Susceptibility of Corn to Isolates of *Colletotrichum graminicola* Pathogenic to Other Grasses

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ABSTRACT

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Anthracnose leaf blight of corn occurs in juvenile leaves and in leaves that are beginning to senesce. Isolates of *Colletotrichum graminicola* from sorghum, shattercane, johnsongrass, and barnyardgrass caused only chlorotic flecks on juvenile corn leaves. When inoculated onto senescing corn leaves, these fungi caused susceptible-type lesions that were indistinguishable from lesions caused by isolates of the fungus pathogenic to corn. The results indicate that these grasses represent an important reservoir of the fungus that may contribute to second-phase anthracnose leaf blight in corn.

Anthracnose, caused by *Colletotrichum graminicola* (Ces.) Wils., is a common disease of grasses including grain crops throughout the world (2,8,9). There are conflicting reports on the host range and pathogenicity of isolates of the fungus obtained from various grass species. Some authors have reported that isolates pathogenic to sorghum are also pathogenic to corn (11) and that isolates from johnsongrass, sudangrass, and broomcorn are also pathogenic to sorghum but that isolates from other grasses are not (3,4), whereas others report that isolates pathogenic to sorghum and other grasses are not pathogenic on corn (1,2,5,11).

Anthracnose leaf blight of corn occurs at two phases of plant growth. Plants are susceptible at the seedling stage, enter a phase of resistance as leaves expand and mature, and then enter a second phase of susceptibility at about the time of anthesis. Recently, we demonstrated that the second phase of susceptibility is associated with the onset of leaf senescence (6). The purpose of the present investigation was to clarify some of the controversy concerning the ability of isolates from other grasses to parasitize corn and to determine whether such isolates can contribute to anthracnose development once leaf senescence has begun.

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MATERIALS AND METHODS

The isolates of *C. graminicola* used for this study were obtained from sorghum (*Sorghum bicolor* (L.) Moench, isolates CgSorg and CgInSorg from Indiana), shattercane (*S. bicolor*, isolate CgShat 1 from Nebraska and CgShat 2 from Indiana), johnsongrass (*S. halepense* (L.) Pers., isolate CgJ 1 from Indiana), and barnyardgrass (*Echinochloa crus-galli* (L.) Beauv., isolate CgBYG from Indiana). An isolate of *C. graminicola* (Cg104) pathogenic to corn (*Zea mays* L.) was used as a standard for comparison with the normal development of anthracnose symptoms at various leaf maturities. Isolates were cultured on oatmeal agar under fluorescent light (60 $\mu E \cdot m^{-2} \cdot s^{-1}$). Conidia were harvested from 10-day-old cultures, and suspensions were adjusted to 5×10^5 conidia per milliliter. Tween 20 (50 μl/100 ml) was added to suspensions as a wetting agent.

Corn lines used were the susceptible inbred Mo940 and hybrid $Mo17_{Ht} \times B73_{Ht}$ and a resistant inbred, 33-16 (6,7). Plants were grown in 20-cm-diameter clay pots in the greenhouse and were inoculated at intervals of 2, 3, 4, or 5 wk after planting. Thus, as plants aged, this provided leaves on the same plant that were juvenile as well as leaves that were in various stages of senescence. Supplemental lighting (230 $\mu E \cdot m^{-2} \cdot s^{-1}$ photosynthetically active radiation, 14-hr photoperiod) was provided by fluorescent tubes positioned 50 cm above plants. Five pots of five plants each were inoculated with each fungal isolate, and the experiment was repeated at least twice for each isolate. Inoculum was applied from atomizers, and each leaf on each plant was inoculated. Plants were kept at 100% relative humidity for the first 18 hr after inoculation. Evaluations of disease development and symptom characterization were made daily through 8 days postinoculation. Lesion development was assessed on the basis of characteristic lesion types as described previously (7).

RESULTS AND DISCUSSION

Symptoms of anthracnose on juvenile corn leaves are first evident as chlorotic flecks (7), which eventually enlarge and become gray-green lesions on susceptible cultivars and appear as a variety of more restricted lesion types in cultivars with different levels of resistance (7). When mature (collared) leaves are inoculated, symptoms are very restricted in that lesions rarely develop beyond the chlorotic fleck stage. Inoculation of leaves that have begun to senesce again results in lesion development (6).

