Taxonomy and Nomenclature of *Septoria* and *Stagonospora* Species on Small Grain Cereals

The taxonomy and nomenclature of *Septoria* and *Stagonospora* fungi on small grain cereals were revised by several workers during the past 29 years (2,5,9,12,17). However, the most recent nomenclature is not used by all researchers working with these fungi. Therefore, a resolution was passed by the participants of the Fourth International Workshop on *Septoria* of Cereals (1) to accept the most recent taxonomy and nomenclature for these fungi and to urge plant scientists to use the proper nomenclature in research and other types of publications. The following discussion summarizes the current status of this group of pathogens. The recommended nomenclature is presented.

Several fungi on cereals fit the original description of *Septoria* fungi (8 [cited by Sprague, 20]). The most economically important of this group is *Septoria tritici* on *Triticum* spp., cause of Septoria tritici blotch. Sprague (18–20) considered three fungi to be forms of *Septoria tritici* based primarily on host range and conidial morphology. These are *S. tritici* f. *avenae* on oats, *S. tritici* f. *holci* on *Holcus* spp., and *S. tritici* var. *lolicola* on *Lolium* spp. Two other species that are usually minor pathogens of cereals also belong in *Septoria*: *S. passerinii*, which causes speckled leaf blotch of barley, and *S. secalis*, which causes a leafspot on rye (19–20).

Mycosphaerella graminicola is the teleomorph of *S. tritici* on wheat (13–15). Teleomorphic stages of the other three forms of *S. tritici*, *S. passerinii*, and *S. secalis* have not been found.

The taxonomy of several other species placed in *Septoria* has undergone considerable revision. Several important pathogens of cereals originally placed in *Septoria* belong in the genus *Stagonospora*. The primary criterion that separates the two genera is that conidia of *Septoria* species are more than 10 times as long as wide, and *Stagonospora* species have conidia less than 10 times as long as wide (20). The teleomorphic stages of each genus are also distinctly different.

Stagonospora nodorum is recognized as the correct designation in place of *Septoria nodorum*, which causes Septoria nodorum blotch or leaf and glume blotch of wheat (3–5,7,12,17). Bissett (2) transferred *Septoria avenae*, cause of speckled blotch of oats, to *Stagonospora*. The status of *Stagonospora avenae* and *S. avenae* f. sp. *triticea* needs consideration. The current separation is based on host range and mor-

phology. Mycologists have differed in recent years about the proper designation of these fungi. Boerema et al. (4) assigned *Stagonospora avenae* to refer to the form that infects only oats. This form produces spermatia-like microconidia. *Stagonospora avenae* f. sp. *triticea* refers to the form that infects barley and wheat. This form does not produce microconidia. Farr et al. (7) recognized the division of the species into two forms used by Eriksson (6) based on host range. Leuchtmann (12) and Shoemaker and Babcock (17) combined both forms under *Stagonospora avenae* but recognized that some workers may wish to indicate the form on wheat and barley as f. sp. *triticea*. Ueng and Chen (21) found that isolates designated *Stagonospora avenae* and *S. avenae* f. sp. *triticea* were not separated consistently by restriction fragment length polymorphism (RFLP) analysis. Johnston and Scott (10) reported that some isolates of *Stagonospora avenae* from oats are pathogenic to wheat and barley. These results argue against the use of host range as a criterion to subdivide *Stagonospora avenae*. Additional genetic studies are needed to resolve these differences.

