HAUSTORIUM

Parasitic Plants Newsletter

Official Organ of the International Parasitic Plant Society

August 2005 **Number 45**

IPPS –A MESSAGE FROM THE SECRETARY

Dear IPPS Members,

Our most recent Symposium on Parasitic Weeds, which took place in Durban (South Africa) last June, was a wonderful occasion to learn about progress in many areas of parasitic plant research, to discuss new ideas, to meet old friends and colleagues, and to make new acquaintances. Let me take this opportunity to once again thank everyone who contributed to the meeting; it was in many ways a resounding success!

The International Parasitic Plants Society was inaugurated during the International Parasitic Weeds Conference in Nantes. Due to some legal difficulties it was possible to officially register the IPPS as an international society only in 2002. The Board of Directors provided the Executive Committee with recommendations that are now gradually implemented. Due to the delay in the formal registration of the Society we postponed our plans for a while and organized an international Symposium only recently. The Executive committee started organizing the Symposium as early as January 2003, but all technical issues could be finalized only shortly before the Symposium. We owe special thanks to the Committee Members Jim Westwood and Jos Verkleij for their continuous involvement in the decisions behind the meeting.

The 8th International Symposium on parasitic weeds has certainly been the highlight of our activities so far. Delegates from 23 countries presented their research results in posters and in lectures, covering many aspects of parasitic plant biology and management. A diversity of parasitic plant problems was discussed in seven sessions.

Thanks to the fruitful collaboration with the International Weed Science Society (IWSS) we were able to link the Symposium to the Weed Science Congress (IWSC), by which the parasitic weed researchers were exposed to the broader scope of weed science and the IWSC participants could take part in presentations and discussions during our Symposium. We are grateful to the organizers of the IWSC, and in particular to Baruch Rubin, Vice-President of the IWSS and member of our Board, for help and encouragement regarding the coordination of these two scientific meetings.

The International Scientific Committee, with representative of the major areas of parasitic plant research and control, evaluated all submitted abstracts, and the final program was constructed according to their recommendations. We happily thank all members of the committee for their contribution to the success of the Symposium. The Proceedings of the 8th International Symposium on Parasitic Weeds can be downloaded from the IPPS website at http://www.ppws.vt.edu/IPPS/ .

The publication of *Haustorium* is a big job. Thanks to the Editors, Chris Parker Jim Westwood and Lytton Musselman, this newsletter is prepared and distributed periodically to the benefit of all of us. The efforts, thinking, and hard work that they contribute are highly appreciated. Obviously the quality of the newsletter depends on contributions from all of us. The newsletter will certainly improve once additional material is submitted to the editors. Please make sure that you update us through *Haustorium* with dissertation summaries, research reports, interesting observations, and new ideas for discussion.

We will soon start preparations for the next IPPS Congress, which is due for 2006. Any suggestions for a venue will be most welcome. Please contact me with your suggestions at dmjoel@volcani.agri.gov.il. The Executive Committee will select the suggestions, and the final decision will be taken by the General Assembly. In

addition, we will be happy to receive suggestions for a workshop on a more focused subject, which should be organized in 2005.

Danny Joel, IPPS Secretary

8TH INTERNATIONAL PARASITIC WEED SYMPOSIUM and 4TH INTERNATIONAL WEED SCIENCE CONGRESS – AN OVERVIEW OF CONTRIBUTIONS

These two meetings were held in tandem in Durban, South Africa, June 21-25, 2004. All the posters and many papers on parasitics were presented at parasitic plant sessions on the final day of the Weed Science Congress while further papers were presented at the specialised 8th International Symposium on the final day, and a few at earlier sessions of the main congress. A total of 69 papers and posters of relevance to parasitic plants were submitted to these two meetings, though not quite all these were personally presented. A full list is included under Meetings below.

The highlight was the keynote presentation by Danny Joel, which reviewed the current status of research, the problems remaining and in some cases still worsening, followed by discussion of the potential for new approaches based on advanced technologies. These might include manipulation of metabolic pathways, development of artificial resistance, parasite-specific herbicides, etc with the aims of developing new resistances, improving biological control agents and developing diagnostic tools to assist in precision parasitic weed management.

The persistent problems from *Striga* and its management were the subject of a major session, starting with a useful review by Joel Ransom, incidentally noting the potential for transplanting, followed by in-depth consideration of many aspects of genetic diversity, breeding, selection, etc. (Ejeta; Menkir; Ouédraogo; Haussmann; Rodenburg). Two papers related specifically to races of *S. gesnerioides* and efforts to map resistance genes (Botanga; Gowda). Among papers on management, several emphasised the value of integrating techniques involving inter-cropping, rotation with trap crops selected for high stimulant production, fertilization, etc (Gworgwor; Kamara, Emechebe; Franke) and the potential for modelling to assist decision-making (Westerman). In East Africa, the use of herbicide-treated seed of herbicide-tolerant maize continues to show promise (Kanampiu), while the use of green-manure crops is highly encouraging in Tanzania (Akulumuka). Two papers dealt with the possibilities of manipulating mycorrhiza (Gworgwor; Lenndzemo).

Papers on *Orobanche* included several on new and increasing problems in Australia (McLaren), and USA (Mallory-Smith; Westwood); some up-to-date consideration of virulence and resistance in the *O. cumana*/sunflowers relationship (Plakhine; Gidoni); imidazolinone use in herbicide-tolerant sunflower (Malidza); modelling to help decision making in control of *Orobanche* spp. (Grenz; Eizenberg); progress in the use of herbicides in tomato (Goldwasser; Lande); and the potential for enhancing resistance with the use of BTH (Müller-Stöver), salicylic acid (Buschmann) or perhaps with transgenically-induced sarcotoxin (Aly) or other novel approaches (Winston).

Biological control of parasitic weeds was reviewed by Joachim Sauerborn and a number of papers described the latest attempts to bring *Fusarium* species into practical use (Yonli), the most promising of these relating to treatment of crop seed with chlamydospores of *F. oxysporum* 'Foxy 2' (Abuelgasim) and combination with BTH treatment (Müller-Stöver). One paper suggested more consideration of *Smicronyx cyaneus* for control of *Orobanche* spp. (Zermane).

More basic work on *Striga* and *Orobanche* spp. included studies of the analysis and production of strigolactones (Yoneyama; Watanabe); influence of fluridone and plant growth regulators on the conditioning process (Chae); effect of nutrients on stimulant production (Song); distinction of *S. hermonthica* from *S. aspera* by SCAR markers (Verkleij); use of tissue culture in studies of *Orobanche* host specificity (Zhou).

Among the few papers on *Cuscuta* spp. was one describing the useful integration of herbicide use with varietal resistance to *C. campestris* in tomato (Lanini).

Papers on mistletoes included new observations on the endophyte of *V. album* (de Mol); on mineral uptake in *Scurrula elata* (Glatzel); on the involvement of jasmonic acid in nutation in *V. album* (Dorka); tissue culture of *Arceuthobium tsugense* (Shamoun); and on possibilities for biocontrol of *Arceuthobium* spp. (Shamoun).

A paper on *Osyris alba* in Jordan included new information on host range (Qasem), while there was

useful new information on the germination biology of *Rhamphicarpa fistulosa* (Gbèhounou); on the floral biology of *Hydnora* spp. (Maass); and on host range in *Rhinanthus minor* (Cameron).

Chris Parker.

NEWS ABOUT CHRISTMAS MISTLETOE, *VISCUM ALBUM*, IN BRITAIN

Following the hugely popular national mistletoe survey in the 1990s (Briggs, 1999) *Viscum album* is enjoying a bit more attention in the UK - and not just at Christmas. Much of this is based on the belief that mistletoe is becoming scarce because of the decline of traditional apple orchards – the best-known host and habitat for *V. album* in Britain. The survey, conducted by the Botanical Society of the British Isles (BSBI) and Plantlife International, asked people to send in sightings of mistletoe, with details of host and habitat. The official period ran from 1994 to 1996 but records were still being submitted in 1998. Results were compared to a similar BSBI survey from 1970.

The survey results could not show a link with apple orchard decline because of the nature of the data – of variable quality and largely un-quantitative. Though general observations suggest that 'cultivated' mistletoe – i.e. mistletoe deliberately tolerated as a side crop on farmed fruit trees, might be in decline, the overall distribution data suggest that mistletoe in general is doing just fine. In fact a comparison of the 1970 and 1990s distribution maps suggest an increase in range – though this may be an artefact of increased recording effort in the 1990s.

Host patterns were consistent from 1970s to 1990s with apple heading the list followed by limes (*Tilia* spp.), hawthorn, poplars, maples, willows etc. Habitats, where recorded, confirmed an expected pattern headed by gardens and followed by orchards, parkland, roadside and hedgerow. An important observation here is that most *V. album* records in Britain are clearly from man-made habitats. This is especially true for records outside the species' main range in the SW Midlands – it is possible that all records east and north of this area have artificial origins.

The implications of any decline, real or imaginary, in 'cultivated' mistletoe are difficult to assess but Britain has always largely depended on imports from northern France for Christmas stocks. Perhaps we should be worrying more about harvestable supplies there – which, like Britain, are largely from the declining traditional apple orchards.

Despite the overall survey results much of the British public, informed by alarmist media coverage, now believe *V. album* to be endangered. This belief, reinforced by the species' natural scarcity in many parts of the country, is not a problem, as it helps deliver a general conservation and sustainability message through one of our best-loved (and, in Britain, harmless) native plants. The most common manifestation of this is the inclusion of mistletoe in local Biodiversity Action Plans (BAPs), especially in areas where mistletoe is genuinely scarce, though not necessarily endangered. Biodiversity Action Plans are not, of course, just for endangered species, and UK guidance at least suggests inclusion on the grounds of local character and cultural importance.

For example the Greater London BAP (London Biodiversity Partnership, 2001) includes *V. album* on the grounds of local rarity, cultural significance and ease of monitoring. The mistletoe plan in the London BAP (accessible via www.lbp.org.uk/03action_pages/ac22_mistletoe.html) includes provision to collate data on existing sites, seeks site protection, establishment of new sites and a review of *V. album* in other similar cities. This has provided an interesting opportunity to supplement the national survey with a detailed local study of populations and their origins. London has scattered records of mistletoe in gardens but also has larger historic colonies, centred on Bushy and Home Parks (near Hampton Court), and Myddelton House and Forty Hall (Enfield). The Hampton Court populations have a long history – known from at least the 1720s – but they are of obscure origin. The Enfield populations were established by, or at least encouraged by, E A Bowles (1864–1954), the plant breeder and garden writer, who lived at Myddelton House all his life.

This pattern and history have similarities with other European cities on the edge of the *V. album* range. A recent study in Brussels (Olivier, 1998) details long-established but isolated mistletoe populations in the city's cemeteries. A comparable study in Hamburg (Poppendieck and Petersen, 1999) describes several populations established in about 1903 which, though thriving, have only spread within a few hundred metres of their origin. Further north in Britain there are scattered garden records in Glasgow and Edinburgh – but long-established small colonies (known from the 19th century) in some districts. These include the Botanic Garden

and the Dean Cemetery in Edinburgh (said to have been introduced by Victorian local botanist William Paxton) and the University Grounds in Glasgow. By encouraging the establishment of new colonies the London project follows in the tradition of these historic introductions. Similar initiatives are described for Hamburg by Poppendieck and Petersen. (This may seem odd behaviour to those more accustomed to dealing with the more pestilential mistletoe species!)

Other recent news on mistletoe in Britain relates to the animal associates of *V. album*. The blackcap (*Sylvia atricapilla*), mistletoe's main continental bird vector, does not usually overwinter in Britain, leaving berry distribution to the less efficient mistle thrush (*Turdus viscivorus*). But recent changes in blackcap behaviour have resulted in increasing numbers in the UK each winter – with possible significance for Britain's mistletoe. The British mistletoe insect fauna is also changing – or perhaps more correctly, being properly documented. Until the 1990s only four obligate associates of *V. album* were known in Britain – the lepidopteran *Celypha woodiana*, the homopteran, *Psylla visci* and the heteropterans *Anthocoris visci* and *Orthops viscicola*. Since then the National Trust's ecological survey team have recorded the mistletoe weevil *Ixapion variegatum* (Foster *et al,*. 2001) and most recently (2003) the team have recorded another bug *Hypseloecus visci* (newspaper reports Dec 2003). Both species are new to Britain but known on continental mistletoe – perhaps there are more to be found…

There is a review of many of these issues, and other aspects of *Viscum album*, in Briggs (2003). I would welcome any comments on the notes above – particularly on *V. album* distribution, possible future supply problems, isolated colonies in cities, reintroductions, and insect/bird associations.

