HAUSTORIUM

Parasitic Plants Newsletter

Official Organ of the International Parasitic Seed Plant Research Group

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● HAUSTORIUM LIVES, IPSPRG NEWS, NEW SYMPOSIUM VOLUMES

We are pleased that once again temporary funding has been found for our newsletter! This assures us of at least two more issues. Please continue to supply articles for publication as well as titles which we can include in our literature section. Due to space limitations, literature must have a publication date of within the past two years.

■ *Index of Parasitic Plant Workers*

This data has been entered on the computer. Hard copies are not available but the list is on disks in either ASCII or WP5.0. Write L. Musselman for information.

■ *Obtaining Copies of the Nairobi Proceedings*

A few copies are available free to workers in developing countries upon request to L. Musselman. Others may order them at **$40** per copy (surface mail) or **$65** per copy (**air** mail) from: J. K. Ransom, CIMMYT, Post Office Box **25171,** Nairobi, Kenya. Check must be drawn on an American bank.

■ *Combating Striga in Africa*

This is the title of the Proceedings of the International Workshop on ***Striga*** organized jointly by IITA, ICRISAT and IDRC at Ibadan, Nigeria in August **1988,** which have now been edited by S. K. Kim and published by IITA. It includes **17** papers, all providing useful reviews of the status of the ***Striga*** problem and of research in progress both in advanced laboratories and in the field. It concludes with a set of recommendations. Copies are available free from IITA, P.M.B. **5320,** Ibadan, Nigeria.

■ *Venue for Next Parasitic Weeds Symposium*

At a final discussion in Nairobi, questions of the timing and venue for the next symposium were raised. It was generally agreed that further broad-spectrum symposia were desirable in addition to the more specialized meetings on ***Striga*** and ***Orobanche*** that have become a more-or-less regular feature. Assuming PASCON would be holding ***Striga*** workshops every two years, the next general symposium could be held in four years time, in conjunction with PASCON as this year, or independently in **3-4** years time. There is a tentative plan for an ***Orobanche*** meeting in Europe but no date is set. Various sites in the U. K. and U. S. were suggested and three main sites were offered for the 6th symposium (subject to confirmation by the respective host institutions):

1. University of Cordoba, ARGENTINA. (Proposer: A. Cocucci)

2. International Institute of Tropical Agriculture, Ibadan, NIGERIA or Cotonou, BENIN. (Proposer: K. Cardwell) (In conjunction with PASCON)

3. University of Cordoba, SPAIN. (Proposer: J. Cubero)

A number of comments and objections were raised in relation to each of these and it was not felt possible nor necessary to arrive at any decision immediately. It was agreed that Chris Parker and Lytton Musselman should be responsible for inviting and seeking a consensus decision in conjunction with the three proposers, within the next **12-18** months and certainly not later than the next specialized workshop. PLEASE, therefore let either of us know what you think. Bear in mind that a dedicated on site staff and substantial financial support are essential.

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• *CUSCUTA* SPECIES IN THE UNITED ARAB EMIRATES

There are severe infestations of ***Cuscuta*** species in various crops in the UAE. ***Cuscuta campestris*** was observed on mint, Jew's mallow, turnip, and alfalfa in the Masafi area in the northern emirates. Further, ***Cuscuta monogyna*** was seen on ***Convolvulus arvensis*** and climbing citrus trees in an orchard in Ghayathia area in the western region.

A. R. Saghir, United Arab Emirates University, Al Ain

• FIFTH INTERNATIONAL SYMPOSIUM ON PARASITIC WEEDS, NAIROBI 1991

This latest in our series of international symposia, completed successfully between June 23rd and 30th, was attended by 132 delegates from at least 33 countries. The Proceedings, available to delegates on arrival, included approximately 100 papers or abstracts, of which 65 were presented as papers and 10 as posters.

Job Kuijt was given a warm welcome as key-note speaker and gave useful clarification of the roles of xylem, phloem and parenchyma at the interface between host and parasite. Inge Dorr later added more detail on the ***Cuscutalhost*** interface, involving unicellular searching hyphae which penetrate both between and within host cells and show plasmodesmata. Other topics covered in the sessions on Morphology and Structure included ***Orobanche, Striga gesnerioides*** and ***Lophophytum*** (Balanophoraceae).

Sessions on Taxonomy and Ecology included the description by Cardwell et al of a useful population dynamics model as the background to IITA's ***Striga*** research program. Other papers provided valuable data on the seed bank dynamics of ***Orobanche crenata*** in Syria, by Linke et **al.,** and described isoenzyme and host-range studies on ***Orobanche,*** diversity in ***Striga,*** nitrogen effects on ***Striga,*** and biology of the Hydnoraceae.

