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HAUSTORIUM

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SPONSORSHIP

The preparation and distribution of this (and the next) issue of Haustorium has been made possible by funds from the Crop Protection Programme (CPP) of the UK Department for International Development (DFID). The CPP funds a wide range of research activities in developing countries including work on parasitic weeds. In this issue, two projects on Striga are briefly reviewed. Further items will be included in the next issue. For more information please contact the individual authors.

Perhaps in future, Haustorium will be funded in a new way? See item below on proposals for the establishment of a new International Parasitic Plant Society.

HAUSTORIUM BY EMAIL AND THE WEB

Although we have funding for this and the next issue of Haustorium, we still have no long-term security and wish to reduce costs as much as possible. The great bulk of our costs are for mailing. Many readers are already helping us by receiving Haustorium by Email. We believe many others could do so but we do not have their Email addresses. If you are one of those, do please let Chris Parker know (Email address on the last page). If you cannot receive Email, or for any reason wish strongly to go on receiving hard copy, you will continue to receive by airmail.

Thanks to arrangement with the Institute of Arable Crops Research, Long Ashton Research Station, Bristol, UK, Haustorium 35 will also be available on the web site: www.lars.bbsrc.ac.uk/cropenv/haust.htm

SEVENTH INTERNATIONAL PARASITIC WEED SYMPOSIUM

Arrangements are continuing for the Seventh International Parasitic Weed Symposium to be held in Nantes, France, 3-8 June, 2001. A first circular has been sent to all recipients of Haustorium. If you know of others who would be interested, or if there are any comments or suggestions on the format of this event please contact Haustorium editors, or Patrick Thalouarn, Laboratoire de Cytopathologie Vegetale, University de Nantes, 2, Rue de la Houssinière, BP 92208, F44322 Nantes Cedex 3 France. Email patrick.thalouarn@svt.univ-nantes.fr

STRIGA PROJECTS FUNDED BY DFID/CPP

Integrated control of Striga species in Tanzania.

The infestation of staple cereals by Striga species is a widespread problem in Tanzanian smallholder cropping systems, particularly in semi-arid areas where farmers can afford few inputs and continuous cultivation has led to a near catastrophic decline in soil fertility. The DFID Crop Protection Programme has been funding field studies in a number of areas of Tanzania since 1996, aimed largely at using existing knowledge to develop integrated Striga management systems through participatory research implemented in collaboration with extension and farmers. This work is being co-ordinated in Tanzania by Ilonga Agricultural Research and Training Institute in collaboration with the UK Natural Resources Institute. Sorghum systems are the major focus of the project, targeting S. hermonthica in the north of the country in the Lake Victoria basin and S. asiatica in Dodoma Region in central Tanzania. On-station and on-farm trials have been used to identify the most resistant lines curre ntly available. The project has undertaken seed multiplication so that participating farmers could be provided with at least half a kilogram of seed for the 1998/99 season to allow them to plant large enough areas for assessment of variety preference. No lines have been found to be completely resistant to either Striga species but the ICRISAT line SAR 29, SRN39 and particularly P9405, bred by Purdue University, USA, support lower numbers of emerged parasite stems than local landraces or the very susceptible improved local cultivars Tegemeo or Pato and, are productive under smallholder management. Pot trials in UK have also shown that parasite emergence is considerably later on the partially resistant lines than on susceptible checks. Farmers in Dodoma have been particularly impressed by SAR 29 and P9405 as these mature in less than 80 days and are perceived to be more productive than the local tall landraces which are only just flowering by this stage. Initial tastings indicate that P9405 produces a s weet porridge, comparable with that made from local sorghums. It also appears to have some resistance to S. forbesii which is a local problem on heavy soils around Morogoro. Both participating and neighbouring farmers are very keen to obtain more seed of P9405 for planting next season. Perhaps the greatest challenge will be securing sustainable supplies of planting seed - currently less than 2% of the sorghum area in Tanzania is currently planted to improved cultivars of sorghum. The main ways farmers in Dodoma obtain seed is through barter with neighbours or small local purchases. Village based seed production, supported by NGOs, will probably have an important role to play in the future dissemination of Striga resistant cultivars. The project has also been investigating with farmers how to integrate cultural practices which also reduce Striga emergence with the production of these selected lines. Inter-cropping with cowpea in the Lake Zone and with groundnut in Dodoma, where loca l cowpea lines are particularly susceptible to Alectra vogelii, has also been selected by farmers for further testing. Targeted use of kraal manure on infested fields has also been demonstrated to improve sorghum growth substantially, despite Striga infestation of the crop. Many farmers, however, lack the transport to move substantial quantities of manure to their fields. The project is therefore moving on to investigate improving soil fertility by the use of Crotalaria juncea (sunn hemp) planted as an inter-crop at second weeding of sorghum.

Although production is in decline due to high labour requirements, finger millet is still an important crop in mid-altitude areas of Mara region in northern Tanzania. Farmers report that S. hermonthica commonly infests the crop and the project has undertaken some work, both in the field and in the glasshouse, to screen germplasm. Although no resistance has been identified, sufficient variability in susceptibility has been noted among the 30 or so lines evaluated to suggest that further work with a larger collection of genotypes will be worth while.

Upland rice is an important cash crop in southern Tanzania where farmers are all too well aware of the association of increasing infestation of the widely grown cultivars Kilombero, Super India and Zambia by S. asiatica and declining soil fertility. The project is working in collaboration with Kyela district extension staff to conduct trials with farmer groups in two villages, primarily aimed at cost effective soil fertility improvement. Top dressing with 25 to 50 kg ha-1 nitrogen as urea has resulted in reduced Striga stands and yield increases of 40% and 70% respectively. While urea use is profitable many farmers lack the cash liquidity to purchase seasonal inputs and not prepared to join credit schemes. Kyela receives 2,500 to 3,000 mm rainfall per year and sunn hemp grows particularly well and may well provide a low-cost alternative to fertiliser; project work has also confirmed that it has the added benefit of being a Striga trap crop. Farmers are showing considerab le interest in planting this as a green manure crop in rotation with rice on the most severely infested portions of land. Plots sown to sunn hemp last season will be cropped with a test crops of rice in 1999/2000 . The project has also begun to involve the farmers in participatory variety selection aimed at evaluating rice lines for resistance. An early maturing local line "wahi wahi" appears to support low numbers of emerged Striga and will be evaluated further at a number of sites next season. Farmers require tall plant types with aromatic grains.

As research has shown elsewhere in Africa, the project has observed that farmers in Tanzania have little knowledge of Striga biology and control. Providing farmers with information about the life cycle of the parasite, at village seminars, has allowed them to appreciate the rationale behind potential Striga management practices and participate more fully in planning and evaluation of field trials.

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A.M. Mbwaga, Ilonga Agricultural Research and Training Institute, PO Kilosa, Tanzania.

Genetic variability of S. hermonthica and stability of resistance in sorghum.

Striga hermonthica is the most important parasitic weed attacking cereal crops in the semi-arid tropics, causing severe reductions in yield. The development of resistant crop varieties has been hampered by the occurrence of variation within and between S. hermonthica populations. This, together with its out-breeding behaviour, threatens durability of resistance. An understanding of the patterns of variability within and between S. hermonthica populations, and the effects of host selection on populations, is of utmost importance if breeding programmes are to target sources of resistance in different areas.

Very few molecular studies on the genetic variation of S. hermonthica have been carried out. This study provided evidence of both geographical differentiation and strong sorghum varietal selection by five sorghum varieties on four S. hermonthica populations, by surveying polymorphisms at the molecular level using isoenzyme and RAPD technologies. The data was subject to multivariate analysis in order to detect the trends of variation, which were found to be consistent between the isoenzyme and RAPD data.

Samples of S. hermonthica from West African sites were found to be more closely related to each other than to one from East Africa. The highest degree of similarity existed between two sites sampled within Mali. Selection pressures increased from the susceptible sorghum varieties, through the tolerant to the resistant varieties. No specific markers identified selection by a particular sorghum variety or a particular population/region.

A degree of genetic analysis with the isoenzyme data revealed deviations from Hardy-Weinberg equilibrium as expected, with a high selection for heterozygotes and particular homozygotes. The high frequency of null alleles detected for two enzyme systems may indicate their importance in the maintenance of polygenic variation.

To date, no sorghum varieties exist that are completely resistant to S. hermonthica. As long as a few S. hermonthica plants can successfully complete their life cycle on their host, the durability of resistance is threatened. In view of the high levels of variability existing in S. hermonthica populations that allows the parasite to quickly adapt to new crops/varieties, the target should be to produce multigenic resistant varieties with a broad selection pressure together with the use of multilocation trials to verify resistance in the field. Integrated approaches to the control of S. hermonthica using treatments and cultural methods which eliminate or minimize parasite seed production, leading to reduction of the seed bank, and which improve soil quality are discussed. Farmer training is also important in the acceptance of an integrated approach by the farming community in the struggle against this very successful parasitic plant.

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A NEW PARASITIC PLANTS SOCIETY?