Jonathan Briggs
jonathanbriggs@mistletoe.org.uk

References:

Briggs, J. 1999. Kissing goodbye to mistletoe? Plantlife/BSBI report

Briggs, J. 2003. Christmas curiosity or medical marvel? A seasonal review of mistletoe. Biologist 50 (6) 249-254 (downloadable from the Institute of Biology's website ww.iob.org/downloads/Mistletoe.pdf).

Foster, A.P., Morris, M.G. and Whitehead, P.F. 2001. *Ixapion variegatum* (Wencker, 1864) (Col., Apionidae) new to the British Isles, with observations on its European and conservation status. Entomologists's Monthly Magazine 137(1644/1647): 95-105.

London Biodiversity Partnership 2001. The Action.Volume 2 of the London Biodiversity Action Plan. London Biodiversity Partnership (www.lbp.org.uk).

Olivier, J-F. 1998. Cartographie de *Viscum album* a Bruxelles et dans les environs Adoxa 20/21, 1–14.

Poppendieck, H. and Petersen, J. 1999. Ein ausbreitungsbiologisches langzeit-experiment: Die einburgerung der mistel in Hamburg und Umgebung Abh. Naturwiss. Verein Bremen, 44/2-3, 377–396. http://plab.ku.dk/tcbh/lectin-links.htm

MEETINGS

8TH INTERNATIONAL PARASITIC WEED SYMPOSIUM and 4TH INTERNATIONAL WEED SCIENCE CONGRESS

The following list includes all the relevant papers presented at both meetings, and all the posters for which abstracts were provided. No Proceedings are to be published, but the abstracts of the 56 papers and posters that were personally presented on the final two days (marked * below) will be available on the IPPS web-site (http://www.ppws.vt.edu/IPPS/). Abstracts for the 4th IWSC, including most of the items without asterisks below will be available on http://www.olemiss.edu/orgs/iws/DEFAULT.HTM.

Abu-Irmaileh, B.E. and Abu-Rayyan, A.M. - Animal manure fermentation reduces *Orobanche* infestation on tomatoes.*

Akulumuka, V. *et al.* - Improving food security through *Striga* and soil fertility management in lowland maize: a participatory development process.

Al-Khateeb, W.M. *et al.* - Influence of salinity on the interaction between tomato and *Orobanche cernua.**

Aly, R *et al.* - A new approach to parasitic weed control based on inducible expression of sarcotoxin in transgenic plants

Benventi S. *et al.* - Germination ecology, emergence and early host parasitization of *Cuscuta campestris* Yuncker.*

Botanga, C.J. and Timko, M.P. - Genetic variability and host specialization in *Striga gesnerioides*.*

Buschmann, H. and Sauerborn, J. - Induced resistance: an effective method for the control of parasitic weeds?*

Cameron, D.D. *et al.* - Using the broad-spectrum hemi-parasitic angiosperm, *Rhinanthus minor*, as a tool to investigate compatible and incompatible host-parasite interactions.*

Chae, S.H. *et al.* - Fluridone promotes conditioning and germination of root parasitic weed seeds.*

Dayan, F.E. *et al.* - Biosynthesis of sorgoleone: retrobiosynthetic NMR, root hair specific EST, and biochemical analyses.

De Mol, M. and Heller, A. - Water relations and development of the European mistletoe *Viscum album* L.*

Dorka, R. *et al.* - Endogenous rhythms of nutational movement in *Viscum album* L. correlates with high level of jasmonic acid.*

Eizenberg, H. *et al.* - Growing degree days - a predicitve tool for *Orobanche* spp. parasitism in certain crops.*

Ejeta. G. and Rich, P.J. -Understanding key developmental processes in parasitic weeds.*

Elzein, A. - Pesta formulation and seed treatment technology: attractive delivery systems for *Striga* mycoherbicides - step towards practical field application.

Elzein, A. *et al.* - Seed treatment technology: an appropriate delivery system for controlling *Striga* spp. with *Fusarium oxysporum* Foxy 2.*

Emechebe, A.M. - Ways to manage *Striga* infestations without herbicides in West and Central Africa.*

Franke, A.C. *et al.*- On-farm testing of *Striga hermonthica* control technologies in the northern Guinea savanna.*

Gbehounou, G. and Assigbe, P. - A study of germination of seeds of *Rhamphicarpa fistulosa* (Hochst.) Benth. , a new pest of rice.*

Gidoni, D. *et al.* - Is host range potential related to genetic diversity in *Orobanche*?*

Glatzel, G. and Devkota, M. - Active vs passive mineral nutrient uptake in mistletoes – a still unresolved question.*

Goldwasser, Y. and Rubin, B. - Utilizing herbicide-resistant tomato to manage *Orobanche aegyptiaca.**

Gowda, B.S. *et al.* - Mapping and cloning of race-specific resistance genes to *Striga gesnerioides* and *Alectra vogelii* in cowpea.*

Grenz, J. *et al.* - Evaluating strategies to control the parasitic weed *Orobanche crenata* in faba bean – a simulation study using APSIM.*

Gworgwor, N.A. - Development of systems approach for ecological management of *Striga* in cereal-based cropping systems in northern Nigeria.*

Gworgwor, N.A. and Ndahi, W.B. - Parasitic weeds and their control/management in north-eastern Nigeria.

Gworgwor, N.A. and Weber, H.C. - The effect of arbuscular mycorrhiza (AM) fungi on the control/management of *Striga hermonthica* in sorghum.*

Haidar, M.A. *et al.* - Blue light induced changes in inositol 1,4,5-trisphosphate in dodder (*Cuscuta campestris*) seedlings.*

Haussmann, B.I.G. - Genetic variability of *Striga hermonthica* (review).*

Haussmann, B.I.G. *et al.* - Arresting the scourge of *Striga* sorghum in Africa by combining the strengths of marker-assisted backcrossing and farmer-participatory selection.*

Joel, D.M. - The parasitic weed problem and its fate in the 21st century.*

Kamara, A.Y. *et al.* - Cereal-legume rotation to control *Striga* and improve on-farm yield of maize in northern Guinea savanna of Nigeria: I. Effects of one-year rotation.*

Kanampiu, F.K. *et al.* - *Striga* weed control in maize using herbicide seed coating technology.*

Lande, T. *et al.* - *Orobanche aegyptiaca* control in processing tomato.*

Lanini,W.T. *et al.* - Management of *Cuscuta* in tomato with resistant varieties and herbicides.*

Lendzemo, V.W. *et al.* - Field inoculation with arbuscular mycorrhizal fungi reduces *Striga* performance on cereal crops and has the potential to increase cereal production.*

Maass, E. - Floral biology of *Hydnora.*

Malidza, G. - Control of *Orobanche cernua* in imidazolinone-tolerant sunflower hybrids.*

Mallory-Smith, C.A. *et al.* - Integrated management of *Orobanche minor* in *Trifolium pratense*.*

McLaren, D.A. *et al.* - Operation rapid response – dealing with the potential incursion of branched broomrape (*Orobanche ramosa* L.) into Victoria, Australia.

Menkir, A. *et al.* - Use of inbreeding as a tool to improve resistance to *Striga.**

Müller-Stöver, D. *et al.* - Enhancing the efficacy of a fungal biocontrol agent against *Orobanche cumana* through combination with a resistance-inducing chemical.*

Murdoch, A. and Dzomeku, I.K. - Linking laboratory and field studies of dormancy in *Striga hermonthica*: is delayed planting an option for integrated control?*

Nadler-Hassar, T. *et al.* - Natural tolerance of *Cuscuta* spp. to herbicides inhibiting amino acid biosynthesis*

Okazawa, A. *et al.* - Characterization of photoreceptors from *Orobanche minor* Sm.
Ouédraogo, O. *et al.* - Identification of resistance mechanisms of some sorghum varieties towards *Striga hermonthica*.*
Plakhine, D. *et al.* - Variation in the response of resistant sunflower to *Orobanche cumana* populations in Israel.*
Qasem, J.R. and Foy, C.L. - Host range of branched broomrape (*Orobanche ramosa* L.) among some cultivated and wild grown plant species.*
Qasem, J.R. - *Osyris alba* occurrence in Jordan: new hosts and importance.*
Ransom, J.K. *et al.* - New methodologies for the management of parasitic weeds.*
Rodenburg, J. *et al.* - Yielding ability, resistance and tolerance as independent selection criteria for breeding against *Striga*.*
Roman, B. *et al.* - Biodiversity in *Orobanche crenata* in the Mediterranean region - a review.*
Sauerborn, J. *et al.* - The role of biological control in managing parasitic weeds.
Shamoun, S. - Recent developments in biological control research for vegetation management in Canadian forests.
Shamoun, S. *et al.* - Advances in tissue culture of western hemlock dwarf mistletoe (*Arceuthobium tsugense* subsp. *tsugense*).*
Song, W.J. *et al.* - Changes in germination of *Orobanche* seeds in response to conditioning temperature and PGR treatments.*
Tesfamichael, N. *et al.* - Prospects and limitations for *Striga asiatica* control in sorghum/*Desmodium* intercrop.*
Tesfamichael, N. *et al.* - Sensitivity of sorghum varieties towards *Striga asiatica* as influenced by nitrogen, potassium and moisture regimes.
Verkleij, J. *et al.* - Analysis of genetic variability in the closely related species *Striga hermonthica* and *S. aspera* by RAPD and SCAR markers.*
Westerman, P.R. *et al.* - Density dependence in the *Striga*-host interaction and its consequences for *Striga* management.*
Westwood, J.H. and Fagg, C.M. - ISSR characterization of *Orobanche minor* populations in the U.S.*
Winston, E.M. *et al.* - Manipulating host defenses to enhance tobacco resistance to *Orobanche aegyptiaca*.*
Yoneyama, K. *et al.* - Effects of nutrients on the production of germination stimulants.*
Yoneyama, K. *et al.* - Determination and quantification of strigolactones.*
Yonli, D. *et al.* - Pathogenicity of *Fusarium* spp isolates and metabolites to *Striga hermonthica* in Burkina Faso.
Yonli, D. *et al.* - Effect of growth medium and method of application of *Fusarium oxysporum* on infestation of sorghum by *Striga hermonthica* in Burkina Faso.
Zermane, N. - *Smicronyx cyaneus* Gyll. (Coleoptera: Curculionidae): a neglected natural enemy of the parasitic weed *Orobanche*.
Zhou Wei-jun. *et al.* - Callus production of parasitic weed *Orobanche* and its novel aseptic infection on host roots.*
Zygier, L. and Rubin, B. - EPSP-synthase presence and activity in Egyptian broomrape (*Orobanche aegyptiaca* Pers.).*

NON-WEEDY HEMIPARASITIC SCROPHULARIACEAE (OROBANCHACEAE)

A two-day symposium on the non-weedy hemiparasitic (ex-)Scrophulariaceae (Orobanchaceae) was held in Wageningen, 15-16 April 2004. It was attended by about 40 participants from Europe and USA. Andrea Wolfe's stimulating talk on the evolution and taxonomy of the Orobanchaceae was followed by about 30 oral and poster presentations on a wide range of aspects of the biology of this group of hemiparasites, as listed below.

Full proceedings will not be published. However, several papers will be submitted for a special volume of Folia Geobotanica that is planned to be published early 2005. A limited number of copies of the booklet with abstracts of oral and poster presentations are still available. The texts can also be forwarded by email. Those interested in receiving either the booklet or the electronic text may send an email to siny.terborg@wur.nl.

