A BLOTCH AND CHAR-SPOT OF WESTERN GRASSES[1]

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Septogloeum oxysporum Sacc. Bomm. et Rouss., although typically recognized as a blotch-causing parasite on certain European grasses, occurs widely in western North America not only as a blotch disease in its early stages but also as a charcoal-like, leaf streak on a number of grass hosts in the area. A list of the hosts and collections studied in connection with this note is given in table 1.

Symptoms.

The leaves are first spotted with tawny, yellow margined, circular but soon elliptical to elongate lesions. The fungus on *Arrhenatherum elatius* rarely forms black stromata, but on other hosts the lesions become covered with dull-black, charcoal-like streaks, 2-5 mm. wide and often several times as long. While the charcoal spots range from nearly circular to elongate, they are typically elongate, tapering to a point at each end. The center of the lesion is often paler than the periphery, being pale gray or isabelline from accumulation of conidia in some instances. Sometimes pycnidia occur as small black dots at the margin of the lesion but more often, if they are present, they are obscured by the charcoal-like stroma and are not visible to the naked eye.

Pure Culture Studies.

Isolations were readily obtained from *Arrhenatherum elatius* at Corvallis, Oreg., on potato-dextrose agar and were maintained for about two years at 40° F. before staling took place. The growth was moderately slow, pale buff with tawny shades. Conidia were produced in great numbers for a considerable period after which the cultures staled to a flat tawny-colored, sterile growth.

Morphology.

The spores are borne on stromatic tissue, in obscure acervuli or in pycnidia, usually in the center of the lesion or about its periphery. The spores arise from hyaline, globular or sub-cuspidate conidiophores (Fig. 1, A) and are usually produced in such large numbers that they sometimes appear as grayish masses in the center of the lesions.

The conidia are yellow to sub-hyaline, fusoid, often flattened slightly on one side, sub-truncate at the base tapering to an obtusely pointed apex. The conidia are 0- to 3-septate but in most collections they are uniformly 2-septate. However, in some collections on *Arrhenatherum elatius* and in the collection on *Distichlis stricta* from Mandan, N. Dak., there are many spores with three septa (Fig. 1,B,F). Usually the 3-septate spores are larger than the ones with fewer septa. Spore dimensions for the various collections are listed in table 1. The spores have very similar size ranges in the collections on the same host. Those on *Agrostis hallii* and *Calamagrostis inexpansa* average slightly smaller (Fig. 1, A) than those on *Arrhenatherum elatuis* (Fig. 1,B), while those on *Elymus* spp. are more erratic with large aberrant forms occurring (Fig. 1,C,D). The spores from *Distichlis stricta* (Fig. 1,F) were relatively short and thick, and ranged from fusoid to nearly cylindrical.

Char spot material showing pycnidia was found at Mt. Wagoner, Wyo., Logan, Utah, Bozeman, Mont., Berkeley and Weed, Calif. The pycnidia are subglobose, brown, more or less imbedded in the creosote brown stromatic tissue, or separate at the margin of the lesions. The pycnidia are 80-160 μ in diameter with ostioles variable, but up to as large as 60 μ in diameter. Pycnospores do not differ from conidia borne on stromatic tissue except that they are hyaline or