The informal Parasitic Seed Plant Research Group has been active for many years in publishing the newsletter Haustorium, and in organizing international symposia and workshops. Lytton Musselman and Chris Parker who led this group for more than twenty years have brought the group

to great success and many important achievements. For some time we were

thinking of the need to establish a formal international Society for parasitic plants, that would continue this important task and extend

activities.

As some of you may recall, I raised this issue during the general discussion in the Albena Orobanche Workshop last summer, and a significant number of participants were supportive of the idea. Thereafter a core of

interested scientists started the procedures that are necessary for formally establishing the Society.

The objectives of the proposed International Parasitic Plant Society will be:

1. To promote the study of parasitic plants.

2. To form and maintain an international network for the advancement of parasitic weed control.

The executive goals of the Society will be:

1. Obtaining financial support from companies and international/national organizations, and from membership fees.

2. Organizing/supporting the International Parasitic Plant Symposia/Conferences.

3. Organizing/supporting workshops on specific groups or specific problems of parasitic plants.

4. Establishing a scientific board, for reviewing, editing and publishing proceedings.

5. Establishing an interdisciplinary web site on parasitic plants.

6. Establishing an internet Discussion Network.

7. Publishing a newsletter.

Of course, officers need to be elected for the executive committee of the Society. This will be done before or during the International Parasitic Plant Symposium in Nantes. In the meantime, the ad-hoc executive committee

includes Andre Fer as president, Jos Verkleij as treasurer, and myself as secretary. Additional members of the executive committee are Jim Westwood and Dana Berner. We are now working on the constitution, aiming to formally register the Society before the International Symposium on Parasitic Plants in Nantes.

At the moment it is highly important for us to have an idea who is interested in becoming a member of the new International Society for

Parasitic Plants. We therefore kindly ask you to send, with no obligation, your name, address, Email, and fields of interest, to me at the Email below, or to Dr Jos A.C.Verkleij, Free University, De Boelelaan 1087, 1081 HV Amsterdam, The Netherlands

Looking forward to fruitful collaboration in the new Society, we thank you in advance for your co-operation and help. Please bring our request also to the attention of others who may be interested.

Daniel M. Joel, Ad-hoc Secretary,

International Parasitic Plant Society,

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ROCKEFELLER FOUNDATION COLLABORATIVE RESEARCH

A substantial body of research on Striga is being funded by Rockefeller Foundation. This is described in two papers by J.D. De Vries and others in the International Weed Science Society Newsletter (see DeVries et al. 1998, 1999 in Literature section). The Foundation has, in collaboration with CIMMYT, IITA, the Kenya Agricultural Research Institute (KARI) and a number of other research institutions initiated a research effort focused on the development of Striga-resistant maize for Africa. It involves breeding, biotechnology, cropping systems and technology transfer. Projects at a range of sites in Africa, associated with back-up projects at four universities in USA, are co-ordinated by a Striga Working Group. The first paper reviews the work in Africa, including (i) collaboration between IITA, CIMMYT and KARI in the crossing of maize with teosinte, Tripsacum and Zea diploperennis and testing of resistant progeny, and the use of molecular markers in the identificati on and transfer of resistance genes; (ii) collaboration between CIMMYT, KARI and the Weizmann Institute of Science, Israel, in the use of imidazolinone herbicides in conjunction with ALS-resistant maize varieties and the transfer of herbicide-resistance to locally suitable cultivars. The collaborating Institutes in USA include (i) Purdue University, where molecular maps are being developed and used to locate and clone genes for low-stimulant resistance and other resistance mechanisms, and to engineer the introduction of genes which could trigger a hyper-sensitive response to Striga infection; (ii) University of Chicago, where the objective is to understand the biosynthetic pathway for the germination stimulants, and to engineer mutants in which their production is minimised (or exaggerated); (iii) University of Virginia , where investigations are concentrated on the specific biochemical factors and gene products involved in rejection of Striga in the cortex of host and non-host roots, and the po ssible cloning and transfer of genes; (iv) University of California, where the related hemi-parasite Triphysaria is being used as a substitute for Striga. It is hoped that maize mutants with resistance to Triphysaria will also show resistance to Striga.

Chris Parker.

Striga in Mozambique

During January 1998 a participatory technology review on plant protection problems was undertaken together with farmers on the Lichinga plateau which covers two districts (Lichinga and Sanga) in Niassa province, northern Mozambique. The plateau farming system is based on a maize-common bean (Phaseolus vulgaris) intercrop sown on large ridges (1.4 m between ridges which are normally from 0.3 to 0.5 m high). The rainy season runs from November to April, maize being planted shortly after rains become established in November or early December. Beans are normally planted twice, in December and March, firstly as an intercrop with the maize and then as a relay crop.

As part of the review, discussions were held with farmers, in their fields, about common weeds and their control. At least five different weeding operations, with local names, were identified in the main rainy season, the actual operations carried out depending on rainfall pattern and soil type. A range of common "weed" species were identified together with farmers, most with local names, although some were also useful to farmers either as relish or feed for animals (for example rabbits, guinea pigs and goats).

Among the weeds species identified was Striga asiatica which was present in one field in Lichinga district (in border rows only) and most fields in Sanga district (throughout fields). In Sanga district farmers were very aware of Striga whose local name was given as "chicungulo" and affirmed that if it was not removed early the maize suffered a drastic yield reduction. Most of these farmers had the opinion that in most years it was not a problem as it was controlled in the first weeding operation on the ridges. Other than hand weeding (hoeing) no farmers had any specific measures to control Striga.

Recommendations were made to monitor the situation and evaluate the impact of Striga over a number of seasons in Sanga district. The main difference between Lichinga and Sanga districts was the greater age of fields in Sanga district, and from this perspective it might be expected that Striga will become more of a problem on the plateau in general as farmers are becoming more settled and using the same fields for longer periods as compared to the past where a more shifting type of agriculture with long fallows (50 years or more) was practised.

Gareth Davies, 40 Burleigh Park, Cobham, Surrey, KT11 2DU, UK.

OROBANCHE IN KENYA

A survey aiming at weed identification, distribution and mapping was carried out beginning June 1997 covering Machakos, Makueni, Mwingi, Kitui, Kajiado, Narok, Nakuru, Nyandarua and Laikipia districts on behalf of National Dryland Farming Research Centre, Katumani and National Plant Breeding Research Centre, Njoro. In June 1998, Orobanche cernua was identified in Kajiando South (agro-ecological zone, Lower Midland 6). The infestation was severe on tomato (Val Cal J) grown under furrow irrigation.

A second survey in December 1998 showed that on the neighbouring farm a half acre of tomato was severely infested resulting in zero yield. The crop was abandoned and was dying, leaving the weed to mature. This is a serious issue because many thousand of seeds would have been banked into the soil. The contact farmer observed that the field had previously been planted with onion, which was not attacked, but there had been some infection of Galinsoga parviflora, while a crop of peppers (Capsicum annuum) was completely destroyed after severe infestation. The parasite has also been observed on Sonchus oleraceus.

This weed, referred to as 'kiama' (= magic or wonder) by the local farmers, needs to be controlled if not eradicated before it spreads, because farmers in this region depend entirely on the income generated from the tomatoes, onions and pepper production now under threat. Adequate crop rotation is impossible because the crop farming land is limited, unfenced and crops are selected to meet production cost in a predominantly livestock keeping zone. This weed is known from the Middle East, The Mediterranean countries, and eastern Europe.

Hottensiah Mwangi., National Agricultural Research Laboratories, P.O. Box 14733, Nairobi, Kenya.

WEB SITES

For this newsletter (in full), see: www.lars.bbsrc.ac.uk/cropenv/haust.htm

We are asked to point out that the web site address for the Yoder Lab in California is now:

http://veghome.ucdavis.edu/Yoder/YoderLab/Index.html

http://www.idrc.ca/nayudamma/striga_e.html gives information on IDRC-funded work on biocontrol of Striga with Fusarium oxysporum.

http://pest.cabweb.org/cpc/report.htm uses the data sheet for Striga hermonthica as a sample to illustrate the new CAB International Crop Protection Compendium, Global Module CDRom.

PROCEEDINGS OF MEETINGS

Proceedings of the 16th Biennial Weed Science Conference for Eastern Africa. 1997. Edited by Adipala, E., Tusiime, G. and Okori, P. Weed Science Society for Eastern Africa, P.O. Box 30321, Nairobi. 310 pp.

Contents include:

Kasembe, E. and Chivinge, O.A. Effect of time of ridging on witchweed growth and maize grain yield in the smallholder farming sector of Zimbabwe. (pp. 131-136) (Ridging at 3 or 5 weeks after crop emergence greatly reduced S. asiatica and improved yields.)

Ransom, J.K. et al. An update on Striga control research in Africa. (pp. 215-219)

Esilaba, A.O. et al. Factors affecting the incidence of Striga and its control in northern Ethiopia: results of a survey. (pp. 221-229)

Abayo, G.O. et al. Stimulation of Striga hermonthica germination by plant species indigenous to Eastern Africa. (pp. 231-239)

Chanyowedza, R.M. et al. Effect of sorghum variety and leaf extracts from multi-purpose trees on the germination and emergence of Striga asiatica. (pp. 241-246.)

