Lytton John Musselman

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HAUSTORIUM BY EMAIL AND THE WEB

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 strongly to go on receiving hard copy, you will continue to receive by airmail.

The web-site version of this and future Haustorium issues will no longer be posted on the Long Ashton Research Station site but on Lytton Musselman's Plant site - see Websites below.

SEVENTH INTERNATIONAL PARASITIC WEED SYMPOSIUM

The 7th International Symposium will be held in Nantes, France from 5-8 June, 2001.

Although the title refers to 'Weed', all aspects of parasitic plants will, as always, be covered, including academic and non-agricultural topics. The organisers report that about 100 abstracts have now been offered, including many with new and interesting information, and the editing process has begun, but late abstracts can still be considered. A provisional programme will be established in February. Those who have not already received a copy of the second circular for this major meeting should contact Patrick Thalouarn, Laboratoire de Cytopathologie Vegetale, University de Nantes, 2, Rue de la Houssinière, BP 92208, F44322 Nantes, Cedex 3, France. Email: ipws@svt.univ-nantes.fr

PARASITIC PLANT MANAGEMENT IN SUSTAINABLE AGRICULTURE

The proposal under this title has now been approved by EU as COST Action 849, subject to acceptance and signatures from 5 participating countries. There will then be a Management Committee formed by 2 members from each country who will appoint a Chairman, and leaders for each working group. Contrary to the impression given by the note in Haustorium 37, funds will not be available for research or equipment, only for organisation and travel costs involved in co-ordination, meetings and conferences. And the total of 25 million ECU mentioned in that note is an estimate of the total budget for all activities being co-ordinated, including the (non-EU) research funds of individual projects. It is NOT the budget available from EU! The editor apologises for that misleading information.

The main objective of the Action is to increase understanding of the interaction between parasitic plants and their hosts in order to implement sustainable means of control. Activities will include annual meetings of the working groups, scientific conferences, publication of proceedings, establishment of a homepage on the internet, and short-term scientific missions, e.g. allowing exchange of staff between projects for training. Four working groups are envisaged on: Biology and ecology of parasitic plants, Parasitic plant-pathogen and -pest interactions, Genetic resistance, and Integrated control. Annual conferences will focus on Biology of parasitic plants, Management measures, Resistance to parasitic plants, Biocontrol of parasitic plants, and in year 5, a final Evaluation meeting.

Dr Diego Rubiales of CSIC, Cordoba, Spain, is to be congratulated on his success in bringing the process this far towards fruition. Those interested in receiving more information may contact him by email at ge2ruozd@uco.es

RECENT RESEARCH ON HYDNORA

Few plant families are as intriguing as the Hydnoraceae, a small family of two genera. Prosopanche is entirely New World and consists of three known species. Hydnora, on the other hand, is African with at least four well described species: H. abyssinica (=H. johannis), H. africana, H. triceps, and H. esculenta. The first species, H. abyssinica, is widespread across Africa and more or less restricted to Acacia species as hosts. Little is known of H. esculenta, a Madagascar endemic(?) which may be extirpated. Hydnora africana is frequent in the succulent karoo vegetation of

southern Africa where it parasitises shrubby species of Euphorbia spp. Most remarkable of this fascinating lot is H. triceps.

It was first described by Drège in 1833 from material collected near Okiep in Namaqualand in the Northwestern Cape region of South Africa and has been seen only a few times since. Our colleague, Professor Johann Visser, who spent the last part of his life studying parasitic plants in southern Africa, rediscovered H. triceps in 1988-more than 150 years after Drège and more than a century since anyone at all had seen it! He found it not far from Okiep. In a survey of herbaria, Visser found that the species had been collected less than ten times. All collections are within a short radius of Okiep. Tragically, Visser died shortly after his discovery. I was fortunate to relocate Visser's site in September 1999 and 2000.

