HAUSTORIUM

Parasitic Plants Newsletter

Official Organ of the International Parasitic Plant Society

December 2003 **Number 44**

IPPS SYMPOSIUM ON PARASITIC WEEDS

We are pleased to announce that the next IPPS Symposium will take place in Durban (South Africa) on June 24-25, 2004, in collaboration with the International Weed Science Congress (IWSC).

The Symposium will include three workshops:
1. *Striga* management in various cropping systems.
2. Genetic variation in parasitic weeds.
3. Physiological and molecular aspects of parasitic plant development.

IPPS members are also invited to attend the Parasitic Weeds Sessions of the 4th International Weed Science Congress, scheduled on Thursday 24 June. The IPPS Symposia and the IWSC parasitic weeds sessions are complementary, so that all participants will have the opportunity to discuss parasitic weeds within the wider scope of weed biology and control.

Programme:
Thursday 24 June 2004
IWSC Plenary lecture - The parasitic weed problem and its fate in the 21st century.
IWSC session - Progress in parasitic weed research, with invited lectures on:
1. Understanding key developmental processes in parasitic weeds (Gebisa Ejeta).
2. New methodologies for the management of parasitic weeds (Joel Ransom).
3. Mechanisms of resistance and their application in susceptible crops (Andre Fer).
4. Demography of parasitic weeds and its impact on management (Paula Westerman).
IPPS Workshop - *Striga* management in various cropping systems.
Poster session on parasitic weeds, including discussion of selected contributions.

Friday 25 June 2004
IPPS Workshop - Genetic variation in parasitic weeds.
IPPS Workshop - Physiological and molecular aspects of parasitic plant development.

Registration:
Registration is organized by the IWSC. Please fill in the form that is found at:
https://secure.turners.co.za/iwsc2004/form.asp#Payment

Registration rates:
Thursday-Friday IWSC sessions and parasitic weed symposium (for those not attending the IWSC):

IPPS members	US$ 120
IPPS students	US$ 50
Non-members	US$ 180
Non-member students	US$ 50

Friday IPPS symposium for those registered for the IWSC

IPPS members	Free
Non-members	US$ 50

Call for papers:
Papers are invited for the three Workshops of the IPPS Symposium. Authors are requested to submit a short summary of their intended contribution in the form of an abstract as described for the IWSC conference at: (http://www.iwsc2004.org.za/Abstracts.htm). The only modification necessary is to include the words, "IPPS Symposium:" in front of the abstract title. The summary should be of not more than 250 words. It should include a clear definition of the objective and approach, present sufficient details regarding results, pointing out

material that is new. The authors are asked to indicate whether they wish to contribute a poster or an oral presentation. The Scientific Committee reserves the right to request authors to present a poster after submission of summary for oral presentation. Contributions will be refereed. All accepted contributions will be published on the IPPS website.

The deadline for abstract submission is February 20, 2004.

Scientific Organizing Committee:
H. Bouwmeester (the Netherlands)
P. Delavault (France)
G. Ejeta (USA)
D.M. Joel (Israel)
F. Kanampiu (Kenya)
M. Press (UK)
B. Roman (Spain)
M.P. Timko (USA)
J.A.C Verkleij (the Netherlands)
J.H. Westwood (USA)
K. Yoneyama (Japan)
W.J. Zou (China)

Danny Joel, IPPS Secretary
dmjoel@volcani.agri.gov.il

THE 4TH INTERNATIONAL WEED SCIENCE CONGRESS

We also encourage IPPS members who are interested in parasitic weed control to attend the 4th International Weed Science Congress, on 20-24 June in the same place, where many aspects of weed science will be discussed in detail. More information on the Congress can be found at: http://www.iwsc2004.org.za/

We are looking forward to meeting all parasitic plant researchers and sharing results and views and for fruitful discussions and for the promotion of parasitic plant research.

Useful internet addresses:
Congress venue (ICC) in Durban: www.icc.co.za
Accommodations in South Africa: www.portfoliocollection.co.za
Kingdom of the Zulu: www.zulu.org.za
Kwazulu-Natal Parks: www.kznwildlife.com
City of Durban: www.kwazulu-natal.co.za/DBN
South African National Parks Board: www.parks-sa.co.za

FIRST REPORT OF *AEGINETIA PEDUNCULATA* CAUSING SUGARCANE WILT IN INDIA

Barring one short mention that *Aeginetia pedunculata* (Roxb.) Wall. (as *Orobanche acaulis* Roxb.) grows on China sugarcane (*Saccharum sinense* Roxb.) in the Botanic Garden at Kolkata (erstwhile, Calcutta) (Roxburgh, 1832), this *Aeginetia* species has not been reported as a parasite on sugarcane (*Saccharum officinarum* L.) in India, although *A. indica* has been (Parker and Riches, 1993). Now, during a survey in 2000 and around Plassey Sugar Mill area in Nadia district of West Bengal, India, the first author observed that nearly 100 ha of sugarcane crop was infected with *A. pedunculata* as identified by Botanical Survey of India, Kolkata. The parasite, 10 to 15 cm tall, appears at the base of sugarcane clumps during July, one month after the onset of the southwest monsoon. Emergence of new inflorescence and flowering continues till harvest of the crop in December-January. The first flowers produce seeds in capsules in September. The seeds are minute (0.3mm x 0.2 mm) and numerous (8-18,000 per capsule). They float on water and can readily spread to other places. Flowers are very attractive bearing ca > 50 mm purple limbs with a yellow lip. Morphological variations in respect of plant height, shape and colour are also common. *A. pedunculata* plants which grow on wild grass hosts are smaller than on sugarcane, dark red in colour, appear during August to October and bear only a few flowers and capsules, whereas plants growing on sugarcane produce luxuriant growth, abundant large flowers with varied shades of colour and many capsules. The parasite can survive during mild winter months only under the dense canopy of sugarcane plants. The loss caused due to the parasite is only visible when the infected canes began to wilt and dry at the time of harvest in December-January. Periodic sampling of infected and healthy canes from different varieties and from plant and ratoon crops showed that on an average the infected cane juice contains Brix 7.8 % and sucrose 2 % in compared to healthy plant which contains Brix 19.6 % and sucrose 16.3 %. The loss is 100 % in completely dried up patches in infected fields. For management of the parasite, weeding with manual labour and spraying herbicides like 2,4-D and glyphosate are practiced but resurgence of the parasitic plant is very quick, needing repeated applications albeit without satisfactory management. Development of resistant varieties may be the sustainable solution of the problem. Work has been initiated in this direction at Sugarcane Research Station, Bethuadahari, Nadia, West Bengal, India since 2000-01. We are also attempting to develop an appropriate IPM. *A. pedunculata* is a rare and threatened plant species which is also a medicinal plant, implying the need for adequate steps in conservation under protection and isolation away from its economic hosts.

A photograph of *A. pedunculata* can be seen at http://www.odu.edu/webroot/instr/sci/plant.nsf

References:
Hedayetullah, S. and Saha, J.C.. 1942. Current Science 11: 109-110.
Parker, C. and Riches, C.R. 1993. Parasitic Weeds of the World. Wallingford, UK: CABI.
Roxburgh, W. 1832. Flora Indica. Vol 3. p 28.

Bikash Ranjan Ray,
Sugarcane Research Station, Bethuadahari 741126, Nadia, West Bengal, India,
brray@sancharnet.in
and MrinaiKanti Dasgupta,
Instiituite of Agriculture, Sriniketan, Birbhum, West Bengal, India.

PARASITIC SCROPHS – NO SUCH THING?

It seems that the problem from serious parasitic weeds of the Scrophulariaceae has at last been eliminated – on paper at least. The editors of Haustorium regret that an important reference – a landmark even – was overlooked two years ago. Olmstead *et al.*'s paper 'Disintegration of the Scrophulariaceae' (American Journal of Botany 2001, 88: 348-361) proposes that all the parasitic genera previously included in the Scrophulariaceae should be transferred to Orobanchaceae. It had previously been pointed out (e.g. by U. Molau in 'Parasitic Plants' by Press and Graves, 1995) that the Orobanchaceae were closely allied with the Rhinanthoideae and should be lumped, or integrated with Scrophulariaceae. We now have a re-splitting, or dis-integration, on new lines which appears to be soundly based on the latest molecular phylogenetic techniques. Dan Nickrent has been adopting the new alignment on his 'Parasitic Plant Connection' web-site and it is apparently accepted by many others of our parasitic plant colleagues. A survey of web-site data-bases, however, suggests that it has not yet gained full recognition. On the USDA GRIN site, the family for *Striga* is given as 'Scrophulariaceae. Also placed in Orobanchaceae', but other sites such as USDA PLANTS, Missouri Botanic Garden, Flora Europaea/Royal Botanic Garden Edinburgh, IPNI and ITIS all continue to place *Striga* etc in Scrophulariaceae. It seems there will be an inevitable long lag before this change is fully adopted. Haustorium will be happy to hear from any who have views or comments.

