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Parasitic Plants Newsletter

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A REQUEST FOR MISTLETOE FLOWERING MATERIAL

Mistletoes are an interesting group of plants, and their embryology shows several unique features, such as the absence of normal ovules, presence of multiple *embryo* sacs, extension of embryo sacs to different heights in the style and stigma, formation of composite **endosperm** as a result of fusion of several endosperms developing in *the* same ***ovary***, vertical division of the ***zygote***, long and tortuous *embryo* suspensor, and structure of the fruit.

Embryological investigations have been confined mostly to mistletoes of the Old World. There are only a few reports of similar work on the New World Loranthaceae, the mst recent and very accurate observations being those of Venturelli on Struthanthus. It has long been believed that multiple **embryo** sacs and composite endosperm are of universal occurrence in the Loranthaceae. However, Venturelli's observations on Struthanthus show beyond doubt that only one *embryo* sac develops and the endosperm is thus not a composite structure. Also there is no **polyembryony.**

In view of these important findings, it is essential that mre genera fran the *New* World be investigated embryologically. Delhi school has made significant contributions to the embryology of **this group.** I am keen to continue and make extensive studies on the **embryology** of mistletoes, particularly the *New* Wrld Loranthaceae, like Gaiadendron, **Aetanthus, Struthanthus, Phrygilathus, Psittacanthus, Ixocactus, Oryctanthus, Alepis, Ileostylus, Trilepidia, and Pthirusa. I would much appreciate** receiving buds, flowers, and fruits at all stages of development in sufficient quantity.

Please collect the material and preserve in formalin-acetic acid-ethanol (FAA). The standard formula is: 50 or 70% ethanol 90 cc, glacial acetic acid **5** cc, and formalin 5 cc. **The** material may be preserved in polythene bottles with the preservative but an alternative is to place the fixed material in cotton **soaked** in preservative and sealed in polythene bags. The material must be sent airmail. Mark the package "preserved material for botanical research and of no commerical value." Please send a representative herbarium specimen separately. **Mail** to: S. P. Bhatnagar, Department of Botany, University of Delhi, Delhi 110007, **India.**

STUDY OF THE **RESISTANCE** To MISTLETOE (VISCUM ALBUM L.)

Mistletoe (Viscum album L.) causes important damage in orchard, forest and hardwood **trees.** In order to control its spread, **mechanisms** of resistance **were** studied on four cultivars of poplar kncwn for their **degrees** of resistance: Populus trichocarpa Torrey and Gray cv. "Fritzi Pauley" (FPL); Populus x euramericana (Dode) Guinier cv. "I214"; Populus x euramericana (Dode); "Bergerac" (BRG); and Populus nigra L. cv. "Blanc de Garonne" (BDG).

Two hypotheses could explain **this** resistance: 1. a toxin contained in the flesh of the mistletoe berry could provoke a "hypersensitive" reaction

according to Paine (1950); 2. a reaction of the host could be involved. Before testing the first hypothesis, a structural investigation performed on the pericarp of the berry showed the complexity of the mesocarp or viscid tissue. It consisted of outer highly vacuolated cells and inner elongated degenerated cells deeply rooted in the endocarp. Their well-developed helical cellulosic structure, identified by cytochemical methods, played an important role during the dispersion of the fruits and the attachment of the *seeds* on host branches.

Artificial inoculations never provoked cankers on poplar trunks as it has been previously described for pear *trees*. For poplar, at least, the viscid tissue is not involved in the phenomenon of resistance to mistletoe. Artificial infestations showed that whatever the cultivar the *seeds* of mistletoe germinated and reached the phenological stage "b" characterized by the presence of a holdfast and the development of the haustorim. This stage marks the boundary between the autotrophic and the parasitic phase of the mistletoe.

The histocytological study performed on the parasitized trunks of the four cultivars established that, irrespective of the cultivar, the penetration of primary haustorim caused the formation of several peridermal layers, the most internal surrounding the haustorium. Each periderm is composed of a thin phellem and many phelloderm cells which are characterized by: 1. a secretion of polyphonols in the vacuole; and, 2. lignification of the newly formed cell walls around the Sinker.

However, the intensity of these reactions depended on the resistance of the host. In the susceptible cultivar, FPL, these structures were rapidly passed through by the young haustorium. On the contrary, in the resistant tree, BDG, the haustorium was never able to disrupt these barriers. Moreover, the secretion of polyphenols and the lignification of cell walls were much greater. In the intermediate cultivars, I214 and BRG, the haustorium developed, more or less, surrounded by the perihaustorial zone, and avoiding the clusters of fibers. However, 41 months after the inoculation, seedlings died.