The teleomorphs of cereal pathogens in the genus *Stagonospora* were formerly placed in the genus *Leptosphaeria*. Eriksson (6) and Hedjaroude (9) transferred *Leptosphaeria nodorum* and *L. avenaria* (anamorph *Stagonospora avenae*) to *Phaeosphaeria*. Several subsequent taxonomic studies recognize *P. nodorum* and *P. avenaria* as the teleomorphs of species of *Stagonospora* (12,16,17). Two important publications on fungal nomenclature also recognize *Phaeosphaeria* (4,7). Characteristics of *Phaeosphaeria* in the key of Shoemaker and Babcock (17) are that the genus occurs on monocots, asci are bitunicate, ascospores are fusoid with the first septum median and slightly constricted, and the cell above the first septum is enlarged toward the base. Shoemaker and Babcock (17) subdivide the genus *Phaeosphaeria* into six subgenera. They assign *P. nodorum* and *P. avenaria* to the subgenus *Phaeosphaeria*. The characteristics of this taxon are fusoid ascospores with three septa, and the enlarged cell above the first septum is isodiametric or short. The genus *Leptosphaeria* differs in that it has the first septum near the middle of the spore, and the septum is often slightly constricted (16). The widest cell is usually above the first septum but is not markedly different from the cell below. Recently, Khashno-

bish and Shearer (11) compared species of *Leptosphaeria* and *Phaeosphaeria*, including *P. nodorum*, by cladistic analyses using both morphological and molecular data. They concluded that separation of the genera is valid, but that interpretation of the subgenera of *Phaeosphaeria* based solely on ascospore morphology is not. Characteristics that separate the genera are shape of the ascoma, position of the ascoma in the substrate, and cell types in the peridium. Shoemaker and Babcock (17) recognize *Stagonospora nodorum* as the anamorph of *P. nodorum* and *S. avenae* as the anamorph of *P. avenaria*.

The following nomenclature and synonymy for *Septoria* and *Stagonospora* fungi on small grain cereals follows Farr et al. (7).

Mycosphaerella graminicola (Fuckel) J. Schröt. in Cohn
anamorph *Septoria tritici* Roberge in Desmaz.

Forms and species with no known teleomorph:

Septoria tritici Roberge in Desmaz. f. *avenae*

Septoria tritici Roberge in Desmaz. f. *holci*

Septoria tritici Roberge in Desmaz. var. *lolicola* R. Sprague & Alb.G. Johnson

Septoria passerinii Sacc.

Septoria secalis Prill. & Delacr.

Phaeosphaeria nodorum (E. Müll.) Hedjar. syn. *Leptosphaeria nodorum* E. Müll.

anamorph *Stagonospora nodorum* (Berk.) E. Castell. & Germano

syn. *Septoria nodorum* (Berk.) Berk. in Berk. & Broome

Phaeosphaeria avenaria (G.F. Weber) O.E. Erikss.

syn. *Leptosphaeria avenaria* G.F. Weber
anamorph *Stagonospora avenae* (A.B. Frank) Bissett

Stagonospora avenae (A.B. Frank) Bissett f. sp. *avenaria* (this name recognized by Boerema et al. [4])

syn. *Septoria avenae* A.B. Frank
Phaeosphaeria avenaria (G.F. Weber) O.E. Erikss. f. sp. *triticea*

syn. *Leptosphaeria avenaria* G.F. Weber f. sp. *triticea*

anamorph *Stagonospora avenae* (A.B. Frank) Bissett f. sp. *triticea*

syn. *Septoria avenae* A.B. Frank f. sp. *triticea*

The issue of common names for the diseases was debated at the Fourth International Workshop and deserves some dis-

cussion here. In 1983 at the Second International Workshop, it was decided to use the full Latin name of the anamorph plus the word blotch to form the common name. This was primarily intended to distinguish the common names used for the diseases caused by *Stagonospora nodorum* and *Septoria tritici*. With the revised nomenclature, *Septoria nodorum* blotch would now become *Stagonospora nodorum* blotch. Frequent name changes cause confusion to researchers and growers alike. A better system is clearly needed, but it was decided not to alter the current system for common names until the Fifth International Workshop in 1999. A system that avoids use of Latin names in the common name will avoid problems caused by any future changes in taxonomy or nomenclature.