Chris Parker.

COST 849

Under this European Union programme, a meeting was recently held in Athens, Greece. See under Proceedings of Meetings below for a list of the papers presented. Further meetings are planned for 2004 including two in February, the first on Genetic Diversity of Parasitic Plants, in Cordoba, Spain, the second on Biological Control, in Rome, Italy.

SYMPOSIUM ON NON-WEEDY HEMIPARASITIC SCROPHULARIACEAE

A two-day symposium on the biology of the non-weedy hemiparasitic Scrophulariaceae (Orobanchaceae) will be held in Wageningen (Netherlands) on 15 and 16 April 2004. A broad range of subjects concerning the biology of this group will be covered by a number of specialists, including Matthies (Ecology), Press (Ecophysiology), Kwak & Bekker (Endangered species), DePamphilis (Evolution), and others. Further information is available on the internet (www.hemiparasites.nl), or can be requested by sending an email to Siny ter Borg (info@hemiparasites.nl).

THESES

Denneal Sarah Jamison-McClung (PhD, Department of Vegetable Crops and Weed Science, University of California, Davis, September 2003) Haustorium Development in the Parasitic Plant, *Triphysaria* (Orobanchaceae): A Genetic and Molecular Analysis.

In the Orobanchaceae, a single origin of root parasitism followed by multiple losses of photosynthetic capacity characterize the evolution of parasitic plants. Increasing heterotrophy or reliance on host nutrients is accompanied by loss of genetic material from the chloroplast, gain of parasite-specific traits, and increasing host specificity via recognition of common plant secondary metabolites.

Triphysaria, a hemiparasitic plant belonging to the Orobanchaceae, was used as a model to investigate the genetic and molecular mechanisms governing haustorium development. Haustoria are the "organs of parasitism" and form at the root tips of parasitic Orobanchaceae in response to host-derived haustorium inducing factors (HIF's). Variation in natural populations of *Triphysaria* was observed for haustorium development in response to the HIF, 2, 6-dimethoxy-p-benzoquinone (DMBQ). DMBQ responsiveness was shown to be heritable and influenced by maternal effects.

Development of autohaustoria, haustoria that form in the absence of host-derived factors, was monitored in *Triphysaria pusilla*. *Triphysaria* rarely form haustoria when grown alone or with conspecific plants, suggestive of a mechanism for self-recognition and avoidance of self-parasitism. Propensity to form autohaustoria showed a strong positive correlation with degree of anthocyanin pigmentation. GA_3 pre-treatment of seeds obtained from high and low anthocyanin parents leads to a significant and unexpected increase in autohaustoria formation for both groups. Results suggest that high anthocyanin plants may be self-inducing via exuded flavonoids and that plant hormones, particularly auxin and gibberellin, may be involved in regulating self-recognition and autohaustorium development in root parasitic plants.

Transcript accumulation of three genes was assayed in variant *Triphysaria* populations. Two genes, TvQR1 and TvQR2, encode putative quinone oxidoreductases and one, TvPirin, encodes a nuclear transcription factor involved in cell cycle regulation. TvQR1 performs a one-electron reduction of quinone to semiquinone, and was positively correlated to haustorium development. TvQR2 performs a two-electron reduction of quinone to phenolic acid and was correlated to DMBQ induction, though not haustorium development. TvPirin was also correlated to DMBQ induction, but not haustorium development. Results support the proposed redox cycling model of semiquinone-induced haustorium development in the Orobanchaceae.

Cinzia Costantino (PhD Università degli Studi, Genova, July 2003) Experiments with *in vitro* growth of *Scurrula pulverulenta* G. Don (plant parasite of woody-plant species widely distributed in sub-tropical areas). (in Italian)

The study involved *in vitro* culture of the hemi-parasitic plant *Scurrula pulverulenta* G.Don (Loranthaceae), grown from *in vitro* germinated seeds, without any growth regulators (exogenous hormones), and followed the development of shoots, leaves and haustorial strands. In the optimum medium numerous new shoots grew close to the chlorophyllous hypocotylar region. These were excised in the second year taking particular care to preserve some of the undifferentiated callus. Cultures involving different hosts revealed that the haustorium penetrated the host by cellular lysis, allowing the haustorium to penetrate further by mechanical means into the inner tissues. The host *Genista monosperma* Lam. responded to the penetration by producing a pink callus but still allowed penetration to the central stele and suffered damage. In the case of the host *Citrus auriantum* L. there was also progressive sub-cortical growth of the haustorium in the stem.

S. pulverulenta grown on a nutrient medium with cellulose, without a host, but with the addition of a *Viscum album* extract, showed abundant development of self-regenerating chlorophyllous callus originating from the site of cotylar fusion in the embryo. Furthermore, this callus and the hypoctyl callus also showed consolidated callus leading to the development of pseudo-xylem tissue, lignin-like material, lining the culture tubes. Addition of the *Viscum* extract was conducive to more vigorous growth, including development of the epidermis and most noticeably, of the powdery surface responsible for the specific name *'pulverulenta'*. After 3 years in *in vitro* culture, *S. pulverulenta* is observed to produce a thin web of viscin and to show full vegetative vigour. Electron microscope study of the epidermis in field-grown plants revealed the presence of *Lactobacillus* sp. inside pedunculate hairs in the form of a three-pointed star.

S. pulverulenta spreads freely in its native habitats in sub-tropical regions, while in the Mediterranean area it only spreads as a result of the sporadic activity of birds or deliberate transfer by researchers. It is suggested that *S. pulverulenta* may be a useful indicator of climate change since the amount of fruiting is noted to be closely correlated to temperature and rainfall.

It is also suggested that improved techniques for *in vitro* culture could be welcome as the cyto-toxic effects from extracts of this species on tumour cells (Ascites-test Yoshida) compare favourably with the standard extract (Hiscia Iscador ®) prepared from *Viscum album* L.. Other comparisons by Drs Urech and Schaller of leaf and pseudo-berry extracts of *S. pulverulenta* with the standard extract (Hiscia Iscador ®) obtained from *V. album* also suggest similar anti-tumour activity.

Finally, chromatographic studies of extracts from *S. pulverulenta* show differences depending on the host plant, confirming interaction between host and hemi-parasite resulting in differences of biochemical compounds in the extracts.

Anat Reizelman-Lucassen (PhD, University of Nijmegen, 4 November, 2003) Synthesis and function of germination stimulants for seeds of the parasitic weeds *Striga* and *Orobanche* spp. (Supervision: Professor Binne Zwanenburg)

This thesis reviews the synthetic methods used in the synthesis of strigol and other strigolactones. All 8 stereoisomers of strigol were prepared and their activity compared. 'Natural' strigol was by far the most active, by a factor of at least 100 compared with most others.

An efficient synthesis of (+/-) orobanchol is reported; also new improved methods for GR7, GR24 and Nijmegen-1, based on a palladium-catalyzed asymmetric coupling

The remainder of the thesis is devoted to studies aimed at the isolation and identification of the strigolactone receptor with the help of a biotin-labelled strigolactone analogue (amino-GR-24), affinity chromatography, immobilized avidin or streptavidin, and fluorescence correlation spectroscopy. The presence of a strigolactone specific binding protein (SPLB) in the insoluble membrane fractions of *Striga* seeds was shown by a dot-blot analysis. Preliminary results with SDS-PAGE showed an enrichment of a 60kDa protein, isolated from these fractions by purification.

