Septoria avenae Spot as an Additional Component of the Fungal Leaf Spot Syndrome of Spring Wheat in New York

W. C. da LUZ, Graduate Student, and G. C. BERGSTROM, Assistant Professor, Department of Plant Pathology, Cornell University, Ithaca, NY 14853

ABSTRACT

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During a survey of spring wheat fields in central and western New York in 1984, moderate to severe leaf spot symptoms were generally observed. One of the causal organisms was subsequently identified as *Leptosphaeria avenaria* f. sp. *triticea* (anam.=*Septoria avenae* f. sp. *triticea*), the causal fungus of Septoria avenae spot of wheat. Isolates of the fungus were found to be pathogenic on barley (cultivars Aramir and Birka) as well as on wheat (cultivars Max and Sinton), but none were pathogenic on two oat cultivars (Larry and Orbit) that were tested. This report of *L. avenaria* f. sp. *triticea* as a prevalent pathogen on wheat in New York is also the first record of the fungus in the northeastern United States.

Septoria avenae spot of wheat (*Triticum aestivum* L.), incited by *Leptosphaeria avenaria* Weber f. sp. *triticea* (anam. = *Septoria avenae* Frank f. sp. *triticea*), was first described on durum wheat in Canada in 1947 (3). Since then, it has been reported in the north central and northwestern United States (1,6,7) and in the prairie provinces of Canada (3,5,7). There are no published reports of *L. avenaria* f. sp. *triticea* in the northeastern United States. During a 1984 survey of fields of spring wheat cultivars Max and Sinton in central and western New York, leaf spot symptoms were commonly observed. In most of the fields, plants showed symptoms (Fig. 1) sufficiently similar to those described for tan spot (*Pyrenophora tritici-repentis* (Died.) Drechs.), Septoria nodorum spot (*L. nodorum* Müller), spot blotch (*Cochliobolus sativus* (Ito & Kurib.) Drechs. ex Dastur), and Septoria avenae spot to suggest that any of these might have been involved.

This report describes the occurrence of Septoria avenae spot, caused by *L. avenaria* f. sp. *triticea*, in spring wheat fields in New York as one of the diseases contributing to the leaf spot disease complex on this crop.

MATERIALS AND METHODS

Samples were obtained from spring wheat cultivars Max and Sinton during 1984 in different locations within central and western New York. Leaf spot severity was estimated as percentage of leaf area showing necrosis, according to James (2), modified for use on different sets of leaves. Most symptoms were observed on the four upper leaves at growth stage 69 (anthesis complete) and on the two upper leaves at growth stages 80 (early dough) to 85 (soft dough) according to the scale of Zadoks et al (10). The ratings were taken from four 2-m^2 areas located about 20–25 m from the edge of each field. Samples of 20 plants, collected in a 2-m^2 satellite area located 5 m from each disease rating area, were used for later laboratory identification of leaf-spotting fungi. Organisms were isolated from leaf spots by putting surface-sterilized leaf sections on moist filter paper in petri dishes. Surface-sterilization was done by dipping spotted leaf sections into 95% alcohol for 15 sec, then into a solution of 1% sodium hypochlorite for 15 sec, and finally, rinsing in sterile distilled water. A total of 50 lesions were examined from each wheat field at growth stages 69 and 80–85. Plates were maintained under near-ultraviolet light under a photoperiod of 12 hr at 21 ± 1 C. The presence and prevalence of the necrotrophic organisms were recorded 4–5 days later.

Pure cultures of *L. avenaria* f. sp. *triticea* maintained on V-8 agar (8) and grown for 15 days (isolates Sa1C84, Sa2C84, Sa4C84, Sa8C84, Sa9C84, and Sa12C84) were tested for pathogenicity on Sinton and Max wheat, Aramir and Birka barley, and Orbit and Larry oats.

Five plants of each cultivar were grown in an 11-cm pot of a sterilized soil mix composed of two parts clay loam and one part sand. Four pots of each cultivar were used. At growth stage 31, leaves were sprayed with a conidial suspension of each isolate, containing 10^7 pycnidiospores per milliliter. One drop of Tween 20 was added as a wetting agent to 200 ml of inoculum. Plants were kept in a mist chamber to maintain free water on the foliage at 22 C for 72 hr after inoculation. Disease severity was rated as the percentage of leaf area showing symptoms 10 days after inoculation.

Cultural, morphological, and pathogenic characterization of the isolates were performed according to methods described previously for these organisms (1,3–5,7).

RESULTS

Syndrome. Severity of the fungal leaf spot diseases ranged from 10 to 60%. Overall, the two predominant leaf-spotting fungi were *P. tritici-repentis* (tan spot) and *L. nodorum* (Septoria nodorum spot). However, *L. avenaria* f. sp. *triticea* was the most common organism isolated from leaf spots (41–50% of the lesions) at growth stage 69 in Steuben County, where only the cultivar Max was surveyed. This organism was also associated with a considerable amount of necrosis in Tompkins, Genesee, Onondaga, and Wyoming counties (5–26% of the lesions). The pathogen was not observed in Ontario and Seneca counties.

