TWO MASTIGOSPORIUM LEAF SPOTS ON GRAMINEAE[1]

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INTRODUCTION

The type species of the moniliaceous genus *Mastigosporium* Riess is *M. album* Riess (*6, p. 56*)[3], which attacks a number of grasses in Wales, France, central Europe, the Union of Soviet Socialist Republics, and Scandinavia (*9, 10, 11, 15*). The fungus is distinguished by the presence of one to several tentaclelike appendages extending from the awl-shaped distal end of its hyaline, elliptical, three-(three-to-five) septate conidia (figs. 1, *J-O*, and 2).

The writer recognized a second species of *Mastigosporium*, which has nonappendaged conidia (fig. 1, *a-i*). The fungus, *M. calvum* (Ellis and Davis) comb. nov., occurs in Germany (*5*), France (*14, p. 254*), England (*16, p. 233*), Wales, Russia (*1*), Ontario, Canada, and in Wisconsin (*3, p. 98*), Montana (*4, p. 361*), and Oregon.[4]

Most of the present study deals with *Mastigosporium calvum*, as it is conveniently abundant in western Oregon. *M. album* apparently has not been found in North America.

DISTRIBUTION AND ECOLOGY OF MASTIGOSPORIUM CALVUM IN THE WESTERN UNITED STATES

The disease caused by *Mastigosporium calvum* is the most important malady of orchard grass (*Dactylis glomerata* L.) in portions of western Oregon. It is common in the northern end of the Willamette Valley from Benton County north to at least the Columbia River and east through the Columbia Gorge into Hood River County. It is prevalent on orchard grass in the coast region from Astoria, south to Lane County, which is as far south as observations were made. In commercial fields of seed grass in Clatsop County the disease is prevalent on redtop (*Agrostis alba* L.). In 1937 it was also very abundant on the locally more important Astoria colonial bent (*A. tenuis* Sibth.) in Clatsop and Tillamook Counties. Scattering infection occurs on creeping bent (*A. palustris* Huds.) in commercial bentgrass seed fields in Clatsop County and is common in pastures in Lincoln County.

The apparent susceptibility of a number of grasses is shown in table 1. These data were compiled from rod-row plots at Astoria, Oreg. All the grasses were the same age and were growing side by side in the

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[2] The writer is indebted to A. G. Johnson and John A. Stevenson for more than routine aid in locating material and literature; to A. G. Johnson for a critical revision of the manuscript; and to John H. Martin for translating Bondarzeva-Monteverde's article from the original Russian.

[3] Italic numbers in parentheses refer to Literature Cited, p. 299.

[4] SPRAGUE, R. A PRELIMINARY CHECK LIST OF THE PARASITIC FUNGI ON CEREALS AND OTHER GRASSES IN OREGON. U. S. Bur. Plant Indus., Plant Disease Rptr. 19: 136-186. 1935. [Mimeographed.]