Christina Vieira Dos Santos (PhD, University of Nantes, France). Molecular aspects of the *Arabidopsis thaliana* response infected by the obligate root parasite *Orobanche ramosa*. (Supervision: Philippe Delavault and Patrick Thalouarn, Groupe de Physiologie et Pathologie Végétales) (in French)

The infection of *Arabidopsis thaliana* roots with the holoparasite *Orobanche ramosa* represents a useful model for a molecular study of the host plant response to a parasitic plant attack. Thus, we developed an in vitro co-culture system, allowing us an investigation by PCR amplification methods of the expression of some host genes already known to be involved in plant/pathogen interactions: ethylene, isoprenoid, phenylpropanoid, and jasmonate pathways, oxidative stress responses and PR proteins. A non-targeted study based on a suppression subtractive hybridization strategy was also used to identify genes that were induced two hours after placing *O. ramosa* seeds near *A. thaliana* roots. Infestation will not start before the seventh day. The kinetic gene expression was assayed from 1h to 7 days after *O. ramosa* germinations were placed. Proteins encoded by these genes are also involved in *A. thaliana* defence pathways: signal transduction, pectin methylesterase inhibition, detoxification of reactive oxygen species, jasmonate-dependent pathway and cell wall reinforcement. From these studies, no salicylic acid-dependent defence has been detected whereas jasmonate- and ethylene-dependent pathways were induced.

Related papers :

Vieira Dos Santos C., Letousey P., Delavault P. and Thalouarn P., 2003. Defence gene expression analysis of *Arabidopsis thaliana* parasitized by *Orobanche ramosa*. Phytopathology, 93:451-457

And Santos *et al.* 2003 – in Literature section below.

Aurélie Rousset (PhD, University of Nantes, France) Contribution to the chemical control of the parasitic and mannitol-producing plants. Identification and characterization of in vitro inhibitors of mannose 6-phosphate reductase and study of their activity on simplified biological models (protoplasts and

calli). (Supervision: Philippe Delavault and Patrick Thalouarn, Groupe de Physiologie et Pathologie Végétales) (in French)

The strategy based on the inhibition of mannose 6-phosphate reductase (M6PR), the key enzyme of mannitol production, could be efficient against *Striga* and *Orobanche*. Some aromatic and phosphorylated compounds inhibit competitively M6PR in vitro and protoplasts and callus culture were obtained from *Striga* leaves to estimate their activity on simple models. Protoplasts and calli kept mannitol synthesis as a major pathway, as shown by the analysis of their carbon fluxes, carbohydrate patterns and M6PR activities. In a similar proportion as in leaves, a significant part of the photosynthetically fixed 14C is incorporated into mannitol in protoplasts. Calli were much less active in photosynthesis but synthesized mannitol from exogenous sucrose or mannose. In presence of M6PR inhibitor, carbon fluxes towards soluble carbohydrates, notably mannitol, were reduced in treated protoplasts and calli.

Related paper :
Rousset *et al.* 2002. in Literature section below.

PROCEEDINGS OF MEETINGS

7th EWRS (European Weed Research Society) Mediterranean Symposium, Adana, Turkey, 2003. The Proceedings of this meeting are not yet published but should be available from the EWRS web site (www.ewrs.org) bookshop before long. The following are selected titles relating to parasitic plants, which will be published in the form of 2-page abstracts.

Manschadi A.M.*et al.* - Development of a systems approach for ecological management of parasitic weeds in legume-based Mediterranean cropping systems.
Grenz J. *et al*. - Identification of optimum sowing strategies for faba bean infested with the parasitic weed *Orobanche crenata* in the Cukurova region, Turkey. Predictions from simulation studies.
Nemli Y. *et al.* - Problems caused by broomrape (*Orobanche* spp.) and some control methods. Review and results.
Goran, M. *et al.* - Weed and broomrape (*Orobanche cernua*) control in Clearfield sunflower.
Orel-Aksoy E. and Uygur F.N. - Distribution of *Orobanche* spp. in the East Mediterranean region of Turkey.
Demirci M. *et al.* - Effect of soil temperature on *Orobanche cernua* Loeffl. growing stages and control strategies.

COST Action 849 Meeting: Biology and control of broomrape. October 30-November 2, Athens, Greece. Abstracts of this meeting are available on the COST web-site (see below). Titles were as follows:

Sauerborn, J. - Parasitic flowering plants – from botanical curiosity to antibiosis.
Cubero, J.I. - Phylogeny of the genus *Orobanche* inferred from cpDNA sequence variation.
Fer, A. - Experimental data strongly suggest the existence of several pathovars in *Orobanche ramosa* L.
Verkleij, J.A.C. *et al.* - Assessing genetic variability in *Striga hermonthica* and *S. aspera* by RAPD and SCAR analysis.
Delavault, P. *et al.* - Defense gene expression in host roots infected by *Orobanche* species.
Press, M.C. - Biology and control of parasitic weeds: *Striga* and *Orobanche.*
Bouwmeester, H. *et al.* - Germination of broomrape seeds.
Wegmann, K. - Recent experience in *Orobanche* control by suicide germination.
Matusova, R. *et al.* Changes in the sensitivity of parasitic weed seeds to germination stimulants.
Joel, D.M. - Sanitation and quarantine policies need to be adopted in Europe.
Murdoch, A.J. - Evaluating integrated management strategies for *Orobanche* and *Striga.*
Slavov, S. *et al.* - Chlorsulfuron resistant transgenic tobacco as a tool for broomrape control.
Kotoula-Syka, E. - *Orobanche ramosa* control in tomato.
Montemurro, P. and Lasorella, C. - Control of *Orobanche ramosa* by glyphosate in tomato.
Cagán, L. and Tóth, P. - Impact of *Orobanche ram*osa to the yield of tomato fruits in the southwest of Slovakia.
Vouzounis, N. - Control of *Orobanche* sp. in melon and watermelon crops in Cyprus.
Nadal, S. *et al.* Control of broomrape (*Orobanche crenata* Forsk.) in narbon bean (*Vicia narbonensis* L) by glyphosate.
Pacureanu-Joiþa, M. and Procopovici, E. - Broomrape control in Romania.

Rubiales, D. *et al.* - Integrated control of crenate broomrape in pea.
Vurro, M. - Toxins from pathogens of parasitic plants.
Gressel, J. - So what if transgenic hypervirulence changes host range of a biocontrol agent? We need not jump to conclusions.
Dor, E. - The efficacy of a mixture of fungi to control Egyptian and sunflower broomrape.
Zermane1, N. *et al.* - Natural antagonists of *Orobanche* spp. in Tunisia with potential as biocontrol agents
Tóth, P. and Cagán, L. - Natural enemies of dodders (*Cuscuta* spp.) in Slovakia.

WEB SITES

For information on the International Parasitic Plant Society see: http://www.ppws.vt.edu/IPPS/

For past and current issues of Haustorium see: http://web.odu.edu/haustorium

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

Abunyewa, A.A. and Padi, F. K. 2003. Changes in soil fertility and *Striga hermonthica* prevalence associated with legume and cereal cultivation in the Sudan savannah zone of Ghana. Land Degradation & Development 14: 335-343. (Growing soyabean or bambara nuts in place of bush fallow provided benefits in terms of soil fertility and *Striga* infestation.)
Adler, L.S. 2002. Host effects on herbivory and pollination in a hemiparasitic plant. Ecology 83: 2700-2710. (Further exploration of the complex interactions between *Castilleja indivisa* and *Lupinus albus* referred to in the next item.)
Adler, L.S., Karban, R. and Strauss, S.Y. 2001. Direct and indirect effects of alkaloids on plant fitness via herbivory and pollination. Ecology 82: 2032-2044. (Studies with *Castilleja indivisa* on *Lupinus albus* with varying alkaloid content +/- insecticide application confirmed that alkaloid reduced predation of *C. indivisa* without interfering with pollination.)
Ahonsi, M.O., Berner, D.K., Emechebe, A.M., Sanginga, N. and Lagoke, S.T.O. 2002. Selection of non-pathogenic ethylene-producing rhizobacteria for accelerated depletion of *Striga hermonthica* seed bank. African Crop Science Journal 10(2): 145-156. (Three strains of *Pseudomonas syringae* pv. *glycinea* shown to have caused high germination of *S. hermonthica*; but gene modification may be needed to reduce risk of pathogenicity to crops.)
Ahonsi, M.O., Berner, D.K., Emechebe, A.M., Lagoke, S.T. and Sanginga, N. 2003. Potential of ethylene-producing

pseudomonads in combination with effective N_2-fixing bradyrhizobial strains as supplements to legume rotation for *Striga hermonthica* control. Biological Control 28: 1-10. (Inoculation of cowpea or soyabean with the ethylene-producing *Pseudomonas syringae* pv. *glycinea* and N-fixing *Bradyrhizobia japonicum* enhanced their trap-crop effect.)

Al-Hussein, N., Bayaa, B. and Erskine, W. 2002. Integrated management of lentil broomrape, 1. Sowing date and chemical treatments. Arab Journal of Plant Protection 20(2): 84-92. (Delaying the sowing date and applying imazapic and imazethapyr resulted in 97-98% control of '*Orobanche* spp.' in lentil.)

