

Leaf Spot of Indiangrass Caused by *Colletotrichum caudatum*

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ABSTRACT

Zeiders, K. E. 1987. Leaf spot of indiangrass caused by *Colletotrichum caudatum*. Plant Disease 71: 348-350.

A leaf disease caused by *Colletotrichum caudatum* was prevalent on indiangrass (*Sorghastrum nutans*) in research plots in Centre County, PA, during five of the six years 1980-1985. The disease was usually moderate to severe in late August and September. Results of cultural studies of the pathogen are presented. *C. caudatum* caused severe damage only on indiangrass cultivars in greenhouse inoculation tests. Differences among mean disease ratings were significant at $P < 0.01$. Six other warm-season grasses, seven cool-season grasses, and three small-grain species were not infected. Corn (*Zea mays*) was slightly susceptible, and sudangrass (*Sorghum sudanense*) was highly resistant to *C. caudatum*. Corn is reported as a new host of *C. caudatum*. This is the first demonstration of the pathogenicity of *C. caudatum* on indiangrass.

Additional key words: *Ellisiella caudata*

Indiangrass (*Sorghastrum nutans* (L.) Nash) is a native perennial warm-season grass that grows in open woodlands and prairies from the Atlantic Coast to the Great Plains and is an important constituent of prairie hay (2). It is one of several warm-season grasses evaluated for midsummer pasture and hay at northeastern and midwestern agricultural experiment stations in recent years (3). Indiangrass in research plots in Pennsylvania during the last 10 yr has been less prone to leaf diseases than several other warm-season grasses. Leaf spots caused by *Colletotrichum caudatum* (Peck ex Sacc.) Peck (5) (*Ellisiella caudata* Sacc.) (7) and *Ascochyta brachypodii* (Sydow) Sprague & A. G. Johnson (11) were observed the most frequently on indiangrass in Pennsylvania, but *C. caudatum* caused the most damage. Because there is little detailed information on diseases of indiangrass, studies were made of the prevalence and importance of the disease incited by *C. caudatum*, including cultural studies of the pathogen, host ranges of selected grasses, and the reactions of cultivars.

Contribution 8603 of the U.S. Regional Pasture Research Laboratory, University Park, PA 16802.

Accepted for publication 4 September 1986.

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MATERIALS AND METHODS

Diseased leaves of indiangrass were collected from experimental plots in Centre and Huntingdon counties in central Pennsylvania over a 6-yr period. Collections were made at 1- to 2-wk intervals from July to mid-October each year. In addition, diseased leaves of indiangrass were collected five times in research plots of Westmoreland County, PA, and twice in plots at Wardsville, WV. Pathogens were isolated on potato-dextrose agar (PDA) and cultured on 20% V-8 juice agar (V-8A). For cultural and morphological studies, *C. caudatum* was grown on V-8A in an incubator at 22 C with 12 hr of fluorescent light and 12 hr of darkness daily.

Plants of the 24 gramineous species and cultivars listed in Table 1 were grown from seed in a 1:1 mixture of peat moss and vermiculite in 10-cm-diameter pots in a greenhouse at 22-27 C. The foliage inoculated in this experiment was the 6- to 7-wk old regrowth from older grass plants that had been clipped. An exception was flaccidgrass plants, which were grown from vegetative sprigs. Plants of corn, sudangrass, wheat, oats, and barley were 4 wk old.

Inoculations. Conidial suspensions of *C. caudatum* were prepared from 8-day-old fruiting cultures of isolate 1442 on V-8A. Conidia and mycelium were scraped from four petri-dish cultures with a razor blade and blended with 900 ml of distilled water and one drop of Tween 20 surfactant. Inoculum was sprayed on leaves of test plants until

thoroughly wet using a pressurized aerosol propellant. Three pots of each species were inoculated, and one pot was sprayed with distilled water as a control. Plants were incubated 48 hr at 19-21 C in a dark chamber, where moist conditions were maintained by periodic misting with distilled water, and then transferred to a greenhouse bench.

