrossing E. arctica, but with little genome size variation in the highly selfing E. micrantha. Concluding that genome size was an outcome of polygenic variation affected by hybridization.]

Bellisa, E.S and 15 others. 2020. Genomics of sorghum local adaptation to a parasitic plant. Proceedings of the National Academy of Sciences of the United States of America 117(8): 4243-4251. [Experiments with CRISPR-Cas9-edited sorghum indicate that the benefit of low-stimulant-mediated resistance (apparently associated with the long-term occurrence of Striga hermonthica) strongly depends on parasite genotype and abiotic environment and comes at the cost of reduced photosystem gene expression. Our study demonstrates long-term maintenance of diversity in host resistance genes across smallholder agroecosystems, providing a valuable comparison to both industrial farming systems and natural communities.]


Cai, L., Arnold, B.J., Xi, Z., Khost, D.E., Patel, N., Hartmann, C.B., Manickam, S., Sasirat, S., Nikolov, L.A., Mathews, S., Sackton, T.B., and Davis, C.C. 2021. Deeply altered genome architecture in the endoparasitic flowering plant *Sapria himalayana* Griff. (Rafflesiaceae). Current Biology 31:1002-1011.e1009. [The nuclear genome of *Sapria* has lost 44% of the genes conserved in eurosids. Remaining genes have either very long or very short introns and at least 1.2% of the genome is the result of horizontal gene transfer.]


*Chaudron, C., Mazalová, M., Kuras, T., Malenovský, I. and Mládek, J. 2021. Introducing TGA codes for tryptophan. Perspectives in Plant Ecology, Evolution and Systematics 52: [https://doi.org/10.1016/j.ppees.2021.125633] Reviewing the literature on the impacts of root hemiparasites such as *Rhinanthus* spp. on plant communities, herbivores, predators, pollinators, and soil biota. Concluding that they can be valuable for suppressing grass species and encouraging diversity of plants, pollinators and herbivores; also possibly for suppressing invasive species.]

Chesterfield, R.J., Vickers, C.E. and Beveridge, C.A. 2020. Translation of strigolactones from plant hormone to agriculture: achievements, future perspectives, and challenges. Trends in Plant Science 25(11): 1087-1106. [Reviewing how manipulation of strigolactone signalling can be used when developing new tools and crop varieties to address critical challenges, such as nutrient acquisition, resource allocation, stress tolerance, and plant-parasite interactions.]


Cirocco, R.M., Watling, J.R. and Facelli, J.M. 2020. The combined effects of water and nitrogen on the relationship between a native hemiparasite and its invasive host. New Phytologist 229(3): 1728-1739. [Results suggested that stem hemiparasites such as Cassytha pubescens can better extract resources from hosts (such as Ulex europaeus) when water availability is high, resulting in a greater impact on the host under these conditions. When hemiparasitic plants are being investigated for biocentral control of invasive weeds, they may be more effective in wetter habitats than in drier ones.]

Clapco, S., Martea, R. and Duca, M. 2020. (The relationship between genetic distance and geographical distance in some populations of Orobanche cumana Wallr. from Moldova.) (in Romanian) Știința Agricolă 2020(1): 73-80 [Principal coordinate analysis revealed a clear grouping of populations of O. cumana from central and southern Romania into two clusters, regardless of their race (E-H).]

Clapco, S., Port, A., Wang Chao and Duca, M. 2020. The study of broomrape diversity in different sunflower cultivating countries based on morphological parameters of parasite seeds. "Ion Ionescu de la Brad" Iasi, Seria Agronomie 63(1): 135-140. [Comparing the precise dimensions of Orobanche cumana seed from a wide range of countries showed no significant differences.]


Costea, M., Elmiari, H., Farag, R., Fleet, C. and Stefanović, S. 2020. Cuscuta sect. Californicae (Convolvulaceae) revisited: 'cryptic' speciation and host range differentiation. Systematic Botany 45(3): 638-651. [Molecular methods were used to clarify the C. californica complex in California, finding that that its members displayed different host ranges, and also confirmed a new species C. diffilis differing from C. brachycalyx in subtle calyx lobe and corolla tube shape differences.]

Cuadra-Valdés, J., Vizenin-Bugoni, J. and Fontúrbel, F.E. 2021. An exotic magnet plant alters pollinator abundance and behavior: a field test with a native mistletoe. Biological Invasions 23(8): 2515-2525. [Eucalyptus globulus acts as an exotic magnet species and apparently alters the behavior of the hummingbird that pollinates Tristerix corymbosus (Loranthaceae). Hummingbirds visited mistletoe flowers more frequently early in the morning at the plantations and in the afternoon at the native forests.]

Da Costa-Lim, J.L. and Chagas, E.C.deO. 2021. Typification and synonymy of the Atlantic Forest endemic species Napeanthus primulifolius (Gesneriaceae). Webbia 76(1): 89-95. [Concluding that Pedicularis acaulis is a synonym of N. primulifolius.]


Dancák, M., Hroneš, M. and Sochor, M. 2020. Thismia ornata and T. coronata (Thismiaceae), two new species from Sarawak, Borneo. Willdenowia 50(1): 65-76. [Describing Thismia ornata and T. coronata, the former from several sites in W. Sarawak, and the latter at only one site in N. Sarawak.]

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Du Chao and 10 others. 2020. (Ecological effect for sunflowers furrow film ridge drought-resistant planting technique in Hetao irrigated area.) (in Chinese) Journal of Northern Agriculture 48(3): 55-59. [In this region of NW China, irrigation can lead to salinity/alkalinity problems - lack of irrigation to drought and damage from *Orobanche cernua* (= O. cumana). Mechanical one-time furrow opening, fertilization, plastic film covering the bottom of the trench to the top of the slope, and seed sowing on the shoulder of the slope resulted in improved sunflower yield and reduced *O. cumana.*]  

Duca, M. and Bivol, I. 2021. Discriminating ability of ISSR markers in the revealing of the genetic polymorphism in Turkish broomrape populations. Abstracts, Agribalkan 2021. III Balkan Agricultural Congress, Edirne, Turkey: 297. [Analysis of informativity level and discriminatory capacity for 14 ISSR-markers shows this it is applicable for the assessment of intra- and interpopulation genetic polymorphism for species *O. cumana* from different regions of Turkey.]  


Durlik, K., Żarnowiec, P., Piwowarczyk, R. and Kaca, W. 2021. Culturable endophytic bacteria from *Phelipanche ramosa* (Orobanchaceae) seeds. Seed Science Research 31(1): 69-75. [Isolating Brevibacterium frigortolerans and *Bacillus simplex,* regarded as plant growth-promoting rhizobacteria, from within seeds of *P. ramosa.*]  

*Dvorakova, M., Hyllova, A., Soudek, P., Retzer, K., Spichal, L. and Vanek, T. 2021. Resorcinol-type strigolactone mimics as potent germinators of the parasitic plants *Striga hermonthica* and *Phelipanche ramosa.* Journal of Natural Products 81(11): 2321–2328. [Reporting the synthesis of resorcinol-type strigolactone mimics related to debranones, highly stable even at alkaline pH levels and able to induce seed germination of *Striga hermonthica* and *Phelipanche ramosa* at low concentrations.]  

Efimov, P.G., Yu, K.G., Kuropatkin, V.V. and Popov, E.S. 2021. (Additions to the "conspectus of the vascular flora of Pskov region.") (in Russian) Botanicheskii Zhurnal 106(8): 807-814. [Noting the new occurrence of *Cuscuta campestris.*]  


Evolution: International Journal of Organic Evolution 75(7): 1681-1698. [Analysis of selection on five phenological traits for three generations of Rhinanthus minor at 12 sites across the Canadian Rocky Mountains shows that although selection was weak for most traits, it consistently favored early flowering across the entire gradient rather than only under short seasons.]


Friday, C. and Scasta, J.D. 2020. Checklist of vascular plants for Wind River Indian Reservation (USA) high-elevation basins: ecological drivers of community assemblages. Plant Ecology and Evolution 153(2): 292-311. [Castilleja flava identified as an important component of vegetation.]

Furuhashi, K., Iwase, K. and Furuhashi, T. 2021. Role of light and plant hormones in stem parasitic plant (Cuscuta and Cassysa) twinning and haustorium induction. Photochemistry and Photobiology 97(5): 1054-1062. [Showing that blue light is essential for twinning, and a lower far-red/red light (FR/R) ratio is important for subsequent haustoria induction in both genera.]

*Gao FangLei, Alpert, P. and Yu FeiHai. 2021. [Parasitism induces negative effects of physiological integration in a clonal plant. New Phytologist 229(1): 585-592. (https://doi.org/10.1111/nph.16884) [Testing the hypothesis that clonal integration, which often increases fitness of clonal plants, may decrease when some (but not all) connected ramets within a clone are parasitized. Results indicate that parasitism can cause clonal integration to negatively affect fitness, possibly because parasites can import resources from connected, but unparasitized ramets through signaling.]

Gao FangLei, He QiaoSheng, Xie RuQian, Hou JiaHui, Shi ChenLu, Li JunMin and Yu FeiHai. 202312. Interactive effects of nutrient availability, fluctuating supply, and plant parasitism on the post-invasion success of Bidens pilosa. Biological Invasions 23(10): 3035-3046. [Showing the effect of Cuscuta australis in suppressing the invasive weed B. pilosa (in China) when nutrient availability was low and fluctuating, but not under other nutrient conditions.]

Gebremedhin, Z., Alemayehu, G. and Ayalew, D. 2021. Intercropping different legumes for striga (Striga hermonthica del Benth) management and enhancement of Sorghum productivity in north west Ethiopia. Journal of Crop and Weed 17(1): 1-12. [Comparing sole crop sorghum with the crop inter-planted with legumes soybean, haricot bean, mung bean, and cowpea. All legumes substantially reduced the infestation of S. hermonthica without significantly reducing sorghum yield and improving overall productivity. Cowpea was the most favourable, followed by soyabeans.]


control in processing tomatoes—laboratory and greenhouse studies. Plants 10; (https://doi.org/10.3390/plants10061182)
[Studying, under laboratory and greenhouse conditions, the factors involved in the behavior of soil-herbigated imazapic, and its resulting influence on P. aegyptiaca and tomato plants. Effects on the parasite only occur after absorption by tomato, but its movement to newly formed roots is limited.]


Greifenhagen, A., Braunstein, I., Pfannstiel, J., Yoshida, S., Shirasu, K., Schaller, A. and Spallek, T. 2021. The Phtheirospermum japonicum isopentenyltransferase PJPT1a regulates host cytokinin responses in Arabidopsis. New Phytologist 23(4) 1582-1590. [During parasitism, the Phtheirospermum haustorium transfers hypertrophy-inducing cytokinins to the infected host root. [Identifying the enzyme that induces response to the hypertrophy-inducing cytokinins transferred through the haustorium of P. japonicum to the infected host root.]

Gu Xi, Chen IngGin and Tsai ChungJui. 2021. Plasma membrane phyloquinone biosynthesis in nonphotosynthetic parasitic plants. Plant Physiology 185(4): 1443-1456. [Findings suggest that nonphotosynthetic holoparasites such as Phelipanche aegyptiaca exploit alternative targeting of phyloquinone, normally involved in photosystem I electron transport, for transmembrane redox signaling associated with parasitism.]


*Haan, N.L., Bowers, M.D. and Bakker, J.D. 2021. Preference, performance, and chemical defense in an endangered butterfly using novel and ancestral host plants. Scientific Reports 11(1): (https://doi.org/10.1038/s41598-020-80413-y) [Euphydryas editha feeds on the native Castilleja hispida and C. levisecta, and now on the exotic Plantago lanceolata on which it grows more strongly, but it has retained breadth in preference and ability to use other hosts.]


Haran, J.M. 2021. This study reviews the species of the tribe Smicronychini Seiditz, 1891 found in southern Africa. European Journal of Taxonomy 735: 34-73. [Describing 18 species of Smicronyx and related genera, 12 of them newly described and their association with a number of families including Orobanchaceae.]

Heer, N., Klimmek, F., Kurtogullari, Y., Prati, D., Rieder, N.S., and Boch, S. 2021. Density effects emphasizing its value in exploiting inheritance traits or low germination stimulant production for developing varities resistant to S. hermonthica.]

Heer, N., Klimmek, F., Kurtogullari, Y., Prati, D., Rieder, N.S., and Boch, S. 2021. Density effects of two hemiparasitic Melampyrum species on grassland plant diversity. Tuexenia 41: 411–422. [Intermediate densities of the two hemiparasite species (13 and 40% cover for M. arvense and M. nemorosum) gave the highest total vascular plant species richness.]

*Hegenauer, V. and 19 others. 2020. The tomato receptor CuRe1 senses a cell wall protein to identify Cuscuta as a pathogen. Nature Communications 11(10): (https://doi.org/10.1038/s41467-020-19147-4) [Identifying a glycine-rich protein which serves as a pathogen-associated molecular pattern and specifically binds and activates a membrane-bound immune receptor in the resistant tomato, the Cuscuta Receptor 1, leading to a defence response in resistant hosts.]

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Kara, A. and Ata, E. 2021. (Determination of weed
Kapitonova, O.A. 2020. Additions to the vascular
Kjiang ZhengQiang and 10 others. 2021. Host
Jhu, M.Y., Ichihashi, Y., Farhi, M., Wong, C. and
Hong Truong Luu, Hieu Cuong Nguyen, Huu Dang
Tran, Quoc Dat Nguyen and Tran Quoc Trung
Nguyen. 2020. Balanopora aphylla
(Balanophoraceae), a new holoparasitic species
from Vietnam. Annales Botanici Fennici 57(1/3):
67-70. [From the central highlands of Vietnam, B.
aphylla differs from B. latidepala in features of
tuber, ovary, spadicles and anther cells.]
Jhu, M.Y., Ichihashi, Y., Farhi, M., Wong, C. and
domain* 25 functions as a key regulator of
haustorium development in dodders. Plant
Physiology 186(4): 2093-2110. Analysing the
transcriptome of 6 *C. campestris* tissues and
identifying a key gene, *LATERAL ORGAN
BOUNDARIES DOMAIN 25* (*CcLBD25*) as highly
expressed in prehaustoria and haustoria. And
generating *CcLBD25* RNAi transgenic tomatoes
on which growth of *C. campestris* was reduced.]
Jiang ZhengQiang and 10 others. 2021. Host
sunflower-induced silencing of parasitism-related
[Recombinant tobacco rattle virus vectors were
constructed to express RNA interference inducers
to cause virus-induced gene silencing in
sunflower, resulting in suppression of *O. cumana*
infection. The possible interference mechanism is
also discussed by analyzing RNAi machinery
genes in *O. cumana.]*
Kakpure, M.R. 2020. Some noteworthy plants record
to the flora of Yavatmal district, Maharashtra,
India. Tropical Plant Research 7(3): 604-608.
[Recording *Striga asiatica* and *Orobanche cernua.]*
Kapitonova, O.A. 2020. Additions to the vascular
flora of the Tyumen region, Western Siberia. Acta
Botanica Sibirica 6: 339-355. [Noting *Pedicularis dasystachts.*]
Kara, A. and Ata, E. 2021. (Determination of weed
species, density and frequency of occurrence in the
vineyards of tekirdağ province.) Journal of
Tekirdağ Agricultural Faculty 18(2): 333-343.
[Including observation that *Cuscuta monogyna*
can occur, causing weakening of the vines.]
*Kavuluko, J., Runo, S. and 9 others. 2021. GWAS
provides biological insights into mechanisms of
the parasitic plant (*Striga*) resistance in
sorghum* BMC Plant Biology 21:
(https://doi.org/10.1186/s12870-021-03155-7)
[Describing a wide range of techniques for
assessing mechanisms of resistance to *S.
hermonthica* in sorghum and the genes
involved.]
*Kawada, K., Uchida, Y., Takahashi, I., Nomura, T.,
Triflumizole as a novel lead compound for
strigolactone biosynthesis inhibitor. Molecules
25(23): (https://doi.org/10.3390/molecules25235525)
[Triflumizole reduced the levels of 4-
deoxyorobanchol in root exudates from rice,
inhibiting the enzymatic activity of Os900, a rice
enzyme that converts the SL intermediate
car lactone to 4DO. Treated rice showed reduced
germination of *Striga hermonthica.*]
(Proposition of a large-scale mistletoe inventory
method.) (in Polish) *Sylwan* 164(7): 568-575. [*V.
album* is causing increasing damage to Polish
forests due to increasing drought. An inventory
method involved the assessment of study of
random 15-tree plots.]
*Kefelegn, G.A. and Desta, B. 2021. *Ximenia americana*: economic importance, medicinal
value, and current status in Ethiopia. The
Scientific World Journal 2021:
(https://doi.org/10.1155/2021/8880021)
[Reviewing the status of *X. americana* as a food,
medicine, essential oil source, and industrial
component to other product and noting that its
existence is threatened by deforestation.]
mycorrhizal fungi improved host-plant resistance
against crenate broomrape in faba bean. Asian
Journal of Plant Sciences 20(3): 477-487. [A
mixture of arbuscular mycorrhizal fungi isolated
from a maize rhizosphere in soils in Alexandria,
Egypt, reduced *Orobanche crenata* and
significantly improve growth in both susceptible
Nubaria1, and tolerant Giza843 faba bean
varieties.]
Kosachev, P.A, Yang ZongZong, Chi JianCai, Ma,
M. and Nahmat, N. 2021. Three species of
*Pedicularis* L. (*Orobanchaceae*) new to china
found in Xinjiang. Turczaninowia 24(2): 5-11.
[Describing *P. alatauica, P. compact. and P.
pubiflora.*]
Kösters, L.M., Wiechers, S., Lyko, P., Müller,
application for the research of parasitic
[Introducing the *Web Application for the
Research of Parasitic Plants (WARPP)* as an
online resource dedicated to advancing
research and development of parasitic plant
biology. The initial set of online tools includes
a genome browser that centralizes genomic
information for sequenced parasitic plant
genomes, an orthogroup summary detailing the
presence and absence of orthologous genes
in parasites compared with nonparasitic
plants, and an ancestral trait explorer showing the evolution of life-history preferences along phylogenies.]


Showing that parasitism was shown to produce twice the P. aeruginosa quinoline signal, which was found to transfer to the parasite.]


*Kumar, K. and Amir R. 2021. The effect of a host on the primary metabolic profiling of Cuscuta campestris main organs, haustoria, stem and flower. Plants 10(10): [https://doi.org/10.3390/plants10102098] [Identifying significant differences in the metabolic profiles of C. campestris that developed on the different hosts, Heliotropium hirsutissimum, Polygonum aquifolium and Amaranthus viridis., suggesting that the parasites rely highly on the host’s metabolites, but changes in the metabolites’ contents between the organs that developed on the same host suggest that the parasite can also self-regulate its metabolites.]

*Kurotani, K.I. and 9 others. 2020. Host-parasite tissue adhesion by a secreted type of β-1,4-glucanase in the parasitic plant Phtheirospermum japonicum. Communications Biology 3(7): [https://doi.org/10.1038/s42003-020-01143-5] [Showing that P. japonicum can be grafted on to interfamily species, proving insights into the commonality between parasitism and grafting in plants.]


Lapirov, A.G., Belyakov, E.A. and Lebedeva, O.A. 2021. Effects of duration and conditions of storage on germination of seeds of Pedicularis sceptor-carolinum (Orobanchaceae). Regulatory Mechanisms in Biosystems 12(2): 234-239. [In a study in Russia, best germination of is P. sceptor-carolinum was obtained by storing dry seeds at 2-3°C for 3-6 months. Severe cold (- 26°C) was less favourable.]

Lara, C., Xicohténcatl-Lara, L. and Ornelas, J.F. 2021. Differential reproductive responses to contrasting host species and localities in Psittacanthus calyculatus (Loranthaceae) mistletoes. Plant Biology 23(4): 603-611. [Finding that fruit formation, percentage of fruits formed, and pollen viability were similar regardless of host species or locality.]


Letemariam Desta, Ibrahim Fitiw, Alemu Araya and Dawit Fisseha. 2020. Chlorsulfuron and nitrogen rates effect on striga and sorghum varieties yield at Humera, North West Ethiopia. International Journal of Agriculture and Biosciences 9(2): 74-82. [Concluding that use of variety Deber, combined with chlorsulfuron and nitrogen fertilizer were optimal for yield and control of Striga hermonthica.]


Li JuanJuan, Li Xin, Han Peng, Liu Hui, Gong JianChuan, Zhou WeiJun, Shi BiXian, Liu Ake and Xu Ling. 2021. Genome-wide investigation of bHLH genes and expression analysis under different biotic and abiotic stresses in Helianthus annuus L. International Journal of Biological Macromolecules 189: 72-83. [Concluding that HabHLH024 is a potential candidate gene in breeding sunflower for resistance to Orobanche cumana.]

Li Rongde and 9 others. 2021. Plastid NDH pseudogenization and gene loss in a recently derived lineage from the largest hemiparasitic plant genus Pedicularis (Orobanchaceae). Plant and Cell Physiology 62(6): 971-984. [Investigating the evolutionary dynamics of plastomes in the monophyletic and recently derived Pedicularis sect. Cyathophora. We obtained 22 new plastomes, 13 from the six recognized species of section Cyathophora, six from hemiparasitic relatives and three from autotrophic relatives. NA(D)H dehydrogenase, accD and ccsA have lost function multiple times, with the function of accD being replaced by nuclear copies of an accD-like gene in Pedicularis spp. The study provides evidence for plastome evolution in the transition from autotrophy to heterotrophy.]

Li Xin, Yang JunBo, Wang Hong, Song Yu, Corlett, R.T., Yao Xin, Li DeZhu and Yu WenBin. 2021. Plastid NDH pseudogenization and gene loss in a recently derived lineage from the largest hemiparasitic plant genus Pedicularis (Orobanchaceae). Plant and Cell Physiology 62(6): 971-984. [Investigating the evolutionary dynamics of plastomes in the monophyletic and recently derived Pedicularis sect. Cyathophora. We obtained 22 new plastomes, 13 from the six recognized species of section Cyathophora, six from hemiparasitic relatives and three from autotrophic relatives. NA(D)H dehydrogenase, accD and ccsA have lost function multiple times, with the function of accD being replaced by nuclear copies of an accD-like gene in Pedicularis spp. The study provides evidence for plastome evolution in the transition from autotrophy to heterotrophy.]

Liu WenSheng, Zheng Li and Qi DanHui. 2020. Variation in leaf traits at different altitudes reflects the adaptive strategy of plants to environmental changes. Ecology and Evolution 10(15): 8166-8175. [A study of 3 species, including Pedicularis densisepica in the Yulong Mountains, China, showed leaf length and width decreasing and leaf thickness increasing at higher elevations, helping to reduce transpiration, enhanced internal temperature and improved photosynthesis.]

*Lobulu, J., Shimelis, H., Laing, M.D., Mushongi, A.A. and Shayanowako, A.I.T., Characterization of maize genotypes (Zea mays L.) for resistance to Striga asiatica and S. hermonthica and compatibility with Fusarium oxysporum f. sp. strigae (FOS) in Tanzania. Agronomy 11(5): [https://doi.org/10.3390/agronomy11051004] In a study in Tanzania of 56 maize genotypes with some resistance to Striga spp., resistance was enhanced by combination with F. oxysporum.]


Luminita, B-D. and Ion, N. 2020. Physiological particularities of the species Viscum album L. ssp. album and Loranthus europaeus jack, hemi-parasites on lignuous species from the Comanesti forest, Romania. Annals of the University of Craiova - Agriculture, Montanology, Cadastre


[Discussing the virulence mechanisms of parasitic plants and resistance mechanisms in their hosts, focusing on Orobanche and Striga. Propositions for many mechanisms by which host plants use NLR (nod-like receptor) proteins to activate downstream resistance gene expression. Also discussing use of CRISPR/Cas9-mediated genome editing and RNAi for deeper insight into the life cycle of parasitic plants and potentially for their control.]


[Infestation of V. karroo by Striga significantly increased grass, forb and tree species diversity in the understory.]


[Women farmers were prepared to make larger yield sacrifices for tolerance to drought, Striga resistance and good storability than men. Men showed higher willingness to sacrifice yield for closed tip.]

Martini, F. 2021. (Upgrades to the flora of Friuli Venezia Giulia (NE-Italy), new series. IV (85-117).) (in Italian) Gortania (Botanica, Zoologia) 41: 31-46. [Recording Rhinanthus alectorolophus.]


[Criticising reviews by Freuding et al., 2019, but supportive of that by Loef and Walach (above).]


[Demonstrating that species of populations ascribed to A, campylpopodium could more properly be re-defined as subspp. of Arceuthobium abietinum, Arceuthobium microcarpum and Arceuthobium tsugense.]


*Mirzaei, K. and Wesselingh, R.A. 2020. Development of a large set of diagnostic SNP markers using ddRAD-seq to study hybridization in Rhinanthus major and R. minor (Orobanchaceae). Conservation Genetics Resources 13(1): 31-33. [Selecting 1106 putative loci that contain diagnostic, species-specific SNPs, which can be used for assessing and monitoring hybridization and introgression between R. major and R. minor.]

*Muchira, N., Ngugi, K., Wamalwa, L.N., Avosa, M., Chepkorir, W., Manyasa, E., Nyamongo, D. and Odeny, D.A. 2021. Genotypic variation in cultivated and wild sorghum genotypes in
response to *Striga hermonthica* infestation. Frontiers in Plant Science 12: (https://doi.org/10.3389/fpls.2021.671984) [64 sorghum genotypes including wild relatives screened for resistance to *S. hermonthica*. Three genotypes F6YQ212, GBK045827, and F6YQ212xB35 and one check SRN39 were among the most resistant to *Striga* in both pot and field trials. Identifying new sources of resistance to be included in further breeding.]

*Murakami, R., Ushima, R., Sugimoto, R., Tamaoki, D., Karahara, I., Hanba, Y., Wakasugi, T. and Tsuchida, T. 2021. A new galling insect model enhances photosynthetic activity in an obligate holoparasitic plant. Scientific Reports 11(6): (https://doi.org/10.1038/s41598-021-92417-3) [Results suggest that the gall-inducing weevil Smicronyx madaransus enhances the photosynthetic activity in *Cuscuta campestris*, and modifies the plant tissue to a nutrient-rich shelter for them.]*


*Murillo-Serna, J.S., Roldán-Palacio, F.J., Carmona-Gallego, I. and Alzate, F. 2021. A new species of Aetanthus (Loranthaceae) from Colombia with notes on *A. engelsii*. Candollea 76(1): 71-76. [A. alternifolius* from northeastern Colombia is newly described and illustrated in relation to *A. colombianus* and *A. coriaceus* Patsh. The rediscovery of original material in Paris herbarium of the poorly known Phyllostephanus engelsii (Tiegh.) Engl. is discussed and an identification key is provided to the 10 species of *Aetanthus* occurring in Colombia.]*


*Nagassa Dechassa and Belay Abate. 2021. *Striga* (witchweed) threats to cereal crops production and its management: a review. Advances in Life Science and Technology 88: (10.7176/ALST/88-02) [A general review of *Striga* problems in Ethiopia, with emphasis on *S. hermonthica* and the various control measures that might be applied, including water conservation practices, soil fertility amendment and use of parasitic fungi (*Fusarium oxysporum*) and vesicular arbuscular mycorrhiza.]*

Narukawa, H., Yokoyama, R., Kuroha, T. and Nishitani, K. 2020. Host-produced ethylene is required for marked cell expansion and endoreduplication in dodder search hyphae. Plant Physiology 185(2): 491-502. [Showing that, when Arabidopsis is invaded by *Cuscuta campestris*, ethylene biosynthesis by the host plant promotes elongation of the parasite’s search hyphae and studying the gene expression involved.]

Ndagurwa, H.G.T., Maponga, T.S. and Muvengwi, J. 2020. Mistletoe litter accelerates the decomposition of recalcitrant host litter in a semi-arid savanna, south-west Zimbabwe. Austral Ecology 45(8): 1080-1092. [Leaf litter from *Erianthemum ngamicum*, *Plicosepalus kalachariensis* and *Viscum verrucosum* greatly accelerated the decay of leaf litter beneath their host *Vachelia karroo* releasing nutrients with resultant effects on other organisms within the ecosystem.]


Nikolin, E.G. and Yakshina, I.A. 2021. (Concrete flora of the Chinke and Sobol-Yuryage river basins (Ust-Lensky Nature Reserve, Yakutia).)

Nobis, M. and 24 others! 2020. Turkish Journal of Botany 44(4): 455-480. [Studies with *Cuscuta chinensis* on hosts (unspecified in abstract) showing differences affecting the leaf waxes of paleo-ecological interest.]

*Oblinger, B.W. 2021. Susceptibility of sugar pine, Shasta red fir and sierra lodgepole pine to mountain hemlock dwarf mistletoe (*Arceuthobium tsugense* subsp. *Mertensianae*, Viscaceae) in south central Oregon. Forest Pathology 51(4): [From a survey of trees close to mountain hemlock heavily infested with *A. tsugense* subsp. *metrtensianae*, it was concluded that sugar pine (*Pinus lambertiana*) can be classified as a secondary host, Shasta red fir (*Abies magnifica* var. *shastensis*) and lodgepole pine (*Pinus contorta*) as immune, and Western white (*Pinus monticola*) and whitebark (*Pinus albicaulis*) pines as susceptible.]


Oloyede-Kamiyo, Q.O., Olaniyan, A.B., Abdul-Waheed, J.A. and Akinseye, B.A. 2021. Sources of tolerance to low soil nitrogen in some *Striga* resistant and quality protein maize (*Zea mays* L.) varieties. Korean Society of Crop Science, Suwon, Korea Republic Journal article : Journal of Crop Science and Biotechnology 24(5): 513-520. [25 varieties tested under low N conditions, confirming that *S. hermonithica*-tolerant maize also possesses the ability to tolerate low N.]


*Parker, C. 2021. A personal history in parasitic weeds and their control. Plants 2021, 10(11), (https://doi.org/10.3390/plants10112249) [A self-indulgent record of my career in the subject, prepared under duress!]

Păun, A. and 9 others. 2020. Separation of impurities from the mass of small seeds by using an innovative technology. Conference paper: ISB-INMA TEH 2020 International Symposium, Bucharest, Romania, 30 October 2020: 814-826. [Describing equipment for removing impurities from crop seeds (foreign bodies, remains of seed plants or fruit, soil, stones, dead insects, weed seeds, etc.) including seeds of Cuscuta spp.]

Pawlikowski, P., Dembicz, I., Kozub, L. and Galus, M. 2020. (Orobanche alba subsp. major (Orobanchaceae) - a new species for Mazovia Province in the planned Raj Nature Reserve by Solec and Wisła.) (in Polish) Fragmenta Floristica et Geobotanica Polonica 27(2): 706-709. [Recording a new site for O. alba subsp. major, a parasite of Salvia spp. in Poland.]

Pawlikowski, P., Dembicz, I., Kozub, L. and Galus, M. 2020. (Orobanche alba subsp. major (Orobanchaceae) - a new species for Mazovia Province in the planned Raj Nature Reserve by Solec nad Wisłą.) (in Polish) Fragmenta Floristica et Geobotanica Polonica 27(2): 709-714. [Recording a new site for O. alba subsp. major, a parasite of Salvia spp. in Poland. (Repetition unclear!)]


*Piwowarczyk, R., Ochmian, I., Lachowicz, S., Kapusta, I., Malinowska, K. and Ruraz, K. 2021. Correlational nutritional relationships and interactions between expansive holoparasite Orobanche laxissima and woody hosts on metal-rich soils. Phytochemistry 190: (https://doi.org/10.1016/j.phytochem.2021.112844) [Recording the uptake of a wide range of minerals by Punica granatum and Fraxinus angustifolia and their transfer Orobanche laxissima. The parasite tended to accumulate K and Ca, and heavy metals such as Zn, Ni, and Cd. Also noting the metabolism and accumulation of polyphenols in the parasite.]


Plata, A. and Guzmán-Guzmán, S. 2020. Pollen morphology of Ombrophytum villamariensis (Balanophoraceae). Phytotaxa 472(1): 74-78. [The study revealed the presence of diagnostic characters in the pollen grain such as small size and a circular endoaperture. Unlike other species, only tricolporate pollen grains were observed.]

