

# HAUSTORIUM

## *Parasitic Plants Newsletter*

### Official Organ of the International Parasitic Seed Plant Research Group

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#### STATUS OF HAUSTORIUM

Our banner still refers to the International Parasitic Seed Plant Research Group, but since the meeting in Nantes and creation of the new International Parasitic Plant Society (IPPS) we expect this newsletter in due course to become an organ of that new society. Discussions are in progress with the officers of IPPS but for the meantime we continue to function on behalf of the old 'Research Group', while adding all members of IPPS to our mailing list.

We are pleased to acknowledge that Old Dominion University is continuing to support the printing and mailing of *Haustorium*.

Many readers are already receiving *Haustorium* by Email. If any more of you wish to do so, please let Chris Parker know (Email address on the last page). Bear in mind that having an electronic version of the newsletter enables you to 'search'. If you cannot receive Email, or for any reason wish to go on receiving hard copy, you will continue to receive by airmail.

The web-site version of this issue and past numbers of *Haustorium* are now available on <http://web.odu.edu/haustorium>, and on the IPPS site – see Websites below.

#### 7<sup>TH</sup> INTERNATIONAL PARASITIC WEED SYMPOSIUM

The 7<sup>th</sup> International Parasitic Weed Symposium was held in Nantes, France from 5-8 June and proved a worthy successor to its distinguished

forerunners. Over 130 delegates from 25 countries met in the Faculté des Sciences of Nantes University and enjoyed 4 days of presentations in excellent facilities. Over 100 papers were delivered requiring the novelty of concurrent sessions. This was a problem for some of us generalists in the subject, but was eased by most platform papers being supported by posters. The coverage of the papers was 50% on *Orobanche*, 34% on *Striga*, 6% on *Cuscuta* and 10% on others.

Several of the sessions on Biology, Ecology, Evolution, Taxonomy and Phylogeny and a later one on Methodologies were dominated by the new technologies available for studying the more basic aspects of parasitic plants and the ways they differ from non-parasites. Jim Westwood provided a valuable review of the techniques and terminology involved in molecular biology, with emphasis on applications to the study of parasitic plants. This also included a challenge to participants to think about which - if any - parasitic species would make a good model for studying genomics of parasitic plants.

The application of molecular techniques was again in evidence in several presentations on the subject of systematics and evolution. Schneeweiss described the use of nuclear ribosomal DNA sequences to clarify relationships in the *Orobanche* sect. *Trionychon*, while Nickrent and Malécot used both ribosomal DNA and *rbcL* sequences to refine the phylogeny of the Santalales. Román *et al.* reported the efficacy of RAPD markers to differentiate among *Orobanche* species from

Southern Spain, and in a separate paper suggested that variation within the species *O. foetida* was correlated with host preference as well as geographic distances. A recent DNA fingerprinting technique, the inter simple sequence repeat (ISSR), was applied for the first time to parasitic plant research, and was able to distinguish among and within *Orobanche* species (Benharrat *et al.*). This approach appears to hold promise for other studies.

Other presentations related to parasite evolution included work by Delavault *et al.*, in which evidence was presented for evolutionary movement of an *O. cumana* plastid gene into the nucleus. A consequence of this finding is the identification of a key difference between this species and the closely related *O. cernua*. Along this same line, studies of plastid function in photosynthetic and nonphotosynthetic *Cuscuta* species indicated that nonchlorophyllous species lack ribosomes, although they were found to retain at least one ribosomal gene (van der Kooij *et al.*). Evidently the transcriptional ability of some *Cuscuta* species has been lost from the plastid, which is thus dependent on nuclear-encoded polymerase (Berg *et al.*). Finally, the evolution of aerial parasitism was discussed by Fineran, and an intriguing paper by Reynal-Roques correlated advances in parasitism with a simplified life cycle and juvenile characteristics.

Mechanisms of parasitism were addressed by Yoder *et al.*, who reported the cloning of two quinone oxidoreductase-like genes from *Triphysaria versicolor* that are induced in response to DMBQ. These genes are proposed to operate in the mechanism of haustorium formation, an idea made all the more interesting by the finding that these genes have homologs in non-parasitic species and thus may have evolutionary implications. Jamison and Yoder also reported heritable variation in DMBQ responsiveness in *T. versicolor* species.

