

Canadian and some extralimital *Ophiobolus* species

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Received March 18, 1976

SHOEMAKER, R. A. 1976. Canadian and some extralimital *Ophiobolus* species. Can. J. Bot. 54: 2365-2404.

Descriptions and illustrations are given for 31 species of *Ophiobolus*. Two allied species of *Lulworthia*, and *Gaeumannomyces graminis* are briefly contrasted. *Ophiobolus* species now recorded in Canada are *O. acuminatus* (Sow. ex Fries) Duby in Rab., *O. anguillidus* (Cooke in Cooke & Ellis) Sacc., *O. cesatianus* (Mont. ex Ces. & De Not.) Sacc., *O. collapsus* Ellis & Sacc., *O. drechsleri* n.sp., *O. erythrosporus* (Riess in Rab.) Winter in Rab., *O. fulgidus* (Clinton & Peck in Peck) Sacc., *O. galii* Richon, *O. herpotrichus* (Fries) Sacc., *O. mathieui* (West.) Sacc., *O. minor* Bubak, *O. niesslii* Bäumler, *O. prunellae* (Ellis & Ev.) n. comb., *O. rubellus* (Pers. ex Fries) Sacc., and *O. tanacetii* (Fuckel) Sacc. Extralimital species include from U.S.A., *O. anthrisci* (L. Holm) L. Holm, *O. castellejiae* Tracy & Earl in Greene, *O. crassus* n.sp., *O. filiformis* (Wehmeyer) n. comb., *O. loniceriae* Fabre, *O. ophioboloides* (Sacc.) L. Holm, *O. robustus* (Strasser) n. comb., and *O. vermisporus* (Ellis) n. comb.; and from Europe, *O. cirsii* (Karsten) Sacc., *O. compressus* Rehm, *O. dictamni* (Fuckel) Sacc., *O. fruticum* (Rob. ex Desm.) Sacc., *O. megalosporus* (Auersw. & Niessl in Niessl) n. comb., *O. ponticus* Petrak, *O. pseudoaffinis* Petrak, and *O. rudis* (Riess) Rehm.

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L'auteur décrit et illustre 31 espèces d'*Ophiobolus* puis fait ressortir les caractères distinctifs de deux espèces affines de *Lulworthia* ainsi que du *Gaeumannomyces graminis*. La liste des espèces mentionnées pour le Canada est maintenant comme suit: *O. acuminatus* (Sow. ex Fries) Duby in Rab., *O. anguillidus* (Cooke in Cooke & Ellis) Sacc., *O. cesatianus* (Mont. ex Ces. & De Not.) Sacc., *O. collapsus* Ellis & Sacc., *O. drechsleri* n. sp., *O. erythrosporus* (Riess in Rab.) Winter in Rab., *O. fulgidus* (Clinton & Peck in Peck) Sacc., *O. galii* Richon, *O. herpotrichus* (Fries) Sacc., *O. mathieui* (West.) Sacc., *O. minor* Bubak, *O. niesslii* Bäumler, *O. prunellae* (Ellis & Ev.) n. comb., *O. rubellus* (Pers. ex Fries) Sacc., *O. tanacetii* (Fuckel) Sacc. Les espèces extraterritoriales comportent, des Etats Unis: *O. anthrisci* (L. Holm) L. Holm, *O. castellejiae* Tracy & Earl in Greene, *O. crassus* n. sp., *O. filiformis* (Wehmeyer) n. comb., *O. loniceriae* Fabre, *O. ophioboloides* (Sacc.) L. Holm, *O. robustus* (Strasser) n. comb., *O. vermisporus* (Ellis) n. comb.; de l'Europe; *O. cirsii* (Karsten) Sacc., *O. compressus* Rehm, *O. dictamni* (Fuckel) Sacc., *O. fruticum* (Rob. ex Desm.) Sacc., *O. megalosporus* (Auersw. & Niessl in Niessl) n. comb., *O. ponticus* Petrak, *O. pseudoaffinis* Petrak, and *O. rudis* (Riess) Rehm.

[Traduit par le journal]

Introduction

There has been no published taxonomic treatment of the species of *Ophiobolus* in Canada. Some species have been intensively studied because of their pathogenicity, but most of the species have been largely ignored. Very useful treatments have been published for Switzerland (Müller 1952) and Sweden (Holm 1948, 1957). These have application for certain species introduced to North America with their cultivated or weed hosts and for some circumpolar species. However, it seemed appropriate to bring together the present information on Canadian collections. The scope of the study includes a number of species occurring in neighbouring

U.S.A. because these species may in time be found in Canada.

Materials and Methods

The main collections studied are those of R. F. Cain, G. D. Darker, J. Dearness, W. L. Gordon, and L. E. Wehmeyer. Specimens are cited by accession number of the National Mycological Herbarium of Canada (DAOM).

Ascomycetes were studied first using a stereoscopic microscope with magnification up to 70 ×. This was a great aid in separating the frequently mixed collections containing several species of *Ophiobolus* as well as other pyrenomyces and coelomyces. Finer microscopic detail was studied using phase contrast. Sections were made freehand to examine wall structure. Asci, paraphyses, and ascospores were examined by extruding the

centrum, removing the ascocarp wall and debris, and gradually flattening the asci by gentle pressure on the cover glass or by letting the water used as a mounting medium evaporate and draw the cover glass down. It was often difficult to get free spores for examination, and many trials were necessary to show the entire spore. The appendages were usually apparent in freshwater mounts with phase contrast, but blue ink (Carters Midnight Blue) enhanced the contrast. The appendages were seen most readily on spores newly released from asci in water mounts. Spores mounted in lactic acid, lactophenol, or polyvinyl alcohol do not show the appendages. Spores were measured and drawn using oil immersion. Special attention was paid to the shape and position of enlarged cells, appendages, sequence of septation, constrictions, as well as the dimensions and shape of the spores. The position of enlargements, or other spore features, is described as a fraction (or decimal) of spore length, i.e., $\frac{1}{4}$ (or 0.25) being at a point one-fourth of the distance from the apex to the base of the spore. The spores provide the most useful key characters and are illustrated at a standard magnification of 1000 \times for every species.

Associated conidial fungi that may be states of *Ophiobolus* species are recorded whenever noted but mostly proved to be of little aid in taxonomic distinctions. Cultures were not used to any extent to establish conidial state connections in the present study.

The generic concept adopted for *Ophiobolus* is relatively broad, about that used by Müller (1952) and Holm (1948). Holm (1957) accepted a much narrowed concept of *Ophiobolus* (two species, with provisional inclusion of a third) and transferred others to *Nodulosphaeria*, *Leptospora*, etc. Reference is made to these important dispositions. However, for a regional study without access to a full range of specimens on a world basis, I choose to use *Ophiobolus* in a fairly broad sense as described below. A key to species based mainly on ascospore features precedes the descriptive part in which the species of *Ophiobolus* (plus *Gaeumannomyces* and *Lulworthia*) are arranged alphabetically by specific epithet.

The extensive synonymy for most species can be found in Holm (1957), who gave good coverage of the European collections. The facultative synonyms cited herein involve additional, mainly North American, names not treated by Holm.

Generic Characteristics of *Ophiobolus*

Ascocarps solitary to clustered, immersed erumpent or exposed, more or less spherical, usually brown to nearly black, rarely red or yellow, mostly glabrous without distinctive setae, but some with conspicuous mycelium under and on ascocarps; wall a textura globulosa near outside and a textura prismatica nearer the centrum. Beak cylindrical, usually apical and erect, not lateral, usually shorter than the ascocarp but may be long in some species, with or without lining periphyses, sometimes with projecting terminal hyphae. Pseudoparaphyses present,

originating at top of centrum and soon branching, lower ends intermingled with crozier system, hyaline, septate, narrow, often mucilage-coated, persistent but not conspicuous with mature asci. Asci numerous, from well-developed basal layer of repeating croziers, bitunicate, without apical annulus or pulvillus, long-cylindrical to clavate, with a short foot, four- or eight-spored, spores in one fascicle or some partly extended into the foot of the ascus. Ascospores some shade of yellow or brown, scolecosporous, multi-septate, often with one or more enlarged cells, rarely with conspicuous constrictions, disarticulating into subequal part spores or individual cells in some species, without a continuous sheath, sometimes with one or more globose gelatinous terminal appendages, mostly 3–5 μ m wide, but some species have very narrow spores about 1 μ m in diameter.

Distinctions of Allied Genera

Gaeumannomyces von Arx & Olivier, Trans. Br. Mycol. Soc. 35: 32. 1952, is distinguished by the presence of an annulus in the ascus and the presence of apically free paraphyses and a lateral beak. The name *O. graminis* Sacc. has been widely used in phytopathology, but the take-all organism clearly does not belong in *Ophiobolus*. A recent description of *G. graminis* (Sacc.) von Arx & Olivier var. *tritici* Walker was given by Shoemaker (1974).

Linospora Fuckel, Jahrb. Nass. Vereins Naturk. 23–24: 123, 1869 (1870), is distinguished by the ink-positive annulus in the ascus and the lateral beak.

Nodulosphaeria Rab., Herb. Myc. ed. 2, 725. 1858, has brown periphyses lining the ostiole of the beak. Ascospores tend to be shorter and typically equipped with curved terminal appendages. Authors do not agree on the distinctions and precise limit between *Ophiobolus* and *Nodulosphaeria*. Brief discussion can be found under *O. acuminatus* and *O. megalosporus*.

Ophiocarpella Theissen & Sydow, Ann. Myc. 13: 644. 1915, contains one species now treated as *Sphaerulina tarda* (Harkness) Barr, Contrib. Univ. Mich. Herb. 9: 606. 1972. This species lacks paraphyses or pseudoparaphyses. The name *Ophiocarpella* is a synonym of *Sphaerulina* Sacc. Michelia, 1: 399. 1878.

Acanthophiobolus Berlese, Atti Congr. Bot.

Genova, p. 571. 1893 (*Ophiochaeta* Sacc.) has setose ascocarps.

Ophioceras Sacc., Syll. Fung. 2: 358. 1883, is distinguished by the extremely long beak on ascocarps.

Leptospora Penzig & Sacc., Malpighia, 11: 406. 1897, differs in having non-fasciculate ascospores.

Leptospora Rab., Hedwigia, 1: 116. 1857, is used for *L. rubella* ([Pers.] Fries) Rab. by Holm

and might be suitable for other narrow-spored species.

Lulworthia Sutherland, Trans. Br. Mycol. Soc. 5: 259. 1915 (1916), lacks pseudoparaphyses and has deliquescing asci and nonseptate scoleospores. Two species of *Lulworthia* described originally in *Ophiobolus* are included in the key and descriptive part. They are *L. halima* and *L. medusa* and can be found by reference to the epithets, which are arranged alphabetically.

KEY TO SPECIES BASED ON CHARACTERISTICS OF ASCOSPORES

- | | |
|---|----------------------|
| 1. Ascospores nonseptate (<i>Lulworthia</i>) | 2 |
| 2. Appendages 3.0–5.5 μm long; on <i>Zostera</i> | <i>L. halima</i> |
| 2. Appendages 7.0–8.5 μm long; on <i>Spartina</i> | <i>L. medusa</i> |
| 1. Ascospores septate (<i>Ophiobolus</i>) | 3 |
| 3. Ascospores disarticulating | 4 |
| 4. Disarticulation giving equal part spores | 5 |
| 5. Part spores 55–60 μm long, 5- to 8-septate | <i>ophioboloides</i> |
| 5. Part spores 70–90 μm long, 12- to 15-septate | <i>acuminatus</i> |
| 4. Disarticulation into individual cells | 6 |
| 6. Cells 1.5 μm wide | <i>anthrisci</i> |
| 6. Cells 3.0–3.5 μm wide | <i>rudis</i> |
| 3. Ascospores remaining intact | 7 |
| 7. No conspicuous cellular enlargement | 8 |
| 8. Ascospores under 2.5 μm wide | 9 |
| 9. Ascospores 1.0–1.5 μm | <i>rubellus</i> |
| 9. Ascospores 1.5–2.5 μm | 10 |
| 10. Ascospores 85–130 μm long | <i>galii</i> |
| 10. Ascospores 140–200 μm long | <i>herpotrichus</i> |
| 8. Ascospores over 2.5 μm wide | 11 |
| 11. Ascospores 5- or 7-septate | 12 |
| 12. Ascospores 5-septate | <i>minor</i> |
| 12. Ascospores 7-septate | 13 |
| 13. Ascospores appendaged | <i>vermisporus</i> |
| 13. Ascospores not appendaged | <i>fulgidus</i> |
| 11. Ascospores over 7-septate | 14 |
| 14. Ascospores over 40-septate | <i>lonicerae</i> |
| 14. Ascospores under 40-septate | 15 |
| 15. Ascospores red-brown 85–125 \times 4.0–4.5 μm , 15-septate | <i>drechsleri</i> |
| 15. Ascospores yellowish 130–160 \times 4.0–5.0 μm , 11- to 15-septate | <i>crassus</i> |
| 7. All or part of a cell obviously enlarged | 16 |
| 16. Enlargement involving complete cell | 17 |
| 17. One cell of ascospore enlarged | 18 |

| | |
|--|----------------------|
| 18. Enlarged cell apical or subapical | 19 |
| 19. Enlarged cell apical | <i>anguillidus</i> |
| 19. Enlarged cell second or third from apex | <i>dictamni</i> |
| 18. Enlarged cell submedian | 20 |
| 20. Ascospores appendaged | 21 |
| 21. Appendages cushion-shaped, fourth cell enlarged | <i>filiformis</i> |
| 21. Appendages conical | 22 |
| 22. Fourth cell enlarged | <i>robustus</i> |
| 22. Sixth cell enlarged | <i>megalosporus</i> |
| 20. Ascospores not appendaged, 10th cell enlarged | <i>cirsii</i> |
| 17. Two or more cells enlarged | 23 |
| 23. Enlargements adjacent | <i>tanaceti</i> |
| 23. Enlargements separated by two-four central cells | 24 |
| 24. Ascospores 16-septate | <i>ophioboloides</i> |
| 24. Ascospores 24- to 30-septate | <i>acuminatus</i> |
| 16. Enlargement involving only part of cell(s) | 25 |
| 25. Enlargement a median or subapical ring | 26 |
| 26. Enlargement median in usually fourth cell | <i>mathieui</i> |
| 26. Enlargement subapical in usually third or fourth cell | <i>pseudoaffinis</i> |
| 25. Enlargement(s) involving part of cell adjacent septa | 27 |
| 27. Enlargement only near first-formed (submedian) septum | 28 |
| 28. Appendages present | 29 |
| 29. Appendage basal | <i>castillejae</i> |
| 29. Appendages apical and basal | <i>niesslii</i> |
| 28. Appendages lacking | 30 |
| 30. Enlargement at 0.25 or above | <i>ponticus</i> |
| 30. Enlargement at 0.40-0.45 | 31 |
| 31. Ascospores 7-septate | 32 |
| 32. Ascospores 70-85 × 2-3 μm | <i>collapsus</i> |
| 32. Ascospores 95-155 × 3-5 μm | <i>prunellae</i> |
| 31. Ascospores 11- to 23-septate | 33 |
| 33. Ascospores 3.0-3.5 μm wide | <i>erythrosporus</i> |
| 33. Ascospores 4.0-4.5 μm wide | <i>compressus</i> |
| 27. Enlargement at septa between cells 4 and 5, 8 and 9, 12 and 13 | 34 |
| 34. Ascospores eight per ascus, not constricted | <i>fruticum</i> |
| 34. Ascospores four per ascus, constricted between enlargements | <i>cesatianus</i> |

Species Descriptions

Ophiobolus acuminatus (Sow. ex Fries) Duby in Rab. Herb. Myc. ed. 2, 57. 1855.

Figs. 23, 33, 34, 52, 62

≡ *Sphaeria acuminata* Sow. ex Fries, Syst. Mycol. 2: 506. 1823.

Ascocarps immersed becoming completely exposed, solitary to loosely clustered, globose to

pyriform, mostly smooth, rarely surrounded by brown mycelium, 300-400(500) μm diam with gradual elongation into a terete beak 50-100 μm diam and 100-150 μm high, furnished internally with periphyses 1.0-1.5 μm wide; wall 35-50 μm thick of two types of cells, external ones in three-five layers, dark brown, globose, thick-walled, 7-10 μm diam, internal ones in three-

five layers, hyaline, rectangular and thin-walled, 7–15 × 3–5 μm. Asci in a broad basal hymenium, bearing eight spores in one fascicle, 150–190 × 13–17 μm, interspersed with pseudoparaphyses 1.0–1.5 μm wide and septate at 15 to 25-μm-intervals. Ascospores straight or slightly intertwined, subcylindrical with slight narrowing towards the lower end, yellow to brown, without appendages or sheath, 140–180 × 3.0–4.0 μm, (17)23- to 30-septate, often separating at the mid-septum into two subequal part spores each with the second (rarely third) cell from the point of disarticulation enlarged near a septum, cells biguttulate, of nearly equal length, and when fully mature only slightly longer than wide.

COLLECTIONS EXAMINED: CANADA: NOVA SCOTIA: 121749, *Cirsium* sp. Duncan Brook, Wolfville, L. E. Wehmeyer 3299 & A. P. Prince, 26.VI.1926. ONTARIO: 136694, *Arctium* sp. overwintered stems, Willowdale, York County, D. Malloch, 6.VII.1969; 136690, *Cirsium arvense* (L.) Scop. overwintered stems, Willowdale, York County, D. Malloch, 6.VII.1969; 136347, *Cirsium* sp. overwintered stem, junction of Gibson River and Hwy. 103, Gibson Township, Muskoka District, D. Malloch, 18.VIII.1968; 37024, *Cnicus lanceolatus* dead stems (*Cirsium vulgare* (Savi) Tenore) London, J. Dearness, V.1891, as Ellis & