

## Anthracnose of Wild Rice

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### ABSTRACT

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A new disease of wild rice (*Zizania aquatica* L.) showing typical anthracnose symptoms was present in Minnesota commercial fields and natural stands in 1979. The disease occurred at low incidence and severity levels in 1980-1982. The pathogen was identified as *Colletotrichum sublineolum*.

Additional key words: *Colletotrichum graminicola*

A new disease of wild rice (*Zizania aquatica* L.) was found in two natural stands and four commercial fields in northern Minnesota in 1979. Light tan, elliptical to fusiform lesions (0.1-1.5 × 0.1-0.6 cm), often with dark brown margins, were observed on aerial leaf blades (Fig. 1). Lesions contained numerous black, setose, vein-limited acervuli (0.05-2.0 × 0.05-0.2 mm), which were frequently covered with orange-pink masses of conidia. Lesions were most common on the lower leaves, occasionally coalescing to cover the entire leaf.

The objectives of this study were to isolate and identify the causal agent of this disease and determine the incidence and severity in Minnesota commercial fields and natural stands.

### MATERIALS AND METHODS

**Survey.** A disease survey was conducted in 1980-1982 to determine incidence and severity of wild rice anthracnose in Minnesota. Six natural stands and 13-22 commercial fields were surveyed by carefully observing plants along a transect of 50-100 m in natural stands or a perimeter 50 × 50 m square in fields. The percentage of plants infected (incidence) and average percentage of the whole plant leaf area affected (severity) were estimated using a disease scale index for foliar diseases of rice (1). Plants were in the late flowering to early milk stage.

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**Isolation.** Diseased plant samples were collected, stored in sealed plastic bags at 3-5 C, and transported to the laboratory. A drop of sterile distilled water (SDW) was placed on the surface of a lesion and allowed to stand for about 5 min to obtain a conidial suspension. The drop was removed and spread with a sterile wire loop on Difco potato-dextrose agar (PDA) plates. Single germinating conidia were transferred with a micromanipulator to fresh PDA plates incubated at 24 C. Stock cultures were maintained at 5 C on PDA.

**Pathogenicity.** Wild rice cultivar Netum was grown as described by Kardin et al (2). Isolates C-7901 and C-7903, from a natural stand and commercial field, respectively, were grown on V-8 juice agar (2) or Difco oatmeal agar plates under cool-white and near-ultraviolet lights (General Electric F40 CW and F40 BL) at a light intensity of 23  $\mu\text{E m}^{-2} \text{s}^{-1}$ . Cultures were given a 12-hr photoperiod and incubated at 24 C for 14 days. Plates were flooded with SDW and conidia were dislodged with a sterile glass rod. The resulting conidial suspension was adjusted to between  $5 \times 10^5$  and  $1 \times 10^6$  conidia per milliliter with SDW. Tween 20 (0.01%, v/v) was added as a wetting agent. Plants were sprayed to runoff with the conidial suspension, using a DeVilbiss atomizer. Inoculated plants were incubated in a moist chamber at 20-35 C and 90-100% relative humidity in a greenhouse for 10 days. Natural light was supplemented by fluorescent light to provide a 16-hr photoperiod. Reisolations were made from sporulating lesions.

**Identification.** Conidial characters of *Colletotrichum* sp. from wild rice were determined from fresh or dried infected wild rice leaves from three locations and from isolate C-7901 cultured on PDA. These were compared with herbarium (University of Minnesota, Department of

Plant Pathology [MPPD]) material distributed by the Ohio Agricultural Experiment Station as *Colletotrichum cereale* Manns (*C. graminicola* (Ces.) Wilson) on wheat (*Triticum aestivum* L.) and with *C. graminicola* (ATCC 34167) from corn grown on PDA. Cultures were incubated as in pathogenicity tests. Appressorial morphology was studied according to the method described by Sutton (7).

### RESULTS AND DISCUSSION

Anthracnose was found in all six natural wild rice stands and seven of 13 (54%) commercial fields in 1980. Incidences ranged from a trace to 5% and severities were less than 1%. Similar results were obtained in 1981 and 1982. Cultivars Johnson, K2, M1, and Netum were susceptible to the disease. At present, anthracnose does not appear to be a significant factor in wild rice production in Minnesota.

