

Additions to Host Range of *Colletotrichum gloeosporioides* f. sp. *aeschyromene*

D. O. TeBEEST, Professor, Department of Plant Pathology, 217 Plant Science Building, University of Arkansas, Fayetteville 72701

ABSTRACT

TeBeest, D. O. 1988. Additions to host range of *Colletotrichum gloeosporioides* f. sp. *aeschyromene*. Plant Disease 72: 16-18.

The fungus *Colletotrichum gloeosporioides* f. sp. *aeschyromene* is currently used as a mycoherbicide to control northern jointvetch (*Aeschynomene virginica*), a leguminous weed in Arkansas. Seventy-seven species from 43 genera and 10 families were inoculated in greenhouse host range tests. Crop species within the genera *Gossypium*, *Abelmoschus*, *Cucumis*, *Cucurbita*, *Citrullus*, *Oryzae*, *Zea*, *Triticum*, *Lycopersicon*, *Spinacia*, *Brassica*, *Raphanus*, *Helianthus*, *Lactuca*, *Daucus*, *Fragaria*, *Phaseolus*, *Glycine*, *Arachis*, and *Vigna* were immune to *C. gloeosporioides*. Only *Aeschynomene virginica* was killed by this pathogen. Several species of *Aeschynomene*, *Lathyrus*, *Lupinus*, and *Vicia faba* and 23 of 26 *Pisum sativum* cultivars tested were susceptible, and lesions developed on leaflets, petioles, and stems of *Lathyrus*, *Lupinus*, *Pisum*, *Vicia faba*, and *Aeschynomene*. The host range is thus larger than originally described.

The fungus *Colletotrichum gloeosporioides* (Penz.) Penz. et Sacc. f. sp. *aeschyromene* (C. g. f. sp. *aeschyromene*) incites an anthracnose of northern jointvetch (*Aeschynomene virginica* (L.) B.S.P.), a weed in rice and soybean fields (1). The fungus is commercially available as Collego, a selective mycoherbicide for control of this weed in Arkansas, Louisiana, and Mississippi. Daniel et al (1) reported the fungus to be specific to *A. virginica* and *A. indica* L. after field and greenhouse tests. It was recently reported, however, that C. g. f. sp. *aeschyromene* infected green pea (*Pisum sativum* L. 'Mars' and 'Venus') (4). Research reported here was conducted to determine if other green pea cultivars and other legumes might also be susceptible to C. g. f. sp. *aeschyromene*. A preliminary report of this work has been published previously (4).

MATERIALS AND METHODS

Plants of all species tested were grown at 24–28 C in the greenhouse from seed or rooted crowns planted in steam-sterilized soil mix (Captina clay loam-sand-vermiculite, 12:3:1, v/v). All plants were grown in the greenhouse under natural

light conditions supplemented by two 40W fluorescent lamps for 15 hr each day.

C. g. f. sp. *aeschyromene* was maintained on Emerson YpSs agar (5) or Torula yeast agar (Torula yeast, 15 g; soluble starch, 15 g; K₂HPO₄, 1 g; MgSO₄, 0.5 g; agar, 16 g; water, 1 L). Conidia of the fungus used as inoculum were obtained from 5- to 7-day-old cultures grown in Richard's solution media (sucrose, 50 g; KNO₃, 10 g; KH₂PO₄, 5 g; MgSO₄ 7H₂O, 2.5 g; FeCl₃, 0.02 g; V-8 juice, 150 ml; and water, 850 ml). Liquid cultures were grown on rotary shakers at 28 C, 150 rpm, in 250-ml Erlenmeyer flasks containing 100 ml of media. Conidia were obtained by filtering cultures through Whatman No. 4 filter paper. Conidia collected in the filtrate were pelleted by centrifugation of the filtrate at 2,000 rpm for 20 min. Conidia were resuspended in water at 2 × 10⁶/ml as estimated by hemacytometer counts.

Plants were inoculated with an aerosol spray until runoff. Inoculated plants and uninoculated checks were incubated for 24 hr at 28 C in a dew chamber before being returned to the greenhouse. Five northern jointvetch seedlings were inoculated each time test plants were inoculated. Three replicates of three to five plants each were inoculated for all species tested except *Cercis canadensis* L., in which case five plants were inoculated. All plants were inoculated 7–14 days after emergence. Uninoculated plants that were not incubated in the dew

chamber served as an additional check.