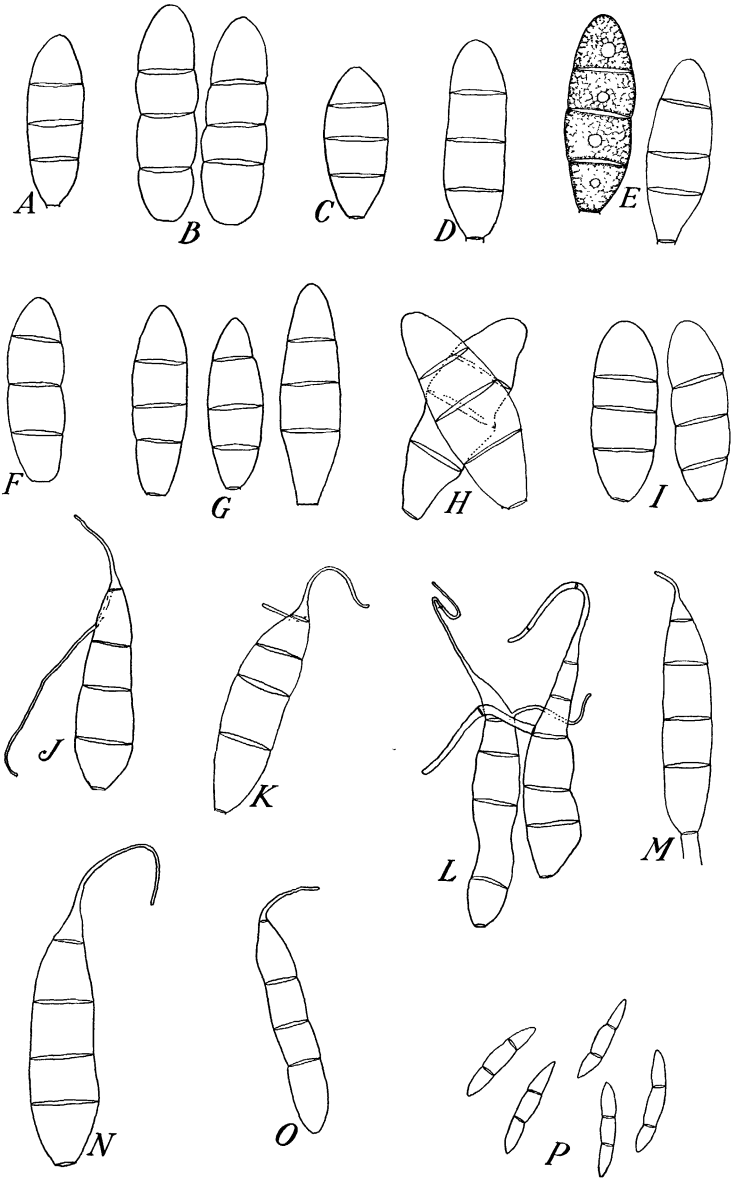

FIGURE 1.—Conidia of *Mastigosporium calvum, A-I; M. album, J-O;* and *Septogloeum athrix, P.* From following sources: *A,* On *Agrostis alba,* Astoria, Oreg., Oregon 10386; *B,* on *A. palustris,* Big Elk Creek, Lincoln County, Oreg., Oregon 8246; *C,* on *A. palustris,* Alsea Valley, Oreg., Oregon 10308; *D,* on *A. tenuis* var., Astoria, Oreg., Oregon 10585; *E,* on *Calamagrostis canadensis,* Ontario, Canada, Univ. Toronto, Crypt. Herb., 1292; *F,* on *C. canadensis,* State Line, Wis., 1903, Univ. Wis., J. J. Davis Herb.; *G,* on *C. canadensis* var. *scabra,* Glacier Park, Mont., type of *Fusoma rubricosa,* Fungi Columb., 5019; *H,* on *C. epigeios,* Germany, Sydow, Myc. Ger., 640; *I,* on *Dactylis glomerata,* Germany, Krieger, Fungi Sax., 792; *J,* on *Alopecurus pratensis,* Germany, Sydow, Myc. Ger., 542; *K,* on *Alopecurus pratensis,* Germany, Krieger, Fungi, Sax., 790A; *L,* on *A. pratensis,*[1] Germany, Krieger, Fungi Sax., 790B; *M,* on *A. pratensis,* Bohemia, Kabát and Bubák, Fungi Imp. Exs., 386; *N,* on *A. pratensis,* Russia, Buchholz et Bondarzew, Fungi Ross. Exs., Ser. A, 197; *O,* on *Deschampsia caespitosa,*[2] Germany, De Thümen, Myc. Univ., 1872; *P,* on *Calamagrostis* sp., Sweden, Eriksson, Fungi Par. Scand., 394. All × 667.

[1] This collection has a number of conidia with very robust appendages that have all the appearances of germ tubes.

[2] This collection has spores badly plasmolyzed.

rows. Infection was heavy in 1937. On redtop, for example, nearly 100 percent of the leaves had at least one spot and most of them had several. The same relative susceptibility had been noted in 1936.

In Benton, Linn, Polk, Marion, Clackamas, Multnomah, and Lincoln Counties, Oreg., the fungus recurs annually on the same

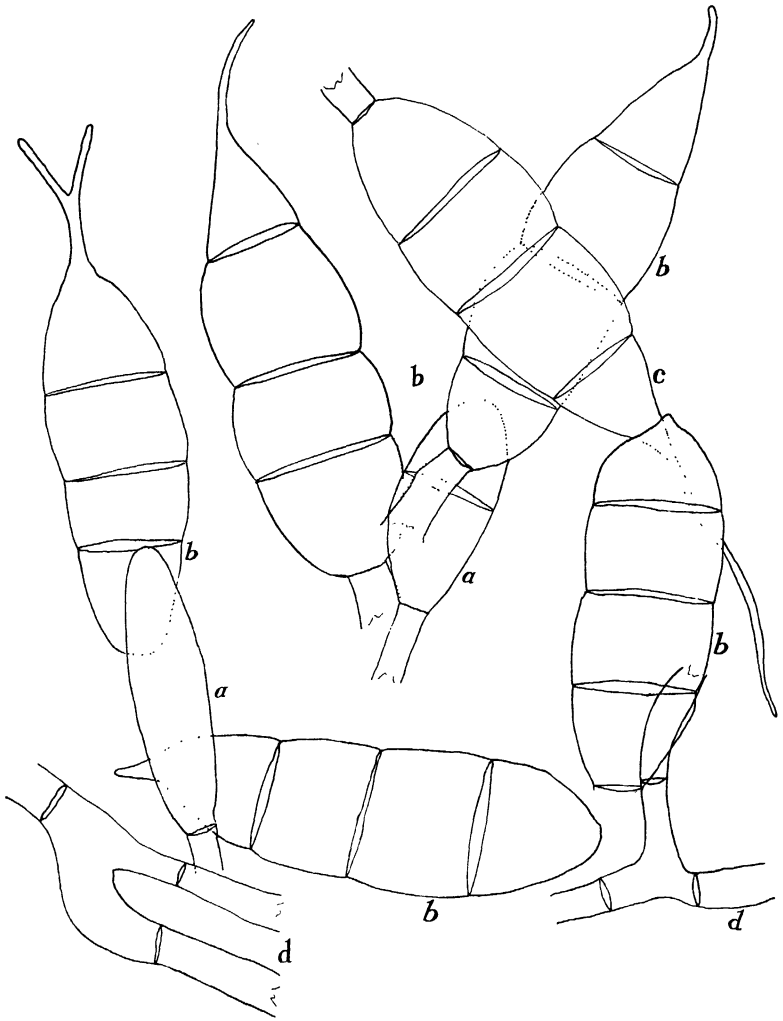

FIGURE 2.—Conidia of *Mastigosporium album* from *Alopecurus pratensis* sent by K. Sampson from Aberystwyth, Wales, April 1937, showing unplasmolyzed condition: *a*, Young conidia with attached conidiophores; *b*, maturing conidia; *c*, nearly mature conidium; *d*, fragments of hyphae. All × 1,375.

plants of orchard grass. The disease very largely disappears during the summer, but after rains start in the autumn it appears again following periods of growing weather. The disease has been most evident during February, March, and April. In the very humid coastal counties of Lincoln, Tillamook, and Clatsop the disease has continued to develop later in the spring than elsewhere, the lateness of development depending largely on the seasonal prevalence of rains. The fungus is evidently soon checked by low humidity.

