

HAUSTORIUM

Parasitic Plants Newsletter

Official Organ of the International Parasitic Plant Society

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IPPS TO ELECT NEW OFFICERS

The time has come to elect a new set of officers for the International Parasitic Plants Society. The term of service for officers is four years, and we are soon approaching the fourth anniversary of the inauguration of IPPS, which took place during the 7th International Parasitic Plant Symposium in Nantes, France. The new group of leaders will continue the work of advancing the Society, decide on all activities of the Society, and coordinate the next symposium and workshops. Elected positions are President, Vice President, Secretary, Treasurer, and two Members at Large.

Three members of the current Executive Committee volunteered as members of the Election Committee: Patrick Thalouarn, Gbèhounou Gualbert, and Jos Verkleij. Patrick Thalouarn, who is currently the Vice President of the IPPS agreed to serve as Chair of the Election Committee.

All members of the IPPS will receive a nomination form by email in early 2005. Then an electronic ballot will be sent to the members. Please begin thinking about who you would like to nominate and whether you would consider serving if nominated.

The IPPS extends its best wishes to all researchers of parasitic plants: let us hope that 2005 will be a fruitful year with breakthroughs in the understanding of key issues concerning the parasitic syndrome in plants, and with the introduction of new methods for an effective management of parasitic weeds.

Danny Joel
IPPS Secretary

ERRATA

We regret to note two errors in Haustorium 45 (partially corrected on the web-site version).

1. the date should of course have read August 2004 not 2005
2. the list of papers noted under the COST meeting in Nicosia, Cyprus (not Cypress!) was a repetition of those presented to the Rome meeting. The correct list of papers is included below.

Our apologies to those confused.

AFTER THE BOOK – PROGRESS IN PARASITIC PLANT RESEARCH SINCE KUIJT'S 'BIOLOGY OF PARASITIC FLOWERING PLANTS' - OVERVIEW OF A SYMPOSIUM JULY/AUGUST 2004

This symposium was held at Botany 2004 - the joint annual meeting of the American Bryological and Lichenological Society (ABLS), the American Fern Society (AFS), the American Society of Plant Taxonomists (ASPT), and the Botanical Society of America (BSA) held from July 31 to August 5 in Snowbird, Utah.

The symposium was presided over by Lytton Musselman and Daniel Nickrent and sponsored by the Tropical Botany and Systematics sections of BSA and Old Dominion University. It was dedicated to Job Kuijt's seminal publication, *The Biology of Parasitic Flowering Plants* (1969), a volume that has indisputably influenced a generation (or two) of botanists. Current research was presented in twelve papers encompassing the ecology, systematics, and anatomy of parasitic plants. In addition to the symposium, five

presentations on parasitic plants were given in other paper sessions at the meeting. The following is a brief overview of all pertinent papers presented at Snowbird, with the senior author in each case indicated in brackets.

The opening presentation by Lytton Musselman discussed the impact of Kuijt's book on plant sciences and reviewed progress of research since its publication. Musselman emphasized the disparity between research progress and the lack of positive change for the poorest world citizens suffering from parasitic plants.

Job Kuijt spoke kindly about the recognition of his efforts, the motivation for his book, and without approbation, the current emphasis on molecular systematics at the expense of descriptive work. David Lye introduced their joint paper giving information about the complex organization of *Arceuthobium* tissues in undifferentiated *Psuedotsuga* apical buds (Kuijt).

Symposium papers on Orobanchaceae included phylogenetic analyses that compared the generic relationships within the family using ITS sequence data (Wolfe); the Orobanchaceae as a model for the molecular evolution of a gene (PHYA) encoding for phytochrome (Bennett); the use of transgenic host plants engineered for hypersensitive response to parasitism by *Orobanche* (Westwood); and a helpful review of parasite-host interactions for root hemiparasites in a community assembly and ecophysiological framework by Malcolm Press. In the regular paper sessions, species relationships in *Hyobanche* complexes were resolved using ISSR markers and correlated with biogeographic patterns of morphology (Wolfe).

A convincing argument was made for the photosynthetic potential of *Cuscuta* using natural history observations and molecular data that included the sequences of entire chloroplast genomes of two *Cuscuta* species (McNeal). *Dactylanthus taylorii* (Balanophoraceae), a New Zealand endemic, faces a variety of conservation issues, primarily introduced rodents, while its intriguing basic biology is just beginning to be understood (Holzapfel). New information regarding the pollination biology of *Hydnora* was presented and a potential cryptic species was identified using ISSR markers (Maass).