A fungus associated with anthracnose lesions produced aseptate, hyaline, fusiform to falcate conidia in setose acervuli and was identified as a *Colletotrichum* spp. (8). Two mono-

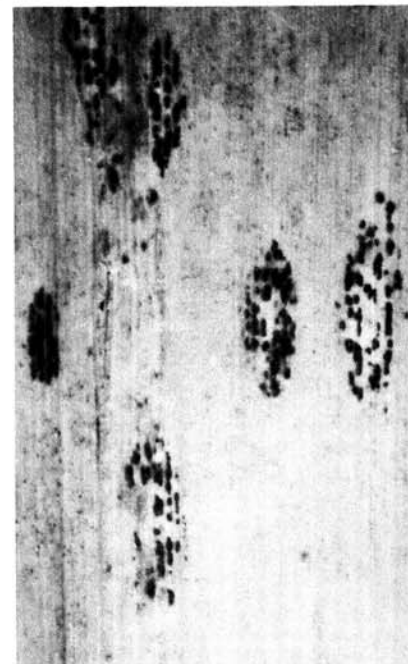


Fig. 1. Anthracnose of wild rice (*Zizania aquatica*), caused by *Colletotrichum sublineolum* (natural infection).

conidial isolates from wild rice produced small, dark greenish brown, water-soaked lesions (1–2 mm diam.) 2–3 days after inoculation. By day 7, fusiform tan lesions with sporulating acervuli were observed. The fungus was subsequently reisolated from sporulating lesions, thus completing Koch's postulates.

Wilson (9) combined 10 falcate conidial *Colletotrichum* spp. from various grasses with *C. graminicola*. Von Arx (10) expanded the synonymy to all falcate-conidial *Colletotrichum* spp. from graminicolous substrates, including *C. falcatum* Went. However, *C. falcatum* has been shown to be distinct in host range (3,4), appressorial characters (7), and perfect stage (6). Sutton (8) divided graminicolous specimens with falcate conidia into *C. falcatum* (from *Saccharum*), *C. sublineolum* (from *Sorghum*), and *C. graminicola* sensu stricto (from *Zea*). The status of specimens on other grasses was not resolved.

Conidia of *Colletotrichum* sp. from wild rice lesions were  $14\text{--}31 \times 3\text{--}5 \mu\text{m}$  (mean  $23.1 \times 4.1 \mu\text{m}$ ) and were similar in shape and size to herbarium specimens of *C. graminicola* (sensu Wilson [9]) on wheat ( $17\text{--}25 \times 3.5\text{--}4.5 \mu\text{m}$ , mean  $22.9 \times 3.9 \mu\text{m}$ ). However, the conidia of a wild rice isolate of *Colletotrichum* (C-7901)

cultured on PDA were longer ( $21\text{--}31 \times 3.5\text{--}4.5 \mu\text{m}$ , mean  $26.4 \times 4.0 \mu\text{m}$ ) than those found on natural substrate or those observed from herbarium specimens of *C. graminicola* on wheat. *C. graminicola* from corn (ATCC 34167, *C. graminicola* sensu Sutton [8]) produced larger conidia ( $26\text{--}34 \times 4.0\text{--}5.5 \mu\text{m}$ , mean  $29.4 \times 4.4 \mu\text{m}$ ) than all samples of *Colletotrichum* from wild rice. The corn isolate of *C. graminicola* produced small elliptical conidia (also noted by Nishihara [5]) that were absent in *Colletotrichum* isolates from wild rice. Wild rice isolates produced colonies with dark gray to black centers, light gray margins, and abundant felt to tufted aerial mycelium, sometimes with diurnal zonation. In contrast, the corn isolate produced a uniform, cottony, brownish gray mat of aerial mycelium. Finally, the wild rice isolates produced light brown, mostly unlobed appressoria, whereas those of the corn isolate were dark brown to almost black and strongly lobed. The wild rice isolates were identified as *C. sublineolum* P. Henn. by B. C. Sutton (CMI). The relationship of these wild rice isolates to sorghum isolates of *C. sublineolum* will require further clarification. Specimens of wild rice anthracnose have been deposited in the University of Minnesota Plant Pathology

herbarium and Commonwealth Mycological Institute culture collections.

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