

Foliar Disease of *Sorghum* Species Caused by *Cercospora fusimaculans*

G. C. WALL, Graduate Student, Department of Plant Pathology and Microbiology, Texas A&M University, College Station 77843; L. K. MUGHOGHO, Principal Pathologist, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, P.O., A.P. 502 324, India; R. A. FREDERIKSEN, Professor, Department of Plant Pathology and Microbiology, Texas A&M University, College Station 77843; and G. N. ODVODY, Assistant Professor, Texas Agricultural Experiment Station, Texas Agricultural Research and Extension Center, Corpus Christi 78410

ABSTRACT

Wall, G. C., Mughogho, L. K., Frederiksen, R. A., and Odvody, G. N. 1987. Foliar disease of *Sorghum* species caused by *Cercospora fusimaculans*. Plant Disease 71:759-760.

A *Cercospora* species with catenulate conidia was isolated on V-8-CaCO₃ from foliar lesions on *Sorghum bicolor* and *S. halepense*, and the original scalariform lesions were reproduced on sorghum cultivar TX7078. Samples of this foliar disease were mailed from Rwanda and from Comayagua, Honduras, to the Commonwealth Mycological Institute, Kew, U.K., for pathogen identification. The pathogen was identified as *Cercospora fusimaculans*. Field inoculations were performed in Choluteca, Honduras. This disease, which we hereby name ladder leaf spot, is distinguishable from gray leaf spot of sorghum caused by *C. sorghi* by its scalariform or ladderlike elliptical lesions. Sources of resistance to ladder leaf spot and gray leaf spot are apparently independent of each other. Ladder leaf spot has been observed on sorghum in Experiment, GA, at various locations in Texas, in Tampico, Mexico, throughout Honduras, and in El Salvador, Cuba, Colombia, Venezuela, Brazil, Rwanda, Malawi, and Zambia.

During work with gray leaf spot of *Sorghum bicolor* caused by *Cercospora sorghi* in Beeville, TX, in 1982, a *Cercospora* species was isolated from lesions atypical from those of *C. sorghi*. This isolate was associated with ladderlike or scalariform lesions apparently formed by adjoining individual lesions progressively developing in a linear pattern in both directions out from the center (Figs. 1 and 2). A similar fungus was isolated from *S. bicolor* cultivars grown in Tampico, Mexico, in Choluteca, Honduras, and from *S. halepense* growing wild at College Station, TX.

Previously, ladderlike lesions on *Sorghum* species were reported as caused by *C. sorghi* (1). Lesions caused by *C. sorghi* differ mainly in the lack of ladderlike markings and in the absence of the pale brown centers of the lesions. The gray leaf spot lesion is uniformly discolored. Scalariform lesions are elliptical, almost rectangular, pale brown, segmented by ladderlike markings, dark-bordered, and delimited by secondary and tertiary veins. We have named this disease ladder leaf spot.

This work was supported in part by funds provided by AID/DSAN/XII/G-0149.

Accepted for publication 1 April 1987 (submitted for electronic processing).

© 1987 The American Phytopathological Society

MATERIALS AND METHODS

Isolation of pathogen. *S. bicolor* leaves with scalariform lesions were collected in Beeville, TX, in 1982. The pathogen was isolated by collecting conidia from the lesions with a sterile camel's-hair brush, streaking them on water agar plates, and

incubating them overnight at room temperature. Plates were inspected 18 hr later, and germinated conidia were transferred to V-8 CaCO₃ agar, potato-dextrose agar, autoclaved sorghum leaf extract agar, and filtered (not autoclaved) sorghum leaf extract plus agar. The last two media were prepared by comminuting 25 g of sorghum leaves per liter of distilled water.

Pathogenicity test. *S. bicolor* plants (cultivar TX7078) were inoculated by spraying 8-wk-old plants at stage 40 of the decimal cereal scale (3) with a suspension containing 5,000 conidia of the fungus per milliliter at College Station. Conidia were obtained from V-8-CaCO₃ agar cultures grown at room temperature for 2 wk. Conidia were collected from culture plates and were sprayed onto plants with a Hudson cordless electric sprayer, lightly covering both surfaces of leaves. Inoculated plants



Fig. 1. Symptoms of gray leaf spot, caused by *Cercospora sorghi*, on *Sorghum bicolor*. Lesions are concolorous, elongate, and lack ladderlike markings.



Fig. 2. Symptoms of ladder leaf spot, caused by *Cercospora fusimaculans*, on *Sorghum bicolor*. Lesions have an outline similar to those caused by *C. sorghi* but show segmented ladderlike markings within the lesions.

were placed in a Percival 1-35-D dew chamber set at 24 C wall temperature and 44 C in the water reservoir. Air temperature inside was 24–25 C. Twenty inoculated plants were removed after 12 hr and taken to the greenhouse; another 20 inoculated plants were removed after 36 hr. Controls were treated similarly but sprayed only with distilled water. Plants were inoculated on 2 November 1982.