Phylogenetic and biogeographic relationships within the Santalaceae were elucidated with sequence data from multiple gene regions (rDNA,

rbcL, and matK), and strong support for several monophyletic clades were discussed (Nickrent). In the paper sessions evidence for the Australian origin of *Santalum* and the affiliations of Hawaiian and other Pacific island taxa are discussed using ITS sequence data (Harbaugh). An 80 million year biogeographic history of the Olacaceae was described using molecular, morphological, and fossil data (Malécot). Relationships within the Rafflesiales were discussed in light of horizontal gene transfer events, questioning the utility of mitochondrial sequences as phylogenetic markers (Blarer).

In the regular paper sessions of the symposium, the queen of the plant parasite world, *Rafflesia*, was placed in the Malpighiales using phylogenetic analyses of the mitochondrial gene matR (Barkman); a novel vector of horizontal gene transfer in angiosperms was presented with evidence for multiple origins of parasitism using three mitochondrial genes (Barkman); and the patterns of character divergence and convergence were shown in canopy dwelling Loranthaceae (Wilson).

The proceedings of this meeting will not be published but a list of relevant titles is included below and abstracts may be found on: <http://www.2004.botanyconference.org/>. or on <http://www.science.siu.edu/parasitic-plants/Meetings/BotSoc2004.html>

Jay F. Bolin
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- Barkman, T.J. *et al.* - Mitochondrial DNA suggests 12 origins of parasitism in angiosperms and implicates parasitic plants as vectors of horizontal gene transfer.
- Barkman, T.J. *et al.* Phylogenetic analysis reveals the photosynthetic relatives of *Rafflesia*, the world's largest flower.
- Bennett, J. and Mathews, S. - Phytochrome evolution in Orobanchaceae.
- Blarer, A. *et al.* - Rafflesiales – problems and advances in research.
- Holzapfel, A.S. - Biology and Conservation of the New Zealand endemic parasitic plant *Dactylanthus taylorii* Hook f. (Balanophoraceae).
- Kuijt, J and Lye, D. - The return of the isophasic filaments – the early *Arceuthobium* endophyte.
- Maass, E. *et al.* - *Hydnora* - the ingenious genus.

- Malécot, V. - Biogeography of Olacaceae - paleobotanical and phylogenetic congruence.
- McNeal, J.R. *et al.* - Evidence for photosynthetic potential across the parasitic plant genus *Cuscuta* using complete plastid genome sequences.
- Musselman, L.J. - Parasitic weeds in world agriculture—the best of times, the worst of times.
- Nickrent, D. and Der, J. - Santalaceae: phylogeny, taxonomy, and biogeography.
- Press, M.C. - Physiological traits of root hemiparasitic Orobanchaceae (ex-Scrophulariaceae): implications for community structure and function.
- Sherman, T.D and Vaughn, K.C. - An ultrastructural overview of adaptations that make dodders (*Cuscuta* spp.) efficient parasites.
- Westwood, J. - Molecular biology of parasitism in *Orobanche*.
- Wilson, C.A. and Calvin, C.L. - Character divergences and convergences in canopy dwelling Loranthaceae.
- Wolfe, A. *et al.* - Phylogeny and biogeography of Orobanchaceae.
- Wolfe, A.D. and Arguedas, N. - Patterns of evolution in *Hyobanche* L. (Orobanchaceae), part II.

A MISTLETOE (*SCURRULA PULVERULENTA*) AND AN UNUSUAL HOST PLANT (*ARAUJIA SERICIFERA*)