Seven days after inoculation, disease severity ratings were made on a scale of 1-9, where 1 = no disease, 2 = trace, 3 = slight, 5 = moderate, 7 = severe, and 9 = very severe, sometimes killing the plant. Ratings were based on size and number of lesions, but lesion size was considered most important in evaluating susceptibility of species. Analysis of variance was used to determine the significance of differences among disease severity mean ratings.

RESULTS AND DISCUSSION

The pathogen. *C. caudatum* is a member of the order Melanconiales of the class Fungi Imperfecti. Genera of this order have an open fruiting body, or acervulus, in which conidia are produced. *C. caudatum* was isolated from indiangrass growing at one location in Centre County, PA, during five of the six years 1980-1985. In culture on V-8A, the fungus produced dark stromata (acervuli) with light-colored mycelium. Within the stromata, which contained dark septate setae, conidia were produced on phialides and were extruded in a viscous mass. Abundant fruiting and sporulation were obtained within 5 days, at which time the colonies averaged 38 mm in diameter. Conidia were light brown, one-celled, slightly curved, and tapered toward the basal end and contained a small nipple-shaped protuberance at the point of attachment to the conidiophore (Fig. 1). Each conidium had a filiform apical appendage at the distal end. Conidia were 19.2-26.4 \times 4.8-6.0 μ m (av. 22.8 \times 5.3 μ m), not including the apical appendages. After 6 days in a petri-dish moist chamber, conidia produced in leaf lesions contained two (occasionally three) conspicuous, round to oval vacuoles in the cytoplasm. Conidia of *C. caudatum* were slow to germinate. After 30 hr at room temperature, no conidia in an aqueous suspension

on water agar had germinated, and after 48 hr, only a few had germinated. Germ tubes arose from the centers or the ends of conidia. One conidium had a germ tube at each end.

Symptomatology. Lesions caused by *C. caudatum* on indiagrass in the field were reddish brown, slightly pointed at the ends, and 4–8 mm long by 1–2 mm wide. In mature lesions, the central portion was buff-colored and contained the acervuli of the fungus. The disease occurred on leaves and leaf sheaths and was usually moderate to severe on indiagrass in late August and September. The disease was only found in research

plots at Milesburg, Centre County, PA, where the environment was especially favorable for development of leaf diseases (11,12). It was not observed in plots at Huntingdon and Westmoreland counties in Pennsylvania or at Wardensville, WV.

Cross-inoculations and host range. Disease reactions of seven warm-season grasses, seven cool-season grasses, and four grain species are given in Table 1. Among the warm-season species, only the indiagrass cultivars were highly susceptible to *C. caudatum*. Differences among mean disease ratings of cultivars were significant at $P < 0.01$. Except for tiny reddish flecks on sudangrass, symptoms did not develop on the other warm-season species. No symptoms were evident on any of the cool-season grasses.

Corn appeared to be slightly susceptible to *C. caudatum*. Narrow tan lesions 3–6 mm long by about 1 mm wide developed on leaves by 7 days after inoculation. Mean disease ratings for corn and sudangrass were significantly different. Wheat, oats, and barley were not susceptible. There were no symptoms on any of the uninoculated control plants.

Symptoms of infection on indiagrass were not evident until 4 days after inoculation. This was an unusually long incubation period for symptom expression and may be directly related to the fact that conidia of *C. caudatum* were unusually slow to germinate in the laboratory. Seven days after inoculation all indiagrass cultivars were heavily infected with leaf spots. Individual lesions were brown to rust-colored (Fig.

Table 1. Reactions of some gramineous species to *Colletotrichum caudatum* from indiagrass

