HAUSTORIUM

Parasitic Plants Newsletter

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IPPS – RESULTS OF ELECTION

The newly elected Officers of the IPPS are:

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A MESSAGE FROM THE NEW PRESIDENT OF IPPS

Dear IPPS Members,

A new team was recently elected for the Executive Committee of our Society. May I thank all those who took part in these elections. May I also thank the Election Committee (Patrick, Jos and Gualbert) for conducting the elections efficiently and promptly.

This is also the time to send our cordial thanks to our colleagues who served as Executive Committee Members during the last four years: André Fer, the first IPPS President, Patrick Thalouarn, the Vice-President, Jos Verkleij, the Treasurer, Jim Westwood, the Editor, and Gualbert Gbehounou, the Member at-Large. I was honoured to work with them as the first IPPS Secretary. The previous Executive Committee had the difficult task of initiating the activity of the new Society, establishing the Constitution and registering the IPPS as an International Society. It was also in charge of the organization of the 8th International Symposium on parasitic weeds, which was held in South Africa last year.

The IPPS has developed only recently, with the objective to promote parasitic plant research and to help the scientific community in developing new effective means for the management of parasitic weeds. Accordingly, the first issues on our agenda are (a) the next IPPS Congress, and potential additional meetings; (b) further development of the Newsletter Haustorium; (c) Standardization of Parasitic Plants terminology. (d) Extending the number of IPPS Members.

Only very few parasitic plant species are known to cause damage in agriculture and forestry. Nevertheless their impact on world economy cannot be ignored and much effort is put every year worldwide in order to find means to reduce their damage. Yet, the mechanisms employed by these parasites are far from being understood. One group of noxious parasitic weeds belongs to the Orobanchaceae. A special symposium on this family was held last month at the International Botanical Congress (IBC2005) in Vienna, indicating the significance of parasitic plants both as vicious weeds and as a model for studies on the parasitic syndrome in plants. Indeed, parasitic plant research, as shown in this Symposium, has recently entered into a new era, when molecular biology allows major changes in the classification of some parasitic plant groups, and allows the understanding of some key mechanisms of this peculiar group of plants, offering the ability to further understand some key steps in their evolution, and identify genes that are involved in parasitism. One of the important contributions of molecular biology is the transfer of the genus *Striga* and of similar parasitic genera from the Scrophulariaceae to the Orobanchaceae. Another major contribution is the establishment of solid evidence that may soon lead to splitting the genus *Orobanche* into two or more genera, as already suggested by the late Prof. Edward Teryokhin in 1998.

Whereas the control of parasitic weeds was almost impossible until very recently, new means for its control are gradually emerging, based not only on the employment of some new herbicides and new resistances, but also on the employment of molecular biology for this sake. One can envisage further developments in this direction during the coming years. The IPPS will do its best to encourage a better communication between parasitic plant research groups in order to accelerate this momentum.

The publication of 'Haustorium' is a difficult task. Thanks to the Editors, Chris Parker, Lytton Musselman and Jim Westwood, this newsletter is prepared and distributed periodically to the benefit of all of us. The effort, thinking, and hard work that they contribute are highly appreciated. Diego Rubiales, the newly elected Editor of the IPPS will soon join them in an effort to strengthen the ties between IPPS members. Obviously the quality and content of the newsletter depend on contributions from all of us. Please make sure that you update us through 'Haustorium' with abstracts of new publications, dissertation summaries, research reports, interesting observations, and new questions for discussion.

We will soon decide on the venue for the next IPPS Congress, which is due for 2006. Any suggestions for a venue will be most welcome.

Danny Joel
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LITERATURE HIGHLIGHT - FINALLY, A *RAISON D'ÊTRE* FOR GERMINATION STIMULANTS

A long-standing question in parasitic plant biology has been what is the "natural" role for germination stimulants? After all, it does not seem to be in the host's best interest to synthesize and exude chemicals that serve only to stimulate parasite seed germination. The stock response to this question has been a vague presumption that germination stimulants probably serve as either phytoalexins or signals to microbes in the rhizosphere. Now, at last, we have some solid evidence on this subject. In a recent issue of Nature, Akiyama and co-authors (see reference in literature section below) show that strigolactones promote hyphal branching in arbuscular mycorrhizal fungi. They isolated a new variant of strigol, 5-deoxy-strigol, from *Lotus japonicus*, and demonstrated that this compound, sorgolactone, strigol, and the synthetic strigolactone GR24 all induce hyphal branching in *Gigaspora margarita* at very low concentrations. Orobanchol is also active in the branching assay (K. Akiyama, personal communication). 5-Deoxy-strigol was reported to be ca. 1/3 as active as (+)-strigol on *O. crenata* (Bergmann, G. et al., J. Plant Physiol. 42: 338-342, 1993) and seems to be a major component of the stimulant complex in sorghum (cv. Hybrid) and in maize (cv. Dent) (K. Yoneyama, unpublished results).

Arbuscular mycorrhizal fungi are obligate symbionts and hyphal branching is required for colonization of host roots. The production of strigolactones by the host makes sense in this context because the symbiosis with the mycorrhizal fungi is an ancient evolutionary association that provides a significant boost in nutrient acquisition. Thus, it appears that success by parasitic weeds is attributable in part to having developed the ability to eavesdrop on the chemical communication taking place between the host and mycorrhizal fungi, thereby gaining the spatial information needed to locate the host.

This work will help in refining our concepts of germination stimulants. The rhizosphere is a complex world, and chemical signals and mechanisms for their perception may be shared across diverse classes of organisms (see the review by Palmer *et al.* below). Parasitic plant research may thus contribute to understanding many other soil biotic interactions. Another implication is that crop protection strategies based on eliminating host production of germination stimulants may not be as simple as initially conceived. We will have to balance the disruption of parasite germination signalling with the preservation of vital symbiotic interactions.

Jim Westwood, Virginia Tech, Blacksburg, USA and Koichi Yoneyama, Utsonomiya University, Japan.

FIGHT *STRIGA* WITH 'UA KAYONGO' HYBRID MAIZE!

For many years now, Kenyan farmers in Nyanza and Western Provinces have suffered from the parasitic weed commonly known as *Striga* as it destroys their cereal crops, particularly maize. *Striga* has invaded approximately 200,000 hectares of Kenyan cropland resulting in losses of about KSh 800 million each year. It is also the major contributor of food insecurity among thousands of households in west Kenya as it causes yield losses of this major staple food crop. To fight the threat of *Striga*, farmers in Kenya will soon have a new maize hybrid Ua Kayongo that is coated with 'Strigaway'TM herbicide that kills *Striga*.

This revolutionary maize technology literally kills the germinating *Striga* seeds as they attempt to infect the maize plants. Among scientists, this technology is known as Imazapyr Resistance-maize (IR-maize) or the Clearfield system. It is based upon a naturally occurring herbicide resistance by maize that was first identified by researchers at BASF, a supplier of agro-chemicals, and was later incorporated into Kenyan maize varieties by African plant breeders at the International Maize and Wheat Improvement Center (CIMMYT) and the Kenya Agricultural Research Institute, (KARI). Currently, three seed companies, Kenya Seed, Lagrotech and Western Seed are producing the new hybrid maize for field testing during the upcoming cropping season (long rains 2005) and are expected to commercialize their seed during the following season (short rains 2005-2006). Recently, representatives of the three seed companies met and agreed to market this new maize hybrid under the common commercial name Ua Kayongo H1 (*Striga* killer).