The results of my 1999 work, in collaboration with Piet Vorster of Stellenbosch University, are summarized on the Hydnora page of my web site: web.odu.edu/plant (scroll down to Hydnora). We located approximately 25 populations at one site. In 2000, I located two additional sites. It is not possible to determine if all the parasites associated with a single plant of the host Euphorbia dregana are a single plant or many plants. In addition to its morphological specialization and very restricted distribution, H. triceps has the remarkable feature of flowering underground. Hypogeous flowering is extremely rare in the angiosperms. Best known and documented is the Australian orchid genus Rhizanthella. Hydnora triceps may be the only dicot with subterranean flowering. It is well adapted for this behavior.

Like a pile-driver in reverse, the perianth lobes are united to form a piston that can crack the soil crust as the flower expands. In this way, sand does not enter the flower. Under normal conditions, the flower never emerges. Its only evidence is a crack in the soil surface and, if fresh, a disgustingly fetid odor. The only link between the nether world and pollinators is a distinctive vent-like opening, formed by the perianth lobes which are pink when fresh. Among the plants of the succulent karoo, only Stapelia (Asclepiadaceae) has flowers which are borne at soil level and have a pollination syndrome involving carrion favoring insects. Despite its soil borne existence, H. triceps probably depends on flying insects for pollination. No fruits of H. triceps have been described.

The region where H. triceps is in the succulent karoo which is characterised by the highest species richness for any semi-arid vegetation. It is also characterized by a high rate of endemism, exceeding 50%. Climatically, this biome is characterized by low (20-290 mm year) but reliable rainfall, chiefly in the winter. The dominant plants in the sandy soil of these low hills are shrubby species of Euphorbia.

Two factors threaten the existence of H. triceps. The most immediate and devastating is widespread diamond mining in the region. Large tracts of land on both sides of the Orange River are designated diamond areas. The second threat to H. triceps is less obvious but just as insidious. Virtually all the area outside the mining preserve is used for grazing sheep and cattle. Ranchers routinely poison raptors and jackals because they eat young sheep. Our preliminary hypothesis is that jackals harvest the fruits and distribute the seeds. This is supported by the frequency of excavated roots and old flowers at the base of the host. In addition, fruits of H. africana are reported to be distributed by jackals.

With Dr Erika Maass, Department of Biology, University of Namibia and Piet Vorster, we are surveying the Orange River populations of E. dregeana for additional stands of H. triceps, which is certainly among the rarest plants in the succulent karoo.

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SANTALUM ALBUM IN Sri Lanka

Research on parasitic plants in Sri Lanka is scant despite there being a total of 57 parasitic species belonging to 22 genera and 8 families in the Sri Lankan flora (see Tennakoon and Weerasuriya, 1998). A remarkable 30% of these species are endemic to Sri Lanka.

This article summarizes some research findings from 2 projects on the economically important woody root hemiparasite Santalum album L. (Santalaceae). S. album, sandalwood, is widely used in Sri Lanka as a medicinal (ayurvedic) product. It is also used for woodcarving and as a source of oil for perfumes and cosmetics. The 2 projects involved an examination of propagation techniques, and the establishment of high value sandalwood tree plantation systems with community participation in Sri Lanka. The research has been conducted by K. U. Tennakoon, E. R. L. B. Etampawala C. V. S. Gunatilleke, I. A. U. N. Gunatilleke and S. P. Ekanayake, all of the Department of Botany, University of Peradeniya, Sri Lanka.

Results of a preliminary PCR (polymerase chain reaction) study carried out to ascertain the genetic variability between the "original" Indian and Sri Lankan S. album varieties showed no distinct variation in the DNA banding patterns. However, results of this study are not yet conclusive and need to be repeated several times using different primers and different seed sources.