*Pointurier, O., Gibot-Leclerc, S., Moreau, D. and Colbach, N.. 2021. How to pit weeds against parasitic plants. a simulation study with Phelipanche ramosa in arable cropping systems. European Journal of Agronomy 130: (https://doi.org/10.1016/j.eja.2021.126368) [Using the model PheraSys (see Pointurier et al. 2021 in Haustorium 80) concluding that delayed sowing and trap- and catch-cropping crops should reduce P. ramosa infestation. Also tolerating a low-density weed flora could contribute to reduction, assuming the weeds triggered suicidal germination.]

fruits in cacao infested by the mistletoe *Oryctanthus cf. alveolatus*.


*Raaijmakers, J.*, Getahun Mitiku, Desaign Etalo, KleinGunniewiek, P., Dominika Rybka, Taye Tessema. 2021. Molecular detection and quantification of the *Striga* seedbank in Ethiopian sorghum field soils. Research Square: (10.21203/rs.3.rs-572695/v1) [Describing a method that combines density- and size-based separation techniques with quantitative polymerase chain reaction (qPCR)-based detection of *Striga* seeds in soil allowing high-through-put and accurate mapping of the *Striga* seedbank in physicochemically diverse field soils.]

*Raaijmakers, J.*, Getahun Mitiku, Desaign Woldesenbet Etalo and Taye Tessema. 2021. Molecular detection and quantification of the *Striga* seedbank in Ethiopian sorghum field soils. Research Square: (10.21203/rs.3.rs-572695/v1) [Describing a method that combines density- and size-based separation techniques with quantitative polymerase chain reaction (qPCR)-based detection of *Striga* seeds in soil allowing high-through-put and accurate mapping of the *Striga* seedbank in physicochemically diverse field soils.]

Rabefirasaina, H.J. and 9 others. 2021. Impact of mulch-based cropping systems using green mulch and residues on the performance of advanced mutant lines of maize (*Zea mays* (L.)) under infested field with the parasitic weed *Striga asiatica* (L.) Kuntze in Madagascar. Chapter 24 in: Sivasankar, S. *et al.* (eds) Mutation breeding, genetic diversity and crop adaptation to climate change 2021: 235-242. [Infestation by *S. asiatica* is greatly reduced and yields significantly improved on 3 maize mutants derived from var. PLATA with or without mulching with *Stylosanthes* sp. and interplanting with cowpea.]


*Ramsauer, J.*, Brotons, L., Herrando, S. and Morán-Ordóñez, A. 2021. A multi-scale landscape approach to understand dispersal of the mistletoe by birds in Mediterranean pine forests. Landscape Ecology 2021: (https://doi.org/10.1007/s10980-021-01369-6) [Climatic conditions and % of olive groves were somewhat more important than the presence of seed-dispersing birds, mainly *Turdus* sp. in the distribution of *Viscum album* in Spain.]

Rätzel, S., Hand, R., Christodoulou, C.S. and Uhlich, H. 2021. *Phelipanche chionistrae* (Orobanchaceae): a new holoparasitic species from Cyprus. Candollea 76(1): 77-82. [*P. chionistrae*, parasitic on *Alyssum troodi* is described from highest summit of the Troodos range in Cyprus. Close to *P. rosmarina* and *P. olbiensis* it differs in colouration, structure of calyx and type of indumentum and being restricted to a high-montane serpentine copoenois.]


Rial, C., Tomé, S., Varela, R.M., Molinillo, J.M.G. and Macías, F.A. 2020. Phytochemical study of safflower roots (*Carthamus tinctorius*) on the induction of parasitic plant germination and weed control. Journal of Chemical Ecology 46 (9): 871-880. [Root exudates from safflower found to contain the sesquiterpene lactone dehydrocostuslactone and the structurally related costunolide, known to stimulate germination of *Striga* roots (*S. asiatica* and *S. hermonthica*).]

Rial, C., Tomé, S., Varela, R.M., Molinillo, J.M.G. and Macías, F.A. 2020. Phytochemical study of safflower roots (*Carthamus tinctorius*) on the induction of parasitic plant germination and weed control. Journal of Chemical Ecology 46 (9): 871-880. [Root exudates from safflower found to contain the sesquiterpene lactone dehydrocostuslactone and the structurally related costunolide, known to stimulate germination of *Phelipanche ramosa* and *Orobanche cumana*. These compounds were found to be toxic to *Lolium perenne*, *Lolium rigidum* and...
Echinochloa crus-galli. Solanacol and fabacyl acetate were also identified."

Richards, J.H., Henn, J.J., Sorenson, Q.M., Adams, M.A., Smith, D.D., McCulloh, K.A. and Givnish, T.J. 2021. Mistletoes and their eucalypt hosts differ in the response of leaf functional traits to climatic moisture supply. Oecologia 195(3): 759-771. [Low moisture caused decreases in leaf area and specific leaf area, while C:N ratio, leaf thickness, N per area, and δ¹³C all increased in a eucalypt host, while, thanks to reduced transpiration and abundant succulent leaf tissue, effects were much less in the mistletoes - Amyema miraculosum, A. miquelii, A. pendula, and Muellerina eucalyptoides - all Loranthaceae.]


*Rouamba, A., Shimelis, H., Drabo, I., Laing, M., Prakash Gangashetty, Mathew, I., Mrema, E. and Shayanowako, A.I.T. 2021. Constraints to pearl millet production, causing up to 40% of farmers in the surveyed area ranked infestation as the primary constraint of faba bean. Journal of Soil Science and Plant Nutrition 21(3): 1856-1866. [Claiming useful and specific leaf area, while C:N ratio, leaf thickness, N per area, and δ¹³C all increased in a eucalypt host, while, thanks to reduced transpiration and abundant succulent leaf tissue, effects were much less in the mistletoes - Amyema miraculosum, A. miquelii, A. pendula, and Muellerina eucalyptoides - all Loranthaceae.]

*Sadda, A-S. and 8 others. 2021. The witchweed Striga gesnerioides and the cultivated cowpea: A geographical and historical analysis of their West African distribution points to the prevalence of agro-ecological factors and the parasite’s multilocal evolution potential. Plos One: https://doi.org/10.1371/journal.pone.0254803 [Noting the increasing severity of S. gesnerioides on cowpea across West Africa, apparently associated with intensification of the crop in the driest zones]

Sasal, Y., Amico, G.C. and Morales, J.M. 2020. Host spatial structure and disperser activity determine mistletoe infection patterns. Oikos 130(3): 440-452. [Studies of Tristerix corymbosus on its most common host species in northwest Patagonia. The distribution was determined by the structure of potential host populations and by the activity of the main dispersal agent, the endemic marsupial Dromiciops gliroides. Compared to bird dispersed mistletoes, the scale of the infection was smaller.]


Sawadogo-Illboudo, T.C., Yonli, D., Traoré, H. and Boussim, J. I. 2021. Use of essential oils from local plants as potential bio-herbicides to deplete seeds of holoparasitic Orobancheae from the Caucasus region: relation to species, climatic conditions and nutritional value. Phytochemistry 17: https://doi.org/10.1016/j.phytochem.2020.112510 [A study of the fatty acid composition of 54 samples of Cistanche, Orobanche, Phelipanche, and Phelypea spp. from the Caucasus revealed variation in content from 1 to 42%. 13 fatty acids were identified, Orobanche and Phelipanche showing divergent ratios of n-6 and n-3 fatty acids.]
**Striga hermonthica** seedbank. Journal of Research in Weed Science 4(1): 57-69. [Oils from Cymbopogon citratus, C. nardus and Lippia multiflora inhibited germination of *S. hermonthica* in the lab, while that from *C. citratus* stimulated germination. Practicality of result not clear.]


Scatigna, A.V., Saraiva, R.V C.; Couto, A.F.M., Souza, V.C. and Muniz, F.H. 2020. *Buchnera nordestina* (Orobanchaceae), an overlooked new species from Northeast Brazil, with an updated identification key for *Buchnera* of Brazil. Acta Botanica Brasilica 34(4): 789-795. [B. nordestina is characterized by long bracts, that are usually two times longer than the calyx tube and by the presence of axillary brachyblasts. Also presenting an updated identification key to all species of *Buchnera* from Brazil.]

*Schelkunov, M.I., Nuraliev, M.S., and Logacheva, M.D. 2019. *Rhopalocnemis phalloides* has one of the most reduced and mutated plastid genomes known. PeerJournal: ([https://doi.org/10.7717/peerj.7500](https://doi.org/10.7717/peerj.7500)) [The plastome is 18.6 kb in length with an AT composition of 86.8%]]

*Schelkunov, M.I., Nuraliev, M.S., and Logacheva, M.D. 2021. Genomic comparison of non-photosynthetic plants from the family Balanophoraceae with their photosynthetic relatives. PeerJournal: ([https://peerj.com/articles/12106/](https://peerj.com/articles/12106/)) [The transcriptomes of *Rhopalocnemis phalloides* and *Balanophora fungosa* were compared to three hemiparasites in Santalales *Daenikera* sp., *Dendropemon caribaeus* and *Malania oleifera*. Although the AT content did not differ markedly, the substitution and negative selection rates were several times higher in the holoparasites. Several plastome repair gene transcripts were not detected.]


*Severns, P.M. and Guzman-Martínez, M. 2021. Plant pathogen invasion modifies the eco-evolutionary host plant interactions of an endangered checkerspot butterfly. Insects 12(3): ([https://doi.org/10.3390/insects12030246](https://doi.org/10.3390/insects12030246)) [Recent invasion by the pathogen *Pyrenopeziza plantaginis* (Dermateaceae) is severely damaging *Plantago lanceolata* an important food plant for the pre-diapause larvae of endangered butterfly *Euphydryas editha taylori*, which otherwise depends on the rare *Castilleja parviflora*.]

Shabbaj, I.I., Abdelgawad, H., Tammar, A., Alsiary, W.A. and Madany, M.M.Y. 2021. Future climate CO2 can harness ROS homeostasis and improve cell wall fortification to alleviate the hazardous effect of *Phelipanche* infection in pea seedlings. Plant Physiology and Biochemistry 166: 1131-1141. [Enhanced eCO2 quenched the severity of *P. aegyptiaca* infection on pea by diminishing the number and biomass of *P. aegyptiaca* tubercles.]

Shen GuoJing, Liu Nian, Zhang JingXiong, Xu YuXing, Baldwin, I.T. and Wu JianQiang. 2020. *Cuscuta australis* (dodder) parasite eavesdrops on the host plants’ FT signals to flower. Proceedings of the National Academy of Sciences of the United States of America 117(37): 23125-23130. [Biochemical analysis revealed that host-synthesized FT flowering signals are able to move into dodder stems, where they physically interact with a dodder.
flowing transcription factor to activate C. australis flowering.]


Shugute Addisu and Gebrekidan Feleke. 2021. Distribution and importance of Striga hermonthica on tef [Eragrostis tef (Zucc.) Trotter] in Tigray regional state of Ethiopia: a preliminary survey. International Journal of Agriculture and Biosciences 10(3): 69-73. [In a survey in 2016/17, 90% of tef fields were infested by S. hermonthica at elevations of 1500 to 2500 m.]


*Sisou, D., Tadmor, Y., Plakhine, D., Ziadna, H., Hübner, S. and Eizenberg, H. 2021. Biological and transcriptomic characterization of pre-haustorial resistance to sunflower broomrape (Orobanche cumana) in sunflowers (Helianthus annuus). Plants 10(9): [Identifying genes β-1,3-endoglucanase, β-glucanase, and ethylene-responsive transcription factor 4 (ERF4). These genes were previously reported to be pathogenesis-related in other plant species.]


Sivaramakrishna, P., Yugandhar, P., and Ekka, G.A. 2021. A new species Dendrophthoe ilaljii (Loranthaceae) infesting Artocarpus heterophyllus Lam. (Moraceae) in Andaman and Nicobar Islands, India. Journal of Asia-Pacific Biodiversity 14:452-459. [This new species is described and a key to the 8 species found in India is given.]

Škorić, D., Jošta-Păcureanu, M., Gorbachenko, F., Gorbachenko, O. and Maširević, S. 2021. Dynamics of change in broomrape populations (Orobanche cumana Wallr.) in Romania and Russia (Black Sea area). Helia 44(74): 1-14. [390 sunflower genotypes were studied over four localities in Romania infested by O. cumana suggesting that some new individuals were occurring beyond races G and H. In a further screen of 10 hybrids, only Hy-7 was resistant at all 5 locations. Further screening in Russia again confirmed the occurrence of a new race. Results suggest a permanent change in variability of broomrape populations can be confirmed practically year after year.]

Smith, J.D., Johnson, B.I, Mescher, M.C. and de Moraes, C.M. 2020. A plant parasite uses light cues to detect differences in host-plant proximity and architecture. Plant, Cell and Environment 44(4): 1142-1150. [Results indicate that Cuscuta epilinum can discriminate minute differences in R:FR signatures corresponding to host proximity and shape. This keen sensory ability underpins its sophisticated foraging behaviour and highlights the broader importance of light cues in plant ecology.]


Dendrophthoe pentandra and Viscum articulatum infested C. fistula, while Macrosolen tetragonous, Scurra atropurpurea and Viscum ovalifolium infested other species.


Sosnovsky, Y., Krasylenko, Y. and Nachychko, V. 2021. Viscum meyeri (Viscaceae)-a new name for Viscum anceps, an old-established mistletoe species endemic to Southern Africa. Phytotaxa 523(4): 284-290. [The reason being that ‘V. anceps’ is the basionym for the presently accepted name Phoradendron anceps.]


[In a pot experiment, ground fresh material added to soil at equivalent of 15-22 t/ha reduced emergence of O. cumana on sunflower. White mustard best, with 47% reduction, other brassicas 20-30%.


[This study explored plastome genetic diversity, located genetically variable hotspots, and proposed several regions as potential DNA barcodes in the taxonomically difficult genus Taxillus.]

Su YaJie, Du Lei, Yun XiaoPeng, Bai QuanJiang, Tian XiaoYan and Ge Tong; Du Chao. 2020. (Effects of soaking with autumn irrigation and overwintering on the seeds germination of sunflower parasitic Orobanche cumana in the Yellow River Irrigation Districts of Bayannur.) (in Chinese) Journal of Northern Agriculture 48(4): 100-104. [Annual irrigation of fields in Inner Mongolia for 5 years reduced germination of O. cumana to zero after 3 years, while germination of non-irrigated seeds were still 70% after 5 years.]


Suetsugu, K. 2021. No evidence of pollination mutualism between the holoparasitic plant Mitrastemon yamamotoi Makino (Mitrastemonaceae) and its herbivore Assara balanophorae Sasaki & Tanaka, 2004 (Lepidoptera: Pyralidae). The Pan-Pacific Entomologist 97 (1): 1-5. [The moth genus Assara is a brood-site pollinator of Balanophora, however, observations of Mitrastemon showed these moths carry few pollen grains and feeding by the pyralid larvae on the plant significantly lowered seed viability.]


[Survey of 23 populations of V. coloratum in NE China showed more red-morphs at high latitudes and more yellow-morphs at low latitudes and proposing two non-exclusive hypotheses - the food-finding strategies hypothesis, and the ecological-fitting hypothesis to explain the patterns observed.]


[Opines originating from Agrobacterium, are found in natural genetically transformed organisms, also in tobacco and Cuscuta spp.]

Teixeira-Costa L, Davis CC (2021) Life history, diversity, and distribution in parasitic

Temam Gemeda Genemo 2021. Optimizing bioethanol production from Striga hermonthica using yeast (Saccharomyces cerevisiae) as a fermenting agent. American Journal of Bioscience and Bioengineering 9(3): 93-97. [Concluding that treating fresh S. hermonthica material with 1% sulphuric acid is economically viable for production of ethanol.]

Thorogood, C.J., Teixeira-Costa, L., Ceccantini, G., Davis, C and Hiscock, S.J. 2021. Endoparasitic plants and fungi show evolutionary convergence across phylogenetic divisions. New Phytologist 232(3): 1159-1167. [Endoparasites spend their entire life cycles within the tissues of other plants, except when briefly emerging to flower and set seed. They occur in 4 distinct families, in 8 genera including e.g. Rafflesia and Cyttinus. This paper reviews their life history, anatomy, and molecular genetics, noting convergence with fungi at molecular and physiological levels.]


Trabelsi, I. Thebi, S., Amri, M., Kharrat, M. and Abbes, Z. 2020. (Study of the behavior of some Tunisian varieties of chickpea towards Orobanche foetida.) (in French) Annales de l'INRAT 93: 65-77. [A study of 9 Tunisian varieties of chickpea showed Nayer, Nour and Bouchra to have good resistance to O. foetida, mainly thanks to low stimulant exudation.]

*Vanhaverbeke, C. and 13 others. 2021. Untargeted metabolomics approach to discriminate mistletoe commercial products. Scientific Reports 11: (https://doi.org/10.1038/s41598-021-93255-z) [Viscum album mistletoe extracts were examined using LC-(HR)MS/(MS) and 1H-NMR. Composition was primarily driven by the manufacturer/preparation method rather than the different host trees. These differences in composition may affect immunostimulation and anticancer activities.]


patterns of local adaptation along climatic gradients between a sympatric parasitic and autotrophic tree species. Molecular Ecology 29(16): 3022-3027. [A study based on the hemiparasite Nyusitas floribunda and sympatric autotroph Melaleuca raphiophylla in Western Australia.]

Wang, D., Yu, H. and Chen, G. 2020. Scent chemistry and pollinators in the holoparasitic plant Cynomorium songaricum (Cynomoriaceae). Plant Biology 23(1): 111-120. [In a study in Inner Mongolia, 42 volatiles were identified in inflorescences of C. songaricum including compounds known as typical carrion scents, such as p-cresol, indole, dimethyl disulphide and 1-octen-3-ol which attracted Musca domestica and other Diptera for pollination.]

Wang YuPei, Yao Ruifeng, Du Xiaoai, Guo Lvjun, Chen Li, Xie DaoXin and Smith, S.M. 2021. Molecular basis for high ligand sensitivity and selectivity of strigolactone receptors in Striga. Plant Physiology 185(4): 1411-1428. [The Striga hermonthica hyposensitive to light (ShHTL) protein ShHTL7 shown to have high affinity for F-box protein AtMAX2 and interacts with AtMAX1 to confer very high sensitivity to strigolactones.]


Wenzell, K.E., McDonnell, A.J., Wickett, N., Fant, J.B. nd Skogen, K.A. 2021. Incomplete reproductive isolation and low genetic differentiation despite floral divergence across varying geographic scales in Castilleja. American Journal of Botany 108(7): 1270-1288. [A study of Castilleja sessiliflora and C. purpurea, characterized by high diversity in floral colour which is not well supported in phylogenetic analyses. Concluding that patterns of genetic distance in C. sessiliflora suggest species cohesion maintained over long distances despite variation in floral traits, while in the C. purpurea complex, divergence in floral color across narrow geographic clines may be driven by recent selection on floral colour.]


*XiaoXin Ye, Meng Zhang, McErlean, C.,P and YongQing Ma. 2021. Nitrogen and phosphorus supply strongly reduced the control efficacy of maize against sunflower broomrape. Archives of Agronomy and Soil Science: (https://doi.org/10.1080/03650340.2021.2004586). [Confirming the value of maize as a trap crop in reducing O. cumana in the following sunflower crop. The effect was increased by N, and particularly P, applied to the maize. There was also an indirect benefit through increased abscisic acid.]


*Xu XueHong, Li WenJun, Shomurodov, O. and Niu ShuKui. 2020. [Thesium longiperianthium (Santalaceae), a new replacement name for T. brevibracteatum P.C.Tam. Biodiversity Data Journal 8: e59007. (https://bdj.pensoft.net/article/59007)]


Yoda, A. and 11 others. 2021. Strigolactone biosynthesis catalyzed by cytochrome P450 and sulfotransferase in sorghum, New Phytologist 232(5): 1999-2010. [Showing that Low Germination Stimulant 1 gene in sorghum uses a sulfo group to catalyze leaving of a hydroxyl group and cyclization of 18-OH-CLA, a unique biosynthetic pathway that confers Striga-resistance to sorghum and is not found in other plant species.]

Yoneyama, K. and Brewer, P.B. 2021. Strigolactones, how are they synthesized to regulate plant growth and development? Current Opinion in Plant Biology 63: (https://doi.org/10.1016/j.pbi.2021.102072) [A review discussing how, in the light of recent transcriptomics and reverse genetic techniques, the various (more than 30) strigolactones so far characterized, are synthesized and what their structural diversity means for plant growth and development.]

Yoshimura and 11 others. 2020. Total synthesis and biological evaluation of zealactone 1a/b. Helvetica Chimica Acta 103(4): (https://doi.org/10.1002/hlca.202000017) [Describing the total synthesis of zealactone 1a/b using a [2+2]-cycloaddition strategy and a chemoselective Baeyer-Villiger oxidation to forge the γ-butyrolactone fragment. Also describing the biological activities of zealactone 1a/b on corn and in soil in comparison with related synthetic analogues.]

Yu, R., Sun, C., Liu, Y., and Zhou, R. 2021. Shifts from cis-to trans-splicing of five mitochondrial introns in Tolypanthus maclurei. PeerJournal: (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8489412/260) [The mitogenome of T. maclurei (Loranthaceae) was sequenced and assembled into a circular chromosome of 256 kb in size containing 33 protein coding genes, three rRNA and 10 tRNA genes. One group I and 23 group II introns were seen as well as five cis-to trans-splicing introns, rare phenomena in angiosperms.]

Yudina, S.V. nd 11 others. 2021. Comparative analysis of plastid genomes in the non-photosynthetic genus Thismia reveals ongoing gene set reduction. Frontiers in Plant Science 12: (https://doi.org/10.3389/fpls.2021.602598) [Demonstrating how a gradual loss of genes shapes the miniaturized plastomes of 18 Thismia spp. where the plastome is reduced to 14-18 kb, loosing genes such as accD, ribosomal protein genes, rRNA and tRNA. Different clades of Thismia have undergone further gene loss (complete absence or pseudogenization).]


Diversity 13: 470-479. [Showing that the presence of mistletoe (Viscum album and/or V. cruciatum) increases the range of insects, including Cacopsilla visci and many others.]

Zare, A. and Porameri, Z. 2021. Breaking of physical dormancy and evaluation of environmental factors on seed germination of field dodder parasite (Cuscuta campestris). Iranian Journal of Seed Science and Technology 10(2): 1-13. [Confirming that 30 minute soaking in sulphuric acid and temperature of 25-35°C as optimal for germination of C. campestris seeds. There was no dependence on light.]


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PRESIDENT’S MESSAGE

Dear IPPS members

The previous issue of Haustorium was distributed amidst Covid problems around the world. Fortunately, since then we have been slowly going back to normal, at least as far as Covid is concerned. Moreover, for the first time in 3 years we were able to have a World Congress on Parasitic Plants (WCPP) again, on location in Nairobi, Kenya. The meeting was wonderful, and it was so great to see many IPPS members and be able to discuss our work again in person. I want to thank Damaris Odeny and Steven Runo for the fantastic organization. For details on the meeting see the report by Lytton Musselman elsewhere in this issue. I am happy that I can also already announce the next WCPP, which will be held in Nara, Japan, in June or July 2024. Keep an eye on www.parasiticplants.org for details and more information on this meeting.

In addition to the WCPP meeting in Nairobi, in the past year the IPPS organized an on-line monthly seminar series (see report by Luiza Teixeira in this issue). This was a great success with often over 50 participants. The IPPS wants to continue to host these online seminars throughout 2022-2024 until the next World Congress on Parasitic Plants. If you or one of your students wants to contribute to these seminars, please drop a line to Jonne Rodenburg at j.rodenburg@greenwich.ac.uk.

To keep the IPPS website lively and up to date we have several dynamic features, such as a Scopus and Google Scholar feed reader showing publications on parasitic plants that are refreshed every couple of days, a Twitter feed showing IPPS as well as #Parasiticplants hashtagged tweets and the option for IPPS members to post news. Please check them out on www.parasiticplants.org! To post news yourself, login into the member area where you can post your most recent paper or project funding, as well as job vacancies. I would also greatly appreciate if you’d update your profile, with your picture and that of your institution and with a short description of your research area.

If you are reading Haustorium but are not an IPPS member yet, consider becoming a member, see www.parasiticplants.org for details and an online membership fee payment option. We use these fees to run the society and to support the organization of the WCPP and its attendance by young researchers from developing countries. Membership entitles you to a reduced fee for WCPP attendance and gives you access to the member area of the IPPS website. If you are a member but did not pay your membership fee, please do so here.

Finally, I am happy to see that this issue of Haustorium again has a great selection of parasitic plant related news. See for example the articles on ‘Natural super glue from mistletoe berries’ and the intriguing sounding ‘Don’t make mistakes about our misunderstood, mysterious mistletoes’. Enjoy reading!

I wish you all a successful academic year 2022-2023.

Harro Bouwmeester
IPPS President

FROM YOUR EDITORS

Our apologies for the lateness of this issue, due to a variety of reasons. Future issues may also fail to follow a regular schedule and may take a modified format which will be apparent next time. But we shall endeavour to keep you informed and entertained on the latest happenings in the fascinating sphere of parasitic plants. Read on!

MEETING REPORTS

The 16th World Congress 16th World Congress on Parasitic Plants, Nairobi, Kenya 10-15 July, 2022.

Over one hundred participants from around the world attended (in person or online) the meeting held at the Eka Hotel in Nairobi, Kenya. Thirty-one years ago, the Fifth Symposium on Parasitic Plants was held in Nairobi and the progress in understanding these remarkable plants since that time is stunning.

The more than forty presentations (some presented virtually) and twenty-four posters covered several groups of parasites and a diversity of research approaches. As usual, the majority of the papers dealt with the parasitic weeds in the genera Cuscuta, Orobanche, and Phelipanche, and Striga. Emphasis on the latter was important because of the impact of witchweeds on cereal crops in Kenya and it was encouraging to see the coterie of young African scientists working on this problem.

Strigolactones received due coverage clearly indicating the remarkable importance of this recently discovered group of plant hormones which help us understand the mechanisms of communication between host and parasite.
Perhaps more than any of the many parasitic plant meetings I have participated in the last half-century, this congress included significant contributions to the understanding of the genus *Hydnora* (the ‘insane asylum of plants’) and other lesser studied parasites like *Cistanche* and *Cynomorium*. Mistletoes garnered two presentations. Thus, there was a good balance between agronomically important parasites and botanically fascinating parasites. There are other groups that need attention, and we can look forward to learning more about the Mitrastemonaceae, Balanophoraceae and more in the asylum at future meetings.

As a long-time student of haustoria, I was excited to hear talks on the role of primary and secondary haustoria, the transcriptome’s role in development of the host-parasite xylem bridge, and more. Genomic studies and sophisticated microscopy are among the tools that elucidated these findings.

There were several genomic and phylogenetic studies on the importance of the evolution of parasites—and the evolution of parasitism—that can provide information identifying points of intervention for control.

Despite reams of elegant and sophisticated studies on witchweeds and broomrapes, it is generally agreed that little has been done to staunch the damage inflicted on the crops raised by small-holder farmers. But many of the studies reported at the meeting clearly indicate a resolve to develop impactful, sustainable control measures like the push-pull system and the toothpick and suicidal germination methods. In mechanized farms, herbicides are practical and there we heard reports on their efficacy and history of use.

A field trip took participants to Embu west of Nairobi to see *Alectra vogelii* in the field.

The discoveries and programs generated spirited discussion and palpable excitement. Having all the sessions plenary, generously punctuated with coffee breaks, lunch, and dinners facilitated this. We were treated to a banquet at the well-known Nairobi Carnivore Restaurant, an appropriate name for people working with parasites, where further discussions ensued over crocodile, ostrich, and other delicacies preceded by a review of the history of our society and symposia.

The full programme and abstracts are available at https://www.parasiticplants.org/wcpp-

meeting/16th-world-congress-on-parasitic-plants-nairobi-kenya/

All of the meetings, socials, field trip, registration, lodging, travel and visa assistance were graciously proffered by our hosts, Damaris Odeny of the International Centre for Research in the Semi-Arid Tropics (ICRISAT) and Steven Runo of Kenyatta University, and the officers of IPPS.

Lytton John Musselman

IUFRO Division 7 (Forest health, Pathology, and Entomology). Technical Session: Parasitic flowering plants in forests. Lisbon, Portugal, 2022 6-9 September 2022.

Organizers: David Shaw, David Watson, Tod Ramsfield and Luiza Teixeira.

The IUFRO Parasitic Flowering Plants in Forests working group, had an oral session at the Division 7 meeting of the International Union of Forest Research Organizations. The meeting was attended by from Australia, Belgium, Brazil, Chile, Germany, and USA.

Relevant papers presented:
Luiza Teixeira-Costa et al.: Leveraging parasitic flowering plant collections to understand and monitor impacts of global (see full paper at https://doi.org/10.1111/2041-210X.13866)
Francisco Fonturbel et al.: Geographic context outweighs habitat disturbance effects in explaining mistletoe population (see full paper at https://doi.org/10.1111/mec.16337)
David Shaw et al.: Transformation of western hemlock (*Tsuga heterophylla*) tree crowns by dwarf mistletoe (*Arceuthobium tsugense*, Viscaceae) (see full paper at https://doi.org/10.1111/efp.12664)
Max Mylo et al.: How the European mistletoe attaches to its host—Biomechanics and functional morphology of their persistent connection (see full paper at https://doi.org/10.1093/jxb/erab518)
Gregorio Ceccantini et al: Fruit and seed dispersal of *Phoradendron quadrangulare* (Santalaceae) by birds in urban areas of the city of São Paulo: a parasite may enhance the conservation of a threatened bird
David Watson et al.: Functional roles of mistletoe in a warming world (see full paper at https://doi.org/10.1146/annurev-ecolsys-102320-115331)

Abstracts for each talk and a complete list of authors can be found at https://iufro-
invasive species in southern Australia. Also, a special issue of the journal Botany, on mistletoes, will include some of these, as well as several others, due in May 2023.

Luiza Teixeira-Costa.

Conference - Overcoming the barriers to adoption of microbial bioherbicides, Bari Italy, 26-28 September, 2022. Several papers related to parasitic weeds. A special issue of Pest Management Science is planned by the end of the year, containing peer reviewed articles prepared after the conference.

PROFILE

CASSYTHA SPECIES

(The following is an edited version of the Introduction to the paper by Zhang H., Florentine, S. and Tennakoon, Kushan, 2022. The angiosperm stem hemiparasitic genus Cassytha (Lauraceae) and its host interactions: a review, recently published in Frontiers in Plant Science 06 June. References are not included here but can be checked in the original article at https://doi.org/10.3389/fpls.2022.864110.)

