HAUSTORIUM

Parasitic Plants Newsletter

Official Organ of the International Parasitic Seed Plant Research Group

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• • SIXTH INTERNATIONAL PARASITIC WEED SYMPOSIUM CORDOBA, SPAIN 16-18 APRIL 1996

Plan to attend the symposium in beautfiul Cordoba, Spain where in addition to plenary sessions, papers, and posters there will be opportunity to see ***Orobanche, Cuscuta.*** and ***Viscum*** in the field. Like previous symposia, all groups of parasitic plants are included. For information contact:

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• BACTERIA THAT SCAVENGE GERMINATION STIMULANTS?

There is a microbiological principle stating no naturally occurring substance exists that cannot be broken down by a microorganism. ***Striga*** depends on the production of tiny seeds that are stimulated to germinate by chemical stimulants of which strigol is the best known. Strategy in the present research is to find a way to intervene into this process by interfering between the stimulant, whether strigol or one of its closely related analogs, and ***Striga*** seed. This project aims at finding a soil microorganism that could scavenge strigol as it exudes from the host root before it reaches the striga seed. Probability that such an organism can be found should be high because the microorganisms could have a number of other functions not confined to breaking down the probably recalcitrant heterocyclic strigol molecule. Simple techniques have been followed to test the hypothesis. Most of the work was carried out in sterile petri dishes with moistened filter papers on which sorghum grains were grown (3-6 days) into seedlings which presumably release the strigol related substance sorgolactone on the filter paper. In the control experiments, preconditioned (10-12 days at 25 ° C) *Striga* ***herrnonthica*** seeds on glass fiber filter paper were placed in the petri dish with the sorghum seedlings, incubated at room temperature and the germinated seeds counted. The soil microorganisms to be tested for their ability to nullify the effect of the stimulant are grown on nutrient agar plates, the cell population suspended in distilled water and the suspension used in the test experiment. Here the bacterial suspension (inhibitor carrier) was added together with the *Striga* seeds to the petri dish carrying the sorghum seedlings. The isolate most commonly used was a mucoid, yellowish bacterium (probably a *Xanthomonas* sp.), originally isolated as a sorghum seed pathogen and was routinely propagated on sorghum seedlings in petri dishes. The addition of the bacterial suspension to the stimulant source reduced the ability to germinate the ***Striga*** seeds. About 65% of the *Striga* seeds germinated in the absence of the bacterial suspension (control) while only 8.4% germinated in the presence of the microorganisms (Treated.) In a supportive experiment, sorghum grains were grown in sterile sand in plastic cups for one week and watered with test bacterial suspension or with distilled water. Then the water was removed by a vacuum pump and used to stimulate ***Striga*** seeds. Controls gave 55.5% germination while test experiments gave 27.4% germination. A few pot experiments were also carried out in which sorghum seedlings were transferred from the petri dishes to large clay pots containing garden soil infested with ***Striga*** seeds at the rate of 0.08 grams per pot. The sorghum was grown for 44 days and plants watered with bacterial suspensions or with distilled water. Then. the plants were uprooted and the attachments of the ***Striga*** to the sorghum roots were counted. The results obtained showed that when bacterial suspensions were added to the soil the attachments of striga to host roots averaged *36;* in the controls, they averaged 114 attachments. We have also tried to gather some preliminary information on the nature of the inhibitor. In one experiment, we separated the liquid from the cell mass in the suspension, using a 0.45 micron bacterial filter. and tested the ability of each to inhibit the germination stimulant. The effective ingredient resided in the filtrate not in the cell mass. Heat treatment destroyed the ability of the inhibitor to have any effect on the stimulant suggesting that the inhibitor is a volatile substance or a protein that is denatured by heat. From a biotechnological view point. once a suitable organism has been obtained and the mechanism of its action on the stimulant has been elucidated, the useful ingredient can be obtained by growing the organism in a suitable growth medium in bioreactors. If the cells themselves are to be mixed with the seeds of sorghum before sowing as a dressing, then they can be provided in dry powder form like any other commercial microbial preparation. Obviously microbes that are pathogenic (e.g., the strain used here) cannot be used. If a chemical produced by the organism is the effective ingredient, then it could be produced in pure form. Both preparations should pose no environmental problems. The technology needed for the production of large scale biomass or chemical is available today. The yields can be improved through modern techniques of process optimization, and the microbial strains could be improved using recombinant DNA technology. It may even be possible to transfer the genes concerned from the microorganism to the host plant itself to make it intrinsically resistant to ***Striga.*** We believe that this research could open an area of useful research in weed control as the technique could equally well be applied to the control of similar parasitic weeds.