Anderson, R.L. 2003. Changing forests and forest management policy in relation to dealing with forest diseases. Phytopathology 93: 1041-1043. (Including reference to mistletoes.)

Aukema, J.E. and Rio, C.M. dell 2002. Where does a fruit-eating bird deposit mistletoe seeds? Seed deposition patterns and an experiment. Ecology 83: 3489-3496. (Finding that the bird *Phainopepla nitens* deposited most seeds of *Phoradendron californicum* into *Prosopis velutina* which was already mistletoe-infested.)

Bako, M.L., Gulyas, A., Hegedus, Z., Szekrenyes, G. and Tuske-Bano, E. 2003. (Population studies in race-differentiating sunflower varieties with sunflower broomrape (*Orobanche cernua* Loefl./*Orobanche cumana* Wallr.) collected from the region of Bacsalmas.) (in Hungarian) Novenyvedelem 39: 429-436.

Babalola, O.O., Osir, E.O and; Sanni, A.I. 2002. Characterization of potential ethylene-producing rhizosphere bacteria of *Striga*-infested maize and sorghum. African Journal of Biotechnology 1(2): 67-69. (Three rhizosphere bacteria, *Pseudomonas* sp., *Enterobacter sakazakii* and *Klebsiella oxytoca*, were analysed for genetic variation. DNA fingerprint patterns of the three bacteria were markedly different.)

Babalola, O.O., Osir, E.O., Sanni, A.I., Odhiambo, G.D. and Bulimo, W.D. 2003. Amplification of 1-amino-cyclopropane-1-carboxylic (ACC) deaminase from plant growth promoting rhizobacteria in *Striga*-infested soil. African Journal of Biotechnology 2,(6): 157-160. (Providing the first report of ACC deaminase in *Klebsiella oxytoca*)

Bar Nun, N. *et al.* – see Nun, N.B. *et al.*

Benharrat, H., Boulet, C., Veronesi, C. and Thalouarn, P. 2003. (An overview of ongoing laboratory and field studies carried out on *Orobanche ramosa*: a pest for rape seed, hemp and tobacco.) (in French) Phytoma.564: 24-26. (A review of current research activity.)

Berner, D.K., Sauerborn, J., Hess, D.E. and Emechebe, A.M. 2002. The role of biological control in integrated management of *Striga* species in Africa. Neuenschwander, P., Borgemeister, C. and Langewald, J. (eds) Biological control in IPM systems in Africa, pp. 259-276. (Discussing the role of biological control agents, especially plant pathogenic fungi and bacteria.)

Beuth, J. 2003. (Evidence-based complementary therapy measures in carcinoma of the breast.) (in German) Medizin 32(1): 21-24. (Concluding that 'although complementary treatments cannot replace the standard oncological therapies for breast cancer…. treatments with mistletoe extracts are also of value.)

Bouwmeester, H.J., Matusova, R., Sun Zhongkui and Beale, M.H. 2003. Secondary metabolite signalling in host-parasitic plant interactions. Current Opinions in Plant Biology 6: 358-364. (Reviewing recent literature on germination stimulants and the analytic techniques involved; also the potential for the use of 'model' plants such as *Arabidopsis* in the study of stimulant biosynthesis and the possibilities for manipulation of germination stimulant production in crops.)

Brand, J.E. 2002. Review of the influence of *Acacia* species on establishment of sandalwood (*Santalum spicatum*) in Western Australia. In: Maslin, B.R. and George, A.S. (eds) Conservation Science Western Australia 4(3): 125-129. (A successful establishment technique involves planting *S. spicatum* seeds near 1-2 year old *Acacia acuminata* seedlings. Other *Acacia* spp. vary in suitability. *Allocasuarina huegeliana* is less suitable than *A. acuminata*, while planting close to *Eucalyptus loxophleba* results in seedling death.)

Braun, J.M., Ko, H.L., Schierholz, J.M. and Beuth, J. 2002. Standardized mistletoe extract augments immune response and down-regulates local and metastatic tumor growth in murine models. Anticancer Research 22(6C): 4187-4190.

Briemle, G. and Ruck, K. 2003. (Poisonous plants in pastures for horses....keep a lookout for them.) (in German) Fachpraxis 43: 14-18. (*Rhinanthus* spp. listed among toxic species.)

Campbell, S., Azuma, D. and Weyermann, D. 2003. Forests of Eastern Oregon: an overview. General Technical Report - Pacific Northwest Research Station, USDA Forest Service No.PNW-GTR-578, 31 pp. (Including reference to *Arceuthobium* spp.)

Carsky, R.J., Akakpo, C., Singh, B.B. and Detongnon, J. 2003. Cowpea yield gain from resistance to *Striga gesnerioides* parasitism in Southern Benin. Experimental Agriculture 39: 327-333. (IITA breeding line IT93KZ-4-5-6-1-5 has shown complete resistance to *S. gesnerioides* at more than 20 field sites in S. Benin and given mean yields over 150% greater than susceptible varieties.)

Christensen, N.M., Dörr, I., Hansen, M., Kooij, T.A.W. van der and Schulz, A. 2003. Development of *Cuscuta* species on a partially incompatible host: induction of xylem transfer cells. Protoplasma 220(3/4): 131-142. (*C. reflexa* and *C. japonica* growing on the incompatible host *Euphorbia pulcherrima* develop xylem transfer cells, not seen on a compatible host; suggesting that *Cuscuta* spp. have this genetic ability, elicited in response to developmental stress.)

Cooke, D. 2002. Control of Branched Broomrape. A literature review. Adelaide, Australia: Department of Water, Land and Biodiversity Conservation. 39 pp. (Including Appendix: A comparison of techniques to reduce the soil seedbank of branched boomrape, by J. Virtue and P. Jupp.)

Daugherty, C.M. and Mathiasen, R.L. 2003. Estimates of the incidence of mistletoes in pinyon-juniper woodlands of the Coconino National Forest, Arizona. Western North American Naturalist 63: 382-390. (About 50% of the woodlands surveyed were infested with *Phoradendron juniperinum* or *P. capitellatum* but only 12% with *Arceuthobium divaricatum* occurring on pinyon *Pinus* spp.)

Deng Xiong, Feng HuiLing, Ye WanHui, Yang QiHe, Xu KaiYang, CaoHongLin and Fu Qiang 2003. (A study on the control of exotic weed *Mikania micrantha* by using parasitic *Cuscuta campestris*.) (in Chinese) Journal of Tropical and Subtropical Botany 11: 117-122. (*C. campestris* could spread up to 5 m within 2 months and inhibited the growth and development of *M. micrantha*.)

DeNitto, G. 2002. Montana: forest insect and disease conditions and program: 2001. Forest Health Protection Report - Northern Region, USDA Forest Service, No.02-1, 41 pp. (Including estimated losses from *Arceuthobium* spp.)

Dubrovsky, J.G. 2002. Tumorous malformations in natural populations of *Pachycereus* and its association with mistletoe. Cactaceas y Suculentas Mexicanas 47(3): 48-56. (A study suggesting that *Phoradendron diguetianum*, although often associated with galls on *Pachycereus, Stenocereus* and *Opuntia* spp., is not their cause.)

Dugenci, S.K., Arda, N. and Candan, A. 2003. Some medicinal plants as immunostimulant for fish. Journal of Ethnopharmacology 88: 99-106. (Extracts of *Viscum album* included in studies on *Oncorhynchus mykiss* but were not active.)

Dzerefos, C.M., Witkowski, E.T.F. and Shackleton, C.M. 2003. Host-preference and density of woodrose-forming mistletoes (Loranthaceae) on savanna vegetation, South Africa. Plant Ecology 167: 163-177. (*Erianthemum dregei* and *Pedistylis galpinii* each had many hosts but *Sclerocarya birrea* was the most favoured and there was negative correlation between host preference and host wood density. *P. galpinii* has the higher market value.)

Eizenberg, H., Colquohoun, J.B. and Mallory-Smith, C.A. 2003. Weed Science 51: 759-763. (14 varieties of *Trifolium pratense* were highly susceptible to *O. minor*; 7 varieties of *T. repens* allowed many attachments but few developed normally and there was little host damage; 2 varieties of *T. incarnatum* were apparently immune in this study.).