Despite a large body of research on the biology of root hemiparasites regarding the Scrophulariaceae and Santalaceae species, plus, mistletoes of families Loranthaceae and Viscaceae, and the stem holoparasites Cuscuta, a notable exception is stem hemiparasitic genus Cassytha. Being stem-parasitic vines, Cassytha and Cuscuta behave similarly and are often referred to together or represented inadvertently as Cuscuta. However, Cassytha is a hemiparasite whilst Cuscuta is a holoparasite, and they actually differ in many aspects such as the action of the haustorium, their stem appearance, and life span. Study on Cassytha has been relatively neglected, leading to it being less well characterized compared to its companion Cuscuta. Cassytha, belongs to the sub-family Cassythoideae, the family Lauraceae and the magnoliid clade. Cassytha filiformis has been exploited for medicines, cosmetics, ropemaking, and cushioning in the Pacific Islands, and is treated as an important medicinal plant both in China and Nigeria. C. filiformis and Cassytha glabella have been treated as sources of bush tucker and medicines by the Australian Aboriginals, and Cassytha pubescens has the potential to be used as a biocontrol agent for alien invasive species in southern Australia. Cassytha pondoensis is recognized as a medicinal plant in Angola whilst C. pubescens, Cassytha melantha, Cassytha racemosa, Cassytha pomiformis, and C. filiformis contain alkaloids and C. filiformis, C. pubescens, and Cassytha capillaris contain essential oils. The Cassytha grouping contains 19 species according to The Plant List, 16 of which occur in Australia. There are 13 species endemic to Australia, one being pantropical (C. filiformis), one extending into Assam, Borneo, Lesser Sunda Islands, Malulu, New guinea, and Vietnam (C. capillaris), and one also being found in New Zealand (C. pubescens). The other three species are endemic to Africa (Cassytha ciliolata and C. pondoensis) or Thailand (Cassytha larsenii). It has been reported that C. capillaris also occurs in Indonesia and China, which has not been confirmed. Cassytha pergracilis was an endemic species found in Japan. However, it is not recorded in Global Biodiversity Information Facility and is recognized as a synonym of C. glabella in The Plant List. Cassytha muelleri, Cassytha paniculata, and Cassytha phaeolasia were recorded as species in the Flora of Australia that follows the Australian Plant Census, but they are treated as synonyms of C. racemosa and C. pubescens, respectively. As a widespread pantropical species, C. filiformis has been more extensively studied than other species of this genus. However, a group of scientists from South Australia has recently investigated the potential of using native C. pubescens to control the alien invasive shrubs Ulex europaeus and Cytisus scoparius. For other species in the Cassytha genus, there are relatively few taxonomic studies and field investigations concentrating on species in certain habitats, with few empirical studies. For example, the cuticular character of all the Cassytha species and the stem and systematic anatomy of C. ciliolata, C. filiformis, C. glabella, C. melantha, and C. pubescens has been studied. The chlorophyll content and photosynthetic characteristics of C. ciliolata and C. filiformis in South Africa and the seasonal fluctuations in pigment chemistry of C. glabella and C. pubescens in Australia have also been investigated. However, the Cassytha–host interactions of any of these species have not been reviewed. We suggest that a detailed interpretation of Cassytha–host interactions are important to allow an understanding of their complex interactive biology and to allow us to build up a relatively detailed picture of the co-physiological behavior of these parasite–host associations. Further, parasites have a great impact on plant
communities even though they might contribute a minor component in the mix, and a single parasite may seriously influence a large portion of an ecosystem. Hence, the understanding of Cassytha–host interactions can also help to control the damage induced by these parasites in both agriculture and natural settings. In addition, it may be possible to utilize these stem parasites to control invasive weeds and use them separately for raw material and medicinal purposes. In this review, we summarize currently available information on Cassytha–host interactions focusing on its parasitic nature and worldwide distribution, identifying host range and preference, noting the impacts of Cassytha on host species and understanding the overall responses to the changes in climate, viable control strategies under heavy infestations and its sustainable utilization. We also identify gaps in current knowledge of this area and suggest future study directions deemed necessary for Cassytha–host interactions.

Kushan Tennakoon, Zhang H. & Florentine, S. Federation University, Australia

PROJECTS

CRP Success Story: Mutation Breeding for Resistance to Striga Parasitic Weed in Cereals for Food Security (D25005)

A recently completed five-year IAEA Coordinated Research Project (CRP) (D25005) has helped experts from 12 countries to identify novel sources of resistance to the devastating parasitic weed Striga in cereals with efficient protocols, which help them to reduce production constraints and improve food security.

Host plant resistance is the most tangible control measure of Striga. This can be achieved through nuclear applications by inducing novel sources of genetic variation for the development of resistant varieties of vulnerable food crops. The CRP on Mutation Breeding for Resistance to Striga Parasitic Weed in Cereals for Food Security (D25005) targeted mutation breeding using physical mutagenesis for broadening resistance to Striga in sorghum, maize and upland rice. It focused on the development or adaptation of screening protocols for Striga resistance in the field, greenhouse and laboratories, and integration of efficiency enhancing technologies.

The CRP attracted experts from 12 research teams from cereal improvement programmes and Striga biologists from several countries. The overall objective of the CRP was to support generation of novel sources of variation, using mutation breeding, by developing efficient screening protocols for Striga resistance in cereals for improvement of food security in Member States. To achieve this goal, the following four specific research objectives were established:

1. Develop, optimize and validate technology packages for screening of mutant populations for resistance to Striga in major cereals.
2. Integrate efficiency enhancing techniques for rapid generation of genetic diversity in major cereals (doubled haploid, rapid cycling & genomics).
3. Generate genetic diversity to develop resistant varieties to Striga infestation.
4. Enhance capacity in efficient mutation breeding for resistance to Striga in Member States.

The CRP has achieved these planned targets as shown by the following examples:

- Three field, four greenhouse and six laboratory protocols were developed, validated and used by participating Member States to induce and characterize novel variation in the targeted crops (sorghum, maize and upland rice). Efficiency enhancing technologies such as rapid generation cycling, doubled haploid, metabolomic and genomic are developed/adapted and used in the characterization of the identified mutants and acceleration of the breeding programme. Four to six generations of sorghum could be produced in one year, reducing the time to deliver advanced mutant lines in two years instead of five to seven years using the conventional approach. 64 induced mutants were identified with resistance/tolerance to S. hermonthica or asiatic in sorghum, maize and upland rice.
- At least three of the verified mutants from each crop were advanced to field evaluation for possible release in three of the participating countries (Burkina Faso, Madagascar and Sudan) to ensure sustainable production under Striga prone fields.
Capacity building: In addition to targeted individual training within the context of the CRP for more than 20 individual fellows/interns at the Plant Breeding and Genetics Laboratory, six MSc and six PhD students conducted their studies in collaboration with participating Member States and the Plant Breeding and Genetics Laboratory.

The CRP was implemented by the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture using six research and two technical contracts, and four agreements. Five of the participating contract holders in the CRP were from Africa, three from Asia, two from Europe and two from USA. An additional indication of the CRP’s success was that it generated 12 peer-reviewed publications and ten conference proceedings. Furthermore, additional papers are in the pipeline. A book compiling twelve chapters of the optimized protocols during the CRP is planned to be published under Springer Nature Open Access publications.

The CRP improved human capacity and the developed resistant mutant lines in the major cereals are expected to generate tangible impact on sustainable production and food security in Striga-prone areas in Africa and part of Asia. Experts involved in the project recommend the following for the best utilization of the results generated by the CRP:

- Official release of resistant lines developed in sorghum, rice and maize through IAEA technical cooperation (TC) projects for wide use by farmers (BK5019, BKF2020005, MAD5025, MAD5026).
- Support of a regional project (TC or specially funded) to test advanced resistant/tolerant lines in Striga-prone countries of Africa for their wide utilization.
- Wide dissemination of technology packages for resistance screening developed by the CRP to affected Member States through TC projects to combat the devastating parasite.

Abdelbagi M.A. Ghanim, IAEA Department of Nuclear Sciences and Applications

*Striga Solutions: Protecting the food security and livelihood of millions by combating the spread of Striga in sub-Saharan Africa.*

Pearl millet is a staple food for African smallholder farmers, ranked 6th as the world’s most important cereal crop. Currently, uncontrolled *Striga hermonthica* infestation is causing significant losses in cereal production, affecting crop yields of cereals equating to at least $7 billion each year. *Striga Solutions* aims to significantly enhance pearl millet production for smallholder farmers, while supporting rural agriculture and economic development in sub-Saharan Africa. To meet this goal, we’ve developed efficient hormone-based methods that hold promise for a significant reduction of *Striga* seedbank and are working on identifying genetic targets for breeding and generating *Striga*-resistant pearl millet varieties.

Led by Professor Salim Al-Babili from King Abdullah University of Science and Technology (KAUST), the *Striga Solutions* team is comprised of experts from the Middle East, Europe, Africa, and Asia. These teams are studying plant hormones and their function in order to increase the yield of crops, plant performance, and food security worldwide. The aim of Professor Al-Babili’s research is to generate crops with improved agricultural performance and enhanced nutritional value. Professor Al-Babili has long-standing experience in engineering biofortified crops, such as Golden Rice, and in elucidating metabolic pathways. His group is currently working on basic and translational aspects of plant metabolism and hormone research, with focus on developing hormone-based chemistries to combat the root parasitic plant *Striga*, identifying novel small molecules regulating crop resilience and performance, and on the metabolism and functions of the plant hormone strigolactone. In addition, he is establishing molecular toolkits required for genetic engineering and gene editing of pearl millet, towards improving the resistance and performance of this nutritious and highly important cereal for arid and hot regions.

*Striga Solutions* is looking for talented and experienced individuals who have a desire to make a positive impact in the world. If you’re interested in joining our team, please email us to learn more about open positions.

*Striga Solutions* is a multidisciplinary project led by the BioActives Lab, Center for Desert Agriculture (KAUST) and funded by the Bill & Melinda Gates Foundation and King Abdullah University of Science and Technology (KAUST). As visionary donors, we thank them for their engagement to preserve life, and to eliminate poverty and food insecurity around the world.
ERC Proof of Concept grant to control witchweed infection in maize

Harro Bouwmeester received a Proof of Concept Grant funded by the European Research Council (ERC) for the project LGSMAIZE. With this grant we will test whether it is possible to genetically modify African maize genotypes so they become resistant to parasitic witchweeds. This can be an enormous asset in the fight against witchweed. The parasitic witchweeds pose an enormous threat for production of cereal crops, such as maize, especially in the African continent. Witchweed seeds can lay dormant in the soil until their germination is triggered by strigolactones that are exuded by the roots of maize. In our research, we found a North-American cultivar that is resistant to witchweed, but is not adapted to the African climate. It carries a mutation altering the composition of the strigolactones which results in less germination, and less witchweed infection. Together with researchers, Pooja Bhatnagar and Amos Alonya of the International Maize and Wheat Improvement Center (CIMMYT) we will test whether mutating this gene in African maize genotypes will result in the same result. This will also be tested in the field in Kenya to test this in a relevant agricultural setting. If this works, this will create a new opportunity to control witchweed infection in maize in Africa. The ERC Proof of Concept competition is open only to ERC grantees. Worth €150,000 each, the grants will be used to explore the commercial or societal potential of the results of grantees research projects. This funding is part of the EU’s research and innovation programme, Horizon Europe. Find an overview of the 55 recipients of this ERC Proof of Concept call here on the ERC website.

Harro Bouwmeester, September 19, 2022

IPPS awards Honorary Fellowship to five members

At the occasion of the 16th World Congress on Parasitic Plants held 3-8 July 2022 in Nairobi, Kenya, the IPPS has awarded Honorary Fellowships Julie Scholes, Dan Nickrent, Abdelgabar Babiker (posthumous), Jonathan Gressel and Barach Rubin. They received this award for their service to the society and their important contributions to the parasitic plant science field.

SOME PARASITIC PLANTS OF RWANDA—DECORATION OR DAMAGE?

Parasitic plants have received little attention in Rwanda. Two species of *Striga* are known and cause considerable crop loss in some regions. *Striga hermonthica* occurs in the southern part of the country where it has been reported to damage grains. I have seen *S. asiatica* in the vicinity of the village of Mbyo where families told me they had to stop growing maize because of the damage. In one field the farmer grew legumes for twenty years and then planted sorghum which was severely damaged by the witchweed.

Broomrapes, species of *Orobanche*, have not been reported to be a serious problem, interesting because of the widespread cultivation of potatoes and cole crops, well known hosts for some broomrape species and a serious constraint to the growth of these crops especially in the Mediterranean region.

There are several species of dodders, *Cuscuta*, in the country but like broomrapes they appear to be of limited importance.

* Cuscuta kilimanjari, is given its name because it was first described from Mount Kilimanjaro. It is widespread in East and Central Africa and is distinct with its rigorous growth and bright color. I have never seen Kilimanjaro dodder on a native host except in South Sudan.
The most common hosts are introduced ornamental shrubs, especially bougainvillea (*Bougainvillea spectabilis*) and *Duranta erecta* (golden dewdrop or pigeon berry). I was always amazed the way the parasite grew more or less evenly on the top of the trimmed shrubs. Turns out the dodder is planted on the top of the hedge! Just how and when this is done remains to be determined but to my knowledge it is the only example of a dodder grown as an ornamental. The burst of bright yellow strands is undeniably appealing.

But this beautiful parasite needs to be monitored. I found it on numerous shrubs of *Isambe*, a cultivar of cassava (*Manihot esculenta*) grown for its leaves which are used to prepare a popular food. It is apparently not grown commercially but rather as a home garden tree. Will it attack other cultivars of cassava? The proverbial further research is needed.

**Should gorillas be concerned?**

*Orobanche minor*, small broomrape, is found throughout much of East Africa and parasitizes a diversity of hosts. Of particular interest in Rwanda is its parasitism of *Peucedanum linderi*, wild celery, a main food of mountain gorillas.

Small broomrape parasitizing wild celery in a garden of plants favored by mountain gorillas. The broomrape is just above the yellow leaf, dying as a result of parasitism. Ellen DeGeneres Campus of the Dian Fossey Gorilla Fund, Northern Province.

**In Search of the Furtive Hydnora**

For many years I have been studying this genus including its ethnobotany, how it is used by local people. *Hydnora abyssinica* has been collected in Rwanda so I was interested to know it is used as a medicine as it in numerous other places in Africa. When I described the medicinal use of the plant for stomach upsets, she immediately responded that her mother had given some terrible tasting medicine when she was a child based on my description of the bitterness and color. While her response was visceral, she helped me search in several markets for the plant but to no avail.

Lyton J. Musselman

With thanks to Tom Allen and Rosine Ndayishimiye for encouragement, logistical support, and information.
Dorota Kawa (UC Davis) - *Mechanisms of microbe-induced resistance to Striga in sorghum.*

*Sorghum bicolor* is one of the most important cereal crops in the world, predominantly grown in sub-Saharan Africa by smallholder farmers. Despite its outstanding resilience to the abiotic stresses, around 20% of sorghum yield is annually lost on the African continent due to the infestation with the parasitic weed *Striga*. Existing Striga management strategies often show low efficiency and are not easily integrated into current agricultural practices. Microbial-based solutions may prove an effective, low-cost mode for reducing *Striga* parasitism in sub-Saharan Africa. We identified a field soil whose microbiome component suppressed *Striga* infection. This soil microbiome promotes endodermal suberization as well as formation of aerenchyma, both coinciding with fewer *Striga* attachments to sorghum root. Moreover, in a presence of microbes we observed a depletion of haustorium inducing factors (compounds essential for *Striga* to establish the host-parasite association) and an increased level of the products of their degradation. With modeling approach, we predicted which microbial strains reduce *Striga* parasitism via identified mechanisms. Our results provide a framework for high-throughput screening of individual microbial isolates that can potentially elicit *Striga* resistance.

March 2, 2022.

Luiza Teixeira (Hanse-Wissenschaftskolleg, Germany) - *New perspectives in haustorium structure and evolution across parasitic flowering plants*

Parasitic flowering plants are characterized by the development of an organ known as haustorium, which has evolved in multiple independent angiosperms clades. The haustorium has also been deemed ‘the most plastic of organs’ due to its ability to accommodate physiological and anatomical differences between the parasite itself and its host plants. This is achieved through the development of vascular connections, which involve the differentiation of various specialized cell types by the parasite. The development, structure, and evolution of the haustorium and the connections it fosters are reviewed here considering all 12 parasitic plant lineages. A multi-level comparison between ‘model’ parasitic plants, such as Orobanchaceae and *Cuscuta* species, with members of often neglected groups, such as Lennoaceae, Mitratsumonaceae, and Santalales yields the idea of a shared general body plan of the mature haustorium. This proposed haustorium bauplan is composed of an upper part, including structures associated with mechanical attachment to the host body, and a lower part, including all parasitic tissues and cell types within the host body. The analysis of multi-level convergence is also applied here to the comparison between haustoria and other plant organs. Considering the structure, molecular development, and functionality of this organ under the framework of continuum and process plant morphology, I propose the interpretation of haustoria as morphological misfits.

Runxian Yu (CAS, Beijing) – *The minicircular and extremely heteroplasmic mitogenome of the holoparasitic plant Rhopalocnemis phalloides*

The plastid and nuclear genomes of parasitic plants exhibit deeply altered architectures, whereas the few examined mitogenomes range from deeply altered to conventional. To provide further insight on mitogenome evolution in parasitic plants, we report the highly modified mitogenome of *Rhopalocnemis phalloides*, a holoparasite in Balanophoraceae. Its mitogenome is uniquely arranged in 21 minicircular chromosomes that vary in size from 4,949 to 7,861 bp, with a total length of only 130,713 bp. All chromosomes share an identical 896 bp conserved region, with a large stem-loop that acts as the origin of replication, flanked on each side by hypervariable and semi-conserved regions. Similar minicircular structures with shared and unique regions have been observed in parasitic animals and free-living protists, suggesting convergent structural evolution. Southern blots confirm both the minicircular structure and the replication origin of the mitochondrial chromosomes. PacBio reads provide evidence for chromosome recombination and rolling-circ cle replication for the *R. phalloides* mitogenome. Despite its small size, the mitogenome harbors a typical set of genes and introns within the unique regions of each chromosome, yet introns are the smallest among seed plants and ferns. The mitogenome also exhibits extreme heteroplasmity, predominantly involving short indels and more complex variants, many of which cause potential
loss-of-function mutations for some gene copies. All heteroplasmic variants are transcribed, and functional and nonfunctional protein-coding variants are spliced and RNA edited. Our findings offer a unique perspective into how mitogenomes of parasitic plants can be deeply altered and shed light on plant mitogenome replication.

April 6, 2022.

Satoshi Ogawa -Orobanchaceae parasitic plants use strigolactones as chemo-attractants for host tropism

A major characteristic shared by parasitic plants is the ability to connect to host plants and acquire nutrients and water from them. To this end, parasites can locate host plants and grow toward them prior to infection. However, the molecular mechanism of such host tropism remains largely elusive in Orobanchaceae parasitic plants such as Striga spp., which causes multibillion-dollar economic loss annually in agriculture. To study host tropism, I selected the model facultative root parasite Phtheirospermum japonicum, a member of the Orobanchaceae. I show that P. japonicum exhibits chemotropism to strigolactones (SLs). Chemotropism to SLs is also observed in S. hermonthica but not in non-parasitic plants, suggesting that chemotropism to SLs might be Orobanchaceae parasite-specific strategy for parasitism. Chemotropism to SLs in P. japonicum is repressed by ammonium in the medium, where the perception of SLs remains but the downstream asymmetrical accumulation of an auxin transporter PIN2 is lost. I also show that among the seven KAI2d homologs encoded in the genome of P. japonicum, at least two receptors are able to recognize exogenous SLs. Expression of a dominant-negative form of KAI2d suppresses chemotropism to SLs. This study provides a novel function of SLs as chemoattractants for Orobanchaceae parasitic plants.

May 4, 2022.

Michael Axtel (Pennsylvania State University) - Molecular Evolution and Transcriptional Control of Trans-Species microRNAs from Cuscuta campestris

Plants can receive functional short interfering RNAs (siRNAs) and microRNAs (miRNAs) from pathogens, parasites, symbionts, and other plants. Little is known about the molecular evolution or transcriptional control of such ‘trans-species’ small RNAs in any system. The obligate parasitic plant Cuscuta campestris expresses over 100 distinct miRNAs that specifically accumulate at the interface between parasite and host. These miRNAs are detectable inside of host tissues suggesting they can move some distance in the recipient organism. Many of these C. campestris miRNAs have been shown to target host plant messenger RNAs (mRNAs) for silencing. Targeted host mRNAs often encode proteins that function in defense responses, hormone responses, and vascular system functions. C. campestris is a generalist that successfully parasitizes diverse host plants. Expression of C. campestris trans-species miRNAs are not host-specific; the same set of miRNAs are induced, with identical kinetics, regardless of host species. C. campestris trans-species miRNAs can also be induced in haustoria (the parasitic organ that attaches to hosts) from parasites grown in the absence of any host plant at all. C. campestris trans-species miRNAs preferentially target extremely conserved regions of host mRNAs. The miRNAs also often are expressed as a constellation of polymorphic sequence variants, with polymorphisms occurring to compensate for synonymous site variation in host mRNAs. This is strong evidence that C. campestris trans-species miRNAs have been selected to maintain targeting to certain host transcripts. The loci that encode the primary transcripts of C. campestris trans-species miRNAs all have a common ten base-pair promoter-proximal sequence motif. This upstream sequence motif (USE) is not found at canonical miRNA-encoding genes of C. campestris or in any other plants. The USE promotes trans-species miRNA accumulation, and thus is a positive cis-acting regulatory element specific for trans-species MIRNA genes. The USE and other sequence features of C. campestris trans-species MIRNA loci strongly suggest transcription by RNA polymerase III. This is previously unknown for plant MIRNA transcription; Pol II has been shown to transcribe canonical MIRNA loci in plants. Our working hypothesis is that coordinated, USE-dependent Pol III transcription distinguishes C. campestris trans-species miRNAs from canonical miRNAs. It may allow them to be specifically exported from the parasite, as opposed to being used within C. campestris tissues.
A Toothpick Revolution: Small scale farmers in Africa lead in a novel bioherbicide for Striga.

Claire Sands Baker & David Sands

Using biology to fight biology in one of the biggest battles against weeds globally, the Toothpick Project’s bioherbicide innovation utilizes a local plant disease to effectively kill Striga (witchweed), Africa’s worst pest threat to food security. Developed by Dr. David Sands, Montana State University, the novel technology brings together two concepts: amino acid inhibition and biocontrol with the host-specific plant pathogen, Fusarium oxysporum. After twelve years of research and development in Kenya, including five years of regulatory processes, the resulting bioherbicide product, Kichawi Kill, was approved for full commercial use in Kenya in November 2021. In 2018, the project selected and trained a team of scientists from a dozen other sub-Saharan countries - in anticipation of expansion beyond Kenya. The innovation is participating in the ICGB effort to harmonize biocontrol regulation in the SADC. Based on the novel innovation, the potential for food security and economic development, and the new opportunity to challenge the dominant synthetic herbicide market, the company has received recent awards including: Milken-Motsepe AgriTech Prize Finalist; World Food Program Sprint 2022; UN Best Small Business Good Food for All Winner 2021; IFT Seeding Solutions Finalist 2021; UNDP Cultiv@te 2021; MacArthur Foundation Bold Solutions Network: Top 100 (2020); Gates Foundation Grand Challenges Exploration 2013. The mission of the Toothpick Project is to create and implement a biological solution for small scale farmers battling Striga (witchweed), the worst pest threat to food security in Africa. Globally, we envision a shift in pest management, mobilizing safer, more effective technology through biocontrol.

OBITUARIES

Siny ter borg

We are sad to report that that Dr Sina Jacoba (Siny) ter Borg passed away on 6 February 2022, in Wageningen, the Netherlands at the age of 85. Siny ter Borg was born in the Northern part of the Netherlands. She was very much encouraged and stimulated by her grandfather, a local alderman on education in her municipality, to take an academic education. Accordingly, after high school, she took on a study in Biology, specialization Plant Ecology, at the University of Groningen. She very much enjoyed her study, became student-assistant, and completed her study in a short period of time. After completion of her study, she was appointed at the same University, working in the field of plant ecology. In 1962, she visited the University of Bangor (Wales) for a couple of months. Back in Groningen, she followed the example of her father, who had obtained a doctor’s degree, and started her doctoral study on ‘Rhianthus, a hemi-parasitic plant species’. She completed and defended her dissertation in 1972.

In 1982, she was asked to join Wageningen University to strengthen the Plant Ecology Group. She accepted and worked at Wageningen University with huge pleasure. She had a great passion for her work, both research and education, and was very committed. She carried out her work with great diligence, also investing ample time in proper documentation of her findings. After her pension she kept visiting the University and made use of an office made available to her. Here she completed the organization of the huge amount of data collected throughout her career and completed some further papers based on those data.

She used her expertise in plant ecology not only in her academic career, but also put it to the benefit of Society. In Groningen, the Province of her birth, she advised on how to successfully turn agricultural land back to nature.
Siny has always been a very active and respected member of the ‘parasitic plant’ community. She enjoyed travelling abroad and was a regular delegate at the meetings organized by IPPS and preceding organizations, and was a contributor at the very first founder meeting in Malta, 1973. She put a lot of effort into supervision of students working on their MSc- and PhD-thesis and was especially committed to students from abroad. Through her membership of the church, she financially supported students from African countries to be able to follow their master and doctoral studies in the Social Sciences at Wageningen University. She also was an active member of organizations that stimulated the position of women in science and society. We will miss a creative, warm and knowledgeable colleague, with an open eye for people who could use some additional support. May she rest in peace.

Aad van Ast, Lammert Bastiaans and Chris Parker

Dr Gospel Oluoch Omany

Our colleague Gospel Omany, who passed away on 16 June 2019 at age 51 after a short illness, was a plant geneticist and Africa’s frontier seed systems expert with decades of combined work experience, mostly spent as a practitioner of technology deployment at AATF where he worked for 15 uninterrupted years, maintaining his exceptional focus and productivity up to the time of his death.

The diversity of responsibilities that Gospel took on at AATF and in his prior professional life was simply extraordinary, as were the intelligence, energy, enthusiasm, and collegiality he brought to all of them. Gospel smiled all the time, often joking that this was because his name literally translated to ‘good news’. Uniquely multilingual, Gospel was fluent in English, French, German and Kiswahili, an attribute that enabled him make friends from all over the world, including those he worked so hard to support – farmers.

Hired by AATF in 2005 as Geneticist and Seed Systems Manager, Gospel would have a trailblazing career that saw him serve in the positions of Projects Manager, Seed Systems Manager, Seed Stewardship Manager rising to become Senior Manager for Deployment and later on as Technology Lead and Coordinator for the Technologies for African Agricultural Transformation (TAAT) Maize Compact.

A Kenyan who grew up in Nairobi, Gospel studied for his bachelors and master’s degrees in plant Breeding at the University of Nairobi. He later earned a doctorate in Agricultural Sciences from the University of Hohenheim in Germany before debuting as research coordinator for millet and sorghum at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Niamey, Niger. His research speaks for itself as the list of his contributions, comprising publications, monographs and press articles and credentialed key note presentations, run into pages.

For us at AATF, his close colleagues, professional colleagues in the TAAT Program and across the world, what Gospel brought to our work was not only a first-class mind, a deeply informed focus on some of the most important issues at the intersection of technology and deployment nexus, an admirable commitment to seed delivery, a mind-boggling stamina for work, and his exceptional standing as a global leader in crop technology diffusion. He was also a wonderful colleague – warm, ever upbeat and enthusiastic, always ready to consider seriously the views of others, always looking for ways to contribute to a better world, a prosperous Africa. We shall surely miss him. May the Almighty God rest his soul in eternal peace and grant his immediate family the fortitude to bear this great loss.

AATF, 2019.

Abdul Gabar Babiker 1949-2022

When I was asked to say a few words in memory of my friend and fellow strigologist, Abdul Gabbar Babiker, I did not expect all the
accolades and affection that speakers at this meeting rightly gave him, even having a presentation dedicated to him. I spent a lot of time with him when I lived in Sudan and he was an invaluable help to me in my research, so I was saddened to hear of his death on June 5th of this year at the age of 73. I knew Abdul Gabbar for many years, he was a guest in my home in Virginia and I enjoyed his hospitality at his house in Wad Medani, Sudan, a home, by the way, which is the only one I have visited with a tile floor ruptured by *Hydnora abyssinica* which he was proud to point out to me despite the damage.

He was an intrepid researcher, always developing new hypotheses, aggressively learning new techniques. While he spent most of his career at the Agricultural Research Center in Wad Medani, he also directed numerous theses and published about 120 papers of which sixty or so dealt with *Striga* and fifteen with *Orobanche*.

Abdul Gabbar started his international activity with doctoral studies in Scotland. He received his PhD at the University of Glasgow after which he spent considerable time in laboratories in the United States, Japan, and Germany.

Abdul Gabbar was a friend and encourager to all strigologists as is clearly evident from the many times his assistance has been mentioned by scientists from different nations at this congress. In his enthusiasm he was always eager to help a researcher. I well remember how he would greet me excited by some new finding or some new idea, ‘Musselman [as he called me] I just found a new activity for ethylene’. Despite infrastructure challenges at that time, he kept up with current literature and was always eager to share this information with me and anyone else.

Once the eminent parasitic plant researcher, Johann Visser, was staying at my house and Abdul Gabbar came to stay at the same time. I told him that our small house with a family of six meant he would have to stay in the same room as Johann. ‘Musselman’, he exclaimed, ‘I can’t stay in the same room with a South African!’ When I explained the alternatives, he grudgingly acceded and by morning was engaged in animated discussion with Johann, adding another collaborator to his expanding list of contacts.

While he researched a diversity of other plants, he was at heart a true strigologist to the end. His last publication I am aware of appeared in 2020.

Abdul Gabbar is survived by his wife, Selwa, two daughters and a son. In the traditional Sudanese expression of condolence, we can say ‘Barakah fiki’.

Lytton John Musselman.

**PRESS REPORTS**

**CSIR-Crops Research Institute releases 5 new maize varieties**

The Crops Research Institute, under the Council for Scientific and Industrial Research has received approval for the release of five new improved hybrids of maize for cultivation and consumption in Ghana. The new hybrids, fortified with Pro Vitamin A, would serve as an alternative source of the vitamin for consumers who are unable to patronize animal-sourced vitamins. The approved five maize hybrids are high yielding capacity, drought resistant, early maturing, and high Vitamin A content. This follows their approval from the National Varietal Release and Registration Committee under the Ministry of Food and Agriculture.

Consumption of low content nutrient cereals, root and tuber crops contributes partly to the high prevalence of Vitamin A deficiency in Ghana

With Vitamin A deficiency resulting in stunted growth and weakened immune system, maize, a major staple food in Ghana, has been found to be a feasible resort to address the situation.

Lead Researcher, Dr. Mrs. Priscilla Francisco Ribeiro said the newly approved hybrids would help reduce malnutrition and improve the livelihood of farmers. ‘One of the varieties is early maturing (110-120 days), has Pro
Vitamin A and is Striga-tolerant. Maize farms are usually attacked by the pest known as Striga which eventually causes the farmer to abandon its farm to rot. However, this new hybrid would reduce malnutrition in many homes as well as improve the farming activity of many farmers,’ he said. The five new hybrids are enriched with various food nutrients and improves vision, good for poultry and livestock feed with averagely 5.5 to 8.1 tons of yields per hectare.

Chairman for the National Varietal Release and Registration Committee, Seth Osei-Akoto revealed that the hybrids after being subjected to careful and scientific scrutiny have been approved for commercial production and use. ‘The Committee has eventually approved 5 out of the 8 seeds presented before it for the Seed Council to gazette for commercial use,’ he said.

Emmanuel Bright Quaicoe
23 December 2021

**African scientists lead the Continent’s gene editing research.** (abridged)

Research using gene editing technology is being undertaken on the continent largely by African scientists to provide solutions for Africa, according to a panel of scientists and regulatory experts. Their work is drawing upon the efficiency and precision of gene editing to restore staples that African farmers prefer, like banana and sorghum, they said. The goal is to support food security and better incomes for farmers, especially in the face of climate change challenges. The panel of scientists included Dr. Leena Tripathi, director of Eastern Africa for the International Institute for Tropical Agriculture; Prof. Steven Runo, associate professor at Kenyatta University in Nairobi, and Josphat Muchiri, deputy director technical services at Kenya National Biosafety Authority (NBA). They made their observations in a recent Alliance For Science Live webinar, in which they noted that gene editing can improve Kenya’s food security. ‘Gene editing is valuable in addressing problems associated with plant diseases and climate resiliency in Africa,’ Tripathi said.

Runo, a botanist fascinated with plants, initially had no idea he would be conducting gene editing research or working on sorghum. However, his passion for solving Kenya’s agricultural problems led him to obtain his PhD in plant genetics and molecular biology. He eventually moved into applying gene editing to combat the *Striga* weed in sorghum. Traditional control measures, such as crop rotation, intercropping and hand weeding, are ineffective over time. Runo’s collaborative research focuses on conferring resistance to this parasitic weed by editing the low germination stimulant 1 (LGS1) gene in sorghum. (see below). This will potentially increase yield and nutrition for millions of people in Africa, he said.

When asked about the cost of the gene-edited sorghum products to farmers, the scientists affirmed that the improved products will be sold at the same price as conventional crops.

The technique is also being used to develop disease-resistant banana varieties, focusing on banana bacterial wilt, fusarium wilt and banana streak virus.