A session on Germination opened with a useful review on ***Striga*** germination by Sam Okonkwo. Egbers et al reported on after-ripening in S. ***hermonthica*** and showed that some germination can occur within one month of seed shed. After-ripening is hastened by high humidity, but at high temperatures, high RH can result in loss of germinability after some months. Whether this represented loss of viability or induced dormancy was not quite certain, and TTC testing was felt not to be reliable. Ransom and Njoroge confirmed the responsiveness of S. ***hermonthica*** to ethylene under field conditions and incidentally showed a lack of after-ripening requirement, even 3 weeks after harvest of seed. Hess et al concluded that something other than sorgoleone is responsible for germination of ***Striga*** seed at a distance from sorghum roots. They describe a useful new assay technique for stimulant exudation based on the distance from roots up to which germination occurs in an agar medium, e.g. 0-0.5 mm in Framida, 20-30 mm in susceptible varieties. A chinese sorghum line IS 4225 produces exceptionally high stimulation and ***Setaria italica*** even higher. Babiker et al reported on the activity of thidiazuron, causing both germination and haustorial initiation in S. ***hermonthica*** but not in S. ***gesnerioides***

Under the heading of Physiology and Biochemistry, Butler et al reported on their search for ***Striga*** germination inhibitors for possible use as crop seed treatments, and tissue culture techniques for selecting tolerant sorghum clones. This session also included an observation from ter Borg and van Ast on the tendency for some parasitic plants to cause stimulation of host growth.

Under the heading of Economic Impact, Sauerborn estimated 16 M ha affected by ***Orobanche*** and 44 M ha by ***Striga,*** the latter causing annual losses of $3 billion. Vogt et al reported on surveys in Ghana and Togo which showed clear correlation between ***Striga*** intensity and years of continuous cropping, apparently linked to soil fertility factors. Other papers concerned S. ***gesnerioides,*** S. ***hermonthica*** on sorghum/sudan grass, and ***Osyris alba*** (Santalaceae) on almond in Israel.

In sessions on Resistance, Salle et **al** updated us on the resistance of poplars to ***Viscum album,*** and Scarpf and Roth reported on the continuing efforts to select ponderosa pine resistant to ***Arceuthobium.*** The time scale involved in this effort was emphasized by the fact that this work was initiated in 1960. Singh and Emechebe gave a report on the very encouraging progress in development of cowpea lines with combined resistance to ***Striga, Alectra*** and a range of other pests and diseases. Isogenic lines with and without ***Striga*** resistance had been used to show **40%** yield loss from ***Striga*** infection. Bagnall-Oakley et al confirmed the resistance of cowpea lines B.301 and B.359 to ***Alectra*** in Kenya. They also reported an

unexpected and unexplained increase in *Alectra* infestation following a "trap crop" of guar bean. Olivier et al reported on the latest ICRISAT work on sorghum in Mali, including the observation of extremely high *Striga*-resistance in the line IS-7777. Ejeta et al reported that the *Striga* resistance in sorghum line SRN-39 is associated with 1 or 2 recessive genes. Other papers concerned resistance of tomato to ***Cuscuta***, the resistance mechanism of faba-bean Giza 402 to O. ***crenata***, sorghum work in Ethiopia, South Africa, Sudan and Zimbabwe, progress with maize at IITA, and resistance of sugar-cane varieties to ***S. hermonthica***.

In sessions on Control, Adu-Tutu and Drennan reported some promising results with new sulphonyl urea herbicides, especially in maize. A report by Awad et al on dicamba showed good reductions in attack by S. ***asiatica*** in sorghum but surprisingly little benefit in terms of yield of the host. Several reports confirmed benefits from nitrogen in suppressing ***Striga*** but others were less favorable and in discussion it was suggested that effects of N will only persist so long as the nutrient continues available and this might explain why higher intrinsic soil fertility (providing N more continuously) may be more reliable than mere addition of fertilizer. For control of ***Orobanche*** Garcia-Torres and Lopez-Granados reported promising new results with several new herbicides in legumes and sunflower, while Kleifeld et al defined some of the conditions necessary for successful use of metham-sodium. Bedi and Donchev gave a very interesting account of the development of a mycoherbicide preparation for control of O. ***cernua*** on sunflower in Bulgaria.

In a final session, Jean Dawson gave a useful review of ***Cuscuta*** control by herbicides, Eplee and Langston described progress in the eradication of S. ***asiatica*** in U.S.A. (83% of the affected area has now been cleared) and Carson and Kunjo reported on the substantial progress being made in the development of practical *Striga*-control methods in the Gambia, based on manuring, rotation, dense planting, hand-pulling and spot-spraying. Well organized extension campaigns aim at progressive introduction of increasingly intensive methods. These involved 15,000 farmers in 1990 and twice this number should be reached this year.

