Rhizoctonia cerealis Causes Yellow Patch of Turfgrasses

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ABSTRACT

BURPEE, L. 1980. *Rhizoctonia cerealis* causes yellow patch of turfgrasses. Plant Disease 64: 1114-1116.

Isolates of a binucleate *Rhizoctonia* sp. that cause chlorosis and blight of turfgrasses fit the species concept of *Rhizoctonia cerealis*. Mycelial and sclerotial characteristics, temperature-growth relations, and hyphal anastomosis of 10 of these binucleate *Rhizoctonia* isolates, which had previously been assigned to anastomosis group CAG 1, were compared with the characteristics of three isolates of *R. cerealis* from small grains. The 10 unidentified isolates and the isolates of *R. cerealis* exhibited similar cultural morphology and were assigned to the common anastomosis group CAG 1. Radial growth rates on potato-dextrose agar were 3.3–5.0 mm/day at 23 C. Based on these criteria, isolates of *R. cerealis* are assumed to be the cause of chlorosis and blight of turfgrasses, and the descriptive name "yellow patch" is proposed for the disease caused by *R. cerealis* on turfgrass species.

Isolates of a *Rhizoctonia* sp. that have binucleate hyphal cells cause foliar chlorosis and blight of at least five turfgrass species (3,5,14). Affected turf develops chlorotic patches or rings ranging from a few centimeters to a meter in diameter (Fig. 1). A "frog-eye" pattern similar to that associated with Fusarium blight may develop (5). In contrast to brown patch caused by *R. solani* Kühn, turfgrasses infected with isolates of the binucleate *Rhizoctonia* sp. usually remain chlorotic for several weeks but fail to become necrotic. At atmospheric temperatures of $<$ 10 C or $>$ 25 C, chlorotic patches or rings often "recover" due to growth of symptomless foliage. If rainfall and temperatures between 10 and 20 C are prolonged, turfgrass infected with isolates of the binucleate *Rhizoctonia* sp. may develop foliar necrosis. However, the dark "smoke ring" pattern, often observed at the margins of brown patches caused by *R. solani* (4,19), is absent from blighted patches of turfgrass infested with the binucleate *Rhizoctonia* sp.

In the temperate zone, symptoms occur in the spring and autumn (5,14). In Bermuda, isolates of the binucleate *Rhizoctonia* sp. were collected from chlorotic Bermudagrass in February. Symptoms diminished as seasonal temperatures increased.

Burpee et al (3) examined pathogenicity of 10 turfgrass isolates of this binucleate *Rhizoctonia* sp. on eight plant species representing six families. The isolates were weakly virulent or not pathogenic on all nongramineous hosts tested. These isolates exhibited a high degree of morphologic homogeneity in culture and were assigned to a common anastomosis group, designated CAG 1 (2). Isolates in this group did not fuse with anastomosis tester isolates of *R. solani* representing four anastomosis groups (9).

To my knowledge, a teleomorph of the binucleate *Rhizoctonia* sp. associated with gramineous hosts has not been identified. However, this fungus has frequently been designated a *Ceratobasidium* sp. solely on the basis of asexual characteristics (5,15). This is technically incorrect (6), but a diagnosis of the anamorph (*R. cerealis* van der Hoeven recently appeared in the literature (1).

According to van der Hoeven (1), isolates of *R. cerealis* exhibit hyphal characteristics similar to *R. solani* (10) except that they have predominantly binucleate hyphal cells. Hyphal widths of *R. cerealis* isolates ranged from 2.8 to 8.7 μm. Colonies on potato-dextrose agar (PDA) appeared white to buff in color.