Muchiri, speaking on the regulatory status of gene-edited products, assured participants that these products are safe for humans and the environment. ‘As the National Biosafety Authority, we have set up a regulatory framework to monitor this technology as it advances,’ he explained. ‘The Kenyan regulatory framework is transparent and offers the researchers an opportunity to engage with NBA, the early consultation process, where we determine whether the technology will be regulated or not based on presence of foreign DNA.’ ‘We are confident in the future of the technology and the opportunities it presents for increasing income for farmers and feeding millions of people,’ Muchiri said.

This webinar was moderated by Doris Wangari, a biotechnology regulatory expert in Kenya.

Modesta Abugu and Doris Wasngari, Alliance for Science.

**Scientists release new, weed-resistant sorghum variety** (extract)

Prof Steven Runo, an associate professor at Kenyatta University, said the *Striga*-smart sorghum has been developed through the modern technology of gene editing. Gene editing is the use of naturally occurring molecular scissors to improve crops and animals’ interaction with the environment for better traits such as weed resistance.

Speaking during a virtual media science café on the deployment of *Striga* Smart Sorghum in Kenya, Runo said science and technology have the potential to increase food productivity in Africa. He said that Calestous Juma, the late
Kenyan scientist and scholar, once said that weeds have done more harm to Africa than colonialism. This is because weeds always come back immediately after they are uprooted. The variety was tested in Busia, Kisumu and Homa Bay Counties where the weed is common. ‘There is a lot of potential in agricultural technology and we need to harness it. African scientists must do this and must leverage partnerships with other countries to be able to use and harness technologies for crop improvement,’ said Runo.

**Researchers gain insights into the genome of European mistletoe.**

Researchers around the world are working on decoding the genomes of plants. Detailed knowledge on biochemical processes in plants can provide important contributions to agriculture, environmental protection and medicine. A team of researchers from Leibniz University Hannover (LUH) has now succeeded in gaining insights into the genome of European mistletoe, *Viscum album*. Mistletoe is a semi-parasitic evergreen flowering plant that grows on branches of various trees and is characterized by a very special life cycle. Moreover, mistletoe is known for its special secondary compounds, which are used in the treatment of numerous diseases. However, the genome of mistletoe could not be analyzed so far due to its exceptional size. With around 90 billion nucleotides—the basic building blocks of the genome—the mistletoe genome is approximately 30 times larger than the human genome.

In order to analyze the mistletoe genome, scientists around Lucie Schröder, Dr. Hans-Peter Braun and Dr. Helge Küster from the Institute of Plant Genetics at LUH used a trick: The genome, which consists of DNA, was not analyzed directly. Instead, transcripts of the genome (RNAs), which code for the mistletoe's proteins, were isolated and transcribed into DNA using enzymes. The resulting shorter DNA molecules could then be subjected to systematic sequence analysis. This way, the researchers were able to determine more than 39,000 mistletoe gene sequences and predict corresponding protein sequences. For the first time, they succeeded in making a systematic inventory of which proteins and thus enzymes occur in *V. album* and which metabolic pathways this plant can perform. Among them are numerous known enzymes that are generally important for life processes in plants, but also special mistletoe proteins, such as viscosotoxins and viscolectins, which are considered to possess significant medicinal potential. Furthermore, the researchers were able to demonstrate that the DNA of the protein-coding sections of the mistletoe genome is characterized by a particularly high stability compared to the DNA of other flowering plants. This could contribute to the stress resistance properties of mistletoe.

‘We can learn a lot from studying parasites and semi-parasites since they do not have to carry out all life processes themselves,’ explains Dr. Hans-Peter Braun. ‘If certain structures are missing, it becomes clearer what they are good for and how exactly they function.’ Mistletoe, for example, has a special respiratory mechanism. Studying this mechanism could also contribute to a better understanding of malfunctions of the respiratory chain in humans and animals during diseases.

The results of the research project were recently published in the British scientific journal *The Plant Journal* (Schröder, L., *et al.* 2022. *Plant Journal* 109(1): 278-294.) The project can initially be seen as the beginning of a systematic molecular characterisation of mistletoe, since so far only a small part of the DNA sequences determined could be evaluated. In order to encourage further analyses, a public database has been set up in which more than 39,000 gene sequences can be accessed. The researchers anticipate that the use of this database will greatly promote future research activities relating to this extraordinary plant. The database is available at [viscumalbum.pflanzenproteomik.de/](viscumalbum.pflanzenproteomik.de/)

Leibniz Universität Hannover

**Scientists uncover the distribution and physiological role of planteose**

Planteose (a storage carbohydrate) metabolism is a possible target for root parasitic weed control. In a previous research Associate Professor Atsushi Okazawa and his collaborators revealed that planteose metabolism was activated after perception of strigolactones (a class of plant hormones that stimulate branching in plants and the growth of symbiotic arbuscular mycorrhizal fungi) in germinating seeds of *Orobanche minor*. Nojirimycin (a potent inhibitor of α-glycosidase) inhibited planteose metabolism and impeded seed germination of *O. minor*, indicating that planteose metabolism is a possible target for root parasitic weed control.
In a more recent study, this team of scientists based at Osaka Prefecture University, investigated \( \alpha \)-galactosidases (AGALs) activities during seed germination of \( O. \ minor \). They also studied planteose distribution in the dry seeds using matrix-assisted laser desorption/ionization-mass spectrometry imaging.

Planteose was found in tissues surrounding the embryo but not within it, indicating that it may have a role as a storage carbohydrate. Biochemical experiments and molecular characterization of a \( \alpha \)-galactosidase family member, OmAGAL2, indicated the enzyme is involved in planteose hydrolysis in the apoplast around the embryo after the perception of strigolactones to provide the embryo with essential hexoses for germination. These results indicated that OmAGAL2 is a potential molecular target for root parasitic weed control.

Mass spectrometry images obtained for two fragment ions were almost identical, indicating that these fragment ions were all generated from a single source, planteose. The authors also provided visual aids demonstrating that planteose is distributed in the endosperm, perisperm and seed coat in the dry seeds of \( O. \ minor \), which coincides with its role as a storage carbohydrate.

In summary, the discovery of this study elucidates that (i) planteose is distributed in \( O. \ minor \) dry seeds and its physiological role is elusive, (ii) during seed germination of root parasitic weeds, planteose is rapidly hydrolyzed after perception of strigolactones (SLs), which is indicative of its role as a storage carbohydrate (iii) tissues surrounding the embryo, namely the endosperm, perisperm, and seed coat, play roles in nutrient supply in root parasitic weeds. Moreover, the novelty of this study lies in the fact that, for the first time, the authors visualized the distribution of the storage carbohydrate (planteose) in seeds of a root parasitic weed.

Osaka Prefecture University

**Rare native mistletoe found in eastern BOP**

NZ’s three beech mistletoe species are semi-parasitic plants which host on native beech trees or tawheowheo. They are best known for their brilliant displays of red flowers in summer. All are considered under threat largely a result of sustained browsing by possums and the loss of native bird species which pollinate them.

Department of Conservation botanist Paul Cashmore said finding red mistletoe (\( Peraxilla tetrapetala \)) on the remote Motu Rd was a pleasant, if not totally unexpected, surprise when Rotorua Botanical Society members first discovered a plant in late 2019. There had been no recorded sightings of any of the parasitic beech mistletoes in areas adjoining Motu Rd until this one large red mistletoe plant was seen overhanging the road on the northern side of Pāpāmoa Hill. It was agreed that further survey should be undertaken along rest of the Motu Rd in December and January when plants were flowering but it took until 2022 for it to happen.

‘Finding 25 red mistletoe plants on tawheowheo is a significant discovery as there are no known or historic red mistletoe records in the immediate area along Motu Rd. ‘The nearest plants present would be those in Otamatuna to the west or Moanui and Matawai to the south.’ ‘Twenty-three out of 25 red mistletoe plants - that’s 92% - showed evidence of dieback which generally recognises the past seasons’ browsing intensity.
by possums. This shows that plants are under regular possum browsing pressure to some extent with only two plants free of dieback.’

Paul says the survey has demonstrated for the first time that not only is red mistletoe still present in and around the Motu-Urutawa forest, but that viable populations still exist in several places. ‘It is important that these remnant populations are prevented from declining to extinction so, at very least, fur trapping needs to be encouraged in these areas. ‘But ultimately this provides further justification for larger scale landscape pest control across this wider forest tract.’ There is good evidence from elsewhere that large scale possum control operations will result in a relatively quick recovery of mistletoe health and recruitment if sufficient residual plants are still present in a block.

Control of predators also contributes to mistletoe recovery through protection of bellbirds and tui which are its main pollinators.

Beech mistletoe populations have drastically declined throughout NZ, especially in the North Island, with only remnant populations in isolated areas. In the Bay of Plenty significant populations are found in Whirinaki Te Pua-a-Tāne Conservation Park and parts of Te Urewera.

**Natural super glue from mistletoe berries**

A team of researchers from the Max Planck Institute of Colloids and Interfaces (MPICI) and McGill University in Canada discovered strong adhesive properties of white-berry mistletoe. The mistletoe berry’s flexible fibers adhere to both skin and cartilage as well as to various synthetic materials and could find application in many fields, such as wound sealant in biomedicine, through ease of processing.

For their research, the materials scientists led by Prof. Dr. Peter Fratzl picked the mistletoe berries from the trees themselves. From his office window, the director of the Department of Biomaterials can see the many green parasitic plants. ‘Mistletoe grows in large numbers everywhere, including the Max Planck Campus, and is biodegradable and renewable,’ says Peter Fratzl, adding, ‘For the first time, we are now investigating how to harness its excellent adhesive properties for potentially medical or technical uses.’

Advantages of the biological glue: it adheres very well and is easy to remove under humid conditions.

To observe the adhesive properties, materials scientist and former carpenter Dr. Nils Horbelt wore the mistletoe glue on his fingers for three days in a self-experiment: ‘Afterwards, I was able to remove the viscin by simply rubbing my fingers together.’ Each mistletoe berry can produce a sticky thread up to two meters long called viscin - a natural cellulose adhesive. This allows the seeds of the semi-parasitic plant to stick to their host plants. The researchers in the former research group of Dr. Matthew Harrington, who has since moved on to a professorship at McGill University in Canada, discovered that viscin fibers can be stretched into thin films or assembled into 3D structures by simply processing them when wet. This natural super glue could potentially find application as a wound sealant, and it also adheres to metals, glass and plastics. Also exciting is the fact that the adhesive properties are fully reversible under humid conditions. ‘Many questions remain about this very unusual material,’ says Nils Horbelt, first author of the present study. The next step will now be to investigate the chemistry behind this swellable, extremely sticky material in order to be able to imitate the bonding process in a second step.

Original publication
Nils Horbelt, Peter Fratzl, Matthew J Harrington; Mistletoe viscin: a hygro- and mechano-responsive cellulose-based adhesive for diverse material applications; PNAS Nexus, Volume 1, Issue 1, March 2022.
Mistletoes, locust bean trees and birds work together in Nigeria’s forest ecology.

In West Africa, mistletoes are found on many indigenous trees and several tree crops of economic importance. These hosts include shea, neem, sweet orange, cocoa, rubber and the African locust bean tree. The African locust bean (*Parkia biglobosa*) is regarded as an important tree crop, used for medicine and food. The trees also play a valuable role in nutrient cycling by fixing atmospheric nitrogen in soils. They are susceptible to mistletoe infection and agroforestry managers usually eradicate the parasitic plant. But if mistletoes provide food and shelter for species that are particularly important in an ecosystem, then removing them might not be a good strategy.

We therefore investigated an aspect of mistletoe’s ecological benefits that was not well researched. We studied how birds use mistletoes that grow on *P. biglobosa* in Amurum Forest Reserve, Nigeria, across its mosaic of habitats. We recorded all visits by birds to trees with mistletoe: when they visited, how long they spent in the trees and how they behaved. As predicted, *Tapinanthus dodoneifolius* mistletoes on *P. biglobosa* were an important provider of food and shelter for birds. In addition, the ecological role of this mistletoe on *P. biglobosa* in times of food scarcity, especially in the dry season, appears important. This broader understanding of mistletoe significance and ecology could inform any action in the management of African locust bean forests, and in conservation.

We carried out our study in Amurum Forest Reserve in Jos, Plateau State, central Nigeria. The reserve has three major habitat types, differing in plant species. It has about 278 bird species, 31% of the total recorded in Nigeria. This makes it one of Nigeria’s biodiversity hotspots. Some of the plant species, including *P. biglobosa*, in the reserve host mistletoes, attached to their stem as parasites. The locust bean trees in the study area are infected by three mistletoe species: *Tapinanthus dodoneifolius*, *T. bangwensis* and *T. sesselifolius*. Only *T. dodoneifolius* was fruiting during our study, so we only observed birds visiting this species.

The Amurum Forest Reserve had a relatively high density of mistletoe-infected *P. biglobosa* trees. Of 663 trees, 398 (60%) were parasitised with *T. dodoneifolius* mistletoes and 265 (40%) were not. Ninety-four (14.2%) of the total number of trees were recorded in the rocky habitat, with 49 infected and 45 non-infected. Seventy-one (10.7%) of the total were in the gallery forest, with 59 infected and 12 non-infected. We recorded 498 (75.1%) of the total in the savanna, with 290 infected and 208 non-infected. In 432 hours of observations, we recorded 725 individual birds, comprising 71 species, and belonging to 31 families and four orders, visiting both the locust bean trees and their associated *T. dodoneifolius* mistletoes. Fruit eaters, insect eaters, nectar feeders and omnivores all visited mistletoe flowers or fruits on the locust bean trees. A total of 352 individual bird visits (from 54 species) were recorded directly on the mistletoes.

The rate of mistletoe infection on the trees in our study did not differ significantly across habitat types. This suggests that the probability of infection does not depend on habitat type but might be related to host plant quality, host availability and bird behaviour. Our findings corroborate the host quality hypothesis: mistletoes favour nitrogen-fixing and leguminous plants as hosts.

Bird species in our study had similar chances of accessing all habitat types. Therefore, they could move seeds from one habitat to another to an available host. This supports larger numbers of birds and increases the chances that the mistletoe and the host plant’s fruits will be dispersed. The number of mistletoes on the host plant also determines birds’ preferences for particular trees (measured as time spent by birds on plants in a tree), as found in other studies. Birds were attracted to a dense build-up of berries of *T. dodoneifolius* mistletoes on the host and tended to spend a lot of time feeding on them, thereby enhancing dispersal. Mistletoes do not all produce fruit or ripen at the same time. Fruit dispersers therefore find their fruit reward available all year round in some species or at times of general food scarcity.

We observed that the height of the host tree and the number of mistletoes on it influenced the bird activity. Aside from eating fruit, we also saw birds perching, pecking, and foraging on insects, seeds, leaves, and nectar on both the mistletoe and host. This benefits the bird, mistletoe and host.

Our study supported the idea we started with – that *T. dodoneifolius* mistletoes on locust bean
trees are a keystone producer, based on the bird species use and visitation. Keystone producers are species that have a large impact or influence on the ecosystem. These mistletoes on the trees appear to have an important role in times of food scarcity, especially in the dry season. They are important resources for birds in the reserve. Understanding relationships like these can help identify critical resources and potential keystone species to inform conservation planning.

Reforestation programmes should consider the parasitic relationship between mistletoes and their hosts and their ecological benefits for bird diversity, fruit dispersal and pollination, and ultimately ecosystem stability.

Islamiat Abidemi Raji, Adams Chaskda, Colleen T. Downs and Shiiwua Manu
March 9, 2022 1.26pm GMT

**Don’t make mistakes about our misunderstood, mysterious mistletoes**

There are few plants so misunderstood as the wonderful mistletoes, which we know best as those great bunches of yellowish leaves growing among the foliage of eucalypts – although there are many kinds. They live by tapping into the sap system of their host and taking a modest amount of water and dissolved minerals for their own use. The first and greatest misconception is that as parasites they must be ‘bad’ and should be eliminated.

I have even known of park care groups in Canberra (in the past, fortunately) who carefully cut vast amounts of mistletoe from the local reserve in the misguided belief that they were ‘helping’. In a moment I will explain just why this was so wrong.

An associated piece of mistletoe fake news is that they are not even Australian, so their removal is even more justified. This is perhaps partly associated with tales of northern mistletoes – related to Australian ones, though not closely – which have strong folklore associations in many cultures, including Christmas connections in recent times. However the mistruth has also been spread by people (including in the Canberra area) who sought to make money by persuading landowners that they needed to get rid of their mistletoes, ‘and we’re here to help!’.

Enough of the myths; how about some truths about mistletoes, which are far more interesting?

Box Mistletoe (*Amyema miquelii*) growing on a Red Box in Canberra; the yellowish clumps of the mistletoe leaves stand out. Photo: Ian Fraser.

Dr David Watson, an ecologist working at Charles Sturt University, has done a lot of work on the role of mistletoes and has concluded they are a ‘keystone resource’. By this he means mistletoes contribute essential food and shelter to a wide range of other species, far more than we might expect from the relatively small number of species and individual plants. The dense clumps provide necessary nesting shelter for many birds and the moist fleshy leaves are an important food for other animals, including several butterfly species. Both birds and insects avidly seek the abundant flowers. Mistletoe fruit is also an important food source in many Australian habitats; many animals eat them and some – such as the Mistletoebird and the endangered Painted Honeysucker – rely on them.

The mistletoe attaches to its host by a thick base called a haustorium, which is easily seen from the ground, the seed having been deposited on the branch by a bird, most likely a Mistletoebird. While the tree overall is unaffected by the extra demands of the mistletoe, the tree branch beyond the mistletoe sometimes dies. Furthermore many mistletoes don’t survive – for one thing the growing tree fatally shades many of them out – and when they or the dead tree branch falls this too is essential ground habitat. For instance David Watson showed that ground-feeding threatened Brown Treecreepers disappear from woodland without mistletoes.
A male Mistletoebird with mistletoe berries. Photo: Ian Fraser.

The Mistletoebird is a delightful red, white and glossy blue-black little bird that follows the mistletoe fruiting around the land and is almost exclusively responsible for spreading the mistletoe. Indeed, apart from insects and spiders, growing chicks only eat mistletoe berries. The seed passes through very quickly with some sticky flesh still attached and to remove this annoyance from its feathers the bird wipes its backside on a convenient branch. The mistletoe seed germinates within this sticky dropping and roots itself in the branch.

Sheoak Mistletoe (Amyema cambagei), growing on River Oak (a casuarina) by the Murrumbidgee. The leaves of this species are needle-shaped to match the host tree’s foliage. Photo: Ian Fraser.

One of the aspects of mistletoes that has always intrigued me is how the leaves of a species seem to mimic those of its host tree, be it the long narrow leaves of eucalypts, the round leaves of the Kurrajong or the needles of the Sheoak. Some say it’s to hide the leaves from browsing possums, but I’m not convinced; I think a possum’s nose would be more useful to it at night than its eyes. No, I think it’s down to the Mistletoebird again. It’s just found a very yummy snack among leaves that look like eucalypt leaves, so where to look for another one? Yep, among leaves that look the same – and most of these are actually going to be eucalypt leaves. The plant effectively sends the bird to find another host tree for its seeds.

Far from being a problem, mistletoes greatly enhance a natural landscape – and they have great stories to tell. What’s not to love?

Ian Fraser  24 April 2022


Striga, a bitcoin and cryptocurrency banking infrastructure provider, became the first virtual asset service provider (VASP) to gain regulatory approval in Estonia following the country’s revamping of its digital asset legal framework, per an announcement from the Financial Intelligence Unit.

BITCOIN Magazine
September 2022.

BOOK REVIEW


Oncology is changing rapidly and new successful therapies are raising hopes. As oncology is changing, the contribution of mistletoe therapy must evolve and redefine its place. For this reason, the role of mistletoe (Viscum album) in tumour therapy is scientifically re-examined at regular intervals in the so-called Mistletoe Symposia, which have been held since 1995 (www.mistelsymposium.de), and subsequently presented in a book. The new volume in this series contains 49 contributions (in English or German) from the fields of biology, pharmacy and pharmacology, preclinical and clinical studies with findings from therapeutic experience and clinical trials, as well as reviews presented at the 7th Mistletoe Symposium in November 2019. The clinical part of the symposium is focused on bronchial and breast carcinoma: What is the potential of conventional tumour therapy, what contribution does mistletoe make, e.g. in different dosages and forms of application, and how does mistletoe therapy also help patients in the psychological dimension? A further focus is on checkpoint inhibitors and modern immunological therapies with which mistletoe is used. The abstracts in German and English preceding each article provide a good overview of the respective topic. All contributions are vividly supplemented with graphics, diagrams and photos. Detailed reference lists and
correspondence addresses facilitate further, more in-depth work.

The book is a contribution to integrative oncology, the medicine of the future. Like its 6 predecessor volumes, it is an important reference work for all those who wish to inform themselves about the state of theoretical and practical knowledge and clinical evidence of mistletoe therapy.

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PUBLICATION NEWS

Plant, people and Planet Special Issue – Call for papers.
https://www.newphytologist.org/news/view/309

Chemical, Biological, and Biotechnological Control of Parasitic Weeds – a new section under Frontiers in Plant Science
https://www.frontiersin.org/research-topics/37883/chemical-biological-and-biotechnological-control-of-parasitic-weeds

FORTHCOMING MEETINGS

https://www.iwsc2020.com

17th World Congress on Parasitic Plants, July 2024, Nara, Japan, 2-8 July, 2023.

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE
some websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see:
http://www.parasiticplants.org/

For Dan Nickrent’s ‘The Parasitic Plant Connection’ see:
http://www.parasiticplants.siu.edu/

For the Parasitic Plant Genome Project (PPGP) see:
http://ppgp.huck.psu.edu/ (may be temporarily unavailable)

For Old Dominion University Haustorium site: see
https://ww2.odu.edu/~lmusselm/haustorium/index.shtml

For information on the new Frontiers Journal ‘Advances in Parasitic Weed Research’ see:
http://journal.frontiersin.org/research-topic/3938/advances-in-parasitic-weed-research

For a description of the PROMISE project (Promoting Root Microbes for Integrated Striga Eradication), see:
http://promise.nioo.knaw.nl/en/about

For Striga Solutions, led by Prof. Salim Al-Babili, KAUST, Saudi Arabia:
https://strigasolutions.com

For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/

For the Toothpick Project – see
https://www.toothpickproject.org/

For the Annotated Checklist of Host Plants of Orobanchaceae, see:
http://www.farmalerleganes.com/Flora/Angiospermae/Orobanchaceae/Host Orobanchaceae Checklist.htm

For a description and other information about the Desmodium technique for Striga suppression, see: http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on Striga) see: http://www.accessagriculture.org/

For information on future Mistel in der Tumortherapie Symposia see:
http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx (NB see above re 7th Symposium)

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see:
http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).

For Viscum album Genespace Database see:
viscumalbum.pflanzenproteomik.de/

For an excellent publication by the Universidade Federal do Rio Grande do Sul on Southern Brazilian Mistletoes (Dettke, G.A. and Waechter, J.L. 2013) see:
For a participatory website cataloguing tools for the identification and localization of fauna and flora, including parasitic plants see: https://nadaba.net/fr

**LITERATURE**

Abdullahi, W.M.; and 10 others. 2022. Integrated management of *Striga gesnerioides* in cowpea using resistant varieties, improved crop nutrition and rhizobium inoculants. Plant and Soil 473(1/2): 197-213. [Inoculation with Bradyrhizobium strain IRJ2180A and P fertilization tended to reduce infestation by *S. gesnerioides* in susceptible cowpea varieties, and enhanced yield also in resistant ones.]


Anteyi, W.O., Klaiber, I. and Rasche, F. 2022. Diaceotoxyscirpenol, a *Fusarium* exometabolite, prevents efficiently the incidence of the parasitic weed *Striga hermonthica*. BMC Plant Biology 22(84):(24 February 2022) (https://doi.org/10.1186/s12870-022-03471-6) [Among the tested *Fusarium* exometabolites, diaceotoxyscirpenol, produced by *F. venenatum* but not by *Fusarium oxysporum* f. sp. *strigae* (Foxy-2), exhibited the most promising herbicidal potential against unconditioned *S. hermonthica*.]


inhibition, conditioning, and germination of the crop parasite Striga. Journal of Biological Chemistry 298 (4): [https://www.jbc.org/article/S0021-9258(22)00174-0/fulltext] [Reporting discovery of a potent strigolactone perception inhibitor, dormirazine which could interfere with response to strigolactone if present at the right time during pre-conditioning.]

Atsmon, G., Nehurai, O., Kizel, F., Eizenberg, H. and Lati, R.N. 2022. Hyperspectral imaging facilitates early detection of Orobanche cumana below-ground parasitism on sunflower under field conditions. Computers and Electronics in Agriculture 196: [https://doi.org/10.1016/j.compag.2022.106881] [Sunflower plants were imaged by a ground-based hyperspectral camera at two early parasitism stages that are relevant for herbicide application. Infected and non-infected plants were distinguished, 31 and 38 days after sunflower planting, with 76 and 89% accuracy, respectively.]

Auftray, P., Rakotofiringa, H.Z.N, Letourmy, P. and vom Brocke, K. 2022. Multi-criteria and participatory assessment of upland rice varieties in contrasted farm environments in Madagascar. Biotechnologie, Agronomie, Société et Environnement 26(1): 43-54. [Comparison of 6 upland rice varieties across a wide range of conditions concluded that the best-performing varieties for yield and Striga asiatica control, were NERICA 4 (already in extension) and FOFIGA 182 (proposed for extension).]


Balam, G.S. and Usman Adamu Izke. 2022. Combining ability analysis for Striga resistance among pearl millet (Pennisetum glaucum L. Br) inbreds in a line × tester cross. In: 44th Annual Conference of Genetic Society of Nigeria, Zaria 2021: 582-592. [Twenty nine F1 hybrids and two checks were evaluated under S. hermonthica infestation, and hybrids SOSAT ×Ex-Baga and PEO 5984 ×Ex-Baga were best specific combiners for Striga tolerance. But high genetic variability exists among the populations.]

Banerjee, A., Schneider, A.C. and Stefanović, S. 2022. Plastid genomes of the hemiparasitic genus Krameria (Zygophyllales) are intact and exhibit little relaxation in selection. International Journal of Plant Sciences 183(5): 393-403. [Concluding that Krameria erecta contains both the largest and the most intact plastid genomes reported to date from parasitic angiosperms suggesting that these plants are still reliant on photosynthesis as an important part of their nutrient acquisition strategy.]

Bänziger, H., Gigon, A., Bänziger, S. and Suttiprapan, P. 2022. Strong emissions of carbon dioxide and water vapour by Sapria himalayana griff. (Rafflesiaaceae): waste or necessity in a cool flower? Taiwania 67(2): 201-21. [Concluding that the high carbon dioxide is merely a waste bi-product, but the high humidity essential because the pollen can be acquired by the flies only in a fluid suspension.]


Baskin, J.M. and Baskin, C.C. 2021. The great diversity in kinds of seed dormancy: a revision of the Nikolaeva-Baskin classification system for primary seed dormancy. Seed Science Research 31(4): 249-277. [The number of named tiers (layers) in the classification hierarchy is increased from three to seven, including one for ‘dust seeds’ of mycoheterotrophs, holoparasites and autotrophs.]


HAUSTORIUM 82

L.) using GBS-SNPS. Turkish Journal of Field Crops 26(2): 157-162. [3 major QTLs for resistance to *O. cumana* race F were identified on LG7, LG11 and LG12 using a high density SNP map in an intraspecific F2 population derived from 300 individuals from a cross between susceptible sunflower cv. RHA 436 and resistant cv. H08.]


Bernal-Galeano, V. Beard, K. and Westwood, J.H. 2022. An artificial host system enables the obligate parasite *Cuscuta campestris* to grow and reproduce in vitro. Plant Physiology 189(2): 687-702. [Describing an inert, fibrous stick that mimics a host stem, wicking water and nutrients to the parasite, enabling *C. campestris* to exhibit a parasitic habit and develop through all stages of its life cycle, including production of new shoots and viable seeds. The phytohormones 1-naphthaleneacetic acid and 6-benzylaminopurine affect haustorial morphology and increase parasite fresh weight and biomass.]

Bragard, C. and 25 others. 2022. Pest categorisation of *Plicosepalus acaciae*. EFSA Journal 20(3): https://doi.org/10.2903/j.efsa.2022.7142 [Suggesting that *P. acaciae* should be subject to quarantine in Europe due to its potential threat to walnut, fig, pistachio and pomegranate.]


Brown, M.R., Moore, P.G.P. and Twyford, A.D. 2021. Performance of generalist hemiparasitic *Euphrasia* across a phylogenetically diverse host spectrum. New Phytologist 232(5): 2165-2174. [Finding that 4 different species of *Euphrasia* were generally benefiting most from *Lotus*, *Cynosurus* and *Plantago* spp. as hosts, while finding *Lagurus ovatus*, *Ononis spinosa*, *Thymus polytrichus* and *Leucanthemum vulgare* were of little benefit.]


Camaño Portela, J.L., Pino Pérez, J.J., Silva-Pando, F. J. and Pino Pérez, R. 2021. (On the presence of *Orobanche hederae* Vaucher ex Duby in the Maritime-Terrestrial National Park of the Atlantic Islands (Galicia, Spain).]
Chen, B.J.W., Xu Jing and Wang XinYu. 2021. Trophic transfer without biomagnification of cadmium in a soybean-dodder parasitic system. Plants 10(12): (2690; https://doi.org/10.3390/plants10122690) [The results suggested no evidence of Cd biomagnification in dodders parasitizing Cd-contaminated hosts, and implied that the Cd transfer from hosts to dodders may be a selective process.]


[Screening over 100 genotypes each of V. sativa and ervilia yielded only one line Vs.1, of V. sativa with high resistance, showing hypersensitive response and less growth inhibition.]


[A general review commending the integration of different genetic resistance mechanisms with innovative agronomical management practices.]


[Clarifying the difference between these two genera, i.e. one anther locale in Dendrophthoe, and two in Phoradendron. And providing a key to the three species of Dendrophthoe and 41 of Phoradendron occurring in Brazil.]

Dieringer, G. and Cabrera, L.R. 2022. Stamen dimorphism, bee visitation, and pollen removal in three species of Agalinis (Orobanchaceae). Botany 100(4): 377-386. [‘The flower form of Agalinis appears to encourage inverted foraging, which has not led to a division of labour for the dimorphic stamens typical of heterantherous species. The annual habit and short-lived flowers in these species likely select for rapid pollen loss.’]


Diniz, U.M., Fischer, N.L.S. and Aguiar, L.M.S. 2022. Changing the main course: strong bat visitation to the ornithophilous mistletoe Psittacanthus robustus (Loranthaceae) in a Neotropical savanna. Biotropica 54(2): 478-489. [Although usually pollinated by birds, robustus is an important resource for bats in the Brazilian savanna, potentially representing a mixed or early transitional state toward bat pollination.]


[Illustrating elegant ways to quantify cost to the host and how this impacts competition between mistletoe species (not specified in the abstract). And offering a fuller consideration of plant parasites as macroparasites.]


[Reviewing the special issue which comprises 11 papers, 5 original research papers, two focused on crop resistance to parasitic plants, 3 providing new insights on...
plant-parasite interaction and one ‘Opinion Paper’ by yours truly (CP)]

Dor, E and Goldwasser, Y. 2022. Parasitic weeds: biology and control’ Special Issue Editors Summary. Plants (Basel). 11(14):1891. (https://doi.org/10.3390/plants11141891) [Reviewing the special issue which comprises 11 papers, 5 original research papers, two focused on crop resistance to parasitic plants, 3 providing new insights on plant-parasite interaction and one ‘Opinion Paper’ by yours truly (CP)]

Duca, M., Clapco, S. and Joita-Pacureanu, M. 2022. Racial status of Orobanche cumana Wallr. in some countries other the world. Helia 45(76): 1-22. [A useful survey of the distribution of O. cumana across Asia and Europe. Races G and H occur in most countries, other than Serbia. The most virulent race H is predominant in Romania, Ukraine and Turkey.]

Duca, M., Mutu, A. and; Clapco, S. 2021. Efficiency of microsatellite markers in genotyping of Orobanche cumana populations. Lucrari Stiintifice, Universitate de Stiinte Agricolte Si Medicina Veterinara ‘Ion Ionescu de la Brad’ Iasi, Seria Agronomie 64(1): 25-30. [A total of 279 O. cumana plants from a wide range of sources from Europe to China, were genotyped and 110 alleles identified. Seven SSR markers were selected as the most informative and efficient markers for measuring genetic diversity in O. cumana.]