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• SEX RATIO IN MISTLETOES

There are many dioecious mistletoes from the new and the old world. The sex ratio of many dioecious plants often deviates significantly from **1:1** with tendency towards a male bias. Earlier sex ratio surveys on mistletoes have reported a female-bias. ***Viscum album*** populations have a strongly female biased sex ratio in natural populations, but in other European and Asian species of ***Viscum*** sex ratios not differing from 1:1 have been found. Sex ratios were at unity in most dioecious African species of ***Viscum.*** but female biased ratios as low as 0.52 and male biased ratios as high as high 1.40 may occur in some species. Female biased sex ratios were found over all populations of ***Phoradendron tomentosum*** in Central Texas by Nixon and Todzia. Recently Marshall et al. stated that, unique among the mistletoes studied to date, the sex ratio of ***Phoradendron juniperinum*** populations is significantly male biased. In populations of ***Loranthus europaeus,*** parasitizing oaks ***(Quercus cerris*** and ***Q. petraea),*** I found male bias. Male plants prevailed: they formed **69.2% of** all living plants. This male biased sex ratio was in relation to the woodland coenopopulation of ***Loranthus.*** Biological and ecological causes of the variations in sex ratios in mistletoes are not known. Barlow found that in dioecious species of ***Viscum,*** males are normally heterozygous for sex associated chromosomal translocations, and in ***V. album*** male plants usually form a ring of eight to ten chromosomes at meiosis. Nixon and Todzia found that only the trees with one mistletoe exhibited a sex ratio near 1:1. Trees with two or more mistletoes generally showed female biased ratios. The authors suggested that a general trend of increased within tree female bias is associated with higher number of mistletoe per tree. But ***Loranthus europeaus*** showed similar sex ratios in both the woodland and within host tree populations. We need more information about sex ratios in several mistletoes species and in several environmental conditions. In mistletoe population dynamic studies it is important to accept the dioecy and sex ratio bias.

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• PROCEEDINGS OF THIRD *OROBANCHE* SYMPOSIUM

The proceedings can be obtained from: KIT Press, Royal Tropical Institute, Mauritskade **63, 1092** AD Amsterdam, NETHERLANDS. The cost is 55 US$ + **$12** for mailing surface mail and $24 for air. Payment is to be made upon receipt of the volume. When ordering, indicate mode of shipment. (See literature section below under Pieterse etc for complete citation. See HAUSTORIUM **29** for a report on the symposium.)

• LITERATURE

Abbasher Awad Abbasher. 1994. Microorganisms associated with ***Striga hermonthica*** and possibilities of their utilization as biological control agents. PLITS 12 (1): 144 p. (28 fungal species recorded in Sudan of which ***Fusarium nygamai*** and ***F. semitectum*** var. ***majus*** show potential for development as mycoherbicides.)

Abu-Irmaileh, B. E. 1994. Nitrogen reduces branched broomrape ***(Orobanche ramosa)*** seed germination. Weed Science 42: 57-60. (Laboratory study showing that N 20-100 mg/l, as ammonium nitrate, reduced germination of ***O. ramosa*** when host seedlings and parasite seed were continuously exposed for 30-35 days.)

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Ariga, E. S., D. K. Berner and J. Chegwa. 1994. Effects of previous season cotton and cowpea on ***Striga hermonthica*** parasitism on maize. Abstract 670. Phytopathology 84: 1151.

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Babiker, A. G. T., T. Cai, G. Ejeta, L. G. Butler and W. R. Woodson. 1994. Enhancement of ethylene biosynthesis and germination with thidiazuron and some selected auxins in ***Striga asiatica*** seeds. Physiologia Plantarum 91: 529-536. (confirming a synergistic interaction between thidiazuron and auxins.)

Banerjee, K., D. C. Khatua and N. Mukherjee. 1993. Some new hosts of ***Cuscuta*** sp. Indian Forester 119: 760-761. (Recording occurrence on a range of forest tree species, leading to death of ***Millingtonia hortensis.)***

Berner, D. K., A. E. Awad and E. I. Aigbolchan. 1994. Potential of imazayuin seed treatment for control of ***Striga gesnerioides*** and ***Alectra vogelii*** in cowpea (***Vigna unguiculata.***) Plant Disease 78: 18-23. (Soaking cowpea seeds in imazayuin, e.g. 3.6 mg/l for 5 minutes before sowing, almost prevents parasite development.)