Araujia sericifera (Asclepiadaceae), cruel plant, is a liana native to Brazil reported as naturalized in western Europe. I have seen its normally developed fruits and seeds only three times: about 1970 in the Hanbury Botanic Gardens (Italy), about 1990 in hedges of a motor-way not far from Milan (Italy) and last year in an orchard in the mountains of Riviera Ligure west of Genoa (Italy). In all three places the climate is Mediterranean with occasional frosts in winter and warm, dry summer. The mistletoe *Scurrula pulverulenta* was introduced about 1980 into Europe using fresh berries received from Shillong (Eastern India). It is said to be native in Kashmir and acclimatized in the Hanbury Gardens on *Citrus* hosts. I am studying a plant of *S. pulverulenta* derived from a seed I placed on the stem of *A. sericifera*. The hemiparasite was able to grow to a size of about 50 cm in spite of the very thin stem of the host (only 1.5 cm at 1 m above soil level) where it germinated. I expected a reduced growth, flowering and fruiting of the host-plant, but in September 2004 it was full of flowers in the upper part (about 4 m high) with about 15 nearly

ripe fruits. There were several seedlings of *A. sericifera* climbing up in different parts of the orchard, thus confirming that the seeds of last year have germinated regularly and successfully. I will monitor both plants and eventually try the germination of another mistletoe on the host because that epiparasitism might lead to a better understanding of the relationship between host and parasite.

G. Grazi.

PROMOTION OF GREEN MANURING TO COMBAT *STRIGA* IN TANZANIA

Continuous production of maize, sorghum or upland rice without using manure or fertilisers has led to a decline in soil fertility and a build up of *Striga asiatica* in many areas of Tanzania. Rice yields for example have fallen by between 30 and 70% over the past 20 years as *Striga* levels have increased. Farmers harvest little more than 300 kg ha⁻¹ from severely infested fields. There is strong market demand for quality aromatic rice so farmers in affected areas, including Kyela district in the southern highlands and Matombo district in the Ulugulu mountains of Morogoro region, are keen to reverse the decline in yield. Farmer groups in Kyela participating in a project funded by the UK DFID Crop Protection Programme learned from on-farm trials with urea fertiliser that *Striga* is an indicator of low soil fertility. Prior to working with the project the farmers had little knowledge of *Striga* other than observing that it is found in fields where cereal crops grow poorly. Yields of rice were increased by 40% with an associated 60% reduction in *Striga* infestation when fertiliser was applied. However lack of cash at the beginning of the season and limited availability discourages farmers from buying inorganic fertilisers. Subsequently the project introduced the idea of a legume-rice rotation to farmers in two villages in Kyela to provide a low-cost locally sustainable alternative. Since October 2002 rotation of rice with the green manure 'marejea' (*Crotalaria ochroleuca*) or the pulse pigeon pea has been promoted by extension officers in Kyela and has also been introduced to communities in Matombo. Initially extension and research staff organised farmer field days at sites in the two villages where use of *C. ochroleuca* and an improved high yielding cultivar of pigeon pea were introduced, and arranged farmer exchange visits with farmers from other villages. The process of farmer evaluation of green manure, initiated by researchers, became farmer driven. By 2004 the

rotations had been implemented at well over 100 sites and demand for seed has risen so that by 2005 both legumes will be in use across 16 villages. Promotion work is also being undertaken with village primary school teachers in both districts to spread knowledge of the cereal/legume rotations through agricultural science classes and school demonstration plots.

C. ochroleuca biomass contains approximately 3.5% N in shoots and 1.3% in root so with dry matter yields of 3 to 4 t ha⁻¹ significant levels of nutrient are available to subsequent crops. The green manure also acts to reduce the *Striga* seed bank because it produces germination stimulant in its root exudates: in laboratory tests, exudates from 10 day old seedlings stimulated 34% germination of *S. asiatica* compared to 57% stimulated by maize root exudates. Results from up-scaling the legume-rice rotations to farmer management are promising and increasing adoption is taking place. Rice yields on 15 farms in Kyela in 2003, where *C. ochroleuca* was grown the previous year, averaged 2408 kg ha⁻¹ compared 1042 kg ha⁻¹ under continuous rice, with associated reductions in *Striga* infestation. In 2004 farmer's rice yields across sites in five villages were again on average more than 100% higher following *C. ochroleuca* or pigeon pea than on plots in continuous cereal production. An additional significant advantage of using *C. ochroleuca* is that it suppresses weeds. Most farmers do not find it necessary to weed the green manure itself and have weeded subsequent rice crops only once, compared to the two to three hand weedings needed in continuous rice, representing a considerable saving of labour. *C. ochroleuca*, provides a low cost, locally sustainable approach to soil fertility and hence *Striga* management. Growers can use farm-saved seed and are now passing on supplies to neighbours and selling seed to farmers in the wider community. One group in Kyela is setting up a shop to provide an outlet for the seed and to encourage greater adoption.