Natural stands of S. album in six localities in Sri Lanka were found to be associated mostly with hosts belonging to the family Fabaceae. However, shrub and host species belonging to the families Verbenaceae, Meliaceae and Lauraceae

were also found to be natural hosts for S. album. Studies on the vegetative characters of S. album grown in different localities suggest that fruit and seed parameters change with the environmental conditions, while leaf parameters remain constant at all sites. Treating seeds with 0.075% gibberellic acid after two months of dormancy period was found to be the best method to enhance the germination rate of S. album to over 80%. Interestingly S. album seeds found in Sri Lanka showed a high germination rate (>70%) even without any pre-treatment in contrast to the low germination rates (about 30-40%) reported for seeds collected in India and Australia (see Surendran et al., 1998). The best soil substratum for the autotrophic pre-parasiti c stage of S. album seedlings was found to be sand, top soil and farm yard manure mixed in equal proportions. This clearly suggests that pre-parasitic S. album seedlings utilise nutrients from the growing medium in addition to the original seed reserves.

A detailed nine-month pot culture study showed that the best hosts for the growth of S. album were Mimosa pudica and Tithonia diversifolia when compared with a range of other leguminous and non-leguminous herbs and shrubs examined (see Tennakoon, Ekanayake and Etampawala 2000). The growth performance of S. album seedlings when grown with many annual leguminous crops such as of Phaseolus aureus and P. mungo were poor, mainly because these host plants complete their life cycles in less than one year and the resulting S. album haustoria have no chance to obtain nutrients continuously over a long period of time. Vesicular arbuscular mycorrhizal (VAM) infections were observed in S. album roots. However the intensity of VAM parasitism was very low in the parasitic S. album roots that had formed haustoria and attached to a host root when compared with S. album roots that were not attached to a host. To unravel the complexities associated with < I>S. album-host associations, we intend to further study the solute transfer between hosts and S. album via intimate haustorial connections, carbon and nitrogen partitioning between the partners of different host-parasite associations, and the mechanisms that under-pin the regulation of host-derived xylem-borne solutes to the parasite.

Financial support from Community Environment Initiative Facility implemented by the Environment Action 1Project of the Ministry of Forestry and Environment (under a World Bank Fund) and the Sri Lanka Conservation and Sustainable Use of Medicinal Plants Project of the Ministry of Health and Indigenous Medicine are gratefully acknowledged.

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Tennakoon KU, Ekanayake SP, Etampawala L. 2000. An introduction and current status of sandalwood research in Sri Lanka. International Sandalwood Research News Letter (ISSN 1321-022X). Volume 10 (1-4).

Tennakoon KU, Weerasuriya A. 1998. Nature's scroungers - the fascinating world of plant parasites. Sri Lanka Nature. 2: 44-58

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BUILDING A SPECIALISED DICTIONARY: A CALL FOR ASSISTANCE

A lexicographer and language teacher working in the teaching of scientific communication, I set out in 1996 to try and build a specialised dictionary covering the area of parasite plant research, the task is not yet finished as many theoretical issues remain to be solved, and I again need your help.

Modern lexicographic research is based on corpora, carefully selected collections of texts in electronic format that represent a given field. In 1996 I was working on a project doing just this, which is why Patrick Thalouarn intervened on my behalf in Cordoba. The texts collected are not treated individually, but are studied using computational routines so as to find regularities of usage and present them for analysis by a human lexicographer. I am now working on the dictionary itself, but need to update my collection of texts, and go further.

After the Cordoba conference I did not get copyright permission to use all the texts, which means that some areas were under-represented. So, as the 2001 meeting is in Nantes and I shall be present I would like to have your permission to include all your texts in a new database. If anyone wishes to give retroactive permission for earlier meetings I am still interested, as I would like to follow terminological usage over time. In addition if you have texts that you have published elsewhere I would be interested as scanning is very fastidious and editors not always forthcoming with permission.

One of the features of conference papers is that the published proceedings differ from what is actually said. This is because spoken and written discourse strategies differ. I, along with teacher/researcher colleagues in the UK and Hungary would like to study these differences so as to help young researchers speak at conferences. The aim would be to record the proceedings in Nantes and compare the written and spoken, again using computers. This is a long-term project as we are all heavily involved in teaching, and, like you, receive little funding for our research.