1. Oral presentations
1.1. Taxonomy & Evolution:
Andrea Wolfe (Ohio, USA) - Phylogeny and biogeography of Orobanchaceae.
Robert Mill (Edinburgh, UK) - A new arboreal epiphytic *Pedicularis* from Nepal: an introduction to its taxonomy and morphology.
Mikael Lönn (Huddinge, SE) - Local and regional differentiation in *Euphrasia*.
Veronique Ducarme (Louvain, B) - Origin and evolution of natural hybridization in the genus *Rhinanthus*.
Per Larsson (Arvika, SE) - Morphologic and genetic variation of *Rhinanthus serotinus* or *angustifolius*, in western Sweden.
1.2. Ecophysiology and Mechanisms:

Malcolm Press (Sheffield, UK) - Ecophysiological characteristics of root hemiparasitic angiosperms: consequences for ecosystems structure-function relations.
John Yoder (Davis, USA) - Genetic mechanisms of host plant recognition.
Wendy Seel (Aberdeen, UK) - Mechanisms underpinning the effects of *Rhinanthus minor* on its host.
Wolfram Hartung, W.D. Jeschke & Fan Yiang (Wuerzburg, D) – Long distance transport within the hemiparasitic association *Rhinanthus minor/Hordeum vulgare.*
Duncan Cameron (Aberdeen, UK) - How does an understanding of parasite nutrition help us to understand the variable effect of *Rhinanthus minor* at the community level?
1.3. Population Ecology:
Diethart Matthies (Marburg, D) - The ecology of hemiparasite-host interactions.
Päivi Lehtonen (Turku, FIN) - Trophic interactions among host plant, endophytic fungus, hemiparasitic plant and its herbivore.
Leonid Rasran (Kiel, D) - Effects of seed limitation and disturbance on the hemiparasitic fen grassland species *Rhinanthus angustifolius* and *Pedicularis palustris*.
Sarah Dalrymple (Aberdeen, UK) - Population ecology of British Small Cow-wheat (*Melampyrum sylvaticum*).
Dorothy Allard (Bakersfield, USA) - An ecological study of *Pedicularis dendrothauma* R. R. Mill and D. J. Allard, sp. nov.
Brita Svensson (Uppsala, SE) - The hemiparasitic plant: friend or foe?
Siny ter Borg (Wageningen, NL) - Dormancy and germination of *Rhinanthus* spp in relation to the local climate; a comparative study.
1.4. Community & Restoration Ecology:
Manja Kwak (Groningen, NL) - Hemiparasitic Scrophulariaceae: plants with special reproductive traits in common.
James Bullock (Dorchester, UK) - *Rhinanthus minor:* a tool for restoration of species rich grasslands.
Duncan Westbury (Reading, UK) - The use of *Rhinanthus minor* to increase forb abundance in newly established meadows on ex-arable land.
2. Posters
Riitta Ahonen (Oulu, FIN) - Are there genetic constraints in utilization of host species and autotrophic performance of *Rhinanthus serotinus*?
Els Ameloot (Leuven, B) - Community structure in a chronosequence of restored semi-natural grasslands and the facilitating role of *Rhinanthus* species.
Duncan Cameron (Aberdeen, UK) - Host resistance to the grassland hemi-parasite, *Rhinanthus minor* and its role in determining community composition.
Susan Dalrymple (Aberdeen, UK) - Identifying factors affecting the survival of *Melampyrum sylvaticum.*
Fan Jiang (Wuerzburg, D) – The haustoria of the host/*Rhinanthus serotinus* association.
Christine Krebs (Marburg, D) - The influence of different hosts on the hemiparasites *Rhinanthus minor* and *R. alecorolophus.*
Tom van Mourik (Wageningen, NL) - Ecological approach to an agronomical pest (*Striga hermonthica*), limitations to a parasites' reproductive output.
Milan Štech (Ceske Budejovice, Tsj) - Morphometric and RAPD study of *Melampyrum sylvaticum* group in the Sudeten, Alpen and Carpathian mountains.
Milan Štech (Ceske Budejovice, Tsj) - Seasonal variation in *Melampyrum pratense* – a morphological point of view.
Zhongkui Sun (Wageningen, NL) - Isolation and characterisation of key-genes in the formation of germination stimulants of the parasitic weeds *Striga* and *Orobanche.*
Jerôme Vrancken (Louvain, B) - Phylogeography of the genus *Rhinanthus* in Europe.

COST 849 - PARASITIC PLANT MANAGEMENT IN SUSTAINABLE AGRICULTURE

This programme, funded by European Union via European Science Foundation, has been able to arrange an increased number of meetings in 2004. Those already completed are noted below. Several more are scheduled. Abstracts and/or reports of most of these meetings are available on the COST849 web-site (http://cost849.ba.cnr.it/) or will be added in due course.

Genetic diversity of parasitic plants held in Cordoba, Spain, 19-21 February. The following is a list of the papers presented and discussed:

Jury, S.L. and Rumsey, F.J. - A new system for *Orobanche* taxonomy in Europe.
Schneeweiss, G.M. - Taxonomy and phylogeny in *Orobanche.*
García, M.A. - Taxonomy and systematics of *Cuscuta* L. (Convolvulaceae).

Domina, G. - *Orobanche canescens* C. Presl in Sicily. Distribution and taxonomic notes.
Carlón, L. *et al.* - Taxonomic, chorological and iconographical contributions to the knowledge of genus *Orobanche* (Orobanchaceae) in the north of the Iberian Peninsula.
Cagáň, Ľ. and Tóth, P. - Distribution of broomrapes (*Orobanche* sp.) in Slovakia.
Wegmann, K. - Ecology and epidemiology of *Orobanche ramosa* in Europe.
Plakhine, D. *et al.* - A new race of *Orobanche cumana* in Israel.
Joita-Pacureanu1. *et al.* - Races of broomrape in Romania.
Molinero, L. and Melero-Vara, J.M. - Highly virulent populations of sunflower broomrape (*Orobanche cumana*).
Batchvarova, R.B. *et al.* - Morphological and genetic diversity of broomrapes in Bulgaria.
Streibig, J.C. - Response of *Striga hermonthica* biotypes to sorghum exudates.
Lyra D. *et al.* - Seed germination study in *Orobanche* populations infesting tobacco plants in Greece.
Lyra D. *et al.* - Abiotic factors affecting the infestation in tobacco crops from *Orobanche* in Greece.
Simier, Ph. *et al.* - Aggressiveness and pectinolytic activities within populations of *Orobanche cumana* Wallr. a root parasite of sunflower.
Nickrent, D.L. - Molecular evolution and phylogeny of parasitic plants.
Letousey, P. *et al.* - Parasitism and evolution of the plastid genome.
Joel, D.M. *et al.* - Genetic diversity of *Orobanche* species and host range potential.
Haussmann, B.I.G. - Genetic variability of *Striga* (review)
Román, B. *et al.* - Molecular markers for diagnosis and genetic diversity studies in *Orobanche.*
Satovic1, Z. *et al.*- Overcoming limitations of dominant marker data: population structure of the parasitic plant *Cistanche phelypaea* inferred from RAPD markers
Curto, M. *et al.* - Two-dimensional gel electrophoresis as a tool to identify and characterize the protein profile of *Orobanche* spp. seeds.

Biological control held in Rome, 27-28 February, 2004. Papers presented and discussed included the following:

Vibeke Leth - Enhancement of pathogens using proper formulations.
Joachin Sauerborn - Integrating biocontrol and induced resistance for parasitic weed management.
Jonathan Gressel - Transgenic synergies for biocontrol.
Joseph Hershenhorn - The efficacy of a mixture of fungi to control Egyptian and sunflower broomrape.
Maurizio Vurro - Synergistic use of phytopathogenic fungi and fungal metabolites.
Angela Boari - Natural compounds for alternative strategies of parasitic plant management.
Ludovit Cagan - Differences in synergistic use of biocontrol agents on *Orobanche* and *Cuscuta*.
Peter Toth - Potential of wild parasitic weed species as a source of biocontrol agents.
Paul C. Quimby Jr. - Sucrose: an osmotic agent for harvesting/stabilizing microbial biocontrol agents.
David C. Sands - Recent progress in development of synergistic components for biocontrol of weeds.
Elzein Abuelgasin - Enhancing *Striga*-mycoherbicide's efficacy though seed treatment delivery system: step towards practical field application.
Nadjie Zermane - Attempts to combine the non pathogenic *Fusarium oxysporum* Tn01 with Rhizobacteria to control the root parasitic weed *O. crenata*.

Herbicide testing for control of broomrape held in Nicosia, Cyprus, 13-15 May, 2004. Papers presented and discussed included the following:

Editor's note: The list of papers included for this meeting in the original version of Haustorium was incorrect. The contents of this meeting will be included in the next issue.

Genetic diversity of broomrape held in Palermo, Sicily, 27-29 May, 2004. Papers presented and discussed included the following:

Schneeweiss, G.M. Taxonomy and phylogeny in *Orobanche*.
Lira, S. *Orobanche* populations infesting tobacco plants in Greece.
Economou, G. Ecology of broomrape.
Joel, D.M. Molecular markers in *Orobanche* research.
Angel, M. Genetic diversity in *Orobanche crenata.*

Fernández-Aparicio, M. Taxonomy in *Orobanche.*
Cagan, L. Distribution of *Orobanche* in Slovakia.

Broomrape management - a joint Working Groups and Management Committee meeting held in Nitra, Slovakia, 15-17 July 2004. Papers presented and discussed were:

1. WG1 Knowledge in broomrape biology relevant to its control:
D. Cameron, D. - Compatible and incompatible interactions in root parasites.
Maldonado, A. - A proteomic approach to study plant – parasitic plant interaction.
González, C - Cloning and analysis of a peroxidase gene expressed during early infection stages *Orobanche ramosa.*
Bowmeester, H. - Biosynthesis of broomrape germination stimulants.
Cagáň, L. and Tóth, P. - Time of emergence and flowering of *Orobanche* species in Slovakia. 2. WG2 Biological control:
Dor, E. - Perspectives for biological control with fungi.
Strange, R. - New biological agents for *O. crenata* control.
Vurro, M. - Perspectives for biological control with aminoacids.
Watson, A. - New perspectives for parasitic plant management.
3. WG3. Resistance breeding:
Pérez-de-Luque, A. - Mechanisms of resistance in legumes.
Satovic, Z. - Mapping QTL for broomrape resistance in grain legumes.
Thalouarn, P. - Arabidopsis as a model for early host-*Orobanche* interaction.
Denev, I. - Use of activation tag mutants of *Arabidopsis* to identify key genes regulating early steps of plant interactions with broomrapes (*Orobanche* spp.).
4. WG4 Integrated control
Rubin, R. - Response of *Cuscuta* and *Orobanche* to herbicides inhibiting amino acid biosynthesis.
Eizenberg, H. - New approaches in chemical control of *Orobanche*.
Goldwasser, Y. - *O. aegyptiaca* control in glyphosate resistant tomato.
Jacobson, R. - Broomrape control in carrot.
van Ast, A. - Delaying the moment of infection by *Striga hermonthica*: an option to improve sorghum yield under *Striga*-infested conditions?
Riches, C.R. - Using legumes to improve the productivity of *Striga* infested land.

THESES

Venasius W. Lendzemo (PhD, Wageningen University, The Netherlands, June 2004)
The tripartite interaction between sorghum, *Striga hermonthica*, and arbuscular mycorrhizal fungi.

The witchweed *Striga hermonthica* is a major biological constraint to cereal production in Africa. The intricate association between this phytoparasite and the cereal host makes management difficult. Damage to the host begins before *Striga* comes out of the soil. Also, infestation correlates negatively with soil fertility. Arbuscular mycorrrhizal (AM) fungi have a variety of ecological functions ranging from improved uptake of immobile nutrients, protection of host from pathogens, to soil aggregation. The question whether these beneficial micro-organisms could play a role within the *Striga*-cereal (patho)system was addressed. Inoculating *Striga*-infested sorghum with AM fungi in pots or in the field resulted in a significant reduction in the performance of *Striga* in terms of numbers attached to the roots, relative time of emergence, numbers emerged and dry weight of *Striga* shoots at sorghum harvest. AM effects on *Striga* were more pronounced with the *Striga*-tolerant S-35 sorghum cultivar compared to effects with the *Striga*-sensitive CK60B. Inoculation with AM fungi compensated for damage by *Striga* in the S-35 cultivar. This compensation was independent of AM inoculum density and was not affected by P application. Germination of preconditioned *Striga* seeds after exposure to root exudates from sorghum colonized by AM fungi was significantly reduced, with effects more prominent with exudates from S-35 plants. AM fungi have the potential to affect *Striga* during germination, attachment, emergence, and possibly subsequent growth and development. It is important to understand the kind of management practices that farmers can apply to enhance mycorrhizal performance in an integrated management system.

