DISEASES OF *AESCHYNOMENE* SPECIES

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ABSTRACT

Diseases of Aeschynomene *spp. observed in forage evaluation trials in South America and Florida, U.S.A. are described and discussed. Newly discovered diseases include* Polythrincium *sp. leaf blotch,* Calonectria *sp. dieback, and* Rhizoctonia solani *Kuhn foliar blight. Diseases previously reported from native populations of* Aeschynomene *spp. and those reported from forage evaluation trials from other areas of the world are reviewed. Most current testing of* Aeschynomene *spp. is conducted with plant materials with a narrow genetic base. There is a need to collect a wider spectrum of* Aeschynomene *germplasm for forage characteristics as well as disease resistance.*

INTRODUCTION

The legume genus *Aeschynomene* is composed primarily of representatives indigenous to tropical America, Africa, Southeast Asia and the Pacific Islands (Kretschmer and Bullock 1980). Representative species range from herbs several centimeters in height to shrubs and tree-like plants up to 8 meters in height. Some are xerophytic while others are hydrophytes (Kretschmer and Bullock 1980). Although various *Aeschynomene* spp. are components of native pastures in South America (J. M. Lenné, *unpublished data*), members of the genus were not thought to have much potential for agronomic use until recently (Quesenberry and Ocumpaugh 1981). 'Bargoo' jointvetch, *A. falcata* (Poir.) DC was released in Australia in 1973 (Wilson 1980). American jointvetch, *A. americana* L. is being used as a grazing forage in Florida in mixtures with grasses (Hodges *et al.* 1982). Recently, forage potential of accessions of 21 and 18 *Aeschynomene* spp., respectively, were evaluated in Florida by Kretschmer and Bullock (1980) and Quesenberry and Ocumpaugh (1981). Kretschmer and Bullock (1980) indicated that the current Florida commercial variety of *A. americana* was inferior in forage yield when compared to several other *A. americana* accessions as well as accessions of several other *Aeschynomene* spp. Various accessions of *Aeschynomene* spp. are also under intensive evaluation in various sites in the flooded savanna ecosystems in South America (J. M. Lenné, *personal observations*). Several promising lines of *A. histrix* Poir are under evaluation by the CIAT Tropical Pastures International Regional Trial Evaluation Network in the forest ecosystems (Pizarro 1983).

Aeschynomene cultivars grown commercially in Australia and Florida were selected from a relatively narrow genetic base. When large plantings of closely spaced plants with little genetic difference are made, such as when these cultivars of *Aeschynomene* come into greater use, potential for losses to diseases will be increased (Yarwood 1962). Because of the relative recent domestication of *Aeschynomene* spp., research on diseases of this genus has been meagre (Sonoda and Lenné 1979). With the increasing use of *Aeschynomene* spp. in pastures, information is needed on diseases of this genus. The following is a report of diseases observed in various forage evaluation trials in Brazil, Colombia, Ecuador, Peru, Venezuela and Florida. Some of these diseases are recorded for the first time. Diseases previously reported are also noted.

DISEASES CAUSED BY FUNGI

Anthracnose

Colletotrichum gloeosporioides (Penz.) Sacc. is one of the most important and widely distributed pathogens of *Aeschynomene* spp. recorded at various sites in at least nine countries (Table 1).