More information can be found on my personal website

http://perso.wanadoo.fr/geoffrey/wiliams

I shall distribute a copyright agreement at the conference itself. Should you wish for more information before then, please do not hesitate to contact me at: geoffrey.williams@ wanadoo.fr

Geoffrey Clive Williams. Université de Bretagne Sud. France.

WEBSITES

For Lytton Musselman's Plant site (including past and current issues of Haustorium) see: http://web.odu.edu/plant

For information on the 7th International Parasitic Weed Symposium at Nantes, 2001 see:

http://www.sciences.univ-nantes.fr/scnat/biologie/GPPV.web

For Dan Nickrent's 'The Parasitic Plant Collection' see:

http://www.science.siu.edu/parasitic-plants/index.html

For IITA Striga Research Methods: a Manual, see: http://www.cgiar.org/iita

For news from Canada of progress with biocontrol techniques for Striga see:

http://www.mcgill.ca/media/releases/1999/december/weedkiller/

For a complete copy of Hawksworth, F.G. and Wiens, D. 1996. Dwarf Mistletoes: Biology, Pathology and Systematics. USDA Agricultural Handbook 709 (now out of print) see: http://www.rmrs.nau.edu/publications/ah_709

LITERATURE

Adetimirin, V.O., Kim, S.K. and Aken'Ova, M.E. 2000. Expression of mature plant resistance to Striga hermonthica on maize. Euphytica 115: 149-158. (Comparison of 12 maize genotypes in plots uninfested or infested with S. hermonthica. Best hybrid, 9012-12, suffered 25% reduction in dry matter v. 60% in susceptible, 8338-1.)

Anil, V.S. and Sankara Rao, K. 2000. Calcium-mediated signaling during sandalwood somatic embryogenesis. Role for exogenous calcium as second messenger. Plant Physiology 123: 1301-1311. (re Santalum album.)

Bakos, Á., Borsics, T., Toldi, O., Babos, K. and Lados, M. 2000. Evidence for somatic embryogenesis during plant regeneration from seedling-derived callus of dodder (Cuscuta trifolii Bab, et Gibs.) Plant Cell Reports 19: 525-528.

Bayaa, B., El-Hossein, N. and Erskine, W. 2000. Attractive but deadly. ICARDA Caravan 21: 16. (Noting that Orobanche crenata has caused decline in lentil growing in Mediterranean region. No varietal resistance yet found. Best results from integrated packages involved delayed planting with short-season varieties and herbicides imazethapyr and imazapic.)

Bedi, J.S. and Sauerborn, J. 1999. A new technique for chlamydospore production by Fusarium oxysporum orthoceras, a new mycoherbicidal agent for Orobanche cumana. Plant Disease Research 14: 207-209. (Best results obtained with a liquid V-8 culture medium, supplemented with sodium sulphate and exposure to nutrient stress.)

Béres, J., Fischl, G. and Mikulás, J. 2000. Biological weed control with fungal pathogens in Hungary. In: Haas, H.V. and Hurle, K.J. (eds.) Proceedings 20th German Conference on Weed Biology and Weed Control, Stuttgart, 2000. pp. 667-670. (Noting limited success in studies with Fusarium spp. against Orobanche spp.)

Bewick, T.A., Porter, J.C. and Ostrowski, R.C. 2000. Field trial results with Smolder: a bioherbicide for dodder control. (abstract) Proceedings, Northeastern Weed Science Society 54: 66. (Bioherbicide based on Alternaria destruens at 1010 viable conidia/acre reduced Cuscuta spp. in cranberry and carrot by at least 90%. Experimental use permit being sought.)

