

# HAUSTORIUM

## *Parasitic Plants Newsletter*

Official Organ of the International Parasitic Plant Society

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### MESSAGE FROM THE IPPS PRESIDENT

Dear IPPS Members,

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

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

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

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

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

Uludağ (Chair of the Local Organizing Committee). It is a beautiful venue in which to enjoy great science.

Sincerely,

Jim Westwood, IPPS President

### ***OROBANCHE CRENATA* IN SUDAN: HISTORY, DISTRIBUTION AND MANAGEMENT**

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

Production of faba bean is threatened by the root parasitic weed *Orobanche crenata*. The parasite is a recent introduction into Sudan and was first reported in 2000/2001 on an area of about 2 ha at Ed Debiba in

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

The parasite was probably introduced in the 1990s when increased urbanization and market demands led to importation of faba bean from neighbouring countries. The high quality, and high price of some of the introduced varieties enticed farmers to grow them locally. The parasite, unnoticed, multiplied, naturalized and has become a problem. The wide spread of the parasite is consistent with its invasive nature, lack of natural enemies, lack of awareness about the parasite, its biology, reproduction, methods of spread, the nature of its association with its host, its debilitating effects, and a series of malpractices. Hand-pulled *Orobanche* spikes are piled in the fields, thrown into the river or onto adjoining roads. Fields were normally grazed immediately after harvest and crop residues were used as animal feed. Land is limited, and mono-cropping of faba bean is the predominant practice; individual holdings are small, 0.5-4 ha, farm equipment including tractors and threshers are in short supply and are in common use. Moreover, faba bean seeds from infested fields are transported over long distances and used for seeding. Spread of *Orobanche* species, as is the case with many invasive alien weeds, occurs through

dispersal and repeated establishment of satellite foci from a founder population. Like other root parasitic weeds no single measure provides effective control and an integrated approach comprising preventive, cultural, biological and chemical methods needs to be adopted. Control of the parasites is further compounded by existence of hosts from among wild plant species. Apart from faba bean, chickpea and lentil the parasite is found growing on *Malva parviflora*, a common weed in northern Sudan, and on an *Euphorbia* species.

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

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

In general, movement of farm equipment from *Orobanche* infested areas into uninfested areas is restricted. Fields with light or spotty infestations may be cropped with faba bean but emergent *Orobanche* spikes are hand-pulled before seed shedding. However, in the case of heavy infestations crop rotation is obligatory.

Rotation with crops such as berseem, maize, wheat, onion and sorghum for several years is encouraged. Subsequent faba bean crops are sprayed with imazethapyr (50 g a.i./ha) as a pre-emergence treatment followed by two sprays of glyphosate (60 g a.i./ha) as post-emergence treatments. Three sprays of glyphosate alone (60 g a.i./ha each) as post-emergence treatments commencing at flowering are equally effective. Remaining *Orobanche* spikes are hand-pulled at harvest and fields are ploughed to discourage grazing.

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

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## LITERATURE HIGHLIGHT

### Strigolactones - a new class of plant hormones?

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

Aside from the impact of this work on understanding plant development, it has implications for parasitic plant

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

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

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Jim Westwood

## THE 5<sup>TH</sup> INTERNATIONAL WEED SCIENCE CONGRESS, 23-27 JUNE 2008, VANCOUVER CANADA.

### A report on the session 'Management of parasitic weeds':

The successful management of parasitic weeds (*Striga* and *Orobanche* species) is a continuing challenge due to the complexities of the host-parasite interaction. Although many questions remain to be answered the papers presented in this session revealed new insights into host-parasite biology that will impact the design of control strategies in the future.

**Kaori Yoneyama (University of Utsunomiya Japan)** has been examining the effect of nutrient deficiencies (nitrogen and phosphorus singly and in combination) on the exudation of strigolactone germination stimulants, orobanchol, orobanchol acetate and 5-deoxystrigol from the roots of a range of plant species. Strigolactones not only stimulate germination of parasitic plants but are also responsible for hyphal branching of arbuscular mycorrhizal fungi. Kaori demonstrated that the effects of N and P deficiencies on strigolactone production by roots varied with plant species, for example, in *Trifolium pratense* and *Medicago sativa* P deficiency promoted exudation of orobanchol and orobanchol acetate whereas in sorghum 5-deoxystrigol production was increased by both N and P deficiency. The effects of nutrient deficiencies on the production of strigolactones has implications for management strategies based on improving soil fertility and may also provide an explanation for the observation that plants infected with mycorrhizal fungi appear to produce less strigolactones than uninfected plants.

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

undertaken to genotype individual parasites (from one ecotype of *S. hermonthica*) growing on a very susceptible, a partially resistant and a highly resistant rice cultivar. The study revealed clear genetic differentiation between the subpopulations of *Striga* attached to the different host cultivars illustrating the importance of understanding the genetics of parasite virulence as well as host resistance (host-parasite specificity) in order to breed cultivars with durable resistance for use in different agro-ecosystems.

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

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

identify the key biotic and abiotic factors affecting the success of the biocontrol strategy.

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

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

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

Julie Scholes, University of Sheffield.

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

#### MISTLETOE IN TUMOUR THERAPY: BASIC RESEARCH AND CLINICAL PRACTICE. 4TH MISTLETOE SYMPOSIUM

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

#### Interdisciplinary symposium

The diversity of standpoints of the organising associations and speakers lent this symposium its particular character. It took place in a constructive atmosphere, which is typical of this series of symposia held every four years. The aim of these meetings is to create a forum for discussion, enabling participants to

review current studies and the latest findings. It is hoped that doctors (whether in general or hospital practice), pharmacists and health insurance companies will get an idea of the use and current state of scientific knowledge about mistletoe extracts in basic research and therapy, but also identify their potential and their limitations. The symposia are also intended to bring about factually based dialogue and stimulate further research.