In the Poster session, some items of interest included the observation of serious attack on millet by ***Buchnera hispida*** in Benin and measurements showing that Striga weights were increased, rather than reduced by ***Smicronyx*** infestation. Progress in ***Striga*** research in Cameroon was well illustrated; also the importance of ***Tapinanthus*** on shea trees in Burkina Faso. A novel introduction on this occasion was the continuous showing of a video film on ***Striga*** prepared by Georges Salle and colleagues. One and a half days were devoted to a very enjoyable field trip westwards to Kisumu on Lake Victoria. This included a visit to the Kibos research station where CIMMYT and KARI have ***Striga*** trials and Eplee had recently installed equipment for the extraction of ***Striga*** seeds from soil samples. Field trials showed encouraging effects from intercropping cereals with legumes, but failed to show control of ***Striga*** by spraying anti-transpirants, presumably because local air temperatures are not sufficiently high.

The International Symposium was held in conjunction with the Second Workshop of the Pan-African ***Striga*** Control Network (PASCON), under the auspices of FAO. They met on Sunday 23rd and again on Tuesday 25th. In introductory addresses, FAO personnel emphasized their commitment to continuing support of the *Striga* network, and with the help of a consultant they had prepared a plan for a 5-year program, requiring a budget of $2M. Funding will be sought for this proposal which covers continuation and expansion of the present Network, publication of the ***Striga*** Newsletter (to be bilingual), further workshops on a 2-year cycle, and training and support to a number of in-country research programs. Four individuals were elected to represent different regions of Africa on a steering committee. A second issue of the ***Striga*** Newsletter was available at the meeting and copies can be obtained from the FAO Regional Office for Africa, P.O. Box 1628, Accra, Ghana. Presentations included country reports from most of the 15 countries already involved and brief reports from collaborating institutions such as CILSS (who have their own plans to establish a ***Striga***-research centre and 3 sub-stations if funds can be raised), IITA, CIMMYT, ICRISAT, etc. Proceedings of this meeting will be published jointly with those from the meeting in Ibadan in 1990.

Overall, the Nairobi meeting was thoroughly successful and enjoyed by all who attended, though a great many of us were sad at the unprecedented absence of Lytton Musselman. CIMMYT are to be congratulated on their relatively new commitment to parasitic weeds and Striga in particular, and thanked for their allocation of substantial resources towards the success of the symposium. Above all, Joel Ransom is to be thanked for his heroic near single handed

efforts with both the local organization, and the preparation of the Proceedings. We hope he has by now had time to recover! Thank you, Joel, from all of us!

C. Parker

• GROWING *BUCKLEYA* AND *PYRULARIA* (SANTALACEAE)

Over the last decade, I have made a study of the North American root parasites ***Buckleya distichophylla*** and ***Pyrularia pubera.*** Seeds germinate equally well after artificial cold treatment or natural outdoor winter conditions. However, outdoor grown seeds almost always lie dormant until spring while refrigerated ones germinate within one to two months of planting. It seems that seeds do not need a long period of very low temperatures to break dormancy as our winters are much warmer than the plants natural habitat. Germination is about 60% if seeds are planted outdoors. Times for germination are similar for both ***Buckleya*** and ***Pyrularia.*** Plants are difficult to grow beyond the seedling stage. My experience over a 10 year period shows that less than 10% of seedlings are successful. In spite of recent contrary evidence, I have found that early haustorial connection seems to be essential for long term survival particularly with ***Buckleya.*** Any plants I have grown without hosts have not survived longer than twelve months, even when seedlings have been transplanted to a host. The few plants I have grown from seed have all been planted directly above the root system of a suitable host, in a situation kept shaded, weed free and well watered during dry periods. I have found that consistent soil moisture seems to be a critical factor for seedling survival in the field.

At the present time I have several plants of both species growing outdoors. The most successful host plants are ***Tsuga canadensis, Pinus taeda,*** and ***P. uirginiana.*** The site is west facing and shaded, near sea level in a clay loam with a clay sub soil, and an artificial layer of surface humus about 30 cm deep. Two thirds of the yearly rainfall occurs between the months of May and September, while summers and autumns are hot and dry. I have tried to simulate the natural habitat of these parasites, and the results are encouraging. The first plants of ***Buckleya distichophylla*** I grew from seed in the 1985/86 season have just completed their sixth growing season. Initial growth was slow with less than 15 cm in the first two years but from the third year onwards extensive lateral branching and height increase took place. In the 1989/90 season one of the plants on ***Tsuga canadensis*** put up several new stems and after two growing seasons these stems are 75 cm in height with many side branches. Another plant on ***Pinus taeda*** is 90 cm tall with a 2 cm basal stem diameter and many branched side shoots.