Naturally diseased plants showed small black, brown or yellowish brown, grayish, or light tan spots on the leaves. Most spots in which *L. avenaria* f. sp. *triticea* fruiting structures developed were oval or lenticular (Fig. 1), usually with a light yellow or gray center, sometimes surrounded by chlorotic tissues and

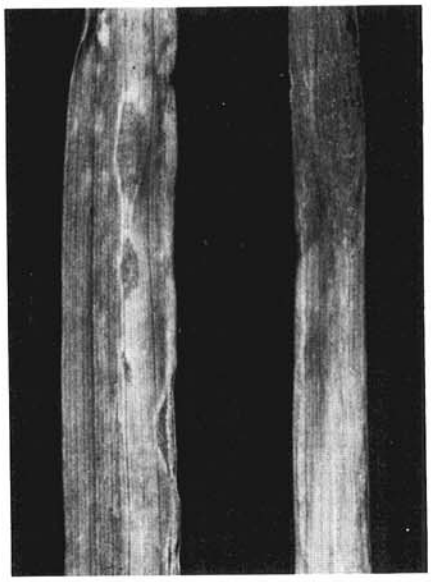

Fig. 1. Septoria avenae spot on leaves of Max spring wheat naturally infected by *Leptosphaeria avenaria* f. sp. *triticea*.

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usually containing large numbers of pycnidia. Coalescing lesions frequently destroyed part of the leaf tissue. Pycnidia were subepidermal or erumpent, light tan to dark brown, globose, and 87–156 μm in diameter.

Cultural characteristics and fungal morphology. Cultural characteristics of *L. avenaria* f. sp. *triticea* are similar to those of *L. nodorum*. The fungus grows well on V-8 agar or CDV-8 agar (8) and sporulation is stimulated if the cultures are kept at 21 ± 1 C under near-ultraviolet light.

Pycnidiospore measurements were (20) 27–38 (41) × (2.5) 2.7–3.6 (4.1) μm (Fig. 2). Most were 3 septate, very few were 2 or 4 septate, and they were hyaline, cylindrical, and straight to slightly curved with rounded or obtuse ends. *L. nodorum* measurements were (12) 16–30 (33) × (1.8) 2.0–2.3 (2.5) μm. Most were 1 septate but varied from 0 to 3 septate.

Cultures of *L. avenaria* f. sp. *triticea* isolates Sa2C84 and Sa4C84 of this study were deposited in the American Type Culture Collection, Rockville, MD, under the ATCC numbers 58582 and 58583, respectively.

Pathogenicity tests. All *L. avenaria* f. sp. *triticea* isolates were pathogenic on wheat and barley. The first symptoms appeared between 72 and 92 hr after inoculation. Both wheat cultivars showed susceptibility to all isolates tested. Between 45 and 80% of leaf areas were necrotic 10 days after inoculation. Symptoms were similar to those observed in the field. Reisolations from leaf spots yielded only the species used as inoculum. The percentage of leaf area showing symptoms on barley cultivars Birka and Aramir ranged from 45 to 75%. None of the *L. avenaria* f. sp. *triticea* isolates were pathogenic on oat cultivars Orbit or Larry.

DISCUSSION

Symptoms observed on wheat in the field and those observed in wheat and barley plants inoculated with all isolates were sufficiently similar to those described for Septoria avenae spot (1,3,7) to indicate that this disease was involved in the leaf spot complex on spring wheat in New York in 1984. Confirmation of pathogen identity was based on the similarity of fungus morphology and cultural characteristics to those described by Johnson (3), Sprague (7), Hosford et al (1), and Richardson and Noble (4). The conidial state of this fungus is distinct from *L. avenaria* f. sp. *avenae* in that it does not infect oats and does not produce micropycnidia and micropycnidiospores. Also, the conidial state of *L. avenaria* f. sp. *triticea* is frequently misidentified as the conidial state of *L. nodorum* (9). In fact, pycnidiospore measurements of both organisms overlap, but the region of overlap is small. *L. avenaria* f. sp. *triticea* pycnidiospores can be distinguished from those of *L. nodorum* not only by their greater width and length but also by a more regularly cylindrical appearance.

The occurrence of *L. avenaria* f. sp. *triticea* has not been documented previously in the northeastern United States. Therefore, the confirmation of this fungus as a prevalent foliar pathogen of spring wheat in central and western New York in 1984 is significant. The contribution of this fungus to leaf spot complexes that limit the yield of wheat and barley in the northeastern United States warrants further investigation.

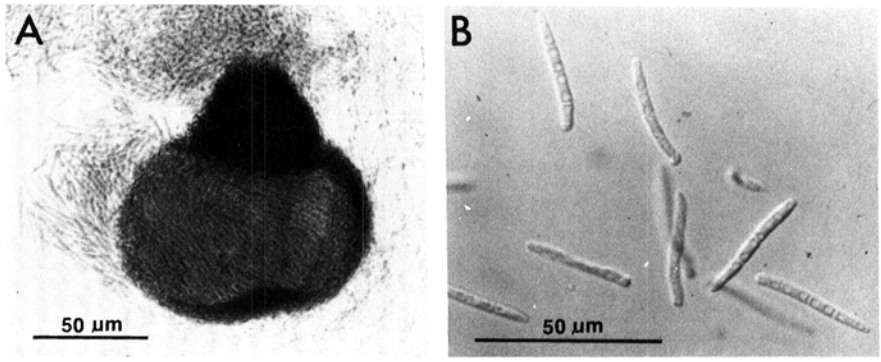

Fig. 2. Typical **(A)** pycnidium and **(B)** pycnidiospores of *Leptosphaeria avenaria* f. sp. *triticea*. B shown with Nomarski optics.

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