All plants were examined for symptoms of disease for a 3-wk period after inoculation. Plants were rated immune if symptoms were not found and susceptible if lesions were visible within the 3-wk period. Additionally, susceptible reactions were described numerically on a scale of 1–5, where 1 = small (1 mm) lesions, 2 = lesions 1 mm to 1 cm, 3 = lesions larger than 1 cm, 4 = top death with regrowth, and 5 = plant death.

RESULTS

C. g. f. sp. *aeschyromene* infected seven of the 13 *Aeschynomene* species, two of four *Lathyrus* species, two of two *Lupinus* species, *Vicia faba*, and 23 of 26 *P. sativum* cultivars inoculated in these experiments (Table 1, Figure 1). The most susceptible species was *A. virginica*, although infection of *P. sativum* 'Mammoth Melting Sugar' and 'Sweet Snap' was also severe. No lesions were observed on green pea cultivars Blue Bantam, Little Marvel, and Grenadier, which were considered immune.

Symptoms of infection by C. g. f. sp. *aeschyromene* varied according to species or cultivar. On *P. sativum* 'Mammoth Melting Sugar' or 'Sweet Snap,' the most susceptible cultivars, lesions were found on stems, leaves, petioles, and tendrils. In addition, sporulation was profuse on all lesions, especially stem lesions. Stem lesions on these two cultivars enlarged rapidly, girdling the stems and killing tissues distal to the lesion. In all susceptible pea cultivars, lesions were first seen 3–4 days after inoculation. On more resistant cultivars, such as Burpeeana and Wando, lesions were found only on leaves and remained as black spots about 1–2 mm in diameter. Sporulation was minimal or absent on these cultivars.

Symptoms of infection on species of *Lathyrus*, *Lupinus*, and *V. faba* were first apparent 3–4 days after inoculation. Symptoms of infection on susceptible *Lathyrus* and *Lupinus* species were similar to those on pea and consisted of tan to light brown lesions on stems, leaves, and petioles. None of the

Published with the approval of the director of the Arkansas Agricultural Experiment Station.

Accepted for publication 8 September 1987 (submitted for electronic processing).

© 1988 The American Phytopathological Society

infections were severe enough to kill plants, and no crown infections were noted. Symptoms of infection on *V. faba* were found only on leaves and consisted of blackened necrotic irregular spots. Sporulation on lesions was not observed.

On *Aeschynomene*, symptoms ranged from small black lesions on stems or leaves of *A. evenia*, *A. indica*, *A. pratensis*, *A. rudis*, *A. scabra*, and *A. sensitiva* to the large, stem-girdling lesions on *A. virginica*. *A. virginica* was the only species killed by *C. gloeosporioides* in these tests. As in the other susceptible species, symptoms of infection were first seen 3-4 days after inoculation.

Symptoms of infection were not observed on 30 species from 25 genera in three subfamilies of the Leguminosae that were inoculated. The following legume species, grouped according to subfamily, were immune to infection: Mimosoidea—*Albizia julibrissin* Durazzini, *Desmanthus depressus* Humb. & Bonpl. ex Willd., and *D. illinoensis* (Michx.). MacM.; Cesalpinoidea—*Cassia obtusifolia* L., *Cercis canadensis* L., and *Gleditsia triaranthus* L.; and Papilionoidea—*Arachis hypogaea* L. 'Virginia Red,' *Baptisia sphaerocarpa* Nutt., *Centrosema pubescens* Benth., *Clitoria ternatea* L., *Coronilla varia* L., *Crotalaria* sp., *Crotalaria intermedia* Kotschy, *Cytisus multiflorus* (Ait) Sweet, *Desmodium laevigatum* (Nutt.) DC., *D. paniculatum* (L.) DC., *Dolichos biflorus* L., *D. lablab* L., *Galactia volubilis* (L.) Britt., *Glottidium vesicarium* (Jacq.) Harper, *Glycine max* (L.) Merr. 'Bragg,' 'Centennial,' 'Forrest,' and 'Hill,' *Phaseolus limensis* L. 'Dixie Butterpea,' *P. vulgaris* L. 'Bush Blue Lake' and 'Gold Rush,' *Psoralea cinerea* Lindl., *Pueraria phaseoloides* (Roxb) Benth., *P. thumbergii* (Sieb. & Zucc.) Benth., *Sesbania exaltata* (Raf.) Cory, *Stylosanthes sundaica* Taub., *Tephrosia ehrenbergiana* Schweinf., and *Vigna sinensis* (L.) Endl. 'California Blackeye No. 5.' Only species within the subfamily Papilionoidea were susceptible to infection by *C. g. f. sp. aeschynomene*.