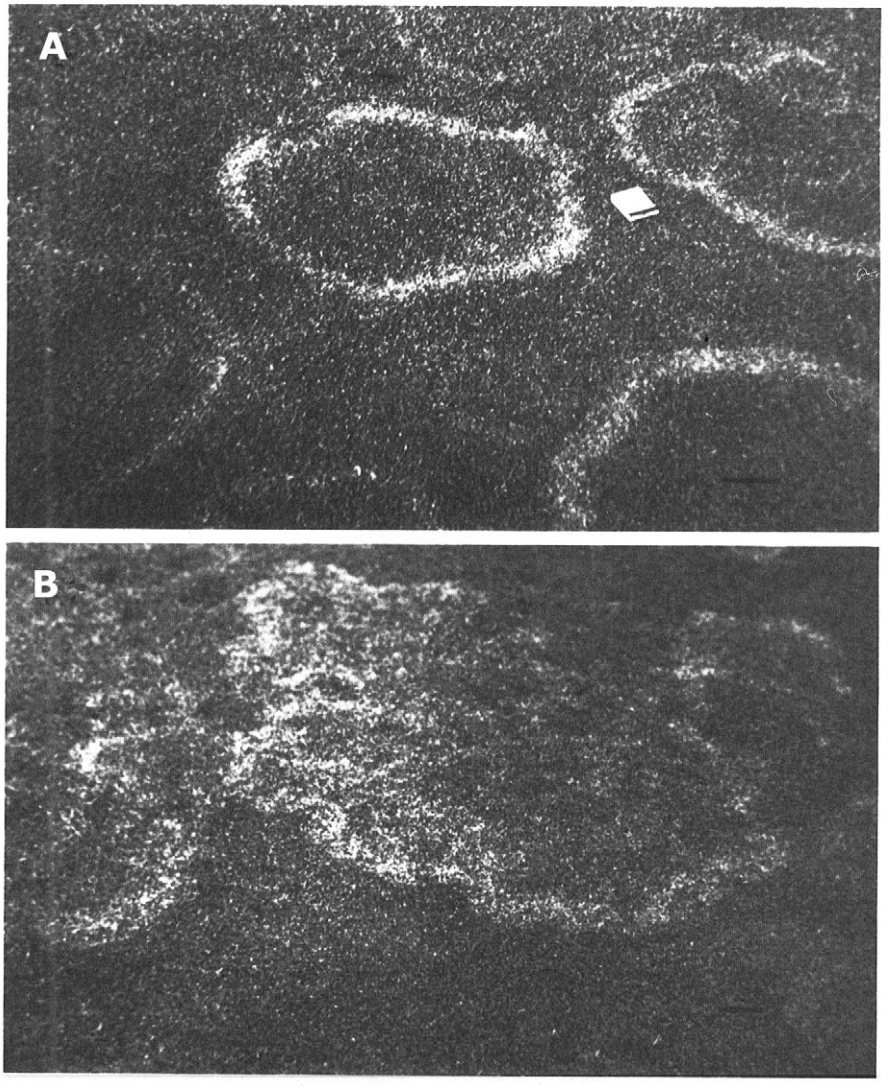

Fig. 1. Creeping bentgrass infected with a binucleate *Rhizoctonia* sp. (*R. cerealis*): **(A)** Chlorotic ring pattern. **(B)** Chlorotic patch pattern. (Bars represent 10 cm.)

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Monilioid cell dimensions were 17–30 × 7–15 μm. Sclerotia, formed by the aggregation of monilioid cells, were white to yellow to dark brown and 0.3–1.2 mm in diameter. Sclerotial aggregates were often formed in culture after several weeks. Radial growth on PDA at 23 C in the dark ranged from 4.8 to 7 mm/day.

Results of this study prove that isolates of the binucleate *Rhizoctonia* sp. associated with chlorosis and blight of turfgrasses fit the species concept of *R. cerealis*.

MATERIALS AND METHODS

Cultural characteristics. Mycelial plugs (8 mm in diameter) of 10 isolates of a binucleate *Rhizoctonia* sp. collected from various turfgrass hosts and geographic regions and three isolates of *R. cerealis* from small grains (Table 1) were transferred to 15 ml of PDA in 100 ×15 mm plastic petri dishes. Comparisons in cultural morphology were made after 8-wk incubation at 23 C in the absence of light. Sclerotial production was further evaluated on malt extract agar (11), nitrate dextrose agar (18), Czapek-Dox agar (Baltimore Biological Laboratories, Baltimore, MD), and wheat shoot agar. The latter was prepared by sterilizing oven-dried (105 C for 24 hr) sections of 3-wk-old wheat shoots and leaves (about 10 mm long) in an atmosphere saturated with propylene oxide vapor and adding 10–15 sections to 15 ml of 2% water agar in plastic petri dishes.

Temperature-growth relations. The influence of temperature on radial mycelial growth was assessed by transferring 8-mm mycelial plugs to PDA plates and incubating at 2 C increments from 2 to 34 C. Cardinal temperatures for growth were then determined by incubating isolates at 1 C intervals over the ranges that appeared to bracket mean and extreme temperatures. Each treatment was replicated three times.

Hyphal anastomosis. Methods used in the determination of hyphal anastomosis were those previously reported (2). Isolates were paired with seven CAG tester isolates of binucleate *Rhizoctonia* sp. (2) and with five AG tester isolates of *R. solani* (8,9). Microscopic observations were made at 100× and 400× on two replicates of each pairing. Isolates were considered to be in the same anastomosis group if hyphal contact with cytoplasmic fusion (9) was observed.