Results of inoculations in this study showed that all isolates of *C. graminicola* caused the chlorotic fleck symptom on juvenile leaves of each of the three corn cultivars. Moreover, this occurred at approximately the same time (within 48 hr of inoculation) for each fungal isolate. As expected (7), when plants were inoculated with the corn isolate of *C. graminicola*, chlorotic flecks on susceptible cultivars developed into oval, gray-green lesions, whereas on the resistant cultivar, flecks developed into small necrotic lesions surrounded by a narrow zone of chlorosis. However, when leaves in the juvenile and expansion stages of development were inoculated with the other *C. graminicola* isolates, the only symptom of infection was the formation of chlorotic flecks. Moreover, flecks did not even develop into necrotic pinpoint lesions.

In contrast to these results, inoculation of leaves that had begun to senesce, based on the onset of leaf chlorosis (6), resulted in the formation of gray-green lesions characteristic of the susceptible-type lesion (7). This occurred in response to each of the *C. graminicola* isolates regardless of its host origin and on each of the corn cultivars regardless of its resistance or susceptibility to *C. graminicola* in the juvenile leaf stage.

In the field, the second phase of susceptibility to *C. graminicola* is most evident after pollination, when leaves begin to senesce. Infection of older leaves by *C. graminicola* causes younger uninfected leaves to senesce more rapidly and to show greater susceptibility to subsequent infection (6).

Results of this investigation show that the onset of senescence also alters the ability of a leaf to express physiological resistance to strains of *C. graminicola* previously not considered pathogens of corn. Other grasses that are common weed competitors in the cultivation of corn include foxtails, quackgrass, and crabgrass; these species are also susceptible to *C. graminicola* (9,10). That isolates of the fungus pathogenic to other grasses, but not to juvenile or vigorously growing corn leaves, are capable of causing lesion development on senescing corn leaves suggests that, in nature, these fungi (and their hosts) may be important contributors to the development of second-phase anthracnose leaf blight in corn. It is important to note that previous studies of host range for *C. graminicola* have not taken into consideration the physiological age of the various host plant species. Thus, it is possible that, in nature, there is considerably more involvement of *C. graminicola* from nonhosts in leaf blight development on various grasses and small grains than previously assumed.

LITERATURE CITED

1. Dale, J. L. 1963. Corn anthracnose. Plant Dis. Rep. 47:245-249.
2. Hooker, A. L. 1977. Corn anthracnose leaf blight and stalk rot. Pages 167-182 in: Proc. Annu. Corn Sorghum Res. Conf. 31st. Chicago, IL.
3. LeBeau, F. J. 1950. Pathogenicity studies with *Colletotrichum* from different hosts on sorghum and sugarcane. Phytopathology 40:430-438.
4. LeBeau, F. J., Stokes, E. I., and Coleman, O. H. 1951. Anthracnose and red rot of sorghum. U.S. Dep. Agric. Tech. Bull. 1035.
5. Nicholson, R. L. 1975. The potential of corn anthracnose. Pages 41-49 in: Proc. 1974 Purdue Corn Dis. Conf. Purdue University, West Lafayette, IN.
6. Nicholson, R. L., Bergeson, G. B., DeGennaro, F. P., and Viveiros, D. M. 1985. Single and combined effects of the lesion nematode and *Colletotrichum graminicola* on growth and anthracnose leaf blight of corn. Phytopathology 75:654-661.
7. Nicholson, R. L., and Warren, H. L. 1976. Criteria for evaluation of resistance to maize anthracnose. Phytopathology 66:86-90.
8. Pastor-Corrales, M. A., and Frederiksen, R. A. 1980. Sorghum anthracnose. Pages 289-299 in: Sorghum Diseases. A World Review. International Crops Research Institute for the Semi-Arid Tropics. Patancheru, A.P., India.
9. Sprague, R. 1950. Diseases of Cereals and Grasses in North America. Ronald Press, New York. 538 pp.
10. U.S. Department of Agriculture. 1960. Index of Plant Diseases in the United States. Agric. Handb. 165. Government Printing Office, Washington, DC.
11. Wheeler, H., Politis, D. J., and Poneleit, C. G. 1974. Pathogenicity, host range, and distribution of *Colletotrichum graminicola* on corn. Phytopathology 64:293-296.