#### **Mistletoe preparations: good new studies**

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

The influence of mistletoe extracts on leukaemia and lymphomas was another focal point. Again there were clinical and preclinical reports that there are no identifiable risks of using mistletoe extracts in this context. Another presentation dealt with mistletoe therapy in paediatric oncology. In addition to the whole

range of clinical trials, there were questions about dosage, pharmacokinetic studies, through to the development and validation of new mistletoe-specific instruments for clinical testing, such as Cancer Fatigue or Internal Coherence questionnaires, and the development of a database embracing both hospital and general practice, which is an instrument of health services research. Several speakers dealt with methodological questions. For instance, Dr. Matthias Rostock (Tumour Biology Clinic, Freiburg) presented results of the Cochrane Review, the latest meta-analysis in which 21 randomised clinical trials were comparatively reviewed. Dr. Gunver S. Kienle (Institute of Applied Cognitive Science and Medical Methodology, Bad Krotzingen) gave an overview of other systematic study reviews and their analysis, stressing that the critical evaluation of a therapy mainly depends on the quality of the method, meaningfulness in medical and medicinal terms and relevance to practice. It became clear from the discussion that comparisons should also take account of the diversity of the mistletoe preparations tested. It is difficult to conduct randomised clinical trials with mistletoe preparations because people often cannot be randomised, i.e. they are understandably reluctant to leave their therapy to chance, and because patients in the non-mistletoe group frequently still take mistletoe, which means the real difference from the mistletoe group is diminished. In addition, the dosage regimen in mistletoe therapy is usually determined on an individual basis, which is why this essential approach in clinical practice cannot always be tested in a rigid trial regimen. In his summary paper, Dr. Harald Matthes (Havelhöhe Community Hospital, Berlin) therefore contrasted health service research with randomised clinical trials and commented on the use of this instrument in complementary oncology.

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

of 'Effects of mistletoe extracts on immuno-competent cells in vitro and in vivo', while subjects covered in short papers and posters included apoptosis, cytotoxicity and again the exclusion of tumour stimulation by mistletoe extracts.

#### Abstracts freely available on the internet

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

#### Next Mistletoe Symposium in 2011

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

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

### PRESS RELEASES

#### 'The witch is dead'

(Extract from IITA press release 5 May 2008)

IITA (International Institute for Tropical Agriculture) and its partners have found a way to control the scourge of witchweed (*Striga hermonthica*) in Sub-Saharan Africa through a biocontrol agent. *Striga* infests some 50 million hectares of cereal crops, ~ specifically maize, sorghum and millet, causing farmers an estimated US\$ 7 billion in annual losses and affecting over 300 million people in the region. Developed by a team led by IITA plant pathologist Dr. Fen Beed with partners from the University of McGill (Canada) and University of Hohenheim (Germany), the technology utilizes certain strains of *Fusarium oxysporum* (*F. oxysporum*) to fight the parasitic weed. The technology is cheap, environment-friendly and safe as the fungus specifically targets witchweed. The fungal strains tested originated from Ghana, Mali and Nigeria but, like witchweed, they are common throughout semi-arid Africa. The fungus can be easily grown in sterile water containing sorghum waste. The hard part was finding a way to coat seeds with it. Through experimentation, the team found that

spores of the fungus can be mixed with liquefied gum Arabic - an organic adhesive extracted from trees and commonly found in many SSA countries - without harming the fungus. The mixture is coated onto the seeds, dried then planted. The fungus remains viable for long periods, making the seeds amenable to storage. The fungus could also be directly dispersed into soil holes where the seeds are to be planted. The treated seeds produce crops that are free of the parasitic weed.

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

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

#### 'Fighting the parasitic weed *Striga*'

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

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

The news article is available at <http://www.oznet.ksu.edu/news/topstory.asp> (from CropBiotech Update March 19, 2008)

**‘Crop breeders on verge of beating Africa's most noxious weed using cutting edge science technique’**

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

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

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

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

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

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

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

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

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

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

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

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



of time crop breeders need to develop improved varieties.

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

### 'Plant parasite 'wiretaps' host'

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

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

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

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

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

Additional information:

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## REVIEWS

**Parasitic Flowering Plants.** Henning S. Heide-Jørgensen. 2008. Brill: Leiden. 438 pages. Illustrated. Hardback ISBN: 978 90 04 16750 6. List price: €99.00 /US\$ 148.00. Members of IPPS (and other readers of *Haustorium*) can quote action code 47762 to obtain a discounted price of €79.20 / US\$118.40 (More information available at [www.brill.nl](http://www.brill.nl) or contact [brill@turpin-distribution.com](mailto:brill@turpin-distribution.com))

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

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

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

Going through this book is like seeing one a favorite black and white movies in color as so much of the work reviewed here was first published in black and white.

Among these are the careful investigations of the parasitism of *Exocarpos* by Fineran, numerous studies by Kuijt, and many others. So much information has been garnered and presented in color for the first time.

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

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

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

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

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

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

Lytton John Musselman, Old Dominion University.

**Mistletoes Pathology, Systematics, Ecology, and Management.** R. L. Mathiasen, Daniel L. Nickrent, David C. Shaw, and David M. Watson. 2008. Plant Disease 92(7): 988-1006.

My first response to this review was amazement at how different the content was compared to mistletoe literature I reviewed ten and twenty years ago. At that

time, to use the words of the present authors, mistletoe was much more of a fiend than a friend. Mistletoe taxonomy was also a lot less complicated and, as is obvious from this review, poorly understood. In short, this is a valuable, readable account of mistletoes.