Abuelgasim Elzein (PhD, University of Hohenheim)
Development of a granular mycoherbicidal formulation of *Fusarium oxysporum* Foxy 2 for the biological control of *Striga hermonthica* (Del.) Benth. (Supervision: Prof. Dr. Jürgen Kroschel, Institute of Plant Production and Agroecology in the Tropics and Subtropics)

Developing a formulation of microbial weed control agents is essential for their storage, ease of application and protection against environmental constraints. *Fusarium oxysporum* Foxy 2 is a fungal antagonist of *Striga hermonthica*, a root parasite of cereal crops that constitutes a major biotic constraint to food production in the Sahelian and the Savannah zones of Africa. The principal objective of this study was to develop a granular formulation of Foxy 2, in order to ease its application and to reduce the amount of inoculum required for adequate infection in the field to a practicable level. Foxy 2 was able to control both *S. hermonthica and S. asiatica*. All tested non-target plant species were immune, none developed any symptoms of infection when inoculated with Foxy 2. The ability of Foxy 2 to control more than one *Striga* species provides an opportunity to control both parasites simultaneously in those regions where they are co-existing (e.g. Tanzania and Kenya). This advantage together with the non-susceptibility of a wide range of non-target test plant species (other closely related species to the target weed *S. hermonthica*, some selected Poaceous crops, crop species reported to be highly susceptible to *Fusarium* diseases in tropical and subtropical regions, as well as economically important cultivated crops) to the fungus, should encourage the regulatory authorities to accept and introduce the antagonist for field testing.

A range of agricultural by-products were tested as substrates for the production of spores, especially chlamydospores, of Foxy 2 in liquid culture. These included maize straw, cotton seed cake, wheat and triticale stillage (the spent fermentation broth of ethanol production). Abundant chlamydospores and microconidia (and very few macroconidia) were produced in all types of substrates tested. The use of agricultural by-products, which are inexpensive and readily available in the areas where *Striga* is a major problem, is attractive for the economic feasibility of the Pesta formulation.

The efficacy of different granular formulations of Foxy 2 including sodium alginate pellets; vermiculite; and Pesta granules were compared with the fungal inoculum propagated on wheat grains. Application of 2 g of formulated Pesta granules per pot (4 kg of soil) provided the same promising level of efficacy of *Striga* control as was achieved when 40 g of inoculum propagated on wheat grains were used. Such enormous reduction (95%) in the amount of fungal inoculum as a result of adopting Pesta formulation technology could offer a significant economical practical possibility for large-scale application.

The 85-100% shelf-life of Pesta granules made with chlamydospore-rich biomass for at least one year at 4ºC is adequate for commercialization. Moreover, the stability of dried chlamydospores inoculum entrapped into Pesta granules during the first six months (100-51%) of storage at room temperature is sufficient for storage, handling and delivery under realistic conditions. Such kind of knowledge has significant applications to better understanding of the conditions for optimizing and prolonging shelf-life of biocontrol products, specially of Pesta formulations.

In conclusion, the results of the present study demonstrate the safety of non-target test plant species and suitability and economic feasibility of Pesta technology for formulating Foxy 2. The promising levels of *Striga* control and of the substantial increase in sorghum yield obtained with Pesta granules containing fresh chlamydospores inoclum of Foxy 2 under glasshouse conditions justify a further development of Pesta granules for field testing. The preparation of Pesta as free-flowing granules enable them to be applied using existing agricultural equipment, and to be easily integrated with existing *Striga* control methods e.g. cultural, mechanical and use of resistant varieties. Additional advantages of Pesta formulation are: non-toxic; relatively cost effective; can be produced on a large scale; convenient to store; and simple to use. These promising results of Pesta granular formulation and seed treatment might contribute significantly to the development of an effective integrated *Striga*-control approach adoptable and acceptable to subsistence farmers.

The thesis is published within the Book Series Tropical Agriculture (12), - Advance in Crop Research (2). The book can be ordered directly from Margraf Publisher: www.margraf-verlag.de, under ISBN 3-8236-1405-3, ISSN 0932-3074.

BOOKS

Broomrape in Israel (in Hebrew) by Goldwasser, Y., Kleifeld, Y. and Golan, S. 2003. Published by The Extension Service, Israel Ministry of Agriculture, P.O. Box 28, Bet Dagan, Israel. This 37 page booklet includes 17 colour photos and summarizes 30 years of *Orobanche* control research. The booklet is intended for students, extension, researchers, farmers, nature lovers and anyone interested in these fascinating plants and those who have to combat them in the field. The

chapters are: 1.Historical background. 2. Biology. 3. *Orobanche* species, description and host range. 4. Infestation and damage according to regions. 5. Control. 6. Why is *Orobanche* difficult to control ? 7. Bibliography (117 references). The authors would welcome any suggestions for sources of funding for the publication of an English version.

Weed Biology and Management edited by Inderjit, 2004. Published by Kluwer Academic Publishers, Dordrecht, Germany. 553 pp.

Living up to its all-encompassing title, 'Weed Biology and Management' offers a compilation of 25 chapters that touch on nearly every aspect of weed science. Chapter topics range from weed evolution, to herbicide fate, to control strategies for specific crops. Of course, Inderjit's affection for allelopathy and weed ecology is well represented, and the emphasis of the book is toward the biology of weeds and agricultural systems. With such a diversity of topics presented, anyone with an interest in weeds is sure to find at least a few chapters of interest. This is equally true for those interested in parasitic plants, because three chapters address the parasitic weeds *Orobanche* and *Striga*. A brief summary of these chapters follows:

'Molecular aspects of host-parasite interactions: opportunities for engineering resistance to parasitic weeds.' James Westwood (pp. 177-198) examines the life cycles of *Orobanche* and *Striga* (and to some extent *Triphysaria*) from the molecular point of view. Starting with germination signaling and continuing through parasite growth and nutrient acquisition, the contribution of molecular approaches to understanding parasitism is integrated into a brief description of our knowledge of the host-parasite interactions. For each stage, there is discussion (or speculation!) of the potential for genetic engineering to enhance host resistance to parasitism.

'Biological control of root parasitic weeds with plant pathogens.' Jürgen Kroschel, and Dorette Müller-Stöver (pp. 423-438) cover the rapidly expanding body of literature on biological control of *Striga* and *Orobanche* species. After a brief consideration of insects, the review concentrates on fungi (primarily of the genus *Fusarium*) that have shown promise in lab and greenhouse studies. Aspects of biological control ranging from target specificity and efficacy to application strategies are covered.

'Recent approaches to *Orobanche* management: a review.' Yaakov Goldwasser and Yeshaiahu Kleifeld (pp. 439-466) concisely review all the methods used to control *Orobanche*, including prevention, cultural practices, chemicals, biological agents, resistant cultivars, and many more. Specific emphasis is given to chemical control, but biological control and resistant cultivars also receive significant attention. This topic covers a vast amount of literature, and is difficult to address in-depth in a single chapter, but the advantages and limitations of each approach are clearly presented. This chapter is likely to be cited frequently as it provides a recent summary of the challenges, practices, and limitations in controlling *Orobanche*.

One minor complaint about the book is that some topics may already be somewhat out of date. Despite the 2004 publication, the chapters were written in 2001 or early 2002, so reviews of rapidly advancing fields do not include the most recent literature. However, this does not substantially diminish the value of the volume.

James Westwood.

South African Parasitic Plants by Johann Visser. 1981. Published by Juta, South Africa. Readers may be interested to know that this beautifully illustrated and informative book is still available from: The Bookshop, National Botanical Institute, Private Bag X101 Pretoria 0001, South Africa (email: bookshop@nbi.ac.za). The price is US$15 plus $14.50 for packing and postage by surface mail. There is an order form on the web-site (www.nbi.ac.za).

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 Hustorium, 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 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 on-line access to USDA Forest Service Agriculture Handbook 709 'Dwarf Mistletoes: Biology, Pathology and Systematics' see: http://www.rmrs.nau.edu/publications/ah_709/

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 brief articles on *Striga* in New Agriculturist on-line see: http://www.new-agri.co.uk/04-1/focuson/focuson5.html

LITERATURE

* indicates web-site reference only

Abouzeid, M.A., Boari, A., Zonno, M.C., Vurro, M. and Evidente, A. 2004. Toxicity profiles of potential biocontrol agents of *Orobanche ramosa*. Weed Science 52: 326-332. (Tests with 53 strains of 15 mainly *Fusarium* spp. showed 9 to be highly virulent against *O. ramosa*. Virulence was not necessarily correlated with production of fusaric or dehydrofusaric acids, or with toxicity to brine shrimps.)

Adhikari, D., Arunachalam, A., Majumder, M., Sarmah, R. and Khan, M.L. 2003. A rare root parasitic plant (*Sapria himalayana* Griffith.) in Namdapha National Park, northeastern India. Current Science 85: 1668-1669. (Describing *Tetrastigma bracteolatum* and *T. serrulatum* the hosts plants of the holoparasitic *S. himalayana* (Rafflesiaceae).)

Aizen, M.A. 2003. Influences of animal pollination and seed dispersal on winter flowering in a temperate mistletoe. Ecology 84: 2613-2627. (It appears that winter flowering in *Tristerix corymbosus* is associated with optimal fruit dispersal by the marsupial *Dromiciops australis* in summer.)

Aliyu, L., Lagoke, S.T.O., Carsky, R.J., Kling, J., Omotayo, O. and Shebayan, J.Y. 2004. Technical and economic evaluation of some *Striga* control packages in maize in the Nigerian Guinea Savanna. Crop Protection 23: 65-69. (Describing a range of integrated control options involving tolerant maize varieties, N fertilizer, and pre- and post-emergence herbicide.)

Amuchástegui, A., Petryna, L., Cantero, J.J. and Núñez, C. 2003. (Parasitic flowering plants of central Argentina.) (in Spanish) Acta Botanica Malacitana 28: 37-46. (Eight taxa belonging to 5 families and 8 genera are reported, but not listed in the abstract.)

Anon 2003. New resistant cultivars. Zashchita i Karantin Rasteniĭ11: 42-44. (Including information on a range of sunflower varieties released in 2002, and their resistance to *Orobanche*.)

Arda, N., Önay, E , Koz, Ö. and Kirmizigül, S. 2003. Monosaccharides and polyols from mistletoes (*Viscum album* L.) growing on two different host species. Biologia (Bratislava) 58: 1037-1041. (Sugar contents varied according to the subspecies of *V. album*, glucose and galactose being much higher in ssp. *abietis* on *Pinus nigra*, while mannose, arabinose, xylitol and inositol tended to be higher in ssp. *album* on *Tilia tomentosa*.)

Aukema, J.E. 2004. Distribution and dispersal of desert mistletoe is scale-dependent, hierarchically nested. Ecography 27: 137-144. (Concluding that seed-dispersing birds are a significant factor in distribution of *Phoradendron californicum* in Arizona, USA.)

Avdeyev, Y.I., Scherbinin, B.M., Ivanova, L.M. and Avdeyev, A.Y. 2003. Studying of tomato resistance to broomrape and breeding varieties

for processing. In: Bieche, B. and Branthome, X. (eds.) Acta Horticulturae 613: 283-290. (Including results of screening tomato for resistance to *Orobanche aegyptiaca* and *O. cernua*.)

Aymerich, P. 2003. (Floristic data of the upper Segre and Llobregat basins.) (in Catalan) Acta Botanica Barcinonensia 48: 15-28. (Noting new sites for *Arceuthobium oxycedri* in the Spanish Pyrenees.)

Barkman, T.J., Emoi, B.E. and Repin, R. 2003. The genus *Balanophora* (Balanophoraceae) in Sabah, Malaysia. Blumea 48: 465-474. (Providing descriptions, illustrations and a key to 5 species of *Balanophora* occurring on Borneo.)

Barkman, T.J., Lim, S.H , Kamarudin Mat Salleh and Jamili Nais. 2004. Mitochondrial DNA sequences reveal the photosynthetic relatives of *Rafflesia*, the world's largest flower. Proceedings of the National Academy of Sciences of the United States of America 101: 787-792. (Proposing relationship of *Rafflesia* with Malpighiales, and of *Mitrastemma* (Mitrastemmaceae) with Ericales.)