RESULTS

Cultural characteristics. All 10 isolates formed white or buff-colored mycelium on PDA during the first 3 wk of growth. Hyphal pigmentation increased with time, resulting in buff or light brown mycelium after 8 wk of growth (Table 2). Diameters of runner hyphae ranged from a minimum of 3.8 μm for each isolate, except Bn 129, to a maximum of 7.6 μm for Bn 130. Eleven isolates produced

Table 1. Isolates of *Rhizoctonia* in this study

Accession	Species	Host	Geographic origin	Source or reference
Bn 1	Unknown	*Agrostis palustris* Huds.	Pennsylvania	Burpee et al (3)
Bn 20	Unknown	*Festuca arundinacea* Shreb.	Pennsylvania	Burpee et al (3)
Bn 21	Unknown	*A. palustris* Huds.	Maryland	Burpee et al (3)
Bn 79	Unknown	*Poa pratensis* L.	Washington, DC	Burpee et al (3)
Bn 97	Unknown	*A. palustris* Huds.	Pennsylvania	Burpee et al (3)
Bn 99	Unknown	*P. pratensis* L.	Pennsylvania	Burpee et al (3)
#52	*R. cerealis*	*Triticum aestivum* L.	England	Martin, S. I., Dept. of Agric., Scotland
#29	*R. cerealis*	*Avena sativa* L.	Scotland	Martin, S. I., Dept. of Agric., Scotland
Bn 129	Unknown	*P. pratensis* L.	Pennsylvania	Burpee
Bn 130	Unknown	*P. pratensis* L.	Pennsylvania	Burpee
CBS 236.77	*R. cerealis*	*Secalis cerealis* L.	Netherlands	Boerma and verHoeven (1)
Bn 139	Unknown	*Zoysia japonica* Steud.	Arkansas	Dale (5)
Bn 147	Unknown	*Cynodon dactylon* (L.) Pers.	Bermuda	Burpee

Table 2. Morphology of isolates of *Rhizoctonia cerealis* from small grains and of isolates of a binucleate *Rhizoctonia* sp. from turfgrasses[a]

Accession	Diameter of runner hyphae (μm)	Mycelial color	Sclerotial size (mm)	Sclerotial color	Monilioid cell size (μm)
Bn 1	3.8–6.5	white to buff	< 0.5–3.0	white to brown	15–27 × 8–12
Bn 20	3.8–4.6	white to buff	< 0.5–3.0	white to brown	17–23 × 7–9
Bn 21	3.8–4.9	white to buff	< 0.5–3.0	white to brown	19–23 × 8–11
Bn 79	3.8–4.6	white to buff	< 0.5–2.0	white to brown	19–34 × 10–12
Bn 97	3.8–4.9	white to light brown	< 0.5–2.0	white to brown	15–30 × 8–11
Bn 99	3.8–6.5	white	< 0.5–3.0	white to brown	19–30 × 9–11
#52[b]	3.8–4.6	white to light brown	< 0.5–3.0	white to brown	15–30 × 8–11
#29[b]	3.8–4.6	white to light brown	< 0.5–2.0	white to brown	15–30 × 8–11
Bn 129	4.2–6.5	white to buff	< 0.5–3.0	white to brown	19–25 × 7–11
Bn 130	3.8–7.6	white to buff	...[c]	...	19–34 × 8–11
CBS 236.77[b]	3.8–5.7	white to buff	< 0.5–2.0	white to brown	15–27 × 8–11
Bn 139	3.8–4.9	white to buff	...	...	15–27 × 8–11
Bn 147	3.8–4.9	white to buff	< 0.5–3.0	white to brown	19–30 × 9–11

[a] Cultures incubated on potato-dextrose agar for 8 wk at 23 C in the absence of light.
[b] Isolate of *R. cerealis*.
[c] Sclerotia absent.