Ariga, E.S. et al. Potential of using cotton and other trap crops for Striga hermonthica management in cereals in Kenya. (pp. 247-253) (Response of S. hermonthica to cotton shown to be complex, depending on cotton variety, Striga seed source, and other factors.)

Kanampui, F.K. et al. Advantages of seed-primed imazapyr for Striga hermonthica control on maize bearing target-site resistance. (pp. 255-259) (Herbicide-resistant maize seeds primed with 0.2-0.33 mg imazapyr/seed (11-18 g/ha) and planted dry resulted in excellent control of Striga (added artificially to seed hole) and good yield.)

Oswald, A. et al. Intercropping - an option for Striga control. (pp. 261-266) (Good results with cowpea and sweet potato in one trial, not in another, possibly due to difference in soil type - better result on a sandy soil.)

Combating Parasitic Weeds through Horizontal Resistance. 1998. Proceedings of an International Workshop organised by the International Agricultural Research Institute (IARI), Kyungpook National University (KNU) and the International Corn Foundation (ICF), South Korea with the support of KOICA, Samsung, PASCON, FAO, SAFGRAD, Brussels, Belgium, 1997. Published by IARI, KNU and ICF (1998) ISBN 89-7180-091-7. Edited by Kim, S.K., Robinson, R.A., Atkinson, V.O., Th¾ , C. and Sall¾ , G. 66 pp.

Contents:

Review:

The main purpose of this workshop was to review past research on managing Striga spp. with a view to expediting the development of appropriate host plant resistance breeding strategies for parasitic weeds, particularly horizontal resistanc. This aim was based on the premise that most past work on breeding for resistance to parasitic weeds had been hampered by a lack of appreciation of the potential contribution of horizontal resistance and an apparent fixation on parameters such as parasite attachment and emergence as the main components of host plant resistance. The workshop was attended by a small group of researchers, many from Korean institutes or foundations. Participation by most of the active parasitic weeds research groups e.g. IITA, ICRISAT, CIMMYT, ICARDA, Long Ashton Research Station, UK and the University of Purdue, USA was mysteriously lacking for such an international workshop.

The workshop was organised in four sections, each comprising technical papers presented and main points discussed. A general discussion is also included. The proceedings are well-presented with high quality colour plates in section IV.

Section I considers the theory of horizontal resistance and its application to managing parasitic weeds by Dr R Robinson and the use of horizontal resistance in maize by Dr S K Kim. Dr Robinson has written several books on the theory and application of horizontal resistance in managing important pathogens of several tropical crops. The examples given in his paper are not referenced and no proof is provided that either the advances made were due to horizontal resistance or the failures due to vertical resistance. Alternative explanations have been published in refereed journals for at least some of the examples e.g. the increase in severity of coffee berry disease on coffee in Eastern Africa has been strongly linked to overuse of fungicides that have destroyed the natural antagonistic flora to Colletotrichum kahawae. Dr Kim introduces his paper with examples of the breakdown of vertical resistance to pathogens in a number of tropical crops and follows this with an account of the success of breeding f or horizontal resistance to maize streak virus. On p.13 he cites a 'breakdown' of resistance of cowpea B301 to Striga gesnerioides though this occurred when it was when first tested in Benin, due to the existence of an unusual, very localised strain of S. gesnerioides, and he fails to add that the same line continues to show 'durable multi-strain resistance' in all other areas and countries in which it has been tested in West Africa. Such resistance is the best available to poor cowpea farmers in West Africa at present and is making a substantial contribution to food production. In contrast on pp.14-15, Dr Kim cites the success of Striga tolerant and resistant maize lines such as 8322-13 with 'horizontal resistance to Striga which gives 90-95% control', but no references are given to support this claim.

Section II presents papers on EEC and GTZ project experiences on managing parasitic weeds in Africa from Drs. Sallé and Kroschel, respectively, as well as papers on breeding for tolerance to Striga. The EEC and GTZ papers summarise various approaches to managing Striga in cereal and cowpea systems and emphasise the complexity and enormity of the task. Both highlight the importance of host plant resistance, the need to work closely with local partners, the need to enhance farmers awareness and understanding of the parasitic nature of Striga and the need for different management strategies in different situations. Various promising tolerant maize lines have been developed from the breeding programme for tolerance in Cameroon but these lines need to be more widely tested (p.28). Tolerant maize lines have also been developed in Nigeria but higher levels of tolerance are considered necessary prior to wider field testing (p.30).

Section III includes two papers by Dr Kim on misconceptions about horizontal resistance in Striga and Orobanche research and on-farm guidelines for testing maize varieties with horizontal resistance. The paper on misconceptions is a rather bizarre historical account by Dr Kim of the difficulties he has had getting various papers accepted by international journals, all of which are cited in the accompanying bibliography. After reading it, I am none the wiser as to what are the key misconceptions researchers have about horizontal resistance to Striga in maize. On p.41 Dr Kim states that Striga emergence and tolerance of the parasite in the horizontally resistant maize lines are under the control of different genes but no evidence is given for this. It is also a surprising statement in the light of earlier statements in the discussions that knowledge of the genetic and biochemical bases of horizontal resistance to Striga is not necessary for developing horizontally resistant lines.

Section IV returns to misundertandings on horizontal resistance and suggests that the horizontal resistance approach is definitely the most sustainable solution to the Striga problem in sub-Saharan Africa that will guarantee the poor people of Africa much needed food and nutrition. Results of studies from 1982-1995 including over 50,000 maize lines, crosses and families are claimed to support the view that the most appropriate Striga control strategy would be to identify or develop genotypes that have a high 'tolerance' to Striga. I remain to be convinced with sound, wide scale field results. Dr Kim believes that tolerance is a type of horizontal resistance against parasitic weeds. Tolerant lines appear to be defended in the guise of horizontal resistance. However, throughout the proceedings as a whole there is an almost total lack of any attempt to distinguish between tolerance and resistance.

The insistence that all efforts by other groups such as ICRISAT (p.60) were strictly focused on vertical resistance and that horizontal resistance was dismissed as irrelevant is quite unjustified. The sorghum cultivar Framida was used by ICRISAT as one of its main sources of resistance to Striga. If it is true as stated on p.18 that "Framida shows a high level of tolerance to Striga and the expression of horizontal resistance in this cultivar is similar to that in the maize cultivar 8322-13", ICRISAT can hardly be accused of ignoring horizontal resistance.

The discussions at the end of each section are marred by frequent efforts to stifle open exchange about the need to develop a range of different management strategies for parasitic weeds and often border on ideological preaching (see pp.45-50 and pp.58-62). We are asked to believe without any convincing field evidence that the only way to manage parasitic weeds of major food crops in Africa is through horizontal resistance alone. The proceedings are a forum for a selected group to criticise much of the past progress on breeding for resistance to parasitic weeds, rather than a useful contribution to further progress on management of one of the most difficult biotic problems affecting food crops in Africa.

Jill Lenné, NR International Ltd., Chatham, UK.

Current Problems of Orobanche Researches. 1998. Proceedings of the 4th International Orobanche Workshop, September 23-26, 1998, Albena, Bulgaria. Edited by Wegmann, K., Musselman, L.J. and Joel, D.M. Published by Institute for Wheat and Sunflower, General Toshevo, 9520, Bulgaria.

Contents (with some abbreviation):

Ivanov, P. et al. An isoenzyme analysis of the NE Bulgarian O. cumana population.

Bozukov, H. Influence of exposure period duration on the germination of broomrape seeds in the presence of synthetic stimulants.

Slavov, S. and Batchvarova, R. Stimulants for Orobanche seeds germination.

Session 2. Penetration of the germ tube and haustoria establishment:

Joel, D.M. et al. The haustorium of Orobanche.

Boelhouwer, G.J. and Verkleij, A.C. A study of the interaction between O. aegyptiaca and Brassica napus.

Joel, D.M. et al. Molecular markers for Orobanche species - new approaches and their potential uses.

Ljubenova, A. and Minkov, I. Five Orobanche ecotypes - what is the difference.?

Ljubenova, A. and Minkov, I. Conservative spots in the chondriome and plastome of five Orobanche ecotypes.

Antonova, T.S. The interdependence between sunflower resistance and broomrape virulence.

Westwood, J.H. and Foy, C.L. Arabidopsis thaliana can be a model host for Orobanche research.

Atanasova, S. et al. An artificial system for monitoring of Orobanche spp./host interactions.

Session 3. Growth and development of the parasite:

Teryokhin, E.S. Ontogenesis of Orobanche as the sum of adaptation to the parasitic mode of life.

Eplee, R.E. et al. Mitigating epidemiology of Orobanche.

Dhanapal, G.N. and Struik, P.C. Natural plant oils: do they kill broomrape spikes?

Scuchardt, B. et al. A new species of weed broomrapes in the community of parasitic plants on tobacco plantations in Bulgaria.

Eizenberg, H. et al. Effect of seasonal conditions on host-parasite relationship in O. crenata and O. aegyptiaca.