It seems that these original plants have established themselves for in their fifth growing season they flowered. One plant produced female flowers on a few branches and two other plants bore several male flowers. The female plant set two fruits; one of these germinated. The same three plants again flowered the next year, but more profusely. More fruits were formed but the majority aborted during the summer; only twenty (30%) matured. With ***Buckleya,*** under New Zealand conditions leaf growth seems to be mainly in one major flush from early September to mid December, and most leaves have fallen by mid April. The first flowers appear not long after commencement of leaf growth and continue until early summer. Most fruits are fully ripe by March.

Pyrularia pubera grows much slower than ***Buckleya*** and generally only one third as tall. Most have not yet branched, but have thick woody stems and seem to be well established. The best hosts appear to be eastern U.S. species of ***Quercus*** and ***Pinus.*** The largest plant, growing with ***Liquidambar styraciflua*** is now five seasons old, and 20 cm tall - an average annual growth of only about 4 cm. In comparison to ***Buckleya*** leaf growth is later in spring for ***Pyrularia,*** and leaves fall earlier in the autumn. None of the plants of ***Pyrularia*** have shown any sign of flowering.

Leaf eating insects do considerable damage to the foliage of ***Pyrularia,*** sometimes completely defoliating some plants, but virtually no damage is done to the leaves of ***Buckleya.***

G. L. Cox, Kaukapakapa, New Zealand

• FLOWER MORPHOLOGY IN *STRIGA HERMONTHICA* AND *S. ASPERA*

These two species have striking resemblance in the color of their flowers and there is often difficulty in distinguishing them. The key in the ICRISAT Information Bulletin No. 15 (Ramaiah et al., 1983, ***Striga*** Identification and Control Handbook) refers to the corolla tube being "bent immediately above the calyx" in S. ***hennonthica,*** and "distinctly longer than

the calyx" in S. *aspera.* but in some areas the calyx of S. *hermonthica* is relatively short and part of the lower corolla tube is distinctly exposed. The alternative character in the key, the width of the bracteoles (**2-3** mm in **S.** *hermonthica* and **1-2** mm in **S.** *aspera)* is a reliable difference but not especially easy to use. For West Africa, Berhaut's key in Flore du Senegal is more reliable in using the position of the bend in the corolla tube - just about halfway in **S.** *hermonthica* and two thirds of the way up in **S.** *aspera.* However in Kenya, I have noted that S. *hermonthica* is consistently different in that the bend in the corolla tube is well above halfway, and hence more like S. *aspera,* though the wide, pectinate bracteoles and generally greater robustness leave no doubt that it is true S. *hermonthica.*

Some limited measurements on herbarium specimens at Long Ashton Research Station are as follows [length of tube below bend (mm/length above bend ratio-mean of **3** flowers in each case]:

S. hermonthica
Cameroon 8.3/9.0/9:1
Niger **7.017.310.9:1**
Mali 8.0/8.7/0.9:**1**
Ethiopia 10.0/9.0/1.1:**1**
Kenya (**1**) 11.3/8.0/1.4:1
Kenya (**2**) 12.0/8.0/1.5:1

S. *aspera*
Gambia **8.314.311.9:1**
Cameron 0.9/5.3/1.7 :**1**

Study of specimens of S. *hermonthica* in the **Nai**robi Herbarium confirmed that all specimens collected in Kenya, Tanzania and Djibouti were of the above "Kenya" type. Those from Uganda were mostly as Kenya but with some perhaps closer to the "typical".

As S. *aspera* is relatively scarce in Eastern Africa, there is no great cause for confusion there, but the actual length of the corolla tube above the bend might prove to be a useful character (less than 6 mm in S. *aspera,* and at least 7 mm in S. *hermonthica?).* Meanwhile I suggest that further more detailed measurements confirming these observations might throw useful light on the relationship between populations of **S.** *hermonthica* in different parts of Africa.