TABLE 1
Diseases of Aeschynomene *species*

Disease	Causal agent	Host range	Symptomatology	Distribution	Source
Anthracnose	*Colletotrichum gloeosporioides* (Penz.) Sacc.	*A. americana* L. *A. brasiliana* (Poir) DC *A. histrix* Poir *A. paniculata* Willd. ex Vog. *A. sensitiva* Sw. *A. virginica* (L.) BSP	Dark brown to black lesions on leaflets, petioles, stems and pods; defoliation and dieback; sometimes dieback of main stem causing plant death	Bolivia, Brazil, Colombia, Ecuador, Peru, Venezuela, Central America, Florida, Australia	Lenné (1981) Lenné & Sonoda (1978) Irwin (per. comm.)
	Colletotrichum truncatum (Schw.) Andrus & Moore	*A. paniculata* Willd. ex Vog. *A. sensitiva* Sw.		Brazil, Colombia, Peru, Central America, Florida	Lenné (1981) Lenné & Sonoda (1978)
Leaf spot	*Cercospora* sp.	*A. americana* L.	Small dark angular lesions with chlorotic halos; defoliation	Colombia	
Pod and foliage spot	*Cercospora* spp.	*A. americana* L.	Dark brown to black lesions on pods, stems and leaflets	Florida	
Leaf spot	*Cercospora aeschynomenes* Muller & Chupp	*A. falcata* (Poir) DC		Brazil	Chupp (1953)
Leaf spot	*Cercosporidium* sp.	*Aeschynomene* spp.		Colombia	
Leaf blotch	*Polythrincium* sp.	*A. brasiliana* (Poir) DC. *A. indica* L. *A. brasiliana* (Poir) DC.	Dark brown to black powdery, irregularly-shaped blotches, 1–2 mm in diameter, on under leaf surface; chlorotic patches on upper leaf surface; defoliation.	Colombia Brazil	
Dieback	*Calonectria* sp.	*A. paniculata* Willd. ex Vog.	Dieback of main stem; black sunken lesions, brown discolouration of cortex	Peru	
Foliar blight	*Rhizoctonia solani* Kuhn	*A. americana* L. *A. brasiliana* (Poir) DC. *A. histrix* (Poir)	Leaflet and whole leaf blight; fungal mycelial growth commonly on leaves (webblight)	Forest ecosystems of Brazil, Colombia and Peru; Florida	
Powdery mildew	*Oidium* sp.	*A. americana* L.	White patches of powdery mycelium on upper leaf surfaces; defoliation	Florida Australia	Quesenberry & Ocumpaugh (1981) Walker (pers. comm.)
Root-Knot	*Meloidogyne javanica* (Treub 1885) Chitwood 1949 *Meloidogyne incognita* (Kofoid & White 1919) Chitwood 1949 *Meloidogyne arenaria* (1889) Chitwood 1949	*A. americana* L.	Single and confluent galls on roots; chlorosis; defoliation	Florida	Quesenberry *et al.* 1985

Anthracnose caused by *C. truncatum* Schw. (Andrus & Moore) has also been recorded in various countries (Lenné and Sonoda 1978; Lenné 1981). Symptoms of anthracnose were initially seen as small dark brown to black lesions on leaflets, petioles, stems and pods. With time, lesions enlarged and when environmental conditions were favorable, coalesced, causing defoliation and dieback of terminal growing points. Severe attack led to dieback of the main stem and plant death.

In a planting of 186 accessions of 14 *Aeschynomene* spp., including *A. americana* L., *A. americana* (Poir) DC, *A. histrix* Poir., *A. paniculata* Willd. ex. Vog. and *A. sensitiva* Sw. in Carimagua, Colombia in 1979, 69% of the accessions were moderately to severely affected by *C. gloeosporioides* and most of these accessions died within the year. In Planaltina, Brazil, 94% of accessions of *Aeschynomene* spp. under evaluation in 1980, were affected by *C. gloeosporioides*, and were killed within eight months. Pathogenicity was established for several *C. gloeosporioides* isolates from diseased plants in the plantings in Carimagua and Brazil. A combination of *C. gloeosporioides* and *C. truncatum* was observed to cause slight to moderate damage of 58% of 45 accessions of 10 *Aeschynomene* spp. in Florida in 1979.

The observations indicated some field resistance to *Colletotrichum* spp. In limited laboratory and greenhouse studies (Lenné and Sonoda 1978) differences in reaction of *Aeschynomene* spp. to *C. truncatum* were noted. All four *Aeschynomene* spp. tested at that time were susceptible to *C. gloeosporioides* . Research is needed to determine if there are different races of *C. gloeosporioides* pathogenic to *Aeschynomene* spp. as well as the relationship of the *C. gloeosporioides* affecting *Aeschynomene* spp. and those affecting *Stylosanthes* spp. *Colletotrichum gloeosporioides* is used as a biological herbicide against *A. indica* L. in rice fields in Arkansas, U.S.A. (Templeton and Tebeest 1979).