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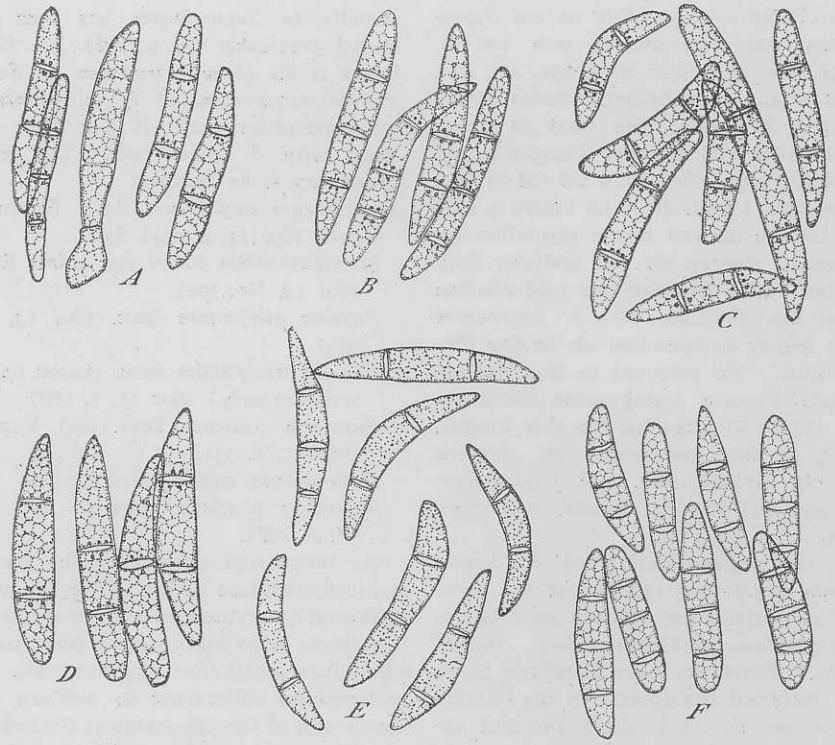
TABLE 1.—Spore dimensions of different collections of *Septogloeum oxysporum* Sacc. Bomm. et Rouss. made in the western United States.

Accession number	Host	Place	Date	Collector	Spore Size
					μ
Wyo. 82,498[a]	*Agropyron spicatum*	Mt. Wagoner, Wyo.	Aug. 5, 1923	Payson and Armstrong	20-38 x 2.5-5.0
OSC 24[b]	*Agrostis hallii*	Near Corvallis, Oreg.	Dec. 15, 1937	W. B. Cooke	21-29 x 3.3-4.1
OSC 66	*Agrostis hallii*	Corvallis, Oreg.	Feb. 8, 1938	R. Sprague	22-29 x 3.4-4.0
OSC 188;216	*Agrostis hallii*	Alpine, Oreg. and area	Apr. 14, 1938	R. Sprague	24-31 x 3.9-4.4
OSC 8278	*Agrostis hallii*	10 mi. so. of Corvallis	May 15, 1937	R. Sprague	22-27 x 3.2-4.0
OSC 8304	*Agrostis hallii*	Corvallis, Oreg.	Sept. 4, 1914	H. S. Jackson	———
OSC 10,236	*Agrostis hallii*	Willamette Grange, Oreg.	May 10, 1935	R. Sprague	26-29 x 3.8-4.0
OSC 10,813	*Agrostis hallii*	8 mi. so. of Corvallis	Nov. 18, 1934	R. Sprague	25-28 x 3.5-4.0
OSC 23	*Arrhenatherum elatius*	Corvallis, Oreg.	Dec. 15, 1937	W. B. Cooke	26-31 x 4.4-4.7
OSC 57;57;63	*Arrhenatherum elatius*	Corvallis, Oreg. and area	Feb. 8, 1938	R. Sprague	29-33 x 4.4-4.7
OSC 713	*Arrhenatherum elatius*	Astoria, Oreg.	Aug. 31, 1939	R. Sprague	24-30 x 3.8-4.3
OSC 794	*Arrhenatherum elatius*	Corvallis, Oreg.	Mar. 6, 1940	R. Sprague	26-29 x 4.1-4.6
OSC 10,136	*Arrhenatherum elatius*	Corvallis, Oreg.	Jan. 1, 1934	R. Sprague	24-30 x 3.8-4.3
OSC 10,866	*Arrhenatherum elatius*	Corvallis, Oreg.	Jan. 2, 1935	R. Sprague	———
B.P.I. 80,008[c]	*Calamagrostis inexpansa*	Near Lisbon, N. Dak.	July 15, 1940	R. Sprague	22-27 x 3.5-4.0
———	*Bromus ciliatus*	Ouray, Colorado	Aug. 5, 1919	E. Bethel	21-31 x 3.3-4.8
B.P.I. 80,061	*Distichlis stricta*	Mandan, N. Dak.	Aug. 4, 1915	J. T. Sarvis	20-25 x 4.3-5.0
———	(?) *Elymus* sp.	Berkeley, Calif.	May 2, 1918	E. Bethel	17-23 x 2.7-3.9
———	*Elymus condensatus*	Yellowstone Park, Wyo.	June 27, 1925	P. A. Young	22-26 x 3.8-4.4
———	*Elymus condensatus*	Near Weed, Calif.	May 21, 1939	R. Sprague	23-27 x 4.0-4.6
OSC 8294	*Elymus condensatus*	Washtucna, Wash.	May 21, 1937	Geo. W. Fischer	24-29 x 3.8-4.7
B.P.I. 80,004	*Elymus condensatus*	Hooper, Wash.	May 8, 1940	Geo. W. Fischer	25-33 x 4.1-6.0
B.P.I. 80,047	*Elymus condensatus*	Logan, Utah	Sept. 1940	Wm. Rader	———
———	*Elymus condensatus*	Bozeman, Mont.	Oct. 6, 1935	P. A. Young	———
B.P.I. 80,003	*Elymus glaucus*	Logan Canyon, Utah	July 14, 1940	Geo. W. Fischer	22-29 x 3.5-5.0 (rarely 47 μ)
B.P.I. 80,046	*Elymus glaucus*	Logan, Utah	Sept. 1940	Wm. Rader	———