El-Sayed, N.E., Abd-Elkrim, M.A., El-Aref, H.M., Taghian, A.S. and El-Lithy, R.E. 2003. Selection and molecular characterization of faba bean lines resistant to broomrape (*Orobanche crenata* Forsk). Assiut Journal of Agricultural Sciences 34(1): 165-180. (Crosses among Giza Blanca, Giza 402, and Giza 674 produced plants with enhanced parasite resistance and host seed yield. PCR-RAPD markers were identified that correlated with the resistance trait.)

Ensbey, R. and Blackmore, P. 2003. Serious weed threats to NSW - your legal obligations for W1 weeds. Agnote - NSW Agriculture No.DPI-451(1st Edition), 6 pp. (Including *Orobanche* spp. among 14 species classified as W1 Noxious.)

Ernst, E., Schmidt, K. and Steuer-Vogt, M.K. 2003. Mistletoe for cancer? A systematic review of randomised clinical trials. International Journal of Cancer.107: 262-267. (Conclusions from a critical analysis of 10 published studies concluded that none of the methodologically stronger trials exhibited efficacy in terms of quality of life, survival or other outcome measures. Sadly 'rigorous trials of mistletoe extracts fail to demonstrate efficacy of this therapy'.)

Fan Jiang, Jeschke, W.D. and Hartung, W. 2003. Water flows in the parasitic association *Rhinanthus minor/Hordeum vulgare*. Journal of Experimental Botany 54: 1985-1993. (Confirming that stomata of *R. minor* remain open day and night despite high levels of ABA, while those of *Melampyrum arvense* do not. Studies showed that *R. minor* extracted 20% of the water taken up by the host. Response of the host involved decreased shoot growth but somewhat increased root development.)

Fayed, M.T.B., Hamdi, A., Samia, A.M. and Shaaban, M. 2002. Performance of *Orobanche* control treatments in faba bean crop. Egyptian Journal of Agricultural Research 80: 753-769. (Comparing a range of treatments involving late sowing, glyphosate application, integrated control, non-chemical integrated control, and the tolerant cv. Giza 429.)

Foley, M.J.Y. 2003. *Orobanche hirtiflora* subsp. *zosimii* M.J.Y. Foley (Orobanchaceae), a new subspecies from Cyprus. Candollea 58(1): 83-95.

Frost, A., López-Gutiérrez, J.C. and Purrington, C.B. 2003. Fitness of *Cuscuta salina* (Convolvulaceae) grown under different salinity regimes. American Journal of Botany 90: 1032-1037. (It is postulated that distribution of *C. salina* may be dictated more by the salt status of the host than by the soil type, but experiments involving the host *Beta vulgaris* grown on varying levels of salt failed to give clear confirmation of this.).

Ganeshaiah, K.N., Shaanker, R.U. and Bawa, K.S. 2001. Theme I: Global change and tropical forest ecosystems. Economic valuation of natural resources: local and global perspectives. In Ganeshaiah, K.N., Shaanker, R.U. and Bawa, K.S. (eds) Proceedings of the International Conference on Tropical Ecosystems: Structure, Diversity and Human Welfare, Banglore, India, July 2001, pp. 29-52. (Including a section on silviculture of *Santalum album*.)

Garkoti, S.C., Akoijam, S.B. and Singh, S.P. 2002. Ecology of water relations between mistletoe (*Taxillus vestitus*) and its host oak *(Quercus floribunda*). Tropical Ecology 43: 243-249. (Measurements of water potential in host and parasite demonstrate a constant differential between the two, with the parasite always lower than its host.)

Gbèhounou, G., Pieterse, A.H. and Verkleij, J.A.C. 2003. Longevity of *Striga* seeds reconsidered: results of a study on purple witchweed (*Striga hermonthica*) in Bénin. Weed Science 51: 940-946. (Studies with seeds buried in nylon gauze bags suggest rapid loss of viability during the rainy season in northern Bénin and no wet dormancy. But note Mourik *et al.*, below, suggesting an effect of seed density which could affect this type of study.)

Gibot-Leclerc, S., Brault, M., Pinochet, X. and Sallé, G. 2003. (Potential role of winter rape weeds in the extension of broomrape in Poitou-Charentes.) (in French). Comptes Rendus Biologies.326: 645-658. (50% of the weeds of winter rape could be parasitized by *Orobanche ramosa*.)

Gibot-Leclerc, S., Brault, M. and Salle, G. 2003. (*Orobanche ramosa*: a true pest for various crops in France.) (in French) Phytoma 561: 9-12. (*O. ramosa* is continuing to spread in France and is now present in 20 of the 96 departments, affecting tobacco and hemp as well as rape.)

Gilmore, A.M., Matsubara, S., Ball, M.C., Barker, D.H. and Itoh, S. 2003. Excitation energy flow at 77 K in the photosynthetic apparatus of overwintering evergreens. Plant, Cell and Environment 26: 1021-1034. (Results with *Amyema miquelii* on *Eucalyptus pauciflora* are consistent with a functional association between the cold-hard-band of chlorophyll a spectra, PSII energy dissipation, and protective storage of chlorophyll in overwintering evergreens.)

Godfree, R.C., Tinnin, R.O. and Forbes, R.B. 2003. Relationships between dwarf mistletoe and the canopy structure of an old-growth lodgepole pine forest in central Oregon. Canadian Journal of Forest Research 33: 997-1009. (Stands of *Pinus contorta* heavily infested by *Arceuthobium americanum* contained fewer large but many more small trees than lightly infested stands.)

Gotts, R.I.C. and Ginn, S.G. 2003. The previously undescribed female of *Delias shunichii* Morita (Lepidoptera: Pieridae) from New Britain, Papua New Guinea. Australian Entomologist 30(1): 1-4. (The larvae are believed to feed on Loranthaceae.)

Gworgwor, N.A. 2002. The use of legume trap crops for control *of Striga hermonthica* (Del.) Benth. in sorghum (*Sorghum bicolor* L. Moench) in Northern Nigeria. Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen, Universiteit Gent 67(3): 421-430. (Confirming the potential of groundnut and bambara to reduce numbers of *S. hermonthica*, especially when planted as alternate hills rather than in alternate rows.)

Gworgwor, N.A. 2003. Resistance of sorghum varieties to *Striga hermonthica*. Tropical Science 43(1): 48-52. (Local varieties Ex-Dapchi and Idon Makaho in Nigeria showed evidence of tolerance to *S. hermonthica*.)

Haas, K., Bauer, M. and Wollenweber, E. 2003. Cuticular waxes and flavonol aglycones of mistletoes. Zeitschrift fur Naturforschung. Section C, Biosciences 58: 464-470. (Neither the crystalloid structures nor the chemical composition of the wax allowed discrimination between *Viscum album* and *V. cruciatum*.)

Haidar, M.A. 2003. Characterisation of the interaction between cryptochromes and phytochromes in blue light-induced coiling and prehaustoria development of dodder (*Cuscuta campestris*) seedlings. Annals of Applied Biology 143: 57-62.

Hirsch, A.M., Bauer, W.D., Bird, D.M., Cullimore, J., Tyler, B. and Yoder, J.I. 2003. Molecular signals and receptors: controlling rhizosphere interactions between plants and other organisms. Ecology 84: 858-868. (Including a section on germination and haustorial stimulants in parasitic plants.)

Hunter, J.T. 2003. Factors affecting range size differences for plant species on rock outcrops in eastern Australia. Diversity and Distributions 9(3): 211-220. (Hemi-parasites apparently contribute to greater species range sizes.)

Hyun JinO, Lim Yongseok and Shin Hyunchur 2003. Validation of *Orobanche filicicola* (Orobanchaceae) from Korea. Novon, 2003 13(1): 64-67.

Idris, A.E., Abouzeid, M.A., Boari, A., Vurro, M. and Evidente, A. 2003. Identification of phytotoxic metabolites of a new *Fusarium* sp. inhibiting germination of *Striga hermonthica* seeds. Phytopathologia Mediterranea 42(1): 65-70.

Idu, M., Begho, E.R. and Akpaja, E.O. 2002. Anatomy of attachment of the root parasite *Thonningia sanguinea* Vahl. on *Hevea brasiliensis*. Indian Journal of Natural Rubber Research 15(1) 33-35. (Detailed observations on *T. sanguinea,* damaging to rubber in Nigeria.)

INTSORMIL 2002. Bibliography - INTSORMIL, 1984-2002: fighting hunger and poverty with research, a team effort. International Sorghum and Millet Collaborative Research Program. 237 pp. (Including INTSORMIL articles on *Striga*.)