Host response to parasitism was discussed by Neumann *et al.*, who presented histological evidence of defence responses in interactions of three Scrophulariaceae species with their host. Griffiths *et al.* reported much the same for *Orobanche* parasitism of tobacco, but used evidence from host gene expression to show a shift in metabolism from normal growth to defence responses.

A special section at this symposium was devoted to methodologies for studying parasitic plants. Mohammed *et al.* described two laboratory assays for *Striga* research, the Extended Agar Gel and Paper Roll techniques, that could be used directly or adapted to other parasite species for facilitating characterisation of resistant host phenotypes. Aly *et al.* reported that transgenic crops expressing an anti-bacterial protein showed increase resistance to *Orobanche*, demonstrating the potential of using genetically modified host plants. An emerging trend at this Symposium was the use of mutagenesis, especially in conjunction with *Arabidopsis*, for investigating aspects of parasitism. This approach was employed in research projects directed at identifying germination or haustorium stimulant mutants in T-DNA tagged *Arabidopsis* (Atanasova *et al.*), germination stimulants in irradiated lines of *Arabidopsis* (Goldwasser and Yoder), and *Orobanche* resistance in EMS-mutagenized tobacco (Slavov *et al.*). Although some promising results were presented, all of these projects are young and will require time to confirm any putative mutants identified. It will be very interesting to see what emerges from this work by the time of the next symposium.

Papers which helped to reinforce our understanding of the germination process included new approaches to the identification of the biosynthetic pathways of germination stimulants for *Orobanche* (Denev *et al.*); the complex of interactions between GR24, ethylene, its precursors and carbon dioxide in *Striga* germination (Babiker *et al.*; Sugimoto *et al.*; Mohammed *et al.*); and corresponding interactions between gibberellins, GR24 and ethylene in *Orobanche* germination (Zehhar and Fer). Zwanenburg and Reizelman described an approach to identifying the strigolactone receptor using both fluorescent- and biotin-labelled stimulants. Although it has not yet yielded a candidate receptor, the approach is very exciting.

Physiological studies included two on the importance of mannitol (Simier *et al.*). Pageau *et al.* described how the need to cope with excess nitrate by converting it to asparagine may contribute to the reduced vigour of *Striga* under nitrogen-rich conditions. Joel *et al.* described detailed studies on the penetration of tissues by haustoria of *Cuscuta*

There were a large number of papers on the topic of Resistance. Relatively few promised fully resistant new varieties but Rubiales *et al.* reported progress towards resistance to *Orobanche crenata* in pea; Sillero *et al.* identified sources of *Orobanche*-resistance in wild *Lathyrus* spp., of potential value for grass pea (*L. sativus*) while Rich *et al.* reported corresponding availability of *Striga*-resistance among wild *Sorghum* spp. New genes for resistance to *Striga gesnerioides* were reported by Dub— *et al.* in local varieties HTR and Wango-1 in Niger. Resistance to *Striga* in *Tripsacum*, for possible transfer to maize, is being explored by Gurney *et al.* but the levels of resistance so far are low. The problem of *Orobanche cumana* continues to present a severe challenge to plant breeders but an inbred line with resistance to *O. cumana* type F in Spain was reported by Rodriguez-Ojeda *et al.*, while work in Bulgaria reported by Batchvarova *et al.* shows promise with the use of mutagenesis and interspecific hybridization in *Helianthus* spp., and Buschmann *et al.* claimed success in inducing systemic acquired resistance (SAR) with the use of a commercially available benzothiodiazole compound 'Bion'. Resistance to glyphosate was the aim of a study by Nadal *et al.* who reported striking results with a new determinate faba bean 'Retaca'.

Otherwise, understanding of resistance mechanisms, and the biochemical and genetic basis for these, was significantly advanced by a range of papers from the Nantes group, while marker-assisted selection of *Striga* resistance in sorghum and in cowpea is brought nearer by the work reported by Haussman *et al.* and Oedraogo *et al.*, respectively.