Berg, S., Krupinska, K. and Krause, K. 2003. Plastids of three *Cuscuta* species differing in plastid coding capacity have a common parasite-specific RNA composition. Planta 218: 135-142. (Although *C. odorata*, *C. gronovii*, and *C. reflexa* reflect a spectrum of reduction in chloroplast genes, all three accumulate approximately equivalent RNA levels.)

Bérubé, C. 2004. FarmServe Africa. Farmer to Farmer Volunteer report. http://www3.telus.net/conrad/index (Report, including photographs, of a 6-week visit to Ghana, promoting benefits of IPM, including legume intercropping, for control of *Striga hermonthica*.)

Botanga, C.J., Alabi, S.O., Echekwu, C.A. and Lagoke, S.T.O. 2003. Genetics of suicidal germination of *Striga hermonthica* (Del.) Benth by cotton. Crop Science 43: 483-488. (A range of cotton genotypes showed a range of germination stimulant activity, which proved to be controlled by a single dominant gene for high stimulant production.)

Boussim, I.J., Guinko, S., Tuquet, C. and Sallé, G. 2004. Mistletoes of the agroforestry parklands of Burkina Faso. In: Teklehaimanot, Z. (ed.) Agroforestry parkland systems in sub-Saharan Africa. Selected papers from an international workshop held in Ouagadougou, Burkina Faso, 13-16 January 2003. Agroforestry Systems 60(1): 39-49. (Listing hosts for *Agelanthus* (= *Tapinanthus*) *dodoneifolius* (the most widespread), *Englerina lecardii, Globimetula cupulata, Tapinanthus bangwensis, T. globiferus* and *T. ophiodes* and suggesting possible control measures.)

Brand, J.E., Robinson, N. and Archibald, R.D. 2003. Establishment and growth of sandalwood (*Santalum spicatum*) in south-western Australia: *Acacia* host trials. Australian Forestry 66: 294-299. (*S. spicatum* sown next to 1-year old hosts grew better on *A. saligna* (53 mm stem diameter after 3 years) than on *A. acuminata* (33 mm), *A. microbotrya* (20 mm) or *A. hemiteles* (11 mm).)

Brandt, J.P., Hiratsuka, Y. and Pluth, D.J. 2003. Adhesives for seed placement during artificial inoculation of *Pinus banksiana* seedlings with the dwarf mistletoe (*Arceuthobium americanum*). Canadian Journal of Botany 81: 1039-1043. (Hydroxypropylcellulose (HPC) proved more effective than lanolin, PVA or the natural viscin.)

Brandt, J.P., Hiratsuka, Y. and Pluth, D.J. 2004. Extreme cold temperatures and survival of overwintering and germinated *Arceuthobium americanum* seeds. Canadian Journal of Forest Research 34: 174-183. (Absence of *A. americanum* on jack pine in N. Canada may be explained by low temperatures.)

Brault, M., Gibot-Leclerc, S. and Sallé, G. 2002. (Branched broomrape in the world.) (in French) France Tabac 192: 8-9.

Brault, M., Gibot-Leclerc, S. and Sallé, G. 2002. (Branched broomrape.)(in French) France Tabac 194: 22-25.

Braun, J.M., Blackwell, C.C., Weir, D.M. and Beuth, J. 2003. Cytokine release of whole blood from adult female donors challenged with mistletoe lectin-1 standardised mistletoe extract and *E. coli* endotoxin or phytohaemagglutinin (PHA). Anticancer Research 23: 1349-1352.

Bungard, R.A. 2004. Photosynthetic evolution in parasitic plants: insight from the chloroplast genome. BioEssays 26: 235-247. (A review of the evolution of the chloroplast genomes of parasitic plants, with consideration of genes that seem to be lost rapidly (chlororespiratory ndh genes) or retained beyond obvious usefulness (rubisco rbcL).)

Buschmann, H. 2004. (Hemp death, tobacco strangler - and soon a threat for rape? The parasitic weed *Orobanche ramosa* is gaining ground.) (in German) Gesunde Pflanzen 56: 39-47. (Referring to the serious infestation of rape-seed by *O. ramosa* in western France, while hemp, tomato and tobacco are the main hosts in central Europe.)

Carranza González, E. 2002. (Flora of Bajio and adjacent regions. Family Rafflesiaceae.) (in Spanish) Flora del Bajío y de Regiones Adyacentes 107: 13 pp. (Four genera of Rafflesiaceae occur in Mexico. The genera *Bdallophytum* and the species *B. americanum* and *Pilostyles thurberi* are described.)

Chae SangHeon , Yoneyama, K., Takeuchi, Y. and Joel, D.M. 2004. Fluridone and norflurazon, carotenoid-biosynthesis inhibitors, promote seed conditioning and germination of the holoparasite *Orobanche minor*. Physiologia Plantarum 120: 328-337. (Fluridone and norflurazon mimicked GA in enhancing conditioning of *O. minor* seed but apparently by some mechanism other than inhibiting ABA biosynthesis.)

Chiu, S.B. and Shen Hao. 2004. Growth studies of *Cuscuta* spp. (dodder parasitic plant) on *Mikania micrantha* and *Asystasia intrusa*. The Planter (Kuala Lumpur) 88(934): 31-36. (In experiments in Malaysia and in W. Kalimantan, Indonesia, artificial establishment of *C. campestris* from seed or stems showed a low rate of establishment but successful control of both target species when establishment succeeded. Establishment of a second, non-flowering species, perhaps *C. reflexa,* was more reliable and also led to good control of *M. micrantha*.)

Corazzi, G. 2003. Taxonomic notes and distribution of *Orobanche* L. (Orobanchaceae) in Latium (Central Italy). Webbia 58: 411-439. (Providing a revised dichotomous key for the 19 taxa now found in this district.)

Coulon, A., Mosbah, A., Lopez, A., Sautereau, A.M., Schaller, G., Urech, K., Rougé, P. and Darbon, H. 2003. Comparative membrane interaction study of viscotoxins A3, A2 and B from mistletoe (*Viscum album*) and connections with their structures. Biochemical Journal 374: 71-78. (NMR determination of the 3D structures of viscotoxins A2 and B help to explain their lesser activity compared with A3.)

Csiky, J., Baráth, K. and Lájer, K. 2004. *Cuscuta* species in Hungary. Zeitschrift für Pflanzenkrankheit und Pflanzenschutz 19: 201-208. (Eight *Cuscuta* spp. have been recorded, though *C. epilinum* is now thought to be extinct. *C. campestris, C. epithymum* and *C. europaea* affected crops in the past and are still the commonest, but are no longer damaging. Other spp. include *C. kotschyi* in dry grassland, *C. lupuliformis* (becoming rare) in flood plains, *C. australis* in sedge vegetation, and *C. approximata* only recently found in oak woodland. A total of 2500 host species are recorded.)

Denirchi, F., Baser, K.H.C. 2004. The volatiles of fresh-cut *Osyris alba* L. flowers. Flavour and Fragrance Journal 19(1): 72-73. (Identifying 13 hexyl and hexenyl compounds contributing to flower fragrance in *O. alba.*)

Denwar, N.N. and Ofori, K. 2003. Variation in trap-crop capacity of soybean genotypes for the control of *Striga hermonthica*. International Journal of Agriculture and Biology 5: 504-506. (Production of germination stimulant varied widely among 60 varieties of soybean tested, but was not apparently correlated with any of the agronomic traits studied.)

Eizenberg, H., Hershenhorn, J., Graph, S. and Manor, H. 2003. *Orobanche aegyptiaca* control in tomato with sulfonylurea herbicides. In: Bieche, B. and Branthome, X. (eds.) Acta Horticulturae 613: 205-208. (Successful control achieved with post-emergence rimsulfuron or sulfosulfuron followed by sprinkler irrigation, and then by repeated chlorsulfuron via drip irrigation.)

Eizenberg, H., Plakhine, D., Hershenhorn, J., Kleifeld, Y. and Rubin, B. 2004. Variation in responses of sunflower cultivars to the parasitic weed broomrape. Plant Disease 88: 479-484. (*O. cernua* germinated but failed to develop on sunflower. Resistance of var. Ambar to *O. cumana, O. ramosa* and *O. aegyptiaca* is also manifested during tubercle development.)

Ekbote, S.D., Kachapur, M.R. and Chattannavar, S.N. 2003. Niger - new host of dodder. Journal of Mycology and Plant Pathology 33(1): 149. (Reporting *Cuscuta* sp. on *Guizotia abyssinica* in Karnataka, India.)

Elzein, A. and Kroschel, J. 2003. Progress on management of parasitic weeds. FAO Plant Production and Protection Paper No.120(Add.1): 109-143. (A general review of control measures for *Striga* and *Orobanche* spp.)

Elzein, A., Kroschel, J. and Müller-Stöver, D. 2004. Effects of inoculum type and propagule concentration on shelf life of Pesta formulations containing *Fusarium oxysporum* Foxy 2, a potential mycoherbicide agent for *Striga* spp. Biological Control 30: 203-211. (Among a range of formulations, Pesta formulation with chlamydospores proved most promising.)

Emechebe, A.M., Ellis-Jones, J., Schulz, S., Chikoye, D., Douthwaite, B., Kureh, I., Tarawali, G., Hussaini, M.A., Kormawa, P. and Sanni, A. 2004. Farmers' perception of the *Striga* problem and its control in Northern Nigeria. Experimental Agriculture 40: 215-232. (A wide survey of farmers revealed attitudes to the *Striga* problem and its control and concluded

that a legume-cereal rotation was the most highly-rated control option.)

Encheva, J., Christov, M., Nenov, N., Tsvetkova, F., Ivanov, P., Shindrova, P. and Encheva, V. 2003. Developing genetic variability in sunflower (*Helianthus annuus* L.) by combined use of hybridization with gamma radiation or ultrasound. Helia 26:99-108. (Use of embryo culture, gamma radiation and ultrasound helped to accelerate the development of useful genetic traits, including 100% resistance to *Orobanche cumana* in lines R114 and R116.)

Escher, P., Eiblmeier, M., Hetzger, I. and Rennenberg, H. 2004. Seasonal and spatial variation of carbohydrates in mistletoes (*Viscum album*) and the xylem sap of its hosts (*Populus x euamericana* and *Abies alba*). Physiologia Plantarum 120: 212-219. (Levels of soluble carbohydrate in *V. album* largely reflected those of its host, more-or-less uniform year-round on *A. alba* while showing a peak in spring, on *P. x euamericana*.)

Fernández-Martínez, J., Pérez-Vich, B., Akhtouch, B., Velasco, L., Muñoz-Ruz, J., Melero-Vara, J.M. and Domínguez, J. 2004. Registration of four sunflower germplasm resistant to race F of broomrape. Crop Science 44: 1033-1034. (Vars K-96, R-96, P-96 and L-86 released in Spain in 2001.)

Fracchiolla, M. and Boari, A. 2003. (Effect of the infestation of *Orobanche ramosa* on tomato and cauliflower yield.) (in Italian) Informatore Fitopatologico 53(2): 52-53. (Recording yield losses of 6-20 t/ha in the two crops in Italy.)

Galal, A.A. 2003. Bacterial wilt disease of broomrape, *Orobanche* spp., in Egypt. Assiut Journal of Agricultural Sciences 34: 163-176. (Studies on *Pseudomonas syringae* pv. *orobanchia* suggest it has some potential as a biocontrol agent.)

Gbèhounou, G., Adango, E., Hinvi, J.C. and Nonfon, R. 2004. Sowing date or transplanting as components for integrated *Striga hermonthica* control in grain-cereal crops? Crop Protection 23: 379-386. (The causes of reduced *Striga* infestation with delayed sowing are discussed without conclusive explanation. Yields of maize and sorghum were not improved by delayed sowing, but transplanting from a *Striga*-free nursery may prove beneficial.)

Giudici, A.M., Regente, M.C., Villalain, J., Pfüller, K., Pfüller, U. and de la Canal, L. 2004. Mistletoe viscotoxins induce membrane permeabilization and spore death in phytopathogenic fungi. Physiologia Plantarum 121: 27. (Viscotoxins VtA_3 and VtB completely inhibited germination of spores of *Fusarium solani* and *Sclerotinia sclerotiorum* at 10μ*M* and 50% inhibition of growth occurred at 1.5 to 3.75 μ*M*.)