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

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

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

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

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

Lytton John Musselman, Old Dominion University

## MEETINGS

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

**Posters:**

- Mitra Ghotbi *et al.* - Comparison of nutritional effects on sporulation, desiccation tolerance and virulence of two isolates of *Fusarium oxysporum* in order to introduce an effective biocontrol agent of *Orobanche aegyptiaca*.
- Mitra Ghotbi *et al.* - Comparison of two liquid media in increasing virulence and desiccation tolerance of two isolates of *Fusarium oxysporum* for biocontrol of broomrape (*Orobanche* spp).
- Khalid Hameed *et al.* - Biological control of broomrape (*Orobanche cernua*) seed germination utilizing an indigenous actinomycete isolate in Jordan.
- Abuelgasim Elzein *et al.* - Does vacuum-packaging atmosphere enhance shelf-life of *Striga-mycoherbicide* products containing *Fusarium oxysporum* f.sp. *strigae* during storage.
- Mustapha Haidar and Chadi Gharib - Companion barley for *Orobanche crenata* control in organic broad bean.
- Eva Kohlschmid *et al.* - *Fusarium oxysporum* - an antagonist of the holo-parasitic weed *Orobanche ramosa*.
- Gualbert Gbe'hounou *et al.* - Discovery of *Merremia tridentata* subsp. *angustifolia* as a wild host of *Striga gesnerioides* in the Republic of Benin: a benefit of Farmer Field School.
- Hilary Sandler - Importance of germination patterns and herbicide application for the control of swamp dodder, *Cuscuta gronovii*, in Massachusetts cranberry production.
- Benesh Joseph *et al.* - GR24 induces germination through distinct metabolic changes in *Orobanche minor* seeds.
- Yaakov Goldwashe *et al.* - Disinfection of broomrape seeds on agricultural equipment with didecyl dimethyl ammonium bromide.
- Zoheir Ashrafi *et al.* - Effect of soil solarization, a nonchemical method, on the control of Egyptian broomrape (*Orobanche aegyptiaca*) and yield improvement in greenhouse grown cucumber.
- Jamal Qasem - Parasitic weeds of the Orobanchaceae family and their natural hosts in Jordan.

- Korne *et al.* - Host and habitat specificity of the *Cuscuta* species in Hungary.
- Jamal Qasem - Mistletoes (*Viscum cruciatum* Siebr. ex Boiss. and *Loranthus acaciae* Zucc) and their hosts in Jordan.
- Sirous Hasannejad *et al.* - *Erwinia carotovora* as a stimulant agent for *Orobanche aegyptiaca*.
- Sirous Hasannejad *et al.* - Evaluation of *Erwinia carotovora* and three isolates of *Fusarium oxysporum* as biological control agents of Egyptian broomrape (*Orobanche aegyptiaca*).
- Oumar Ouedraogo - Biological control of *Striga hermonthica* by the use of *Polygala rarifolia* on maize in Burkina Faso.
- Girija Vijayaraghavan and Chirathadam Abraham - Phanerogamic parasite on fruit crops of Kerala.
- Tom Lanini - Dodder (*Cuscuta pentagona*) control in processing tomato (*Lycopersicon esculentum*).
- Sirous Hasannejad and Saber Mirzaii - Effects of some medicinal plant extracts on *Orobanche cernua* seed germination.
- Ahmet Uludag and Yildiz Nemli - Parasitic flowering plants in Turkish flora.
- Friday Ekeleme *et al.* - The Influence of sowing date and *Striga hermonthica* on the yield of different varieties of sorghum (*Sorghum bicolor*).
- Somayeh Foruzesh *et al.* - Evaluating the possibility of chemical control of broomrape.
- Nadjia Zermane - New options for biocontrol of parasitic weeds of the genera *Orobanche* and *Cuscuta*.
- Majid Amini Dehghi *et al.* - Host-range and factors enhancing the virulence and desiccation tolerance of *Fusarium oxysporum* as promising biocontrol agent of *Orobanche aegyptiaca*.
- Barakat Abu Irmaileh - *Trichoderma* is a promising bio-agent for controlling *Orobanche* in tomato.
- Mou-Yen Chiang *et al.* - Host-specific *Colletotrichum* for control of field dodder (*Cuscuta campestris*).
- Paul But *et al.* - A tale of three dodders for the biocontrol of *Mikania micrantha* in Hong Kong.
- Paul But *et al.* - Application of fresh vegetative cuttings of dodders for the biocontrol of *Mikania micrantha*.

**Oral presentations:**

- Rosemary Ahom *et al.* - Management of *Striga hermonthica* (Del) Benth in *Zea mays* with *Sesamum indicum* and *Glycine max* as intercrops and nitrogen fertilization in Benue State, Nigeria., University.
- Julie Scholes - Can resistant cereals solve the *Striga* weed problem in Africa.
- Kazuteru Takagi *et al.* - Photoresponse analysis of phytochrome A in a non-photosynthetic parasitic plant, *Orobanche minor* Sm.