Cercospora leaf spot diseases

A *Cercospora* sp. leaf spot was recorded on accessions of several *Aeschynomene* spp. in Carimagua, Colombia during 1980 and 1981 (Table 1).

In Florida, in 1982, *Cercospora* spp. were recorded on pods, stems and leaflets of an *A. americana* accession, particularly when plants were seeding. Conidia on pods averaged 5.1 μ wide and 250 μ long. Conidia on stem lesions were 3.3 μ wide and 68 μ long indicating that a different *Cercospora* sp. was involved. Chupp (1953) also reported a Cercospora-like fungus on *A. falcata* (Poir.) DC in Brazil (Table 1). A leafspot caused by a *Cercosporidium* sp. was observed on *Aeschynomene* spp. in Colombia in 1979 (Table 1).

At present, these diseases do not appear to be important problems in the production of Aeschynomene forage.

Polythrincium leaf blotch

Leaf blotches recorded on 3 accessions of *A. brasiliana* and 2 accessions of *A. indica* L each year from 1980 to 1984 in Carimagua, Colombia, and on *A. brasiliana* in Teresina, Brazil in 1984, were caused by a *Polythrincium* sp. (Table 1). The extent of Polythrincium leaf blotch in these plantings was rated from slight to moderate. During the wet season, dark blotches occasionally coalesced causing some defoliation. Stems were not affected and no plant deaths were recorded due to this disease. This is the first record of *Polythrincium* spp. on *Aeschynomene* spp. Further work is required to establish whether this *Polythrincium* is *Polythrincium trifolii* described on *Trifolium* spp. (Wolf 1935; Ellis 1971).

Calonectria dieback

A severe dieback caused by a *Calonectria* sp. was observed on *A. paniculata* CIAT 9665 in Pucallpa, Peru in 1981 (Table 1). This disease has not been found elsewhere to date. A *Calonectria* perfect stage was found and identified as such by the Commonwealth Mycological Institute. An imperfect stage of the fungus was not found. Further work on the taxonomy and host range of this pathogen is warranted.

Rhizoctonia foliar blight

During the wet season, *Rhizoctonia solani* Kuhn has often been recorded causing moderate foliar blight of accessions of *A. americana*, *A. histrix* and *A. brasiliana* in pasture evaluation sites in the forest ecosystems of Colombia, Brazil and Peru (Table 1). Plants usually recovered toward the end of the wet season. Similar observations have been made in south Florida on prostrate accessions of *Aeschynomene* spp. during periods of frequent rain and warm temperatures. Leaf loss was usually slight and plants recovered quickly during periods of dry weather.

Powdery mildew

Powdery mildew, *Oidium* sp., has been reported on *A. americana* in north Florida (Quesenberry and Ocumpaugh 1981) in late fall (Table 1). Several accessions of *A. americana* were very susceptible. In south Florida, however, only slight powdery mildew damage has been observed on some *A. americana* accessions in late fall.

DISEASES CAUSED BY NEMATODES

Root-Knot nematode

The common Florida ecotype of jointvetch *A. americana* is only moderately resistant to *Meloidogyne* spp. found in Florida (Quesenberry *et al.* 1985). From 1982 to 1984, 73 lines of *A. americana* were evaluated for reaction to *M. arenaria* (Neal 1889) Chitwood 1949 race 1, *M. incognita* (Kofoid and White 1919) Chitwood 1949 race 3 and *M. javanica* (Treub 1885) Chitwood 1949 under glasshouse and field conditions (Quesenberry *et al.* 1985). Although a number of lines with resistance to each of the nematodes were identified, no line was found with resistance to all three species. Research is therefore continuing on resistance breeding (Quesenberry *et al.* 1985).