Dale, H. and Press, M.C. How will elevated concentrations of atmospheric carbon dioxide influence Orobanche species and their hosts?

Fawaz Azmeh, M. and Musselman, L.J. Cistanche phelypaea, a native root parasite attacking introduced shrubs.

Romanova, V.O. et al. The intraspecies taxonomy of O. cernua Loefl. 1. The system of Beck-Mannagetta (1930) and the data of seed morphology.

Ibrahim, H.M. et al. ES - Parasitic Weeds: a computerised expert system for parasitic weed identification and management with special reference to Orobanche spp.

Deif, H.A.R. and Ahmed, M.F. A taxonomic study on the populations of three common species of the genus Orobanche L. in Egypt. 1. Macro- and micromorphology of the pollen and their taxonomic implication.

Hassenein, E.E. et al. Estimation of number of chromosomes in Orobanche spp. in Egypt.

Session 4. Resistance to Orobanche and resistance breeding:

Alonso, L.C. Resistance to Orobanche and resistance breeding: a review.

Al-Menoufi, O.A. and Adam, M.A.Susceptibility/resistance of some wild Lycopersicon accessions to O. ramosa.

Raju, C.A. and Nagarajan, K. Performance of tobacco germplasm accessions to Orobanche incidence.

Zemrag, A. Critical threshold of O. crenata Forsk. in faba bean…

Slusar, E.L. et al. The susceptibility of sunflower to broomrape biotypes of different geographical origin.

Alvarodo-Aldea, J. et al. Interactions of host genotype and planting time in the infection of sunflower by O. cernua.

Saber, H.A. et al. A new Egyptian source for Orobanche resistance in faba bean.

Iliescu, H.C. et al. Response of some sunflower hybrids to the attack of the parasitic phanerogame O. cumana Wallr.

Nikolova, L. et al. New sunflower forms, resistant to O. cumana Wallr., originating from interspecific hybridization.

Venkov, V. and Shindrova, P. Development of sunflower form with partial resistance to O. cumana Wallr. By seed treatment with nitrosomethylurea.

Petakov, D. et al. Combining ability of new sunflower lines that are resistant to broomrape.

Svetkova, F. et al. Breeding of fertility restorer lines resistant to broomrape (O. cumana Wallr.) and inheriting the resistance in F1 sunflower hybrids.

Christov, M. et al. New sunflower forms, resistant to broomrape.

Goldwasser, Y. et al. Factors involved in resistance of Vicia atropurpurea to O. aegyptiaca.

Session 5. Progress in Orobanche control:

GarcÍ a-Torres, L. Reflections on parasitic weed control: available or needed technology?

Kleifeld, Y. Progress in Orobanche control.

Jacobsohn, R. et al. Crenate broomrape control in garden and field peas with foliarly applied imazethapyr.

Jacobsohn, R. et al. Broomrape control in sunflowers with foliar applied herbicides.

Khalaf, K.A. Effect of glyphosate and fosamine-ammonium phosphorous herbicides on controlling Orobanche spp. in faba bean and tomato.

Raju, C.A. and Nagarajan, K. Propects of control of Orobanche in tobacco in India.

Kleifeld, Y. et al. Selective control of Orobance spp. with imazamethapyr.

Nandula, V.K. et al. Effect of glyphosate on amino acid composition of O. aegyptiaca and two of its hosts.

Valkov, V. et al. Broomrape control by transgenic tobacco plants.

Bedi, J.S. and Sauerborn, J. Survival and virulence of different propagules of Fusarium oxysporum f. sp. orthoceras on storage, against O. cumana.

GarcÍ a-Torres, L. et al. Chemical control of Orobanche in legumes: achievements and constraints.

Chalakov, H. Present situation and prospects for solving the tobacoo broomrape problem in Bulgaria.

Weinberg, T. et al. Carotenoids biosynthesis inhibitors and their effects on field dodder (Cuscuta campestris Yuncker).

Thomas, H. et al. Impact and management of Orobanche in cropping systems in Nepal.

Iliev, I. et al. A possibility for industrial production of a bioherbicide for control of O. cumana.

Abu-Irmaileh, B.E. Present status of Orobanche control in the Near East.

Vouzounis, N. and Americanos, P. Control of Orobanche in tomato and eggplant.

Zaitoun, F.M.F. and Ibrahim, H.M. Effect of planting date and faba bean genotypes on O. crenata growth.

Khattril, G.B. et al. Agronomic problems and control of broomrape (Orobanche spp.) in Nepal.

Murdoch, A. Long-term integrated control strategies for Orobanche based on a life cycle model.

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Advances in Parasitic Weed Control at On-Farm Level. Volume 1. Joint Action to Control Striga in Africa. 1999. Edited by Kroschel, J., Mercer-Quarshie, H. and Sauerborn, J. GTZ/University of Hohenheim. 324 pp. (Selected papers from a Regional Workshop held in Ghana, October, 1997.)

List of Contents:

Kroschel, J. Analysis of the Striga problem, the first step towards future joint action.

Albert, H. Farmers in northern Ghana and the problem of Striga.

Gehri, A. et al. Assessing women's needs in Striga control.

Sauerborn, J. Striga biology versus control.

Hess, D.E. and Haussmann, B.I.G. Status quo of Striga control: prevention, mechanical and biological control methods and host plant resistance.

Adetimirin, V.O. and Kim, S.K. Farm level options for controlling Striga on maize in Africa.

Diarra, C. Biological control of Striga hermonthica in the Sahel.

Kroschel, J. et al. Insects for Striga control - possibilities and constraints.

Ransom, J. The status quo of Striga control: cultural, chemical and integrated aspects.

Kombiok, J.M. and Clottey, V.A. On-farm verification of Striga hermonthica control using some trap crops in rotation with cereals.

Kanton, R.A.L. et al. Evaluation of Striga-resistant sorghum varieties and effect of leguminous trap crop rotation with millet/sorghum intercrop on cereals in northern Ghana.

Sauerborn et al. Parasitic weed infestation of maize and sorghum as influenced by crop rotation.

Oswald, A. et al. Intercropping - an option for Striga control.

Oswald, A. et al. Developing a catch-cropping technique for small scale subsistence farmers.

Kureh, I. et al. On-farm verification of agronomic packages for the control of Striga in sorghum.

Traore, H. and Yonli, D. Study of farmers' perception of the Striga problem and inventory of indigenous Striga control methods in Burkina Faso.

Tarfa, B.D. et al. Effect of nitrogen and phosphorus levels on the reaction of soybean cultivars to Alectra vogelii Benth.

Kachelrieis, S. Facilitating conscious choices: sharing information, learning and generation of knowledge as joint action.

Fischer, P.A. et al. The "Striga control programme" - development, use and impact of a communication aid.

Fischer, P.A. et al. Putting it into practice - experiences with farmer experimentation.

Kunjo, E.M. Extension options for the management of Striga hermonthica in small holdings: the Gambia experience.

Ayongwa, G.C. and Ngawa, L. Report of the Striga project during the 1994/95 cropping seasons.

Agunda, J. Community participation in Striga weed control in western Kenya region.

Kachelreiss, S. et al. Sharing information between research and extension - training courses for extension staff.

Advances in Parasitic Weed Control at On-Farm Level. Volume 2. Joint Action to Control Orobanche in the WANA Region. 1999. Edited by Kroschel,, J., Abderabihi, M. and Betz. H. GTZ/University of Hohenheim. 347 pp. (Selected papers from a Regional Workshop held in Morocco, April, 1998.)

List of Contents:

Yazough, A. and Klein, O. Problème et gestion de l'Orobanche au Maroc.

Ait Abdallah, F. et al. Le problème de l'Orobanche en Algérie.

Hassenein, E. and Salim, A. Country paper about Orobanche and its control in Egypt.

Mò ller-StØ ver, D. et al. Importance of Orobanche spp. in two regions of Egypt - farmers' perceptions, and difficulties, and prospects of control.

Kleifeld, Y. Orobanche management and control in Israel.

Bourarach, K. et al. La participation du genre dans la protection de la fève contre l'Orobanche au Maroc.

Manschadi, A.M. et al. A model for simulation of growth and development in faba beans (Vicia faba) infected with Orobanche crenata.

Linke, K-H. Status quo of Orobanche management: preventive, cultural, and physical control.

Kroschel, J. and Klein, O. Biological control of Orobanche spp. with Phytomyza orobanchia Kalt., a review.

Klein, O. et al. Éfficacité de lachers supplementaires de Phytomyza orobanchia Kalt. [Diptera: Agromyzidae] pour la lutte biologique contre l'Orobanche au Maroc.

Zermane, N. Prospects for biological control of the parasitic weed Orobanche in Algeria.

Zaitoun, F.M.F. and Al-Aryan, M. Loss assessment and forecasting work on plant diseases: 2. prediction of Orobanche crenata seed yield and its reduction due to Phytomyza orobanchia and rot fungi.

Norambuena, H. et al. Introduction of Phytomyza orobanchia for biocontrol of Orobanche spp. in Chile.