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Canevari, M. and E. Sieckert. 1993. Timing and rate of MON 13200 for dodder control in alfalfa. In: Lvm, R. G. (Ed.) Proceedings, Western Society of Weed Science 46: 20-21. (Thiazopyr at 1 lb/ac applied to established alfalfa in January provided good control of ***Cuscuta*** through to August.)

Carsky, R. J., L. Singh and R. Ndikawa. 1994. Suppression of ***Striga hermonthica*** on sorghum using a cowpea intercrop. Experimental Agriculture 30: 349-358. (More evidence for the possible value of cowpea interplanted within the row in reducing ***Striga*** density and seed production.)

Carsky, R. J., L. Singh and R. Ndikawa. 1994. Effect of herbicide and handweeding on current and subsequent season ***Striga hermonthica*** density on sorghum. International Journal of Pest Management 40: 111-116. (No significant effect from 2 seasons of suppression, but initial infestation very high - >100/m2.)

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Cechin, I. and M. C. Press. 1994. Influence of nitrogen on growth and photosynthesis of a C_3 plant, ***Oryza sativa*** infected with the root hemiparasite, *Striga hermonthzca.* Journal of Experimental Botanv 45: 925-930. (Photosynthesis reduced bv 30 arid 44% at high and low N respectively.)

Cechin, I. and M. C. Press. 1994. The influence of nitrogen on growth and photosynthesis of sorghum infected with ***Striga hermonthica*** from different provenances. Weed Research 34: 289-298.

Chowdhury, Al-Mamum and A. Ahmed. 1993. Histopathological studies of ***Striga*** spp. with sugarcane roots. Journal of Mycopathological Research 31(1): 1-4. (Observations on S. ***asiatica*** and S. ***densiflora.***)

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Dawoud, D. A. and J. Sauerborn. 1994. Impact of drought stress and temperature on the parasitic weeds ***Striga hermonthica*** and ***Alectra vogelii*** in their early growth stages. Experimental Agriculture 30: 249-257.

Dawson, J., Musselman, L. J., Doerr, I. and P. Wolswinkel. 1994. Biology and Control of ***Cuscuta.*** Reviews of Weed Science 6: 265-317. (A comprehensive survey of virtually every aspect of dodders: ecology, floral biology, taxonomy. distribution, ethnobotany, physiology, haustorial structure, control and more with extensive bibliography and numerous illustrations.)

Dembele, B., A. Raynal-Roques, G. Salle, and C. Tuquet. 1994. Plantes Parasites des Cultures et des Essences Forestiees au Sahel. CTA/John Libbey Eurotext. 43 pp. (A beautifully illustrated account of a wide range of parasitic species in West Africa.)

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Erskine, W. and M. C. Saxena. 1993. Problems and prospects of stress resistance breeding in lentil. In: Singh, K. B. and Saxena, M. C. (Eds) Breeding for Stress Tolerance in Cool-season Food Legumes. John Wiley. pp. 51-62.

Erslcine. W., M. Tufail, A. Russel, M. C. Tyagi, M. M. Rahman and M. C. Saxena. 1994. Current and future strategies in breeding lentil for resistance to biotic and abiotic stresses. Euphrtica 73: 127-135. (Noting the lack of sources of resistance to ***Orobanche*** spp. in lentil.)

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Fer, A., N. Russo, P. Simier, M-C. Arnaud and P. Thalouarn. 1994. Physiological changes in a root hemiparasitic angiosperm, ***Thesium humile*** (Santalaceae) before and after attack. Journal of Plant Physiology 143: 704-710. (Growth and photosynthetic rate in unattached parasite declines after 2 weeks, perhaps associated with high N/low P uptake by parasite roots. Initial photosynthesis comparable with that of wheat.)

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Filip, G. M., J. J. Colbert, C. G. Shaw, P. Hessburg and K. P. Hosman. 1993. Influence of dwarf mistletoe and western spruce budworm on growth and mortality of Douglas-fir in unmanaged stands. Forest Science 39: 465-477. (Results showed serious effects from both pests but no synergistic interaction between them.)

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Gomes, A. L. and G. W. Fernandes. 1994. Influence of parasitism by ***Pilostyles ingae*** (Rafflesiaceae) on its host plant ***Mimosa naguirei*** (Leguminosae.) Annals of Botany 74: 205-208.