Parameters involved in the resistance of poplar to mistletoe were identified on healthy barks of the four cultivars. Three anatomical aspects were specific for each cultivar: 1. the thickness of the phellem; 2. the number of secondary phloem parenchyma cells with a polyphenolic content; and, 3. the number of fibers. A statistical study established that these parameters showed a good correlation with the resistance. For example, the cultivar FPL had the thinnest phellem and the lowest number of fibers and polyphenolic cells in the secondary phloem. The cultivar BDG was just the opposite whereas I214 and BRG were intermediate. These histo-cytological criteria are proposed to test the phenomenon of resistance to mistletoe during the selection of poplars for future plantations. * A. Armillotta, Pierre et Marie Universite, Paris, France.

PROCEEDINGS OF ALL THREE PARASITIC WEED SYMPOSIA STILL AVAILABLE

Proceedings of the Third International Symposium on Parasitic Weeds are available from: Chris Parker (see address of editors below) for US$20.00 or equivalent in UK sterling per copy inclusive of air mail. Please make payment payable to: "Third Parasitic Weed Symposium," not to Weed Research Organization nor to Parker. A limited number of free copies are available to official workers in the ICARDA region on request to: M. C. Saxena, ICARDA, P.O. Box 5466, Aleppo, Syria.

Copies of the proceedings of the second symposium, including the supplement, are available from: A. D. Worsham, Department of Crop Science, Box 5155, North Carolina State University, Raleigh, North Carolina 27650, USA, for US$15.00 and US$1.00 for postage in the USA and US$2.00 for overseas surface mil. Make check payable to: North Carolina State University. Proceedings of the first symposium are available from Chris Parker for 28 Swiss francs made payable to the European Weed Research Society.

A NEW TECHNIQUE FOR OROBANCHE CONTROL?

In a verbal presentation at the Aleppo symposium, M. K. Zahran of the Ministry of Agriculture, Cairo, reported 58-85% reduction in the emergence of O. crenata on ~~V. faba~~ following treatment of the crop seeds with a soybean oil/herbicide mixture. The herbicides included fluazifop-butyl, sethoxydim, NC-302, and chlorazifop, each being mixed with the oil at 1.8 ul product per 2 ml oil. After wetting with the mixture, seeds were allowed to dry before sowing in pots. Further experiments are planned to confirm this interesting observation.

THIRD INTERNATIONAL SYMPOSIUM ON PARASITIC WEEDS

After welcoming ceremonies with the Director General of ICARDA, the technical papers began with the session on mistletoes and Hydnoraceae. Resistance to Viscum album in Populus cultivars was shown to involve both mechanical and chemical factors. Seedling stages of Cuscuta, Orobanche, and Viscum were described and compared. A review of the embryology of mistletoes included a discussion of the systematic value of embryology in the Loranthaceae and Viscaceae. Hydnora johannis in Sudan was discussed in relation to its floral biology.

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The second session included a special paper on the evolution of parasitism in the Scrophulariaceae and Orobanchaceae. The two families were viewed as a continuumwith some genera easily being placed in either or both families. The specialization of the haustorium involves the development of primary haustoria from secondary.

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The next two papers dealt with Striga. A study of Striga hemnthica has shown that it is an obligate outcrosser. The implications of this for the breeder--resilence, variability--were discussed. In the second paper, a survey of host specificity in sorghum and millet growing regions of Sahelian Africa suggest that host specificity is the outcome of the intensive cultivation of sorghum or millet.

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The third session dealt with the taxonomy and ecology of Scrophulariaceae and Orobanchaceae. A new key to East Africa species of Striga was discussed along with taxonomic problems in some African species. A survey of the British species of Orobanche and Lathraea and their ecology was presented. A study of Rhinanthus angustiafolius in the Netherlands elucidated some of the complexities in the population biology of this species which may produce vigorous individual plants on certain hosts while the density of the population is due to other factors.

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Session four concerned biochemistry and physiology, mainly of Striga, and began with a survey of the glutamine synthetase complex in plants varying from normal to holoparasitic. The ration of GS1 to GS2 appears to vary according to the photosynthetic activity of the plants and the ratio in Striga species suggests a low photosynthetic efficiency--confirmed by the next speaker who also reported on the main amino acids in Striga (asparagine, aspartic acid, glutamine and glutamic acid) and the changes in amino acid balance in the infected host (a marked increase in glutamine, arginine and histidine). Nitrate reductase activity is low in Striga. The main sugar in S. hermonthica is mannitol, and this may have an osmoregulatory function related to the high accumulation of K by Striga. Striga hemnthica was shown to begin stimulating root systems of sorghum about the same stage that shoot systems were retarded. Nitrogen tends to counterbalance this change in the root/shoot ratio. "Wet dormancy" in S. hemnthica was re-investigated and more complex results were obtained than those reported earlier.

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Indian collections of S. asiatica were shown to have pronounced host specificity (to sorghum, millet, and Paspalum scrobiculata) associated with differences in germination requirements, etc. Several phenolic substances were compared for their ability to stimulate haustorial initiation in S. hemnthica. Syringic and ferulic acids were the most active and a structure/activity relationship was proposed.