(a) Rocky Mtn. Herb., Univ. of Wyoming, Laramie. A fragment sent by W. G. Solheim is filed at Oregon State College, Corvallis, Oreg. as Acc. No. 597 in the Mycological Herbarium of the Department of Botany.
(b) Accession numbers of Mycological Herbarium. Department of Botany, Oregon State College, Corvallis, Oreg.
(c) Bureau of Plant Industry, Mycological Collections accession number. These collections are being filed in the collections at Washington, D. C.



TEXT OF FIGURE

Fig. 1 *Septogloeum oxysporum* Sacc. Bomm. et Rouss.
A, Conidia from *Agrostis hallii*, Corvallis, Oreg. One of the spores has a conidiophore still attached and broken away from the parent stroma; B, Conidia from *Arrhenatherum elatius*, Corvallis, Oreg., O.S.C. 23; C, Conidia and pycnospores from *Elymus glaucus*, Logan Canyon, Utah, July 14, 1940, G. W. Fischer (B.P.I. 80,003); D, Conidia from *Elymus condensatus*, Hooper(Wash., May 8, 1940, G. W. Fischer; E, Pycnospores from *Agropyron spicatum*, Mt. Wagoner, Lincoln Co., Wyo.; F, Pycnospores from *Distichlis spicata*, Mandan, N. D., Aug. 4, 1915, J. T. Sarvis.
All drawings made with the aid of the camera lucida, x 1,000.

essentially so. In the material on *Agropyron spicatum* from Mt. Wagoner, Wyo., the spores are more frequently sub-falcate than in other collections (Fig. 1,E).

Details of the developing stroma and ascigerous stage have been noted in the collections. The perithecia are globose to very strongly flattened and as much as 250 μ in diameter with the stroma composing the wall of the perithecium. Most of the perithecia are filled with hyaline prosenchyma, which contrasts sharply with the creosote-brown, compacted, polygonal cells of the stromatic wall. Nearly mature asci, which are short, fascicled and without paraphyses, were noted in material on *Elymus condensatus* collected at Logan, Utah (B. P. I. 80,047).

Taxonomy.