A number of papers on biological control included a progress report by Norambuena *et al.* on the project to use *Phytomyza orobanchia* against *Orobanche* in Chile; and several on various aspects of the use of *Fusarium* spp. on both *Orobanche* and *Striga*. A new approach was reported by Ahonsi *et al.* involving the selection of fluorescent pseudomonad bacteria for their suppression of *S. hermonthica* germination. These organisms are apparently responsible for suppressing *Striga* under normal field conditions. They can provide useful results when applied as seed dressings to maize, at least in sterilised soils. The hope is that highly suppressive strains will prove beneficial in normal soils.

Reports on control methods for *Striga* in the field were none too numerous but encouraging results were reported on the selection and promotion of *Striga*-resistant varieties of sorghum in Tanzania (Mbwaga *et al.*); on the use of rotations and relay cropping in sorghum in Ethiopia (Fasil Reda *et al.*; L—tourneau *et al.*); and on inter-cropping in millet in Nigeria (Gworgwor *et al.*). Of greatest interest was the report from Kenya of the striking suppressive effects on *Striga hermonthica* from intercropping maize with *Desmodium uncinatum* (Khan *et al.*). Studies so far suggest a pronounced allelopathic influence not evident with other leguminous inter-crops. Other novel observations included those from Gworgwor and Weber concerning the unexplained but almost complete suppression of *S. hermonthica* under the canopy of the leguminous tree *Faidherbia (Acacia) albida*; and from Lenzemo and Kuyper on the apparent suppression of *S. hermonthica* by arbuscular mycorrhiza. Integrated methods suitable for parts of West Africa were described by Hess *et al.*

For *Orobanche* there has been progress in the selection of herbicide treatments suitable for tomato (Eizenberg *et al.*; Plakhine *et al.*), and in the development of treatments exploiting herbicide-resistant tobacco (Valkov *et al.*) and herbicide-resistant maize (Kanampiu *et al.*).

The Proceedings include 124 papers, though just over half of these are in the form of one-page summaries only. There is an index of authors and a delegate index with email addresses. See below for full contents.

One session of the meeting was devoted to the formal establishment of the new International Parasitic Plant Society and election of officers – see below.

A range of enjoyable social events and excursions were arranged for delegates and their spouses and the city of Nantes provided a fine background to all our activities. Andr— Fer and Patrick Thalouarn and all their colleagues at Nantes are to be thanked and congratulated on a highly successful meeting.

Chris Parker and Jim Westwood.

## IPPS

### THE INTERNATIONAL PARASITIC PLANT SOCIETY

The first General Assembly of the International Parasitic Plant Society was held in Nantes, France, during the International Parasitic Weed Symposium on June 4, 2001. At this meeting the General assembly approved the Constitution, elected the IPPS officers, and introduced the Board of Directors.

About one hundred people attended the inauguration of the IPPS, and many more expressed their wish to become members and to take part in the activities of the new Society. The founders of the Society (Danny Joel, Jim Westwood, Jos Verkleij, Patrick Thalouarn and Andr— Fer) felt the need for a more formal framework for the activities of the parasitic plant working groups, that deals with all various aspects of parasitism in plants, and in particular with the biology and control of parasitic weeds. We thought that a formal society might allow a more intensive collaboration, exchange of information, and research coordination in this highly intriguing and economically important field. During the Albena *Orobanche* Workshop in 1998 a significant number of participants were supportive to this idea. The establishment of the IPPS was a very long process that started shortly after that. We discussed the objectives of the society, and in July 2000 we met in Nantes to discuss the Constitution. Then the IPPS had to be officially registered and a bank account opened. We are pleased to announce that the Society is now fully registered in Amsterdam as a non-profit scientific and educational society.

The first action that the new society chose to take was the formal acknowledgement of the immense contribution of the former International Parasitic Seed Plant Research Group that was led for many years by two distinguished members of our community, Lytton Musselman and Chris Parker. In special ceremonies during the Nantes meeting the IPPS awarded Chris and Lytton as the first Honorary Members of the Society “in commemoration of a career of extraordinary contribution to the community of parasitic plant research”.

In addition, the Deputy Mayor of Nantes awarded a medal to Siny terBorg for her distinguished contribution in the field of parasitic weed research, during the formal reception in the Town Hall.