Grimble, D. G. and R. C. Beckwith 1993. Temporal changes in presence of late instar ***Mitoura spinetorum*** (Lyceanidae) in eastern Oregon. Journal of the Lepidopterists' Society 47: 329-330. (On

Arceuthobium camplylopodum on *Pinus ponderosa*.)

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Hawksworth, F. G. and D. W. Johnson. 1993. You can save your trees from dwarf mistletoe. USDA Forest Service Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-225. 10 pp. (Control methods include felling, pruning, spraying with ethephon every 3-5 years, improving tree vigor, planting resistant tree species.)

Hess, D. E. 1994. Crop-specific strains of ***Striga hermonthica*** in Niger. Abstract 674. Phytopathology 84: 1151.

Hsiao, S., J. D. Mauseth, and C. Peng. 1995. Composite bundles, the host/parasite interface in the holoparasitic angiosperms ***Langsdorffia*** and ***Balanophora*** (Balanophoraceae.) American Journal of Botany 82(1): 81-91. (Composite bundles are the host parasite interface in these plants. Transfer cells are present and may represent the main pathway of interchange between host and parasite.)

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Krishnamurty, G. V. G., M. S. Chari and K. Nagarajan. 1994. Broomrape ***(Orobanche cernua*** Loefl.) on tobacco. Central Tobacco Research Institute, Rajahmundry - 533105, India. 35 pp. (A useful, well-produced summary of biological and control studies in India.)

Kuijt, J. 1994. Typification of the names of New World mistletoe taxa (Loranthaceae and Viscaceae) described by Martius and Eichler. Taxon 43: 187-199.

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Leake, J. R. 1994. Tansley Review No 69. The biology of myco-heterotrophic ('saprophytic') plants. New Phytologist 127: 171-216. (A comprehensive review relating to 400 species in 87 genera, discussing among much else whether 'saprophytic' plants are symbiotic with, or parasitic upon, their associated fungi.)

McKinnel, F. H. (ed.) 1993. Sandalwood in the Pacific Region. Australian Council for International Agricultural Research. 43 pp. (Surveying biodiversity, cultural practices and uses for timber, aromatic oil and fruit.)

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Pieterse, A. H., J. A. C. Verkleij and S. J. ter Borg (Eds.) 1994. Biology and Management of Orobanche. Proceedings of the Third International Workshop on Orobanche and related *Striga* Research. Royal Tropical Institute, The Netherlands. 736 pp. (Containing 96 papers, which will not be separately listed in Haustorium - see separate announcement for further information.)

Porta-Puglia, A., K. B. Singh and A. Infantino. 1993. Strategies for multiple-stress resistance breeding in cool-season food legumes. pp. 411-427 in K. B. and Saxena, M. C. (Eds) Breeding for Stress Tolerance in Cool-season Food Legumes. John Wiley.

Prance, G. T. and P.H. Raven, editors. 1995. The World of Plants. Weekly Encyclopedia 40(1/22): 97-128. Tokyo: Asahi Shimbun Publishers. (Popular treatment with spectacular photographs of the most bizarre of all angiosperm families: the Rafflesiaceae, Mistrastemonaceae, Hydnoraceae, Balanophoraceae, Eremolepidaceae, Viscaceae, Loranthaceae, Misodendraceae, Santalaceae, Opiliaceae, Olacaceae, Diptentodontaceae, and Medusandraceae by leading students of each family. In Japanese but with Latin names on photographs.)

Prather, L. A. and R. J. Tyrl. 1993. The biology of Cuscuta attenuata Waterfall. Proceedings of the Oklahoma Academy of Science 73: 7-13. (Unlike most species of dodder, C. attenuata has a restricted host range, preferring *Iva* annua; Asteraceae.)

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Press, M. C. and J. B. Whittaker. 1993. Exploitation of the xylem stream by parasitic organisms. Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences 341: 101-111. (Relating especially to ***Striga asiatica*** and ***Viscum album.)***

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Sharma, S. B., D. H. Smith, P. Subrahmanyam, M. J. Freire, T. Faria, D. R. Butler and G. V. Ranga Rao. 1994. Parasitism of groundnut by *Striga* sp. in Mozambique. International ***Arachis*** Newsletter 14: 24-25. (Confirming the parasitism of groundut by an identified *Striga* sp., likely ***S. gesnerioides.)***

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