Species and cultivar/selection	Mean disease rating ^a
Warm-season grasses	
Indiagrass	
(<i>Sorghastrum nutans</i> (L.) Nash)	
cv. Nebraska 54	6.0 ^b
cv. Cheyenne	7.0
cv. Osage	7.3
cv. Western	7.3
Ky-591	5.7
Big bluestem	
(<i>Andropogon gerardi</i> Vitman)	
cv. Kaw	1.0
cv. Pawnee	1.0
cv. Niagara	1.0
Little bluestem	
(<i>Andropogon scoparius</i> Michx.)	1.0
Caucasian bluestem	
(<i>Bothriochloa caucasica</i> C. E. Hubb.)	1.0
Switchgrass	
(<i>Panicum virgatum</i> L.)	
cv. Carthage	1.0
Flaccidgrass	
(<i>Pennisetum flaccidum</i> Griseb.)	1.0
Sudangrass (annual)	
(<i>Sorghum sudanense</i> (Piper) Stapf.)	1.7
Cool-season grasses	
Smooth bromegrass	
(<i>Bromus inermis</i> Leyss)	1.0
Orchardgrass	
(<i>Dactylis glomerata</i> L.)	1.0
Reed canarygrass	
(<i>Phalaris arundinacea</i> L.)	1.0
Kentucky bluegrass	
(<i>Poa pratensis</i> L.)	1.0
Perennial ryegrass	
(<i>Lolium perenne</i> L.)	1.0
Tall fescue	
(<i>Festuca arundinacea</i> Schreb.)	1.0
Red fescue	
(<i>Festuca rubra</i> L.)	1.0
Grain crops	
Corn (<i>Zea mays</i> L.)	3.3
Wheat (<i>Triticum aestivum</i> L.)	1.0
Oats (<i>Avena sativa</i> L.)	1.0
Barley (<i>Hordeum vulgare</i> L.)	1.0

^aScale: 1 = no disease, 2 = trace, 3 = slight, 5 = moderate, 7 = severe, 9 = very severe. Ratings made 7 days after inoculation. Values are the average for three replicate plots.

^bLSD 0.01 = 0.97.

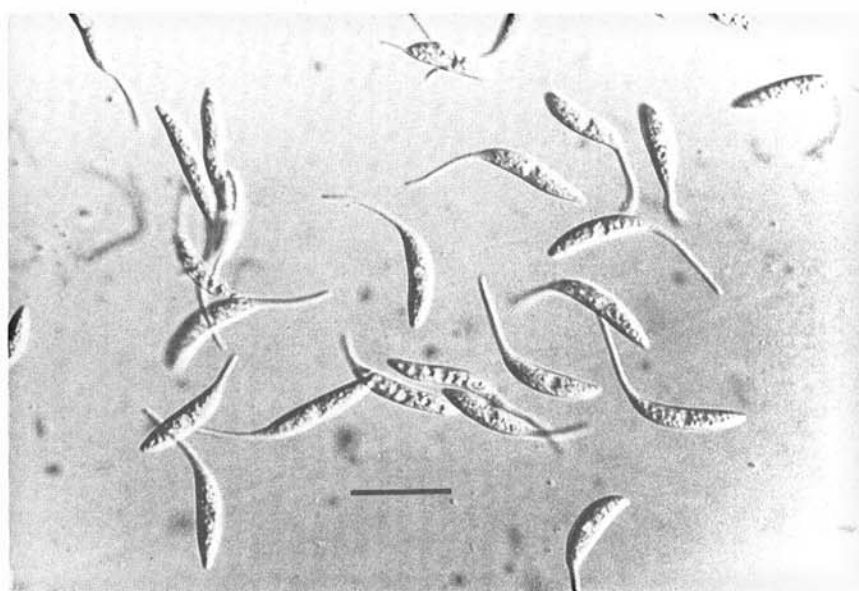


Fig. 1. Conidia of *Colletotrichum caudatum* from culture on V-8 juice agar. Scale bar = 25 μ m.