TABLE 1.—*Relative susceptibility to Mastigosporium calvum of certain grasses grown under humid field conditions in the plots at the John Jacob Astor Experiment Station, Astoria, Oreg., as indicated by observations made May 12, 1937*

Host		Relative susceptibility
Technical name	Common name	
Agrostis alba L.	Redtop	Completely susceptible.
A. canina L.	Velvet bent	Susceptible.
A. palustris Huds.	Creeping bent	Do.
A. stolonifera L.	do	Moderately susceptible.
A. tenuis Sibth.	Astoria colonial bent	Very susceptible.
A. tenuis Sibth.	Rhode Island colonial bent	Susceptible to very susceptible.
A. tenuis var.	Highland colonial bent	Do.
A. verticillata Vill.	Water bent	Slightly resistant.
Alopecurus pratensis L.	Meadow foxtail	Apparently immune.
Arrhenatherum elatius (L.) Mert. and Koch.	Tall oatgrass	Do.
Dactylis glomerata L.	Orchard grass	Susceptible.
Lolium perenne L.	Perennial ryegrass	Apparently immune.
Phleum pratense L.	Timothy	Do.

Fusoma rubricosa Dearn. and Barth., which, as shown later, is the same fungus as *Mastigosporium calvum*, was collected on *Calamagrostis scabra* Presl from Glacier National Park, Mont., in August 1915 (*4*). The host, which is now generally known as *C. canadensis* var. *scabra* (Presl) Hitchc., is a plant of subalpine and alpine areas in the northern United States and Canada. It is interesting to note that Frank (*5*) found a muticate form of *M. album* on *Alopecurus pratensis* on the highest parts of the Erzgebirge of Saxony, Germany. In commenting on this, Lindau (*10*) wondered whether the muticate spores were due to the altitude or to a species difference. It is noted in Oregon that most of the collections of *M. calvum* have been made at elevations between 0 and 400 feet above sea level. Whether or not *M. calvum* occurs on alpine and subalpine grasses in Oregon has not been determined.

SYMPTOMS CAUSED BY MASTIGOSPORIUM CALVUM

SYMPTOMS ON DACTYLIS GLOMERATA

The disease caused by *Mastigosporium calvum* on *Dactylis glomerata* is first visible as small, dark, purple-brown flecks on the leaves. Some of these enlarge, becoming elliptical in outline, with ashy-gray to fawn-color centers. The lesions measure 1 to 8 mm in length and are somewhat restricted by the parallel veins of the leaf (fig. 3). Where the fungus is able to make rapid headway or where secondary infection from spores occurs the lesions may be larger, somewhat mottled, and with less definite borders. These larger lesions show various shades of gray, ashy, or light-fawn color, with more or less definite purple, red, or ocher borders. Any or all leaves of a plant may be attacked, as the fungus is an active parasite and may practically defoliate the orchard grass plants.

The presence of long, dead striae, with black dots of conidiophore tufts, is indicative of the presence of the streak disease caused by *Scolecotrichum graminis* Fckl., which is frequently associated with the mastigosporium disease in Oregon. The symptoms of the streak disease, which are well described by Horsfall (*7*), are sometimes confusable with those of the mastigosporium leaf spot. The purple

flecking mentioned for the latter is sometimes duplicated in early stages of the streak disease. Usually, however, *Mastigosporium calvum* causes a more abundant development of pigments than does *S. graminis*, and, furthermore, the latter produces longer lesions, usually with rather conspicuous black tufts of conidiophores.

SYMPTOMS ON AGROSTIS SPECIES

The symptoms produced by *Mastigosporium calvum* on *Agrostis* spp. differ from those on orchard grass in the tendency to form broader, elliptical, light-brown lesions with light-fawn centers. The lesions are often of an eyespot or frogeye type on account of a broad red or red and yellow margin. On redtop the lesions were sufficiently numerous to destroy most of the leaves of plants in certain fields near Astoria in 1936 and1937. On Astoria colonial bent the spots averaged from one to six per leaf with a tendency to develop at the tips or where moisture collected at the base of the leaf blades. In 1937 colonial bent was heavily infected during April and May in Clatsop and Tillamook Counties.

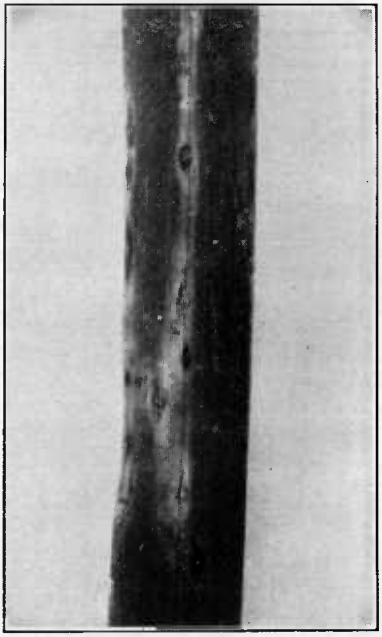

FIGURE 3.—Leaves of *Dactylis glomerata* attacked by *Mastigosporium calvum*, Corvallis, Oreg. × 2.

SYMPTOMS ON CALAMAGROSTIS SPECIES

On species of *Calamagrostis*, *Mastigosporium calvum* produces small brown flecks, 1 to 3 mm in diameter, with very small gray centers. The entire lesion is sometimes surrounded by larger areas of fawn- or pale buff-colored tissue. Specimens from Montana showed extensively coalesced, mottled lesions.