Ebrahimi, E., Darbandi, E.I., Mohassel, M.H.R. and Tavakolafshari, R. 2021. Effect of temperature and salinity on two eastern dodder (Cuscuta monogyna vahl) ecotypes seed germination characteristics. Journal of Plant Protection (Mashhad) 35(3): fa347-en356. [Germination of C. monogyna was reduced 50% at salinity levels of -0.68-0.90, and inhibited at -1.2 Mpa, though recovery was possible on leaching.]


En-Nahli, Y. and 9 others. 2021. Resistance to Orobanche crenata Forsk. in lentil (Lens culinaris Medik.): exploring some potential altered physiological and biochemical defense mechanisms. Journal of Plant Interactions 16: 321-331. (https://doi.org/10.1080/17429145.2021.1949498) [Accumulation of α-linolenic acid and arachidonic acid was more pronounced in the resistant genotypes ILL6415, ILL7723 which could be associated with resistance pathways involved in the resistance to O. crenata.]


Fatino, M.J. and Hanson, B.D. 2022. Evaluating branched broomrape (Phelipanche ramosa) management strategies in California processing tomato (Solanum lycopersicum). Plants 11(3): (https://doi.org/10.3390/plants11030438) [Treatments with sulfosulfuron and imazapic had reasonable crop safety on tomato but rotational crops would need to be resistant to sulfosulfuron. Sulfosulfuron and imidazolinone treatments reduced P. ramosa...
shoots per plot but none were fully effective and tomato yields were not significantly improved.


Ferreira, V.C.M., Neves, F.S. and Guerra, T.J. 2021. Direct and indirect effects of ant-trophobiont interactions on the reproduction of a hummingbird-pollinated mistletoe. Plant Ecology 223(3): 285-296. [The ant Camponotus rufipes did not affect pollination of Psittacanthus robustus by the hummingbird Eupetomena macroura but seed size was somewhat reduced.]


Fornier, S.D. and 9 others. 2022. Noncanonical strigolactone analogues highlight selectivity for stimulating germination in two Phelipanche ramosa populations. Journal of Natural Products 85(8): 1976-1992. [P. ramosa on rape, hemp, and tobacco in France. P. ramosa 2a preferentially attacks hemp, while P. ramosa 1 attacks rapeseed. The recently isolated cannalactone from hemp root exudates has been characterized as a non-canonical strigolactone that selectively stimulates the germination of P. ramosa 2a seeds in comparison with P. ramosa 1.]

Fu JiNe and 10 others. 2022. Chromosome-level genome assembly of the hemiparasitic Taxillus chinensis (DC.) Danser. Genome Biology and Evolution 14(5): (https://doi.org/10.1093/gbe/evac060) [A genetic study providing a valuable genomic resource for elucidating the genetic basis underlying the recalcitrant characteristics of T. chinensis seeds and the evolution of photosynthesis loss in parasitic plants.]


Gaier, L., Graiss, W., Klingler, A., Schaumberger, A. and Krautzer, B. 2022. Measures to control yellow rattle in extensive grassland. Proceedings of the 29th General Meeting of the European Grassland Federation, Caen, France, 26-30 June 2022: 94-396. [On a two-cut grassland that had been unfertilized for ten years, a single early first cut resulted, a yeat later, in a decrease of Rhinanthus minor compared with the usual cutting time.]

Galili, S., Hershenhorn, J., Smirnov, E., Yoneyama, K., Xie XiaoNan, Amir-Segev, O., Bellalou, A. and Dor, E. 2021. Characterization of a chickpea mutant resistant to Phelipanche aegyptiaca Pers. and Orobanche crenata Forsk. Plants 10(12): (https://doi.org/10.3390/plants10122552) [An ethyl methanesulfonate mutant population of F01 variety (Kabuli type) yielded the line CCD7M14, highly resistant to both P. aegyptiaca and O. crenata thanks to zero exudation of orobanchol and related strigolactones; and identifying the point mutation in the Carotenoid Cleavage Dioxygenase 7 (CCD7) gene.]

100(3): 729-747. [Search of herbaria revealed 411 species in 14 families, including 14 species of holoparasites, 10 species of epiparasitic mistletoe and 24 species endemic to Mexico. Beautifully illustrated.]


Gasura, E., Nyandoro, B., Mabasa, S., Setimela, P S., Kyal0, M. and Yao, N. 2021. Breeding strategy for resistance to Striga asiatica (L.) kuntze based on genetic diversity and population structure of tropical maize (Zea mays L.) lines. Genetic Resources and Crop Evolution 69(3): 987-996. [A study of 222 inbred lines revealed that molecular variance was larger (91%) within individuals than within populations (9%), providing the basis for a breeding strategy for resistance to S. asiatica]

Gateva, S.P. and 9 others. 2022. Effect of UV radiation and other abiotic stress factors on DNA of different wild plant species grown in three successive seasons in alpine and subalpine regions. Phyton (Buenos Aires) 91(23): 293-313. [Including results on Pedicularis orthantha in Bulgaria.]


Gibot-Leclerc S. and 8 others. 2022. Screening for potential mycoherbicides within the endophyte community of Phelipanche ramosa parasitizing tobacco. FEMS Microbiological Ecology. 98(3): (doi: 10.1093/femsec/fiac024) [Finding 374 endophyte isolates in P. ramosa infesting tobacco, mostly Fusarium spp. including F. venenatum which inhibited germination and caused necrosis of the parasite.]

Giesemann, P. and Gebauer, G. 2021. Distinguishing carbon gains from photosynthesis and heterotrophy in C3- hemiparasite-C3-host pairs. Annals of Botany 129(6): 647-656. [Studies with Lathraea squamaria parasitizing the same carbon nutrient source (xylem-transported organic carbon compounds) as potentially Pedicularis, Rhinanthus, Bartsia, Melampyrum and Euphrasia spp. concluded the progressive 2H-enrichment can be used as a proxy to evaluate carbon gains from hosts.]


Goremykina, Ye.V., Azaryan, A.D., Akime, E.L. and Leshchina, K.Ye. 2021. The relationship between Striga and many narrow, typical of climbing plants, while Cuscuta spp have only narrow elements and many fewer.]

Guerra, P.C., Escobedo, V.M., Gutiérrez, G.O. and Gianoli, E. 2021. Mistletoe infection changes arthropod community on its cactus host through indirect effects. Insect Conservation and Diversity 15(2): 288-298. [Infection by Tristerix aphyllus results in a more diverse arthropod community on its cactus host, Echinopsis chiloensis in the...
Chilean coastal desert through induced susceptibility to stem-borers whose brood chambers are colonised by arthropods.

Guajral, A.K., Misiewicz, T.M., Hauser, C. and Carter, B.E. 2022. Natural history and demography of the imperiled redwood forest specialist *Pedicularis dudleyi* (Dudley's Lousewort, Orobanchaceae). Madroño 69(1): 6-15. [Studying the rare *P. dudleyi* and concluding that its decline is due to very poor establishment from seed.]

Guo ChengLin, Qin LiuYan, Ma YongLing and Qin JianLin. 2022. Integrated metabolomic and transcriptomic analyses of the parasitic plant *Cuscuta japonica* Choisy on host and non-host plants. BMC Plant Biology 22(393) ([https://doi.org/10.1186/s12870-022-03773-9]) [Studying the different metabolomics involved when *C. japonica* infected susceptible *Ficus microcarpa* and non-host mango.]

Gutierrez, N. and Torres, A.M. 2021. QTL dissection and mining of candidate genes for *Ascochyta fabae* and *Orobanche crenata* resistance in faba bean (*Vicia faba L.*). BMC Plant Biology 21(551) ([https://doi.org/10.1186/s12870-021-03335-5]) [A fine-mapping approach proposes increases in genetic resolution of relevant QTL regions, paving the way for efficient deployment of alleles for faba bean ascochyta and broomrape resistance.]


Hilman, E.T. and Busch, J.W. 2021. Floral traits differentiate pollination syndromes and species but fail to predict the identity of floral visitors to *Castilleja*. American Journal of Botany 108(11): 2150-2161. [Floral trait differentiation among 5 *Castilleja* species reflects both taxonomy and pollination syndromes. Differentiation was generally more evident in morphological traits compared to VOCs. Furthermore, ideas of pollination syndromes in this system are overly simplistic and fail to predict which animals most frequently visit *Castilleja* in natural populations.]

Holmes, M.A. 2022. Host quality, mediated by land-use history and landscape position, shapes distributions of parasitic plants in postagricultural forests. International Journal of Plant Sciences 183(5): 348-356. [Studying the abundance of *Conopholis americana* and *Epifagus virginiana*, in forests in Ohio 40-60, 61-80, 81-100, and >130 yr since canopy closure. The presence of both species and the abundance of *C. americana* were linked to large individual host trees. *C. americana* was associated with uplands and older forests, and *E. virginiana* was limited to stands of more than 80 yr old.]


Hosseini, A. and Soleimani, R. 2022. *Loranthus europaeus* Jacq. infection alters leaves morphology and physiology of Persian oak (*Quercus brantii* Lindl.). BioResources 17(2): 2896-2905. [Detrimental effects of *L. europaeus* on *Quercus brantii* included reduced area and weight of leaves and the amount of leaf K, P, and Ca. Leaf N, Mg, Mn, Zn, and Fe contents were not significantly affects.]

Hu JieDong, Li KaiHui, Deng ChengJun, Gong YanMing, Liu YanYan0 and Wang Lei. 2022. Seed germination ecology of semiparasitic weed *Pedicularis kausensis* in alpine grasslands. Plants 11(13): ([https://doi.org/10.3390/plants11131777]) [Seed germination was improved by GA3, GR24, and aqueous extracts of *Festuca ovina*, *Stipa purpurea*, and *Leymus secalinus* and by two to eight weeks of cold stratification but not by temperature, light or drought.]

Ito, S. and 23 others (including Al-Babili, S. 2022. Canonical strigolactones are not the tillering-inhibitory hormone but rhizospheric signals in rice. bioRxiv (https://doi.org/10.1101/2022.04.05.487102) [Confirming that 4-deoxyorobanchol (4DO) and orobanchol, do not have major role in determining rice shoot architecture, and any procedure to reduce their exudation could confer resistance to Striga spp. without affecting rice root structure.]


Jhu MinYao and 10 others. 2022. Heinz-resistant tomato cultivars exhibit a lignin-based resistance to field dodder (Cuscuta campestris) parasitism. Plant Physiology 189(1): 129-151. [Finding that the stem cortex in Heinz tomato hybrids responds with local lignification upon C. campestris attachment, preventing parasite entry into the host. Lignin Induction Factor 1 (LIF1, an AP2-like transcription factor), SIMYB55, and Cuscuta R-gene for Lignin-based Resistance 1, a CC-NBS-LRR (CuRLR1) are identified as factors that confer host resistance.]

Jia Yan, Fu PeiLong, Li Qian, Li WenXiang, Zhang TianYao, Huang MeiJuan and Huang HaiQuan. 2021. Diversity of culturable endophytic bacteria from Viscum liquidambaricolum and its survival promotion. (in Chinese) Journal of Southern Agriculture 52(12): 3415-3424. [Concluding that V. liquidambaricolum is rich in microbial resources and life-promoting strains, among which Pseudomonas strain SWFU34 had the ability to produce siderophore and dissolving phosphorus and potassium which has the potential of agricultural application.]


**HAUSTORIUM 82**

**Lee, C.T. and 9 others. 2021**


Jørg. (Santalaceae), newly recorded for the Acanthosyris annonagustata haustorial development. [Research & Growth 10:2455-6211.]


Rambold, G. 2022. Consuming and consumed: Biotic interactions of African mistletoes across different trophic levels. Biotropica (https://doi.org/10.1111/btp.13130) [Reviewing the taxonomic and functional diversity of symbionts associated with mistletoes in Africa and adjacent islands that contribute to the major biological functions of mistletoes, such as establishment and growth, nutrition and fitness, resistance to external stresses, as well as pollination and dispersal.]

Kuang JingGe, Wang YuFei, Mao KangShan, Milhe, R., Wang MingCheng and Miao Ning. 2022. Transcriptome profiling of a common mistletoe species parasitizing four typical host species in urban Southwest China. Genes 13(7): (https://doi.org/10.3390genes13071173) [Studying Taxillus nigrans on Broussonetia papyrifera, Cryptomeria fortunei, Cinnamomum septentrionale and Ginkgo biloba.]

Kuramana, S., Gandipilli, G., Gera, V.K. and Kumar, P.K.R. 2022. Haustorial development of Dendrophthoe falcata (L.f.) Ettingsh. - an overview. International Journal of Scientific Research & Growth 10:2455-6211. [Morphological and physiological features of D. falcata, a parasite of mango in India, were systematically studied to understand the dynamics of host-parasite interaction and haustorial development.]


Lemma Degebasa, Taye Tessema, Zelalem Bekeko and Ketema Belete. 2022. Prevalence and socioeconomic impact of Striga (Striga hermonthica) in sorghum producing areas of East and West Hararghe zones, Oromia, Ethiopia. International Journal of Agronomy 2022: 8402280 (https://doi.org/10.1155/2022/8402280) [A survey in the Hararghe district of Oromia in Ethiopia found that there was at least 23% occurrence of S. hermonthica in all fields and over 70% in much of the area, causing 20-70% yield loss. Current control methods rarely go beyond hand-weeding.]


Li Li, Teng JianBei, Zhu YiLin, Xie FengFeng, Hou Jing, Ling Yuan and Zhu Hua. 2021. Metabolomics study of flavonoids of Taxillus chinensis on different hosts using UPLC-ESI-MS/MS. Molecules 26(24): (https://doi.org/10.3390/molecules26247681) [The total flavonoids in Taxillus chinensis from growth on Morus alba. was significantly higher than that Journal of Plant Ecology 15(2): 294-309. (Contrary to expectation, the number of host species did not significantly...]

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[japonicum. Nature Communications 13(5): (https://doi.org/10.1038/s41467-022-30550-x)](https://doi.org/10.1038/s41467-022-30550-x)
change the asynchrony of reproductive
distributional updates. Systematic Botany
phenology of Dendrophthoe falcata.]
46(3): 700-710. [Reviewing the the 5 species
Li ManRu, Chen Jin and Zhang Ling. 2021. Host-
of Cathedra occurring in South Americas,
mediated effects on the reproductive
including a new species, C. rupestris,
phenological asynchrony of a generalist
differing in reticulate bark, length of pedicel
mistletoe in China. Journal of Plant Ecology
in flower (1.5-2.2 mm), length of petals (3-3.5
15(2): 294-309. [Finding that both flowering
mm), as well as by the proportion of the
mistletoe and fruiting in Dendrophthoe pentandra in S.
hypogynous disk in relation to the fruit.]
China exhibited unimodal peaks in successive
Maazou, A.R.S., Gedil, M., Adetimirin, V.O.,
years; the first flowering date was significantly
Mengesha, W., Meseka, S., Ilesanmi, O.,
influenced by crown area of the mistletoe and
Agre, P.A. and Menkir, A. 202. Optimizing
light, such that clumps with larger crown and
use of U.S. Ex-PVP inbred lines for
more light exposure had an earlier FFD and
enhancing agronomic performance of tropical
longer flowering and fruiting durations; and
Striga resistant maize inbred lines. BMC
different host species had a significant impact
Plant Biology 22(286): (https://doi.org/10.1186/s12870-022-03662-1)
on the phenotype of mistletoes. The number of
[Six Ex-Plant Variety Act inbred lines
host species did not significantly change the
identified with positive GCA effects for grain
asynchrony.] no fold
yield under S. hermonthica-infested and
Liu Rong, Wang Hong, Yang JunBo, Corlett,
contact regions and across multiple
R.T., Randle, C.P, Li DeZhu and Yu WenBin. 2022. Cryptic species diversification of
positive tests locations. Inbred lines HB8229-1 and
Cryptic species diversification of the Pedicularis siphonantha complex
WIL900-1 also displayed negative GCA
two south China since the pliocene. Frontiers
effects for emerged Striga count and Striga
to Plant Science 13(March)
distributional updates. Systematic Botany
[https://doi.org/10.3389/fpls.2022.811206] [A
detailed study of the Pedicularis siphonantha.] effects for emerged Striga count and Striga
damage rating.]
Liu TaiLong, Ji YaLi, Liu YiXuan, Wu
[Revealing that Striga germination is
XuanFeng, Chen FeiFei and Liu Xing. 2021.
associated with genes encoding hormone
Study on the adaptive mechanisms of five
signalling functions, and that ABA-
plants to high-altitude light based on
related to photosynthesis, porphyrin and chlorophyll metabolism,
transcriptome sequencing in Maidica wetland
apparently helping to protect against high light levels.]
plants to high-altitude light based on
porphyrin and chlorophyll metabolism,
to transcriptome sequencing in Maidica wetland
apparently helping to protect against high light levels.]
[0.3389/fpls.2022.811206] [A
detailed study of the Pedicularis siphonantha.] effects for emerged Striga count and Striga
damage rating.]
Lu Zhang, Xiaolei Cao, Zhaoqun Yao, Xue Dong,
[Revealing that Striga germination is
Meixiu Chen, Lifeng Xiao and Sifeng Zhao.
associated with genes encoding hormone
2022. Identification of risk areas for
signalling functions, and that ABA-
Orobanche cumana and Phelipanche
related to photosynthesis,
aegyptiaca in China, based on the major host
porphyrin and chlorophyll metabolism,
plant and CMIP6 climate scenarios. Ecology
apparently helping to protect against high light levels.]
and Evolution 12(4): [Concluding that very
large areas, notably in Xinjiang and Inner
Orobanche cumana and P. aegyptiaca. Elevation and
topsoil pH were the decisive factors for O.
cumana distribution, while rainfall was the
main factor limiting the spread of P.
aegyptiaca. Climate change would shift the risk
zones further north.]
[https://doi.org/10.1186/s12870-022-03662-1]
Manou, T.G.I., and Al-Rewany, M.A.M. 202. Optimizing
resistant maize inbred lines. BMC
[Assessing the
use of U.S. Ex-PVP inbred lines for
response of 35 sunflower varieties to sowing
effects for emerged Striga count and Striga
damage rating.]
Mallu, T.S., Irafasha, G., Mutinda, S., Owuor,
[Reviewing the the 5 species
E., Githiri, S.M., Odeny, D.A. and Runo, S.
of Cathedra occurring in South Americas,
2022. Mechanisms of pre-attachment Striga
[0.3389/fpls.2022.811206] [A
detailed study of the Pedicularis siphonantha.] effects for emerged Striga count and Striga
damage rating.]
Manou, D., Giumba, A.M., Jinga, V., Radu, I.
and Gurau, L.R. 2021. The improvement of
the old lands at El Beheira Governorate.
[0.3389/fpls.2022.811206] [A
detailed study of the Pedicularis siphonantha.] effects for emerged Striga count and Striga
damage rating.]
Egyptian Journal of Agricultural Research
[Assessing the
response of 35 sunflower varieties to sowing
effects for emerged Striga count and Striga
damage rating.]
Mansour, T.G.I., and Al-Rewany, M.A.M. 2022.
Faba bean farmer's implementation of
Orobanche integrated control techniques in
the old lands at El Beheira Governorate.
Mar Iman, A.H., Nor Hizami Hassin, Muhamad Azahar Abas and Zulhazman Hamzah. 2021. Modelling in-situ factors affecting bud's growth of Rafflesia kerrii Meijer in Lojing Highlands, Kelantan, Peninsular Malaysia. Pertanika Journal of Science & Technology 29(2): 1243-1266. [The most influential of 8 ecological factors assessed for influence on bud growth in R. kerrii, were its ecological ability, level of temperature, light shading, soil acidity, and interaction between plant survival condition and growth stage.]


Martin Gil, T. 2021. Viscum album L. subsp. album, new taxon for the flora of Segovia (Spain). Flora Montiberica 80: 29-35. [V. album recorded on Frangula alnus and Salix atrocinerea.]


Matthies, D. 2021. Closely related parasitic plants have similar host requirements and related effects on hosts. Ecology and Evolution 11(17): 12011-12024. [Studies with Rhinanthus minor, R. electrolophrus, Odontites vulgaris and Melapytum arvense show that closely related parasites have similar host requirements and correlated negative effects on individual hosts, but that there are also specific interactions between pairs of parasitic plants and their hosts.]

Mazo, K.R., Nickrent, D.L. and Pelser, P.B. 2022. Macrosolen zamboangensis (Loranthaceae), a new mistletoe species from Zamboanga Peninsula, Philippines. Webbia 77(1): 127-134. [Describing M. zamboangensis, a member of the M. melintangensis species complex, but differing in having a conspicuously papillose corolla head, a combination of papillose pedicels, calyculus and fruits, at least 3-4 inflorescence axes grouped at a node, and relatively small flowers that are clustered at the apex of a raceme.]


MinYao Jhu and Sinha, N.R. 2022. Parasitic Plants: an overview of mechanisms by which plants perceive and respond to parasites Annual Review of Plant Biology 73(1): 433-455. [A comprehensive review of the current understanding of host perception of parasitic plants and the pre-attachment and post-attachment defence responses mounted by the host, suggesting that understanding non-conventional haustorial connections on other host organs, for example, when stem parasitic plants form haustoria on their host roots could provide the potential for developing a universal resistance mechanism.]

Mishev, K., Dobrev, P.I., Lacek, J., Filepova, R., Yuperlieva-Mateeva, B., Kostadinova, A. and Hristeva, T. 2021. Hormonomic changes driving the negative impact of broomrape on plant host interactions with arbuscular mycorrhizal fungi. International Journal of Molecular Sciences 22(24): (https://doi.org/10.3390/ijms222413677)[Co-cultivation of tobacco with broomrape (Phelipanche ramosa and P. mutelii) and AM fungi, alone or in combination led to characteristic changes in the levels of endogenous and exuded abscisic acid, indole-3-acetic acid, cytokinins, salicylic acid, and orobanchol-type strigolactones. Also, a significant reduction in AM colonization of infested tobacco plants, pointing to a dominant role of the holoparasite within the tripartite system.]

Miura, H., Ochi, R., Nishiwaki, H., Yamauchi, S., Xie XiaoNan, Nakamura, H., Yoneyama, K. and Yoneyama, K. 2022. Germination stimulant activity of isothiocyanates on Phelipanche spp. Plants 11(5): (https://doi.org/10.3390/plants11050606) [21 commercially-available isothiocyanates and several further analogues synthesised were assessed for germination of P. ramosa. Several found to have high activity, also on P.
aegyptiaca, but not Orobanche minor or Striga hermonthica.

Molina, J. and 14 others. 2021. Living with a giant, flowering parasite: metabolic differences between Tetrastigma loheri gagnep. (Vitaceae) shoots uninfected and infected with Rafflesia (Rafflesiaceae) and potential applications for propagation. Planta 255(1): (https://doi.org/10.1007/s00425-021-03787-x) [Showing that benzylisoquinoline alkaloids were naturally more abundant in non-infected shoots, perhaps proving some defence against infection. Oxygenated fatty acids, or oxylipins, and a flavonoid, previously shown involved in plant immune response, were significantly elevated in infected hosts.]

Muhammad Jamil and 12 others. 2022. A new formulation for strigolactone suicidal germination agents, towards successful Striga management. Plants 11(6): (https://doi.org/10.3390/plants11060808) [A welcome paper exploring the use of strigolactones for practical use in the field to induce suicidal germination. Emulsifiable concentrates of both methyl phenlactonoate 3 (MP3) and Nijmegen were more stable than the previously available ‘AG’ formulations and gave excellent results against S. hermonthica in lab and pot tests. Field results were not quite so promising but the authors conclude - ‘The development of proposed EC formulated simple SL analogs is the first step towards the large-scale synthesis of suicidal agents for field application and we believe this product will bring a breakthrough in suicidal technology to combat Striga in Africa.’]

Muhammad Jamil, Wang, J.Y., Yonli, D., Ota, T., Berqdar, L., Traore, H., Margueritte, O., Zwanenburg, B., Asami, T. and Al-Babili, S. 2022. Striga hermonthica suicidal germination activity of potent strigolactone analogs: evaluation from laboratory bioassays to field trials. Plants 11; 1045. (https://doi.org/10.3390/plants11081045) [Analogue MP16 caused the maximum reduction of S. hermonthica emergence (97%) in the greenhouse experiment, while Nijmegen-1 w the most promising under field conditions, with a 43% and 60% reduction of Striga emergence in pearl millet and sorghum fields, respectively.]


Muttaqin, Z., Sri, W.B., Basuki, W., Siregar, I.Z. and Corryanti. 2021. The pattern of germination of teak mistletoe seeds in relation with parasitism. Conference paper: Earth and Environmental Science. International Symposium on Arboriculture in the Tropics: Trees and Human Health, Bogor, Indonesia, 2021 Vol.918. [Studying the viability and germination of Dendrophthoe pentandra and Macrosolen tetragonus. The former was faster to establish and was the more predominant on teak trees.]

Mylo, M.D., Hofmann, M., Delp, A., Scholz, R., Walther, F., Speck, T. and Speck, O. 2021. Advances on the visualization of the internal structures of the European mistletoe: 3D reconstruction using microtomography. Frontiers in Plant Science 12(September) (https://doi.org/10.3389/fpls.2021.715711) [Recording the morphology of the endophytic systems of various ages of Viscum album parasitizing Aesculus flavia using X-ray microtomography scans and corresponding stereomicroscopic images. In older mistletoes, one main sinker was predominant and occupied an increasingly large proportion of the stem cross-section. Bands of vessels ran along the axis of the wedge-shaped haustoria and sinkers and bent sideways toward the mistletoe-host interface.]

[Manipulating the population of Phoradendron californicum on the host Prosopis velutina and finding that intraspecific competition exists for xylem resources between mistletoe individuals, including host carbon and there were significant.]

International Journal of Applied Sciences and Biotechnology 9(4): 242-249. [Local control methods for S. hermonthica include organic and or mineral fertilization, associated crops, crop rotation and the use of false hosts and trap crops. Some farmers cultivate resistant varieties and early maturing varieties, others use shea flour and herbicide treatment.]

Ndifon, E.M., Lum, A.F., Ndoh, D. and Educk-Mbe, E.P. 2022. Host-parasite relationship between Meloidogyne javanica and plantain (Musa paradisiaca), and nematidical activity of Lantana (Lantana camara L.) and mistletoe (Viscum album L.). Nigerian Agricultural Journal 53(1): 229-233. [Application of 16 g/plant of ground-up foliage of V. album per banana plant reduced nematode populations and prevented gall formation on plant roots. The result was equivalent to the use of the nematidical Ethoprophos.]


Nickrent, D.L. and Vartak, A. 2021. Parasitic flowering plants on postal stamps: vehicles for learning. Current Science 121 (12): 1538-1548. [At least 95 different stamps show parasitic angiosperms representing 52 species in 29 genera. Indonesia has the highest number of parasitic plant stamps (7) followed by Malaysia (6). These two countries achieved high numbers because Rafflesia is a popular plant to be represented on stamps (18 times), closely followed by Viscum album. (15). The examples are fully listed and many colourfully illustrated.]


Plant Signaling and Behavior 17(2114647): (https://doi.org/10.1080/15592324.2022.2114647) [Showing that, although P. japonicum germinates readily in an N-rich soil, germination is enhanced in the absence of N, by host exudates and by strigol.]

Okazawa, A., Baba, A., Okano, H., Tokunaga, T., Nakaue, T., Ogawa, T., Shimma, S., Sugimoto, Y. and Ohta, D. 2021. Involvement of α-galactosidase OmAGAL2 in planteose hydrolysis during seed germination of Orobanche minor. Journal of Experimental Botany 73(7): 1992-2004. [Detecting planteose in tissues surrounding-but not within-the embryo, supporting its suggested role as a storage carbohydrate. And identifying the α-galactosidase enzyme, OmAGAL2, involved in planteose hydrolysis in the apoplast around the embryo after the perception of strigolactones, to provide the embryo with essential hexoses for germination, suggesting that the enzyme OmAGAL2, which is involved in the hydrolysis of planteose, is a promising molecular target for root parasitic weed control. See also Press Report above.]

hybrids in multiple environments. Plants 11(7): (https://doi.org/10.3390/plants11070964) [Identifying hybrid TZEEI 79 × TZEERI 30 as the most outstanding in terms of grain yield and stability across environments, including Striga-infested, drought and optimal growing environments in Nigeria.]

Ossa, C.G., Aros-Mualin, D., Mujica, M.I. and Pèrez, F. 2021. The physiological effect of a holoparasite over a cactus along an environmental gradient. Frontiers in Plant Science 12(November): (https://doi.org/10.3389/fpls.2021.763446) [The mistletoe Tristerix aphyllus had its most serious effect on Echinops chiloensis under drought conditions towards the north of Chile when it reduced host photosynthesis more than in the south, where moisture and nitrogen were more favourable for the host.]


Park SoYon, Shimizu, K., Brown, J., Aoki, K. and Westwood, J.H. 2021. Mobile host mRNAs are translated to protein in the associated parasitic plant Cuscuta campestris. Plants 11(1): (https://doi.org/10.3390/plants11010093) [Showing that host-derived GUS mRNAs are translated in C. campestris and that fusion of (tRNA)-like structures enhances RNA mobility in the host-parasite interaction.]


Pendall, E. and 10 others. 2022. Remarkable resilience of forest structure and biodiversity following fire in the peri-urban bushland of Sydney, Australia. Climate 10(6): (https://www.mdpi.com/2225-1154/10/6/86) [Tree (Eucalyptus spp.) and unspecified mistletoe cover increased following fir in ironbark forest.]

Pinto-Carrasco, D., Delgado, L., Sánchez Agudo, J.A., Rico, E. and Martínez-Ortega, M.M. 2021. Phylogeography and ecological differentiation of strictly Mediterranean taxa: the case of the Iberian endemic Odontites recordontii. American Journal of Botany 109(1): 166-183. [Three species from the O. vernus group were recovered as distinct species, and three genetic groups were found within O. recordontii, which could have been restricted to narrow refugia during the Quaternary.]


Punia, S.S., Paras Kamboj, Yadav, D.B., Vinay Sindhu and Sushil Kumar. 2021. Herbicides’ efficacy on Egyptian broomrape (Orobanche aegyptiaca Pers.) in tomato and brinjal in South-West Haryana, India. Indian Journal of Weed Science 53(4): 392-397. [Sulfosulfuron and ethoxysulfuron applied at 50 g/ha 30, 60, and 90 days after planting were more on tomato providing 90% control of O. aegyptiaca, and a yield increase of 50% over untreated check. Both herbicides were damaging to brinjal. Neem cake or metalaxyl were not effective.]


Qian Shi Lin, Banerjee, A. and Stefanović, S. 2022. Mitochondrial phylogenetics of Cuscuta (Convolvulaceae) reveals potentially functional horizontal gene transfer from the host. Genome Biology and Evolution 14(6): [https://doi.org/10.1093/gbe/evac091] [Mitochondrial atp1 genes of South African subgenus Pachystigma were inferred to be transferred from Lamiales, with high support. Moreover, the horizontally transferred atp1 gene has functionally replaced the native, vertically transmitted copy, has an intact open reading frame, and is under strong purifying selection, all of which suggests that this xenolog remains functional.]

Qin RuiMin and 11 others. 2022. Effects of Pedicularis kansuensis expansion on plant community characteristics and soil nutrients in an alpine grassland. Plants 11(13): [https://doi.org/10.3390/plants11131673] [P. kansuensis increased the community richness index, and the soil pH which had a significant negative effect on the soil AOC, NO3-N, and available P, and finally caused the decline of soil quality.


Rubiales, D., Moral, A. and Flores, F. 2022. Agronomic performance of broomrape resistant and susceptible faba bean accession. Agronomy 12(6): [https://doi.org/10.3390/agronomy12061421] [Assessing 3 Orobanche crenata-susceptible, and 8 resistant lines of faba bean across 2 sites in southern Spain, over 3 seasons. Finding varieties Quijote, Navio6, Baraca and FaraonSC to be most suitable for their response to O. crenata and local weather conditions.]