Chanika C.S.M., Abeyasekera, S., Ritchie, J.M., Riches, C.R., Mkandawire, C.B.K., Mputeni, H., Makina, D. and Daudi, A.T. 2000. On-farm trials of technologies for the management of Striga asiatica in Blantyre/Shire Highlands. In: Integrated Crop Management Research in Malawi: Developing Technologies with Farmers. Proceedings of the Final Project Workshop, Mangochi, 1999. pp. 216-225. (Reporting substantial benefits to maize yields from application of 50 kg N/ha or green manuring with Tephrosia vogelii.)

Chanika C.S.M., Abeyasekera, S., Ritchie, J.M., Riches, C.R., Mkandawire, C.B.K., Mputeni, H., Makina, D. and Daudi, A.T. 2000. Initial results from small-scale use of Tephrosia and Crotalaria in intercropping experiments in Blantyre/Shire Highlands. In: Integrated Crop Management Research in Malawi: Developing Technologies with

Farmers. Proceedings of the Final Project Workshop, Mangochi, 1999. pp. 256-262. (Including reference to experiments described in Chanika et al., above, but reporting a wider range of studies.)

Chikoye, D., Manyopng, V.M. and Ekeleme, F. 2000. Characteristics of speargrass (Imperata cylindrica) dominated fields in West Africa: crops, soil properties, farmer perceptions and management strategies. Crop Protection 19: 481-487. (Striga spp. important weeds for only 4% of farmers in the coastal/derived and southern Guinea savanna zones of S. Nigeria, Cote'd'Ivoire and Benin with rainfall of 900-1500 mm per annum.)

Costello, D.A., Lunt, I.D. and William, J.E. 2000. Effects of invasion by the indigenous shrub Acacia sophorae on plant composition of coastal grasslands in south-eastern Australia. Biological Conservation 96: 113-121. (Reduction in grazing and burning has favoured invasion by Acacia sophorae, threatening the 'nationally threatened herb' Thesium australe.)

Davies, D.M. and Graves, J.D. 2000. The impact of phosphorus on interactions of the hemiparasite angiosperm Rhinanthus minor on its host Lolium perenne. Oecologia 124: 100-106. (In pots, high P greatly favoured the host at the expense of the parasite, at least partly by reducing attachment success.)

Dobbertin, M. 1999. Relating defoliation and its causes to premature tree mortality. In: Forster, B, Kník, M. and Grodski, W. (eds.) Methodology of forest insect and disease survey in Central Europe. Proceedings of the 2nd Workshop of the IUFRO Working Party 7.03.10, Switzerland, 1999. pp. 215-220. (Mistletoe infestation, presumably by Viscum album, included among factors contributing to mortality of Pinus sylvestris.)

Dozet, B., Škorić , D. and Marinković , R. 1999. Sunflower breeding for resistance to broomrape Orobanche cumana Wallr.). Helia 22(3): 125-135. (Race E of O. cumana is becoming troublesome in Yugoslavia. The Or5 gene with resistance to race E has been found in a number of lines including L-414.)

Dzerefos, C.M., Shackleton, C.M. and Witkopwski, E.T.F. 1999. Sustainable utilization of woodrose-producing mistletoes (Loranthaceae) in South Africa. (Socio-economic study suggests a viable, sustainable market for wood-roses formed by Pedistylis galpinii and Erianthemum dregei.)

Fineran, B.A. and Calvin, C.L. 2000. Transfer cells and flange cells in sinkers of the mistletoe Phoradendron macrophyllum (Viscaceae), and their novel combination. Protoplasma 211: 76-93. (Reporting novel anatomical features, apparently associated with loading and unloading of substances passing from host to parasite.)

Gagne, G., Roekel-Drevet, P., Grezes-Besset, B., Shindrova, P., Ivanov, P., Grand-Ravel, C., Vear, F., Charmet, G. and Nicolas, P. 2000. Amplified fragment length polymorphism (AFLP) as suitable markers to study Orobanche cumana genetic diversity. Journal of Phytopathology 148: 457-459. ('AFLP markers gave a higher degree of resolution for discriminating closely related germplasm than RAPD.')