SYMPTOMS CAUSED BY MASTIGOSPORIUM ALBUM IN EUROPE

While field comparisons have not been made, it is doubtful whether *Mastigosporium calvum* and *M. album* can be readily distinguished in the field except possibly by hosts. *M. album* is the more common, in exsiccati at least, on *Alopecurus pratensis* and *Deschampsia caespitosa* (L.) Beauv., while *M. calvum* prefers *Dactylis glomerata*, *Agrostis* spp., and *Calamagrostis* spp. Lindau (*10*), however, lists a number of hosts other than these for *M. album*. Since he has not distinguished entirely between the muticate and nonmuticate collections, and since these collections are not available to the writer, it is not possible to give a more extensive host range. Lindau lists, in addition to the ones cited, *Brachypodium sylvaticum* (Huds.) Beauv., *Molinia caerulea* (L.) Moench, *Avena elatior* L., *Briza media* L., *Glyceria fluitans* (L.) R. Br., *Holcus lanatus* L., *H. mollis* L., *Phleum pratense* L., *Poa trivialis* L., and *Trisetum flavescens* (L.) Beauv.

The following notes on symptoms are based on an examination of exsiccati and a study of the brief reports in literature.

SYMPTOMS ON ALOPECURUS PRATENSIS

On *Alopecurus pratensis* there usually are numerous small elliptical purple-brown to dark-brown flecks which later enlarge and develop white to ashy-gray centers. The coloration on *A. pratensis* is deeper than for most collections of *Mastigosporium calvum* on *Dactylis glomerata*, but this probably is attributable as much to host reaction as to differences in the two fungi.

SYMPTOMS ON DESCHAMPSIA CAESPITOSA

On *Deschampsia caespitosa* (*Aira caespitosa* L.) the symptoms are very similar to those on *Alopecurus pratensis* except that the spots on the former grass seem to be slightly less deeply pigmented than those on the latter, as indicated by the specimens in De Thümen, Myc. Univ., 1872.

PURE-CULTURE STUDIES

MASTIGOSPORIUM CALVUM FROM DACTYLIS GLOMERATA

Pure cultures of *Mastigosporium calvum* were obtained from spores washed from leaves of orchard grass collected at Corvallis, Oreg. The fungus, which grows relatively slowly on potato-dextrose agar, produces a leathery, somewhat folded and mounded colony which becomes pebbly or roughened by the formation of small, partially embedded, stromatic or sclerotic mycelia that resemble pycnidia. Brief descriptions of the development of the fungus during the first month after transfer of diseased host tissue to four kinds of nutrient media are given in table 2.

TABLE 2.—*Development of mycelia of Mastigosporium calvum on four kinds of nutrient agar at 35° to 40° F. in total darkness*

Agar culture medium	Color of—		Description of colony
	Substratum	Aerial mycelia	
Difco corn decoction	Yellow	Straw, later yellow	Stellate-margined, leathery wrinkled colonies, partially submerged.
Mix's synthetic	White	White	Flat, thin, spreading colonies.
Difco potato dextrose	Pale umber	Tan to fawn	Leathery, pebbly mounded, wrinkled colonies.
Difco prune	Pale cocoa	Pale cocoa to fawn	Less mounding, margins more stellate.

Normal-appearing conidia were produced in moderate quantities on the surface of the colonies on potato-dextrose agar after incubation for several weeks in the ice box at 35° to 40° F. After growing several months at this temperature the colonies finally became orange brown and the sclerotia increased in number, frequently forming rings in the substratum around the original point of transfer.

MASTIGOSPORIUM CALVUM FROM AGROSTIS SPECIES

Pure cultures of *Mastigosporium calvum* were isolated from *Agrostis alba*, *A. canina*, and *A. tenuis* collected at Astoria, Oreg.

MASTIGOSPORIUM CALVUM FROM ALOPECURUS

A culture of *Mastigosporium album* from *Alopecurus pratensis*, kindly forwarded by Kathleen Sampson from Aberystwyth, Wales,

had the same general yellow-brown color of *M. calvum* but produced masses of conidia in glistening orange-brown mounds on the surface of the colony. After transfer to potato-dextrose agar the sporulation continued but was at first putty-colored, later darker. The conidia were typically navicular, three- to five-septate, and bore the characteristic appendages at the apex. The fact that this fungus continues to produce typical conidia in culture that do not revert to the muticate type is additional strong evidence that the muticate and ciliated species are distinct.

DILOPHOSPORA ALOPECURI FROM HOLCUS LANATUS

Since Rainio (*11*) has strongly contended that *Mastigosporium album* is an early stage of *Dilophospora alopecuri* (Fries) Fries, the writer isolated cultures of the latter fungus from *Holcus lanatus* from Oregon. This fungus grew very slowly, and germinating spores required nearly 8 weeks to produce macroscopically visible colonies when incubated at 38° F. After 6 months the colony covered the surface of test-tube slants with a mounded, felty, olive and gray growth, which was covered with guttulae. These cultures, therefore, differed distinctly from those of *M. calvum*.

INOCULATION STUDIES

Water suspensions of viable conidia of *Mastigosporium calvum* taken from naturally infected plants in the field were sprayed with an atomizer on pot-grown, healthy grasses in the greenhouse at Corvallis. The inoculated plants, together with adequate checks, were incubated in a moist chamber for 1 week. The first series, conducted in January 1934, and a second series, conducted the following month, produced a light infection on orchard grass only. Another more extensive series of inoculations was conducted in May 1937 with *M. album* from Wales and with spore washings of *M. calvum*, both from *Dactylis glomerata* and *Agrostis alba*. The results are shown in table 3.