- Radi Aly *et al.* - Gene silencing of mannose 6-phosphate reductase in the parasitic weed *Orobanchae aegyptiaca*.
- Kaori Yoneyama *et al.* - How mineral nutrients affect the exudation of strigolactones, germination stimulants for root parasitic weeds.
- Hanan Eizenberg *et al.* - Developing a decision support system (DSS) for *Orobanchae aegyptiaca* control in tomato.
- Heiko Parzies *et al.* - Introgression of quantitative trait loci (QTL) for *Striga* resistance into adapted sorghum landraces through marker assisted backcrossing in sub-Saharan Africa.
- Abebe Menkir *et al.* - Combining an herbicide resistance gene with natural polygenic resistance to control *Striga hermonthica* (Del.) Benth in maize.
- Abuelgasim Elzein *et al.* - Co-delivering of *Striga*-mycoherbicides with fungicides using seed treatment technology: compatibility, field efficacy and implication.
- Dorette Müller-Stöver *et al.* - Field applications of *F. oxysporum* f.sp. *orthoceras* for the control of *Orobanchae cumana* Wallr.
- Dionyssia Lyra *et al.* - Exploratory spatial analysis of noxious *Orobanchae* species data in Greece.
- Kassim Al-Khatib *et al.* - Managing *Striga* infestation with metsulfuron and imazapyr seed treatments in grain sorghum resistant to acetolactate synthase-inhibiting herbicides.
- Aijan Jusupova *et al.* - Control of the field dodder on sowings of sugar beet and alfalfa.
- Koichi Yoneyama *et al.* - Characterization of strigolactones, plant derived signals for symbiosis and parasitism.
- Chad Brommer *et al.* - Strategies and innovations in the control of *Striga asiatica*.

### FORTHCOMING MEETINGS

**The 2nd Symposium on 'Biology of Non-weedy Hemiparasitic Orobanchaceae'**, held in Ceske Budejovice, Czech Republic, August 27-30 2008.. More information on the conference (including a detailed program and a book of abstracts) is available on its web site: <http://botanika.prf.jcu.cz/hemiparasites>  
The organizers are: Jakub Tesitel, Milan Stech and Jan Leps, Dept. of Botany, Faculty of Science, University of South Bohemia. (A report on this meeting will be included in the next issue)

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

Co-Directors:

Maurizio Vurro, Bari, Italy - [maurizio.vurro@ispa.cnr.it](mailto:maurizio.vurro@ispa.cnr.it)  
Jonathan Gressel, Rehovot, Israel - [jonathan.gressel@weizmann.ac.il](mailto:jonathan.gressel@weizmann.ac.il)

**The 10<sup>th</sup> World Congress on Parasitic Plants** will be held in Kusadasi, Turkey, June 8-12, 2009.

Contribution and participation from researchers, industry and all relevant people on any weedy or non-weedy parasitic plants is encouraged. The programme will consist of oral presentations and posters. Oral presentations will be invited or selected from submitted preliminary abstracts. Contact for scientific queries: Ahmet Uludag ([secretary@ippsippsturkey.com](mailto:secretary@ippsippsturkey.com)). For registration and accommodation queries: Deniz Yanar Servi ([info@ippsturkey.com](mailto:info@ippsturkey.com)). Or refer to the conference website: [www.ippsturkey.com](http://www.ippsturkey.com).

### Canopy Conference, Bangalore, October 2009 – mistletoe session

Dear colleagues interested in mistletoes,

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

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

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

Professor Gerhard Glatzel  
Institute of Forest Ecology, UNI BOKU Vienna  
Peter Jordan-Strasse 82, A-1190 Vienna, Austria  
email: [gerhard.glatzel@boku.ac.at](mailto:gerhard.glatzel@boku.ac.at)

### GENERAL WEB SITES

For individual web-site papers and reports see  
LITERATURE

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

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

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

For past and current issues of Haustorium see also:  
<http://www.odu.edu/~lmusselm/haustorium/index.shtml>  
(This site is being modified and moved to a new server.)

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

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

For Dan Nickrent's 'The Parasitic Plant Connection'  
see: <http://www.parasiticplants.siu.edu/>

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

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

For information on the 10<sup>th</sup> World Congress on Parasitic  
Plants in Kusadasi, Turkey, June 8-12, 2009, see:  
[www.ippsturkey.com](http://www.ippsturkey.com)

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

For information on the EWRS Working Group  
'Parasitic weeds' see: <http://www.ewrs.org/>