Twenty genera of nonleguminous species within nine other families were immune to infection by *C. g. f. sp. aeschynomene*: Chenopodiaceae—*Spinacia oleracea* L. 'Grandstand'; Compositae—*Helianthus annuus* L. 'Mammoth Russian,' *Lactuca sativa* 'Waldmann's Green' and 'Summer Queen'; Cruciferae—*Brassica napus* L. 'Purple Top White Globe' and *Raphanus sativus* L. 'Early Scarlet Globe'; Cucurbitaceae—*Cucumis sativus* L. 'Marketmore' and 'Bounty 17185,' *Cucurbita maxima* L. 'Senator,' and *Citrullus vulgaris* Schrad. 'Crimson Sweet'; Graminae—*Oryza sativa* L. 'Mars' and 'Starbonnet,' *Zea mays* L. 'Merit' and 'Commander,' and *Triticum aestivum* L. 'McNair 1003' and 'Coker 68-15'; Malvaceae—*Gossypium hirsutum* L.

'New Rex,' *Abelmoschus esculentus* (L.) Moench 'Clemson spineless,' *Anoda cristata* (L.) Schlecht., *Abutilon theophrasti* Medic., and *Sida spinosa* L.; Rosaceae—*Fragaria* × *ananassa* Duch. 'Cardinal'; Solanaceae—*Lycopersicon esculentum* Mill. 'Ace 55' and *Datura stramonium* L.; and Umbelliferae—*Daucus carota* L. 'Red Core Danvers.'

DISCUSSION

These results show that several species within five genera in the Leguminosae are susceptible to infection by *C. g. f. sp. aeschynomene*, thus extending the known host range of this fungus. Previously, Daniel et al (1) reported that

only two species of *Aeschynomene* were susceptible. The genera with susceptible species include *Lathyrus*, *Lupinus*, *Pisum*, and *Vicia*. These results, although adding new species to the host range of *C. g. f. sp. aeschynomene*, in part confirm the work of Daniel et al (1) because no species or cultivars they listed as resistant were found to be susceptible in these new tests.

However, it is also noted that the genera *Aeschynomene*, *Lathyrus*, and *Lupinus* contain both immune and susceptible species. Daniel et al (1) showed that *Lupinus alba* was resistant to infection. More significantly, it should be noted that 23 of 26 cultivars of *P.*

Table 1. Reactions of legume species from genera containing species susceptible to infection by *Colletotrichum gloeosporioides* f. sp. *aeschynomene*

Genus	Species	Cultivar	Reaction ^a
<i>Aeschynomene</i>			
	<i>americana</i> L.		I
	<i>brasiliana</i> DC.		I
	<i>evenia</i> C. Wright		S-2
	<i>indica</i> L.		S-2
	<i>falcata</i> DC.		I
	<i>histris</i> Poir		I
	<i>paniculata</i> Willd. ex. Vog.		I
	<i>pratensis</i> Small		S-2
	<i>rudis</i> Benth.		S-2
	<i>scabra</i> G. Don.		S-2
	<i>sensitiva</i> Swartz		S-2
	<i>villosa</i> Poir		I
	<i>virginica</i> (L.) B.S.P.		S-5
<i>Lathyrus</i>			
	sp.		I
	<i>hirsutus</i> L.		S-2
	<i>latifolius</i> L.	Perennial Sweet Pea	I
	<i>odoratus</i> L.		S-2
<i>Lupinus</i>			
	<i>densiflorus</i> Berth.	White Lupine	S-2
	<i>subcarnosus</i> Hook	Texas Blubonnet	S-2
<i>Pisum</i>			
	<i>sativum</i> L.	Alderman	S-2
		Alaska	S-2
		Blue Bantam	I
		Burpeeana	S-1
		Early Snap	S-2
		Extra Early Alaska	S-2
		Freezonian	S-2
		Green Arrow	S-2
		Grenadier	I
		Laxton's Progress No. 9	S-2
		Little Marvel	I
		Maestro	S-2
		Mammoth Melting Sugar	S-4
		Mars	S-3
		Miragreen	S-2
		Novella II	S-2
		Patriot	S-2
		Snow Bird	S-3
		Sparkle	S-2
		Sugar Bun	S-2
		Sugar Snap	S-2
		Sweet Snap	S-4
		Thomas Laxton	S-3
		Venus	S-3
		Victory Freezer	S-2
		Wando	S-1
<i>Vicia</i>			
	<i>faba</i> L.		S-2

^aReaction: S = susceptible, where I equals small (1 mm), nonenlarging lesions to 5 equals plant death; I = immune.