TABLE 3.—*Results of inoculating grasses in the greenhouse with spore suspensions of Mastigosporium album and M. calvum*

Host	Inoculated with *M. album* from *Alopecurus pratensis*, May 1, 1937		Inoculated with *M. calvum* from—							
			Dactylis glomerata						*Agrostis alba*, May 1937	
			January 1934		February 1934		May 1937			
	Leaves infected	Leaves not infected	Leaves infected	Leaves not infected	Leaves infected	Leaves not infected	Leaves infected	Leaves not infected	Leaves infected	Leaves not infected
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Agrostis palustris Huds.	0	190	-------	-------	-------	-------	0	400	10	265
A. tenuis Sibth.	0	175	-------	-------	-------	-------	0	215	78	65
Alopecurus pratensis L.	38	46	-------	-------	-------	-------	0	80	0	240
Avena sativa L.	-------	-------	-------	-------	0	48	0	90	0	98
Brachypodium pinnatum (L.) Beauv.	6	30	-------	-------	-------	-------	-------	-------	-------	-------
Bromus rigidus Roth.	0	15	-------	-------	-------	-------	-------	-------	0	120
Dactylis glomerata L.	0	205	5	206	39	180	31	0	10	290
Deschampsia caespitosa (L.) Beauv.	16	227	-------	-------	-------	-------	0	165	0	190
Festuca elatior L.	0	150	-------	-------	-------	-------	-------	-------	-------	-------
F. rubra L.	-------	-------	-------	-------	0	60	-------	-------	-------	-------
Holcus lanatus L.	0	51	-------	-------	0	84	0	88	0	155
Lolium perenne L.	-------	-------	0	63	0	79	0	100	0	180
Phleum pratense L.	0	40	-------	-------	-------	-------	-------	-------	-------	-------
Poa pratensis L.	0	75	0	52	0	75	0	85	-------	-------
Triticum aestivum L.	0	36	-------	-------	0	45	0	25	-------	-------

It will be noted that *Mastigosporium album* from *Alopecurus pratensis* attacked that host, *Brachypodium pinnatum*, and *Deschampsia caespitosa; M. calvum* from *Dactylis glomerata* attacked only that host, and this fungus from *Agrostis alba* attacked *A. palustris*, *A. tenuis*, and *D. glomerata*.

While further inoculations are needed, the present results indicate (1) that *Mastigosporium album* and *M. calvum* differ in host range as well as in morphology, and (2) that there are distinct physiologic races in *M. calvum*.

MORPHOLOGY OF MASTIGOSPORIUM CALVUM

In pure cultures of *Mastigosporium calvum* the conidia are produced on the tips of hyphae (fig. 4). The distal portions of the conidia, following the constriction at the base of the conidiophore, develop faster than the basal portions. In the young conidium there are two nuclei which divide and form four cells in the mature spore. The four-celled condition is typical and is remarkably uniform. Sometimes spores with only two cross walls are found, but these are immature spores with the basal portions incompletely developed.

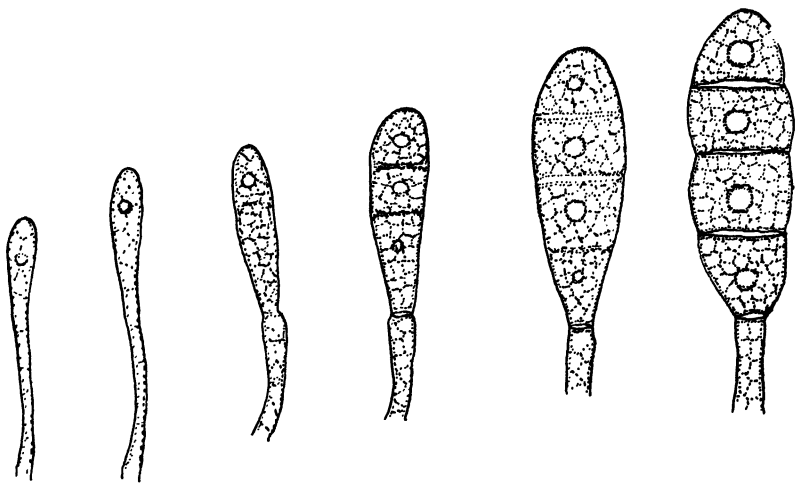

FIGURE 4.—Stages in the development of conidia of *Mastigosporium calvum* in pure culture on potato-dextrose agar at 40° F. × 1,075. (Diagramed from photomicrographs.)

On the host the development of the conidia (fig. 5) is approximately the same as on media. The spores are borne on short conidiophores which emerge directly from the leaf tissue, usually between the epidermal cells or through stomata. Stromatic development is moderate to slight, the fungus developing between the epidermal cells or in the cells.

Conidia usually are produced in relatively moderate numbers, and if the lesions are small and immature, few if any spores develop. On some of the bentgrasses larger numbers of spores were found, but the conidia do not occur in masses as in *Fusarium* or *Septogloeum*. The conidia, in addition, are somewhat brittle, and one or more cells may collapse, particularly under desiccation. As indicated from germina-

tion trials, the conidia apparently are fitted for quick germination and are relatively short-lived. They germinate from the apical end, producing one or two stout germ tubes which soon branch repeatedly.