A.M. Mbwaga, Ilonga Agricultural Research Institute, Tanzania.

C. R. Riches, Natural Resources Institute, University of Greenwich, UK.

STUDIES ON *HYDNORA*

Among activities on parasitic plants in the Department of Biological Sciences at Old Dominion University, Norfolk, USA, Dr Kushan Tennakoon has joined Lytton Musselman from Sri

Lanka for a sabbatical period to study the functional attributes of the genus *Hydnora*. This is a group of rare parasitic angiosperms growing on the roots of *Euphorbia* and *Acacia* species in southern Africa, some parts of the Arabian peninsula and Madagascar. Due to its furtive nature this genus is poorly studied and the new investigations include studies of the anatomy of *H. triceps* and *H. africana* and their haustorial structure, using light and electron microscopy, and of the factors governing the movement of assimilates from the hosts to the parasite.

TAXONOMY OF BALANOPHORACEAE IN BRAZIL

A study is in progress at the Botanical Gardens Research Institute in Rio de Janeiro on a revision of the taxonomy of the Balanophoraceae, including the genera *Langsdorffia*, *Ombrophytum*, *Lathrophytum*, *Scybalium*, *Lophophytum* and *Helosis* in Brazil. The scientists involved would welcome any assistance that readers of *Haustorium* can provide in the form of information on herbarium collections and duplicate herbarium specimens from other parts of the world, photographs, literature, etc. Any help or advice should please be passed to Dr Leandro Cardoso, Instituto de Pesquisas, Jardim Botânico do Rio de Janeiro, Rua Pacheco Leão, 915, Rio de Janeiro CEP 22460-030, Brazil.
email: leandrocardoso@msn.com
(With thanks to Jan Bartlett for translation.)

BECA LAUNCHED IN NAIROBI

The Biosciences Eastern and Central Africa (BECA) was officially launched in Nairobi, Kenya by the country's Agriculture Minister Kipruto arap Kirwa. The Minister reiterated the country's support for the use of science and technology to increase food production.

BECA consists of a network of institutional nodes and a hub, located at the International Livestock Research Institute, in Nairobi, Kenya. The hub provides a common biosciences research platform, research-related services, and capacity building and training linked to a network of laboratories, universities and other institutions throughout eastern and central Africa. Prof. James Ochanda, BECA Coordinator, said the facility offers a unique opportunity for African scientists to access state-of-the-art biosciences laboratory facilities and training

to develop technological innovations to help relieve hunger in Africa.

Minister Kipruto arap Kirwa called for rapid adoption of new agricultural technologies to help in the fight against *Striga* weed and stem borer whose damage to maize is said to cost sub-Saharan Africa up to US \$ 7 billion and US\$ 90 million annually, respectively. He said Kenya would increase investment in agricultural research in general to meet the challenges of food requirements. He commended NEPAD for striving to harness science and technology for Africa's sustainable development.

Following a NEPAD request, Canada pledged C\$30 million of the Canada Fund for Africa to support the facility. The Fund has so far released C\$4.5 million to support the planning and design phase of BECA.

For more information contact Daniel Otunge of the Kenya Biotechnology Information Center at dotunge@absf africa.org

(From Crop Biotech Update December 10, 2004)

OBITUARY – ROBERT J. CARSKY
20 April 1955 – 6 November 2004

His colleagues at IITA and WARDA have reported with sadness that in the recent turmoil in Côte d'Ivoire, Bob Carsky was tragically killed when a bomb struck the French school in Bouaké where he was sheltering. Bob, an American citizen, had worked for IITA and more recently for WARDA over a period of 15 years as an agronomist, working closely with and for local farmers. His studies had included intensive field work on *Striga*. To quote a long-time colleague, Dr Christian Noble, 'He constantly adapted his approach to work on solutions for those agricultural problems that haunted farmers most.' He left a wife and three children in the US. He will be sorely missed.

THE MAILING LIST

The current circulation of *Haustorium* is approximately 360, about 220 by email and 140 by airmail. We are always seeking to reduce mailing costs (which are at present kindly borne by Old Dominion University) and any readers receiving this as hard copy who are prepared to receive by email are asked to contact Chris Parker accordingly. Those already receiving by email are asked to

advise any change of address. Meanwhile, contact has been lost with the following:

Dr Dana Berner in USA
Dr Pavol Elias in Slovakia
Dr Govind Khattri in Nepal
Dr H.C. Lakshmi in Karnataka, India
Mr Kaddour Saffour in Morocco
Dr A. Zemrag in Morocco
Dr Sevda Atanasova, lately in The Netherlands
Dr Awad Farah in Saudi Arabia (or Sudan?)
Dr Are Rogler in Norway

If anyone can help us re-establish contact with any of these individuals it will be appreciated by all concerned.