Sadda, A.S., Issa, O.M., Jangorzo, N.S., Saïdou, A.A., Issoufou, H.B.A. and Diouf, A. 2021. Striga gesnerioides (Willd.) Vatke infestation and distribution as affected by soil properties and varieties at the plot and landscape scales in cowpea-based cropping systems. Weed Research (Oxford) 61(6): 519-531. [In screening 27 cowpea lines over 14 sites in Niger, varieties C5030 and C5095 were consistently resistant to S. gesnerioides, and occurrence of the parasite was negatively correlated with P and N and moisture levels.]

Sadda, A.S., d’Eeckenbrugge, G.C., Saïdou, A.A., Diouf, A., Jangorzo, N.S., Issoufou, H.B.A. and Issa, O.M., 2021. The witchweed Striga gesnerioides and the cultivated cowpea: a geographical and historical analysis of their West African distribution points to the prevalence of agro-ecological factors and the parasite’s multi-local evolution potential. PLOS ONE August 4, 2021 [https://doi.org/10.1371/journal.pone.0254803] [Commenting on ‘the increasing severity of Striga gesnerioides attacks on cowpea across West Africa’ and attributing it to ‘the increasing importance and intensification of the crop, and the consequent loss of biodiversity’. Also noting ‘Senegalese strains of S. gesnerioides from the wild developing virulence on cowpea’.

Saharan, G.S., Mehta, N.K. and Meena, P.D. 2021. Principles of host resistance. In:
Genomics of Crucifer’s Host-Resistance. Springer, Singapore: 1-64. (https://doi.org/10.1007/978-981-16-0862-9) [Apparently including reference to parasitic weeds e.g Phelipanche ramosa, but no detail in abstract.]


Sarić-Krsmanović, M., Zagorchev, L., Umiljendić, J.G., Rajković, M., Radivojević, L., Teofanova, D., Božić, D. and Vrbničanin, S. 2022. Variability in early seed development of 26 populations of Cuscuta campestris yunck.: the significance of host, seed age, morphological trait, light, temperature, and genetic variance. Agronomy 12(3): (https://doi.org/10.3390/agronomy12030559) [Seeds of 26 populations of C. campestris were collected from different locations in Serbia. Study of different temperatures and light on seed germination and seedling growth showed large variability of germination patterns each agronomic region reflecting the ability of C. campestris to adapt to local agricultural management practices.]


Sebastián Padrón, P. and Vélez, A. 2021. Description of the immature stages of the high Andean pierid butterfly Catasticta incerta incerta (Dognin, 1888) (Lepidoptera: Pieridae). Tropical Lepidoptera Research30(21): 65-71. [Noting that the host of C. incerta is the mistletoe Antidaphne andina.]


Siahmarguee, A., Taliei, F. and Yazdandost, M. 2022. (Evaluation of resistance and biochemical responses of different varieties of tomato to dodder (Cuscuta campestris yunck.,) (in Persian) Journal of Plant Environmental Physiology 17(65); fa19-fa37. [Comparing the metabolites of 2 varieties of tomato, susceptible Supra Urbana and resistant Super Chef, at various times after infection by C. campestris showed a greater increase in enzymes catalase, guaiacol peroxidise and ascorbate peroxidise in the resistant variety. There were also differences in build-up of phenolics and flavonoids.]


Snyder, S.A., Blinn, C.R. and Roth, S. 2021. Results of a survey of Minnesota foresters regarding knowledge of and treatment practices for dwarf mistletoe in black spruce stands in northern Minnesota. Staff Paper Series - Department of Forest Resources, University of Minnesota.261: 75 pp. [This
study relating to *Arceuthobium pusillum* infestation on black spruce (*Picea mariana*) in Minnesota highlighted information gaps that could be addressed through education, research and monitoring to better understand the economic and ecological importance of the disease as well as the understanding of the effectiveness of dwarf mistletoe treatments.


Somssich, M. and Cesarino, I. 2022. Parasite-resistant ketchup! Lignin-based resistance to parasitic plants in tomato. Plant Physiology 189(1): 4-6. [Concluding that resistance to *Cuscuta campestris* in tomato is due to lignification in the ciretx.]


Soriano, G., Siciliano, A., Fernández-Aparicio, M., Peralta, A.C., Masi, M., Moreno-Robles, A., Guida, M. and Cimmino, A. 2022. Iridoid glycosides isolated from *Bellardia trixago* identified as inhibitors of *Orobanche cumana* radicle growth. Toxins (Basel) 14(8): 559. [Five iridoid glycosides were isolated from shoots of *B. trixago* among which melampyrose was the most abundant and the most inhibitory to *O. cumana*.]

Soriano, G., Fernández-Aparicio, M., Masi, M., Vilarriño-Rodríguez, S. and Cimmino, A. 2022. Complex mixture of arvensic acids isolated from *Convolvulus arvensis* roots identified as inhibitors of radicle growth of broomrape weeds. Agriculture 12: 585. ([https://doi.org/10.3390/agriculture12050585](https://doi.org/10.3390/agriculture12050585)) [C. arvensis is resistant to *Orobanche* spp. This study suggests that this is due to the presence of arvensic acids (resin glycosides) which caused abnormal radicle development in *O. crenata*, *O. cumana*, *O. minor* and *Phelipanche ramosa*.]


Stanley, A.E. and 10 others. 2021. Association analysis for resistance to *Striga hermonthica* in diverse tropical maize inbred lines. Scientific Reports 11(12): ([https://doi.org/10.1038/s41598-021-03566-4](https://doi.org/10.1038/s41598-021-03566-4)) [Evaluating 150 diverse maize inbred lines under *Striga*-infested and non-infested conditions for two years and genotyping using the genotyping-by-sequencing platform revealed 30 single nucleotide polymorphisms associated with *Striga*-resistance.]


Sui XiaoLin, Guan KaiYun, Chen Yan, Xue RuiJuan and Li AiRong. 2022. A legume host benefits more from arbuscular mycorrhizal fungi than a grass host in the presence of a root hemiparasitic plant. Microorganisms 10(2): ([https://doi.org/10.3390/microorganisms10020440](https://doi.org/10.3390/microorganisms10020440)) [Finding that a legume host such as...
Trifolium repens benefits more from mycorrhizal inoculation than a grass host in the presence of the hemiparasitic plant Pedicularis kansuensis and discussing the mechanisms involved.

Sun Xiao Pei Jin, Zhao Lei, Bashir Ahmad ndf Huang LinFang. 2021. Fighting climate change: soil bacteria communities and topography play a role in plant colonization of desert areas. Environmental Microbiology 23(11): 6876-6894. [Discussing the role of Cistanche deserticola, Cynomorium songaricum and Cistanche salsa) in desert management in arid areas under global warming, demonstrating their high adaptability to future climate change. Streptomyces eurythermus and S. flaveus also somehow involved?]


[Presenting a draft of the S. hermonthica genome, providing insight into the makeup and evolution of this species and leveraging the genome in combination with a population genetics analysis to identify several candidate genes for parasite virulence. See detailed commentary by Westwood, 2022 below.]


[Reporting the development of a series of strigolactone analogs derived from cinnamic acid (CA) and the methylbutenolide ring (D-ring) and finding that all the cis-CA-derived SL analogs had stronger activities as seed germination inducers for Orobanche minor and Striga hermonthica, compared with the corresponding trans-CA-derived analogs. They also stimulated the host Arabidopsis.]


Takele Nagewo, Taye Tessema, Seid Ahmed and Tamado Tana. 2022. Biological characteristics, impacts, and management of crenate broomrape (Orobanche crenata) in faba bean (Vicia faba): a review. Frontiers in Agriculture 25(March): (https://doi.org/10.3389/fagro.2022.708187) [A general review, including a graphic account of its increasing spread in Ethiopia across South Tigray, South Gondar, and the South and North Wollo Zones, at low, medium and high elevations. Many farmers have had to give up growing faba bean and other legume crops and it is a threat to many other districts. Possible control measures are outlined and the need for legislative policies of the government bodies and the commitment of the community at all levels to implement them.]

Takikawa, H. 2021. Studies on strigolactone based on synthetic organic chemistry. Journal of Synthetic Organic Chemistry Japan 79(9): 819-828. [Reviewing the history of strigolactone research and introducing it from the viewpoint of synthetic organic chemistry. Also discussing their application for the control of root parasitic weeds.]

Tao Bo, Zhao Xu, Du Lei and Yun XiaoPeng. 2022. Study on induction of sunflower resistance by elicitor. Journal of Northern Agriculture 50(3): 53-59. ['The 600 and 800 times diluted elicitor (undefined but e.g. salicylic acid?) had obvious control effect on Orobanche cumana'. Reporting 90% control of O. cumana and safety to sunflower. The best application time was at 8-10 leaf stage and 12-14 leaf stage of sunflower.]

Teklay Abebe, Gurja Belay, Taye Tadesse and Gемечу Keneni. 2022. In vitro evaluation of marker assisted conversion of adapted sorghum varieties into *Striga hermonthica* resistant versions. SINET: Ethiopian Journal of Science 45(1): 69-85. [The study confirmed that marker-assisted backcrossing for transfer of lgs QTLs from donor into popular and farmer-preferred cultivars has the potential to enhance tolerance/resistance to *Striga* in sorghum]


Teofanova, D., Lozanova, Y., Lambovska, K., Pachedjieva, K., Tosheva, A., Odjakova, M. and Zagordhev, L. 2022. *Cuscuta* spp. populations as potential reservoirs and vectors of four plant viruses. Phytoparasitica: (https://doi.org/10.1007/s12600-022-00981-9) [The introduced *C. campestris* frequently proved positive for Tomato Yellow Leaf Curl Virus (19%) and Cucumber Mosaic Virus (30%) in Bulgaria, while only a single population of the other 3 native species were positive for both.]


Tonev, T., Kalinova, S., Yanev, M., Mitkov, A. and Neshev, N. 2021. Weed association dynamics in the oilseed rape fields. Scientific Papers - Series A, Agronomy 64(1): 591-599. [Noting that *Phelipanche ramosa* and *P. mutellii* are commonest in S. Bulagaria and are associated with inadequate rotation.]

Touchette, B.W., Feely, S. and McCabe, S. 2022. Elevated nutrient content in host plants parasitized by swamp dodder (*Cuscuta gronovii*): evidence of selective foraging by a holoparasitic plant? Plant Biosystems 156(3): 671-678. [C. gronovii had limited impact on plant size for *Justicia americana*, but reduced that in *Impatiens capensis*. It is suggested this difference arises from the higher mineral content of *I. capensis*.]


Vasilevskaya, N.V. 2022. Polyvariance of ontogeny of *Castilleja lapponica* Gand. under industrial pollution of the subarctic. Conference paper : IOP Conference Series : Earth and Environmental Science 2022(981): 618 [Populations of *C. lapponica* studied in Murmansk, NW Russia, where it was exposed to chemical and radiation from tantalum-niobium and rare earth mining. Usually perennial it usually succumbed after a year, but it survives as an annual due to enhanced seed production.]


(9%), Macrosolen cochinchinensis (3%). Commonest hosts were Falcataria moluccana followed by Samanea saman, and Averrhoa carambola. Virtually all were on hosts in open areas."

Wakabayashi, T. Ueno, K. and Sugimoto, Y. 2022. Structure elucidation and biosynthesis of orobanchol. Frontiers in Plant Science Feb 9: (https://doi.org/10.3389/fpls.2022.835160) [Reviewing the history leading to the discovery of the genuine structure of orobanchol and the current understanding of its biosynthetic mechanisms, involving cytochrome P450 monoxygenases downstream of carlactonoic acid via two pathways: either through 4-deoxyorobanchol or direct conversion from carlactonic acid.]

Wallach, A., Achdari, G. and Eizenberg, H. 2022. Good News for cabbageheads: controlling Phelipanche aegyptiaca infestation under hydroponic and field conditions. Plants 11(9): 1107. (https://doi.org/10.3390/plants11091107) [Three sequential applications of glyphosate, 21, 35, and 49 days after planting, effectively controlled P. aegyptiaca without damaging the cabbages at a dose of 72 g ae ha⁻¹. At 18 g ae ha⁻¹ ethametsulfuron-methyl was less effective as a spray but more so by overhead irrigation.]


Wang SiHai, Chen Jian, Yang Wei, Hua Mei and Ma YongPeng. 2021. Fruiting character variability in wild individuals of Malania oleifera, a highly valued endemic species. Scientific Reports 11:12. (https://doi.org/10.1038/s41598-021-03080-7) [Studies of levels of nervonic and other fatty acids in M. oleifera (Olacaceae) could lead to selection of individuals with excellent fruit traits for commercial cultivation.]

Wang WeiJia, Liu Rong, Wu You, Wang Hong and Yu WenBin. 2022. The complete chloroplast genomes of two Pedicularis species (Orobanchaceae) from southwest China. Mitochondrial DNA Part B 7(6): 971-973. [Reporting on endemics Pedicularis cephalantha (147,087 bp) and P. nigra (145,726 bp), closely related to each other and sister to P. oederi.]

Wei He, Yan Li, Wenfang Luo, Junhui Zhou, SiFeng Zhao and Jianjun Xu. 2022. Herbicidal secondary metabolites from Bacillus velezensis JTB8-2 against Orobanche aegyptiaca. AMB Express 12(52): (https://doi.org/10.1186/s13568-022-01395-w) [Four compounds isolated from B. velezensis, with diketopiperazine structure inhibited germination of O. aegyptiaca at concentrations from 0.5 mM to 4 mM. A B. velezensis broth Reduced O. Aegyptiaca in the field and increased tomato yield.]


Wu YuGuo, Luo Dong, Fang LongFa, Zhou Qiang, Liu WenXian and Liu ZhiPeng. 2022. Bidirectional IncRNA transfer between Cuscuta parasites and their host plant. International Journal of Molecular Sciences 23(1): (https://doi.org/10.3390/ijms23010561) [Finding that numbers of long non-coding RNAs are transferred between C. australis and its host soybean, which may act as critical regulators to coordinate the host-dodder interaction at the whole parasitic level.]


Xiao TingTing, Kirschner, G.K., Kountche, B.A., Jamil, M., Savina, M., Lube, V., Mironova, V., Al-Babili, S. and Bilou, I. 2022. A PLETHORA/PIN-FORMED/auxin network mediates prehaustorium formation in the parasitic plant Striga hermonthica. Plant Physiology 189(4): 2281-2297. [Results reveal a fundamental molecular and cellular framework governing the switch of S. hermonthica roots to form the invasive prehaustoria - shortly after germination, cells in the root meristem undergo multiplanar divisions. During growth, the meristematic activity declines and is associated with reduced expression of the stem cell regulator PLETHORA1 and the cell cycle genes CYCLINB1 and HISTONE H4.]

Xiaolei Cao, Sifeng Zhao, Zhaoqun Yao, Xue Dong, Lu Zhang and QY Zho. 2022. First report of Cirsium arvense (Canada thistle) as a new host of Orobanche cumana in Xinjiang, China. Plant Disease 6: (https://doi.org/10.1094/PDIS-04-21-0773-PDN). Yuxing Xu and 9 others. 2021. A chromosome-scale Gastrordia elata genome and large-scale comparative genomic analysis indicate convergent evolution by gene loss in mycoheterotrophic and parasitic plants. Plant Journal 108(6): 1609-1623. [Comparing the genome of the completely heterotrophic G. elata (Orchidaceae) with that of Cuscuta australis and finding both had lost 10% of conserved orthogroups, genes associated with photosynthesis etc, while Striga asiatica had lost only 4.5%.]

Xu YuXing, Zhang JingXiong, Ma CanRong, Lei YunTingm and Shen GuoJing. 2022. Comparative genomics of orobanchaceous species with different parasitic lifestyles reveals the origin and stepwise evolution of plant parasitism. Molecular Plant 15(8): 1384-1399. [Concluding that an ancient whole-genome duplication (WGD) about 73 million years ago, which occurred earlier than the origin of Orobanchaceae, might have contributed to the emergence of parasitism. However, no such events occurred in any lineage of orobanchaceous parasites except for Striga after divergence from their autotrophic common ancestor, suggesting that, in contrast with previous speculations, WGD is not associated with the emergence of holoparasitism.]


Yapa, S.S., Mohotti, A.J. and Samita, S. 2021. Mistletoe (Dendrophthoe neelgherrensis Wigh & Arn. Tiegh.) parasitism on yield of nutmeg (Myristica fragrans Houtt.): have we been underestimating the destructivity? Tropical Agricultural Research 33(12): 18-28. [Results suggest that 40% coverage of nutmeg by D. neelgherrensis caused 65% yield loss. Loss was much higher in infested than in uninfested branches.]

Ye HuiYing, Zhao WanLi, Li YanQiong, Chen Xia, Zhang YaXing nd Zhao Ping. 2021.


Yu RunXian, Sun ChenYu, Liu Ying and Zhou RenChao. 2021. Shifts from *cis*-to *trans*-splicing of five mitochondrial introns in *Tolypanthus maclurei*. PeerJ 9(12260): ([https://doi.org/10.7717/peerj.12260](https://doi.org/10.7717/peerj.12260)) [Results suggest that shifts to trans-splicing of mitochondrial introns may not be uncommon among angiosperms.]


Zhang YiXiao, Su JieTian, Yun Xiaopeng, Wu Wen Long, Wei ShouHui, Huang ZhaoFeng and Huang HongJuan. Molecular mechanism of the parasitic interaction between *Orobanche cumana* wallr. and sunflowers. Journal of Plant Interactions 17: 549-561. [Showing that *O. cumana* infestation significantly inhibits sunflower height, fresh weight, chlorophyl contents, photosynthetic and the MDA content, while superoxide dismutase and peroxidase activities were increased. 6 parasite-related genes were selected, which are markedly enriched in plant hormone signal transduction, photorespiration and phenylpropanoid metabolism pathway.]

Zhang YiXiao, Su JieTian, Yun Xiaopeng, Wu WenLong, Wei ShouHui, Huang ZhaoFeng and Huang HongJUan. Molecular mechanism of the parasitic interaction between *Orobanche cumana* wallr. and sunflowers. Journal of Plant Interactions 17: 549-561. [Showing that *O. cumana* infestation significantly inhibits sunflower height, fresh weight, chlorophyl contents, photosynthetic and the MDA content, while superoxide dismutase and peroxidase activities were increased. 6 parasite-related genes were selected, which are markedly enriched in plant hormone signal transduction, photorespiration and phenylpropanoid metabolism pathway.]

Functional Ecology of Plants and Ecosystems

HAUSTORIUM 82 has been edited by Chris Parker, 6 Royal York Crescent, Bristol BS8 4JZ, UK (Email chrisparker5@compuserve.com ), Lytton Musselman, Parasitic Plant Laboratory, Department of Biological Sciences, Old Dominion University, Norfolk Virginia 23529-0266, USA (fax 757 683 5283; Email lmusselm@odu.edu) and Luiza Teixeira-Costa,
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Pleinlaan 2. 1050 Brussels. Belgium. (luiza.teixeirac@gmail.com). It has been produced and distributed by Chris Parker and published by IPPS (ISSN 1944-6969).
Send material for publication to any of the editors.
Parasitic Plants Newsletter
ISSN 1944-6969
Newsletter of the International Parasitic Plant Society,
Amsterdam, Javakade 712, 1019 SH, The Netherlands
(http://www.parasiticplants.org

May 2023

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PRESIDENT’S MESSAGE

Dear IPPS members

In the previous issue of Haustorium we were looking back to the successful World Congress on Parasitic Plants (WCPP) held in Nairobi, Kenya (see: https://www.parasiticplants.org/2022/07/16th-world-congress-on-parasitic-plants-3-8-july-2022-nairobi-kenya-a-great-success/). Now I can announce that the organization of the next WCPP, which will be held in Nara, Japan, 3-7 June 2024 is in full swing (see https://www.parasiticplants.org/2023/01/the-17th-world-congress-on-parasitic-plants-3-7-june-2024-nara-japan/). Keep an eye on the IPPS website for details and more information on this meeting. I hope that many of you plan to attend this meeting.

This spring, the IPPS started again with the online monthly seminar series (see ZOOMINARS below). The next two will be held on 7 June and 5 July, On 5 July, after the seminar we will also host the IPPS General Assembly, online, using the same Zoom link as for the seminar. I hope you will all join to discuss IPPS matters and strategy with the EC. We will continue to host the online IPPS seminars throughout 2023. If you or one of your students wants to contribute to these seminars, please drop a line to Jonne Rodenburg at j.rodenburg@greenwich.ac.uk.

To keep the IPPS website lively and up to date we have several dynamic features, such as a Scopus and Google Scholar feed readers showing the latest publications on parasitic plants. Our Twitter feed was temporarily out of order but is working again and shows IPPS as well as #Parasiticplants hashtagged tweets. And the website has an option for IPPS members to post news and vacancies. Please check them out on www.parasiticplants.org! To post news yourself, login into the member area where you can post your most recent paper or project funding, as well as job vacancies. These will also automatically be Tweeted from the IPPS Twitter account, giving you even more exposure. I would also greatly appreciate if you’d update your member profile, with your picture and that of your institution and with a short description of your research area, if you have not already done that.

On an administrative note, all IPPS members received an email explaining that we have changed the membership year from the academic to the calendar year. In this way we hope there will be less confusion about when the membership fees are due. We use these fees to run the society and to support the organization of the WCPP and its attendance by young researchers from developing countries. Membership entitles you to a reduced fee for WCPP attendance and gives you access to the member area of the IPPS website. If you are reading Haustorium but are not an IPPS member yet, consider becoming a member, see www.parasiticplants.org for details and an online membership fee payment option.

In this issue of Haustorium you can find again a great selection of parasitic plant related news. Remarkable is the article on the protection, moreover sowing of mistletoe in Australia to support bird wildlife. Another parasitic plant related fact that attracted a lot of media attention already is “How rare island bunnies do a parasitic plant’s bidding”. Haustorium is also paying attention to the possible use of parasitic plants and parasitic plant extracts for treatment of disease, including a Viscum album extract for treatment of cancer. Of course, it also includes plenty of articles like ‘Cuscuta conundrum: Amarbel poses great risk to greenery in Dwarka (Gujarat)’ discussing problems caused by parasitic plants. Enjoy reading!

I wish you all a good summer break.

Harro Bouwmeester

LITERATURE HIGHLIGHT

Crop diversification and parasitic weed abundance: a global meta-analysis (Scott and Freckleton, 2022.)

Parasitic weeds like Striga cause significant losses to crop production in sub-Saharan Africa, resulting in billions of dollars in damages annually. A recently completed PhD project by Donald Scott at the University of Sheffield in the group of Professor Rob Freckleton has taken an ecological approach to help improve our understanding of this pernicious weed and how it can be better managed in the future.

Large-scale data on the distribution of Striga is scarce, impeding efforts to control and predict its
spread. To address this issue, Donald developed a method for monitoring *Striga* populations on a large scale. He applied this approach in Madagascar to investigate the abundance and distribution of *Striga asiatica* at a landscape scale. Having established large-scale transects that traversed the country, he collected data on crop management, soil structure, and environmental conditions and he identified correlations between *Striga* density and factors such as crop variety, companion crop, and previous crop.

The study also revealed a positive relationship between *Striga* density within a field and the density of neighbouring fields, highlighting the significance of spatial configuration and habitat connectivity in the spread of *Striga*.

Notably, the study emphasizes the importance of crop varieties and cropping patterns as potential control options, leveraging existing practices rather than relying on new technologies. Crop variety and legumes played key roles in driving *Striga* density, while precipitation seasonality, mean temperature, and altitude also had significant effects. This work emphasized the need for a multifaceted approach to manage *Striga* effectively, as single measures were deemed insufficient. One output of this work was a composite management index that incorporated various cultural practices, offering guidance for integrated *Striga* management beyond the study's geographical scope.

Taking a broader context, Donald conducted a meta-analysis encompassing 67 studies across 24 countries that examined the relationship between parasitic weed density, crop yields, and diverse cropping systems. The analysis of 1525 paired observations revealed that both spatial (intercropping) and temporal (crop rotation) diversification had a significant impact on reducing parasitic weed density. The study highlighted that spatial diversification had a stronger suppressive effect than temporal diversification. Additionally, intercrops that altered microclimate and soil chemistry, such as *Crotalaria*, *Stylosanthes*, Berseem clover, and *Desmodium*, showed the most effective management of parasitic weeds. This analysis further underscores the potential of crop diversification as a tool to enhance global food security by mitigating the impact of parasitic weeds.

Although Donald’s project has now finished, work on weeds continues at Sheffield and the group would be more than happy to talk to anyone about possible collaborations (r.freckleton@sheffield.ac.uk).


CONGRATULATIONS

Lytton Musselman

Lytton J. Musselman, Professor and Eminent Scholar celebrated his retirement from Old Dominion University, Norfolk VA USA where he served 50 years (since 1973) with a splendid retirement gala at the Norfolk Botanical Garden, February 18th, 2023. Dr. Musselman was celebrated in a packed garden ballroom, with old friends, colleagues, former and current students, and scores and scores of children and grandchildren stacked up like cordwood, and most importantly his wife and life partner, Libby Musselman. Stories of Musselman’s extensive field work abroad, spanning the globe and many decades, and his positive impact on lives of so many, were recounted through individual stories and tributes at the event. As Dr. Musselman would say, the lively event was “fine and dandy like sugar candy”, a Lytton-ism recounted by many of his students. Among his PhD students that spoke were plant parasite workers, Kamel Mohamed, Daniel Nickrent, and Jay Bolin.
Dr. Musselman’s impressive influence on literature of plant parasites, his enterprise in the establishment of Haustorium and in many of the international meetings is well known to our readers, and he continues to make contributions to the ecology and taxonomy of quillworts, longleaf pine communities, plants of the holy books, and ethnobotany. In retirement his infectious enthusiasm for plants continues unabated, he is currently the editor of the *Chinquapin* newsletter of the Southern Appalachian Botanical Society and completing a book (his 10th!) titled ‘Parasitic Plants in African Agriculture’ with Jonne Rodenburg that should be released by CABI Press in August 2023.

The event was a fitting tribute to a pillar of IPPS since its inception and a kind man whose contributions to plant parasite biology will echo for years.

Jay Bolin

**IPPS ZOOMINARS**

*April 5, 2023*

Changsheng Li - Hunan University, China - Elucidation of the biosynthetic pathway and biological functions of strigolactones in maize and rice.

Strigolactones are a class of plant signaling molecules of great importance, with diversified structures and diverse biological roles in and outside the plant, in the rhizosphere. Maize (*Zea mays*) is one of the most important staple crops in the world. However, its yield is severely compromised by the parasitic witchweeds. In the maize work, by using a combination of approaches, we revealed natural variation in the maize strigolactone production, identified three new maize strigolactones, and elucidated their complete biosynthetic pathways.

We discovered a novel cytochrome P450, ZmCYP706C37, catalyzing several steps in the biosynthesis of maize strigolactones. Among those, two (zealactol and zealactonoic acid) showed much lower activity than zealactone, in inducing *Striga* germination. We also showed that changes in the composition of the strigolactone blend in some lines correspond to differences in *Striga* germination and infection.

Similar strategies were used in the rice project. A new strigolactone 4-oxo-MeCLA was identified and its biosynthetic pathway was further elucidated, in which OsCYP706C2 was involved. Moreover, bioassays using *Striga* and AM fungi indicate that oscyp706c2 mutants were not affected in *Striga* germination inducing activity but showed delay in AM fungi colonization.

Taken together, we show how intricate strigolactone biosynthesis (in maize and rice) is and shed further light on their biological significance.

Moez Amri - University Mohammed VI, Morocco - Breeding for resistance to broomrapes in cool season legumes: the cornerstone of a successful control strategy.

He has selected, development and released to the farmers several faba bean, chickpea, lentil and grass pea varieties in Tunisia and the CWANA and Sub-Saharan regions. Most of the faba bean released varieties are carrying good resistance to the broomrapes *Orobanche crenata* and *O. foetida*. These varieties are now largely adopted by farmers and highly recommended by the seed companies and extension agencies. Association (APBA) Executive committee representing NA region.

*May 3, 2023*

Hanan Eizenberg - Newe Ya'ar Research Center, Israel - Predicting the dynamics of broomrape parasitism as a basis for decision support systems to control the parasite. What
have we learned after twenty years of research?

Root parasites (*Phelipanche* and *Orobanche* spp.) are serious pests in Israeli agriculture. Species of economic importance include Egyptian broomrape (*P. aegyptiaca*), crenate broomrape (*O. crenata*), and sunflower broomrape (*O. cumana*). Crops affected by broomrape include mostly plants from the botanical families of Solanaceae, Fabaceae, Asteraceae, and Umbellifers. The damage caused by the aforementioned broomrape species in field and vegetable crops can be highly severe and may result in total yield loss. Current broomrape control protocols are exclusively targeted at the specific host-parasite interaction.

Chemical-based solutions (herbicides) may be suitable for different broomrape species parasitizing the same host, however, they are not always efficient for hosts from other botanical families. There are several reasons for this: a) as reported in many papers, the interactions between the parasite and the host are different in terms of the dynamics of parasitism; b) selectivity of the hosts to different herbicidal modes of action; c) different herbicides application methods. The major challenge in developing principles for smart broomrape management is based on the fact that most of the parasitic plant life cycle occurs below the soil surface, resulting in great difficulty to determine the optimum timing for herbicide applications. Other issues that may prevent successful management are; the spatial variations in seed infestation within plots, the duration of herbicide action and depth in the soil, the timing of subsequent applications, and the most appropriate dosage for each stage of parasite infection. Therefore, the basis for smart broomrape management is the study of the temporal and spatial dynamics of the parasite in the agricultural field, and the correct and precise herbicide application using the most effective application systems available at each farm. Over twenty years of research, we have developed several decision support systems based on these principles for the control of Egyptian broomrape in tomatoes, carrots, and cabbage and also for the management of sunflower broomrape in sunflower.

These decision support systems allow growers to cultivate crops such as tomatoes, carrots, cabbage, and sunflower in fields infested with broomrape with minimal damage. In my talk, I will describe different models for predicting host-parasite dynamics based on soil temperature measurements, I will discuss approaches for studying the spatial variation of broomrape in the field and the means for precise application of herbicides. In addition, I will discuss various obstacles encountered by farmers in the field using these models and how research is addressing issues of herbicide-induced damage, herbicide degradation in soil, and the role of the microbiome in broomrape control with herbicides.

Ahmet Uludag – Çanakkale Onsekiz Mart University, Turkey - *Broomrape control in tomato growing: one method is not enough.*

Tomato has worldwide importance from nutritional value to economical value. Broomrapes (*Orobanche* and *Phelipanche* spp.) are among foremost problems in tomato growing. Five out of seven important crop parasitizing broomrapes have been recorded on tomato, namely *P. ramosa, P. aegyptiaca, O. cernua, O. cumana* and *O.crenata*. The motto of broomrape control has been ‘one method is not enough’. In this presentation, methods to control broomrape will be reviewed although there have been several high-quality reviews published. Knowledge on the implementation of measures and our experiences will be blended to convey our view to colleagues.

7th June
Sylvia Mutinda, Kenyatta University
James Bradley, University of Toronto

5th July
Elvin Mulaa, ICRISAT
Natsumi Aoki, Nara Institute
to be followed by an online IPPS General assembly.

PRESS REPORTS

Rare parasitic plant rediscovered in dunes over Lake Michigan

The Wisconsin Department of Natural Resources (DNR) today announced that a population of a rare parasitic plant was rediscovered on the dunes overlooking Lake Michigan in Manitowoc County. A trained volunteer for the Rare Plant Monitoring Program spotted the clustered broomrape (*Orobanche fasciculata*), which has not been seen in over 44 years. This discovery
and others are featured in the Rare Plant Monitoring Program’s recently released 2022 Annual Report. Almost 15% of Wisconsin’s 2,366 native plant species are considered rare, meaning they are listed as endangered, threatened or of special concern.

Photo credit: Robbin Moran

More than 50 trained volunteers from around the state submitted over 220 reports of rare plants in 2022, including 42 populations in areas of Wisconsin where they have not been documented before.

‘These new discoveries are very exciting. They help increase our understanding of the number and locations of rare plant species in Wisconsin so we can better monitor and protect them,’ said Kevin Doyle, DNR Natural Heritage Conservation Botanist and Rare Plant Monitoring Program Coordinator. ‘Volunteers also revisit known locations, another important part of the conservation process. If we don’t check on these populations, we won’t know when they are in trouble.’