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

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

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

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

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

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

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

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

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- family. *Botanicheskii Zhurnal* 92(12): 1793-1808. (The structural and functional relations between the organizing of transport communications and the types of nutrition as well as the evolutionary sequence of host and parasitic taxa establishment are discussed.)
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186. (Reviewing recent developments in basic research.)
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- Sharma, R.C. and Sanjeev Sharma 2006. Diseases of poplar in India and their management. In: Verma, K.S., Khurana, D.K. and Christersson, L. (eds) Short rotation forestry for industrial and rural development. Proceedings of the IUFRO-ISTS-UHF International Conference on World Perspective on Short Rotation Forestry for Industrial and Rural Development, Nauni, Solan, India, 7-13 September 2003: 364-370. (Attack by *Viscum album* is serious in the hills.)
- Shaw, D.C., Huso, M. and Bruner, H. 2008. Basal area growth impacts of dwarf mistletoe on western hemlock in an old-growth forest. *Canadian Journal of Forest Research* 38(3): 576-583. (Growth of trees over 13 years was not affected by light or moderate infestation by *Arceuthobium tsugense* but severe infection caused 16-46% reduction in growth.)
- Shekhawat, U.K.S., Ganapathi, T.R., Srinivas, L., Bapat, V.A. and Rathore, T.S. 2008. *Agrobacterium*-mediated genetic transformation of embryogenic cell suspension cultures of *Santalum album* L. *Plant Cell, Tissue and Organ Culture* 92(3): 261-271.
- Shishkova, S., Rost, T.L. and Dubrovsky, J.G. 2008. Determinate root growth and meristem maintenance in angiosperms. *Annals of Botany* 101(3): 319-340. (Including a section on parasitic species, mentioning work on *Striga*, *Tryphysaria*, *Cuscuta* and *Pholisma* (Lennoaceae).)
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- Shukla, A.N. and Singh, Y.P. 2007. Status of dwarf mistletoe (*Arceuthobium minutissimum* Hook. f.) on Blue pine in Jammu & Kashmir. *Indian Forester* 133(9): 1179-1184. (A survey showing increased infection in older trees.)
- Siami, K., Vazan, S., Jamshidi, S. and Alimohammadi, R. 2007. (Using of crops as trap for *Orobanche aegyptiaca* management in tomato in greenhouse conditions.) (in Persian) *Journal of New Agricultural Science* 3(8): 37-44. (*Trifolium alexandrinum*, flax and sorghum were most effective trap crops for *O. aegyptiaca*. Soyabean was among the least active.)
- Sileshi, G.W., Kuntashula, E., Matakala, P. and Nkunya, P.O. 2008. Farmers' perceptions of tree mortality, pests and pest management practices in agroforestry in Malawi, Mozambique and Zambia. *Agroforestry Systems* 72(2): 87-101. (Noting that farmers regard insect and *Striga asiatica* as more serious constraints than crop diseases.)
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- Siqueira, I.R., Fochesatto, C., Torres, I.L.S., da Silva, A.L., Nunes, D.S., Elisabetsky, E. and Netto, C.A. Antioxidant activities of *Ptychopetalum olacoides* ("muirapuama") in mice brain. *Phytomedicine* 14(11): 763-769. (Confirming antioxidant activity in *P. olacoides* (Olacaceae), used by Amazonian peoples to treat nervous conditions.)
- Soberón, J.R., Sgariglia, M.A., Sampietro, D.A., Quiroga, E.N. and Vattuone, M.A. 2007. (Isolation, identification and determination of the antioxidant activity of a glycoflavonoid from *Tripodanthus acutifolius* (Ruiz & Pavón) Van Tieghem.) (in Spanish) In: Martinez, J.L. and Garcia, J.M.P. (eds) *Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas* 6(5): 276-277. (Evaluating the anti-oxidant content in *T. acutifolius* (Loranthaceae).)
- Somsab, W., Kongkachuichai, R., Sungpuag, P. and Charoensiri, R. 2008. Effects of three conventional cooking methods on vitamin C, tannin, myo-inositol phosphates contents in selected Thai vegetables. *Journal of Food Composition and Analysis* 21(2): 187-197. (Stir-fried *Melientha suavis* (Opiliaceae) is an excellent source of vitamin C.)
- Stanton, S. 2007. Effects of dwarf mistletoe on climate response of mature ponderosa pine trees. *Tree-Ring Research* 63(2): 69-80. (Results suggest that *Arceuthobium*-infected trees are more sensitive to climatic factors than uninfected trees and may be useful for dendroclimatic analyses.)
- Suetsugu, K., Kawakita A., and Kato, M. 2008. Host range and selectivity of the hemiparasitic plant *Thesium chinense* (Santalaceae). *Annals of Botany* 102: 40-55. (*T. chinense* is shown to have a wide host range attaching to 22 spp. in 11 families, but with a possible preference for *Lespedeza juncea* and *Eragrostis curvula*.)
- Suffredini, I.B., Paciencia, M.L.B., Frana, S.A., Varella, A.D. and Younes, R.N. 2007. *In vitro* breast cancer cell lethality of Brazilian plant extracts. *Pharmazie* 62(10): 798-800. (A member of the Olacaceae (not specified in abstract) among only 11 of 351 species screened to show activity.)