Goldwasser, Y. and Kleifeld, Y. 2004. Recent approaches to *Orobanche* management: a review. In: Inderjit (ed.) Weed Biology and Management. Dortmund, Germany: Kluwer, pp. 439-466. (see Book review above.)

Gressel, J. and Amsellem, Z. 2003. Transgenic mycoherbicides for effective and economic weed control. In: Proceedings, Crop Science and Technology 2003, BCPC International Congress, Glasgow, 2003, pp. 61-68. (Suggests that biological control organisms will need to have their virulence increased to be effective. Engineering fungi to overproduce auxin or toxins enhances pathogenicity.)

Gressel, J., Hanafi, A., Head, G., Marasas, W., Obilana, A.B., Ochanda, J., Souissi, T. and Tzotzos, G. 2004. Major heretofore intractable biotic constraints to African food security that may be amenable to novel biotechnological solutions. Crop Protection 23: 661-698. (A useful review of biotic constraints affecting African farmers, including new estimates of the extent and seriousness of problems from both *Striga* and *Orobanche* spp. and discussion of available control methods)

Gurney, A.L., Grimanelli, D., Kanampiu, F., Hoisington, D., Scholes, J. D. and Press, M.C. 2003.Novel sources of resistance to *Striga hermonthica* in *Tripsacum dactyloides*, a wild relative of maize. New Phytologist 160: 557-568. (Results suggest that *T. dactyloides* produces a signal that inhibits haustorial development and is mobile in the parasite, so preventing further attachments to a susceptible maize root.)

Gworgwor, N.A. and Weber, H.C. 2003. Arbuscular mycorrhizal fungi-parasite-host interaction for the control of *Striga hermonthica* (Del.) Benth. in sorghum (*Sorghum bicolor* (L.) Moench.). Mycorrhiza 13: 277-281. (Among 5 *Glomus* spp. tested in pots, *G. mosseae* reduced emergence of *S. hermonthica* by 60% and increased sorghum weight by 30%.)

Hellström, K.. Rautio, P., Huhta, A.P. and Tuomi, J. 2004. Tolerance of an annual hemiparasite, *Euphrasia stricta* agg., to simulated grazing in relation to the host environment. Flora (Jena) 199: 247-255. (Removing the top 10% of *E. stricta* had no detrimental effect and could even be beneficial in some mowing/grazing situations, but removing 50% was fatal.)

Hess, D.E. and Dodo, H. 2004. Potential for sesame to contribute to integrated control of *Striga hermonthica* in the West African Sahel. Crop Protection 23: 515-522. (Rotation with sesamum reduces the *Striga* problem in pearl millet, but soil fertility and water conservation also need to be addressed.)

Ho JiauChing, Chen ChiuMing and Row LieChing. 2004. Neolignans from the parasitic plants. Part 2. *Cassytha filiformis*. Journal of the Chinese Chemical Society 51(1): 221-223. (*C.filiformis*, parasitic on *Ipomoea imperati* or *Imperata cylindrica* is known as a folk medicine in Taiwan and used for the treatment of kidney diseases.)

Huber, R., Klein, R., Berg, P.A., Lüdtke, R. and Werner, M. 2002. Effects of a lectin- and a viscotoxin-rich mistletoe preparation on clinical and hematologic parameters: a placebo-controlled evaluation in healthy subjects. Journal of Alternative and Complementary Medicine 8: 857-866. (Comparing the effects of the lectin-rich Iscador Qu and the lectin-poor but viscotoxin-rich Iscador Pini mistletoe preparations on clinical and haematologic parameters in healthy subjects.)

Huguet, B., Guéry, B., Moinard, J. and Pillon, O. 2004. (Protein crops - 2000/2003 plant health review: cold snap for some, heat wave for others.) (in French) Phytoma 567: 26-29. (*Orobanche ramosa* mentioned as a weed of rapeseed.)

Hwang SukYeon, Yang EunYoung, Yeo JeongHoon, Jin JiYoung, Kim HyunSung, Park WonBong and Suh JungJin. 2003. Anti-tumor effect of Korean mistletoe extract intensified with mistletoe lectin against melanoma cells in vitro and in vivo. Korean Journal of Pharmacognosy 34: 218-222.

Idžojtic, M., Pernar, R., Kauzlaric, Ž., Abramovic, M., Jankovic, D. and Pleše, M. 2003. (Intensity of infestation of silver fir (*Abies alba* Mill.) with mistletoe (*Viscum album* L. ssp. *abietis* (Wiesb.) Abrom.) on the area of the Forest Administration Delnice.) (in Croatian) Šumarski List 127: 545-559. (Results of a survey.)

Inderjit (ed.) 2004. Weed Biology and Management. Dordrecht, Germany: Kluwer Academic Publishers,. 553 pp. (Containing several chapters relating to parasitic plants – see Book review above.)

IWSC. 2004. Weed Science Serving Humanity. Abstracts of the 4th International Weed Science Congress, June 20-24, 2004, Durban, Southe Africa. IWSC/South African Weed Science Society, 128 pp. (Including abstracts of many papers and posters -on parasitic plants. See under Meetings above.)

Jain, S.H., Angadi, V.G., Shankaranarayana, K.H. and Ravikumar, G. 2003. Relationship between girth and percentage of oil in trees of sandal (*Santalum album* L.) provenances. Sandalwood Research Newsletter 18: 4-5. (In a survey of *S. album* trees in S. India, oil content was found to increase from about 1.5-2.5% at 40 cm girth to about 4% at 80cm girth with little increase beyond this stage.)

Kanampiu, F.K., Friesen, D. and Gressel, J. 2002. CIMMYT collaborative efforts unveils herbicide-coated maize seed technology to curb problematic *Striga.* Integrated Pest Management Reviews 7,(1): 63-64. (A further review of this successful technology.)

Kaplan, A. 2003. Leaf anatomy and morphology of 14 species belonging to the Turkish Rhinantheae (Scrophulariaceae) tribe. Israel Journal of Plant Sciences 51: 297-304. (Studies of leaf anatomy in 14 species of 11 genera showed striking variation.)

Kataria, O.P. , Chauhan, D.R. and Balyan, R.S. 2003. Effect of herbicides on weeds and seed yield of tobacco (*Nicotiana tobacum* L.). Indian Journal of Weed Science 35(1/2): 151-152. (Weeds included *Orobanche aegyptiaca*.)

Kim MyungSunny, Lee Jienny, Lee KangMin, Yang SeiHoon, Choi Sujinna, Chung SangYoung, Kim TaeYoung, Jeong WonHun and Park Raeki. 2003. Involvement of hydrogen peroxide in mistletoe lectin-II-induced apoptosis of myeloleukemic U937 cells. Life Sciences 73: 1231-1243. (Korean mistletoe lectin II promotes strong induction of H_2O_2 in tumor cells, leading to cell death.)

Koch, A.M., Binder, C., Sanders, I.R. 2004. Does the generalist parasitic plant *Cuscuta campestris* selectively forage in heterogeneous plant communities? New Phytologist 162: 147-155. (There was no evidence for direct benefits of a mixed host diet. *Cuscuta campestris* foraged by parasitising the most rewarding hosts the fastest and then investing the most on them.)

Korol'kova, E.O. 2002. Comparative stem anatomy of *Cistanche* (Orobanchaceae) representatives: systematics problems. Moscow University Biological Sciences Bulletin 57(3): 31-39. (Noting the absence of glandualr hairs on the stems of *Cistanche* compared with *Orobanche*. And suggesting arrangement of local species into a different grouping than that proposed by Beck.)

Kroschel, J. and Elzein, A. 2004. Bioherbicidal effect of fumonisin B1, a phytotoxic metabolite

naturally produced by *Fusarium nygamai*, on parasitic weeds of the genus *Striga*. Biocontrol Science and Technology 14: 117-128. (Fuminosin B1 at 1 mg/l caused some reduction in germination. Much higher concentrations were toxic when applied to foliage.)

Kroschel, J. and Muller-Stover, D. 2004. Biological control of parasitic weeds. In: Inderjit (ed.) Weed Biology and Management. Dortmund, Germany: Kluwer, pp. 423-438. (See Book review above.)

Kureh, I., Hussaini, M.A., Chikoye, D., Emechebe, A.M., Kormawa, P., Schulz, S., Tarawali, G., Franke, A.C. and Ellis-Jones, J. 2003. Promoting integrated *Striga* management practices in maize in northern Nigeria. In: Proceedings, Crop Science and Technology 2003, BCPC International Congress, Glasgow, 2003, pp. 1023-1028. (Describing the development of an integrated programme for control of *Striga hermonthica*, based on a tolerant maize variety, N fertilizer, and intercropping with soybean.)

Kutafin, A.I. 2003. Control of foci of quarantine weeds. Zashchita i Karantin Rasteniĭ12: 10-11. (Including reference to *Cuscuta* spp.)

Kuyper, T.W. 2002. (Deceit in mycorrhiza world, or how the mycorrhizal fungus proved to be a cheat. (in Dutch) Coolia 45(4): 205-207. (Reviewing literature on the triangular relationship between the parasitic plant *Monotropa hypopitys*, the ectomycorrhizal genus *Tricholoma* and the tree host, whereby *M. hypopitys* obtains its nutrients from the fungus and its sugars from the tree via the fungus.)

Labrada, R. 2003. Present trends in weed management. FAO Plant Production and Protection Paper No.120(Add.1): 257-269. (Including reference to management of *Striga* in Ethiopia and Sudan.)

Labrousse, P., Arnaud, M.C., Griveau, Y., Fer, A. and Thalouarn, P. 2004. Analysis of resistance criteria of sunflower recombined inbred lines against *Orobanche cumana* Wallr. Crop Protection 23: 407-413. (Suggesting several different resistance mechanisms available from crosses of *Helianthus annuus* with the resistant wild species *H. debilis*.)

Liu Hui and Yuan ShiBin 2003. Biological characteristics of *Glomerella cingulata* (Penz.) Sacc. f.sp. *cuscutae* Chang. Journal of Sichuan Agricultural University 21(1): 23-26. (*G. cingulata*, the active ingredient of Lubao No. 1, used for biocontrol of *Cuscuta chinensis*, is shown to be stimulated by extracts of the *Cuscuta*.)

Lundquist, J.E., Goheen, E.M. and Goheen, D. J. 2002. Measuring positive, negative, and null impacts of forest disturbances: a case study using dwarf mistletoe on Douglas fir. Environmental Management 30: 793-800. (Describing a model which indicates positive, negative, and neutral impacts from *Arceuthobium douglasii* on douglas fir.)

Lynch, A.M. 2004. Fate and characteristics of *Picea* damaged by *Elatobium abietinum* (Walker) (Homoptera: Aphididae) in the White Mountains of Arizona. Western North American Naturalist 64(1): 7-17. (Mortality of *Picea pungens* and *P. microcarpum* from *E. abietinum* was enhanced by infestation with *Arceuthobium microcarpum*.)

Ma YongQing 2003. Allelopathy research in mainland China. Allelopathy Journal 12(2): 163-178. (Including a report of allelopathic effects of *Pedicularis longiflora*.)

Magda, D., Duru, M. and Theau, J-P. 2004. Defining management rules for grasslands using weed demographic characteristics. Weed Science 52: 339-345. (Studies on *Rhinanthus minor* in the French Pyrenees suggested longevity of only 2 to 3 years. Lack of mowing or grazing could lead to dominance but a single well-timed grazing could give eradication within a few years.)

Maloy, O.C. and Lang, K.J. 2003. Carl Freiherr von Tubeuf: pioneer in biological control of plant diseases. Annual Review of Phytopathology 41: 41-52. (Noting von Tubeuf's interest in the mistletoes.)

Marley, P.S., Aba, D.A., Shebayan, J.A.Y., Musa, R. and Sanni, A. 2004. Integrated management of *Striga hermonthica* in sorghum using a mycoherbicide and host plant resistance in the Nigerian Sudano-Sahelian savanna. Weed Research 44: 157-162. (Emergence of *S. hermonthica* was reduced by 95% and sorghum yields increased 50% by a combination of a mycoherbicide based on *Fusarium oxysporum* isolate PSM 197, applied in the planting hole, and use of sorghum variety Samsorg 40 (ICSV 111).)