Since 2013, the DNR’s Rare Plant Monitoring Program has trained and sent volunteers to check on the health and size of rare native plant populations. The volunteer program is Wisconsin’s largest source of rare plant data and is unique in the Midwest for its breadth of surveys statewide.


PS For short video from Nature World News see: https://youtu.be/Jg14zGuZFSs

Researchers are exploring the role of plant hormones known as strigolactones (SLs) in preventing infestations by the parasitic plant Striga hermonthica. Plant architecture, plant development and stress response are regulated by SLs in cereal crops. The SLs released by plant roots attract mycorrhizal fungi, which provide plant nutrients. But SLs are also known to induce germination and invasion by the parasitic plant Striga, with severe impacts on agricultural production, particularly on cereal yields in Africa. Researchers say they have managed to show that canonical SLs do not affect plant architecture in rice.

The researchers employed CRISPR/Cas9 technology to generate rice lines without canonical SLs and compared them to wild-type plants. The shoot and root phenotypes did not differ significantly between the mutants and the wild type, indicating that canonical SLs are not major regulators of rice architecture. The research showed that canonical SLs do contribute to a symbiosis with mycorrhizal fungi and play a major role in stimulating seed germination in root parasitic weeds. Modulation of SL content by gene editing is a long-term solution, but the application of specific inhibitors of SL biosynthesis may lead much faster to cereal plants lacking the canonical strigolactones.

The team set out to identify chemicals that inhibit canonical SL biosynthesis in rice. They found a chemical enzyme inhibitor TIS108 significantly lowered Striga infestation without affecting plant growth or grain yield. They also tested the effect of TIS108 on Indica rice and sorghum, both major crops in Striga-infested regions in Africa. Once again, they observed lower Striga germination activity from the root exudates isolated from treated plants. Al-Babili says direct application of TIS108, as well as employing gene editing, represents promising strategies for alleviating the threat posed by Striga and other root parasitic plants to global food security.

The group is now investigating the effect of TIS108 on pearl millet, a wider project funded by the Bill & Melinda Gates Foundation, aiming to improve the architecture of this cereal and increasing its resistance towards Striga.

T4MAG Technology magazine. 3 November 2022.

Striga invasion in plants may be prevented through strigolactones
Maize varieties resistant to Striga weed unveiled - YouTube

In a bid to fight striga weed that has ravaged maize plantations in Busoga region of Uganda, the national Agriculture and research organization[NARO] has unveiled eight new varieties of maize which are resistant to the witchweed. Researchers say that the new maize varieties have been under experiment in demonstrations gardens set up in Iganga district.

Click on YouTube above for short video.

Birdlife Australia working with Aboriginal land council to return mistletoe to burnt woodlands

Mistletoe is often associated with Christmas, yet native mistletoe is something of an unsung hero when it comes to woodland birds. It provides food, shelter, and nest sites, including for the critically endangered regent honeyeater, but repeated bushfires in recent years have wiped it out from a key breeding area in New South Wales' Lower Hunter region. Mistletoe does not regenerate after bushfires and, without intervention, it will take many years to re-establish in the Tomalpin Woodlands — time the regent honeyeater does not have, as there are only about 300 left in the wild.

A male mistletoe bird feeds on box mistletoe (Photo: Allan Richardson)

Hoping to ‘fast-track’ the restoration of mistletoe and boost the regent honeyeaters' chances of survival, Birdlife Australia (BA) has partnered with the Mindaribba Local Aboriginal Land Council (LALC) in a seed-planting project. ‘It's really exciting work. As far as we know this is a world first,’ BA NSW Woodland Bird program manager Mick Roderick said. ‘Waiting for [the seed-spreading] birds to go off somewhere else, eat mistletoe and bring it back, could take at least 30 years and we don't have that much time.’ Mistletoe relies on a host plant to survive and there are 97 different species across Australia.

Planting mistletoe in treetops

NSW Woodland Bird project officer Kristy Peters said the project, which was launched a few years ago, was very hands-on. ‘The idea started from a project that Professor David Watson and his team at Charles Sturt University had been working on with the City of Melbourne, where they had been planting mistletoe into trees in Melbourne to boost biodiversity in urban areas,’ she said. ‘We have a team of arborists who climb into the treetops and pick the mistletoe fruit from the canopy for us. ‘Then you need to squeeze the ripe fruit out, and it has this sticky coating over the seed, and you basically wipe it onto the underside of a branch and that's mimicking what a mistletoe bird would do naturally. ‘Then you sit and wait patiently and hope you get a new mistletoe plant growing from that.’

Project proving successful

About 2,000 mistletoe seeds had been planted since the summer of 2020-21 and early monitoring was showing signs of success. Mr Roderick said in the wild about 10 per cent of mistletoe seeds deposited by birds and animals grew into a healthy mistletoe clump, and the project was achieving a similar success rate. ‘It hasn't been done before, so we have been learning as we are going,’ he said. ‘We've learnt there's a certain width of branch, which is best to plant the mistletoe on. ‘You also need to check the tree to make sure the bark isn't shedding, otherwise the mistletoe can't attach. ‘I like to say that mistletoe supercharges a woodland. Wherever you get mistletoe you are going to get way more diversity of birds and other fauna.’

Summer planting to occur

A large number of seeds would again be planted in the Tomalpin Woodlands this summer. ‘The mistletoe will be fruiting around Christmas time and into January and that's when we will be getting out with our arborists,’ Mr Roderick said. ‘We are aiming to have about 2,000 seeds planted up into the canopy this season.’ The idea has attracted interest from other areas, including the Manning region where the MidCoast Council has sought information. ‘It's been great to see the expanding interest throughout NSW, because there are species of mistletoe that regent
honeyeaters and a lot of other woodland birds rely on all along the coast,’ Ms Peters said.

**Birds released into area**
The restoration work is being undertaken in conjunction with a regent honeyeater captive-breeding program, with 50 regent honeyeaters recently released into the Tomalpin Woodlands. ‘Those birds are helping boost the wild population,’ Ms Peters said. ‘So we are really hopeful, if we continue doing the habitat restoration, in hand with these captive releases, that we can eventually reverse the steep decline in regent honeyeaters we have unfortunately seen over the past 20 years.’

By Emma Siossian and Cameron Marshall. 23 Dec 2022

**Mistletoe decline could threaten nectar-feeding bird populations**

The regent honeyeater often relies on mistletoe nectar, fruit and foliage during drought. (Photo: Lachlan Hall)

Ecologists fear the widespread loss of native mistletoe due to drought could leave nectar-feeding birds even more vulnerable.

**Key points:**

- Researchers have discovered a concerning decline in mistletoe across Australia
- Mistletoe can be the only source of food for nectar feeding birds during droughts
- Ecologists say more needs to be done to protect the shrub

Charles Sturt University ecology professor David Watson said birds relied on mistletoe nectar, fruit and foliage during drought. But researchers recently discovered a concerning decline in the shrub while monitoring nectar-feeding birds at 2,000 sites across south-eastern Australia. ‘(We) found that during the height of the drought, when it was not just really dry, but critically also quite warm at night, almost all mistletoes died,’ Professor Watson said. ‘And we were like, 'Oh gosh, this is the one plant that seems to be really important for holding these guys together’.

**Misconceptions about mistletoe**

There are almost 100 species of mistletoe in Australia. Professor Watson said there was a misconception that mistletoe was a pest, due to its parasitic nature. ‘But mistletoes are a native plant, they've been in Australia as long as kangaroos and wattle,’ he said. ‘And when it's very dry and crispy and plants are struggling to get enough water to survive, mistletoes don't care, they just slurp water out of the tree.’

Professor Watson was a co-author of a report on the decline that was led by Australian National University's Difficult Birds Research Group member Ross Crates. Birdlife Australia national public affairs manager Sean Dooley said the study's discoveries didn't come as a surprise. ‘This research is confirming our worst fears,’ Mr Dooley said. He said the critically-endangered regent honeyeater was among the most vulnerable nectar-feeding birds. ‘Saving these birds is important not just because they're wonderful birds, but they're also part of of our woodland ecosystem and are really important pollinators,’ he said. ‘We need them to keep our forests healthy.’

**Threats to survival**

Mr Dooley said woodland bird populations were declining across south-east Australia due to historical and ongoing land clearing. ‘We need to preserve what we have left, and often the best areas of woodland are remnants on private land,’ he said. He said work needed to be done to protect and enhance woodland on public and private property. ‘And it may come down to trying to transplant or grow mistletoe in areas where it has disappeared because of drought,’ he said. Mr Watson said something needed to change urgently before it was too late. ‘If we keep pushing the lever of climate change just a little further, things are going to start succumbing,’ he said.

Charmayne Allison and Sandra Moon, 18 Jul 2022
**Cuscuta conundrum: Amarbel poses great risk to greenery in Dwarka (Gujarat).**

*Cuscuta filiformis*, commonly known as ‘Amarbel’ is now posing a great risk to the greenery of the sub city these days. Be it road side plants or trees or the horticulture of a park or green areas - all are getting affected with the parasite leading to a slow death. The devastating effect of Amarbel can be seen easily on trees and plants in many areas of the city. Morning walkers and the nature lovers have been witnessing its growth all across the city. An environment activist from Dwarka, Diwan Singh says, ‘I have noticed the parasites on the vegetation in various sectors this time. The attack is damaging the greenery of the area.’

The plants with new leaves and shrubs besides the roads have been attacked by such parasites. ‘I have witnessed that in Sector 12. The effect is worst on the greenery. In my every day notice during morning walk for five years, I must say that this time the Cuscuta affect is much greater than previous years. DDA must look into the matter seriously,’ said T Sampat Kumar, a resident of Vikram Nagar. In various sectors, the parasites can be seen in parks, along the major roads of the city, service lanes, etc. Trees and particularly ornamental plants are getting infected with Amarbel.

Vijay Dhasmana, naturalist and ecological conservator says, ‘Cuscuta is a dangerous parasite plant, marring the beauty of the areas killing the plants. These are parasitic plants which suck their food from the host plants and finally cause the death of host plants. These need to be trimmed and removed at an early stage to save or ensure good health and growth of plants. These should be manually removed by the horticulture department as soon as possible.’ He further added, ‘Such parasites spread from one tree to another by ‘carriers’. These parasites are carried by the birds in their excreta. Though such parasites are sticky in nature, the excreta of the birds stick on the branches of the trees and thus Cuscuta reproduces itself. These plants are like green thread and mainly affect the arid area’s plants.’

January 06, 2023

**How rare island bunnies do a parasitic plant’s bidding.**

The world’s only wild black-furred rabbit has a very important job — distributing seeds for a parasitic plant.

The five-pound, black-furred Amami rabbits of Oshima Island and Tokunoshima Island in Japan are sometimes called ‘living fossils’ because their ancestors have died out on mainland.

In February 2020, an amateur naturalist named Yohei Tashiro was walking through the evergreen forests of the islands, situated about halfway between mainland Japan and Taiwan. On the ground, nestled against the roots of a tree, he noticed a cluster of strange, red globes — like strawberries crossed with red cap mushrooms. Even more interesting: Something clearly had been going to town on the ruby-red growths, the fruits of a weird little plant called *Balanophora yuwanensis*. A plant oddity, *B. yuwanensis* does not perform photosynthesis, but rather leaches its energy from the roots of other plants. Technically, it’s a parasite.

While scientists had long figured that *B. yuwanensis* relied on the wind to spread its seeds, dense plants growing beneath the tree canopy cut down on how much air can blow through the forest. In addition, the plant’s seeds are tightly packed, dry and rather unappealing aside from their vibrant color. ‘Yes, I tried it,’ said Kenji
Suetsugu, an ecologist at Kobe University in Japan, ‘but it was not sweet and not tasty.’ Birds have been known to eat the fruits, but only sparingly, leaving the scientists to wonder: Could the parasitic plant get around by advertising its seeds to an ancient, endangered and equally weird mammal instead?

The *B. yuwanensis* fruit does not perform photosynthesis, but leaches its energy from the roots of other plants. Technically, it’s a parasite. Credit...Kenji Suetsugu and Hiromu Hashiwaki

Enter the nocturnal *Pentalagus furnessi*, or Amami rabbit, the world’s only dark-furred wild bunny. In a study published this week in the journal Ecology, Dr. Suetsugu and Hiromu Hashiwaki, a co-author also of Kobe University, posit an evolutionary bargain between Amami rabbits and *B. yuwanensis*. The root-sucking plants give food in exchange for seed dispersal services — something that has never been documented between a mammal and a parasitic plant. The five-pound Amami rabbits have died out on mainland China. But on two small, volcanic islands known as Oshima Island and Tokunoshima Island, about 5,000 of the short-eared bunnies soldier on. The International Union for Conservation of Nature considers the species endangered, a result of a combined habitat about 130 square miles, and the ever-present threat of annihilation by nonnative predators on the islands, including mongooses, cats and dogs as well as logging operations by humans. Amami rabbits hold cultural significance to the people who live on these islands and they are a flagship species for conservation and tourism. But not a lot is known about them, Dr. Suetsugu said.

Acting on a hunch that it was the rabbits gnawing the fruits to their nubs, the scientists trained three infrared camera traps on *B. yuwanensis* fruit bundles in January 2021. By March, they had an answer. During the day, pale thrushes and Ryukyu robins visited the bright red fruits, but the birds tended to consume only a little bit of fruit at a time. Invasive rats also infrequently dined on the fruits. But when night fell, the Amami rabbits feasted, sometimes gobbling up a whole, golf-ball-sized globe in a single sitting. Combining the frequency of visits and the amount of fruit consumed, the scientists concluded that the rabbits were the main creatures feeding on the parasitic plants. On a hunch, the scientists trained three infrared camera traps on *B. yuwanensis* fruit bundles and captured the Amami bunnies feasting.

To further investigate their hypothesis, the scientists then set out to find Amami rabbit feces in the wild. Examing five pellets - the small sample size a result of the rarity of the species - they confirmed that each one contained at least one viable *B. yuwanensis* seed. Using a combination of the wild rabbit droppings and Amami rabbits housed at the Kagoshima Hirakawa Zoo, the scientists found that nearly 55 percent of the *B. yuwanensis* seeds to pass through the animals’ digestive tracts were still viable. Compared with similar studies of the European rabbit, which show an average of just 5 percent viability with 19 other plant species, it would seem the Amami rabbits have greater success planting new seeds. Most importantly, it’s possible that these bunnies are much more effective parasitic-plant seed dispersers than birds, because of their natural behavior of digging burrows at the base of large trees, where *B. yuwanensis* requires a host plant’s roots to survive. In other words, the rabbits’ dropping
patterns are less random, in the evolutionary eyes of the parasites.

While Amami rabbits and Balanophora plants may not be household names, the study reveals yet another complex relationship that has evolved through the ages, said Dr. Suetsugu. It also hints at the greater toll incurred when we drive species to extinction. He added: ‘The loss of the Amami rabbit could also have a ripple effect on the entire ecosystem.’ All the more reason to study the Amamis before they’re gone.


Jason Bittel, New York Times, January 26, 2023

**Mistletoe glue could one day be used to seal wounds**

The adhesive was made from a substance surrounding the seeds in mistletoe berries, known as viscin. (Photo: Depositphotos)

In order to spread to other host trees, the parasitic mistletoe plant has very sticky seeds that cling to bird feathers, bark, and other materials. According to a recent study, the ‘glue’ on those seeds could inspire new biomedical adhesives.

Contained within the plant's berries, mistletoe seeds are surrounded by a mucus-like substance known as viscin. It is in turn made up of cellulose nanofibers suspended within a gelatinous matrix. The basic idea is that when birds are eating the berries, the seeds will stick to their beak or feathers, then get transferred onto the bark of other trees. There, they'll grow into other mistletoe plants.

Assoc. Prof. Matthew Harrington, from Canada's McGill University, became curious about the potential human applications of viscin after seeing his daughter playing with a sticky mistletoe berry. Working with colleagues from Germany's Max Planck Institute of Colloids and Interfaces, he proceeded to devise a technique in which wetted viscin fibers could be formed into thin films or three-dimensional structures. The resulting adhesive was applied to a number of different materials, then allowed to dry. As it did so, the cellulose fibers aligned with one another and bonded together. As a result, the adhesive was found to stick well to synthetic materials like metal, plastic and glass, along with biological tissues such as skin and cartilage.

That said, raising the relative humidity of the adhesive (by exposing it to water vapor) caused the fibers to swell and release their hold on one another – thus making the adhesive easy to remove from the various materials. And as an added bonus, it's both biocompatible and biodegradable. In one experiment, a film of the viscin-based adhesive was successfully used to seal wounds cut into non-living pig skin. While that film was flexible enough to move with the skin without breaking, it could still be taken off as needed. Plans now call for more research to be conducted, to better understand what chemistry is at work within the adhesive.

By Ben Coxworth
June 16, 2022

**Kiss of life for rare dwarf mistletoe species**

A naturally uncommon mistletoe species that only grows in a handful of spots across the Kāpiti Coast has been given a kiss of life thanks to a decade of work by a local biodiversity champion.

Rhys Mills, Reserve Supervisor at Ngā Manu Nature Reserve has spent the last 10 summers painstakingly harvesting locally endangered *Korthalsella salicornioides* seeds, one of eight species of mistletoe found in Aotearoa New Zealand.

‘We’re seeing incredibly heightened groundwater levels across the district which are effectively drowning two of the three main mānuka habitats where you could find mistletoe growing naturally. ‘It’s an all-out effort to get as much seed out as possible now.’ Unfortunately, Mills’
ability to collect seeds this year was hampered by a hand injury, so he called on Kāpiti Coast District Council for some help. ‘Rhys has really been an unsung hero in the conservation of this threatened species,’ says Andy McKay Team Leader Environment and Ecological for Council. ‘We’ve been more than happy to help out with harvesting this year at ecological sites in Waikanae Park, which has dying mānuka currently sitting in a metre of water,’ says Mr McKay.

Dwarf Mistletoe growing in Kapiti

Collecting seeds isn’t as simple or easy as it sounds, however. This mistletoe sheds its seeds explosively, similar to a mushroom shedding spores. The seeds travel between 60 to 100cm from the plant into the surrounding canopy. ‘We’re not sure what the release trigger is but we know that it generally happens in February for about four weeks. That means we need our sites prepped, ladders in place and manpower on standby by the end of January,’ says Mills. ‘The seeds are tiny so we set traps of fine mesh curtain secured by cable ties over each plant that catch expulsions. We need to check the cloth every 24 hours and when we find seeds, we use a slushy straw to gently scrape them off into an old pill canister. ‘To help the seeds stick to a new host, they are ejected with a gelatinous substance that dries on the cloth, so we dampen it to help remove them, then sow onto new hosts in a safer ecosystem. We spray them with a 10 percent solution of PVA glue and water to reduce transpiration.’

Mills says that over the years he has experimented with locations, including a successful planting programme at Ngā Manu Nature Reserve. ‘Dwarf mistletoe needs a dense canopy habitat of either kānuka or mānuka so that the seeds can spread but we don’t have that at the remaining sites in Kāpiti anymore. Our species prefers mānuka which only has a 20-year lifespan so I’m now trialing seeds on kānuka as it has a lifespan of up to 120 years,’ says Mills. ‘Humidity is important for success, too. Seeds take better by open water so I think if we can do some planting on the edge of the wetlands in Waikanae Park, we’ll have a good shot at reintroducing dwarf mistletoe back to the area in the future – but it will be years away.’

So, after countless hours, year upon year, dedicated to saving a tiny exploding native parasite, has it all been worth it? Mills thinks so. ‘Native mistletoe is extremely overlooked and gets a bad rep as a parasite but we have to remember that not all parasites are bad,’ says Mills. ‘So many of the modern and traditional medicines we rely on originate from compounds found in plants. What if there is something that could be important in mistletoe? I think it’s worth saving. If we lose it, it’s gone forever.’

Mills celebrated 30 years of tenure at Ngā Manu in February, a huge achievement and testimony of his dedication to conservation work in Kāpiti.

Kapiti Coast District Council 4 April 2023

How mistletoes are expected to fare on a warming planet.

As ecosystems degrade in our warming world, many animals and birds are coming to rely more heavily on common, berry-bearing parasitic plants like mistletoes. Mistletoes also provide cool havens for nesting birds and welcome shade for animals resting below. They may even help to cool cities. But mistletoes also are exceptionally vulnerable to bouts of extreme weather like droughts. Climate change is taking a heavy toll on them, just as animals come to rely on them more.

David Watson knows these things well. In both academia and the media, he has come to be referred to as ‘the mistletoe guy’ — ever since his student research project stumbled on the fact that certain desert birds were found only in places with mistletoes in the trees. He has since tracked mistletoes across the globe, and coauthored a paper in the 2022 issue of Annual Review of Ecology, Evolution, and Systematics about the role of parasitic plants in a warming world. (see Watson et al. 2022 below.)
Why are mistletoes particularly sensitive to environmental stress, like drought or frost?
The fundamental reason is just basic physiology. They’ve got no storage organs, no way to store carbohydrates. They’ve got no root system, no bulbs, no rhizomes. So when they lose their leaves, that’s it, they’re screwed. That could happen through herbivory, like if a whole lot of caterpillars come along, or a low-level fire that comes through and crisps up the canopy. If the host plant is drought-stressed and starts to wilt, mistletoes will just curl up and die. They’re weirdly sensitive to a lot of these disturbances. That’s why the world isn’t full of them, because they’re actually quite picky. They’re hard to grow.

How are these plants faring in the face of climate change?
We see again and again that when climates shift, foods and things that depend on those foods can often be out of sync — a shift to earlier springs, for example, might mean most berries are produced too early for animals that need them later in the season. We’re seeing that mistletoe becomes disproportionately important in many systems because other stuff is out of whack, but mistletoe is still there — it’s reliable. Any month of any year, you can find a mistletoe in most parts of the world that’s either fruiting or flowering. They’re just good at what they do. So there’s increased reliance on mistletoe as a resource.

But then, we’re also seeing mistletoe die-offs. We’re seeing increased sensitivity to disturbances, whether it’s heat waves or drought or fire. So, on the same page, you’ve got animal communities leaning more and more heavily towards this group of plants, but those plants struggling to persist.

My colleague, Francisco Fontúrbel, works in southern Chile. Where mistletoe is around, because it’s a reliable nectar source, the southernmost hummingbird (Sephanoides sephanoides) becomes resident. They pollinate the mistletoes, but they also pollinate all sorts of other plants. After drought, mistletoes die, and those hummingbirds become migrants: They pack up, they follow the nectar further and further north. One study showed mistletoe deaths doubling in the dry year of 2015, and visits from hummingbirds dropped. When the hummingbirds leave, the local plants don’t have pollinators anymore. This is predicted to trigger a community-wide cascade of extinctions, although that hasn’t been documented yet.

In Australia, large-scale research shows that mistletoe is super-important during drought as a sort of last-ditch nectar resource. But then, that same work shows that drought kills many mistletoes: In the summer of 2009, for example, there was a prolonged heat wave in Melbourne, including the hottest day ever recorded — and nearly 90 percent of a monitored set of mistletoes died. That caused a crash in bird numbers and insect-eating animals.

It’s not across the board. Some tropical systems, some temperate forest systems, are not showing those early warnings of system failure, these mistletoe deaths. But in many arid zones, and in some southern forests at higher latitudes, we’re already seeing food webs breaking down. We don’t want to ring the alarm bells and say the sky is falling, but it’s not looking good.

Albury-Wodonga, December 17, 2022, speaking with Knowable Magazine about the latest results. The interview has been edited for length and clarity.

PARASITIC PLANTS IN MEDICINE
We decided some years ago to cease covering the literature on the use of parasitic plants in medicine. There seemed to be no great interest among our readership, and there are often serious doubts about the identification of the species involved as was noted in Haustorium 66, p.7 ‘Mistletoes and medicine: a plea for better taxonomy’ by Dan Nickrent, commenting on the widespread assumption that the species involved in many studies in Nigeria and elsewhere in West Africa, was Viscum album, which does not occur in that region.

It is very striking, however, how the literature on therapeutic uses dominates the literature, being well over 50% of the abstracts on parasitic plants in e.g. CABIDirect. Perhaps parasitic plants are not over-represented, considering the great interest in plants as sources of medicine? Perhaps it is a bias in the assembly of the CABI database? Are they over-represented simply because their lifestyle suggests special properties? Or are they really special? If anyone has a theory we would love to hear about it.

Meanwhile the one quite well-established example is the use of extracts of Viscum album in at least moderating the effects of certain cancers.
The following provides a useful updated survey of the recent studies on the evidence:

**U.S. study of intravenous mistletoe extract to treat advanced cancer**

The findings are from a small study at John Hopkins Kimmel Cancer Center reported online Feb. 9 in Cancer Research Communications. (Paller et al., 2023)

Mistletoe extract (ME), known as Helixor M, was studied in 21 patients with advanced and treatment-resistant cancers of various types. The phase I trial used dose escalation to determine the maximum dose that could be safely tolerated by patients. ME was delivered intravenously three times per week until disease progression or until toxicity. The study concluded that dose to be 600 milligrams of ME.

The median follow-up duration on mistletoe was 15.3 weeks. Stable disease was observed in five patients and lasted, on average, for 15 weeks. Tumors in three participants decreased in size, and remained stable for two to five months, however, this did not meet official criteria for partial response. Patients also reported overall improved quality of life via a questionnaire. The most common side effects reported were fatigue, nausea, and chills and they were noted as manageable. ‘Intravenous mistletoe demonstrated manageable toxicities with disease control and improved quality of life in this group of patients, who had already received multiple cancer therapies,’ says Paller, adding that additional phase II studies in combination with chemotherapy are the next step, pending additional funding.

In addition, Paller says, laboratory research to better decipher ME’s mechanisms are needed, as the cytokines (cell-signaling proteins) measured in this study are preliminary and hypothesis generating.

Mistletoe extract is from *Viscum album* with several active ingredients that, in preclinical studies, appear to directly cause the death of tumor cells and stimulate an immune response. It has been used in Europe for several decades as a complementary medicine approach to cancer treatment alone or in combination with chemotherapy and radiation therapy, but it has not been evaluated in clinical trials. ME is not currently FDA approved for cancer treatment in the U.S. but is listed in the Homeopathic Pharmacopoeia and is offered in integrative care clinics.

Johns Hopkins Medicine, February 22, 2023

**Mistletoe Extract for Cancer Treatment: Composition and Usage**

Photo: Natalia Golubnychya via Shutterstock

Cancer is a major cause of death globally, leading to nearly one in six deaths each year. Several traditional treatments are available for cancer. However, they can cause adverse side effects which deteriorate people’s quality of life. In such scenarios, the effectiveness of complementary treatments like mistletoe can be of interest.

**Key takeaways:**

Mistletoe (*Viscum album*) is a semiparasitic plant that has been used as a traditional medicine in Europe for centuries.

The first use of mistletoe as a cancer treatment was proposed by Rudolf Steiner in 1920.

Mistletoe helps in cancer treatment by showing anti-tumor activity as well as improving the patient’s quality of life.

Further research is required to understand how mistletoe impacts people with cancer.

Mistletoe extracts have been used for centuries to treat several human diseases along with cancer. It has been used in different forms for the treatment of various diseases such as hypertension, headache, epilepsy, asthma, infertility, menopausal symptoms, and dermatitis. It is capable of growing on several types of trees. The chemical composition of the extracts depends on:

- Species of the host tree
- Time of the year when the tree was harvested
- Preparation of the extracts
- The commercial producer
Mistletoe extracts are made either in water-based solutions or solutions of water and alcohol. Some extracts are made as per homeopathic preparations, while others are not. The main active compounds found in mistletoe are:

- Lectins
- Flavonoids
- Viscotoxins
- Phenolic acids
- Fatty acids
- Alkaloids
- Phenylpropanoids
- Terpenoids
- Lignans
- Sterols

These active compounds help to mediate the pharmacological activities of mistletoe extracts. Administration of mistletoe extracts mostly takes place by subcutaneous injections, which are given 2–3 times a week. However, the duration of treatment is variable.

The side effects of mistletoe extracts are limited and not life-threatening. A few of the side effects include:

- Headache
- Fever
- Soreness at the injection site
- Chills
- Swelling of lymph nodes

However, a few cases of severe side effects such as anaphylactic shocks have been reported. Mistletoe plants and berries can also be poisonous to humans. Moreover, high doses of recombinantly-produced mistletoe lectins were reported to cause reversible hepatotoxicity in a few cases.

Research suggests that mistletoe extract can help to treat cancer in various ways. It was demonstrated that the extract can kill cancer cells through the down regulation of genes involved in malignancy, progression of cancerous tumors, as well as cell invasion and migration. Moreover, mistletoe extract can fight cancer through modulation of the immune system activation of dendritic cells, activation of natural killer cells, increase in cytokine secretion, as well as enhancement of humoral and cellular responses. The mistletoe extract can also inhibit angiogenesis. This helps to prevent the formation of new blood vessels, which in turn can inhibit the growth of tumors.

Above mentioned anticancer properties of mistletoe are mostly mediated by two active compounds, lectins and viscotoxins:

Lectins are proteins that easily bind to carbohydrates, in this way they are able to attach to the cell’s surface and cause biological changes in them.

Viscotoxins are proteins that have both immune system-stimulating and cell-killing properties.

Extensive research has been carried out regarding the impact of mistletoe extract on cancer. Findings from more than 50 clinical trials have been published concerning the use of mistletoe extract in cancer patients. Most of these studies indicated an improvement in the quality of life of the patients. A systematic review of 26 studies reported an improvement in fatigue, emotional well-being, depression, vomiting, concentration, and nausea. Another systematic review also reported improvement in chemotherapy-associated fatigue along with other quality-of-life measures. A 2020 study also indicated mistletoe extract to improve physical functioning, insomnia, and cancer-related fatigue in 319 non-metastasized breast cancer patients.

However, most of these studies suffered from one or more limitations. A two-part review indicated that mistletoe extract did not show any improvement in the quality of life and survival of patients with various types of cancer. Therefore, the use of mistletoe extract for the treatment of cancer patients is controversial. Some studies have shown it to have beneficial effects, while others have shown it to have little or no beneficial effects. More studies aimed at improving the current limitations are needed to understand whether mistletoe extract should be considered as a treatment option for cancer patients.

Legal aspects of mistletoe extract cancer therapy. Mistletoe extract is an extensively studied alternative cancer therapy that is commonly used for the treatment of cancer patients in Europe. However, it is not approved for treatment in the United States.

Many studies have reported that mistletoe extract can be useful to improve quality of life, survival rates, and cancer-related fatigue in cancer patients. However, a few studies have also reported no positive or beneficial effects of mistletoe extract. Therefore, it is important to
consult an oncologist before taking mistletoe extract for the treatment of cancer.

Mistletoe extracts are mostly used to treat cancer in German-speaking countries. A few of the commercially available formulations of European mistletoe include Iscador, Plenosol, Helixor, Eurixor, abnobaVISCUM, Iscucin, and Isorel.

It is worth mentioning that, mistletoe extracts are not sold in the United States since they have not been approved by the Food and Drug Administration (FDA).

Resources:
National Cancer Institute. Mistletoe Extracts (PDQ®)–Health Professional Version.

Milda Alksnė, PhD medically reviewed this article
Suchandrima Bhowmik, MSc, Healthnews, March 15, 2023

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Johns Hopkins Medicine, February 22, 2023

BOOK REVIEWS


Over six chapters, this book deals with different aspects of parasitic plants, from generalities to specific case studies.
https://www.intechopen.com/books/10772
1. Parasitic Plants in Agriculture and Management. Pervin Erdogan
   A well-illustrated general review of the major groups of parasitic weeds, and available management options.

2. Parasitic Plants as Vectors for Pathogens. Anupam Gogoi and others.
   A valuable review of the importance of parasitic plants, mainly Cuscuta spp. in the transmission of virus, phytoplasma and proteobacteria pathogens, listing the many instances of resulting damage to commercial crops. Also discussing the endophytic bacterial and fungal communities of parasitic plants and the exchanges that can occur between parasite and host, quoting interesting examples.

   A comprehensive, nicely illustrated, listing of the genera of parasitic species in Nigeria, and the traditional uses of many of them, refreshingly free of the errors in identification which have occurred in many papers from that region.