IUFRO WORLD CONGRESS

The World Congress of the International Union of Forestry Research Organizations, to be held in Brisbane, Australia from August 8-13, 2005, will include a session on 'Stem and shoot fungal pathogens and parasitic plants: the value of biological diversity'.

For any further detail contact Simon Shamoun sshamoun@nr can.gc.ca

**COST 849 - PARASITIC PLANT
MANAGEMENT IN SUSTAINABLE
AGRICULTURE**

This programme, funded by European Union via European Science Foundation, has been able to arrange an increased number of meetings in 2004. Most recently there have been meetings in Wageningen, Bucharest, Naples and Cordoba. The programmes, abstracts and/or reports of these meetings are on the COST849 web-site (<http://cost849.ba.cnr.it/>) or will be added in due course. More details appear below, together with lists of paper presented and the corrected list of papers presented at the meeting in Nicosia in May.

COST 849 MEETINGS

Herbicide testing for control of broomrape held in Nicosia, Cypress, 13-15 May, 2004. The corrected list of papers presented at this meeting is as follows:

Reuven Jacobsohn - Potential activities to be promoted on herbicide testing for broomrape control.

Diego Rubiales - *Orobanch* spp. problem in Europe. Perspectives for cooperative actions in the frame of COST 849.

Nicos Vouzounis - Broomrape problem and its chemical control in Cyprus.

Salvador Nadal - The status of broomrape and its control in Spain.

Joseph Hershenhorn - Control of *Orobanch* *aegyptiaca* in tomatoes using sulfosulfuron.

Maria Chrysayi-Tokousbalides - Broomrape problem in Greece. Strategies of control.

Mechanisms of susceptibility and resistance in parasitic angiosperm-host symbioses: a comparative approach held in Wageningen, The Netherlands, 13-15 October, 2004. Papers presented and discussed were:

John Yoder - Haustorial signalling and development: *Triphysaria* as a model.

Danny Joel - Structural development of haustoria in *Orobanch*.

Malcolm Press - Haustorial structure/function relations.

Radoslava Matusova - Biosynthesis of germination cues.

Sissy Lyra - Induction of *Orobanch* seed germination by stimulants.

Eliane Dumas-Gaudot - Plant-mycorrhizas interaction.

Hans Helder - Plant-nematode interactions.

René Geurts - Legume/rhizobia interactions.

Philippe Délavault - Early molecular responses of host and non host roots infected by *Orobanch* spp.

Ana Maria Maldonado - Proteomics as a high throughput global approach to understand parasitic angiosperm-host symbioses cues.

Patricia Letousey - Molecular events in resistant and susceptible sunflowers infested by *O. cumana*.

Sun Zhongkui - *Arabidopsis* as a model to study germination stimulant formation.

Patrick Thalouarn - Comparison of host root responses to *Orobanch* spp and other pathogens.

Alex Levine - The role of active oxygen species in *Orobanch* infection.

Julie Scholes - Host resistance in rice

Bob Vasey - Non-host resistance in *Arabidopsis*.

Maurizio Vurro - Natural compounds: tools to defend host plants from parasite aggression

Maria Pacureanu - Sunflower resistance.

Use of natural compounds for parasitic plant management held in Naples, Italy, 29-31 October, 2004. Papers presented and discussed were:

Anna Andolfi *et al.* - Plant and fungal bioactive metabolites as stimulants for germination of *Orobanch* *ramosa* seeds.

Anna Andolfi *et al.* - Fungal toxins in the control of the parasitic weed *Orobanch* *ramosa*.

Harro Bouwmeester *et al.* Manipulation of germination stimulants for control.

Maria Chrysayi-Tokousbalides and Konstantinos Aliferis - Studying the mode of action of fungal phytotoxins.

E. Dor and J. Hershenhorn - Metabolite from *Inula viscosa* is toxic to dodder (*Cuscuta campestris*)

Stephen Duke and Jim Westwood - The potential for genetically engineering natural phytotoxins into crops for parasitic weed resistance.