Joita, M.P., Procopovici, E. and Raranciuc, S. 2002. Sunflower breeding for resistance to the new races of broomrape (*Orobanche cumana* Wallr.) in Romania. In: Taborsky, V., Polak, J., Lebeda, A. and Kudela, V. (eds) Plant Protection Science 38(Special 2): 604-607. (Demonstrating the existence of a new race F, and corresponding dominant resistance gene Or6.)

Joshi, S.K. and Sanjay Gairola 2003. *Cuscuta europaea* Linn. (dodder plant): an emerging threat to plant diversity of Valley of Flowers. Current Science 84: 1285-1286. (Hosts in Uttah Pradesh include medicinal plants *Dactylorhiza hatagirea, Gentianella moorcroftiana, Swertia paniculata, Selinum tenuifolium* and *Potentilla* spp.)

Kanampiu, F., Friesen, D. and Gressel, J. 2003. A new approach to *Striga* control. Pesticide Outlook 14(2): 51-53. (A general review of recent developments including seed-coating with imazapyr or pyrithiobac and new locally adapted, herbicide-resistant, open-pollinated maize cultivars.)

Kanampiu, F.K., Kabambe, V., Massawe, C., Jasi, L., Friesen, D., Ransom, J.K. and Gressel, J. 2003. Multi-site, multi-season field tests demonstrate that herbicide-coating herbicide-resistance maize controls *Striga* spp and increases yields in several African countries. Crop Protection 22: 697-706. (Tests with imazapyr and pyrithiobac on over 90 sites in Kenya, Malawi, Tanzania, and Zimbabwe gave excellent control of *S. hermonthica* and *S. asiatica* and showed increased yields up to 4-fold on heavily infested sites.)

Krause, K., Berg, S. and Krupinska, K. 2003. Plastid transcription in the holoparasitic plant genus *Cuscuta*: parallel loss of the rrn16

PEP-promoter and of the rpoA and rpoB genes coding for the plastid-encoded RNA polymerase. Planta 216: 815-823. (Three achlorophyllous species, *C. odorata, C. subinclusa*, and *C. gronovii*, lack promoters for the plastid-encoded RNA polymerase but contain motifs similar to a nuclear-encoded RNA polymerase promoter. This contrasts with the chlorophyll-containing *C. reflexa*, which retains the plastid-encoded polymerase promoter. Parasitic plants continue to be useful in studying the evolution of plastid genes and their regulation.)

Kuchinda, N.C., Kureh, I., Tarfa, B.D., Shinggu, C. and Omolehin, R. 2003. On-farm evaluation of improved maize varieties intercropped with some legumes in the control of *Striga* in the Northern Guinea savanna of Nigeria. Crop Protection 22: 533-538. (Intercropping the improved varieties with either soyabean or groundnut was more profitable than the local cultivar grown alone.)

Kuijt, J. 2003. Miscellaneous mistletoe notes, 37-47. Novon 13(1): 72-88. (Proposing 9 new species of Loranthaceae, 2 of *Cladocolea*, 4 of *Struthanthus* and 3 of *Dendrophthora*.)

Li XueMei, Pfiz, M., Kuppers, M., Einig, W., Rennenberg, H. and Hampp, R. 2003. Sucrose phosphate synthase in leaves of mistletoe: its regulation in relation to host (*Abies alba*) and season. Trees: Structure and Function 17(3): 221-227. (Seasonal changes in carbohydrate metabolism in the parasite may be tied to availability of sugar in the host xylem.)

Mack, R.N. and Lonsdale, W.M. 2003. Eradicating invasive plants: hard-won lessons for islands. In: Veitch, C.R. and Clout, M.N. (eds) Turning the tide: the eradication of invasive species: Proceedings of the International Conference on eradication of island invasives, pp.164-172. (Using the *Striga* control programme in USA as an example of what is possible.)

Macklin, J. and Parnell, J. 2002. An account of the Santalaceae of Thailand. Thai Forest Bulletin (Botany) 30: 75-108. (Keys and full descriptions for 13 species in 7 genera, including some aerial parasities, mostly occurring in montane regions on e.g. *Quercus*, *Lithocarpus* and *Vaccinium*.)

Manschadi, A.M., Wang, E., Robertson, M.J., Meinke, H. and Sauerborn, J. 2003. Development of a parasite module in APSIM - case study: the parasitic weed *Orobanche crenata* infesting faba bean. In: Unkovich, M. and O'Leary, G. (eds) Solutions for a better environment: Proceedings of the 11th Australian Agronomy Conference, Geelong, Victoria, February 2003, pp.0-4. (The parasite module, together with APSIM-Faba bean, was capable of predicting the biomass accumulation of *O. crenata* and the yield loss of infected faba bean for various infestation levels and sowing dates, also under different water supply conditions.)

Marambe, B., Wijesundara, D.S.A., Tennakoon, K.U., Peneniya, D. and Jayasinghe, C. 2002. Growth and development of *Cuscuta chinensis* Lam. and its impact on selected crops. Weed Biology and Management 2: 79-83. (In pot experiments '*C. chinensis*' (just possibly *C. campestris*?) showed greatest vigour on tomato causing about 80% reduction in dry weight; it was less vigorous and caused only 30-40% reduction of chilli; and it failed to parasitize rice. Germination was increased by scarification.)

Maurer, W.D. 2003. (Dendroecological research on silver fir (*Abies alba* Mill.) stands damaged by mistletoe (*Viscum album*).) (in German) Mitteilüngen aus der Forschungsanstalt für Waldokologie und Forstwirtschaft Rheinland-Pfalz 50(3) 161-170. (Analysing attack by mistletoe under varying climate, soil, stand structure, and atmospheric deposition.)

Millot, M. 2002. (Forest renewal one century after reforestation with black pines of badlands in the Haute-Provence.) (in French) Comptes rendus de l'Academie d'Agriculture de France 88(6): 59-68. (With reference to *Viscum album* as a factor in growing *Pinus nigra*.)

Mohamed, A., Ellicott, A., Housley, T.L. and Ejeta, G. 2003. Hypersensitive response to *Striga* infection in Sorghum. Crop Science 43: 1320-1324. (Characterising the hyper-sensitive response (HR) in varieties Framida and Dobbs and in the wild accession P47121. HR in P47121 proved heritable. Genotypes SRN-39, IS9830, and 555 had low stimulant activity but no HR. Framida had both characters.)

Mooney, K.A. 2003. *Promylea lunigerella glendella* Dyar (Pyralidae) feeds on both conifers and parasitic dwarf mistletoe (*Arceuthobium* spp.): one example of food plant shifting between parasitic plants and their hosts. Journal of the Lepidopterists' Society 57: 47-53. (Feeding noted on both

Arceuthobium vaginatum and on *Pinus ponderosa.* Comparisons made with *Dasypyga alternosquamella*, a closely related phycitine, also feeding on *Arceuthobium* at this site.)

Morlon-Guyot, J., Helmy, M., Lombard-Frasca, S., Pignol, D., Pieroni, G. and Beaumelle, B. 2003. Identification of the ricin lipase site and implication in cytotoxicity. Journal of Biological Chemistry 278: 17006-17011.

Mourik, T.A. van, Stomph, T.J and Westerman, P.R. 2003. Estimating *Striga hermonthica* seed mortality under field conditions. In: Bekker, R.M., Forcella, F., Grundy, A.C., ,Jones, N.E., Marshall, E.J.P. and Murdoch, A.J. (eds) Aspects of Applied Biology 69: 187-194. (Loss of viability under field conditions in Mali was less in sterilised soil, and when seed density was lower.)

Murdoch, A.J. and Kunjo, E.M. 2003. Depletion of natural soil seedbanks of *Striga hermonthica* in West Africa under different integrated management regimes. In: Bekker, R.M., Forcella, F. and Grundy, A.C., Jones, N.E., Marshall, E.J.P. and Murdoch, A.J. (eds) Aspects of Applied Biology 69: 261-268. (Depletion of *S. hermonthica* seeds over 2 seasons in Gambia was 90% when fertilised cotton was grown but only 46% under unfertilised sorghum.)

Mullen, J.D., Taylor, D.B., Fofana, M. and Kebe, D. 2003. A bio-economic model of long-run *Striga* control with an application to subsistence farming in Mali. International Journal of Pest Management 49: 251-264.

Murwani, R. 2003. Indonesian tea mistletoe (*Scurrula oortiana*) stem extract increases tumour cell sensitivity to tumour necrosis factor alpha (TNFalpha). Phytotherapy Research 17: 407-409. (Confirming that extracts of *S. oortiana* are cytotoxic to the WEHI-164 tumour cell line and increase tumour cell sensitivity to TNFalpha mediated lysis.)