Marley, P.S., Toure, A., Shebayan, J.A.Y., Aba, D.A., Toure, A.O., Diallo, A.G. and Katilé, S.O. 2004. Variability in host plant resistance of sorghum to *Striga hermonthica* infestation in West Africa. Archives of Phytopathology and Plant Protection 37: 29-34. (As a result of field trials in Nigeria and Mali, the varieties MALISOR 84-1, SAMSORG 41, 97-SB-F5DT-64, 97-SB-F5DT-65, CMDT 39 and SAMSORT 14 are proposed for wider evaluation.)

Mathiasen, R., Haefeli, M. and Leatherman, D. 2003. First report of *Arceuthobium vaginatum* subsp. *cryptopodum* on *Pinus mugo*. Plant Disease 87: 1395. (In Colorado, USA.).

Mathiasen, R.L., Melgar, J., Beatty, J.S., Parks, C.G., Nickrent, D.L., Sesnie, S., Daugherty, C.M., Howell, B.E. and Garnett, G.N. New distributions and hosts for mistletoes parasitizing pines in Southern Mexico and Central America. Madroño 50(2): 115-121. (Miscellaneous observations on distribution and hosts ranges of *Psittacanthus, Struthanthus* and *Arceuthobium* spp.)

Matsubara, S., Morosinotto, T., Bassi, R. , Christian, A.L., Fischer-Schliebs, E., Lüttge, U., Orthen, B., Franco, A.C., Scarano, F.R., Förster, B., Pogson, B.J. and Osmond, C.B. 2003. Occurrence of the lutein-epoxide cycle in mistletoes of the Loranthaceae and Viscaceae. Planta 217: 868-879.

Matthes, M., Napier, J.A., Pickett, J.A. and Woodcock, C.M. 2003. New chemical signals in plant protection against herbivores and weeds. In: Proceedings, Crop Science and Technology 2003, BCPC International Congress, Glasgow, 2003, pp. 1227-1236. (Referring to the use of *Desmodium uncinatum* in control of *Striga hermonthica*.)

Mbwaga, A. 2004. Rice is greener on the other side. Annual Report for 2003-2004. Crop protection Programme. Department for International Development. Aylesford, UK: Natural Resources International Ltd. p. 1.25. (Describing successful use of rotation with '*Crotalaria* sp.' (*C. ochroleuca*) or pigeon pea as a green manure, for improving soil fertility and controlling *Striga asiatica* in rice. Rice yields have been increased four-fold.)

Mercadé, A. 2003. (Notes on the flora of Moianès (Catalonia, Spain).) (in Catalan) 2003. Acta Botanica Barcinonensia 48: 29-44. (Including notes on *Odontites lanceolata* spp. *olotensis.*)

Meyer, L. 2004. Montana - forest insect and disease conditions and program highlights - 2003. Forest Health Protection Report - Northern Region, USDA Forest Service, 2004, No. 04-1, 53 pp. (Including reports on *Arceuthobium* infestation.)

Miller, A.C., Watling, J.R., Overton, I.C. and Sinclair, R. 2003. Does water status of *Eucalyptus largiflorens* (Myrtaceae) affect infection by the mistletoe *Amyema miquelii* (Loranthaceae)? Functional Plant Biology 30: 1239-1247. (Concluding that increasing water and/or salinity stress make *E. largiflorens* a less suitable host for *A. miqelii*.)

Mishra, J.S., Manish Bhan, Moorthy, B.T.S. and Yaduraju, N.T. 2003. Influence of seeding depth on emergence of *Cuscuta* with linseed and summer blackgram. Indian Journal of Weed Science 35: 281-282. (Most emergence of *C. ?campestris* was from the surface and 2 and 4 cm depths. None occurred from below 8 cm depth.)

Mishra, V., Sharma, R.S., Yadav, S., Babu, C.R. and Singh, T.P. 2004. Purification and characterization of four isoforms of Himalayan mistletoe ribosome-inactivating protein from *Viscum album* having unique sugar affinity. Archives of Biochemistry and Biophysics 423: 288-301.

Moorthy, B.T.S., Mishra, J.S. and Dubey, R.P. 2003. Certain investigations on the parasitic weed *Cuscuta* in field crops. Indian Journal of Weed Science 35: 214-216. (Mung bean, niger seed, lentil and chickpea were highly susceptible to *C. ?campestris*; linseed and pea were less susceptible; and wheat, Indian mustard and *Phaseolus* beans were unaffected.)

Muir, J.A., Robinson, D.C.E. and Geils, B.W. 2003. Characterizing the effects of dwarf mistletoe and other diseases for sustainable forest management. BC Journal of Ecosystems and Management 3(2): 88-94. (The effects of *Arceuthobium tsugense* on western hemlock are being manipulated and modelled to clarify the potential for reducing damage via a range of management options.)

Murphy, M. and Garkalis, M. 2003. Hopping into a bright future – the woylie sandalwood story. Western Wildlife 7(3), July 2003 and reproduced in Sandalwood Research Newsletter 18: 6-7. (Confirming the role of the marsupial rat-kangaroo *Bettongia pencillata* in dispersing the seeds of *Santalum spicatum* in Western Australia.)

Nagaveni, H.C. and Vijayalakshmi, G. 2003. Growth performance of sandal (*Santalum album* L.) with different host species. Sandalwood Research Newsletter 18: 1-4. (In pot and field comparisons of 9 potential hosts, *Pongamia pinnata* and *Caasuarina equisetifolia* supported most robust growth of *S. album* while *Aacacia auriculiformis* and *Sweitenia mahogani* hindered growth.)

Nickrent, D.L., Garcia, M.A., Martin, M.P. and Mathiasen, R.L. 2004. A phylogeny of all species of *Arceuthobium* (Viscaceae) using nuclear and chloroplast DNA sequences. American Journal of Botany 91: 125-138. (A revised classification of the genus based on molecular data.)

Noetzli, K.P., Müller, B. and Sieber, T.N. 2003. Impact of population dynamics of white mistletoe (*Viscum album* ssp. *abietis*) on European silver fir (*Abies alba*). Annals of Forest Science 60: 773-779. (Growth of 70-year old *A. alba* had apparently been seriously reduced by infestation of *V. album* since 1983.)

Odebiyi, J.A., Bada, S.O., Omoloye, A.A., Awodoyin, R.O. and Oni, P. 2004. I. Vertebrate and insect pests and hemi-parasitic plants of *Parkia biglobosa* and *Vitellaria paradoxa* in Nigeria. In: Teklehaimanot, Z. (ed.) Agroforestry parkland systems in sub-Saharan Africa. Selected papers from an international workshop held in Ouagadougou, Burkina Faso, 13-16 January 2003. Agroforestry Systems 60(1): 51-59. (*Tapinanthus globiferus* and *T. dodoneifolius* are both of concern. Pruning affected branches had not proved an effective control method.)

*O'Driscoll, C.W. 2003. Preliminary review of the genus *Cuscuta* in North America prepared for the NAPPO PRA panel – July/August 2003. North American Plant Protection Organization. http://www.nappo.org/PRA-sheets/CuscutaTable2003.pdf (Listing about 80 species occurring in N. America, with brief notes on their characteristics and host range and their distribution within USA, Canada and Mexico.)

Okonta, J.M. , Ezugwu, C.O. and Nwodo, J. N. 2003. Blood sugar lowering effect of *Viscum album* seed extract in rabbits. Journal of Tropical Medicinal Plants 4(1): 39-41.

Oswald, A. and Ransom, J.K. 2004. Response of maize varieties to *Striga* infestation. Crop Protection 23: 89-94. (Field screening suggests some useful degrees of tolerance or resistance, among medium-term maize varieties in western Kenya.)

Pérez-de-Luque, A., Jorrín, J.V. and Rubiales, D. 2004. Crenate broomrape control in pea by foliar application of benzothiadiazole (BTH). Phytoparasitica 32: 21-29. (Foliar application of BTH reduced infection of pea by *O. crenata*, reducing attachment and slowing development.)

Piotrowski, A., Ochocka, J.R., Stefanowicz, J. and Luczkiewicz, M. 2003. Molecular genetic survey of European mistletoe (*Viscum album*) subspecies with allele-specific and dCAPS type markers specific for chloroplast and nuclear DNA sequences. Planta Medica 69: 939-944. (Of 118 plants surveyed, 103 displayed characteristics consistent with strict host specificity of the subspecies. No evidence was found for hybridization among subspecies.).

Pryme, I.F., Bardocz, S., Pusztai, A., Ewen, S.W. and Pfüller, U. 2004. A mistletoe lectin (ML-1)-containing diet reduces the viability of a murine non-Hodgkin lymphoma tumor. Cancer Detection and Prevention 28: 52-56.

Punz, W. 2001. (Heavy metal accumulating and hyperaccumulating plants on mining areas in the Eastern Alps.) (in German) Verhandlungen der Zoologisch-Botanischen Gesellschaft in Österreich 138: 129-136. (*Euphrasia* is among a number of genera found to accumulate more than 1000 ppm zinc.)

Puustinen, S., Koskela, T. and Mutikainen, P. 2004. Direct and ecological costs of resistance and tolerance in the stinging nettle. Oecologia 139: 76-82. (An expansion of previous work (see Mutikainen, P. and Koskela, T. 2002 in Haustorium 44) and concluding that there were no significant correlations among resistance and tolerance of *Urtica dioica* to different natural enemies (i.e. *Cuscuta europaea*, snails, and mammals).

Quested, H.M., Cornelissen, J.H.C., Press, M.C., Callaghan, T.V., Aerts, R., Trosien, F., Riemann, P., Gwynn-Jones, D., Kondratchuk, A. and Jonasson, S.E. 2003. Decomposition of sub-arctic plants with differing nitrogen economies: a functional role for hemiparasites. Ecology: 84: 3209-3221. (Concluding that production of nutrient rich, rapidly decomposing litter by *Bartsia apina*, *Pedicularis lapponica, P. hirsuta*, *P. sceptrum-carolinum*, *Rhinanthus minor, Euphrasia frigida* and *Melampyrum silvaticum* has the potential to greatly enhance the availability of nutrients within patches where they are abundant, with possible consequent effects on small-scale biodiversity (cf. Quested *et al.*, 2003 in Haustorium 44)).

Rassoulzadeh , S., Saneii, S.M. and Asgarii, M.A. 2003. Selective control of dodder (*Cuscuta monogina* L.) parasitizing pomegranate trees (*Punica granatum* L.). In: Lee JungMyung and Zhang DongLin (eds.) Asian plants with unique horticultural potential: genetic resources, cultural practices and utilization. Proceedings of the XXVI International Horticultural Congress, Toronto, Canada, 11-17 August 2002. Acta Horticulturae 620: 215-219. (Reporting successful trials with diluted glyphosate for control of *C. monogyna* on pomegranate.)

Rodríguez-Conde, M.F., Moreno, M.T., Cubero, J.I. and Rubiales, D. 2004. Characterization of the *Orobanche-Medicago truncatula* association for studying early stages of the parasite-host interaction. Weed Research (Oxford) 44: 218-223. (*M. trunculata* shows variation in its

stimulation of, and susceptibility to, *Orobanche* spp., making it a potentially useful model plant for studies on host/parasite interactions.)

Ross, K.C., Colquhoun, J.B. and Mallory-Smith, C.A. 2004. Small broomrape (*Orobanche minor*) germination and early development in response to plant species. Weed Science 52: 260-266. (*O. minor* from a red clover host was tested on a wide range of crop and weed species in polyethylene bags and in the field. Several other *Trifolium* spp., and lucerne/alfalfa were susceptible hosts in both situations; many other species stimulated germination only in the bags. Among these *Vicia sativa* did not support development in polyethythene bags but was attacked in the field.)

Rubiales, D. 2003. Parasitic plants, wild relatives and the nature of resistance. New Phytologist 160: 459-461. (A review, highlighting the resistance of *Tripsacum dactyloides* to *Striga hermonthuca*.)

Rubiales, D., Alcántara, C. and Sillero, J.C. 2004. Variation in resistance to *Orobanche crenata* in species of *Cicer*. Weed Research 44: 27-32. (A high degree of resistance to *O. crenata* was shown in many of the 99 accessions tested, belonging to 11 species of *Cicer* (curiously excluding *C. arietinum*). Resistance was based largely on low stimulant exudation, but also included some apparent hyper-sensitive response.)