Garifalia Economou *et al.* - Germination response of *Orobanch* populations to GR24 and to a new natural product.

J. Hershenhorn *et al.* - *Fusarium moniliforme* as a new pathogen of parasitic plant *Orobanch* *spp.*

Francisco Macías *et al.* - New chemical clues for sunflower-broomrape host-recognition.

Alice Nielsen and Jens Streibig - Root exudates from sorghum responsible for *Striga hermonthica* (Del.) Benth. germination.

A. Pérez-de-Luque *et al.* - Induction of systemic resistance in pea and faba bean to crenate broomrape (*Orobanch* *crenata*) by exogenous application of benzothiadiazole.

Peter Tóth and Ludovít Cagán - Possible role of secondary metabolites emitted by parasitic weeds in attraction of insects.

Maurizio Vurro and Angela Boari - Natural compounds: weapons against parasitic plant aggression.

Klaus Wegmann - Search for inhibitors of the exoenzymes of the *Orobanch* radicle.

Nadjia Zermane - Secondary metabolites of rhizobacteria and perspectives of their use for biocontrol of *Orobanch* *spp.*

Binne Zwanenburg - The quest for natural germination stimulants. A critical account on the structure and chemistry of compounds with claimed germinating activity.

Breeding for *Orobanch* resistance in sunflower held in Bucharest, Romania, 4-8 November, 2004. Papers presented and discussed were:

Breeding methodologies:

B. Pérez - Sources of broomrape resistance in sunflower.

Skoric - Transferring resistance traits from wild *Helianthus* species.
 CC Jan - Developing germplasm pools having wild *Helianthus* genes in domestic background.
 Christov - Broomrape resistance in interspecific hybrids of sunflower.
 R. Batchvarova - The use of mutagens.
Genetic mapping:
 Patrick Thalouarn - Sunflower amphiploids and genetic diversity for broomrape resistance.
 B. Perez-Vich - Mapping broomrape resistance in sunflower.
 André Bervillé - Marker-assisted selection in sunflower resistance breeding.
 Z. Satovic - Mapping broomrape resistance in faba bean.
 Haussmann - Marker assisted breeding for *Striga* resistance in sorghum.
Breeding lines for broomrape resistance:
 Pacureanu Joita – Breeding lines for broomrape resistance in Romania.
 Kotoula-Syka – ditto in Greece.
 B. Pérez-Vich – ditto in Spain.
 Shindrova – ditto in Bulgaria.
 Kitain – ditto in Israel.
 Skoric – ditto in Serbia and Montenegro.
Resistance Mechanisms:
 Thalouarn - Resistance mechanisms in sunflower.
 Wegmann - Manipulation of germination stimulants.
 Boumeester - Manipulation of stimulant biosynthesis.
 Rubiales - Broomrape resistance in legume species.
*Race Differentiation in *Orobanche cumana*:*
 Joel - How can a farmer identify the race in a field?
 Melero - *O. cumana* race differentiation in Spain.
 Pacureanu-Joita - ditto in Romania.
 Kitain - ditto in Israel.
 Batchvarova – ditto in Bulgaria.
 Economou - ditto in Greece.
 L. Moliner - Diversity within populations of *O. cumana*.

Management of parasitic weeds held in Cordoba, Spain, 18-20 November, 2004. Papers presented and discussed were:

Robert Bulcke - Parasitic weeds - distribution and strategies of control in Belgium.
 Henry Darmency – ditto in France.
 Klaus Wegmann – ditto in Germany.
 Pasquale Montemurro - ditto in Italy.
 Nikos Vouzounis – ditto in Cyprus.
 G. Economou – ditto in Greece.
 Goran Malidza – ditto in Serbia.