Finally, a website for the new society has been established at <http://www.ppws.vt.edu/IPPS/>. As the society grows, this will expand to serve as a source of information for parasitic plant researchers and the general public.

Now that all formalities have been met we are about to discuss our future activities, and need to start routine activity in order to get the IPPS into action. The only way the IPPS can really contribute to all members according to its objectives is by having direct communication between the members and the officers. We urge everybody not to hesitate to correspond directly with us concerning ideas, suggestions, queries, desires and complaints. We will do our utmost to consider seriously every communication.

#### IPPS Objectives:

- To promote the study and understanding of parasitic plants.
- To promote the exchange of information and transfer of technologies concerning parasitic plants and their control.
- To promote the exchange of biological material relevant to parasitic plant research.
- To form and maintain an international network for the advancement of parasitic plant research and control.
- To convene international meetings on parasitic plants and their control.
- To publish information of interest to persons working with parasitic plants.
- To distribute scientific and technical publications related to parasitic plants.

President of the Society is Andr— Fer. Full details of the Officers and Board of Directors, together with information on membership etc. may be found on the web-site, or by contacting the Treasurer, Jos Verkeij (email [verkleij@bio.vu.nl](mailto:verkleij@bio.vu.nl)) or the Secretary Danny Joel (email [dmjoel@netvision.net.il](mailto:dmjoel@netvision.net.il))

Danny Joel, IPPS Secretary

## RESEARCH ON *STRIGA ASIATICA* CONTROL STEPS UP IN MALAWI

The Rockefeller Foundation has renewed its funding to work on *Striga* control and other soil fertility issues for the season 2000/01. Activities are already on the ground and include the following:-

1. Evaluation for trap crop efficiency among different varieties or accessions of green manure crops and grain legumes. Grain legumes and green manures are now being promoted widely to diversify the food and income base and for soil fertility enhancement. The objective of this work is to allow researchers to recommend the most effective packages for integrated management of *Striga* amongst the many options. The crops being evaluated are either released or promising varieties of groundnuts or peanuts (7 varieties), soyabeans (14 entries), pigeon peas (8), *Mucuna pruriens* (4 accessions), *Canavalia ensiformis* (3) and *Crotalaria* spp.(3). The same entries are also being evaluated for their susceptibility to *Alectra vogelli*. The soyabean entries include three varieties from IITA, recommended on the basis of good adaptability and high stimulation of *S. hermonthica* germination.
2. Identifying suitable population and plant arrangement of cowpeas in a maize intercropping system. Previous work showed remarkable suppression of *Striga* emergence, but there was some suppression of maize yield.
3. Screening for *Striga* resistance among maize lines from IITA and developing hybrids and open pollinated varieties.
4. Evaluating the effectiveness of imadazolinone herbicide (imazapyr) at varying fertilizer levels.

Lead scientist in these studies is Dr Vernon Kabambe (agronomist/weed biologist). Rosan Ganunga has now taken over genotype development work. Other collaborators are Dr W. Sakala (agronomist/soil scientist), T. Kapewa (groundnut breeder), Dr H.N. Soko (soyabean breeder), C.E. Mainjeni (weed scientist) and Dr H. Mloza-Banda (agronomist - University of Malawi). Further contacts or sharing of information will be most welcome.

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## FIRST REPORT OF *SMICRONYX* *CYANEUS* GYLL. ON *OROBANCHE FOETIDA* POIRET: INVESTIGATIONS IN TUNISIA

A preliminary survey on natural enemies of *Orobanche* spp. of economic importance in Tunisia was conducted from April to May 2000 in the main faba bean growing areas. Examination of *Orobanche foetida* shoots collected from infested faba bean fields in the region of Béja (western Tunisia) showed symptoms of weevil attack similar to those caused by *Smicronyx cyaneus* Gyll. (Coleoptera, Curculionidae) on *O. crenata* Forsk. described in previous reports (Zermane, 1997; Zermane *et al.*, 1999). The adult weevils were collected from the tips of the *O. foetida* shoots and were identified by Lutz Behne from the Curculio-Institut in Mönchengladbach, Germany, as being *Smicronyx cyaneus* Gyll. The present report of *S. cyaneus* on *O. foetida* is new. The larvae were feeding on the *Orobanche* stem tissues and were also found on *O. crenata* feeding into the stems as well as inside the capsules.