Field inoculation. *S. bicolor* leaves with 20–25% ladder leaf spot severity were collected in Comayagua, Honduras, in November 1984. Leaves were chopped, comminuted and filtered through cheesecloth. Conidia obtained were adjusted to 5,000/ml and sprayed onto one-row plots at the International Cercospora Test (ICT) Nursery planted in September 1984. The nursery, grown at Choluteca, Honduras, consisted of 12 entries with two replicates. A moderate level of gray leaf spot epidemic (5–15% severity) was occurring naturally at the ICT nursery at the time of the inoculation. Half of each 5-m row was sprayed to runoff with the conidial suspension with a backpack sprayer. Plants were inoculated just before sunset.

Identification of pathogen. Leaves of *S. bicolor* with ladder leaf spots were collected in Rwanda and in Comayagua, Honduras, and mailed to the Commonwealth Mycological Institute, Kew, UK, for identification of the causal organism.

RESULTS

Isolation of pathogen and pathogenicity test. The fungus isolated from scalariform lesions (Fig. 2) on sorghum leaves grew well on all media tested. It sporulated readily on V-8-CaCO₃ agar and on sorghum filtrate agar. Colonies tended to be smaller in diameter and darker than those of *C. sorghi*; no ring pattern was evident on the colonies as normally occurs with *C. sorghi*.

Disease developed in the group of plants inoculated and left 36 hr in the dew chamber. Symptoms as originally observed were reproduced, and the pathogen was reisolated.

Field inoculation. Inoculated plants developed scalariform lesions 2 wk after inoculation. Severity on susceptible cultivars at that time was 15%. The uninoculated half-rows of the ICT nursery continued to develop gray leaf spot lesions, and the severity of this disease exceeded 25% on susceptible cultivars.

Entries SC167-14, R3338, 80B2892, and 77CS1 were resistant to ladder leaf spot in this test. In addition, ratings from of naturally occurring ladder leaf spot on sorghum in Comayagua in 1984 and 1985 identified a number of sorghum entries that may serve as sources of resistance.

Identification of pathogen. The Commonwealth Mycological Institute, Kew, UK, identified the fungus as *C. fusimaculans* Atk. (2) from the samples collected at Rwanda and at Comayagua, Honduras, in 1985. Other specimens from Mexico, Texas, and Georgia were identical to the samples of the diseased host from Honduras based on observations made in the laboratory at Texas A&M University.

DISCUSSION

Ladder leaf spot has been observed on *S. bicolor* and *S. halepense*. On *S. bicolor*, it has been observed at Experiment, GA, various locations in Texas, Mexico, throughout Honduras, Brazil, Rwanda, Malawi, and Zambia.

Symptoms of a ladder leaf spot have previously been reported from El Salvador, Cuba, Colombia, and Venezuela (1). Ciccarone (1) had previously concluded that the scalariform symptoms were caused by *C. sorghi* infections under a unique set of environmental factors. Our investigation shows that the causal agents of gray and ladder leaf spots are different fungi. *C. sorghi* isolated from gray leaf spot lesions produced gray leaf spot symptoms on inoculated sorghum plants in the lab and in the field (4). Ladder leaf spot symptoms were reproduced when *C. fusimaculans* isolated from ladder leaf spot lesions was inoculated on cultivar TX7078 in the lab.

In the field, ladder leaf spot symptoms were reproduced in experimental plots where gray leaf spot was also present. This suggests that the scalariform lesions of ladder leaf spot are not caused by the same pathogen as gray leaf spot in response to a particular set of environmental conditions as Ciccarone suggested (1). This fact, together with the completion of Koch's postulates, leads us to the conclusion that ladder leaf spot on *Sorghum* species is caused by *C. fusimaculans*.

Sorghum nurseries planted in Comayagua, Honduras, in 1985 were severely affected by ladder leaf spot. Previously considered to be caused by *C. sorghi*, this disease needs to be recognized as distinct from gray leaf spot.

Levels of resistance to both gray leaf spot and ladder leaf spot exist in *S. bicolor*. From observations in Honduras, we are led to believe that sources of resistance to ladder leaf spot and to gray leaf spot are independent of each other; however, this question needs to be addressed specifically.

Gray leaf spot and ladder leaf spot on *Sorghum* species can be readily distinguished from each other on the basis of lesion morphology; ladder leaf spot lesions are scalariform with straw-colored centers and dark borders, whereas gray leaf spot lesions are discolored throughout, displaying the color of the host pigments (purple, red, or tan) (3). Lesions caused by both species may appear on the same leaves at the same time.

LITERATURE CITED

1. Ciccarone, A. 1950. Alcune osservazioni su *Cercospora sorghi* E. et E. Ann. Sperim. Agric. 4:281-289.
2. Ellis, M. B. 1976. More Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, Surrey, England.
3. Frederiksen, R. A., ed. 1986. Compendium of Sorghum Diseases. American Phytopathological Society, St. Paul, MN. 82 pp.
4. Wall, G. C. 1983. Development of a technique to screen for resistance to *Cercospora sorghi* in sorghum. Master's thesis, Texas A&M University, College Station. 65 pp.