Musambasi, D., Chivinge, O.A. and Mariga, I.K. 2002. Intercropping maize with grain legumes for *Striga* control in Zimbabwe. African Crop Science Journal 10: 163-171. (Intercropping maize with cowpea, groundnut, field bean and bambara nut caused only partial and unreliable reductions in emergence of *S. asiatica* but there may have been small advantages in total crop yields.)

Mutikainen, P. and Koskela, T. 2002. Population structure of a parasitic plant and its perennial host. Heredity 89: 318-324. (Allozyme studies suggested little evidence for co-evolution of *Cuscuta europaea* with its host *Urtica dioica*.)

Nadler-Hassar, T. and Rubin, B. 2003. Natural tolerance of *Cuscuta campestris* to herbicides inhibiting amino acid biosynthesis. Weed Research 43: 341-347. (*C. campestris* from several different hosts and sources, including Israel and USA, also one sample of *C. monogyna*, proved highly tolerant of glyphosate and related herbicides. Treatment of glyphosate-resistant sugar beet and tomato in the field resulted in initial suppression of *C. campestris* but there was later recovery and only limited benefit in host vigour. Over-expression and/or high specific activity of the target enzyme is suspected of being responsible. The usefulness of these herbicides for *Cuscuta* control in herbicide-resistant crops is questioned.)

Ndakidemi, P.A. and Dakora, F.D. 2003. Legume seed flavonoids and nitrogenous metabolites as signals and protectants in early seedling development. Functional Plant Biology 30: 729-745. (Summarizing the roles of seed coat metabolites in symbiotic legumes, with the aim of evaluating the potential for manipulating these molecules to increase plant yields. *Striga* also considered.)

Nun, N.B., Plakhine, D., Joel, D.M. and Mayer, A.M. 2003. Changes in the activity of the alternative oxidase in *Orobanche* seeds during conditioning and their possible physiological function. Phytochemistry 64(1): 235-241. (AOX respiratory pathway plays an important role during seed preconditioning and may function in reducing levels of reactive oxygen species.)

Ohashi, K., Winarno, H., Mukai, M., Inoue, M., Prana, M. S., Simanjuntak, P. and Shibuya, H. 2003. Indonesian medicinal plants. XXV. Cancer cell invasion inhibitory effects of chemical constituents in the plant *Scurrula atropurpurea* (Loranthaceae). Chemical & Pharmaceutical Bulletin 51(3): 343-345. (Among the constituents studied, the alkynic fatty acid octadeca-8,10,12-triynoic acid exhibited inhibitory effects on cancer cell invasion *in vitro*. *S. atropururea* is referred to as a parasite of tea.)

Olmstead, R.G., Depamphilis, C.W., Wolfe, A.D., Young, N.D., Elisens, W.J. and Reeves, P.J. 2001. Disintegration of the Scrophulariaceae. American Journal of Botany 88: 348-361. (On the basis of molecular studies involving three plastid genes, proposing the transfer of all parasitic genera of Scrophulariaceae into Orobanchaceae. Apologies for late posting – see item above 'Parasitic Scrophs – no such thing?'.)

Olupot, J.R., Osiru, D.S.O., Oryokot, J. and Gebrekidan, B. 2003. The effectiveness of *Celosia argentea* (*Striga* "chaser") to control *Striga* on sorghum in Uganda. Crop Protection 22: 463-468. (Inter-planting *C. argentea* reduced *Striga* about 50% and increased sorghum yields. *C. argentea* is shown to stimulate *Striga* germination.)

Ouyang Jie, Wang XiaoDong, Zhao Bing and Wang YuChun 2003. Light intensity and spectral quality influencing the callus growth of *Cistanche deserticola* and biosynthesis of phenylethanoid glycosides. Plant Science 165: 657-661. (Blue light caused increased callus biomass and phenylethanoid glycoside (PeG) production as compared to cultures growing under white light. Greater PeG levels are attributed to higher phenylalanine ammonia lyase activity in blue light.)

Parnell, J. 2001. A revision of Orobanchaceae in Thailand. Thai Forest Bulletin (Botany) 29: 72-80. (Describing the widespread *Aeginetia indica*, the rarer *A. pedunculata* and the endemic *Christisonia siamensis*.)

Pierce, S., Ley, G., Mbwaga, A.M., Lamboll, R.I., Riches, C.R., Press, M.C. and Scholes, J.D. 2003. Farmers, farms and physiology: an integrated approach to *Striga* research. In: Proceedings, Crop Science and Technology 2003, BCPC International Congress, Glasgow, 2003, pp. (Reviewing a range of inter-related studies leading to practical choices of new sorghum varieties for farmers, based on soil type and fertilizer use.)

Plitmann, U. 2002. Agamospermy is much more common than conceived: a hypothesis. Israel Journal of Plant Sciences 50(Supplement): S111-S117. (Discussing the evolutionary implications of casual or facultative agamospermy in opportunistic plants and higher parasitic plants.)

Procopovici, E. 2001. (Behaviour of some sunflower hybrids to *Orobanche cumana* attack under conditions of Dobrogea.) (in Romanian) Probleme de Protectia Plantelor 29(2): 209-214. (Varieties Favorit, Turbo, Melody, Arena, and Pixel are recommended for growth in *O. cumana*-infested areas of Dobrogea.)

Puustinen, S. and Mutikainen, P. 2001. Host-parasite-herbivore interactions: implications of host cyanogenesis. Ecology 82: 2059-2071. (Studies on *Trifolium repens* with varying levels of cyanogenic glucosides, in the presence of parasitic *Rhinanthus serotinus* and/or the predatory snail *Arianta arbustorum* show that cyanogenesis deters the snail but not the parasite, while the snail was deterred by parasitism only in the absence of cyanogenesis.)

Quested, H.M., Press, M.C. and Callaghan, T.V. 2003. Litter of the hemiparasite *Bartsia alpina* enhances plant growth: evidence for a functional role in nutrient cycling. Oecologia 135: 606-614. (Showing that litter from the nutrient-rich foliage of *B. alpina* enhances growth of *Betula nana* and *Poa alpina*.)

Rathore, B.S. 2003. Blond psyllium - a new host for *Orobanche.* Indian Phytopathology 56(1): 121. ('*Orobanche* sp.' recorded on *Plantago ovata*.)

Rehms, L. and Osterbauer, N.K. 2003. Detecting *Orobanche minor* seeds in soil using PCR. Plant Health Progress. July, 2003: 1-3.

Robinson, D.C.E., Geils, B.W. and Muir, J.A. 2002. Spatial statistical model for the spread of dwarf mistletoe within and between stands. In: Crookston, N.L., Havis, R.N. (eds) Proceedings - Rocky Mountain Research Station, USDA Forest Service, 2002, No.RMRS-P-25, pp.178-185.

Rodriguez-Cruz, M.E., Perez-Ordaz, L., Serrato-Barajas, B.E., Juarez-Oropeza, M.A., Mascher, D. and Paredes-Carbajal, M.C. 2003. Endothelium-dependent effects of the ethanolic extract of the mistletoe *Psittacanthus calyculatus* on the vasomotor responses of rat aortic rings. Journal of Ethnopharmacology 86(2/3): 213-218. (Suggesting a mechanism for the supposed actiity of extracts of *P. calyculatus* against hypertension in traditional Mexican medicine.)

Rousset, A., Simier, P. and Fer, A. 2003. Characterisation of simple *in vitro* cultures of *Striga hermonthica* suitable for metabolic studies. Plant Biology 5: 265-273. (Attempts to standardise the use of protoplasts were not successful, but the use of globular calluses looks promising.)

Rubiales, D., Alcantara, C., Perez-de-Luque, A., Gil, J. and Sillero, J.C. 2003. Infection of chickpea (*Cicer arietinum*) by crenate broomrape (*Orobanche crenata*) as influenced by sowing date and weather conditions. Agronomie 23: 359-362. (Although there is somewhat more attack by *O. crenata* on chickpea with early, winter, sowing, the crop is still relatively resistant and little damaged.)

Rubiales, D., Perez-de-Luque, A., Cubero, J.I. and Sillero, J.C. 2003. Crenate broomrape (*Orobanche crenata*) infection in field pea cultivars. Crop Protection 22: 865-872. (Reporting little resistance in 20 pea varieties but some useful results from delayed sowing and imazethapyr pre- and post-emergence.)