While several *Smicronyx* spp., gall forming weevils, are known to attack *Striga* spp. or *Cuscuta* spp., only *S. cyaneus* is reported to be associated with *Orobanche* spp. and seems to be relatively scarce. Thus, *S. cyaneus* has been reported to feed on *O. crenata* in Italy, Morocco and in Algeria where it occurs also on *Phelipaea lutea* Desf. and *O. rapum-genistae* Thuill. It is reported elsewhere on *O. hederiae* Fauch. and *O. cruenta* Bert.

Under natural conditions *S. cyaneus* can reduce the seed production of *O. crenata* in Algeria by 14,3% and significantly reduce the stem height, the number of capsules and the dry weight of the infested broomrapes compared to healthy plants.

Further investigations will be undertaken in Tunisia to evaluate the impact of *S. cyaneus* as well as of *Phytomyza orobanchia* (Diptera, Agromyzidae), which was also found as a herbivore on the two *Orobanche* species.

### References:

Zermane, N. 1997. Investigations on the behaviour of *Smicronyx cyaneus* Gyll. (Coleoptera, Curculionidae) feeding on *Orobanche crenata* Forsk. in Algeria and the preliminary evaluation of its impact on this

broomrape (Abstract). In : Khouri, W. and Bayaa, B. (eds.), Proceedings of the Sixth Arab Congress of Plant Protection, Beirut, Lebanon.

Zermane N., Kroschel, J., Sall—, G. and Bouznad, Z. 1999. Prospects for biological control of the parasitic weed *Orobanche* in Algeria. In: Kroschel, J. Abderabihi, M and Betz, H. (eds.), Advances in Parasitic Weed Control at On-farm Level. Vol. II. Joint Action to Control *Orobanche* in the WANA Region. Margraf Verlag, Weikersheim, Germany, pp. 173-184.

N. Zermane, J. Kroschel, University of Kassel, 37 213 Witzenhausen, Germany

T. Souissi, Institut National Agronomique de Tunis (INAT), 1082 Tunis-Mahrajene, Tunisia and M. Kharrat, Institut National de la Recherche Agronomique de Tunis (INRAT) , 2080 Ariana. Tunisie

#### **COST ACTION 849 – PARASITIC PLANT MANAGEMENT IN SUSTAINABLE AGRICULTURE**

The European Union-funded COST Action 849 'Parasitic Plant Management in Sustainable Agriculture' was officially launched in March 2001 with a first Management Committee Meeting in Brussels. At that meeting, administrative issues were dealt with and officers were elected as follows:

Chairman of the Action - Diego Rubiales, Spain  
Vice-chairman - Daniel Joel, Israel

Coordinators of Working Groups:

- Group 1 Biology and Ecology of Parasitic Plants - Jos Verkleij, The Netherlands
- Group 2 Parasitic Plant-Pathogen and Pest Interaction - Jrgen Kroschel, Germany
- Group 3 Genetic Resistance - Danny Joel, Israel
- Group 4 Integrated Control - Charlie Riches

These 5 constitute the Executive Board that will plan the activities of the Action. They met in Nantes in June and are at present in a process of organisation and considering future activities. Any suggestions for relevant activities will be welcomed. The following countries are involved in the Action: Austria, Bulgaria, Denmark, France, Germany, Greece, Hungary, Israel, Italy, Romania, Slovakia, Spain, Holland and UK

COST stands for European Cooperation in the Field of Scientific and Technical Research. For more information on this organisation see website <http://www.belspo.be/cost/>

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#### **A NEW TECHNICAL MANUAL**

**A Technical Manual for Parasitic Weed Research and Extension.** Edited by Jrgen Kroschel. (2001). Kluwer Academic Publishers, Dordrecht, The Netherlands. 292 pp. (Hardbound). ISBN 0-7923-6880-0. Price: Euro 130.00; US\$ 113.00; £79.00.