Abdalla, M.M.F. and Darwish, D.S. Breeding faba bean for Orobanche tolerance using the concept of breeding for uniform resistance.

Nawar, A.I. et al. Variation among three Orobanche crenata accessions in their virulence in relation to growth and yield characters of the faba bean cultivars Giza 3 and Giza 429.

Saber, H. et al. Performance of a newly bred faba bean line (X-843) resistant to Orobanche in Egypt.

GarcÍ a-Torres, L. et al. Chemical control of Orobanche spp. in legumes: achievements and constraints.

Kleifeld, Y. et al. Selective control of Orobanche spp. in various crops with sulfonylurea and imidazolinone herbicides.

Kharrat, M. and Halila, M.H. Evaluation d'autres moyens de lutte contre l'Orobanche foetida Poir. sur Vicia faba L.

Zemrag, A. Lutte integrée contre l'Orobanche (Orobanche crenata Forsk.) dans la culture de fève (Vicia faba L.) au Maroc.

Dhanapal, G.N. and Struick, P.C. Reduction of infestation of broomrape on tobacco by metabolic inhibition using maleic hydrazide.

Chattou, Z. and El-Amrani, M. Analyse des constraintes au transfert de la technologie de lutte chimique contre l'Orobanche.

Loudie, N. et al. Développement du matériel didactique pour le contrôle de l'Orobanche au Maroc (Bloc d'images).

El-Idrissi, R.M. et al. Situation du contrôle phytosanitaire de l'Orobanche sur fève dans les régions du Saïs et Zaer (Maroc).

Betz, H. La vulgarisation de la lutte chimique contre l'Orobanche (Orobanche crenata Forsk.) sur fève (Vicia faba L.) avec la matière active 'Glyphosate': Quelques problèmes rencontrés.

El-Idrissi, R.M. et al. Développement d'un système de formation participative sur la biologie et les méthodes de lutte contre l'Orobanche au Maroc.

The 15th Conference of the Weed Science Society of Israel, Bet Dagan, Israel, March 1998.

Abstracts of papers presented at this meeting are included in Phytoparasitica 1999. Vol. 27. Relevant papers (pp. 109-115) are:

Eizenburg, H. et al. B. Effect of carrot sowing date on parasitism of Orobanche crenata and O. aegyptiaca.

Eizenburg, H. et al. B. Effect of temperature on host-parasite relationship in Orobanche spp.

Portnoy, V.H. et al. Diagnosis of soilborne Orobanche seeds.

Goldwasser, Y. et al. Studies of the resistance of Vicia atropurpurea to Orobanche aegyptiaca.

Shomer-Ilan, A. Proteolytic activity of germinating Orobanche aegyptiaca seeds controls the degrading level of its own excreted pectinase and cellulase.

Mayer, A.M. et al. Involvement of pectinases in plant infection by parasitic weeds.

Kleifeld, Y. et al. Control of Orobanche in tomatoes with sulfonylurea herbicides.

Kleifeld, Y. et al. Selective Orobanche control with imadazolinones herbicides in various host crops.

Amsellem, Z. et al. Isolation of mycoherbicidal pathogens from juvenile broomrape plants.

Cohen, B. et al. J. Green fluorescent protein (gGFP) as a marker in a phytopathogenic fungus, Fusarium oxysporum, on Orobanche.

Joel, D.M. et al. Grafting for Orobanche resistance.

Weinberg, T. et al. Effects of herbicide inhibitors of carotenoid biosynthesis on field dodder (Cuscuta campestris).

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Adipala, E., Tusiime, G. and Okori, P. (eds.) 1997. Proceedings of the 16th Biennial Weed Science Society Conference for Eastern Africa, Kampala, 1997. 310 pp. (Includes 8 papers on Striga - see item under Proceedings of Meetings above.)

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Alonso, L., Rodriguez-Ojeda, M.I., Fern« ndez-Escobar, J. and LÙ pez-Ruiz-Calero, G. 1998. Chemical control of broomrape (Orobanche cernua Loefl.) in sunflower (Helianthus annuus L.) resistant to imazethapyr herbicide. Helia 21(29): 45-53. (Imazethapyr post-emergence at 40 days completely prevented emergence of O. cernua on naturally resistant wild sunflower. cf. reference to Al-Khatib et al. in Haustorium 34!)

Arnaud, M.C., V¾ ron¾ si, C. and Thalouarn, P. 1999. Physiology and histology of resistance to Striga hermonthica in Sorghum bicolor var. Framida. Australian Journal of Plant Physiology 26: 63-70. (Resistance of Framida not due to low stimulant exudation but apparently to inhibited haustorial development, difficulty of penetration of the endodermis, reduced nutrient availability and accumulation of phenolics.)

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Bright, E.O. and Okusanya, B.A. 1998. Infestation of economic plants in Badeggi by Tapinanthus dodoneifolius (DC.) Danser and T. globiferus (A.Rich.) van Tiegh. Nigerian Journal of Weed Science: 11: 51-56. (Both species widespread, on shea butternut (Vitellaria paradoxa = Butyrospermum paradoxum), neem, citrus, Parkia globosa and Nerium oleander, frequency over 30% on the first 2 named. The main bird responsible for dispersal was the tinker bird Pogoniulus chrysoconus: others included the bulbul Pyconotus barbatus, weaver Ploceus cucullatus and plantain-eater Crinifer piscator.)

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Gebisa Ejeta. 1998. Striga biotechnology development and technology transfer. Project PRF-213. INTSORMIL Sorghum/Millet Collaborative Research Support Programme (CRSP). 1998 Annual Report, pp. 24-28. (Summarising laboratory studies on inheritance of low-stimulant character, effects of prolonged moist storage of seeds, interpretation of tetrazolium tests, screening techniques for other resistance mechanisms, and field testing of promising lines in Africa.)

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Hassan, R.M. and Ransom, J.K. 1998. Determinants of the incidence and severity of Striga infestation in maize in Kenya. In: Hassan, R.M. (ed.) Maize Technology Development and Transfer. A GIS Application for Research Planning in Kenya. CAB International, Wallingford, UK, pp. 163-174. (S. hermonthica estimated to occur on 39% of moist mid-altitude zone, causing 50% yield loss, and to be spreading. Tobit analysis used to assess the influence of a number of variables. This failed to confirm the supposed tolerant behaviour of local varieties.)

Hassanein, E.E., Fayad, Y., Shalaby, F.F. and Kkolosy, A.S. 1998. Natural role of Phytomyza orobanchia Kalt., a beneficial fly against the parasitic weeds Orobanche spp. infesting legumes and carrot in Egypt. Annals of Agricultural Science (Cairo) 43(1): 201-206. (Infestation of O. crenata plants varying from 24-100%.)

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Hussein, A.H.A., ElDeeb, M.A. and Saleib, S.R. 1998. Effect of number and timing application of glyphosate on Orobanche infestation and faba bean yields in middle Egypt. Arab Universities Journal of Agricultural Sciences 6: 437-444. (O. crenata reduced 80-90% by application of glyphosate at 34 g a.i./ha, half recommended dose, 75 days after planting, combined with NPK.)

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Orobanche aegyptiaca seeds. Journal of Experimental Botany 50: 655-664. (Reporting results at variance with previous assumptions and proposing a new thermal time model which accounted for 78% of variation in the data.)

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Khalaf, K.A. Ali, A.M., Youssef, K.A. and Abd-Alaziz, S.A. 1999. Studies on the control of Orobanche crenata. I. Use of Azotobacter spp. and Escherischia coli transformants to break dormancy of Orobanche crenata. FABIS Newsletter 40: 25-30. (see following item.)

Khalaf, K.A., Youssef, K.A., Ali, A.M. and Abd-Alaziz, S.A. 1999. Studies on the control of Orobanche crenata. II. Effectiveness of Azotobacter spp. and Escherischia coli transformants in biological control of Orobanche crenata on Vicia faba under soil conditions. FABIS Newsletter 40: 31-35. (Cultures of A. chroococcum and E. coli 'transformed' by exposure to crude DNA extracts from V. faba shown to induce germination of O. crenata, not induced by untransformed cultures.)

Khalil, S. and Saxena, M.C. 1998. More faba bean, less pollution. ICARDA Caravan No 9, Summer/Autumn, 1998: 7-9. (Rising production of faba bean in Egypt attributed partly to the availability of Orobanche-resistant cultivar 'Giza 402'.)

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Kranz, B., Fugger, W.D., Kroschel, J. and Sauerborn, J. 1998. The influence of organic manure on Striga hermonthica (Del.) Benth. infestation in Northern Ghana. In: Towards sustainable land use. Furthering cooperation between people and institutions. Volume 1. Proceedings of the International Soil Conservation Organization, Bonn, 1996. Advances in Geoecology No. 31: 615-619. (Lower infestation by S. hermonthica in regularly manured fields associated with higher nutrients and microbial activity.)

Kroschel,, J., Mercer-Quarshie, H. and Sauerborn, J. (eds.) 1999. Advances in Parasitic Weed Control at On-Farm Level. Volume 1. Joint Action to Control Striga in Africa. GTZ/University of Hohenheim. 324 pp. (Selected papers from a Regional Workshop held in Ghana, October, 1997. See report in Haustorium 33 and list of contents elsewhere in this issue.)