When the writer first collected *Septogloeum oxysporum* on *Arrhenatherum elatius* in Oregon he referred it to *Fusoma* sp.[3] on the basis of the illustration of *F. biseptatum* Sacc. in Rabenhorst (4, p. 395)[4], which is a copy of Saccardo's illustration (6, pl. 184, fig. 15). Through the courtesy of H. A. Edson and John A. Stevenson material and pure cultures were sent to H. W. Wollenweber for comparison with European material. Wollenweber replied as fol-

[3]Sprague, R. A preliminary check list of the parasitic fungi on cereals and other grasses in Oregon. U. S. Dept. Agr., Bur. Plant Indus., Plant Dis. Reptr. 19: 156-186. July 15, 1935. (Mimeographed.)
[4]The numbers in parenthesis refer to literature at the end of the text.

lows: "Der ——— Pilz ist ein *Septogloeum* und unterscheidet sich von *S. oxysporum* (Konidien in diagn. 2-3 sept. 30-33 x 4 μ) anscheinend durch etwas dickere Konidien. Sie sind in Ihrer Agarkultur 2-3-, seltener 1-septiert und messen 3-sept. etwa 30 x 5.2 (23-30-39 x 4-6 μ) und 1-sept. 26 x 4.8 (20-31 x 4.5-5 μ). Da die Sporen etwas gequellen erschienen, werden sie auf anderen Substraten veilleicht schmaler und dürften dann den Grössen für *S. oxysporum* noch besser entsprechen als in der Einzelkultur". He referred to Nos. 442-445 of his Fusaria autographie delineata (10, 11) as illustrations for this fungus, which he mentions occurs on *Agrostis vulgaris, Briza media,* and *Calamagrostis* spp. in Sweden, Russia, and Germany.

In the original description of *Septogloeum oxysporum* (1, p. 294) the name and authorities are written as follows: "*Septogloeum oxysporum* Sacc. Bomm. Rouss." However, when Saccardo (5, p. 497) included the species in his Sylloge Fungorum, he wrote the name and authorities as follows: "*Septogloeum oxysporum* Bomm. Rouss. Sacc." The order of the authorities should be that as given in the original description.

The writer is convinced that the fungus in question on western grasses listed in table 1 is *Septogloeum oxysporum* Sacc., Bomm. et Rouss. *Septogloeum oxysporum* has been known by a number of names but it is earlier than the others, having been established in 1890 (1, p. 294). In 1891, Eriksson (2, No. 394) described and distributed *Mastigosporium album* var. *athrix* Erikss. nov. var. on *Calamagrostis arundinacea* from Sweden. In 1939, Sprague (8, p. 298) mentioned that this did not belong as a variety of *M. album* and transferred it to the genus *Septogloeum* and suggested further that it probably was the same as *S. oxysporum.* It appears to be identical with *S. oxysporum* collected on *Agrostis hallii* in Oregon. The relation of *Fusoma biseptatum* Sacc. and of *F. triseptatum* to *Mastigosporum* and incidentally to *Septogloeum* has been discussed previously (8, p. 298). *F. biseptatum* is an obvious synonym of *Septogloeum oxysporum* but *F. triseptatum* is by description only. It has been confused with *F. rubricosum.* The entire synonomy is as follows:

Septogloeum oxysporum Sacc. Bomm. et Rouss. 1890 (1, p. 294) Syn.
Mastigosporium album var. *athrix* Eriks. 1891 (2, No. 394).
Fusoma biseptatum Sacc. 1891 (3, No. 683).
Fusoma triseptatum Sacc. (based on description only) 1892 (5, p. 566).
Fusarium osiliense Bres. and Vesterg. 1900 (9, p. 33).
Septogloeum athrix (Eriks.) Spr. 1939
Septogloeum athrix (Erikss.) Spr. 1939 (8, p. 298).