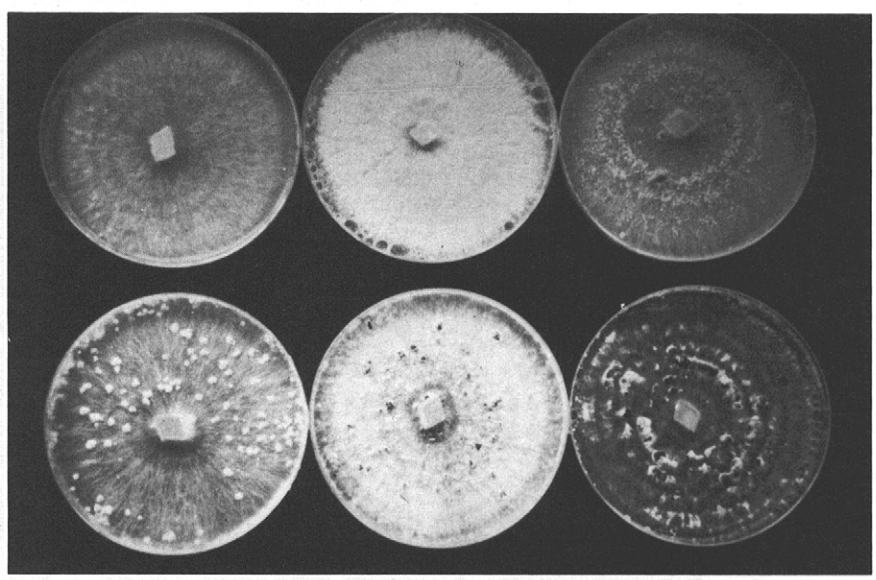

Fig. 2. Isolates of a binucleate *Rhizoctonia* sp. (*R. cerealis*) collected from turfgrass species and cultured on potato-dextrose agar 8 wk at 23 C in the absence of light.

Table 3. Cardinal temperatures and radial growth rates at optimum temperature on potato-dextrose agar for isolates of *Rhizoctonia cerealis* and isolates of a binucleate *Rhizoctonia* sp. from turfgrasses

Accession	Cardinal temperatures (C)[a]	Radial growth rate at 23 C (mm/d)[a]
Bn 1	2:23:28	4.5
Bn 20	2:23:28	3.3
Bn 21	2:23:28	3.4
Bn 79	2:23:28	4.3
Bn 97	4:23:28	5.0
Bn 99	4:23:28	3.4
#52[b]	2:23:30	4.3
#29[b]	2:23:28	4.2
Bn 129	2:23:30	4.7
Bn 130	2:23:28	4.7
CBS 236.77[b]	2:23:28	4.5
Bn 139	6:23:30	5.0
Bn 147	4:23:28	4.3

[a] Based on three replicates per isolate. Colonies measured after 96 hr of growth.
[b] Isolate of *R. cerealis*.

sclerotia ranging from 0.5 to 3.0 mm in diameter. Sclerotial color ranged from white or buff to dark brown. Monilioid cells in the range of 15–34 × 7–12 μm were produced by each isolate. Cultural variation on PDA is depicted in Fig. 2.

Variability in sclerotial production as influenced by media was observed among the isolates. Six isolates (Bn 20, Bn 21, Bn 99, Bn 147, #52, CBS 236.77) formed sclerotia on each medium tested, but none of the media served as an inclusive substrate for sclerotial production for all isolates.

Temperature-growth relations. The optimum temperature for growth on PDA was 23 C for each isolate (Table 3). Minimum and maximum temperature ranges were 2–6 C and 28–30 C, respectively. Radial growth rates on PDA at 23 C ranged from 3.3 to 5.0 mm/day.

Hyphal anastomosis. Vegetative hyphae of all isolates fused with the CAG 1 tester isolate (Bn 1) of *R. cerealis* but failed to fuse with hyphae of other CAG testers or with AG testers of *R. solani*.

DISCUSSION

The results of this study indicate that the binucleate *Rhizoctonia* turfgrass pathogens identified by Sanders et al (14), Dale (5), and Burpee et al (3) represent a single taxonomic species, *R. cerealis*. Radial growth rates and mycelial and sclerotial morphometrics presented by van der Hoeven (1) for *R. cerealis* parallel those of the binucleate turfgrass pathogens except that two isolates failed to form sclerotia on PDA. As a result of substrate-dependent variation, however, sclerotial production appears to be of limited taxonomic value. Parmeter and Whitney (10) reported that isolates of *R. solani* exhibited similar variability, and therefore the ability to form sclerotia is not a primary consideration in the species concept.

Isolates of *R. cerealis* are distinguished from those of *R. solani* by forming vegetative hyphae with predominantly binucleate hyphal cells. Characterististics such as hyphal diameter, mycelial color, and monilioid cell size differentiate isolates of *R. cerealis* from those of other binucleate *Rhizoctonia* spp. (7,13,17). Host specificity and anastomosis reaction may also be of taxonomic value. Results of this study and previous investigations (2,3) demonstrated that the isolates of *R. cerealis* studied were host-specific on members of the Graminae and that they comprised a common anastomosis group (CAG 1) distinct from those of *R. solani* (8,9) and other *Rhizoctonia* spp. (2). Recent studies (12,16) revealed that isolates of *R. cerealis* cause root decay and sharp eye spot of wheat.

This is the first report associating *R. cerealis* with the turf disease described by Sanders et al (14), Dale (5), and Burpee at al (3). This disease was previously denoted as cool-weather brown patch (14). However, isolates of *R. cerealis* seldom cause brown patch on turf (5) and the term "cool-weather" is nonspecific and therefore confusing. In this light, the descriptive name "yellow patch" is proposed for this disease.

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