Kroschel,, J., Abderabihi, M. and Betz. H. (eds.) 1999. Advances in Parasitic Weed Control at On-Farm Level. Volume 2. Joint Action to Control Orobanche in the WANA Region. GTZ/University of Hohenheim. 347 pp. (Selected papers from a Regional Workshop held in Morocco, April, 1998. See report in Haustorium 33 and list of contents elsewhere in this issue.)

Kubus, M. 1998. (The mistletoe Viscum album L. on the area of the right-side part of Szczecin.) (in Polish) Folia Universitatis Agriculturae Stetinensis, Agricultura 71: 51-62. (Survey to east of R. Odra, Poland, recorded V. album on 9 genera of trees in 5 families.)

Kuiper, E., Groot, A., Noordover, E.C.M., Pieterse, A.H. and Verkleij, J.A.C. 1999. Tropical grasses vary in their resistance to Striga aspera, S. hermonthica and their hybrids. Canadian Journal of Botany 76: 2131-2144. (Grasses resistant to one or other Striga sp. included Chloris pycnothrix, Pennisetum pedicellatum, Rhynchelytrum repens, Sporobolus pyramidalis, Aristida adscensionis and Digitaria longiflora. Sorghum resistant to all samples of S. aspera and Pennisetum millet susceptible to only one. Resistant spp. stimulated germination but did not allow penetration of the endodermis.)

Kurkin, K.A. 1998. Interaction of plants in meadow phytocenoses: peculiarities, types and mechanisms. Russian Review of Ecology 29: 375-379. (translated from Ekologya 29:419-423.) (Interaction of grasses with Rhinanthus angustifolius is discussed.)

Lados, M. Effect of temperature, pH and host plant extracts on the germination of Cuscuta trifolii and C. campestris. Acta Agronomia Hungarica 46: 317-325.

Linke, K-H. 1998. Vernacular names of Orobanche. In: Martin. K, Mò ther, J., Auffarth, A.J. (eds.) Agroecology, Plant Protection and the Human Environment: views and concepts. PLITS 16(2): 57-67. (Over 200 vernacular names of Orobanche are given.)

Lodoen, D. 1999. Two agroforestry innovations for richer soils and bountiful harvests. Agroforestry Today Jan-Jun '99: 22-23. (Noted that Sesbania sesban fallow for 12-18 months reduces seed bank of Striga hermonthica in W. Kenya.)

Lohan, A.J. and Wolfe, K.H. 1998. A subset of conserved tRNA genes in plastid DNA of nongreen plants. Genetics

150: 425-433. (Comparisons made between Epifagus virginiana and Orobanche minor.)

LÙ pez-Granados, F. and GarcÍ a-Torres, L. 1999. Longevity of crenate broomrpae (Orobanche crenata) seed under soil and laboratory conditions. Weed Science 47: 161-166. (O. crenata stored in the field, undisturbed, showed an annual cycle of germinability and apparently lost viability almost completely after 6-9 years.)

Lundborg, G. 1998. Lifting the curse of witchweed. African Farming, November/December 1998: 33. (A review of the progress in development of cowpea varieties resistant to Striga gesnerioides and suggesting that they will be of value also as trap crops for Striga spp. attacking cereals.)

Lusson, N.A., Delavault, P.M. and Thalouarn, P.A. 1998. The rbcL gene from the non-photosynthetic parasite Lathraea clandestina is not transcribed by a plastid-encoded RNA polymerase. Current Genetics 34: 212-215.

Maass, E. 1999. A comparative study on the germination requirements of some economically important Striga species. PhD Thesis, University of Stellenbosch, South Africa. 178 pp. plus Addendum. (Studies on S. hermonthica, S. asiatica and S. gesnerioides, giving useful results on optimum times and temperature for conditioning and germination, incidence of secondary dormancy, inhibition by light, etc.)

Manschadi, A.M. 1999. Modelling the growth and development of faba bean (Vicia faba L.) infested with the parasitic weed Orobanche crenata Forsk. Agroecology 1: 1-128. (Doctoral thesis, the first in a new series replacing PLITS. A model, VIFOR, has been developed and a copy is provided on floppy disc attached to the volume.)

Marley, P.S., Ahmed, S.M., Shebayan, J.A.Y. and Lagoke, S.J.O. 1999. Isolation of Fusarium oxysporum with potential for biocontrol of the witchweed (Striga hermonthica) in the Nigerian savanna. Biocontrol Science and Technology 9: 159-163. (Isolate PSM-197 from S. hermonthica controlled the weed when used as a foliar spray or when incorporated into soil (at a massive dose).)

Marvier, M.A. 1998. Parasite impacts on host communities: plant parasitism in a California coastal prairie. Ecology 79: 2616-2623. (Triphysaria pusilla grew 3-6 times better on grass species, and had correspondingly more damaging effect, than on Hypochaeris glabra or Lupinus nanus. Removal increased grass component of natural community.)

Mathiasen, R.L. 1998. Comparative susceptibility of conifers to larch dwarf mistletoe in the Pacific Northwest. Forest Science 44: 559-568. (Extensive survey established the principal host of Arceuthobium laricis to be Larix occidentalis; secondary hosts to be Tsuga mertensiana and Pinus contorta; occasional hosts to be Abies lasiocarpa and Pinus ponderosa; rare hosts to be Picea engelmannia and Abies grandis, and probably also Tsuga heterophylla, Abies amabilis and Pinus albicaulis; uninfected were Pseudotsuga menziesii and Thuja plicata.)

Mathiasen, R.L. 1999. Comparative susceptibility of subalpine firs to Douglas-fir dwarf mistletoe. Canadian Journal of Plant Pathology 21: 45-51. (On the basis of infection of trees close to infected Pseudotsuga menziesii, Abies lasiocarpa classified as a secondary host of Arceuthoboium douglasii and Abies bifolia as an occasional host.)

Molvray, M., Kores, P.J. and Chase, M.W. 1999. Phylogenetic relationships within Korthalsella (Viscaceae) based on nuclear ITS and plastid trn L-F sequence data. American Journal of Botany 86: 249-260. (Study of 25 populations suggest the need for some revision of the genus, currently based on branching characters, but still difficulty in delimiting species.)

Morozov, I.V., Foy, C.L. and Westwood, J.H. 1998. Comparison of small broomrape (Orobanche minor Sm.) and Egyptian broomrape (Orobanche aegyptiaca Pers.) parasitization of red clover (Trifolium pratense L.). (Abstract) Proceedings, Southern Weed Science Society 51: 247. (Infestation of T. pratense by O. minor increased in the presence of rhizobial inoculum; no corresponding increase of O. aegyptiaca infestation.)

Naithani, H.B. 1998. Epiphytes/parasite. Indian Forester 124: 265-266. (Ficus religiosa parasitized by Dendrophthoe falcata.)

Nandula, V.K. and Foy, C.L. 1998. Effect of parasitization by Egyptian broomrape (Orobanche aegyptiaca Pers.) on aminoacid composition of carrot. (Abstract) Proceedings, Southern Weed Science Society 51: 246-247.

Neumann, U., Sall¾ , G. and Weber, H.C. 1998. Development and structure of the haustorium of the parasite Rhamphicarpa fistulosa (Scrophulariaceae). Botanica Acta 111: 354-365. (A detailed study and description of the initiation and development of the xylem bridge in roots of Pennisetum millet.)

Nierhaus-Wunderwald, P.D. and Lawrenz, P. 1998. (A note on the biology of mistletoe.) (in French) ForÃ t 51(2): 5-9. (A short account of the 3 forms of Viscum album in Switzerland.)

Nun, N.B. and Mayer, A.M. 1999. Culture of pectin methylesterase and polyphenoloxidase in Cuscuta campestris. Phytochemistry 50: 719-727. (Enzymes obtained from C. campestris in aseptic culture and partially characterised.)

Obilana, A.B. 1998. Sorghum improvement. International Sorghum and Millet Newsletter 39: 4-17. (Reviews 15 years work of SADC/ICRISAT Sorghum and Millet Improvement Program, including screening and development of Striga-resistant cultivars.)

Oliver, J. 1999. Dodder on bramble. BSBI News 81: 32. (Cuscuta epithymum observed causing damage to Rubus ?ulmifolius.)

Ou¾ draogo, O., Neumann, U., Raynal-Roques, A., Sall¾ , G., Tuquet, C. and Demb¾ l¾ , B. 1999. New insights concerning the ecology and the biology of Rhamphicarpa fistulosa (Scrophulariaceae). Weed Research 39: 159-169. (R. fistulosa is shown to be a facultative parasite which can mature without a host but grows much better with one. Germination does not require a host but does require light. Maize and Pennisetum millet can be severely damaged.)