DISEASES REPORTED IN THE LITERATURE

References to several other diseases of *Aeschynomene* spp. were found in a search of the literature. Unfortunately only a few were more than a listing of their occurrence.

Several rusts have been reported on this genus: *Phakospora aeschynomenis* (Arth.) Bull. (Kern 1938; Standen 1952) on *A. americana* in Colombia and Venezuela; *P. diehlii* Cumm. (Cummins 1978) was reported on *A. americana* in southern Mexico, Guatemala, South America and possibly Ethiopia; *Uropyxis wiehi* Cumm. on stems of *A. abyssinica* Vatke in what is now Malawi (Cummins 1956); *U. daleae* (Diet. & Holw.) Magn var. *africana* Baxt. on *A. trigonocarpa* Taub. (Baxter 1959); *Uropyxis* sp. on *A. americana* in Barbados (Norse 1974) and *Uredo posita* on *A. virginica* (L.) BSP in Florida (Wehlberg *et al.* 1975).

Other fungal pathogens reported include *Entyloma* sp. causing leaf smut on *Aeschynomene* spp. in Malawi (Wiehe 1953); *Parodiella paraguayensis* Speg. on *A. nyassana* Taub. in Zimbabwe (Hopkins 1950); *Physoderma aeschynomenis* Thiramalachar & Whitehead causing large galls on submerged parts of aquatic *A. indica* in India (Thiramalachar and Whitehead 1951) and *Dothidea gramma* (S.) Fr., *Phoma gramma* (S.) Starb., *Sphaeria grama* S. and *Phyllosticta phaseolina* on *A. sensitiva* Sw. in North America (Seymour 1929). Legume "little leaf" a possible mycoplasma-type disease was reported in Australia on *A. falcata* (Hutton and Grylls 1955).

CONCLUSIONS

Observations made by the authors in forage evaluation trials in South America and Florida indicate that there is great diversity in the reaction of accessions of *Aeschynomene* spp. to a range of pathogens. Further work is needed to determine if pathogenic specialization exists among different isolates of the various pathogens, and for the more important pathogens to determine the effect of environmental factors and the physiological status of the host on disease development. This knowledge will be of value in developing improved pastures of plants with enough genetic diversity to reduce the risk of heavy losses due to plant diseases.