Rubiales, D., Pérez-de-Luque, A., Joel, D.M., Alcántara, C. and Sillero, J.c. 2003. Characterization of resistance in chickpea to crenate broomrape (*Orobanche crenata*). Weed Science 51: 702-707. (Resistant chickpea varieties CA2065 and P2245 were shown to cause very little germination of *O. crenata* but also resisted penetration of haustoria by a form of resistance which did not involve host cell death but discolouration, inhibition and death of the invading haustorium.)

Rugutt, K.J., Rugutt, J.K. and Berner, D.K. 2003. In vitro germination of *Striga hermonthica* and *Striga aspera* seeds by 1-aminocyclopropane-1-carboxylic acid. Natural Product Research 17(1): .47-62. (Results suggest a hormonal mode of action for ACC, involving indirect stimulation of biosynthesis of ethylene that then triggers seed germination.)

Sanjai, V.N. and Balakrishnan, N.P. 2001. A note on the cryptic mimicry exhibited by Indian Viscaceae. Indian Journal of Forestry 24: 233-234.

Sanjai, V.N. and Balakrishnan, N.P. 2001. A note on hyper-parasitism in Indian Viscaceae. Indian Journal of Forestry 24: 235-236.

Santos, C.V. dos – see Vieira Dos Santos, C.

Sarikaya, O. and Avci, M. 2002. (Pest and diseases of the West Mediterranean forest tree, Cilician fir (*Abies cilicica* Carr.).) (in Turkish) Orman Muhendisligi 39(9/10): 20-23. (Including reference to damage by *Viscum album*.)

Sauerborn, J., Kranz, B. and Mercer-Quarshie, H. 2003. Organic amendments mitigate heterotrophic weed infestation in savannah agriculture. Applied Soil Ecology 23: 181-186. (Observations in N. Ghana on 'near' and 'far' fields with contrasting manuring and soil fertility help to confirm a negative correlation between soil fertility and *Striga* infestation.)

Schawaller, W. 2002. (The plant parasite *Cynomorium* as a feeding plant of cetonid beetles (Coleoptera: Scarabeidae) in southeastern Kazakhstan.) (in German) Entomologische Zeitschrift mit Insekten-Borse.112: 363-364. (*Cetonia aurata* and *Potosia karelini* observed feeding and causing damage.)

Schneeweiss, G.M. and Weiss, H. 2003. Polyploidy in *Aeginetia indica* L. (Orobanchaceae). Cytologia 68(1): 15-17. (2n found to be 120 – apparently octoploid.)

Showemimo, F.A. 2002. Evaluation of sorghum lines for *Striga* resistance. Tropical Agriculture 79: 237-240. (Field trails in Nigeria suggest lines SS-3, KSV-4 and KSV-8 are potential sources of *S. hermonthica* resistance.)

Showemimo, F.A. 2003. Selection criteria for combining high yield and *Striga* resistance in sorghum. Tropicultura.21(3): 157-159. (Plant vigour, stem girth, root weight, shoot weight and plant height all shown to be positively correlated with crop yield in the presence of *Striga*.)

Singh, H.P., Batish, D.R. and Kohli, R.K. 2003. Allelopathic interactions and allelochemicals: new possibilities for sustainable weed management. Critical Reviews in Plant Sciences 22: 239-311. (Including a section on the stimulatory allelochemicals involved in parasitic plant germination and haustorial initiation, also the use of microorganisms for parasitic weed control.)

Stein, G.M., Bussing, A. and Schietzel, M. 2002. Stimulation of the maturation of dendritic cells *in vitro* by a fermented mistletoe extract. Anticancer Research.22(6C): 4215-4220.

Sugimoto, Y., Ali, A.M., Yabuta, S., Kinoshita, H., Inananga, S. and Itai, A. 2003. Germination strategy of *Striga hermonthica* involves regulation of ethylene biosynthesis. Physiologia Plantarum 119: 137-145. (Detailed studies tend to confirm that conditioning of *S. hermonthica* seeds involves expression of ACC oxidase genes peaking after 15 days, while exposure to GR24 resulted in expression of ACC synthase genes, peaking after 10 hours, leading to endogenous ethylene generation and hence germination.)

Swift, K., Turner, J. and Rankin, L. 2002. Cariboo Forest Region: Part 1 of 3. Forest health Stand Establishment Decision Aids. BC Journal of Ecosystems and Management 2(1): 13-18. (An extension note including discussion of the problem of *Arceuthobium americanum* in *Pinus contorta*.)

Tang, S.X., Heesacker, A., Kishore, V.K., Fernandez, A., El-Sayed, S., Cole, G. and Knapp, S.J. 2003. Genetic mapping of the Or5 gene for resistance to *Orobanche* Race E in sunflower. Crop Science 43: 1021-1028. (Simple sequence repeat (SSR) markers were used to map Or5 to sunflower linkage group 3. This adds detail to previous maps, but Or5 is located in a telomeric region and is proving difficult to map precisely.)

Tikader, A. and Thangavelu, K. 2002. Incidence of *Elyctranthe parasitica* (L.) Dans., an epiphyte on mulberry. Indian Journal of Sericulture 41(2): 162-163.

Tsanuo, M.K., Hassanali,A., Hooper, A.M., Khan, Z., Kaberia, F., Pickett, J.A,. and Wadhams, L.J. 2003. Isoflavones from the allelopathic aqueous root exudates of *Desmodium uncinatum*. Phytochemistry 64: 265-273. (Paper based on the thesis reported in the previous issue – reporting the separation of several active fractions from the root exudates of *D. uncinatum,* and the chemical structure of some of the major iso-flavanoid components, one, uncinanone B, stimulating germination at 10-50 ppm, while uncinanone C inhibited radicle elongation at 5-10 ppm.)

Vaughn, K.C. 2003. Dodder hyphae invade the host: a structural and immunocytochemical characterization. Protoplasma 220(3/4) 189-200. (Close examination of *C. pentagona* reveals that hyphae do not grow through the host cell walls but rather induce the host to form a new cell wall which coats the growing hypha. It is also shown that the chimeric walls so formed are unique in composition and structure.)

Vieira Dos Santos, C, Delavault, P., Letousey, P. and Thalouarn, P. 2003. Identification by suppression subtractive hybridization and expression analysis of *Arabidopsis thaliana* putative defence genes during *Orobanche ramosa* infection. Physiological and Molecular Plant Pathology 62: 297-303. (Twelve host genes induced by parasitism are characterized, notably including potential signalling components, sucrose carriers, antioxidants, and wall fortifiers.)

Watson, D. M. 2002. Effects of mistletoe on diversity: a case-study from southern New South Wales. Emu, Journal of the Royal Australasian Ornithologists Union 102(3): 275-281. (Removal of mistletoes was associated with a significant reduction in numbers of bird species recorded.)

Weinberg, T., Lalazar, A. and Rubin, B. 2003. Effects of bleaching herbicides on field dodder (*Cuscuta campestris*). Weed Science 51: 663-670. (Effects of xylem-mobile fluorochloridone in reducing β-carotene levels was much more short-lived than that of phloem-mobile sulcotrione and mesotrione but all three led to destruction of plastids, and reduction of starch. β-carotene appears to be important to the integrity of amyloplasts.)

Wijesundara, D.S.A., Jayasinghe, C., Marambe, B. and Tennakoon, K.U. 2001. Host-parasitic associations of *Cuscuta chinensis* Lam. in Sri Lanka. Annals of the Sri Lanka Department of Agriculture 3: 343-351. (Over 100 hosts listed for '*C. chinensis*' in Sri Lanka but some confusion with *C. campestris* suspected. *Hibiscus esculentus* and *Phaseolus vulgaris* noted to be resistant.)

Woodall, G.S. and Robinson, C.J. 2002. Direct seeding *Acacias* of different form and function as hosts for Sandalwood (*Santalum spicatum*). In: Maslin, B.R. and George, A.S. (eds) Conservation Science Western Australia 4(3): 130-134. (Proposing a multi-host system, based mainly on *Acacia acuminata,* for cultivation of *S. spicatum*.)

Yasuda, N., Sugimoto, Y., Kato, M., Inanaga, S. and Yoneyama, K. 2003. (+)-Strigol, a witchweed seed germination stimulant, from *Menispermum dauricum* root culture. Phytochemistry 62: 1115-1119. (Claiming to be the first report for the isolation of a strigolactone from aseptic plant culture.)

HAUSTORIUM 44
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.