Overfield, D., Riches, C.R., Amasoah, M., Sarkodie, O. and Baah, F. 1998. A farming systems analysis of the mistletoe problem in Ghanaian cocoa. Cocoa Growers' Bulletin No. 51, June, 1998: 42-53. (A detailed study of the serious problem of Tapinanthus banguensis on cocoa in Ghana, proposing the provision of long-handled pruning devices as the most viable solution.)

š zge, N., Mehmet, H.N., Bò yò k, H. and Daá , S. 1998. (Investigations on the effect of imazapic on broomrape (Orobanche spp.) in sunflower and tobacco fields.) (in Turkish) In: Nemli, Y. and Demirkan, H.J. (eds.) Proceedings, Second Turkish Weed Science Congress, Bornova, 1997, pp. 269-278.

Park WonBong, Ju YeunJin and Han SeonKyu 1998. Isolation and characterization of ¢ -galactoside specific lectin from Korean mistletoe (Viscum album var. coloratum) with lactose-BSA-Sepharose 4B and changes of lectin conformation. Archives of Pharmacal Research 21: 429-435.

Pazy, B. 1998 Diploidization failure and apomixis in Orobanchaceae. Botanical Journal of the Linnean Society 128: 99-103. (Concludes that facultative apomixis is common in Orobanchaceae.)

Pickett, J. 1999. Pest control that helps to control weeds at the same time. BBSRC Business No. 7, April 1999: 16-17. (Some combinations of trap crops Sorghum sudanensis and Pennisetum purpureum, and intercrops Melinis minutiflora and Desmodium uncinatum, effective against stem borers in maize, also apparently reducing Striga hermonthica, but detail far from clear.)

Pohl, P., Antonenko, Y.N., Evtodienko, V.Y., Pohl, E., Saparov, S.M., Agapov, I.I. and Tonevitsky, A.G. 1998. Membrane fusion mediated by ricin and viscumin. Biochimica et Biophysica Acta, Biomembranes 1371(1): 11-16. (A hypothesis is proposed to explain the toxicity of ribosome-inactivating plant proteins (RIPs), including viscumin from Viscum album, on the basis of their vesicle-vesicle fusion activity.)

Pronier, I., Par¾ , J., Traor¾ , D., Vincent, C. and Stewart, R.K. 1998. A histological study of the effect of feeding by Smicronyx spp. (Coleoptera: Curculionidae) larvae on seed production by Striga hermonthica (Scrophulariaceae). Biological Control 13: 152-157. (Field study in Burkina Faso showed synchronous development of seeds and larvae.)

Pundir, Y.P.S., Dhan Singh and Hamant Singh. 1997. Three new hosts of Garhwal Himalayan mistletoes. World Weeds 4(3/4): 77-80. (Reporting Dendrophthoe falcata on Cassia siane, Scurrula pulverulenta on Juglans regia and S. cordifolia on Holoptelea integrifolia.)

Radomiljac, A.M., McComb, J.A. and Pate, J.S. 1999. Gas exchange and water relations of the root hemi-parasite Santalum album L. in association with legume and non-legume hosts. Annals of Botany 83: 215-224. (Results 'reinforce earlier conclusions that Santalum transpiration rate perpetuates a favourable water potential gradient from its host.')

Radomiljac, A.M., McComb, J.A. and Shea, S.R. 1998. Field establishment of Santalum album L. - the effect of time of introduction of a pot host (Alternanthera nana R.Br.). Forest Ecology and Management 111(2/3): 107-118. (Establishment of S. album on A. nana in the nursery substantially improved growth and survival of S. album when subsequently planted out in the field.)

Rao, M.R. 1998. Prospects of agroforestry for Striga management. In: Edwards-Jones, G. and Sinclair, F.L.J. (eds.) Special issue on Pests, Diseases and Weeds of Agroforestry Systems. Agroforestry Forum 9(2): 22-27. (Agroforestry techniques useful in reducing Striga include short-duration fallows and biomass transfer of tree foliage.)

Raynal-Roques, A. and Par¾ , J. 1998. (The biodiversity of phanerogamous parasities: their place in the classification system.) (in French) Adansonia 20: 313-322. (Discusses the difference between 'direct parasitism' occurring mainly in the more advanced plant families, and the less common 'mycoparasitism' involving an endotropic fungus, which appears to be a more ancient phenomenon.)

Richael,, C. and Gilchrist, D. 1999. The hypersensitive response: a case of hold or fold? Physiological and Molecular Plant Pathology 55: 5-12. (No specific mention of parasitic plants, but useful commentary: preceding editorial, pp. 1-3, also relevant.)

Robert, S., Simier, P. and Fer, A. 1999. Purification and characterisation of mannose 6-phosphate reductase, a potential target for the control of Striga hermonthica and Orobanche ramosa. Australian Journal of Plant Physiology 26: 233-237. (The enzyme, important in both spp. in production of mannitol, shown to differ in only very small detail - encouraging if one were to develop an inhibitor aimed at this parasite-specific target.)

Rothe, K., Diettrich, B., Rahfeld, B. and Luckner, M. 1999. Uptake of phloem-specific cardenolides by Cuscuta spp. growing on Digitalis lanata and Digitalis purpurea. Phytochemistry 51: 357-361. (Cardenolides in C. reflexa, C. platyloba and C. europaea are apparently derived from those in the host by deglucosylation.)

Rubiales, D., Sillero, J.C. and Cubero, J.I. 1998. Broomrape (Orobanche crenata Forsk.) resistance in peas (Pisum sativum L.). In: 3rd European Conference on Grain Legumes. Opportunities for high quality, healthy and added-value crops to meet European demands, Valladolid, Spain, 1998, p. 238. (Over 700 lines of P. sativum and wild relatives screened, of which about 50 showed low infection.)

Salem, I.E.M. 1998. Resistance of faba bean to the African bean aphid Aphis craccivora Koch. (Hom.: Aphididae) caused by parasitic broomrape Orobanche crenata. Mededelingen-Facukteit Lanbouwkundige en Toegpaste Biologische Wetenschappen, Universiteit Gent 63(2a): 329-332. (Resistance of parasitised faba bean plants to aphids attributed to the development of alkaloids.)

Sandri, G., Sandri, A. and Martini, G. 1998. (Protection of tobacco against Orobanche.) (in Italian) Informatore Agrario 54(26): 74-75. (Glyphosate in 2-4 doses totalling 400 g/ha controlled O. ramosa without reducing crop yield.)

Sassa, T., Ooi, T., Nukina, M., Ikeda, M. and Kato, N. 1998. Structural confirmation of cotylenin A, a novel fusicoccane-diterpene glycoside with potent plant growth-regulating activity, from Cladosporium fungus sp. 501-7W. Bioscience, Biotechnology and Biochemistry 62: 1815-1818. (Cotylenin A referred to as a 'potent plant growth stimulant with known seed germination stimulating activity towards parasitic weeds'.)

Schaller, G., Urech, K., Grazi, G. and Giannattasio, M. 1998 Viscotoxin composition of the three European subspecies of Viscum album. Planta Medica 64: 677-678. (Viscotoxin composition differed between the subspecies album, abietis and austriacum.)

Shamoun, S.F. 1998. Development of biological control strategy for management of dwarf mistletoes. In: Sturrock, R. (compiler) Proceedings of the 45th Western International Forest Disease Work Conference, Prince George, Canada, 1997, pp. 36-42. (Describing the collection of a wide range of fungi from Arceuthobium tsugense, and tests with 2 of these - Colletotrichum gloeosporioides and Nectria neomacrospora - which are considered to have practical potential for treating established infestations on trees bordering new plantings.)

Shimi, P. 1998. Hope for effective biological control of Cuscuta monogyna in Iran. Near East Working Group for Improved Weed Management Newsletter Issue 18: 16-17. (Unidentified gram-negative bacterium severely damaging C. monogyna in a grape and pomegranate orchard near Tehran.)

Shindrova, P., Ivanov, P. and Nikolova, V. 1998. Effect of broomrape (Orobanche cumana Wallr.) intensity of attack on some morphological and biochemical indices of sunflower (Helianthus annuus L.). Helia 21(29): 55-62. (Recording reductions in height, head diameter, seed weight, and oil and protein content.)

Simmons, E.G. 1998. Alternaria themes and variations (224-225). Mycotaxon 68: 417-427. (A new species A. destruens is described from Cuscuta gronovii.)

Soler, M.H., Stoeva, S. and Voelter, W. 1998. Complete amino acid sequence of the B chain of mistletoe (Viscum album) lectin I. Biochemical and Biophysical Research Communications 246: 596-601.

Solymosi, P. 1998. (The identification of seeds of sunflower broomrape (Orobanche cumana Wallr.) and tobacco broomrape (O. ramosa L.) using scanning electron microscopy.) (in Hungarian) NØ v¾ nyv¾ delem 34: 405-408.

Stranger, A., Corbett, J.M., Dunn, M.J., Totty, N.F., Sterling, A. and Bolwell, G.P. 1999. Identification of developmentally-specific markers in germinating and haustorial stages of Striga hermonthica (Del.) Benth. seedlings. Journal of Experimental Botany 50: 269-274.

