Typhula-like Snow Mold on Wheat in Oklahoma

KENNETH E. CONWAY and ERVIN WILLIAMS, JR., Associate Professors, Department of Plant Pathology, Oklahoma State University, Stillwater 74078

ABSTRACT

Conway, K. E., and Williams, E., Jr. 1986. *Typhula*-like snow mold on wheat in Oklahoma. Plant Disease 70:169-170.

Snow mold of wheat caused by a sclerotia-forming basdiomyceteous fungus similar to *Typhula* spp. occurred during the winter of 1978–1979 as a result of a prolonged covering of snow in a field near Guthrie, OK. Sclerotia of this fungus occurred on 90–95% of cultivar Osage wheat plants in one 4-ha north-sloping field. Sclerotia were also present in an adjoining 16-ha field planted with cultivar Centurk wheat. Infestation was limited to these two fields. Differences in cultural characteristics and morphology were found between the Oklahoma isolate and isolates of *Typhula incarnata, T. idahoensis*, and *T. ishikariensis*. However, similarities did exist to indicate that this fungus has affinities with *Typhula* spp.

Snow mold caused by *Typhula* spp. occurs primarily in the northern latitudes (1,4,7,9). Much research has been done to elucidate the pathology, taxonomy, and genetic relationships of species in this genus (1–3,5,7). In addition to reports from the Pacific Northwest region of the United States, reports from Japan (5) indicate economic losses of winter cereals and forage crops caused by snow mold. *Typhula* spp. have also been reported from Germany on barley (7), from the north central and northeastern United States (9) on turfgrass, and from Canada on petioles of *Acer* sp. (4). The occurrence of *Typhula* spp. is usually associated with prolonged periods of snow cover lasting into late spring (1,5,7).

Snow cover in the north central counties of Oklahoma was unusually long (more than 40 days) during the spring of 1979, especially on north-sloping fields. In March, a sample of dying wheat was sent to our Plant Disease Diagnostic Laboratory from Logan County near Guthrie, OK. Additional samples were collected from this field and observations were made in adjacent fields. The purpose of this report is to describe the disease from wheat in Oklahoma and compare this isolate with species of *Typhula*. This is the first report of a *Typhula*-like fungus causing snow mold in Oklahoma.

MATERIALS AND METHODS

The first sample of wheat infected with this *Typhula*-like fungus (OKLA-1) was the cultivar Osage (CI 17292). Adjacent fields planted with the cultivars Centurk (CI 15075) and Payne (CI 17717) were surveyed for the presence of small orange to black sclerotia in the basal leaf sheaths of living and dead plants. Cultures of the fungus were obtained from surface-sterilized sclerotia and maintained on slants of potato-dextrose agar (PDA) at 5 C.

Cultures of *Typhula incarnata* Lasch. ex Fr., *T. idahoensis* Remsberg, and *T. ishikariensis* Imai were obtained from either the Department of Plant Pathology, University of Minnesota, St. Paul, or from G. W. Bruehl, Department of Plant Pathology, Washington State University, Pullman, for comparison with our OKLA-1 isolate. Rind patterns of sclerotia were examined according to the methods of Bruehl and Cunfer (1), and isolates were paired on a medium developed by McLaughlin and McLaughlin (6) or on malt-extract agar (MEA). Nuclear condition and hyphal characteristics were examined with fluorescence microscopy and an acidified aniline blue stain (10).

Diameters of 20 sclerotia from each isolate grown on PDA at 5 C were measured for comparison using a ×7 Bausch & Lomb measuring magnifier. Induction of basidiocarps was attempted with the soil-over-culture technique (11), long-term storage of cultures at 5 C in both light and darkness, and techniques reported by Bruehl et al (3). Pathogenicity of isolates was determined on wheat cultivars Sage (CI 17277) and Osage by adding one sclerotium per plant to the soil near the bases of 50 seedlings grown in pots placed outside during the winter of 1980. Sclerotia were also placed near germinating seeds with a technique similar to that of Singleton and Ziv (8). Seedlings were maintained in an

Journal Series No. J-4605, Oklahoma Agricultural Experiment Station, Oklahoma State University, Stillwater.

Accepted for publication 28 August 1985 (submitted for electronic processing).

The publication costs of this article were defrayed in part by page charge payment. This article must therefore be hereby marked "*advertisement*" in accordance with 18 U.S.C. § 1734 solely to indicate this fact.

incubator at 5 C with 8 hr of light for 6–8 wk.

T. incarnata, T. idahoensis, and OKLA-1 were grown on MEA for 3 wk at 5, 13, and 20 C, and measurements of radial growth were taken at weekly intervals. A survey of the original field was conducted during February 1985 to determine the presence of diseased plants and to discuss incidence of the disease with the landowner.

RESULTS AND DISCUSSION

During 1979, incidence of sclerotia of this fungus in Osage wheat was 90–95% with about 10% plant mortality within a 4-ha field. Incidence of sclerotia in a 16-ha field of Centurk wheat was about 1% with no plant mortality. No sclerotia were found in Payne wheat in a nonadjacent field. This did not imply that the cultivars Centurk and Payne are resistant but rather that the infestation of this *Typhula*-like fungus was limited to a small area. Observations of incidence and damage on the two cultivars of wheat (Osage and Centurk) indicate that this fungus was a weak pathogen. The field planted with Osage wheat had the longest period of snow cover (1–2 wk longer than adjacent fields) because of its northern slope. Although subsequent winters have been colder, none have had as prolonged a period of snow cover as occurred during spring 1979. Roots of all cultivars were also infected with *Pythium arrhenomanes* and/or *Polymyxa graminis*, the vector of soilborne wheat mosaic virus. No diseased plants were observed during our survey in spring 1985, and the landowner indicated that he had not observed the damage on wheat in this field since 1979.