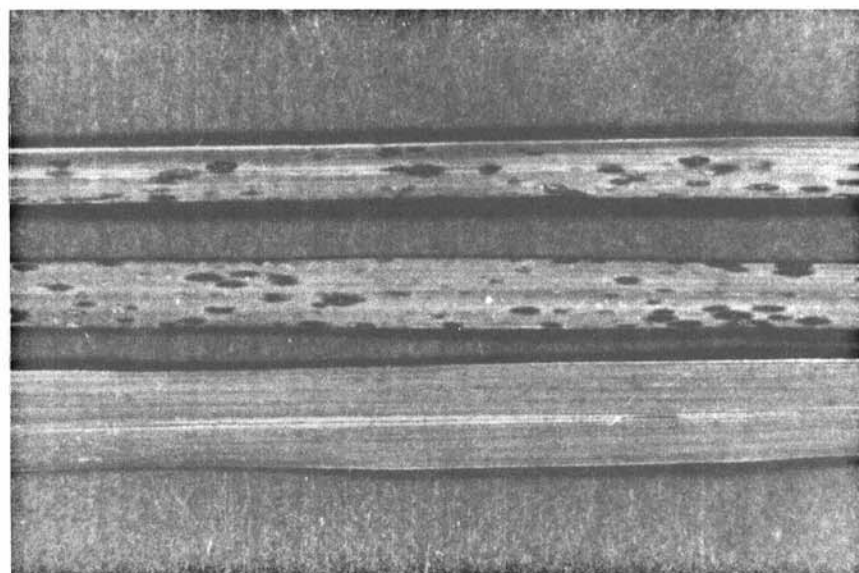


Fig. 2. Leaf spots on indiagrass caused by *Colletotrichum caudatum*. Top and middle leaves inoculated, bottom leaf uninoculated.

2). The spots ranged from 1 to 3 mm long by about 1 mm wide. Spots were very numerous on most leaves and often were coalesced, resulting in many brown to dull gray withered leaves. After 13 days, disease was generally severe on all indiagrass cultivars. Raised, setose sporodochia of *C. caudatum* developed rapidly (within 2 days) on detached inoculated leaves in petri-dish moist chambers. Dark setae emerged around the base of the sporodochia, which contained viscous conidial masses in the center.

Leaf spot disease caused by *C. caudatum* (*Ellisiella caudata*) has been reported on indiagrass and on *Agropyron trachycaulum* (Link) Malte, *Andropogon holli* Hock., *A. scoparius* Michx., and *Eragrostis spectabilis* (Pursh.) Steud. in Oklahoma (6) and on *Andropogon gerardi* Vitman in North Dakota (1). In a taxonomic study, Nag Raj (4) examined isolates of *C. caudatum* from indiagrass leaves collected in Wisconsin and New Jersey and from *Cymbopogon caesius* from Bangalore, India. In addition to the species mentioned above, Nag Raj (4) lists *Andropogon provincialis*, *Cymbopogon polyneuros*, and *Manisurus cylindrica* (Michx.) Kuntze as hosts of *C. caudatum*. Sutton (9) indicated that *C. caudatum* also occurs on *Imperata cylindrica* (L.) Beauv. (cogongrass) and on several grass species from Australia, Burma, Brunei, and Sarawak.

C. caudatum has been recorded on

indiagrass in four states, but the reports give no indication of its importance as a pathogen. Results of field and greenhouse studies reported here show that *C. caudatum* is capable of causing severe damage to foliage of indiagrass and must be considered a potentially important pathogen. Of the 18 gramineous species inoculated, only indiagrass was highly susceptible, corn was slightly susceptible, and 16 species (with the exception of sudangrass) were non-susceptible to *C. caudatum*. Two species, *Andropogon gerardi* (big bluestem) (1) and *A. scoparius* (little bluestem) (6), reported to be hosts of *C. caudatum*, were not susceptible to the isolate used in this experiment. Moreover, during this investigation, *C. caudatum* was never isolated from these grasses, and their susceptibility to *C. caudatum* is questionable. *Septogloeum bartholomaei* (Pk.) Wr., which also causes leaf spot, has been reported only on indiagrass in Kansas (10). However, *C. caudatum* is morphologically different from *S. bartholomaei* in two characteristics: 1) the acervuli of *C. caudatum* contained dark setae and 2) the conidia had an appendage at only one end, whereas *S. bartholomaei* does not have setae and its conidia have a bristle-like appendage at both ends (8). This is the first demonstration of the pathogenicity of *C. caudatum* on indiagrass and the nonsusceptibility of 16 other gramineous species to the fungus. Corn is reported as a new host of *C. caudatum*.

ACKNOWLEDGMENTS

I wish to thank John Bissett, Biosystematics Research Institute, Agriculture Canada, Ottawa, Ontario, for assistance in the identification of *Colletotrichum caudatum*; R. T. Sherwood, U.S. Regional Pasture Research Laboratory, University Park, PA, for taking the photomicrograph of conidia of *C. caudatum*; and G. A. Jung of the same institution for making his research plots available for this study.

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