REFERENCES

BAXTER, J. W. (1959)—A monograph of the fungus genus Uropyxis. *Mycologia* **51**: 210–226.
CHUPP, C. (1953). A monograph of the fungus genus Cercospora by the author. (Ithaca Press: New York).
CUMMINS, G. B. (1956). Description of tropical rusts-VIII. *Bulletin of the Torrey Botanical Club* **83**: 221–233.
CUMMINS, G. B. (1978). Rust fungi on legumes and composites in North America. (University of Arizona Press: Tucson, U.S.A.).
ELLIS, M. B. (1971). Dematiaceous hyphomycetes. (Commonwealth Agricultural Bureaux: Farnham Royal, U.K.).
HODGES, E. M., KRETSCHMER, A. E., JR., MISLEVY, P., ROUSH, R. D., RUELKE, O. C. and SNYDER, G. H. (1982). Production and utilization of the tropical legume Aeschynomene. Florida Agricultural Experiment Stations Circular S–290.
HOPKINS, J. C. F. (1950)—A descriptive list of plant diseases in Rhodesia and list of bacteria and fungi in Southern Rhodesia. Memoirs of the Department of Agriculture, Number 2.
HUTTON, E. M. and GRYLLS, N. E. (1955)—Legume "little leaf", a virus disease of subtropical pasture species. *Australian Journal of Agricultural Research* **7**: 85–97.
KERN, F. D. (1938)—Additions to the Uredinales of Venezuela. *Mycologia* **30**: 537–552.
KRETSCHMER, A. E., JR. and BULLOCK, R. C. (1980)—*Aeschynomene* spp.: distribution and potential use. *Proceedings of the Soil and Crop Science Society of Florida* **39**: 145–152.
LENNE, J. M. (1981)—Diseases of important tropical pasture plants in Central and South America. *Australasian Plant Pathology* **10**: 10–12.
LENNE, J. M. and SONODA, R. M. (1978)—*Colletotrichum* spp. on tropical forage legumes. *Plant Disease Reporter* **52**: 813–817.
NORSE, D. (1974)—Plant disease in Barbados. Phytopathological Papers, Number 18. Commonwealth Mycological Institute. Kew, England.
PIZARRO, E. A. (1983)—Results 1979–1982 of the International Evaluation Network of Tropical Pastures (CIAT-ISSN 0120–4882: Cali, Colombia).
QUESENBERRY, K. H., HARDY, S. R. and and DUNN, R. A. (1985)—Evaluation of *Aeschynomene americana* L. germplasm for response to *Meloidogyne* spp. Proceedings of the XV International Grasslands Congress, Kyoto, Japan. August, 1985 (In press).
QUESENBERRY, K. H. and OCUMPAUGH, W. R. (1981)—Forage potential of *Aeschynomene*-species in north central Florida. *Proceedings of the Soil and Crop Science Society of Florida* **40**: 159–162.
SEYMOUR, A. B. (1929)—Host index of the fungi of North America. (Harvard University Press: U.S.A.).
SONODA, R. M. and LENNE, J. M. (1979)—Diseases of *Aeschynomene* spp. a bibliography. Fort Pierce ARC Research Report RL-1979–11.
STANDEN, J. H. (1952)—Host index of plant pathogens of Venezuela. *Plant Disease Reporter Supplement* **212**: 106 pp.
TEMPLETON, G. E. and TEBEEST, D. O. (1979)—Biological weed control with mycoherbicides. *Annual Review of Phytopathology* **17**: 301–310.
THIRAMALACHAR, M. J., and WHITEHEAD, M. D. (1951)—An undescribed species of Physoderma on *Aeschynomene indica*. *Mycologia* **43**: 430–436.
WEHLBERG, C., ALFIERI, S. A., JR., LANGDON, K. R. and KIMBROUGH, J. W. (1975)—Index of Plant Diseases in Florida. Florida Department of Agricultural and Consumer Services. Division of Plant Industry. Bulletin 11.
WIEHE, P. O. (1953)—The plant diseases of Nyasaland. Mycological Paper Number 54. Commonwealth Mycological Institute. Kew, England.
WILSON, G. P. M. (1980)—Bargoo jointvetch: tough legume for tough country. *Agricultural Gazette of New South Wales* **91**: 51–53.
WOLF, F. A. (1935)—Morphology of *Polytrincium* causing sooty blotch of clover. *Mycologia* **27**: 58–73.
YARWOOD, C. E. (1962)—Some principles of plant pathology. *Phytopathology* **52**: 166–167.

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TECHNICAL NOTE

A GENETIC BASIS FOR MALE STERILITY IN KIKUYU GRASS

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ABSTRACT

Evidence from controlled crosses suggests that male sterility in kikuyu grass (associated with non-exsertion of stamens) is controlled by a single dominant gene, with fertility (exsertion of stamens) being recessive. Genetic dominance of male sterility influences the spread of kikuyu grass and the ways in which the genetic merit of indigenous pastures can be upgraded.

INTRODUCTION

Plants of kikuyu grass (*Pennisetum clandestinum* Hochst. ex Chiov.) which do not exsert stamens are male sterile. The morphological processes have been well documented (Stapf 1921; Edwards 1937; Parker 1941; Narayan 1955; Carr and Eng Kok Ng 1956; Madhava Rao and Ramalingam 1964; Piggot and Morgan 1983). Information about the physiology and genetics of male sterility is limited. Narayan (1955), from a few relatively uncontrolled crosses, suggested that male sterility was a recessive condition, although Carr and Eng Kok Ng (1956) disputed this conclusion. Our work attempted to clarify the inheritance of male sterility because the subject is