Sallé, G. and Frochot, H. 2002. (The forestry problems caused by muérdago (*Viscum album*) and potential methods of control.) (in Spanish) Chapter 7 in: Lopez Saez, J.A. and Catalan, P. (eds) Plantas parasitas de la peninsula iberica y Baleares, Spain: Mundi-Prensa. pp. 477-499.

Sallé, G. and Neumann, U. 2003. (Angiosperm parasites: biology and control methods) (in French) In: Lepoivre, P. (ed.) Phytopathologie. Bases moléculaire et biologiques des pathosystèmes et fondeme de lutte. Traité de phytopathologie végétale. Gembloux, Belgium : de Boeck and Les Presses Agronomiques de Gembloux, pp. 145-159.

Samaké, O. 2003. Integrated crop management strategies in Sahelian land use systems to improve agricultural productivity and sustainability: a case study in Mali. Tropical Resource Management Papers 47, 132 pp. (Reporting trials with cowpea intercropping or rotation, and phosphate fertilizer among strategies to improve millet yields in the presence of severe *Striga hermonthica* infestations.)

Sánchez Gómez, P., Carrión Vilches, M.Á., Hernández González, A., Vera Pérez, J.B. and López Espinosa, J.A. 2003. (Chorological and nomenclatural notes about vascular flora of SE Spain.) (in Spanish) Anales de Biología 25: 109-112. (Including a first record of *Odontites luteus* in Albacete province.)

Sandler, H.A., Shumaker, D.E. and Mason, J. 2003. Compost recipe development and weed seed viability evaluation with cranberry leaves. Compost Science & Utilization 11: 351-360. (Composted cranberry leaves reached temperatures sufficient to kill weed seeds including those of *Cuscuta*.)

Sanginga, N., Dashiell, K.E., Diels, J., Vanlauwe, B., Lyasse, O., Carsky, R.J., Tarawali, S., Asafo-Adjei, B., Menkir, A., Schulz, S., Singh, B.B., Chikoye, D., Keatinge, D. and Ortiz, R. 2003. Sustainable resource management coupled to resilient germplasm to provide new intensive cereal-grain-legume-livestock systems in the dry savanna. In: Lyasse, O., Sanginga, N., Vanlauwe, B., Diels, J. and Merckx, R. (eds.) Agriculture, Ecosystems & Environment 100(2/3): 305-314. (Claiming promising potential for an integrated livestock/cropping system in *Striga hermonthica*-infested land, involving rotations of maize and 'promiscuous' (high-nodulating) soybean, with finger millet and dual-purpose cowpeas.)

Satô, M. 2004. (The first record of *Orobanche coerulescens* from Rishiri Island, northern Hokkaido.) (in Japanese) Rishiri Studies 23: 3,5.

Schneeweiss, G.M., Colwell, A., Park JeongMi, Jang ChangGee and Stuessy, T.F. 2004. Phylogeny of holoparasitic *Orobanche* (Orobanchaceae) inferred from nuclear ITS sequences. Molecular Phylogenetics and Evolution 30: 465-478. (Concluding that *Orobanche* is not monophyletic, but falls into two lineages: (1) the *Orobanche* group comprises *Orobanche* sect. *Orobanche* and the genus *Diphelypaea*; (2) the *Phelipanche* group contains *Orobanche* sects. *Gymnocaulis, Myzorrhiza,* and *Trionychon*.)

Schneeweiss, G.M., Palomeque, T., Colwell, A.E. and Weiss-Schneeweiss, H. 2004. Chromosome numbers and karyotype evolution in holoparasitic *Orobanche* (Orobanchaceae) and related genera. American Journal of Botany 91: 439-448. (Concluding that chromosome number has evolved by polyploidisation from two ancestral base numbers, 5 and 6 to x = 20 in *Cistanche*, to x = 12 or 24 in *Orobanche* (sections *Gymnocaulis, Myorrhiza* and *Trionychon*) and, after dysploidisation, to x =

19 in *Orobanche* (section *Orobanche*) and *Diphelypaea*.)

Showemimo, F.A. and Alabi, S.O. 2004. Influence of cotton plant population in the control of *Striga hermonthica* in maize under greenhouse condition. Journal of Food, Agriculture & Environment 2: 281-284. (In a pot experiment, cotton variety TAMCOT-CAMD-E proved superior to 3 other varieties in suppressing *S. hermonthica*. and improving maize growth)

Snyder, A.M., Clark, B.M., Robert, B., Ruban, A.V. and Bungard, R.A. 2004. Carotenoid specificity of light-harvesting complex II binding sites: occurrence of 9-cis-violaxanthin in the neoxanthin-binding site in the parasitic angiosperm *Cuscuta reflexa.* Journal of Biological Chemistry 279: 5162-5168. (*C. reflexa* has a unique carotenoid composition, in which the novel compound 9-cis-violaxanthin replaces neoxanthin, which is found in all other higher plant species studied to date.)

Ssango, F. and Balitenda, M. 2003. Effect of application of witch weed control options on performance of two maize varieties in Uganda. Muarik Bulletin 6: 83-88. (Recording profitable effects of integrating urea fertilizer, dicamba, and mechanical weeding for control of *Striga (?hermonthica)*. Sunflower as a trap crop did not appear to be effective.)

Stein, G.M., Bussing, A. and Schietzel, M. 2002. Activation of dendritic cells by an aqueous mistletoe extract and mistletoe lectin-3 in vitro. Anticancer Research.22 (1A): 267-274.

Strange, R. 2003. Introduction to Plant Pathology. London, UK: John Wiley & Sons, Ltd. 464 pp. (A text book with comprehensive coverage of plant disease, including a section on parasitic plants.)

Sweetapple, P.J. 2003. Possum (*Trichosurus vulpecula*) diet in a mast and non-mast seed year in a New Zealand *Nothofagus* forest. New Zealand Journal of Ecology 27: 157-167. (Noting that mistletoes *Peroxilla tetrapetala* and *Alepis flavida* are preferred foods of the possum but are only ever available in small quantities.)

Tănase, M., Bobes, I. and Moldovan, I. 1998. Contributions to the study of *Cuscuta* varieties from Sibiu county. Notulae Botanicae, Horti Agrobotanici, Cluj-Napoca 28: 7-10. (Describing *Cuscuta* spp. and their hosts in Romania.)

Tănase, M., Neata, L. and Barbu, H. 2000. (Some aspects concerning the germination of *Cuscuta* seed.) (in Romanian) Lucrai Stiintifice - Agricultura, Universitatea de Stiinte Agricole si Medicina Veterinara a Banatului Timisoara 32(1): 403-406.

Tei, F., Montemurro, P., Baumann, D.T., Dobrzanski, A., Giovinazzo, R., Kleifeld, Y., Rocha, F., Rzozi, S.B., Sanseovic, T., Simončič, A. and Zaragoza, C. 2003. Weeds and weed management in processing tomato. In: Bieche, B., Branthome, X. (eds.) Acta Horticulturae 613: 111-121. (Increasing problems in tomato include *Orobanche* spp. in Spain, Portugal, Morocco, Israel and Italy, while *Cuscuta campestris* is a problem in Spain and Israel.)

Thomas, P.A. and Polwart, A. 2003. *Taxus baccata* L. Journal of Ecology (Oxford) Vol.91: .489-524. (Including reference to occurrence of plant parasites in U.K. – presumably *Viscum album*.)

Tomilov, A., Tomilova, N. and Yoder, J.I. 2004. *In vitro* haustorium development in roots and root cultures of the hemiparasitic plant *Triphysaria versicolor*. Plant Cell, Tissue and Organ Culture 77: 257-265. (Concluding that root cultures should provide useful material for molecular studies of haustorium development.)

Tsopelas, P. and Angelopoulos, A. 2003. Incidence of root diseases in the fir forest of Mount Parnis National Park, Greece. In: Laflamme, G., Bérubé, J.A. and Bussières, G. (eds.) Information Report - Laurentian Forestry Centre, Quebec Region, Canadian Forest Service, 2003, No. LAU-X-126, pp. 408-412. (*Viscum album* described as an 'important factor' in tree mortality of *Abies cephalonica*.)

Tugnoli, V. 2003. (Costs and benefits of weed control in sugarbeet.) (in Italian) Informatore Agrario 59(49) 57-60. (Referring to '*Cuscuta*' as a major weed of sugar beet.)

Udod, A.N. 2003. Systematic work is needed. Zashchita i Karantin Rasteniĭ11: 36. (Noting the infestation of over 40,000 ha with the quarantine weeds *Cuscuta* spp. in Rostov region.)

Vitek, E. 2002. (Comments to the revised edition of "Exkursionsflora von Deutschland, Band 4 (Kritischer Band)". 4. A new subspecies of *Euphrasia officinalis*.) (in German) Schlechtendalia 8: 15-16. (Describing a new combination *E. officinalis* ssp. *versicolor*.)

Vurro, M. and Boari, A. 2004. Evaluation of *Fusarium* spp. and other fungi as biological control agents of broomrape (*Orobanche ramosa*). Biological Control 30: 212-219. (Among 50 isolates of 15 species tested on *O. ramosa* on tomato in southern Italy, *Fusarium oxysporum, F. solani, F. chlamydosporum* and *F. camptoceras* were among those showing some potential as biocontrol, agents.)

Wass, E.F. and Mathiasen, R.L. 2003. A new subspecies of *Arceuthobium tsugense* (Viscaceae) from British Columbia and Washington. Novon 13: 268-276. (*A. tsugense* ssp. *contortae* described from shore pine, *Pinus contorta* var. *contorta*.)

Westwood, J.H. 2004. Molecular aspects of host-parasite interactions: opportunities for engineering resistance to parasitic weeds. In: Inderjit (Ed.) Weed Biology and Management. Dortmund, Germany: Kluwer, pp. 177-198. (See Book review above.)

Wiens, D. and Hawksworth, F. 2004. New species of *Phoradendron* (Viscaceae) from Mexico and Guatemala and a synopsis of species in section Pauciflorae. Aliso (dated 2002) 21(1): 33-43. (Describing 7 new species of *Phoradendron* including 3 species epi-(hyper-)parasitic on other *Phoradendron* or *Cladocolea* spp.)

Wood, B.W. and Reilly, C.C. 2004. Control of mistletoe in pecan trees. HortScience 39: 110-114. (Spot treatment of *Phoradendron flavescens*, with 2,4-D at 1.2 to 2.4 g/litre (plus 2% crop oil), 2 to 3 weeks before bud-break, gave effective long-term control of *P. flavescens* without adverse effect on pecan.)

Yakutkin, V.I. It is possible to prevent sunflower diseases. 2003. Zashchita i Karantin Rastenii, 2003, No. 6, 40 pp. (Referring to the use of varieties resistant to *Orobanche cumana*.)

*Young, E. and Mottram, A. 2004. Transplanting sorghum and millet – a key to risk management. http://www.bangor.ac.uk/transplanting/Transplanting.pdf. (Referring to successful trials in Zimbabwe and Ghana and relevance to *Striga* control.)

Zhang, L.Y., Ye, W.H., Cao, H.L. and Feng, H.L. 2004. *Mikania micrantha* H.B.K. in China – an overview. Weed Research 4: 42-49. (Referring to a number of studies in China suggesting useful control of *M. micrantha* by *Cuscuta campestris, C. australis* and *C. chinensis*.)

Zhou, W.J., Yoneyama, Y., Iso, S., Rungmekarat, S., Chae, S.H., Sato, D. and Joel, D.M. 2004. *In vitro* infection of host roots by differentiated calli of the parasitic plant *Orobanche*. Journal of Experimental Botany 55: 899-907. (Calli from *O. ramosa, O. aegyptiaca* and *O. minor* were induced to produce roots which infected roots of red clover and carrot.)

Zuber, D. 2004. Biological flora of Central Europe: *Viscum album* L. Flora (Jena) 199: 181-203. (A general review on taxonomy, biology, physiology, etc.)

HAUSTORIUM 45
has been edited by Chris Parker, 5 Royal York Crescent, Bristol BS8 4JZ, UK (Email chrisparker5@compuserve.com), Lytton John 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 Jim Westwood, Dept. of Plant Pathology, Physiology and Weed Science, Virginia Tech, Blacksburg, VA 24061-0331, USA (Email westwood@vt.edu). Send material for publication to any of the editors. Printing and mailing has been supported by Old Dominion University.