Hanan Eizenberg – ditto in Israel.
 Hanan Eizenberg - Modelling parasite development - a predictive tool for timing herbicide applications.
 Svend Christiansen - How precision farming can be applied for parasitic weed management?
 Yaacob Goldwasser - Management of *Cuscuta campestris* in tomato.
 Alistair J. Murdoch - Linking laboratory and field studies of dormancy in parasitic plants: When is delayed planting an option for integrated control?
 A. Pérez-de-Luque - Sowing date, chemical control and host resistance: effect on establishment and development of *O. crenata* in faba bean.
 D. Rubiales - Integrated control of broomrape in pea.
 C. García-Galindo - Natural products and allelopathy for parasitic weeds management.
 Jesús Jorrín - Molecular approximation for the control of broomrape.
 Rafael De Prado - Herbicide resistance – mechanisms and global overview.
 Baruch Rubin - Risk of herbicide-resistance evolution in parasitic weeds.
 Giovanni Dinelli - The use of molecular markers for the study of weed populations.
 Goran Malidza - Control of broomrape in imidazolinone-tolerant sunflower hybrids.
 Eleni Kotoula - Glyphosate for broomrape control in solanaceous crops.
*Regional Project – assessment of *Orobanche* development model as a tool for *Orobanche* management:*
 Hanan Eizenberg - Introduction and overview.
 Hanan Eizenberg - Practice of processing tomato cropping in Israel.
 Falia Economou.- ditto in Greece.
 Nikos Vouzounis.- ditto in Cyprus.
 Pasquale Montemurro – ditto in Italy.
 Hanan Eizenberg - Degree days- a predictive tool for *Orobanche* development in certain crops.

THESIS

Brenda J. Grewell (PhD, University of California, Davis, USA, September 2004)
Species diversity in Northern California salt marshes: functional significance of parasitic plant interactions.

I studied how parasitic plant interactions contribute to species coexistence in tidal wetlands of northern California. First, I address the effects of the native parasite *Cuscuta salina* on species interactions and

plant community structure. I showed that *Cuscuta* is restricted to nutrient poor areas with significant canopy gaps and high species diversity. I examined timing, level, and frequency of host infectivity and identified *Plantago maritima* as the primary host. I experimentally removed *Cuscuta* from the community and measured host fitness, rare plant fitness, and plant community response. *Cuscuta* reduction of host biomass and reproductive effort resulted in indirect positive effects on a rare hemiparasite, *Cordylanthus mollis*, and enhanced plant community diversity.

Then I present results demonstrating how parasitic plant – host interactions ameliorate physical stress conditions and generate environmental heterogeneity. Experimental bare plots, artificially shaded bare plots, and parasite removal plots across intertidal elevations were compared to controls with hemiparasites (*Cordylanthus mollis* and *Cordylanthus maritimus* ssp. *palustris*) at two coastal California sites representing a steep environmental stress gradient. Over three years, plant species richness was enhanced with parasites at both locations. Parasitic plants improve sediment salinity and redox potential, and parasite-generated habitat heterogeneity contributes to species coexistence.

Lastly, I present results of an experimental reintroduction of an endangered hemiparasite (*Cordylanthus mollis*) to a restoration site in the Suisun Marsh of the San Francisco Estuary, California. I tested disturbance management methods for enhancement of plant establishment and fitness. I identified critical life stages and used failure time survival analysis models for a demographic comparison of restoration and reference populations. I demonstrate that successful restoration requires a unique, productive host community to support the introduced parasite load. Disturbance-gap creation is a successful restoration technique that will enhance rare plant establishment and fitness, but benefits can be offset by exotic plant invasions. Applied conservation significance of the study points to a critical need for regional invasive plant control as the first step in restoration efforts.

Overall, my dissertation clarifies the functional role of parasitic plants within mid-Pacific Coast salt marshes of North America. Results demonstrate that preferential parasitism, spatial contingency of species interactions, and creation of habitat heterogeneity through parasitic amelioration of physiological stress conditions all play a role in

supporting coexistence within the salt marsh community.

CD-ROM

CABI Crop Protection Compendium 2004 Edition. This latest edition has been comprehensively updated with the addition of over 300 new datasheets (now totalling 2100 pests, diseases, weeds and natural enemies), new search facilities, a new LUCID key to 425 weeds, and new library documents. Parasitic weed species having fully illustrated datasheets with distribution maps, host range, biology, ecology, control methods etc include *Alectra vogelii*, ten *Arceuthobium* spp., four *Cuscuta* spp., five *Orobanche* spp. and six *Striga* species.

The Compendium is available to individuals either as a one-off CD-ROM, or in the form of internet access (annually) for £70 (US\$100) via CABI in UK (orders@cabi.org) or in USA (cabinao@cabi.org) or via the web-site (www.cabicompendium.org/cpc)

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE

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

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

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

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

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

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

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

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

LITERATURE

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