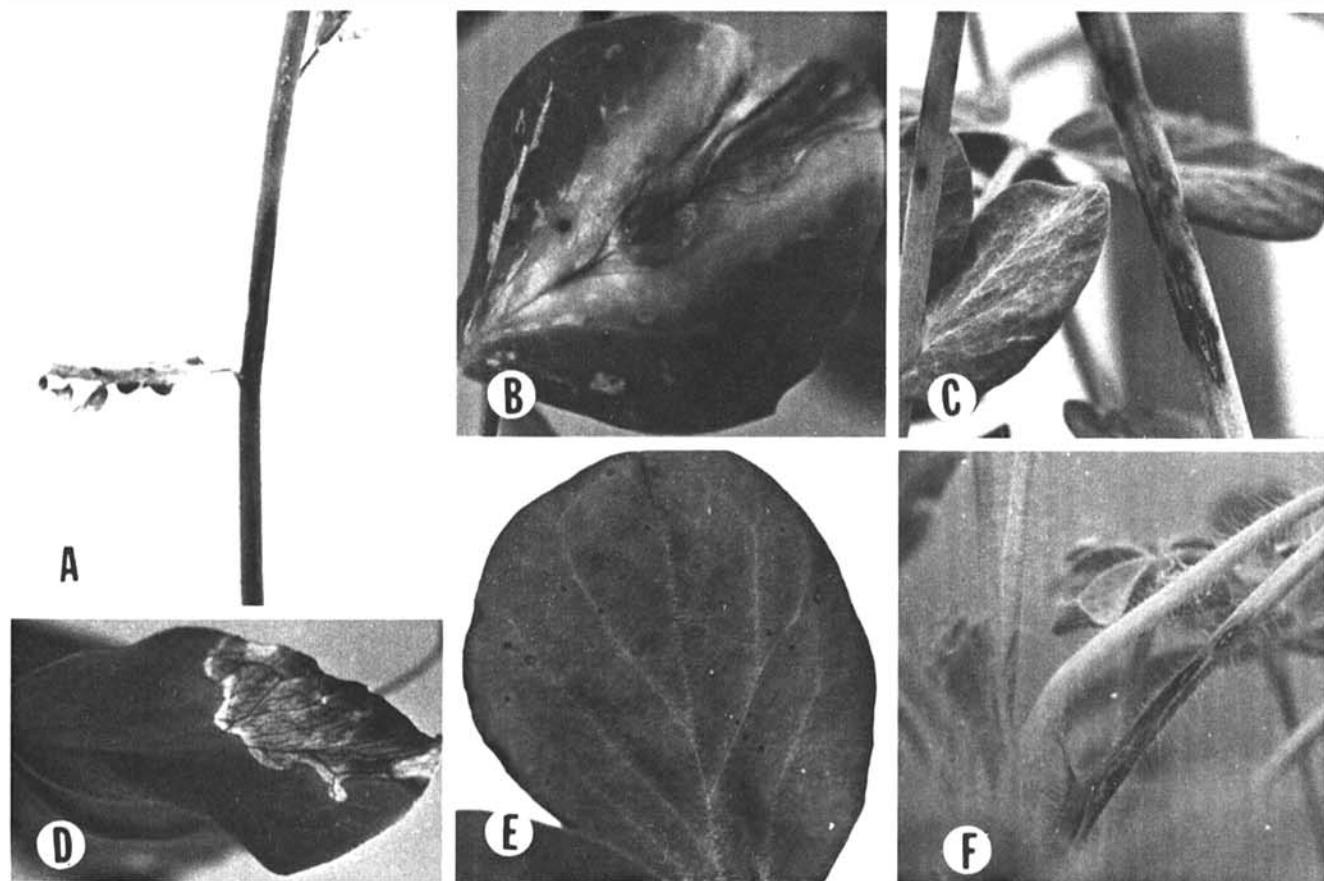


Fig. 1. Symptoms of infection of susceptible hosts by *Colletotrichum gloeosporioides* f. sp. *aeshynomene*: (A) stem lesion on *Aeschynomene virginica*, (B) leaf lesion on *Pisum sativum* 'Thomas Paxton,' (C) stem lesions on *P. sativum* 'Mammoth Melting Sugar,' (D) leaf lesion on *Lathyrus odoratus*, (E) leaf lesions on *Vicia faba*, and (F) stem lesions on *Lupinus densiflorus*.