The appendages or cilia that occur on conidia of the type material of *Mastigosporium album*, and which are characteristic of the genus on a majority of the reported collections from Europe, are apical or subapical, hyaline, tentaclelike protuberances (fig. 1, *J–O*). They resemble, except that they are considerably narrower, the mycelia from germinating conidia of *M. calvum* seen on potato-dextrose agar at Corvallis. Since, however, their position, shape, and length are fairly constant, they appear to be normal outgrowths formed as the result of some physiologic reaction which is not understood at present. They are believed to represent further development of the apical portions of the conidia and probably are morphologically akin to arrested germ tubes. Saccardo was uncertain about their nature, as indicated from his remarks (*14*).

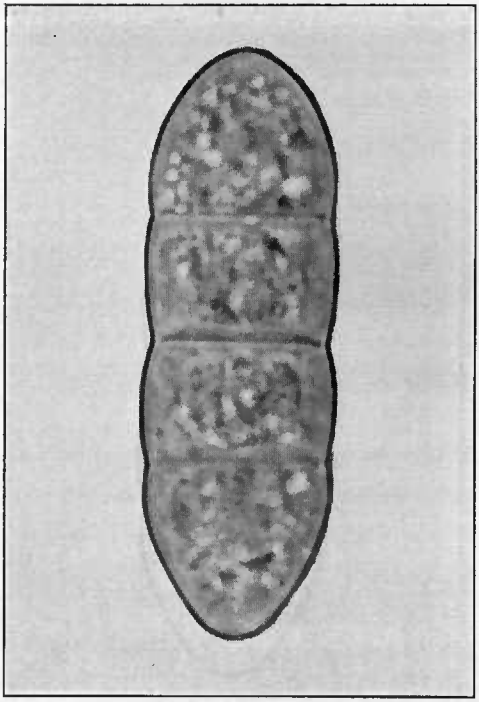

FIGURE 5.—Photomicrograph of conidium of *Mastigosporium calvum* on *Dactylis glomerata*, Corvallis, Oreg. × 2,000.

TAXONOMY

The appendaged *Mastigosporium album* and the nonappendaged *M. calvum* are distinct species if the present criteria for segregating species of fungi are logical. The two fungi are distinct because—

(1) The spores of *M. album* often have four cross walls, sometimes five; those of *M. calvum* have never more than three.

(2) The spores of *M. album* have appendages; those of *M. calvum* have not.

(3) The spores of *M. album* usually are longer and sometimes narrower than those of *M. calvum*.

(4) The two fungi maintain their respective characteristics in artificial culture on nutrient media.

(5) The host range of each fungus is fairly distinct.

A study of fresh material sent from Wales by Kathleen Sampson shows that the two fungi are, however, closely related. Both have coarse mycelia, which produce short, thick conidiophores. In their early stages the fungi appear almost identical, and until the tip of *Mastigosporium album* starts to elongate they appear to be the same species. *M. album*, however, grows from the apical end, producing the awl-shaped cell which frequently develops one or two cross walls in addition to the usual three cross walls in the main body of the spore. The apical cell then continues to elongate into the characteristic

appendage, which may become once, or more, forked. Additional appendages are sometimes formed from the side of the apical cell or cells. There is no question in the writer's mind that both fungi belong in the same genus and have arisen apparently from the same original species. The writer has considered the hypothesis that on certain hosts *M. album* produces appendages and on others not, and that this is a reaction to the host. From comparison with pure cultures this hypothesis appears unlikely. Therefore he proposes making two species in the genus *Mastigosporium*.

The genus *Mastigosporium* needs some revision to conform to the fungi included. It belongs in subsection Micromereae of section Hyalophragmeae of the Moniliaceae. This group includes among others *Fusoma* Corda and *Amastigosporium* Bond.-Mont. *Fusoma* has a very vague status as a fungus, with fusiform septate spores borne on scanty mycelia. Neither of the species of *Mastigosporium* appears to belong in *Fusoma*, although *F. rubricosa*, which is a synonym of *M. calvum*, has been described (*4*).

Amastigosporium graminicolum Bond.-Mont. (*1*) is the same as *M. calvum*. *Amastigis graminicola* Bond.-Mont. appears to be a simplified spelling of *Amastigosporium* attributed to Clements in Clements and Shear (*2*).

Mastigosporium is emended as follows:

Mastigosporium Riess (Emended).

Syn.: *Monothecium* Lib. in herb. and *Amastigosporium* (*Amastigis*) Bond.-Mont.

Mycelia in plants, epidermal and subepidermal, endophytic or somewhat ectophytic, septate, coarse, branched, hyaline; conidiophores, brief single or in small groups, short stipitate, continuous; conidia hyaline elliptical, large, navicular to subulate, formed by expansion of the hyphal tips, three-to-five septate, apical cells of conidia rounded and muticate, or awl-shaped and appendaged with simple or forked usually aseptate filiform appendages.

Included species, *Mastigosporium album* Riess (appendaged) and *M. calvum* (Ellis and Davis) comb. nov. (nonappendaged). Excluded, *M. lupini* (Sor.) Cav.

Mastigosporium lupini is excluded solely because of its pigmentation. Its manner of producing spores is remarkably like that of *M. album* and *M. calvum*.

Because it is virtually impossible to locate *Mastigosporium calvum* by use of present keys, it is suggested that future analytical keys to genera of fungi take cognizance of both the appendaged and nonappendaged species of *Mastigosporium*.

The data on spore size for available collections are presented in table 4. Apparently the two species are the same size until the elongation of the tip of *Mastigosporium album* starts. Most collections of the latter therefore average longer in mature spores than *M. calvum*.