4. Anatomy, Embryology and Life Cycle of Lophophytum, a Root-Holoparasitic Plant. Hector Arnaldo Sato and Ana Maria Gonzalez (see Haustorium 81)

5. Parasitic Plants in Forage Legumes – Medicago sativa L. Rozafa Fetahaj and others.
   Reviewing the importance of Cuscuta spp. on lucerne/alfalfa, but lacking detail.

   Listing 16 species of Cuscuta used medicinally and reviewing their phytochemistry (flavonoids, alkaloids, lignans, saponins, phenolics, tannins and fatty acids), and their traditional uses as anti-bacterial, anti-oxidant, anti-osteoporotic, hepatoprotective, anti-inflammatory, anti-tumor, antipyretic, antihypertensive, analgesic, anti-hair fall and anti-stereogenic agents.


and:

For its size, Jordan has a remarkable diversity of parasitic angiosperms not all of which are ‘weeds’ but rather benign components of the local flora. No one knows these plants better than Jamal Qasem who provides an exhaustive overview of most Jordanian parasitic plants. In person, he is enthusiastic about these parasites; this enthusiasm and depth of knowledge comes to print in this book and provides the most comprehensive national treatment of such plants.

The volumes (I am treating them together) are clearly laid out. After a thorough introduction to these unusual organisms, enough to introduce someone who knew little about parasitic angiosperms. This is followed by treatments of each family and genus including the following: germination and development (particularly germane when discussing parasites), contact and attachment; biology, ecology and physiology; distribution and host range, economic importance (including ethnobotany), and control. The section is concluded with many images, and an extensive reference. Based on the author’s intimate knowledge of the weedscape, it is surprising there are no distribution maps for the species.
One could argue over some relatively less important things like an updated taxonomy. For example, *Cuscuta* has been shown to clearly belong in the Convolvulaceae. The genus *Orobanche* taxonomy is in state of flux and the author can be excused for using some names not currently recognized. More serious is the exclusion *Parentucellia viscosa* (Orobanchaceae), which is not mentioned even though it has been a weed problem in other parts of the world. Same for the genus *Bellardia*, also Orobanchaceae, but a less weedy group. Both genera are reported for Jordan. A truly authoritative work would try to determine the species in the group. For example rather than *Cuscuta* sp., give the species name, e.g., *Cuscuta speciesname*.

The volumes are well edited, the images are not. This would be a magisterial work if there were proper images. They are of poor quality, often out of focus, and frequently do not clearly display the features mentioned in the legends. And there are too many of them. How many images of branched broomrape on tomato do I need to see to learn that branched broomrape attacks tomato?

A few images are even misidentified, especially in the *Cuscuta* chapter. On page 129 showing *Cuscuta monogyna* on an orange tree, the flowers having two stigmas places this plant in the subgenus Grammica, not the subgenus Monogyna where it belongs, making it most likely to be *C. campestris*. I am leery of claiming that *Cuscuta* and *Orobanche* species can parasitize grasses but the images purport that are too poor a quality to verify the connection.

A major thrust of the author’s work is the documentation of host range. Like other workers, he does not clearly distinguish between host preference and host range. However, unlike some parasitic plant workers, Qasem attempts to show the host-parasite connection, the only way to document authentic parasitism, but again the problem is the blurred picture. Inclusion of pictures showing parasites ‘under’ or ‘near’ a possible host are not helpful. His compilation of hosts the most complete I know of and is based on his extensive review of the literature as well his many years studying plants firsthand.

Despite the failure to provide clear images for many if not most of the parasites, this is a contribution of value to agriculturalists, botanists, ethnobotanists, and extension workers in Jordan as well as those beyond the borders of the Hashemite Kingdom. It is a major contribution to the literature of parasitic angiosperms,

Lynton John Musselman


Chapters cover:

- Regulation of strigolactone biosynthesis.
- Strigolactones and plant stress tolerance.
- Strigolactones and parasitic plants (see: Ennahali et al. below).
- Alkamides and plant-microbe interaction in rhizosphere.
- Pharmacological potential of alkamides.
- Molecular associations of strigolactones and karrikins.
- Karrikins in plant biotechnology.
- Commercial realities of karrikins in biodiversity restoration.

**FORTHCOMING BOOK**


**THESES**

Conclusion:

Among the tested *Fusarium* exometabolites, diacetoxyscirpenol (DAS) was unequalled for completely inhibiting *S. hermonthica* seed germination *in vitro*, and preventing *S. hermonthica* incidence *in planta*. Notwithstanding the promising attributes of DAS in this study, there is need to further investigate its specific mode of action against the germination of *S. hermonthica* seeds. This investigation would be a critical step, before performing in situ verification (field trials) of the *S. hermonthica*-biopesticidal efficacy of DAS. Through this, DAS specificity of action against the target weed (*S. hermonthica*) at very low concentrations (≤ 20 μM), as opposed to non-target soil organisms, will be clearly understood.

Also, our study revealed that contrary to *F. venenatum, F. oxysporum* f. sp. *strigae* (Fos) is a non-producer of DAS. It therefore raises the question if *F. venenatum* could be a complementary bioherbicide for controlling *S. hermonthica*. In this regard, an additional positive feature of this ubiquitous soil-borne saprophytic fungus is its inability to produce some mycotoxins, including T-2, deoxynivalenol, nivalenol, zearalenone and sambucoid.

Furthermore, *F. venenatum* is phylogenetically closely related to the phytopathogenic fungi *F. graminearum*, which is globally notorious for causing *Fusarium* head blight in cereals and vascular wilt to non-cereal plants, however, the non-phytopathogenic status of *F. venenatum* was confirmed. Thus, as part of future research directions, *F. venenatum* could be tested for its *S. hermonthica* incidence prevention *in planta*. This will reveal whether the quantity of DAS produced by *F. venenatum* in the soil will sufficiently prevent *S. hermonthica* germination, whilst unaffected the non-target organisms. Therefore, *F. venenatum* could serve as a sustainable, cheaper (compared to isolated/purified DAS), and proactive biocontrol agent for *S. hermonthica* eradication. Another option would be to test if the co-inoculation of *F. venenatum* and *Fos* isolate (with known pathogenicity towards the given *S. hermonthica* population) will better increase the overall *S. hermonthica* biocontrol efficiency through synergism. This is based on the assumption that DAS from *F. venenatum* will primarily attack *S. hermonthica* germination, while *Fos* will attack the incidence of germinated or attached *S. hermonthica* seedlings that escaped the reach of DAS in the soil.

Li Changsheng, 2022. Elucidation of the biosynthetic pathway and biological roles of strigolactones in maize and rice. PhD thesis University of Amsterdam, Promoter: Prof. H.J. Bouwmeester

Summary:

Strigolactones (SLs) are a class of plant signaling molecules of great importance, with diversified structures and diverse biological roles in and outside the plant, in the rhizosphere.

In Chapter 1, I introduce the SLs, and review their discovery and biological functions, the regulation of their production by nutrient availability, and their perception and downstream signaling. I particularly emphasize the biosynthesis of SLs, including carlactone biosynthesis and the structural diversification of the SLs generated in the biosynthetic pathways downstream of carlactone. In this process of SL structural diversification, a range of enzymes such as cytochrome P450s are involved of which many are still unknown. I pay attention to possible approaches of SL biosynthetic gene discovery and characterization of their function.

(Parasitic plants employ a haustorium to connect to the vasculature of their host plants, through which they then absorb water, assimilates, and nutrients. As root parasitic plants are obligate parasites, depending completely on a host for their survival, they need to closely coordinate their lifecycle with that of their host. Hereto, parasitic plants have evolved a number of host detection/host response mechanisms.)

In Chapter 2 the germination stimulants, triggering germination of the Orobanchaceae, one major parasitic plant family, are reviewed, in which SLs are the major class. We review how these compounds are produced and in which host plants. And we discuss why they are reliable signals, how parasitic plants have evolved mechanisms that detect and respond to them, and whether they play a role in host specificity. The knowledge underlying this signaling relationship between host and parasitic plant will improve our understanding of the evolution of plant parasitism and will facilitate the development of more effective control measures in cases where these parasitic plants have developed into weeds.

In Chapter 3 and 4, I elucidated the biosynthetic pathway and biological functions of maize and rice SLs. Maize (*Zea mays*) is one of the most
important staple crops in the world. However, in Africa, its yield is severely compromised by the parasitic witchweeds, *Striga hermonthica* and *Striga asiatica*. Maize roots exude at least six SLs but only two of them were structurally identified when I started my PhD project. The identity of the other maize SLs, as well as their role in *Striga* germination and their biosynthetic origin, all remained elusive. In *Chapter 3*, by using a combination of approaches, including co-expression analysis and (transient) gene expression in *Nicotiana benthamiana* and yeast, I revealed natural variation in the maize SL production, identified three new maize SLs, and elucidated the biosynthetic pathway of the maize SLs. We discovered a biosynthetic gene cluster for zealactone biosynthesis and a novel cytochrome P450, ZmCYP706C37, catalyzing several steps in the biosynthesis of maize SLs. Among these SLs, zealactol and zealactonoic acid showed much lower activity than zealactone, in inducing *Striga* germination. I also showed that changes in the composition of the SL blend in some mutant lines correspond to differences in *Striga* germination, and, as a consequence, *Striga* infection.

In *Chapter 4*, similar strategies were used to screen and characterize candidate genes involved in rice SL biosynthesis. Intriguingly, OsCYP706C2, a homolog of ZmCYP706C37, attracted our attention. Its expression is induced by phosphate starvation and it closely co-expresses with known rice SL biosynthetic genes. Mutant analysis and chemical synthesis allowed us to identify a new rice SL, 4-oxo-MeCLA and show that OsCYP706C2 is required for its biosynthesis. Using heterologous expression in *Nicotiana benthamiana* and yeast, I further elucidate the biosynthetic pathway of 4-oxo-MeCLA, in which 4-oxo-19-hydroxy-carlactone is an intermediate. Moreover, bioassays using *Striga* and AM fungi indicate that osccyp706c2 mutants were not affected in *Striga* germination inducing activity but did have decreased AM fungi colonization. Taken together, in *Chapter 3 and 4*, I show how intricate SL biosynthesis (in maize and rice) is, and shed further light on their biological significance.

In the past decades, an increasing number of natural SLs have been identified in a range of plant species. However, the low production of natural SLs hampers their identification, discovery of new biosynthetic genes and our further understanding of their biological roles and agricultural applications. Thus, exploring suitable heterologous expression systems may contribute to addressing those issues and provide opportunities for better utilization of SLs. *Nicotiana benthamiana* has been widely and increasingly used for transient expression of plant natural product biosynthetic pathways.

In *Chapter 5*, I established methods to increase the SL production, through transient expression, in *Nicotiana benthamiana*. Several β-carotene pathway genes/gene combinations were co-expressed with the carlactone pathway genes (OsD27, OsCCD7 and OsCCD8) to investigate their boosting activity in carlactone production. Among the tested constructs, an *Arabidopsis PSY-GGPS11* fusion and *Zea mays ZmPSY1* showed capability in boosting the metabolic flux towards β-carotene and increased carlactone production. The possibility to further improve the flux by RNAi silencing of endogenous competing pathways of carlactone was also investigated (*NbLCYE, NbCHYB*), although it did not further increase carlactone level. To take this to the next level, I showed that coexpression of *Arabidopsis PSY-GGPS11* and *ZmPSY1* can also increase the heterologous production of two natural SLs, orobanchol and zealactone, up to 2-3 fold. This provides us with a new tool for the characterization of unknown strigolactone biosynthetic genes and possibly the production of reference standards.

Finally, in *Chapter 6* I summarize the main findings of my thesis and discuss several aspects of SL biosynthesis, including the importance of SL structural diversification under selection pressure and how to control parasitic plants through modification of SL biosynthesis. Finally, I present an outlook on future research and remaining scientific challenges.

**FUTURE MEETINGS**

**5th International Symposium on Broomrape in Sunflower**, 1-3 November 2023, Megasaray Westbeach Hotel, Antalya, Turkey
www.orobans.com

**8th International and Interdisciplinary Mistletoe Symposium**, Nonnweiler, Germany, 9-11 November 2023, See: https://www.mistelsymposium.de

**28th Asian-Pacific Weed Science Society Conference 2023**, during 26-29 November 2023
in Phuket, Thailand. Will include a session on parasitic weeds. [www.apwss2023-phuket.com](http://www.apwss2023-phuket.com)

**17th World Congress on Parasitic Plants Nara, Japan 3-7 June, 2024.**
https://www.parasiticplants.org/2023/01/the-17th-world-congress-on...

**9th International Weed Science Congress, 7-11 July 2024 Jerusalem.** [https://www.iwse2024.com/](https://www.iwse2024.com/)

**COMPOSITE FILES**

A reminder that all previous issues of Haustorium are available in two PDF documents, ‘Haustorium1-48’ and ‘Haustorium 49-82 (shortly to be updated) via the ODU Haustorium website - [https://sites.wp.odu.edu/musselmanpage/haustoriu](https://sites.wp.odu.edu/musselmanpage/haustoriu)/

**WEB SITES**

For individual web-site papers and reports see LITERATURE

Some websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: [http://www.parasiticplants.org/](http://www.parasiticplants.org/)

For Dan Nickrent's ‘The Parasitic Plant Connection’ see: [http://www.parasiticplants.siu.edu/](http://www.parasiticplants.siu.edu/)

For the Parasitic Plant Genome Project (PPGP) see: [http://ppgp.huck.psu.edu/](http://ppgp.huck.psu.edu/) (may be temporarily unavailable)

For Old Dominion University Haustorium site: see [https://sites.wp.odu.edu/musselmanpage/haustoriu](https://sites.wp.odu.edu/musselmanpage/haustoriu)/

For a description of the PROMISE project (Promoting Root Microbes for Integrated Striga Eradication), see: [http://promise.nioo.knaw.nl/en/about](http://promise.nioo.knaw.nl/en/about)

For Striga Solutions, led by Prof. Salim Al-Babili, KAUST, Saudi Arabia: [https://strigasolutions.com](https://strigasolutions.com)


For the Toothpick Project – see [https://www.toothpickproject.org/](https://www.toothpickproject.org/)

For the Annotated Checklist of Host Plants of Orobanchaceae, see: [http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm](http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm)

For a description and other information about the Desmodium technique for Striga suppression, see: [http://www.push-pull.net/](http://www.push-pull.net/)

For information on the work of the African Agricultural Technology Foundation (AATF) on Striga control in Kenya, including periodical ‘Strides in Striga Management’ and ‘Partnerships’ newsletters, see: [http://www.aatf-africa.org/](http://www.aatf-africa.org/)

For Access Agriculture (click on cereals for videos on Striga) see: [http://www.accessagriculture.org/](http://www.accessagriculture.org/)

For information on future Mistel in derTumortherapie Symposia see: [http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx](http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx)

For a compilation of literature on Viscum album prepared by Institute Hiscia in Arlesheim, Switzerland, see: [http://www.vfk.ch/](http://www.vfk.ch/)

For Viscum album Genespace Database see: [viscumalbum.pflanzenproteomik.de/](http://viscumalbum.pflanzenproteomik.de/)


For a participatory website cataloguing tools for the identification and localization of fauna and flora, including parasitic plants see: [https://nadaba.net/fr](https://nadaba.net/fr)

**SELECTED LITERATURE**

With acknowledgement to CABIDirect as a major source.

Adam, J.H and 6 others. 2022. *Rafflesia tunku-azizahiae* (Rafflesiaceae), a new species from Pahang, Malaysia. Sains Malaysiana 51(11): 3843-3855. [Describing *R. tunku-azizahiae* which differs from *R. tuanku-halimii* by larger flower diameter, broader diaphragm and disc diameter, larger aperture diameter and longer ramenta.]

Aguilar-Venegas, M. and 8 others. 2023. Protein profiling of *Psittacanthus calyculatus* during mesquite infection. Plants 12(3): [https://doi.org/10.3390/plants12030464](https://doi.org/10.3390/plants12030464) [Proteomic analyses revealed cell wall-degrading enzymes cellulase and β-1,4-glucosidase active in haustorium development, while xylanase, endoglucanase, and peptidase were highly active in the...
haustorium penetration and xylem connection stages.]

Albanova, I.A., Zagorchev, L.I., Teofanova, D.R., Odjakova, M.K., Kutueva, L.I. and Ashapkin, V.V. 2023. Host resistance to parasitic plants - current knowledge and future perspectives. Plants 12(7): [https://doi.org/10.3390/plants12071447] [A detailed review of host resistance, pointing out the underestimated aspect of cross-resistance/tolerance to multiple stresses, and how the epigenetic regulation of host response and resistance to parasitic plants is a surprisingly understudied area.]

Aliyu, K.T. and 10 others. 2023. Spatial modelling indicates Striga seedbank density dependence on rainfall and soil traits in the savannas of northern Nigeria. Weed Research (Oxford) 63(2): 88-101. [Determining the optimum conditions for S. hermonthica across N. Nigeria where 60% of fields have moderate to high infestation, Finding 550mm rain optimal and certain sil types.]

Aoki, N, Cui SongKui and Yoshida, S. 2022. Cytokinins induce prehaustoria coordinately with quinone signals in the parasitic plant Striga hermonthica. Plant and Cell Physiology 63(1): 1446-1456. [Reporting that cytokinins are effective in inducing haustoria in Orobanche and Phelipanche spp. while DMBQ is not effective as it is in Striga spp. However, cytokinins can also be effective in Striga sp., but not in Phtheirospermum japonicum. Also showing that host root exudates may include cytokinins.]

Banerjee, A. and Stefanović, S. 2023. A comparative study across the parasitic plants of Cuscuta subgenus Grammica (Convulvulaceae) reveals a possible loss of the plastid genome in its section Subulatae. Planta 257(4): [https://doi.org/10.1007/s00425-023-04099-y] [Showing that 13 of the 15 sections of the 153-species subgenus grammica retain plastids and some photosynthetic activity, while section Ceratophorae and 3 species within section Subulatae lack plastids and are totally holoparasitic.]


Bian PengXuan, Sun Chang, Cao XiaoLei, Yao ZhaoQun, Zhang XueKun and Zhao SiFeng. 2002. Screening of haustorium induction factors of Phelipanche aegyptiaca Pers. based on metabolome analysis of Cucumis melo L. root exudates. Agronomy 13(1): [https://doi.org/10.3390/agronomy13010128] [Determining that scopoletin, quercetin, IAA, and DMBQ from C. melo exudates had relatively high haustorium induction activity on P. aegyptiaca.]


David, O.A., Obiakara, M.C., Fabolude, G.O., Akomolafe, G.F. and Ajiboye, M.D. 2022. Habitat suitability and dispersal of invasive Striga species under climate change in Africa. African Journal of Ecology 60(4): [https://doi.org/10.1111/aje.13064] [An interesting assessment of the likely future distribution of Striga species under moderate or extreme global warming. Concluding that S. hermonthica would see moderate expansion, mainly into forest areas, S. asiatica would see a small increase, and S. gesnerioides a considerable decrease. Breeding of polyploid S. hermonthica which causes sterility is considered as an alternative biological control to its spread.]

El Amri, M., Amri, M., Kadir, E.M., Triqui, Z.E.A., Khayi, S. and Mentag, R. 2023. First report of the branched broomrape (Phelipanche schlultzii (Mutel) Pomel.) on fennel (Foeniculum vulgare Mill.) in Morocco. Horticulturae: [https://doi.org/10.3390/horticulturae9050567] [P. schlultzii, known from the Mediterranean region on hosts Galium spp., Distichoselinum tenuifolium and Scorpiurus, also on olive and almond trees, now reported in fennel in Morocco, causing estimated yield loss of 20%-50%.]
Soumya Mukherjee, Tariq Aftab. Strigolactones, Alkamides and Karrikins in Plants Recent Updates and Future Prospects. 13 pp. [A review focusing on strigolactone biosynthesis, structural diversity, production, role in the host-parasite interaction, and potential use for parasitic weed control.]


Garrett, N., Viruel, J., Klimpert, N., Gomez, M.S., Lam, V.K.Y., Merckx, V.S.F.T. and Graham, S.W. 2023. Plastid phylogenomics and molecular evolution of Thismiaceae (Dioscoreales). American Journal of Botany 110(4): [https://doi.org/10.1002/ajb2.16141] [Concluding that gene losses in Thismiaceae occurred early and rapidly, following the initial loss of photosynthesis in its stem lineage. As a species-rich, fully mycoheterotrophic lineage, Thismiaceae provide a model system for uncovering the unique and divergent ways in which plastid genomes evolve in heterotrophic plants.]

Gibot-Leclerc, S and 8 others. 2022. Screening for potential mycoherbicides within the endophyte community of Phelipanche ramosa parasitizing tobacco. FEMS Microbiology Ecology 98(3): [https://doi.org/10.1093/femsec/fiac024] [374 isolates studied, mostly Fusarium spp., of which 87 inhibited germination of P. ramosa. Best was F. venenatum causing germination inhibition and necrotic activity, and non-pathogenic to tobacco.]


Hatt, S.A., Thorogood, C.J., Bolin, J.F., Musselman, L.J., Cameron, D.D. and Grace, O.M. 2023. A taxonomic revision of the genus Hydnora (Hydnoraceae). bioRxiv: [https://doi.org/10.1101/2022.10.13.512068] [A detailed monograph with descriptions, full synonymy, distribution maps, and discussion concerning confusable taxa, along with notes on ethnobotany, ecology and conservation. Including the newly described H. bolinii. Particular emphasis is placed on the taxonomic value of osmophore geometry and positioning which are highly consistent within species. Richly illustrated. Worthy of the coffee table!]

Henrique, H and 8 others. 2023. Spread of Striga asiatica through suitable climatic conditions: Risk assessment in new areas producing Zea mays in South America. Journal of Arid Environments 210: [https://doi.org/10.1016/j.jaridenv.2022.104924] [A risk assessment indicated that the Southeast and Northeast of Brazil are at the most significant risk of S. asiatica invasion. Projections for climate change between 2040–2059 showed expansions in areas suitable for S. asiatica compared to the current climate of South America.]

Hosseini, P., Osipatan, O.A. and Mesgaran, M. 2022. Seed germination responses of broomrape species (Phelipanche ramosa and Phelipanche aegyptiaca) to different sanitation chemicals. Weed Technology 36(5):1-17. [Findings suggest that quaternary ammonium compounds could be used as potential sanitation agents to disinfect agriculture machinery from P. ramosa P. aegyptiaca seeds.]

Huang QiXiu, Lei ZhongHua, Xiang LiJun, m Zhang WangFeng, Zhang Li and Gao Yan. 2022. Transcriptomic analysis of sunflower (Helianthus annuus) roots resistance to Orobanche cumana at the seedling stage. Horticulturae 8(8): [https://doi.org/10.3390/horticulturae8080701] [Showing that the expression level of the 3 most significantly upregulated genes in the resistant variety HZ2399 (4CL2, EDS1, and TGA3) was significantly higher than that of susceptible SQ15, suggesting that they may be the main causes of O. cumana immunity in HZ2399. These suggest that sunflower resistance to O. cumana parasitism is dependent on salicylic acid.]

Ito, S. 2022. Recent advances on the regulation of root parasitic weed damage by strigolactone-related chemicals. Bioscience Biotechnology and Biochemistry 87(3): [https://doi.org/10.1093/bbb/zbac208] [A useful review.]

International Journal of Plant Sciences 184(1):1-18. [Concluding that that Lennoaceae should not be treated as a separate family. Aberrant fruit morphology of _P. arenarium_ should be driven clearly reflects a position in Ehretiaceae.]

Kawada, K. and 10 others. 2023. Synthesis of carlactone to develop a novel inhibitor of strigolactone biosynthesis. ACS Omega 8(15): 13855-13862. [Using rice enzyme Os900 which oxidises carlactone to deoxyorobanchol (4DO) to synthesise 10 carlactone derivatives, some of which inhibited strigolactone synthesis in vitro and in vivo.]

Kimathi, E., Abdel-Rahman, E.M., Lukhoba, C., Ndambi, A., Mudereri, B., Niassy, S., Tonnang, H.E. and Z. Landmann, T. 2023. Ecological determinants and risk areas of _Striga hermonthica_ infestation in western Kenya under changing climate. Weed Research (Oxford) 63(1): 45-56. [Predicting future spread of _S. hermonthica_ in western Kenya under predicted climate change up to 2050. Concluding minimum 19% and maximum 53% spread, with elevation, annual precipitation, land use and land cover, temperature seasonality and soil type were determined to be the most influential ecological predictor variables.]

Lemaire, J., Vennetier, M., Prévosto, B. and Cailleret, M. 2002. Interactive effects of abiotic factors and biotic agents on Scots pine dieback: a multivariate modeling approach in southeast France. Forest Ecology and Management 526: (https://doi.org/10.1016/j.foreco.2022.120543) [The models all pointed to a preponderance of processoryn moth and mistletoe in explaining the intensity of foliar deficit in _Pinus sylvestris_. Also showing that strong interactions between climate, soil, water balance and biotic factors help to explain the intensity of dieback which was thus greater in the driest topoedaphic and climatic conditions where the mistletoe and processoryn moth were present.]

_Lemma Diriba_. 2023. Identification of host critical stage affected by _Orobanche crenata_ and variation in the resistance of fava bean genotypes under infested field and controlled conditions in Ethiopia. Advances in Agriculture No.1553452: (https://doi.org/10.1155/2023/1553452) [Noting that _O. crenata_ causes about 75-100% of yield loss of fava bean in parts of Ethiopia. Among 18 genotypes assessed in field experiments, only Ashange, Dide’a, and Obsa showed partial resistance or tolerance.]

Li, C. and 29 others. 2023. Maize resistance to witchweed through changes in strigolactone biosynthesis. Science 379(6627): 94-99. [Identifying two strigolactones, zealactol and zealactonoic acid, which stimulate less _Striga_ germination than zealactone. Also identifying a cytochrome P450 involved in the oxidation of strigolactones, responsible for reducing _Striga_ germination.]


Lurthy, T., Perot, S., Gerin-Erveillard, F., Rey, M., Wisniewski-Dyé, F., Vacheron, J. and Prigent-Combaret, C. 2023. Inhibition of broomrape germination by 2,4-diacetylphloroglucinol produced by environmental _Pseudomonas_. bioRxiv (https://doi.org/10.1101/2023.03.01.529533) [Demonstrating the potential herbicidal effect of the bacterial model _Pseudomonas ogarae_ F113, a PGCs-producing bacterium, on germination of _Orobanche ramosa_ without detrimental effect on oilseed rape.]


Niassy, S. and 11 others. 2022. Performance of push-pull technology in low-fertility soils under conventional and conservation agriculture farming systems in Malawi. Sustainability 14(4): (https://doi.org/10.3390/su14042162) [Results confirmed the benefits of push-pull technology in Malawi, achieving 70% reductions in Striga asiatica and stemborer. The cost of labour was described as a challenge, and research to identify more suitable Desmodium species is needed. The current study suggests the release of the technology in Malawi, emphasizing the value of Desmodium and Brachiaria as animal fodder.]

Ohlson, E.W. and Timko, M.P. 2022. Mapping and validation of Alectra vogelii resistance in the cowpea Landrace B301. Agronomy 12(11): (https://doi.org/10.3390/agronomy12112654) [Two resistance loci identified and introgressed independently into susceptible cowpea were found to be simply inherited and conferred immunity.]

Okunola, G., Badu-Apraku, B., Ariyo, O., Agre, P., Offernedo, Q. and Ayo-Vaughan, M. 2022. Genome-wide association studies of Striga resistance in extra-early maturing quality protein maize inbred lines. G3: Genes, Genomes, Genetics 13(2): (https://doi.org/10.1093/g3journal/jkac237) [Scanning 41 inbred lines and identifying 22 SNP makers associated with improved response to S. hermonthica infection, of potential value in further breeding work.]


Paller, C.J. and 17 others 2023. Phase I Trial of intravenous mistletoe extract in advanced cancer. Cancer Research Communications: https://doi.org/10.1158/2767-9764.CRC-23-0002 [see PRESS REPORT above.]

Peralta, A.C and 7 others. 2023. Host–guest complexation of phthalimide-derived strigolactone mimics with cyclodextrins. Application in agriculture against parasitic weeds. Organic & Biomolecular Chemistry 21: 3214-3225. https://doi.org/10.1039/D3OB00229B [N-Substituted phthalimides with a furanone ring were found to be efficient in inducing the germination of Phelipanche ramosa and Orobanche cumana. Three bioactive phthalimide-lactones (PL01, PL04, and PL07) were selected and studied to form complexes of increased water...
solubility with α-, β-, HP-β-, and γ-cyclodextrin having equal or greater bio-activity.]

Qiu Suo, Bradley, J.M., Zhang PeiJun, Chaudhuri, R., Blaxter, M., Butlin, R.K. and Scholes, J.D. Genome-enabled discovery of candidate virulence loci in Striga hermonthica, a devastating parasite of African cereal crops. New Phytologist 236(2): 622-638. [Identifying virulence factor proteins by detecting their increase in a Striga-resistant variety of rice.]


Scott, D. and Freckleton, R.P. Crop diversification and parasitic weed abundance: a global meta-analysis. Scientific Reports 12(11): ([https://doi.org/10.1038/s41598-022-24047-2]) [Using meta-analysis of 67 studies to compare occurrence of Cuscuta, Orobanche, Phelipanche and Striga as weeds of crops in the presence of a second crop. Finding that intercrops which alter both microclimate and soil chemistry (e.g. Crotalaria, Stylosanthes, Berseem clover and Desmodium) are most effective in parasitic weed management. See SYNOPSIS above.]

Shruti, Madan Singh, Singh, B.P., Shyamkumar, T.S., Aneesha, V.A., Dinesh Kumar and Dey, U.K. 2022. Leveraging the critical incident technique to identify the detrimental effect of Cuscuta reflexa Roxb. on dairy animals. Indian Journal of Extension Education 58(4): 102-106. [Showing that feeding cows berseem contaminated with ‘C. reflexa’ (more likely C. campestris?) reduced milk yield by 68%).]


Suetsugu, K. and Hashiwiki, H. 2023. A non-photosynthetic plant provides the endangered Amami rabbit with vegetative tissues as a reward for seed dispersal. Ecology: ([https://doi.org/10.1002/ecy.3972]) [see PRESS REPORT above.]

Teixeira-Costa, L. and Suetsuga, K. 2022. Neglected plant parasites: Mitrastemonaceae. Plants, People, Planet Flora Obscura: ([https://doi.org/10.1002/ppp3.10322]) [A detailed description of this family comprising only 2 species, one from Central America, the other from SE Asia, each devoid of roots, stems, and regular leaves and living inside the roots of their host plants for most of their life cycle.

Fruits of Mitrastemon yamamotoi. Their white-pink flowers and berry-like fruits become visible on the forest floor only during their reproductive phase.]


Vurro, M. 2023. Are root parasitic broomrapes still a good target for bioherbicide control? Pest Management Science ([https://doi.org/10.1002/ps.7360]) [A review providing an overview of the bioherbicide approaches attempted until now, briefly discussing the causes of the failures and the possibility to improve biocontrol agents’ effectiveness.]

Wakabayashi, T. 2022. Identification of novel canonical strigolactones produced by tomato. Front.i.ers in Plant Science, Section Plant Physiolgy 13:
Wakabayashi, T., Ueno, K. and Sugimoto, Y. 2002. Structure elucidation and biosynthesis of orobanchol. Frontiers in Plant Science 13: [Reviewing the history leading to the discovery of the genuine structure of orobanchol and the current understanding of its biosynthetic mechanisms. Studies on the biosynthesis pathway of orobanchol show that cytochrome P450 monoxygenases are involved downstream of carlactonoic acid (CLA) via two pathways: either through 4-deoxyorobanchol or by direct conversion from CLA.]


Zhou Di and 11 others. 2022. ACC deaminase-encoding Pseudomonas putida arrests seed germination: an alternative strategy for grass and weed control. Plant and Soil 480(1/2): 391-406. [1-aminocyclopropane-1-carboxylic acid (ACC) deaminase-encoding Pseudomonas aeruginosa inhibits germination of Nipponbare rice and other species. This study showed that wild-type P. putida does likewise, thanks to down-regulating ethylene synthesis and up-regulating abscisic acid, while a mutant form of P. putida lacking the
ACC deaminase gene was safe on rice, while still inhibiting certain weed species including *Striga asiatica.*