C. Parker

● *STRIGA* SPECIES FROM UPLAND RICE

In a recently completed MSc. study, the host range of **S.** *asiatica* from Zanzibar and S. *hermonthica* from Mali, each collected from plants parasitizing maize or upland rice, were examined. The results of a pot trial indicated that S. *asiatica* (**ex** maize) has a broader host range than the sample from rice. The maize sample emerged well (**>12** per host plant) on maize, sorghum, finger millet, *Rottboellia cochinchinensis* and rice cv. IAC **164.** Emergence was moderate (**2-4** per plant) **on** rice cv. BKN, and limited (up to 1 per plant) on pearl millet, rice cv. IDSA 6, *Zschaemum rugosum* and the wild rice, *Oryza punctata.* For the sample from rice, emergence was good on maize, moderate on BKN and IAC **164** and limited on R. *cochinchinensis* and IDSA **6.** Other species were not attacked. The two **S.** *hermonthica* samples had a similar host preference, emerging moderately on the cereals other than rice which showed only low susceptibility. *Oryza punctata* was not attacked by S. *hermonthica.*

A number of upland rice varieties appeared more susceptible to **S.** *asiatica* than *S. hermonthica* in a screening trial. IDSA 6 was not attacked in this pot trial by S. *asiatica.* Emergence of *S. hermonthica* was limited and none was recorded on **WAB21,** LAC **23, Kihigo** or Tox. It would be worthwhile testing the apparent resistance of these varieties under conditions of higher infestation and with *Striga* samples from other rice growing areas.

A. M. Suleiman, C. R. Riches and P. J. Terry, Long Ashton Research Station, University of Bristol

● LITERATURE

Adu-Tutu, K. O. and D. S. H. Drennan. **1991.** Studies of the effects of metsulfuron- methyl on the parasitism of sorghum by ***Striga hermonthica*** (Del.) Benth. Tropical Pest Management **37: 252-255.**

Baker, **F.** A. and D. **W.** French. **1991.** Radial enlargement of mortality centers caused by ***Arceuthobium pusillum*** Peck in black spruce stands. Forest Science **37: 364-367.**

Barber, W. R. **1990.** New taxa, names and combinations in ***Lindernia, Paplidum, Stenodia*** and ***Striga*** (Scrophulariaceae) mainly in the Kimberly region, Western Australia. Journal of the Adelaide Botanic Gardens **13: 79-93.**

Beyer, v. C., H. C. Weber, and W. Forstreuter. 1990. Die keimlingsentwicklung von ***Nuytsia floribunda*** (Labill.) R.Br. (Loranthaceae). Beitrage zur Biologie der Pflanzen 65: 393-408.

Borschsenius, F. and J. M. Olesen. 1990. The Amazonian root parasite ***Lophophytum mirabile*** (Balanophoraceae) and its pollinators and herbivores. Journal Tropical Ecology 6: 501-505.

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Elliott, S. 1990. The distribution, status and ecology of ***Sapria himalayana*** Griff. (Rafflesiaceae) in Thailand. Bulletin of the British Ecological Society 11(4):246-249. (It is one of the more "modest" members of this bizarre family but similar in its habit to other Rafflesiaceae. ***Sapria*** is considered to be endangered due to habitat destruction. A helpful diagram of the complex flower is included).

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Gworgwor, N. A. and H. C. Weber. 1991. Studies on biology and control of ***Striga.*** II. Varietal response of cowpea. Beitrage zur Biologie der Pflanzen 65: 393-408. [***Vigna unguiculata*** (L.) Walp.] to ***Striga gesnerioides.*** (In pot experiments no germination of ***Striga*** took place in the presence of B-301. Parasitism of this resistant variety under field conditions is attributed to the presence of ***Merremia emarginata,*** a common weedy host).

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Krishna Murthy, G. V. G. and K. Nagarajan. **1991.** Post emergence control of ***Orobanche cernua*** on tobacco with oils. Tropical Pest Management **37: 149-151.**

Kuijt, J. **1991.** Inflorescence structure and generic placement of some small-flowered species of ***Phthirusa*** (Loranthaceae). Systematic Botany 16(2): **283-391.**

Kuijt, J. **1991.** Two new species of ***Ixocactus*** (Loranthaceae) and a reformulation of the genus. Systematic Botany 16(2): **292-298.**

Kuijt, J. **1991.** ***Panamanthus,*** a new monotypic genus of neotropical Loranthaceae. Annals of the Missouri Botanical Garden **78:** 172-176.

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Milvain, H. **1990.** Golden dodder. **Farmers** Newsletter, Large Areas **135: 25-26.** (Reports **9** infestations of ***Cuscuta campestris*** along the Murumbidgee River in Australia).

Molau, U. **1990.** The genus ***Bartsia*** (Scrophulariaceae- Rhinanthoideae). Opera Botanica **102: 5-99.** (The genus is revised to **49** spp, **45** endemic to the Andes, **2** Afromontane, **1** Circumboreal and **1** Mediterranean).

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