This very well-produced volume, dedicated to the late Dr Werner Koch, 'provides up-to-date methodologies for various aspects of research and extension related to parasitic weed species of the genera *Striga*, *Alectra*, *Orobanche* and *Cuscuta*. It has the intention to support scientists and extension workers of international and national research and extension institutes and universities who are either new to the subject or plan to apply further techniques they are not yet familiar with.' It has seven main chapters prepared with the help of 21 co-authors. The sections within chapters often have separate authorship and their own set of references, but all citations are repeated in a final combined reference section.

After a general **Introduction**, a chapter on **Ecological studies** includes brief but practical sections on preparation of herbarium samples, morphological studies, use of DNA markers, ecological work and host-parasite relations. **Relevance to agriculture** includes sections on survey and crop-loss techniques. **Seed features** includes advice on collection and testing of seeds, separation from soil and the agar gel test. **Investigations of developmental stages** describes box, Petri-dish and polybag techniques, *in vitro* culture, pot and field experiments and collection of data. **Application of control methods** is by far the longest chapter with sections on all the main control approaches, including cultural, breeding, chemical, physical and especially detailed descriptions of biocontrol techniques. **Putting it into practice** covers many aspects of training and extension, preparation of training materials etc. There is a **Glossary**, **List of Crop Names**, **Literature**, while annexes

include identification keys reproduced from Parker and Riches, 1993, life-cycle diagrams, lists of potential trap crops, various survey forms, questionnaires and a training course outline. Finally there is a section of informative colour plates. There is no index. For further detail of contents, and to order, see: [http://www.uni-hohenheim.de/~www380/parasite/tema/TeMa\\_main\\_Frame.htm](http://www.uni-hohenheim.de/~www380/parasite/tema/TeMa_main_Frame.htm)

Dr Kroschel is to be congratulated on this distillation from the many years of work conducted by the Hohenheim group. The price will sadly restrict its distribution somewhat but this will none-the-less be a valuable source for many institutions and individuals concerned with parasitic plants, and especially those involved in training.

Chris Parker.

### STRIGA CD AND VIDEO

The Systemwide Program on Integrated Pest management (SP-IPM) have produced 'Breaking the cycle', a 20-minute video/CD on the *Striga* research of the CGIAR centres. This is available from: Braima James, SP-IPM Secretariat, IITA Plant Health Management Division, 08 BP 0932 Tri Postal, Cotonou, Republic of Benin. Email [b.james@cgiar.org](mailto:b.james@cgiar.org); fax +229-35-05-56.

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### PROCEEDINGS OF MEETING

#### Proceedings of the 7<sup>th</sup> International Parasitic Weed Symposium, Nantes, France, June 2001.

Edited by Fer, A., Thalouarn, P., Joel, D.M., Musselman, L.J., Parker, C. and Verkleij, J.A.C. 312 pp. Available as a CD Rom from Faculté—des Sciences, Université—de Nantes – BP 92 208, Nantes 44 322, France. (Email [Patrick.Thalouarn@svt.univ-nantes.fr](mailto:Patrick.Thalouarn@svt.univ-nantes.fr)) Price: Euro 40.00 or \$US 40.00.

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(1<sup>st</sup>) EWRC Symposium on Parasitic Weeds, Malta, 1973. Available from EWRS Bookstore, B.J. Post, Postbus 28, NL-6865 Doorwerth, The Netherlands. Price 10 Euro. (Email [bookshop@ewrs.org](mailto:bookshop@ewrs.org))  
'Advances in Parasitic Plant Research' Proceedings of the 6<sup>th</sup> International Symposium, Cordoba, Spain, 1996. Available from Mundi-Prensa Libros S.A., Castellón, 37, 28001 Madrid, Spain. (Email [export@mundiprensa.es](mailto:export@mundiprensa.es); Internet: [www.mundiprensa.com](http://www.mundiprensa.com)). Price 6,481 Pesetas or 38.95 Euro.  
Regrettably, the Proceedings of 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> International Symposia, in Raleigh, USA, 1979; in Aleppo, Syria, 1984; in Marburg, Germany in 1987; and in Nairobi, Kenya in 1991 respectively, are no longer available.

### WEBSITES

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

For Lytton Musselman's Plant site see: <http://web.odu.edu/plant>

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

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

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### HAUSTORIUM 39

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