In comparing the relatively fresh material from Wales with older exsiccati it appears that *Mastigosporium album* shrinks considerably after prolonged desiccation. The difference in width of the spores of the two species does not appear to be as great as indicated in table 4.

Mastigosporium calvum occurs on *Dactylis glomerata*, *Calamagrostis* spp., and *Agrostis* spp. Jaap (*8*) and Frank (*5*) report muticate spores of a *Mastigosporium* on *Alopecurus pratensis* which may be *M. calvum*. The fungus has not been found on *A. pratensis* in Oregon, although *M. calvum* occurs on *Dactylis* within short distances of small plots of *A. pratensis* on the experiment station farms at Corvallis and Astoria (table 1).

TABLE 4.—*Host, exsiccati number, ciliation (+ or −), location, conidial size, etc., of Mastigosporium album and M. calvum on grasses in Europe and North America*

Fungus	Host	Exsiccati, authority, or literature citation	Ciliation, verified by examination of exsiccati	Geographic location	Size of conidia	Appendages
M. album	*Alopecurus pratensis* L.	Riess (*6, p. 56*)	(1)		55 × 12 μ	+
	Deschampsia caespitosa (L.) Beauv.	De Thümen, Myc. Univ., 1872	+	Belgium	45–55 × 9–12	+
	A. pratensis L.	Sydow, Myc. Ger., 542	+	Germany	43–49 × 8–13	+
	do	Buch. et Bond. Fungi Ross. Exs., Ser. A, 197.	+	Union of Soviet Socialist Republics.	50–51 × 11–13	+
	do	Linhart, Fungi Hungar., 96	+	Hungary	50–55 × 13	+
	do	Krieger, Fungi Sax., 790 A and B	+	Germany	43–50 × 9–14	+
	do	Kabát et Bubák, Fungi Imp. Exs., 386	+	Bohemia	38–51 × 10–11	+
	do	Schroeter	−	Germany	48–55 × 11–13	+
	do	K. Sampson (Oreg. 8248)	+	Wales	31–53 × 12–16	+
Range of conidial size					31–55 × 8–16	
M. calvum	*Agrostis alba* L.	Oregon 10586	+	Oregon	32–51 × 12–16	−
	do	Oregon 8268	+	do	39–47 × 13–17	−
	A. palustris Huds.	Oregon 10308	+	do	29–38 × 10–15	−
	do	Oregon 8246	+	do	40–46 × 14–16	−
	A. tenuis Sibth.	Oregon 10585	+	do	35–45 × 11–16	−
	do	Oregon 10584	+	do	36–38 × 11–13	−
	A. verticillata Vill.	Oregon 8262	+	do	38–45 × 13–16	−
	Calamagrostis canadensis (Michx.) Beauv.	Herb., J. J. Davis	+	Wisconsin	40–45 × 11.5–12	−
	do	Univ. Toronto, Crypt. Herb., 1292	+	Ontario	33–40 × 11–14	−
	C. canadensis var. *scabra* (Presl) Hitchc.	Fungi Columb., 5019	+	Montana	37–44 × 10.7–14	−
	C. epigeios (L.) Roth	Sydow, Myc. Ger., 640	+	Germany	40–50 × 14–16	−
	C. halleriana	Krieger, Fungi Sax., 791	+	do	35–42 × 11–12	−
	Dactylis glomerata L.	Saccardo (*14*)	−	France	30–32 × 11	−
	do	Wakefield (*16, p. 233*)	−	England	32–38 × 10–12	−
	do	Oregon 10583	+	Oregon	40–45 × 13–15	−
	do	Oregon 10044	+	do	30–41 × 12–14	−
	do	Oregon 10011	+	do	34–38 × 10–12	−
	do	Oregon 10094	+	do	30–39 × 11–13	−
	do	Oregon 10205	+	do	31–37 × 10–12	−
	do	Oregon 10322	+	do	34–37 × 9–12	−
	do	Krieger, Schol. Pilze, 192	+	Germany	32–36 × 11–12	−
	do	Krieger, Fungi Sax., 792	+	do	35–40 × 12–14	−
	do	Bondarzeva-Monteverde (*1*)	−	Union of Soviet Socialist Republics.	40–60 × 14–16	−
Range of conidial size					29–60 × 9–17	

[1] Illustrations showed ciliated spores.

The earliest, although brief, description of *Mastigosporium calvum* appears to be that of *M. album* var. *calvum* Ellis and Davis (*3*). The combination *M. calvum* (Ellis and Davis) comb. nov. is proposed and the following synonymy listed:

Mastigosporium calvum (Ellis and Davis) comb. nov.

Syn.: *M. album* var. *calvum* Ellis and Davis, 1903.
M. album var. *muticum* Sacc., 1911.
Fusoma rubricosa Dearn. and Barth., 1917.
Amastigosporium graminicola Bond.-Mont., 1921.
Amastigis graminicola Bond.-Mont. (Clements), 1931.
Excluded, *M. album* var. *athrix* Eriks.

Wollenweber proposed *Bactridium triseptatum* (Sacc.) Wr. in his illustrated card index (*17*). His illustration 457 is based on Jaap's Fungi Rel. Exs. 494 and is typical for *Mastigosporium calvum* on *Calamagrostis*. His illustration 458, however, shows a typical species of *Bactridium* (*B. gymnosporangii* (Jaap) Wr.) that has distinct, somewhat elongated conidiophores arising from a small but definite sporodochial pad. *M. calvum* can scarcely be placed under *Bactridium*. To have placed this fungus under the combination *B. triseptatum*, Wollenweber must have seen the type of *Fusoma triseptatum* Sacc. If this material were *M. calvum*, Saccardo may have fallen into a trap, because his description and his illustration (*12*) and those of the apparently identical species *F. biseptatum* Sacc. (*13, p. 69*) are apparently those of a very much smaller-spored fungus referable to *Septogloeum oxysporum* Bomm., Rouss., and Sacc. Saccardo names his fungus *F. triseptatum* and then lists it as two-septate, while *M. calvum* is triseptate. His later description of *F. biseptatum* is singularly like his earlier one of *F. triseptatum*. It is possible that both *M. calvum* and *S. oxysporum* occur in the type of *F. triseptatum*. However, the published description is the final criterion; and *M. calvum* cannot possibly be referred to *F. triseptatum*.