The African Agricultural Technology Foundation (AATF) was recently established to assist African farmers access appropriate technologies. One of its identified priorities is the introduction of IR-maize technology to the farming communities of west Kenya. To achieve this goal, AATF is in partnership with CIMMYT, KARI, and BASF and seeks further collaboration of NGOs (We RATE - SACRED-Africa, SCODP, FORMAT), seed companies and their distribution network and stockists (Kenya Seed, Lagrotech, Western Seed), international organizations such as TSBF-CIAT and others in disseminating the IR-maize technology to fight *Striga*. This partnership will establish extensive field demonstrations and conduct numerous field days to promote Ua Kayongo H1 throughout Nyanza and Western Provinces during the next three cropping seasons. We RATE is an alliance of NGOs, farmer associations and research organizations that establishes different recommended technologies and facilitates farmer adaptation to these technologies and their incorporation into smallholder practice.

Ua Kayongo H1 is planted and managed in the same way that farmers currently grow their maize. However, as is recommended with all commercially available maize seed coated with insecticide and fungicide, farmers should wash their hands after handling Ua Kayongo. They should also not handle other seeds before they wash off the StrigawayTM herbicide as this may affect germination of the other crops. Ua Kayongo can be intercropped with legumes, but the two must not be planted in the same hole, as the StrigawayTM herbicide is likely to affect the legume seed. For long-term control of *Striga*, Ua Kayongo should be combined with other *Striga* management technologies, such as the Push-Pull system, or MBILI planted with groundnut, golden gram, soyabean or lablab. One recently identified advantage of using Ua Kayongo is that the first weeding is less tedious due to the reduced number of weeds near the young maize seedling.

During the upcoming long rains 2005, the partnership to fight *Striga* will showcase this technology through numerous Ua Kayongo demonstration plots in *Striga*-infested areas and conduct farmer-managed trials to demonstrate the efficacy of the technology in farmers' fields. The partners will also distribute Ua Kayongo to over 16,000 households and conduct several farmer field days and other activities including a travelling workshop in June 2005.

For more information on the partnership to fight *Striga*, please contact:
African Agricultural Technology Foundation
P.O. Box 30709, Nairobi 00100, Kenya.
Email: aatf-information@cgiar.org
You can also contact:
CIMMYT: cimmyt-kenya@cgiar.org
Dascot Ltd: dascot@nbi.ispkenya.com

(reproduced from the web-site http://www.africancrops.net/striga)

FAO PROJECTS ON PARASITIC WEEDS

FAO is executing two regional projects on integrated management of parasitic weeds. One, in collaboration with ICARDA, for *Orobanche* management in leguminous crops, includes countries from North Africa (Morocco, Algeria, Tunisia, Egypt and Sudan), Near East (Syria), and Ethiopia. The second project, for *Striga* control, started recently in Benin, Togo, Burkina Faso, Niger, Mali and Senegal . The main objective of these projects is to strengthen management capabilities of technical field staff and farmers; to establish a sustainable network for collecting and disseminating information on new control alternatives for parasitic weeds, and to enhance public awareness of the problems. These projects are the first steps in a long-term program since it is estimated to take a 4-5 year project for the management of parasitic weeds. The main activities of the projects are training of technicians (extension workers and other agents working with farmers) and farmers. In each of the countries one Training of Trainers (TOT) was implemented as well as two Farmers Field Schools (FFS) with the participation of an average of 25 farmers in each of the schools for two cropping seasons. The curriculum of FFS includes training on eco-biology of the parasitic plants (life cycle, importance of seed bank in soil and others) and control methods (rotation, use of post-emergence herbicide treatments, preventing flowering). In addition, the project on *Orobanche* has included training to prevent entry of exotic parasitic weeds, e.g. *Orobanche crenata*. into Ethiopia and Sudan. Both projects also include training in biological control. The *Orobanche* project will start its second cropping season soon while the *Striga* project is just starting its work plan. Both programs are carried out with the collaboration of the expertise available in the countries and in the region.

Ricardo Labrada, FAO, Rome.

THESES

Talia Nadler-Hassar (PhD, Hebrew University of Jerusalem, Israel, June 2004)
Amino acid biosynthesis inhibitors, and their effect on assimilates and nutrients translocation between the field dodder (*Cuscuta campestris* Yuncker) and its hosts
(Supervision: Prof. Baruch Rubin)

Cuscuta campestris Yuncker (field dodder) is a nonspecific above-ground holoparasite, totally dependent on a host plant for assimilates, nutrients and water supply. The parasite uses haustoria to penetrate the host and make contact with its vascular bundles. An established parasite employs a strong sink ability (super sink) and competes against the host's sinks for assimilates and solutes. The strong sink ability of the parasite combined with its wide geographical distribution and wide range of hosts, makes *C. campestris* an extremely damaging weed that causes heavy loss of yield. Many groups of herbicides are unsuitable for *C. campestris* control since they act on target sites that either do not exist or are not essential to the parasite. Also, close association between host and parasite necessitates the use of herbicides that would only harm the parasite. Glyphosate and acetolactate synthase (ALS) inhibitors belong to a group of amino acid biosynthesis inhibitors (AABI) reported to be somewhat effective in *C. campestris* control. Glyphosate inhibits the biosynthesis of aromatic amino acids by inhibiting the enolpyruvylshikimate-3-phosaphate (EPSPS) and ALS inhibitors obstruct the biosynthesis pathway of branched chain amino acids. AABI are also reported to inhibit translocation of assimilates in treated plants. The damage caused to plants treated with these herbicides may be alleviated by adding the missing amino acids to the growing medium.

As *C. campestris* operates as a "super-sink" when attached to a host, it should not then be affected by AABI since it has an alternative source for amino acids. The fact that these herbicides are somewhat effective in *C. campestris* control suggests that another mechanism is involved in the parasite injury. The hypothesis for this study will be that the parasite dies due to inhibited translocation of assimilates and solutes from the host, whereas lack of amino acids is a minor factor. The objectives of this work were: to determine if the *C. campestris* has functional amino acid biosynthesis (AAB) pathways and if so how they are influenced by AABI herbicides; to elucidate the AABI mode of action in host-parasite associatio; and to better understand the relationship between the *C. campestris* and its host under the influence of these herbicides.

The response of *C. campestris* seedlings to different AABI was evaluated by measuring the shoot length of parasite seedlings 4 days after sowing (DAS) without a host in Petri dishes filled with coarse sand and different concentrations of glyphosate or ALS inhibitors (sulfonylureas, imidazolinones, triazolopyrimidines and pyrithiobac). The I_{50} values (the herbicide concentration that causes 50% inhibition of shoot elongation) of *C. campestris* in each herbicide were calculated from dose response curves and compared to those of suitable sensitive and herbicide resistant species. In order to test the response of parasitized *C. campestris* to various AABI, the parasite was grown in association with Roundup Ready (RR) soybeans RR sugar beet and sulfonylurea resistant (SuR) tomatoes and exposed to high herbicide rates. Both assays conducted on independent seedlings of *C. campestris* and those attached to a host revealed that the parasite was tolerant to high concentrations of AABI. The I_{50} value of *C. campestris* seedlings for glyphosate was 8, 330 and 650-fold higher then those of RR cotton, regular cotton and sorghum seedlings respectively and the I_{50} values for *C. campestris* and sorghum in chlorsulfuron (ALS inhibitor) were 500μM and 0.004μM. The response of *C. campestris* seedlings to AABI is unique since when exposed under the same conditions to trifluralin (a microtubule assembly inhibitor) the I_{50} of *C. campestris* seedlings was similar to that for sorghum roots. Attached *C. campestris* plants were also tolerant to AABI herbicides, half of those on SuR tomato and RR sugar beet survived and recovered from commercial herbicide rates sprayed on the host and parasite, leading to the assumption that under field conditions well established *C. campestris* could survive and recover from AABI application and harm the crop.

The evaluation of EPSPS and ALS response to AABI was done after establishing that these enzymes are active in *C. campestris*. Shikimate accumulation in parasite seedlings exposed to glyphosate indicated that *C. campestris* has an active, glyphosate sensitive EPSPS. As a substrate of EPSPS, shikimate accumulates rapidly in sensitive plant tissues treated with glyphosate. The presence of an active ALS in *C. campestris* was established directly on plant protein extracts. The ALS assays showed that the parasite has an active ALS enzyme, possibly less sensitive to sulfonylureas (rimsulfuron, chlorsufuron, sulfometuron) and imidazolinones (imazaquin) than other non-parasitic plants.

To test the effect of glyphosate on the translocation between the host and parasite, *C. campestris* was allowed to parasitize a transgenic tobacco host that expresses the green fluorescent protein GFP. The GFP under the control of the *Arabidopsis thaliana* sucrose transporter (*At*SUC2) promoter is expressed exclusively in the companion cells of source tissues from which it enters the sieve elements via the plasmodesmata and is translocated and unloaded symplastically at sink tissues. A confocal laser scanning microscope and Immune blots with specific GFP antibodies detected GFP accumulation in the parasite between 14 and 25 DAS. Glyphosate applied to the host 22 DAS led to shikimate accumulation in the parasite one day after glyphosate treatment (DAGT) and a significant reduction in GFP accumulation 2 DAGT. Glyphosate caused a similar reduction in [^{14}C] sucrose translocation between the tobacco host and parasite. The results from this part of the work indicate that glyphosate inhibits translocation between tobacco and *C. campestris* but since the host is not glyphosate resistant it is impossible to determine whether the inhibition is due to the damage caused to the host or to the parasite.

To pinpoint the exact cause for this inhibition, *C. campestris* was attached to regular (sensitive) and transgenic soybeans resistant to glyphosate (RR). Both soybean hosts were used to compare the movement of [^{14}C] glyphosate from a RR and sensitive host to *C. campestris* and to determine if glyphosate has a different effect on the movement of [^{14}C] sucrose and [^{14}C] phenylalanine from host to parasite. In all assays carried out, *C. campestris* acted as a 'super sink' and rapidly accumulated up to 70% of the total translocated [^{14}C] glyphosate, and up to 40% of the translocated [^{14}C] sucrose and [^{14}C] phenylalanine. The accumulation of [^{14}C] in *C. campestris* following the application of [^{14}C] phenylalanine supports the postulation that the host can serve as an alternative source for amino acids. However, unlike the inhibiting effect glyphosate had on translocation between tobacco and *C. campestris*, the herbicide did not inhibit [^{14}C] sucrose translocation from RR and regular soybeans to *C. campestris*. This could be attributed to the partial tolerance of soybean to glyphosate.

In conclusion, this research revealed the high tolerance of *C. campestris* seedlings to AABI and the parasite's ability to recover from high rates of these herbicides while parasitizing resistant host plants. Tolerance to ALS inhibitors could be attributed to a resistant target site but the resistance mechanism to glyphosate is yet to be investigated. The inhibiting effect of glyphosate on the translocation from tobacco to *C. campestris* supports the hypothesis that glyphosate treated *C. campestris* is affected at least partially by the lack of assimilates and solutes. This research did not define whether glyphosate inhibits translocation in the host or the parasite but the tolerance of *C. campestris* seedlings to glyphosate may lead to the conclusion that glyphosate inhibits translocation in the host.

Rosemary Ahom (PhD University of Nigeria, Nsukka, Nigeria, January, 2005)
Studies on management of *Striga hermonthica* (Del.) Benth. in maize with inter crop, trap crop varieties and nitrogen fertilization in Benue State, Nigeria. (Supervision: Dr O.U. Okereke)

In this project, studies on the management of *S. hermonthica* in maize with intercrops, trap crop varieties and nitrogen fertilization were conducted in a relatively highly *Striga*-infested area in Benue State, Nigeria with the aim of demonstrating to the small scale, resource-poor farmers the benefits of using these techniques in combination to reduce the severity of this devastating weed on maize production. The three management strategies used as an integrated *Striga* management (ISM) package here fit into the cultural practices of the small-scale farmer in Benue State and it was hoped that they would facilitate easy adoption. To achieve these aims, three studies were carried out.

The first step was an extensive and intensive survey in year 2000 to determine the extent of *Striga* infestation in the three agricultural zones in Benue State (latitude $6^{o}30'$E and $8^{o}10'$N and longitude 8^{o}E and 10^{o}N), with a typical Southern Guinea Savannah vegetation. The second study was a field trial in a naturally heavily *Striga*-infested area in Eastern agricultural zone in Benue State to determine the possible effects of intercropping and N-fertilization on *Striga* infestation using two maize varieties intercropped with either soybean or sesame at three levels of N- application (0, 60, and 120 $kgNha^{-1}$). The experiment was laid out as a factorial in randomized complete block design (RCBD) with three replications. This study was aimed at demonstrating the advantage of an integrated package for suppression of *S. hermonthica* parasitism on maize using cultural practices familiar to the small-scale farmer. The third study, which was a follow-up to the second study, was conducted in year 2001. Since the trap-crops (soybean and sesame) used in the field trial in year 2000 differed in their ability to reduce or suppress *S. hermonthica*, a laboratory assay was designed to screen a large number (17) of sesame varieties and 13 pigeon pea accessions for their efficacy in stimulating *S. hermonthica* seed germination *in vitro*. The design of the experiment was completely randomized design (CRD) with four replications. Since varietal differences exist between and within trap-crops and among *Striga* strains, the aim of this screening was to find out the varieties of the test crops that are more efficient or very efficient in inducing suicidal seed germination in *S. hermonthica* strains in Benue State. The *Striga* seeds used were therefore collected from Benue State to forestall the problem of strain variation in *S. hermonthica.*

The extensive and intensive surveys conducted were successful in establishing the status of *Striga* as a serious weed and a major constraint to maize production in Benue State. It was found that the crop management practices employed by farmers in the state are not helping the problem of *Striga* infestation. This is the major reason why farmers cannot cope with *Striga* parasitism on maize and some have stopped growing the crop.

The field trial achieved the aim of demonstrating the advantage of using an ISM package to reduce the severity of *Striga* infestation and thus increasing maize yields where soybean was intercropped with maize. But with sesame, which was more efficient than soybean as an intercrop in reducing *Striga* infestation, yield advantage of maize was not obvious. Optimum plant population and spatial arrangement of maize and sesame in the mixture may not have been used. This needs to be verified.

The laboratory assay confirmed the variability between and within the pigeon pea and sesame varieties screened. On the whole, pigeon pea was more efficient in stimulating seed germination in *S. hermonthica* compared to sesame. On this basis, the pigeon pea accessions were grouped as follows: very high stimulant production varieties (TCC 1035, Cita 4, TCC 6, TCC 8126, Cita 3, TCC 87 and Cita 2); high stimulant production varieties (TCC 2, TCC 8127, TCC 151, and Cita 1); and moderate stimulant production varieties (TCC 8 and TCC 8129).

For sesame, the following groups were established: high stimulant production varieties (69B – 882 and Yandev 55); moderate stimulant production varieties (Ex-Pankshin-98, 73A – 79B, Cross-95, E-8, Ncriben – 01M, 73A-82B, 60-2-3-1-8B and Ciano-16); low stimulant production varieties (Yandev-75, Type-4, Ciano-27, Eva and 69-1-1); and very low stimulant production varieties (Pachequeno and Ncriben-03L).

In conclusion, *S. hermonthica* is a major constraint to maize production in Benue State. At the moment the crop husbandry practices used by farmers in Benue

State are not efficient in tackling *Striga* problem. It is concluded that ISM is more beneficial in reducing or contending *Striga* problem. Varietal differences exist among trap crops in their efficacy in stimulating suicidal seed germination in *S. hermonthica* and consequently reduction or control of *Striga* parasitism on cereals.

Recommendations are made for the adoption of appropriate procedures by farmers and for further research where this is required.

SANDALWOOD

The latest issue of Sandalwood Research Newsletter announces that publication is ceasing after Issue 20, released in April 2005. However, further information on the Forest Products Commission (FPC)'s interest in tropical and arid sandalwood establishment and management can be found on the FPC web-site (see below). It also announces that the Asia-Pacific Regional Sandalwood Workshop will be held in Suva, Fiji in October 2005. For further details contact Mr Sairusi Bulai, SPC Regional Forestry Adviser, SPC Private Mail Bag Suva, Fiji or via sairusib@spc.int (fax 679-3305212).

NON-WEEDY HEMIPARASITIC SCROPHULARIACEAE (OROBANCHACEAE)

Thirteen papers from the symposium held in Wageningen in April 2004 have now been published in full in Folia Geobotanica 40: 113-318, together with an Introduction and Synthesis. Copies of this attractive special volume are available from Opulus Press for 20 euros plus postage. To order and/or to view abstracts of these 13 papers, see www.opuluspress.se The individual papers will be noted in Haustorium 48. Meanwhile copies of the booklet with abstracts of all 30 oral and poster presentations (listed in Haustorium 45) are still available from Siny ter Borg at Hamelakkerlaan 11, 6703 EE Wageningen, The Netherlands.

RECEIVING HAUSTORIUM BY EMAIL

If you received this issue by airmail, do please consider changing to our email mailing list in future. You will receive it sooner, be able to file it electronically, with benefit of searchability, while also saving our costs of distribution.

If you already receive by email, do please keep us informed of any change of address. And if you would prefer to have it 'zipped' as a smaller file, this option is now available.

Chris Parker will be pleased to hear from you on any of these points..

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://web.odu.edu/haustorium

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/misteltoe/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 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

LITERATURE

* indicates web-site reference only

NB Chris Parker will be pleased to provide authors' contact addresses wherever possible, on request.

*African Agricultural Technology Foundation. 2005. Fight *Striga* with Ua Kayongo hybrid maize! http://www.africancrops.net/striga (see full extract in text above.)

Ahonsi, M.O., Berner, D.K., Emechebe, A.M. and Lagoke, S.T. 2004. Effects of ALS-inhibitor herbicides, crop sequence, and fertilization on natural soil supressiveness to *Striga hermonthica*. Agriculture, Ecosystems and Environment 104: 453-463. (Pot experiments with a soil from Ibadan, Nigeria provide rather striking evidence for the importance of microbial soil-suppressiveness of *S. hermonthica,* its enhancement by rotation with soybean, and/or nitrogen fertilization, and its reduction after application of ALS inhibiting herbicides.)

Akiyama, K., Matsuzaki, K. and Hayashi, H. 2005. Plant sesquiterpenes induce hyphal branching in arbuscular mycorrhizal fungi. Nature 435: 824-827. (Spores of the AM fungus *Gigaspora margarita* germinate without need for a stimulus but fail to show hyphal branching and further development in the absence of a stimulant, now identified as 5-deoxy-strigol. See further comment above.)

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. (Eight fungal compounds (1-10 µM concentrations) showed inhibitory activity to seed germination.)

Ang, S.L.P. and Yong, J.W.H. 2005. A protocol for *in vitro* germination and sustainable growth of two tropical mistletoes. Plant Cell, Tissue and Organ Culture 80: 221-228. (Describing germination and sustained growth of *Dendrophthoe pentandra* and *Macrosolen cochinchinensis* using Murashige and Skoog (MS) media supplemented with coconut water (15-20% v/v) in ventilated culture vessels. *D. pentandra* was somewhat easier to culture than *M. cochinchinensis*.)

Anjum Perveen and Mohammad Qaiser. 2004. Pollen flora of Pakistan - XLI. Cuscutaceae. Pakistan Journal of Botany 36: 475-480. (Study of the pollen from 11 *Cuscuta* spp. by light microscopy and SEM showed 3 types – a *C. reflexa* type, a *C. capitata* type and a *C. campestris* type. A key to species based on pollen characteristics is presented.)

Arunachalam, A., Adhikari, D., Sarmah, R., Majumder, M. and Khan, M.L. 2004. Population and conservation of *Sapria himalayana* Griffith. in Namdapha national park, Arunachal Pradesh, India. Biodiversity and Conservation 13: 2391-2397. (*S. himalayana* in Rafflesiacese is on the brink of extinction, due to loss of habitat and narrow host range, locally observed to be a woody vine, *Tetrastigma* sp.)

Babalola, O.O., Sanni, A.I. and Odhiambo, G.D. 2004. Isolation of rhizobacteria associated with maize and assessment of their potential for use in *Striga hermonthica* (Del.) Benth. suicidal germination. Journal of Tropical Microbiology 3(1): 64-70. (Apparently suggesting potential for *Enterobacter sakazakii, Pseudomonas* sp. and *Klebsiella oxytoca* as biocontrol agents in Kenya, but abstract not at all clear.)

Bach, C.E. and Kelly, D. 2004. Effects of forest edges on herbivory in a New Zealand mistletoe, *Alepis flavida*. New Zealand Journal of Ecology 28: 195-205. (Leaf herbivory by possums was sometimes greater on forest edges than in forest interior. Differences in damage from insects was less consistent.)

Baker, F.A. and Knowles, K.R. 2004. Case study: 36 years of dwarf mistletoe in a regenerating black spruce stand in Northern Minnesota. Northern Journal of Applied Forestry 21(3): 150-153. (Recording the re-establishment of a severe infestation of *Arceuthobium pusillum* in black spruce when very few small trees were left after felling, emphasising the need for complete clearing to prevent infection of new plantings.)

Benvenuti, S., Pompeiano, A., Macchia, M. and Miele, S. 2004. Evaluation of an experimental stimulant for germination induction of hemp broomrape (*Orobanche ramosa* L.) in tobacco crops (*Nicotiana tabacum* L.). Italian Journal of Agronomy 8: 17-28. (Nijmengen 1 ex BASF applied to the field before planting (dose not stated in abstract) reduced *O. ramosa* seed numbers in upper 10 cm of soil by 75% but was less effective below this depth.)

Boulet, C., Boutin, F., Théodet, C., Esbérard, E. and Thalouarn, P. 2004. (*Odontites luteus*, vineyard root parasite.) (in French) Phytoma 576: 32-35. (*O. luteus* is strongly suspected to be the cause of vine death in a vineyard in southern France. Haustoria are described from the vine roots.)

Braby, M. F. 2005. Afrotropical mistletoe butterflies: larval food plant relationships of *Mylothris* Hübner (Lepidoptera: Pieridae). Journal of Natural History 39: 499-513. (Reviewing the known food plants of *Mylothris* spp., several of which are closely associated with parasitic Santalales and concluding that *Mylothris* had its major period of evolution and adaptive radiation on the Loranthaceae.)

Brandt, J.P., Hiratsuka, Y. and Pluth, D.J. 2004. Collecting and storing seeds of *Arceuthobium americanum* from *Pinus banksiana*. Canadian Journal of Plant Pathology 26: 397-402. (Stockinet was used to intercept 62% of discharged seeds. After storage in sealed jars at 2^{o}C, germination was 60-70% after 300 days, declining to 11-30% after 2 years.)

Buschmann, H., Kömle, S., Gonsior, G. and Sauerborn, J. 2005. Susceptibility of oilseed rape (*Brassica napus* ssp. *napus*) to branched broomrape (*Orobanche ramosa* L.). Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz 112: 65-70. (Pot experiments showed contrasting virulence of 2 German populations of *O. ramosa*, also differing reactions of summer ('Jumbo') and winter ('Akela') varieties of rapeseed, suffering 70 and 58% biomass reduction respectively.)

Chauvel, B., Dessaint, F., Lonchamp, J.P. and Gasquez, J. 2005. (Survey on invasive weed species in France.) (in French) Phytoma 578: 16-20. (Reporting a survey of 5 invasive weed species, including *O. ramosa*.)

Daugherty, C. and Mathiasen, R. 2005. First report of chihuahua pine dwarf mistletoe (*Arceuthobium gillii*) on apache pine (*Pinus engelmannii*). Plant Disease 89: 106. (A first report of *A. gillii* on *P. engelmannii*, in Arizona, perhaps associated with severe infection of nearby chihuahua pine (*P. leiophylla* var. *chihuahuana*.).)

Devkota, M.P. and Glatzel, G. 2004. Feedback of water stress on wood properties of trees: experiments with mistletoes on *Rhododendron arboreum* Sm. Ecoprint 11(1): 13-17. (Infestation by *Scurrula elata* causes death of *R. arboreum* branches distal to the haustorial atachment, but is shown to have no significant effect on wood properties of the branch proximal to the attachment.)

Doran, J., Thomson, L., Brophy, J., Goldsack, B., Bulai, P., Faka'osi, T. and Mokoia, T. 2005. Variation in the heartwood oil composition of young sandalwood trees in the South Pacific (*Santalum yasi*, *S. album* and F1 hybrids in Fiji, and *S. yasi* in Tonga and Niue. Sandalwood Research Newsletter 20: 3-7. (Non-destructive coring of trees of different age showed large plant to plant variation in oil quality, and hence scope for selection and breeding. It also suggested rotation lengths of 25-30 years could be more realistic than the current 15-20.)

Eizenberg, H., Calquhoun, J and Mallory-Smith, C. 2005. A predictive degree-days model for small broomrape (*Orobanche minor*) parasitism in red clover in Oregon. Weed Science 53: 37-40. (Reporting a refinement of the model described by Eizenberg *et al*., 2004, noted in Haustorium 46.)

Eizenberg, H., Plakhine, D., Landa, T., Achdari, G., Joel, D.M. and Hershenhorn, J. 2004. First report of a new race of sunflower broomrape (*Orobanche cumana*) in Israel. Plant Disease 88: 1284. (Recording a newly virulent race of *O. cumana* from several localities in Israel.)

El-Akkad, S.S., Hassan, E.A. and Ali, M.E. 2002. Phenolic acid changes during *Orobanche* parasitism on faba bean and some other hosts. Egyptian Journal of Biology 4: 37-44.

El-Hammady, M., Albrechtsen, S.E., Abdelmonem, A.M., El-Abbas, F.M.A., Rasmi, M.R. and Ghazalla, W. 2004. Interaction and frequencies of seed-transmitted faba bean (*Vicia faba* L.) viruses under natural conditions. Arab Universities Journal of Agricultural 12: 851-866. (Some viruses were translocated from infected faba bean plants into *Orobanche* (?*crenata*) sp. but the viruses were not detected in mature, dry broomrape plants or in their seeds.)

El-Kassas, Karem El-Din, Z., Beale, M.H., Ward, J.L. and Strange, R.N. 2005. Bioassay-led isolation of *Myrothecium verrucaria* and verrucarin A as germination inhibitors of *Orobanche crenata*. Weed Research 45: 212-219. (The fungus *Myrothecium verrucaria* (= *M. atroviride*) completely suppressed *O. crenata* at 12.5×10^6

spores per ml soil, without causing apparent damage to faba bean. The active ingredient was identified as verrucarin A.)

Elzein, A. and Kroschel, J. 2004. *Fusarium oxysporum* Foxy 2 shows potential to control both *Striga hermonthica* and *S. asiatica*. Weed Research (Oxford) 44: 433-438. (Under glasshouse conditions *Fusarium oxysporum* isolate Foxy 2 suppressed *S. asiatica* as well as *S. hermonthica* but had no effect on *S. gesnerioides*.)

Elzein, A. and Kroschell, J. 2004. Influence of agricultural by-products in liquid culture on chlamydospore production by the potential mycoherbicide *Fusarium oxysporum* Foxy 2. Biocontrol Science and Technology 14: 823-836. (Cotton seed cake, maize stover, wheat and triticale stillage were compared as substrates for the culture of *F. oxysporum* Foxy 2 with and without UV light and agitation. Particularly successful was the combination of 0.5% (w/v) maize stover plus 20% (v/v) wheat-based stillage and agitation at 200 rpm.)

Encheva, J., Christov, M., Todorova, M., Shindrova, P. and Encheva, V. 2004. New sunflower restorer lines, developed by direct organogenesis method from intergeneric cross *Helianthus annuus* (cv. Albena) x *Verbisina helianthoides* (Genera Verbisina) - disease resistance, combining ability. Bulgarian Journal of Agricultural Science 10: 417-422. (The direct organogenesis method was used for production of new forms from the intergeneric cross between *Helianthus annus* and '*Verbisina (?Verbesina) helianthoides* Some progeny exhibited resistance to *Orobanche cumana*.)

Farah, A.F. and Al-Abdulsalam, M.A 2004. Effect of field dodder (*Cuscuta campestris* Yuncker) on some legume crops. Scientific Journal of King Faisal University (Basic and Applied Sciences) 5(1): 103-113. (A pot experiment with 12 legume crops showed most susceptible (over 50% reduction) were lablab, lentil, chickpea, faba bean, alfalfa and fodder pea; intermediate were fenugreek, Egyptian clover (*Trifolium alexandrinum*), lupin and garden pea; and least affected (less than 10% damage) *Phaseolus vulgaris* and *Lathyrus sativus*.)

Folia Botanica. 2005.

Gethi, J. G. and Smith, M.E. 2004. Genetic responses of single crosses of maize to *Striga hermonthica* (Del.) Benth. and *Striga asiatica* (L.) Kuntze. Crop Science 44: 2068-2077. (When inbred lines from TZL, *Z. diploperennis* (Diplo) or 'low emergence stimulant' (LE) pools were crossed with susceptible lines, Diplo and LE pools were best sources for *S. hermonthica* resistance and TZL and LE pools for *S. asiatica*.)

Gethi, J.G., Smith, M.E., Mitchell, S.E. and Kresovich, S. 2005. Genetic diversity of *Striga hermonthica* and *Striga asiatica* populations in Kenya. Weed Research 45: 64-73. (AFLP analysis showed low genetic diversity for these species, sampled extensively from three regions in Kenya.)

Ghotbi, T., Shahraeen, N. and Winter, S. 2005. Occurrence of tospoviruses in ornamental and weed species in Markazi and Tehran Provinces in Iran. Plant Disease 89: 425-429. (A new virus sp., tomato varamin virus, was detected in a range of weed species, including a *Cuscuta* sp.)

Göbel, T. 2004. *Nuytsia floribunda* and *Viscum album,* medicinal plants for psychosis and cancer. (in German) Stuttgart, Germany: Verlag Freies Geistesleben, 172 pp. (The morphology, the peculiarities and the ecology of these two species are fully described and discussed. 'Goetheanistic' and 'anthroposophic' approaches lead to the conclusion that the two mistletoes somehow correlate with two disease developments in human beings and therefore could be used as remedies against them.) (With thanks to Dr G. Grazi.)

Gonsior, G., Buschmann, H., Szinicz, G., Spring, O. and Sauerborn, J. 2004. Induced resistance – an innovative approach to manage branched broomrape (*Orobanche ramosa*) in hemp and tobacco. Weed Science 52: 1050-1053. (Confirming the potential for the salicylic acid analogue BTH ('Bion') to suppress *O. ramosa* in hemp and tobacco when applied as a drench 2 weeks after planting. A strain of *Pseudomonas* sp. ('Proradix') was a little less active, while an extract of the alga *Ascophyllum nodosum* ('Fruton') was toxic.)

Haidar, M. A., Iskandarani, N., Sidahmed, M. M. and Darwish, R. 2005. Susceptibility of *Orobanche ramosa* and potato tolerance to rimsulfuron. Crop Protection 24: 7-13. (Single or repeated applications of rimsulfuron at 20-50 g/ha significantly reduced *O. ramosa*, but most potato varieties tested were seriously damaged. Cultivars Timate and Score were more tolerant but yields were not increased?)

Hao Shen, WanHui Ye, Lan Hong, HongLin Cao and ZhangMing Wang, 2005. Influence of the obligate parasite *Cuscuta campestris* on growth and biomass allocation of its host *Mikania micrantha*. Journal of Experimental Botany 56: 1277-1284. (Infestation by *C. campestris* reduced fresh weight of *M. micrantha* by 98% after 72 days and completely prevented flowering; but there was some recovery later.)

Hawkeswood, T..J. and Turner, J.R. 2004. Observations on the habitat and an apparently new larval host plant of *Phalaenoides glycinae* (Lewin, 1805) (Lepidoptera: Noctuidae: Agaristinae) in the Sydney district, New South Wales, Australia. Giornale Italiano di Entomologia 11(51): 151-156. (Larvae of *P. glycinae* observed feeding on *Amyema gaudichaudii.*)

Ho JiauChing, Chen ChiuMing, Li ZhiQiang and Row LieChing. 2004. Phenylpropanoid glycosides from the parasitic plant, *Aeginetia indica*. Journal of the Chinese Chemical Society 51: 1073-1076. (Two new phenylpropanoid glycosides identified from *A. indica* in Taiwan.)

Joita-Păcureanu, M., Veronesi, C., Raranciuc, S. and Stanciu, D. 2005. The interaction parasite-host plant, in the system *Orobanche cumana* Wall. (*Orobanche cernua* Loefl.) - *Helianthus annuus* L. Romanian Agricultural Research 19/20: 7-11. (Referring to a new race F of *O. cumana* controlled by a single dominant gene. Also comparing races from Turkey, Spain and Yugoslavia with two from Romania.)

Jones, C. 2005. Indian sandalwood: genetic and oil diversity and biochemistry of the Australian germplasm collection. Sandalwood Research Newsletter 20: 7-8. (Describing a study from which results will be published elsewhere.)

Kim, A.K., Ellis, D.J., Sandler, H.A., Hart, P., Darga, J.E., Keeney, D. and Bewick, T.A. 2004. Genetic diversity of dodder (*Cuscuta* spp.) collected from commercial cranberry production as revealed in the *trn*L (UAA) intron. Plant Molecular Biology Reporter 22(3): 217-223. (Two ecotypes were identified that corresponded with two peak seedling emergence times. One ecotype showed greater sequence similarity to *C. gronovii*, while the other, more abundant, ecotype showed greater similarity to *C. attenuata.*)

Kong JingLin, Du XiuBao, Fan ChongXu, Xu JianFu and Zheng XiaoJun. 2004. Determination of primary structure of a novel peptide from mistletoe and its antitumor activity. Acta Pharmaceutica Sinica 39: 813-817. (The primary structure of a peptide, named viscotoxin B2, from *Viscum coloratum* is presented. together with evidence for its anti-tumour activity.)

Lendzemo, V.W., Kuyper, T.W., Kropff, M.J. and van Ast, A. 2005. Field inoculation with arbuscular mycorrhizal fungi reduces *Striga hermonthica* performance on cereal crops and has the potential to contribute to integrated *Striga* management. Field Crops Research 91(1): 51-61. (Inoculation of maize and sorghum with the arbuscular mycorrhizal (AM) fungi *Glomus clarum* and *Gigaspora margarita* resulted in significant 30-50% reductions in numbers and dry weight of *S. hermonthica*.)

Lethbridge, B. 2005. Field grafting of quandong (*Santalum acuminatum*). Sandalwood Research Newsletter 20: 1-2. (Reporting the successful grafting of *S. acuminatum* onto both *S. spicatum* and *S. acuminatum*. This technique may be useful in allowing the establishment of high quality fruiting scions onto other sandalwood trees before or after their own productive life.)

Liao GwoIng, Chen MingYih and Kuoh ChangSheng. 2005. Pollen morphology of *Cuscuta* (Convolvulaceae) in Taiwan. Botanical Bulletin of Academia Sinica 46(1): 75-82. (LM, SM and TEM studies confirmed different pollen morphology in the Grammica spp. *C. campestris, C. australis* and *C. chinensis*, and in the Monogyna sp. *C. japonica*, vars. *japonica* and *formosana*.)

Malécot, V., Schatz, G.E. and Bosser, J. 2003. (Synoptic revision of *Phanerodiscus* Cavaco (Olacaceae) in Madagascar.) (in French) Adansonia 25. 119-128. (Three species recognised, including the new *P. capuronii* (replacing the invalid name *C. louveli*). *P. perrieri* var. *orientalis* is transferred to *Anacolosa pervilleana*.)

Manen, J.F., Habashi, C., Jeanmonod, D., Park JeongMi and Schneeweiss, G.M. 2004. Phylogeny and intraspecific variability of holoparasitic *Orobanche* (Orobanchaceae) inferred from plastid *rbcL* sequences. Molecular Phylogenetics and Evolution 33: 482-500. (Further characterizing relationships within the Orobanchaceae using 106 specimens representing 28 *Orobanche* species. Intraspecific variation was low, and not correlated with host range.)

Marley, P.S. and Shebayan, J.A.Y. 2005. Field assessment of *Fusarium oxysporum* based mycoherbicide for control of *Striga hermonthica* in Nigeria. BioControl 50: 389-399. (Field trials with *F. oxysporum* isolate PSM 197, using 5-10 g (per hill?) reduced *S. hermonthica* and increased yields of sorghum, suggesting potential for further development.)

Marvaldi, A.E. 2005. Larval morphology and biology of oxycorynine weevils and the higher phylogeny of Belidae (Coleoptera, Curculionoidea). Zoologica Scripta 34(1): 37-48. (Including new information on the Argentinian species *Hydnorobius hydnorae* whose larvae develop inside the flower and fruit bodies of *Prosopanche americana*.)

Mathews, S. 2005. Phytochrome evolution in green and nongreen plants. Journal of Heredity 96:197-204. (Review of phytochrome evolution, including insight from *Orobanche minor*. Phytochrome and cryptochrome genes in parasitic species can evolve under relaxed evolutionary constraints and may take on new functions.)

Mathiasen, R., Haefeli, M. and Marcus, N. 2005. Southwestern dwarf mistletoe, *Arceuthobium vaginatum* subsp. *cryptopodum*, found parasitizing *Picea pungens* in Colorado. Plant Disease 89: 106. (A first report of this species on *Picea*, perhaps associated with heavy infection of a nearby ponderosa pine.)

Matusova, R., van Mourik, T. and Bouwmeester, H.J. 2004. Changes in the sensitivity of parasitic weed seeds to germination stimulants. Seed Science Research 14: 335-344. (Confirming the tendency of both *Striga hermonthica* and *Orobanche cumana* to develop secondary dormancy after prolonged conditioning.

Menkir, A., Kling, J. G., Badu-Apraku, B., and Ingelbrecht, I. 2005. Molecular marker-based genetic diversity assessment of *Striga*-resistant maize inbred lines. Theoretical and Applied Genetics 110:1145-1153. (41 *Striga*-resistant maize inbred lines were found to reflect clear genetic variation, suggesting that the genetic potential exists to improve maize resistance to *Striga*.)

Mishra, J.S., Bhan, M., Moorthy, B.T.S. and Yaduraju, N.T. 2004. Bio-efficacy of herbicides against *Cuscuta* in blackgram [*Vigna mungo* (L.) Hepper]. Indian Journal of Weed Science 36(3/4): 278-279. (*Cuscuta* sp. was significantly reduced and crop yield improved by pre-emergence pendimethalin or fluchloralin at 1 kg/ha, and by post-emergence imazethapyr 50 g/ha or glyphosate 15-50 g/ha.)

Moorthy, B.T.S., Mishra, J.S., Bhan, M. and Dubey, R.P. 2004. Effect of different densities of *Cuscuta chinensis* on lentil and chickpea. Indian Journal of Weed Science 36(3/4): 221-223. (The losses in seed yield due to increasing densities of *C. chinensis* (or maybe C. *campestris*?) ranged from 20 to 95% in lentil and 28 to 100% in chickpea.)

Moorthy, B.T.S., Bhan, M. Mishra, J.S. and Dubey, R.P. 2004. Effect of different densities of *Cuscuta* on varieties of niger [*Guizotia abyssinica* (L. f.) Cass]. Indian Journal of Weed Science 36(3/4): 249-252. (Varying numbers of *Cuscuta* (*campestris*?) seeds per m^2 reduced niger seed yields by 52-99%. Among 5 varieties of niger, GA10 proved most susceptible and Ootacamund most tolerant.)

Morrison, J.R., Sandler, H.A. and Romaneo, L.K. 2005. Management of swamp dodder (*Cuscuta gronovii* Willd.) in cranberry may be enhanced by the integration of a nontoxic household cleaner. Crop Protection 24: 1-6. (While white vinegar and a liquid dish detergent failed to show selectivity, the household cleaner 'Simple Green' as a 20% solution was damaging to *C. gronovii* and more selective than glyphosate.)

Mower, J.P., Stefanovic, S., Young, G. J. and Palmer, J.D. 2004. Plant genetics: gene transfer from parasitic to host plants. Nature (London) 432: 165-166. (Evidence for direct transfer of the mitochondrial *atp1* gene from *Cuscuta* and *Orobanche* to *Plantago*.)

Musambasi, D., Chivinge, O.A., Bunya, D.R. and Mabasa, S. 2005. The role of different component crops grown in association with maize and their residues in controlling *Striga asiatica* (L.) Kuntze in Zimbabwe. Crop Research (Hisar) 29(1): 47-55. (Two pot experiments involving live or crop residues of cowpea, soyabean, field bean, groundnut or sweet potato caused varying suppression of *S. asiatica*.)

Musambasi, D., Rimawu, S., Chivinge, O.A. and Mariga, I.K. 2005. The residual effects of multi-purpose trees and cowpea cultivars on witchweed [*Striga asiatica* (L.) Kuntze] density and maize grain yield under dryland crop production system in Zimbabwe. Crop Research (Hisar) 29(1): 56-62. (The residual effects of *Sesbania sesban* and *Sesbania macrantha* and 3 cowpea cultivars (IT 90K-59, IT 18 and Kavara) grown in *S. asiatica*-infested fields for 2 consecutive seasons, were mostly non-significant, but *S. sesban* caused some reduction in *S. asiatica* numbers.)

Nekouam, N. and Marley, P.S. 2003. Micro-organisms associated with *Striga hermonthica* and rhizosphere soil in the Nigerian savannah - isolation and evaluation for possibilities in biological control of the witchweed. In: Jamin, J.Y., Seiny Boukar, L. and Floret, C. (eds) Savanes africaines: des espaces en mutation, des acteurs face à de nouveaux défis. Actes du colloque. Garoua, Cameroun, 27-31 mai 2002: pp. 5-21. (The 6 most promising fungal species were *Fusarium oxysporum*, other *Fusarium* (2 isolates unidentified), *Curvularia* sp., *Aspergillus niger* and *A. terreus*.)

Nikolova, L. 2004. Results from interspecific hybridization between *Helianthus grosseserratus* Martens and *H. annuus* L. Bulgarian Journal of Agricultural Science 10(3): 291-298. (Resistance to *Orobanche cumana* was found in different progenies of the interspecific hybrids of *H. grosseserratus*.).

Nikolova, L., Christov, M., Seiler, G. 2004. Interspecific hybridization between *H. pumilus* Nutt. and *H. annuus* L. and their potential for cultivated sunflower improvement. Helia 27: 151-162. (Some progenies proved resistant to *Orobanche cumana*.)

Nowak, A. and Nowak, S. 2004. The effectiveness of plant conservation: a case study of Opole Province, Southwest Poland. Environmental Management 34: 363-371. (Referring to the obligatory control of *Orobanche* and *Cuscuta* species, which may be counter to desirable conservation programmes.)

Osadebe, P.O., Okide, G.B. and Akabogu, I.C. 2004. Study on anti-diabetic activities of crude methanolic extracts of *Loranthus micranthus* (Linn.) sourced from five different host trees. Journal of Ethnopharmacology 95(2/3): 133-138. (The methanolic extract of *L. micanathus* (= *Ileostylus micranthus*) showed hypoglycaemic and anti-hyperglycemic activities in rats and is considered a potential alternative medicine for diabetes mellitus.)

Osadebe, P.O. and Ukwueze, S.E. 2004. A comparative study of the phytochemical and anti-microbial properties of the Eastern Nigerian species of African mistletoe (*Loranthus micranthus*) sourced from different host trees. Bio-research 2(1): 18-23. (Antimicrobial activity of *L. micranthus* (=*Ileostylus micranthus*) harvested from *Cola acuminata* and *Persea americana* was higher than that harvested from *Irvingia gabonensis, Pentaclethra macrophylla, Azadirachta indica* or *Baphia nitida*.)

Oswald, A. 2005. *Striga* control – technologies and their dissemination. Crop Protection 24: 333-342. (Discussing possible control methods and constraints on their adoption and describing extension techniques used in a project in western Kenya.)

Padi, F.K. 2004. Relationship between stress tolerance and grain yield stability in cowpea. Journal of Agricultural Science 142: 431-443. (Resistance to *Striga gesnerioides* among the characters considered.)

Palmer, A.G., Gao, R., Maresh, J., Erbil, W.K. and Lynn, D. G. 2004. Chemical biology of multi-host/pathogen interactions: chemical perception and metabolic complementation. Annual Review of Phytopathology 42: 439-464. (Review comparing *Agrobacterium tumefaciens* to *Striga asiatica* with respect to mechanisms of host signaling and pathogenesis.)

Parniske, M. 2005. Cue for the branching connection. Nature 435: 750-51. (Commenting on the Letter from Akiyama *et al.* – see above.)

Patel, D.M, Bhatt, D.C., Dodia, S.K. and Parmar, R.P 2004. Selection of host plants by *Cuscuta* L. species in semi-arid area of Visnagar, North Gujarat. Advances in Plant Sciences 17: 549-552. (48 hosts listed for '*Cuscuta* sp.' in N. Gujarat.)

Pérez-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. (Unsuccessful parasitism cannot be attributed to cell death in the host root; rather the darkening often observed is due to secretions from the host and necrosis of the parasite.)

Phoenix, G.K. and Press, M.C. 2005. Linking physiological traits to impacts on community structure and function: the role of root hemiparasitic Orobanchaceae (ex-Scrophulariaceae). Journal of Ecology (Oxford) 93: 67-78. (Reviewing the wide range of effects of hemi-parasitic Scrophulariaceae on the competitive balances between hosts and non-hosts and the resultant impacts at the community level, which may be positive as well as negative.)

Press, M. C. and Phoenix, G. K. 2005. Impacts of parasitic plants on natural communities. New Phytologist 166: 737-751. (An insightful review from the laboratory of the leading researcher in parasitic plant ecology, this article deals with the consequences of parasitism not only in the direct aspects which have been most studied but also in the effect on composition of plant communities and, reciprocally, the impact of plant communites on parasites as well as interactions at different tropic levels, and the abiotic environment.)

Procházka, F. 2004. A centre of occurrence of *Viscum album* subsp. *album* in eastern Bohemia and an overview of the diversity of its host plants in the Czech Republic. Preslia 76: 349-359. (*V. album* has been recorded on 53 taxa in 13 families in the Czech Republic. Main hosts are in Salicaceae, Rosaceae and Aceraceae. *Prunus padus* is reported as a host for the first time from the Czech Republic.)

Pronos, J., Mathiasen, R.L. and Beatty, J.S. 2004. Gray pine dwarf mistletoe. Forest Insect & Disease Leaflet No.173, 7 pp. (Noting the distribution, biology and control methods for *Arceuthobium occidentale*, an important parasite of *Pinus sabiniana* in California.)

Pujadas-Salvà, A.J. and Plaza-Arregui, L., 2004. What is *Orobanche haenseleri* var. *deludens* Beck? Anales del Jardin Botànico de Madrid 61(2): 129-134. (Re-naming *O. henseleri* var. *deludens*, occurring in S. Spain and previously known also as *O. austrohispanica*, as a new ssp. of *O. gracilis* – *O. gracilis* var. *deludens* (Beck) A. Pujadas.)

Pujadas-Salvà, A.J., Plaza-Arregui, L., Triano-Muñoz, E. and Algarra-Ávila, J.A. 2005. *Orobanche icterica* (Orobanchaceae) revisited. Botanical Journal of the Linnean Society 148: 117-124. (Reviewing the taxonomic status of *O. icterica* and comparing its morphology with that of *O. elatior*, to which it is closely related. The name *O. icterica* is lectotypified, its distribution (in eastern Spain), habitat and phenology are indicated, together with a brief description and illustration.)

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