- Sugimoto, Y. and Ueyama, T. 2008. Production of (+)-5-deoxystrigol by *Lotus japonicus* root culture. *Phytochemistry* 69(1): 212-217.
- Sujetovienė, G. and Stakėnas, V. 2007. Changes in understorey vegetation of Scots pine stands under the decreased impact of acidifying and eutrophying pollutants. *Baltic Forestry* 13(2): 190-196. (*Melampyrum pratense* among the understory species which increased in occurrence as pollution decreased.)
- Sun Zhongkui 2008. Biosynthesis of germination stimulants of parasitic weeds *Striga* and *Orobancha*. Thesis. Wageningen, Netherlands: Wageningen University. 115 pp. (Discussing the cloning and characterization of a maize carotenoid cleavage dioxygenase gene (*ZmCCD1*), and its relevance to germination stimulants in *Arabidopsis* and rice.)
- Suzuki, K., Dohzono, I. and Hiei, K. 2007. Evolution of pollinator generalization in bumblebee-pollinated plants. *Plant Species Biology* 22(3): 141-159. (Showing that 3 bumblebee species are equally effective pollinators of *Melampyrum roseum*, but lead to self-pollination; seed production is then reduced by abortion of selfed embryos.)
- Szymańska, R. and Kruk, J. 2008. Tocopherol content and isomers' composition in selected plant species. *Plant Physiology and Biochemistry* 46(1): 29-33. (*Cuscuta epithymum* and *C. japonica* both shown to contain  $\gamma$ -tocopherol and  $\delta$ -tocopherol. *C. japonica* was exceptional by the complete absence of  $\alpha$ -tocopherol.)
- Tájek, P. 2007. (Flora and vegetation of the prepared Nature Reserve Rašeliniště u myslivny.) (in Czech *Erica* (Plzeň) 14: 39-56. (A list of 'most valuable' species includes *Pedicularis sylvatica* and *Thesium alpinum*.)
- Tank, D.C. and Olmstead, R.G. 2008. From annuals to perennials: phylogeny of subtribe Castillejinae (Orobanchaceae). *American Journal of Botany* 95(5): 608-625. (Molecular phylogenetic analysis confirms existing genera and suggests perennality arose just once within the group.)
- Tamokou, J.D., Kuate, J.R., Njateng, G.S.S., Simo, D.J.M., Njouendou, A.J., Tane, P. and Zollo, P.H.A. 2008. Antimicrobial activity of dichloromethane-methanol (1:1 v/v) extract from the stem bark of *Coula edulis* Bail. (Olacaceae). *Research Journal of Microbiology* 3(6): 414-422. (Confirming antibacterial and anti-fungal activities which justify the traditional use of this plant in Cameroon for the treatment of infectious diseases.)
- Tang Ya, Xie JiaSui and Sun Hui 2007. Pollination ecology of *Pedicularis muscoides* H. L. Li subsp. *himalayca* Yamazaki from alpine areas of Western Sichuan, China. Arctic, Antarctic, and Alpine Research 39(3): 481-487. (Exclusively pollinated by queens of 4 bumblebee species over a very short flowering period.)
- Tariq Husain and Priyanka Agnihotri 2007. Taxonomic notes on *Pedicularis* L. series Robustae Prain (Scrophulariaceae). *Journal of Economic and Taxonomic Botany* 31(3): 696-700. (Referring to *P. robusta*, *P. elwesii*, *P. nepalensis* and *P. daltoni*.)
- Tassin, J., Barré, N. and Bouvet, J.M. 2008. Effect of ingestion by *Drepanoptila holosericea* (Columbidae) on the seed germination of *Santalum austrocaledonicum* (Santalaceae). *Journal of Tropical Ecology* 24(2): 215-218. (Germination was enhanced following passage through the bird *D. holosericea*.)
- Thomson, J.A. 2008. The role of biotechnology for agricultural sustainability in Africa. In: Pollock, C., Pretty, J., Crute, I., Leaver, C. and Dalton, H. (eds) *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 363(1492): 905-913. (Referring to use of herbicide-resistant maize for *Striga* control.)
- Tian JiYu and Chen Jianzong 2003. The effects of desertliving cistanche [*Cistanche deserticola*] on the apoptosis of dopaminergic neurons induced by 1-methyl-4-phenylpyridinium (MPP<sup>1</sup>) *Chinese Journal of Information on Traditional Chinese Medicine* 10(11): 19-21.
- Togola, A., Inngjerdingen, M., Diallo, D., Barsett, H., Rolstad, B., Michaelsen, T.E. and Paulsen, B.S. 2008. Polysaccharides with complement fixing and macrophage stimulation activity from *Opilia celtidifolia*, isolation and partial characterisation. *Journal of Ethnopharmacology* 115(3): 423-431. (The leaves of *O. celtidifolia* a medicinal plant in Mali, contain polysaccharides of pectic type that have both complement fixing and macrophage stimulating activity.)
- Tsai TungHu, Wang Guei and Lin LieChwen 2008. Vasorelaxing alkaloids and flavonoids from *Cassytha filiformis*. *Journal of Natural Products* 71(2): 289-291.
- Tusenius, K.J., Spoek, A.M. and van Hattum, J. 2005. Exploratory study on the effects of treatment with two mistletoe preparations on chronic hepatitis C: biochemical and quality of life improvement. *Arzneimittel Forschung* 55(12): 749-753. (Results suggest an improvement of liver inflammation and thus possibly reduction of the long term complications, viz cirrhosis and liver cancer. *V. album* preparations 'have the advantage of easy administration and low cost'.)
- \*Umehara, M., Hanada, A., Yoshida, S., Akiyama, K., Arite, T., Takeda-Kamiya, N., Magome, H., Kamiya, Y., Shirasu, K., Yoneyama, K., Kyoizuka, J. and Yamaguchi, S. 2008. Inhibition of shoot branching by new terpenoid plant hormones. *Nature*.