Mastigosporium album var. *athrix* Eriks. is a *Septogloeum* and should be known as *S. athrix* (Eriks.) comb. nov. (fig. 1, *P*). It is highly probable that it may be the same as *S. oxysporum*.

The writer has found no evidence that *Mastigosporium calvum* is connected with *Dilophospora alopecuri*. In Oregon material of *D. alopecuri* on *Holcus lanatus*, it certainly does not appear to be connected with *M. album*. *M. album* has not been found in Oregon, and Miss Sampson's pure culture of it appears to be entirely different from a pure culture of the race of *D. alopecuri* on *H. lanatus*.

SUMMARY

Mastigosporium calvum (Ellis and Davis) comb. nov. causes a purple flecking and a leaf spot on *Dactylis glomerata* and an eyespot on the leaves of several species of *Agrostis* in northwestern Oregon. The fungus is a destructive parasite on these grasses during mild, rainy weather in winter and spring. It occurs on *Calamagrostis* spp. in Wisconsin. It also occurs on these grasses in Europe. It has been considered a variety of *M. album* Riess, which differs from it in having hyaline apical appendages, whereas *M. calvum* is muticate. *M. album*, which is common on *Alopecurus pratensis* and *Deschampsia caespitosa* in Europe, has not been reported from North America.

The genus *Mastigosporium* is emended to include elliptical, three- to five-septate, hyaline conidia borne on short, stipitate conidiophores. The apex of the conidia may have appendages (*M. album*) or may not have appendages (*M. calvum*).

No evidence was obtained that *Mastigosporium album* Riess is related to *Dilophospora alopecuri* (Fries) Fries.

Mastigosporium album var. *athrix* Eriks. is assigned to *Septogloeum athrix* (Eriks.) comb. nov., and its possible relation to *S. oxysporum* is mentioned.

LITERATURE CITED

(1) Bondarzeva-Monteverde, V.
1921. [On the microflora of lower Orlovski. two new parasitic fungi.] Materialy po Mikologicheskomu Obsledovaniiu Rossii 5, No. 1, 4 pp. [In Russian. Description of fungi in Latin.]

(2) Clements, Frederic E., and Shear, Cornelius L.
1931. the genera of fungi. 496 pp., illus. New York.

(3) Davis, J. J.
1903. third supplementary list of parasitic fungi of wisconsin. Wis. Acad. Sci., Arts, and Letters, Trans. 14: [83]–106.

(4) Dearness, John.
1917. new or noteworthy north american fungi. Mycologia 9: 345–364.

(5) Frank, A. B.
1896. i. mastigosporium riess. *In* his Krankheiten der Pflanzen, Aufl. 2, v. 2, pp. 356–357. Breslau.

(6) Fresenius, Georg.
1850–63. beiträge zur mykologie. 111 pp., illus. Frankfurt-a.-M.

(7) Horsfall, James G.
1930. a study of meadow-crop diseases in new york. N. Y. (Cornell) Agr. Expt. Sta. Mem. 130, 139 pp., illus.

(8) Jaap, Otto.
1914. ein kleiner beitrag zur pilzflora von thüringen. Ann. Mycol. 12: 423–437.

(9) Jorstad, I.
1924. beretning om plantesygdommer i land og hagebruket i 1922–23. iv. landbruksvekster og grønnsaker. 38 pp. Christiania. [Abstract in Rev. Appl. Mycol. 4: 16–18. 1925.]

(10) Lindau, G.
1907. fungi imperfecti: hyphomycetes. (erste hälfte). *In* Rabenhorst L., Kryptogamen-flora von Deutschland, Oesterreich und der Schweiz. Aufl. 2, Bd. 1, Abt. 8. Leipzig.

(11) Rainio, A. J.
1936. über die dilophospora-krankheit von phleum pratense l. und alopecurus pratensis l. Valtion Maatalouskoet. Julkaisu. 87, 32 pp., illus. [In German. Selostus in Finnish, pp. [30]–32.]

(12) Saccardo, P. A.
1892. fusoma triseptatum sp. nov. *In* his Sylloge Fungorum . . ., v. 10, pp. 566–567. Patavii.

(13) ———
1893. fungilli novi europaei et asiatici. Grevillea 21 (99): [65]–69.

(14) ———
1911. notae mycologicae. Ann. Mycol. 9: [249]–257.

(15) Stapledon, R. G., Williams, R. D., Sampson, Kathleen, and Jenkin, T. J.
1922. preliminary investigations with herbage plants. Welsh Plant Breeding Sta. Aberystwyth, Bull. Ser. H, No. 1, 97 pp.

(16) Wakefield, E. M.
1918. new and rare british fungi. Roy. Bot. Gard. Kew, Bull. Misc. Inform. 1918 (6): 229–233.

(17) Wollenweber, H. W.
1917. fusaria autographice delineata . . . 56 pp. Berlin. (Extract from Ann. Mycol. v. 15, Nos. 1–2, 1917.)