LITERATURE CITED

- Arseniuk, E., Góral, T., and Czembor, P., eds. 1994. Proc. Int. Workshop Septoria Cereals. Plant Breeding and Acclimatization Institute, Radzików, Poland.
- Bissett, J. 1982. *Stagonospora avenae*. Fungi Canadenses No. 239. National Mycological Herbarium, Biosystematics Research Institute Agriculture Canada, Ottawa.
- Bissett, J. 1982. *Stagonospora nodorum*. Fungi Canadenses No. 240. National Mycological Herbarium, Biosystematics Research Institute Agriculture Canada, Ottawa.
- Boerema, G. H., Pieters, R., and Hamers, M. E. C. 1992. Check-list for scientific names of common parasitic fungi. Suppl. Ser. 2b (additions and corrections): Fungi on field crops: Cereals and grasses. Neth. J. Plant Pathol. 98 Suppl. 1:1-32.
- Castellani, E., and Germano, G. 1977. Le Stagonosporae graminicole. Ann. Fac. Sci. Agric. Univ. Torino 10:1-132.
- Eriksson, O. 1967. On graminicolous Pyrenomyces from Fennoscandia. 2. Phragmosporus and scolecosporus species. Ark. Bot. Ser. 2, 6:381-440.
- Farr, D. F., Bills, G. F., Chamuris, G. P., and Rossman, A. Y. 1989. Fungi on Plants and Plant Products in the United States. American Phytopathological Society, St. Paul, MN.
- Fries, E. 1829. Systema Mycologicum. Vol. 3. Lund, Sweden.
- Hedjaroude, G. A. 1968. Etudes taxonomiques sur les *Phaeosphaeria* Miyake et leurs formes voisines (Ascomycetes). Sydowia 22:57-107.
- Johnston, H. W., and Scott, P. R. 1988. Identification of oat-adapted isolates of cereal *Septoria* in the UK using a detached leaf technique. Plant Pathol. 37:148-151.
- Khashnobish, A., and Shearer, C. A. 1996. Phylogenetic relationships in some *Leptosphaeria* and *Phaeosphaeria* species. Mycol. Res. 100:1355-1363.
- Leuchtmann, A. 1984. Über *Phaeosphaeria* Miyake und andere bitunicate Ascomyceten mit mehrfach quersseptierten Ascosporen. Sydowia 37:75-194.
- Sanderson, F. R. 1972. A *Mycosphaerella* species as the ascogenous state of *Septoria tritici* Rob. and Desm. N.Z. J. Bot. 10:707-710.
- Sanderson, F. R. 1976. *Mycosphaerella graminicola* (Fuckel) Sanderson comb. nov., the ascogenous state of *Septoria tritici* Rob. apud Desm. N.Z. J. Bot. 14:359-360.
- Sanderson, F. R. 1977. Synonymy of *Sphaerella graminicola*: A correction. N.Z. J. Bot. 15:779.
- Shoemaker, R. A. 1984. Canadian and some extralimital *Leptosphaeria* species. Can. J. Bot. 62:2688-2729.
- Shoemaker, R. A., and Babcock, C. E. 1989. *Phaeosphaeria*. Can. J. Bot. 67:1500-1599.
- Sprague, R. 1934. A physiologic form of *Septoria tritici* on oats. Phytopathology 24:133-143.
- Sprague, R. 1944. *Septoria* disease of Gramineae in western United States. Oregon State Monographs, Studies in Botany No. 6. Oregon State College, Corvallis.
- Sprague, R. 1950. Diseases of cereals and grasses in North America. Ronald Press, New York.
- Ueng, P. P., and Chen, W. 1994. Genetic differentiation between *Phaeosphaeria nodorum* and *P. avenaria* using restriction fragment length polymorphisms. Phytopathology 84:800-806.

Barry M. Cunfer

bcunfer@gaes.griffin.peachnet.edu

Department of Plant Pathology

Georgia Station, University of Georgia

Griffin, GA 30223

Publication no. D-1997-0324-06O