- <http://dx.doi.org/10.1038/nature07272> (GR24 is shown to reduce branching in dwarf (*d*) rice. The *d*-type rice is also shown to be strigolactone-deficient, stimulating very little *Striga* germination. See also literature highlight above.)
- van Auken, O.W., Grunstra, M. and Brown, S.C. 2007. Composition and structure of a West Texas salt marsh. *Madroño* 54(2): 138-147. (Listing *Agalinis calycina* among minor components of the flora.)
- van Mourick, T.A., Bianchi, F.J.J.A., van der Werf, W. and Stomph, T.J. 2008. Long-term management of *Striga hermonthica*: strategy evaluation with a spatio-temporal model. *Weed Research* 48: 329-339. (Proposing that the model can be used in a participatory learning context with farmers. Also noting that weeding and inter-cropping millet with sesame or cowpea reduced the *Striga* seedbank in the long term, but rotation with trap crops did not.)
- Vanlauwe, B., Kanampiu, F., Odhiambo, G.D., de Groote, H., Wadhams, L.J. and Khan, Z. R. 2008. Integrated management of *Striga hermonthica*, stemborers, and declining soil fertility in western Kenya. *Field Crops Research* 107(2): 102-115. (In a six-season experiment comparing herbicide-resistant maize (with imazapyr-coated seed) with a local variety, each in conjunction with intercropping with *Desmodium uncinatum* or *Phaseolus* bean, or rotation with soyabean or *Crotalaria ochroleuca*, best results were achieved with IR maize plus *Desmodium* followed by local maize plus *Desmodium*.)
- Vidal-Russell, R. and Nickrent, D.L. 2008. Evolutionary relationships in the showy mistletoe family (Loranthaceae). *American Journal of Botany* 95: 1-16. (Combining molecular phylogenetic and fossil studies to confirm five origins of aerial parasitism, first in Misodendraceae ca. 80 million years ago (mya), then in Viscaceae (72 mya), 'Eremolepidaceae' (53 mya), tribe Amphorogyneae in Santalaceae (46 mya), and Loranthaceae (28 mya). In all except Misodendraceae, it appears aerial parasites evolved from ancestors that were polymorphic for either root or stem parasitism - 'amphiphagous')
- Vidal-Russell, R. and Nickrent, D.L. 2007. The biogeographic history of Loranthaceae. *Darwiniana* 45: 52-54. (Divergence Vicariance Analysis (DIVA) was applied to a molecular data set for Loranthaceae and various hypotheses, including those of Barlow (1983), are discussed.)
- Vidal-Russell, R. and D. L. Nickrent. 2007. A molecular phylogeny of the feathery mistletoe *Misodendrum*. *Systematic Botany* 32: 560-568. (Two chloroplast genes and morphological characters were analyzed for nearly all species in the genus and the resulting trees generally agreed with the existing taxonomic classification.)
- Vidal-Russell, R. and D. L. Nickrent. 2008. The first mistletoes: origins of aerial parasitism in Santalales. *Molecular Phylogenetics and Evolution* 47: 523-527. (Two chloroplast genes and morphological characters were analyzed for nearly all species in the genus and the resulting trees generally agreed with the existing taxonomic classification.)
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- Vidal-Russell, R. and Nickrent D. L. 2008. Evolutionary relationships in the showy mistletoe family (Loranthaceae). *American Journal of Botany* 95: 1015-1029. (60 of the 73 genera of Loranthaceae were analyzed using chloroplast and nuclear genes. The molecular phylogeny confirms that *Nuytsia* is sister to the remaining genera and that aerial parasitism arose once in the family).
- Vinogradova, T.N. 2008. Some peculiarities of propagation biology of *Neottia asiatica* (Orchidaceae) from Petropavlovsk-Kamchatsky environs. *Botanicheski Zhurnal* 93(4): 541-552. (*N. asiatica* spreads by seed (over 4000 per shoot) and root suckers. It is an obligate mycosymbiotroph, but mycorrhiza infection is not consistent.)
- Wagner, M.L., Ricco, R.A., Ranea, F.G. and Gurni, A.A. 2007. (Comparative study of phenolic compound in different population of *Phoradendron liga* (Gill.) Eichl. - Viscaceae from Argentina.) (in Spanish) In: Martinez, J.L. and Garcia, J. (eds) *Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas* 6(5): 301-302. (*P. liga* is common in Argentina and is used traditionally as a hypertensive agent. Studies showed levels of flavonoids differed according to locality.)
- Walker, R.E., Fecko, R.M., Frederick, W.B., Johnson, D.W. and Miller, W.W. 2007. Forest health impacts of bark beetles, dwarf mistletoe, and blister rust in a Lake Tahoe Basin mixed conifer stand. *Western North American Naturalist* 67(4): 562-571. (Noting light infestations *Arceuthobium abietinum* in white fir and *A. campylopodum* in Jeffrey pine, less damaging than the bark beetle infestations.)
- Watson, W.T. and Martinez-Trinidad, T. 2006. Strategies and treatments for leafy mistletoe (*Phoradendron tomentosum* (DC.) Engelm ex. Gray) suppression on cedar elm (*Ulmus crassifolia* Nutt.).