As mentioned previously the melanconiaceous phase of the above fungus is followed or accompanied by a sphaeropsidaceous stage and in some cases by an immature perithecial stage as well. Undetermined collections in western herbaria and in the Mycological Collections of the Bureau of Plant Industry, Washington, D. C., contain all stages of this fungus. It has been a common error, of which the writer is also guilty, to consider the fungus as an immature stage of *Phyllachora graminis* (Pers.)[5] Fckl. However, material collected recently, indicates that the ascigerous stage is not a *Phyllachora* but more likely is near Dothidella. The most nearly mature material of the group, on *Elymus condensatus* (B. P. I. 80,047), was recently sent to C. R. Orton. He very kindly replied that it was not a *Phyllachora,* that he believed it was the same fungus that is sometimes known as *Phyllachora aristidae* but which he says is more likely better placed in *Eurychora* by Thiessen and Sydow. In referring to Seymour's check list (7), we find a considerable list of synonyms for this fungus. Seymour preferred *Dothidea aristidae* (S.) Ell. but some workers, including the writer, prefer *Dothidella aristidae* (S.) Ell. and Ev. What appears to be very

[5]Loc. cit.

close to if not identical with *Dothidella aristidae,* is a very common char spot on *Distichlis stricta* in North Dakota, west to Washington and Oregon. The writer has mentioned finding the *Septogloeum* stage in North Dakota material. He has, however, examined *Distichlis* material from Oregon at various times over a period of years without finding either conidia or perithecia. He has seen *Dothidella aristidae* on *Distichlis stricta,* collected by Wm. Cusick in Oregon many years ago, but determination of the fungus was based only on the very typical char spot symptoms. Recently Fischer[6] reported *Dothidella aristidae* on *Distichlis stricta* from Washington and Oregon.

The writer is convinced that the stromatic phase, the pycnidial, and the *Dothidella*-like immature perithecial stage are all stages of the same fungus, but it is not possible at present to assign *Septogloeum oxysporum* to *Dothidella aristidae* because it has not been proved that the fungus on *Elymus,* for instance, is the same as the fungus on *Aristida.* In some miscellaneous collections sent by John A. Stevenson, a trace of a *Septogloeum*-like fungus was found, in one mount, on Aristida sp. from Mississippi, but a *Hendersonia*-like conidial or pycnidial stage was noted also.[7]

Discussion.

It is the purpose of this note to present evidence that the blotch and char spot of these several western grasses is due to a fungus having not only *Septogloeum oxysporum* as part of its life cycle but also a pycnidial and an ascigerous stage. It is expected that further study will disclose determinable material that specialists in the ascomycetes will be able to classify. In that event, the char spot and blotch fungus will be definitely assigned to the ascomycetes. For the present, the fungus must be left as *S. oxysporum.* To transfer it to its pycnidial stage would be most futile, particularly because there is much doubt as to where in the Sphaeropsidales this fungus should go. Examination of several collections shows that the pycnidia are more often than not imbedded in the thin but definite stroma. This rules it out of *Stagonospora* and suggests possibly *Stagonostroma* Diedicke; but a critical study of the description only of this genus indicates that the material under consideration does not belong to this genus. Because the path of this problem is already strewn with the wreckage of abortive attempts to classify this fungus, we prefer to outline its present status with increasing faith that its final classification is within sight.

Summary.

The tawny leaf blotch of some Pacific Coast grasses and the charcoal or char spot of some western grasses is caused by *Septogloeum oxysporum.* This fungus produces stromata in which pycnidia and perithecia occur. It is expected that the fungus will eventually be assigned to a *Dothidella*-like genus. It is related to if not identical with the fungus known sometimes as *Dothidella aristidae* (S.) Ell. and Ev.

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[6]Fischer, George W. Grass diseases in the Pacific Northwest in 1940. U. S. Dept. Agr., Bur. Plant Indus., Plant Dis. Reptr. 24: 481-497. 1940. (Mimeographed.)
[7]The status of *Hendersonula aristidae* (S.) Ell. has not been studied.