Sukno,, S., Melero-Vara, F.M. and Fern« ndez-MartÍ nez, J.M. 1999. Inheritance of resistance to Orobanche cernua Loefl. In six sunflower lines. Crop Science 39: 674-678. (Concludes that resistance involves dominant alleles at a single locus, or at a cluster of closely linked non-allelic sites. Two lines found, JD-6 and W-14, resistant to O. cernua populations which overcame the Or5 resistance gene.)

Sweeney, E.C., Tonevitsky, A.G., Palmer, R.A., Niwa, H., Pfueller, U., Eck, J., Lentzen, H., Agapov, I.I. and Kirpichnikov, M.P. 1998. Mistletoe lectin I forms a double trefoil structure. FEBS Letters 431: 367-370.

Tepe, I., Deveci, M. and Keskiin, B. 1998. (Studies on damage and parasite levels of dodder (Cuscuta approximata Bab.) on some alfalfa (lucerne) cultivars.) (in Turkish) In: Nemli, Y. and Demirkan, H.J. (eds.) Proceedings, Second

Turkish Weed Science Congress, Bornova, 1997, pp. 353-360.

Thomas, H., Heller, A., Sauerborn, J. and Mò ller-StØ ver, D. 1999. Fusarium oxysporum f. sp. orthoceras, a potential mycoherbicide, parasitizes seeds of Orobanche cumana (sunflower broomrape): a cytological study. Annals of Botany 83: 453-458. (O. fusarium shown to attack all underground stages including dormant seed. Encouraging.)

Torres, G., Calderon, O. and Villegas, J.L. 1998. Occurrence of weeds in alfalfa seeds imported from Spain to Mexico. Sixth EWRS Mediterranean Symposium, Montpellier, 1998. pp. 55. (Included Cuscuta spp.)

Trummer, L.M., Hennon, P.E., Hansen, E.M. and Muir, P.S. 1998. Modelling the incidence and severity of hemlock dwarf mistletoe in 110-year-old wind-disturbed forests in Southeast Alaska. Canadian Journal of Forest Research 28: 1501-1508. (Severity of Arceuthobium tsugense on regenerating Tsuga heterophylla closely linked to levels of infection in residual trees surviving wind damage.)

Uludaá , A. and Demir, A. 1998. (Parasitic weeds of lentil fields in South East Anatolia region.) (in Turkish) In: Nemli, Y. and Demirkan, H.J. (eds.) Proceedings, Second Turkish Weed Science Congress, Bornova, 1997, pp. 379-384.

Vallauri, D. 1998. (Dynamics of Viscum album L. on Austrian black pine in the Saignon watershed (southern French Alps.) (in French) Annales des Sciences Forestières 55: 823-835. (Infestation of Pinus nigra related to the flight paths of Turdus viscivorus.)

Vissoh, P., Manyong, V.M., Carsky, R.J., Osei-Bonsu, P. and Galiba, M. 1998. Experiences with Mucuna in West Africa. In: Buckles, D., Etika, A., Osiname, O., Galiba, M. and Galiano, G.J. (eds.) Cover Crops in West Africa: Contributing to Sustainable Agriculture. Cotonou, 1998: 1-32. (Includes comment on the potential for use of Mucuna in suppression of Striga hermonthica.)

Volney, W.J.A. and Mallett, K.I. 1999. Integrated pest management in Western Canadian boreal forests. Forestry Chronicle 74: 597-605. (Review and discussion of IPM, including mistletoes.)

Vouzounis, N.A. and Americanos, P.G. 1998. Control of Orobanche (broomrape) in tomato and eggplant. Technical Bulletin, Cyprus Agricultural Research Institute No. 196: 1-7. (Useful treatments for O. aegyptiaca/ramosa were black polythene at time of transplanting in both crops, and rimsulfuron at 10 or 20 g/ha in tomato only.)

Weber, K., Mengs, U., Schwarz, T., Hajto, T., Hostanska, K. Allen, T.R., Weyhenmeyer, R. and Lentzen, H. 1998. Effects of standardized mistletoe preparation on metastatic B16 melanoma colonization in murine lungs. Arzneimittel Forschung 48: 497-502. (A preparation from Viscum album, Lektinol, inhibited pulmonary metastases by 58-95% without signs of treatment-related toxicity.)

Wegmann, K., Musselman, L.J. and Joel, D.M. (eds.) 1998. Current Problems of Orobanche Researches. Proc., 4th International Orobanche Workshop, Albena, Bulgaria, 1998. Institute for Wheat and Sunflower, General Toshevo, 9520, Bulgaria. 452 pp. (See report of meeting in Haustorium 34 and list of contents elsewhere in this issue.)

Westwood, J.H. and Foy, C.L. 1999. Influence of nitrogen on germination and early development of broomrape (Orobanche spp.). Weed Science 47: 2-7. (Effects of 5 mM ammonium greatest on O. minor, least on O. aegyptiaca, with O. crenata, O. ramosa and O. cernua intermediate: damage can occur within 4-8 hours during conditioning or germination and takes the form of inhibition of germ tube elongation. Host species much less sensitive. Useful clarification.)

Westwood, J.H., Nandula, V.K. and Foy, C.L. 1998. Metabolic basis for ammonium inhibition of broomrape (Orobanche spp.) growth. (Abstract) Proceedings Southern Weed Science Society 51: 245-246.

Wigchert, S.C.M., Kuiper, E., Boelhouwer, G.J., Nefkens, G.H.L., Verkleij, J.A.C. and Zwanenburg, B. 1999. Dose-response of seeds of the parasitic weeds Striga and Orobanche toward the synthetic germination stimulants GR 24 and Nijmegen 1. Journal of Agricultural and Food Chemistry 47: 1705-1710. (Confirming high activity of GR 24 at 10-9--10-8M on S. hermonthica and S. asiatica and at higher concentrations on O. crenata, but not on S. aspera. Activities of Nijmegen 1 about 3 orders of magnitude lower. Proposing further practical testing of both in the field.)

Wigchert, S.C.M. and Zwanenburg, B. 1999. A critical account on the inception of Striga seed germination. Journal of Agricultural and Food Chemistry 47: 1320-1325. (Proposing that Striga germination is induced by strigolactones via a receptor-mediated mechanism and is quite distinct from that resulting from sorgholeone.)

Wilson, J.P., Hess, D.E., Cass¾ , B., Hanna, W.W. and Youm, O. 1998. Striga hermonthica infection of wild Pennisetum germplasm is related to time of flowering and downy mildew incidence. International Sorghum and Millet Newsletter 39: 149-150. (Emergence of S. hermonthica varied on 275 lines of P. glaucum, being lower on early-flowering accessions and those infected by downy mildew.)

Wolfe, A.D. and de Pamphilis, C.W. 1998. The effect of relaxed functional constraints on the photosynthetic gene rbcl in photsynthetic and nonphotosynthetic parasitic plants. Molecular Biology and Evolution 15: 1243-1258. (Describing the evolution of a photosynthetic gene in achlorophyllous plants.)

Yoder, J.I. 1997. A species-species recognition system directs haustorium development in the parasitic plant Triphysaria (Scrophulariaceae). Planta 202: 407-413. (Describing self- and species recognition, and the in vitro parasitism of Arabidopsis.)

Yoder, J. 1999. Parasitic plant responses to host plant signals: a model for subterranean plant-plant interactions. Current Opinion in Plant Biology 2(1): 65-70. (A brief but perceptive review of recent developments in understanding the evolution of Scrophulariaceae and Orobanchaceae, and the mechanisms involved in host recognition and penetration, with intriguing conclusions on the potential for e.g. transferring parasitic genes into crops!)

Yokota, T., Sakai, H., Okuno, K., Yoneyama, K. and Takeuchi, Y. 1998. Alectrol and orobanchol, germination stimulants for Orobanche minor, from its host red clover. Phytochemistry 49: 1967-1973. (Three stimulants isolated from root exudates of Trifolium pratense, including alectrol and a strigol-related compound 'orobanchol'.)

Yoneyama, K., Ogasawara, M., Takeuchi, Y., Konnai, M., Sugimoto, Y., Seto, H. and Yoshida, S. 1998. Effect of jasmonates and related compounds on seed germination of Orobanche minor Smith and Striga hermonthica (Del.) Benth. Bioscience, Biotechnology and Biochemistry 62: 1448-1450. (Methyl jasmonate most active of compounds tested on S. hermonthica and O. minor.)

Zeid, M., Madkour, M., Koraiem, Y., Nawar, A., Soliman, M. and Zaitoun, F. 1997. Molecular studies on Orobanche. Journal of Phytopathology 145: 351-355. (RAPD analysis applied to several species of Orobanche: results confirm a distinction between O. ramosa and O. aegyptiaca, with O. oxyloba apparently closest to O. aegyptiaca.)

Zonno,M.C. and Vurro, M. 1999. Effect of fungal toxins on germination of Striga hermonthica seeds. Weed Research 39: 15-20. (Toxin T-2, most active, at 10-5 M; deoxinivalenol active at 10-4 M; both from Fusarium spp. Discussion of potential as natural herbicides and possible role of biotechnological techniques in their production.)

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