Sclerotial rind patterns of OKLA-1 were similar to that of *T. ishikariensis* (parenchymatous) (1). Sclerotial measurements and black coloration were the same for OKLA-1, *T. idahoensis*, and *T. ishikariensis* (0.7 ± 0.2 mm). Sclerotia of *T. incarnata* were larger (1.2 ± 0.3 mm) and were orange-brown. Bruehl and Machtmes (2) separated *T. ishikariensis* from *T. idahoensis* by several characteristics. They stated that *T. ishikariensis* produced sphaerical sclerotia superficially on wheat leaves, whereas sclerotia of *T. idahoensis* were subsphaerical and subepidermal. Sclerotia of OKLA-1 were subepidermal and appeared flatter than either *T. ishikariensis* or *T. idahoensis*.

Hyphae of the OKLA-1 isolate had dolipore septa in the cross walls, a mixture of dikaryotic and monokaryotic cells, and only a few clamp connections limited to the older aerial hyphae produced in culture. Hyphae of *T. incarnata* and *T. ishikariensis* were dikaryotic and possessed abundant clamp connections. Microscopically, hyphae of OKLA-1 were most similar to *T. ishikariensis* in appearance and width. Mycelia of OKLA-1 overgrew and delimited the growth of the *T. ishikariensis* colony in dual culture. OKLA-1 grew as fast as *T. incarnata*, and a pigment barrier was produced in the agar between the colonies. Hyphae of OKLA-1 eventually overgrew and produced typical sclerotia of OKLA-1 on the *T. incarnata* isolate. Di-mon pairings of OKLA-1 with monokaryotic tester cultures of *T. idahoensis* produced no nuclear migration or clamp connections in the mycelium of *T. idahoensis*. No basidiocarps were produced by OKLA-1 with several techniques, including incubation on sand contained in clay pots placed out-of-doors during the winter months. Only *T. incarnata* produced abundant fruiting bodies with this technique.

All three isolates of *Typhula* and OKLA-1 were nonpathogenic when inoculated onto plants and germinated seeds of Sage or Osage wheat with our techniques.

Radial growth 3 wk after inoculation on MEA at 5, 13, and 20 C was 19.0, 11.5, and 0 mm for *T. idahoensis*; 25.5, 24.5, and 0 mm for *T. incarnata*; and 18.5, 29.0, and 29.0 mm for OKLA-1, respectively. OKLA-1 grew as well as the *Typhula* spp. at the lower temperatures and was the only isolate capable of growth at 20 C.

OKLA-1 isolate is unique, possessing characteristics of at least three other species of *Typhula*. Sclerotia of OKLA-1 are similar in size and color to *T. ishikariensis* and *T. idahoensis*. Sclerotia form subepidermally, similar to *T. idahoensis*, but appear flatter. Hyphal characteristics of OKLA-1 were most similar to *T. ishikariensis*. Cultures of OKLA-1 grew as fast as *T. incarnata* and *T. idahoensis* but had smaller and darker sclerotia than *T. incarnata*. OKLA-1 grew over a greater temperature range than either *T. incarnata* or *T. idahoensis*.

Placement of OKLA-1 into the genus *Typhula* is dependent on induction of fruiting bodies, which are difficult to produce even in the *Typhula* spp. used in this study. In addition, speciation of *Typhula* spp. is difficult and disagreement as to species delimitations is common. Until the taxonomy of the genus *Typhula* is better defined and our isolate is induced to produce a sexual state, we feel it would serve no purpose to place our isolate into the genus *Typhula*. However, we do feel that OKLA-1 has close affinities to *Typhula* spp. OKLA-1 was deposited with the American Type Culture Collection, Rockville, MD, to be available for researchers as ATCC 56912.

LITERATURE CITED

1. Bruehl, G. W., and Cunfer, B. M. 1975. *Typhula* species pathogenic to wheat in the Pacific Northwest. Phytopathology 65:755-760.
2. Bruehl, G. W., and Machtmes, R. 1980. Cultural variation within *Typhula idahoensis* and *T. ishikariensis* and the species concept. Phytopathology 70:867-871.
3. Bruehl, G. W., Machtmes, R., and Kiyomoto, R. 1975. Taxonomic relationships among *Typhula* species as revealed by mating experiments. Phytopathology 65:1108-1114.
4. Koske, R. E. 1974. *Typhula erythropus*: Field history, germination of basidiospores, mycelial growth and sclerotial formation. Mycologia 66:298-318.
5. Matsumoto, N., and Sato, T. 1982. The competitive saprophytic abilities of *Typhula incarnata* and *T. ishikariensis*. Ann. Phytopathol. Soc. Jpn. 48:419-424.
6. McLaughlin, D. L., and McLaughlin, E. G. 1972. Pure culture studies of fruiting and sporulation in a clavarioid fungus, *Pterula* sp. Mycologia 64:599-608.
7. Remsburg, R. E. 1940. Studies in the genus *Typhula*. Mycologia 32:52-96.
8. Singleton, L. L., and Ziv, O. 1981. Effects of *Pythium arrhenomanes* infection and root-tip amputation on wheat seedling development. Phytopathology 71:316-319.
9. Smiley, R. W. 1983. Typhula blight. Pages 34-36 in: Compendium of Turfgrass Diseases. R. W. Smiley, ed. American Phytopathological Society, St. Paul, MN.
10. Tu, C. C., and Kimbrough, J. W. 1973. A rapid staining technique for *Rhizoctonia solani* and related fungi. Mycologia 55:941-944.
11. Tu, C. C., and Kimbrough, J. W. 1975. A modified soil-over-culture method for inducing basidia in *Thanatephorus cucumeris*. Phytopathology 65:730-731.