sativum were susceptible to infection; symptoms of infection among these cultivars ranged from the black non-expanding spots on Wando to large, stem-girdling and sporulating lesions on Mammoth Melting Sugar. Three cultivars of *P. sativum*, Blue Bantam, Grenadier, and Little Marvel, were immune to infection. The cultivar Little Marvel, as originally tested, is a representative of *P. sativum* for registration and permit for use of *C. g. f. sp. aeshynomene* as Collego.

The determination of the host range of a fungus is important to its development and use as a mycoherbicide and is also required for the introduction of foreign organisms into the United States for biological control of weeds (2). Wapshere (7) reviewed the various methods to determine host range and has proposed a strategy to evaluate the safety of biological control organisms but also stated that none of these strategies are generally applicable and all have disadvantages. Application of Wapshere's strategy to *C. g. f. sp. aeshynomene* shows that the fungus is specific to the subfamily Papilionoidea, because none of the species within the Mimosoidea or Cesalpinoidea were infected. However, specificity within the Papilionoidea

appears to be less clear because the five susceptible genera are not closely related, and specificity is further complicated by the occurrence of immunity and susceptibility within each genus. The varied disease reactions of *Pisum sativum* further complicate the application of the strategy proposed by Wapshere (7). Selection of one of the three immune cultivars of *P. sativum* during the registration process for Collego implied the species was immune to *C. g. f. sp. aeshynomene*. Inclusion of cultivars of different genetic backgrounds in host range tests and in Wapshere's proposed strategy (7) would help to define more closely the host range of a pathogen.

Susceptibility of *Pisum*, *Lathyrus*, *Lupinus*, and *Vicia* to *C. g. f. sp. aeshynomene* also raises questions concerning the taxonomic and pathological relationship of this fungus to other *Colletotrichum* species infecting legumes. Recently, *C. trifolii* was shown to infect blue lupine (*Lupinus angustifolius*) (9). *C. pisi* Pat. also infects *Pisum* and *Lathyrus* species (6). Lenne and Sonoda (3) have isolated *C. gloeosporioides* from 10 genera of tropical forage legumes including *Aeschynomene* and *Stylosanthes*. More recently, Weidemann et al (8) showed that

although *C. g. f. sp. aeshynomene* infected *Pisum* and *Aeschynomene*, *C. pisi* did not infect *Aeschynomene* (8). More research is needed to determine the host range of *C. g. f. sp. aeshynomene* and related *Colletotrichum* species.

LITERATURE CITED

- Daniel, J. T., Templeton, G. E., Smith, R. J., Jr., and Fox, W. T. 1973. Biological control of northern jointvetch in rice with an endemic fungal disease. *Weed Sci.* 21:303-307.
- Klingman, D. L., and Coulson, J. R. 1982. Guidelines for introducing foreign organisms into the U.S. for biological control of weeds. *Plant Dis.* 66:1205-1209.
- Lenne, J. M., and Sonoda, R. M. 1978. *Colletotrichum* spp. on tropical forage legumes. *Plant Dis. Rep.* 62:813-817.
- TeBeest, D. O. 1984. Additions to the host range of *Colletotrichum gloeosporioides* f. sp. *aeshynomene*. (Abstr.) *Phytopathology* 74:864.
- Tuite, J. 1969. *Plant Pathological Methods*. Burgess Publishing, Minneapolis, MN. 239 pages.
- U.S. Department of Agriculture. 1960. *Index of Plant Diseases in the United States*. Agric. Handb. 165. U.S. Government Printing Office, Washington, DC. 531 pp.
- Wapshere, A. J. 1974. A strategy for evaluating the safety of organisms for biological weed control. *Ann. Appl. Biol.* 77:201-211.
- Weidemann, G. J., Cartwright, R. D., and TeBeest, D. O. 1985. Host specificity of *Colletotrichum pisi* and *Colletotrichum gloeosporioides* f. sp. *aeshynomene*. (Abstr.) *Phytopathology* 75:1361.
- Welty, R. E. 1984. Blue lupine as a host for *Colletotrichum trifolii* from alfalfa and for *C. fragariae* from strawberry. *Plant Dis.* 68:142-144.