- Arboriculture & Urban Forestry 32(6): 265-270. (Regrowth of *P. tomentosum* controlled by removing the branch on which it grew, removing the parasite and caulking over the point of removal, or applying naphthalene acetic acid and black paint after removal.)
- Wilkinson, K.M. 2007. Propagation protocol for 'iliah (Santalum freycinetianum). Native Plants Journal 8(3): 248-251. (Suggestions made for successful propagation of Hawaiian sandalwood.)
- Xia, J., Sun, S.G. and Guo, Y.H. 2007. Honeybees enhance reproduction without affecting the outcrossing rate in endemic *Pedicularis densispica* (Orobanchaceae). Plant Biology 9(6): 713-719. (Introduction of honeybees significantly enhanced reproductive success in *P. densispica* in SW China.)
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- Xie XiaoNan, Yoneyama, K., Kusumoto, D., Yamada, Y., Takeuchi, Y., Sugimoto, Y. and Yoneyama, K. 2008. Sorgomol, germination stimulant for root parasitic plants, produced by *Sorghum bicolor*. Tetrahedron Letters 49(13): 2066-2068. (Describing a new strigolactone, more active on *Striga* than on *Orobanche*. Possibly a precursor in the biosynthesis of sorgolactone.)
- Xie XiaoNan, Yoneyama, K., Kusumoto, D., Yamada, Y., Yokota, T., Takeuchi, Y. and Yoneyama, K. 2008. Isolation and identification of alectrol as (+)-orobanchyl acetate, a germination stimulant for root parasitic plants. Phytochemistry 69(2): 427-431. (Describing the purification of (+)-orobanchyl acetate from exudates of *Trifolium pratense* and its presence also in those from cowpea and soyabean.)
- Winkler, K., Jäger, S., Lenewit, G. and Schubert, R. 2008. Interactions of viscotoxins with vesicles of genuine plant membranes. Planta Medica: 74(2): 163-167.
- Yang ChongJun, Zhang XiuSheng and Zhang ZhiKun 2007. Effect of acetylcholine on seed germination and endogenous IAA and ABA contents of *Cistanche tubulosa*. Plant Physiology Communications 43(2): 295-297. (Germination of *C. tubulosa* accelerated by 1.0-3.0 mmol/litre acetylcholine.)
- \*Yatskiyevych, G., Jiménez, C. and Luis, J. 2008 A new genus of holoparasitic Orobanchaceae endemic to Guerrero, Mexico. Presented at Botany without Borders, July 26 – 30, 2008, University of British Columbia, Vancouver BC  
<http://www.botanyconference.org/engine/search/ind ex.php?func=detail&aid=594>) (This new achlorophyllous species is parasitic on the roots of the tree *Hedyosmum mexicanum* (Chloranthaceae), distinguished from other Orobanchaceae by 1) strongly 5-ribbed ovary and fruit; 2) production of 5 parietal placentae; 3) unusual anthers in which the pollen sacs are more or less embedded in the expanded filament apex; 4) regularly pantohexaporate pollen grains.)
- Ye Guan, Peng Hua, MingSong and Huang ChengGang 2007. A new hopane triterpene from *Dipentodon sinicus* (Celastraceae). Biochemical Systematics and Ecology 35(12): 905-908. (Should read Dipentadonaceae?)
- Ye WenHui, Nanga, R.P.R., Kang CongBao, Song JooHye, Song SeongKyu and Yoon HoSup 2006. Molecular characterization of the recombinant A-chain of a type II ribosome-inactivating protein (RIP) from *Viscum album coloratum* and structural basis on its ribosome-inactivating activity and the sugar-binding properties of the B-chain. Journal of Biochemistry and Molecular Biology 39(5): 560-570.
- Yen FengLin, Wu TzuHui, Lin LiangTzung, Cham ChauMing and Lin ChunChing 2008. Nanoparticles formulation of *Cuscuta chinensis* prevents acetaminophen-induced hepatotoxicity in rats. Food and Chemical Toxicology 46(5): 1771-1777. (Showing that a nanoparticle formulation of *C. chinensis* extract substantially increased hepatoprotective effect in rats.)
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- parasites. *Planta* 227(1): 125-132. (The parasite being *Striga hermonthica*. Results contrast with those with *Trifolium pratense* in which only P deficiency increases stimulant.)
- Yu WenBin and Wang Hong 2008. Pollen morphology of *Pedicularis* sect. *Cyathophora*, a group endemic to the eastern Himalaya-Hengduan Mountains region. *Journal of Integrative Plant Biology* 50(2): 244-252.
- Yu WenBin, Zhang ShuDong and Wang Hong 2008. New taxa of *Pedicularis* (Scrophulariaceae) from the Hengduan Mountains, Southwestern China. *Novon* 18(1): 25-129. (Describing *P. gyrorhyncha* ssp. *glabrisepala* and *P. siphoantha* var. *stictochila*.)
- Yuan ChengShan, Sun XiaoBai, Zhao PeiHua and Cao MeiAi 2007. Antibacterial constituents from *Pedicularis armata*. *Journal of Asian Natural Products Research* 96/8: 673-677. (8-epi-loganic acid and aucubin exhibited strong antibacterial activities against *E. coli* and *S. aureus* respectively.)
- Yuan QingJun, Zhang ZhiYong, Peng Hua and Ge Song 2008. Chloroplast phylogeography of *Dipentodon* (Dipentodontaceae) in southwest China and northern Vietnam. *Molecular Ecology* 17(4): 1054-1065. (A detailed genetic analysis of *D. longipedicellatus* and *D. sinicus* on the southern Tibetan plateau, throwing doubt on the justification for recognising the two separate species.)
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- Zaidi, M.A., Huda, A. and Crow, S.A. Jr. 2008. Biological activity and elemental composition of *Arceuthobium oxycedri* (dwarf mistletoe) of juniper forest of Pakistan. *Acta Botanica Hungarica* 50(1/2): 223-230. (Extracts of *A. oxycedri*, a serious threat to the medicinal plant *Juniperus excelsa*, was shown to have activity against several bacteria and the fungus *Candida albicans*.)
- Zhang ZhanXin, Xie WeiDong and Jia ZhongJian 2008. Glycosides from two *Pedicularis* species. *Biochemical Systematics and Ecology* 36(5/6): 467-472. (Reporting the isolation of glycosides of potential chemotaxonomic significance from *P. kansuensis* and *P. resupinata* ssp. *lasiophylla*.)
- Zhao RenYou, Wang MingYue, Xu ZhenWang, Cheng RongLiang, Zhu ZhenXin and Ye YuZhu 2006. Forest injurious plants and their control in Lishui City of Zhejiang Province. *Journal of Zhejiang Forestry College* 23(6): 625-628. (39 species of injurious plants include 8 Lorantheaceae.)
- Zhao YunLi, Wang XiaoYing, Zhao YingChun, Gao XiaoXia, Bi KaiShun and Yu ZhiGuo 2007. HPLC determination and pharmacokinetic study of homoeriodictyol-7-O- $\beta$ -D-glucopyranoside in rat plasma and tissues. *Biological & Pharmaceutical Bulletin* 30(4): 617-620. (Studies relating to homoeriodictyol-7-O- $\beta$ -D-glucopyranoside isolated from *Viscum coloratum*.)
- Zhou YuBi, Ye RunRong, Lu XueFeng, Liu Yang and Peng Min 2007. Effect of BSA on RAPD analysis of *Cynomorium songaricum*. *Agricultural Science & Technology – Hunan* 8(3/4): 64-67.
- Zimmer, K., Meyer, C. and Gebauer, G. 2008. The ectomycorrhizal specialist orchid *Corallorhiza trifida* is a partial myco-heterotroph. *New Phytologist* 178(2): 395-400. (Nitrogen isotope studies confirm that *C. trifida* derives only about 50% of its N and 77% of its C from companion fungi and is therefore only partially mycoheterotrophic.)

### HAUSTORIUM 53

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