In session five, difficulty was reported in identifying the resistance mechanism in certain sorghum varieties, and it was proposed that chemotropism, rhizosphere microflora, and root morphology might all be implicated. Techniques for pot experimentation with Striga were described and critical factors identified as temperature, light, soil nitrogen, and Striga seed number. Some resistance to S. gesnerioides has been identified in cowpea, and the genetics of the resistance factor was described. Agronomic and cultural practices for Striga control in Sudan were reviewed. Short presentations on the Striga problems in Kenya and Ethiopia revealed that in both countries there are localities where S. asiatica and S. hermonthica occur—wether.

Session six dealt exclusively with Cuscuta. A special review paper on control in alfalfa highlighed the importance of low rates of glyphosate applied to the host and subsequently translccated to the parasite. Chlorpropham is effective when used as a soil-applied herbicide that will kill the parasite before it attaches to a host. Other, less favorable treatments as well as cultural control were discussed.

The second paper dealt with the inhibition of cellulase activity by the application of calcium chloride to Cuscuta relexa. The next discussed the spread of C. campestris, C. pedicellata, and C. hyalina in Sudan through poor seed sanitation. The last paper showed how C. planiflora can readily be distinguished from C. campestris and C. indecora by its lack of tendrils.

The last two sessions dealt with Orobanche. In session seven, a review of the O. ramosa problem in the United states emphasized the role of surveys and eradication. This was followed by a study on the early stages in germination and attachment of O. crenata where a distinctive radicle-like structure, the procaulan, is unique in never developing vascular tissue. The last two papers dealt with breeding for resistance and genetic aspects of resistance in Vicia faba and V. sativa parasitized by O. crenata. There appears to be no dominance for resistance in V. faba while a slight partial dominance for resistance may be operating in V. sativa.

In the final session on control of Orobanche, glyphosate was reported as promising for O. ramosa control in eggplant in Sudan, as was the solar heating technique using polyethylene mulch. Flax was shown to have a useful trap crop effect in pot experiments with O. ramosa in tmato. Glyphosate continues to be the main component in *any* control program for O. crenata in V. faba. A new program was described in which tmato is being screened for resistance both to O. aegyptiaca and to glyphosate. In field visits to local farms and to the ICARDA station at Tal Hadya an abundance of O. crenata was seen on both V. faba and on lentil. Occasionally, there was simultaneous attack by both O. crenata and O. aegyptiaca on both crops. In varietal experiments there was no clear resistance demonstrated even by the "resistant" Egyptian ~~V. faba~~ F402 in this dry season conducive to heavy attack. Early winter sown chickpea showed more varied susceptibility.

The scientific profit of the symposium was pleasantly augmented by the excellent staff and facilities of ICARDA which were graciously provided for symposium use. Particular thanks are due the Director General, M. A. Nour, and M. C. Saxena who attended to so many details which ensured the success of the symposium. Our hearty thanks for all this help.

INTERNATIONAL PARASITIC SEED PLANT RESEARCH GROUP BUSINESS MEETING

Chris Parker presided at the informal business meting on 9 May at the Aleppo symposium and called for suggestions for IPSPRG activities. A good discussion followed with many helpful comments. It was suggested that it would be beneficial to assemble a collection of slides of parasites to be made available for publishers of textbooks, etc., but while all agreed this would be a worthwhile idea, no action was taken.

The matter of a "theme" for symposia was introduced, but it was the clear consensus of the group that no theme should be set at the main symposia, rather, there is benefit in having diversity with the single unifying theme being parasitic vascular plants. More specialized workshops might, however, be appropriate inbetween the main symposia, and tentative plans are already in hand for one on resistance mechanisms, resistance breeding, and associated topics for both Striga and Orobanche.

There is a need for a directory of workers in parasitic *seed* plant research, and it was agreed that this is an ideal subject for the organization to take up. A form will be included in the next issue of HAUSTORIUM. The idea is to make these directories available to *any* group or individual who needs some expertise in parasitic seed plant biology and control. No change in officers was proposed and readers may be reminded that they are Chris Parker, chairman, Lytton Musselman, secretary, and Anita Wilson, treasurer. There is also a steering committee composed of the above and J. L. Riopel, A. R. Saghir, F. Hawksworth, J. Kuijt, S. ter Borg, J. Dawson, M. Calder, and H. C. Weber.

FOURTH SYMPOSIUM ON PARASITIC WEEDS

One of the items discussed at the IPSPRG business meeting was the matter of the next, the fourth, symposium. We have been invited by Hans Christian Weber to hold the next meeting in 1987 at the university in Marburg. This year was selected as it is the year of the next International Botanical Congress to be held in West Berlin in August 1987. It was suggested that the symposium be held prior to the congress. As soon as the date is finalized we shall include information in HAUSTORIUM.

LITERATURE

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