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Guba, R. 2000. Sweet healing. Letter to New Scientist No. 2262. 28 October 2000. p. 54. (Noting that among essential oils with antibiotic action against Salmonella aureus, that from Australian sandalwood, Santalum spicatum is active at 0.1.mg/l.)

GuoFengGen and Li Yanghan. 2000. (Effect of spore germination and pathogenicity of parasitic fungi on dodders by solvent and temperature.) (in Chinese) Chinese Journal of Biological Control 16: 81-83. (Reporting effects of sucrose, Tween 80 and temperature on germination and pathogenicity of Alternaria alternata, Pestalotiopsis guepinii and Fusarium semitectum on Cuscuta japonica.)

Gwo-lng Liao, Ming-Yih Chen and Chang-Sheng Kuoh. 2000. Cuscuta L. (Convolvulaceae) in Taiwan. Taiwania 45: 226-234. (4 species recorded - C. australis, C. chinensis, C. japonica and C. campestris, the latter repeatedly collected since 1964 but only now correctly identified - previously called C. australis or C. chinensis. No mention of hosts or crop damage.)

Hadfield, J.S. 1999. Douglas-fir dwarf mistletoe infection contributes to branch breakage. Western Journal of Applied Forestry 14(1) 5-6. (Survey in Washington State, USA, confirmed that branches infected by Arceuthobium douglasii are more likely to break - of concern in public access areas, such as campsites, etc.)

Hassan, E.A., Satour, M.M. and El-Awadi, M.E. 1999. Biological control of parasitic weeds: broomrape-pathogen interactions. Proceedings, 11th European Weed Research Society Symposium: 90. (Studies on the reaction of tubercles of Orobanche sp.(not specified) to Trichodesma and Fusarium spp. (also not specified).)

Haussmann, B.I.G., Hess, D.E., Reddy, B.V.S., Welz, H.G. and Geiger, H.H. 2000. Analysis of resistance to Striga hermonthica in diallel crosses of sorghum. Euphytica 116: 33-40. (Showing poor correlation between stimulant

exudation, as determined by the agar gel assay, and Striga emergence in the field. Lines recommended for use in a breeding programme include low stimulant lines IS9830, M.35-1 and 555, and the high stimulant N.13.)

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Ibrahim, H.M. and Zaitoun, F.M. 1999. Effect of infection with Orobanche crenata and time of planting on resistant and susceptible faba bean genotypes. Proceedings, 11th European Weed Research Society Symposium: 28. (Yields of faba bean reduced 20-77% by infestation with O. crenata: var. X123A gave lowest yields in absence of Orobanche but highest when infested.)

IITA. 2000. Integrated management of Striga and other parasitic pests. International Institute of Tropical Agriculture Annual Report 1999. pp. 50-51. (Two Striga-tolerant vars of maize, EV DT-W 99 STR CO and TZEW-PopX1368STR CO 'showed superior performance' in regional trials on S. hermonthica.)

IDRC. 1000. Biological warfare. International Development Research Centre Annual Report 1998-1999. pp. 36-38. (Reporting the promising results with Fusarium for biocontrol of Striga as summarised in Haustorium 37 pp. 3-4.)

Jafarzadeh, N. and Pourmirza, A.A. 1999. (A study on the biology of Phytomyza orobanchiae Kalt. under laboratory and field conditions in Urmia (Iran.) (in Persian) Iranian Journal of Agricultural Sciences 30: 791-798. (A detailed record of the life cycle of P. orobanchiae, which completes 4 generations per year in Urmia, and affects 45% of Orobanche capsules.)

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Joshi, J., Matthies, D. and Schmid, B. 2000. Root hemiparasites and plant diversity in experimental grassland communities. Journal of Ecology 88: 634-644. (Rhinanthus alectrolophus sown in mixture with various combinations of grass, legume and non-legumes. Parasite biomass greatest in most diverse mixtures. Grasses reduced more than other hosts. Total biomass unaffected in diverse communities but increased when only 1 or 2 hosts present.)

Kabambe, V.H. and Mloza-Banda, H. 2000. Options for management of witchweeds in cereals for smallholder farmers in Malawi. In: Integrated Crop Management Research in Malawi: Developing Technologies with Farmers. Proceedings of the Final Project Workshop, Mangochi, 1999. pp. 210-215. (Summarising farmer understanding of the biology of Striga asiatica in Malawi and the potential for integrated control in maize, involving fertiliser, crop rotation, inter-cropping and resistant varieties.)

Keyes, W.J., O'Malley, R.C., Kim, D. and Lynn, D.G. 2000. Signalling organogenesis in parasitic angiosperms: xenognosin generation, perception and response. Plant Growth Regulation 19: 217-231. (Detailed study of the sequence of events of haustorial initiation, involving release of H20 2 by the parasite root tip stimulating generation of xenognostic quinones from the host root surface.)

Khan, Z.R., Pickett, J.A., van den Berg, J., Wadhams, L.J. and Woodcock, C.M. 2000. Exploiting chemical ecology and species diversity: stem borer and striga control for maize and sorghum in Africa. Pest Management Science 56: 957-962. (Presenting the promising results with Desmodium spp. on Striga hermonthica summarised by John Pickett in Haustorium 37, pp 1-2.)

Kim, S.K. 2000. Tolerance: an ideal co-survival crop breeding system of pest and host in nature with reference to maize. Korean Journal of Crop Science 45:(1): 59-71. (Includes reference to Striga.)

Krebs, W. and Otto, H.W. 1999. (Ten years of monitoring of Orobanche purpurea on the 'Stolpener Burgberg'.) (in German) Bewrichte der Naturforschenden Gesellschaft der Oberlausitz 7/8: 57-59. (A small colony rediscovered after 150 years.)

Lados, M. 1999. (Effect of temperature, pH and host plant extract on the germination of Cuscuta trifolii and C. campestris seeds.) (in Hungarian) Növénytermeles 48: 367-376. (Following sulphuric acid treatment optimum temperatures for germination were 18-260C for C. trifolii and 16-320C for C. campestris.)

Mainjeni, C.E.D. and C.R. Riches. 2000. Resistance to the yellow witchweed, Alectra vogelii Benth., in common bean and cowpea in Malawi. Integrated Crop Management Research in Malawi: Developing Technologies with Farmers. Proceedings of the Final Project Workshop, Mangochi, 1999. pp. 226-233. (Pot experiments revealed apparently useful variation in susceptibility of Phaseolus vulgaris to A. vogelii, local variety Mkhalira showing high resistance, while complete resistance was shown by cowpea var. B359 ex Botswana.)

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Mutikainen, P. Salonen, V., Puustinen, S. and Koskela, T. 2000. Local adaptation, resistance , and virulence in a hemiparasite plant-host interaction. Evolution 54: 433-440. (Studies with different populations of Rhinanthus serotinus and Agrostis capillaris showed varying virulence, but failed to confirm the coevolution of local adaptation of parasites to their sympatric hosts.)

Nava-Díaz, C., Osada-Kawasoe, S., Rendón-Sánchez, G. and Ayola-Escobar, V. 2000. Organisms associated with cherimoya (Annona cherimola Mill.) in Michoacán, México. Agrociencia 34: 217-226. (Psittacanthus sp. recorded on branches of A. cherimola.)

Odo, P.E. and Futuless, K.N. 2000. Millet-soyabean intercropping as affected by different sowing dates of soyabean in a semi-arid environment. Cereal Research Communications 28(1/2): 153-160. (Reference to use of soyabean as a break crop for Striga control.)

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HAUSTORIUM 38

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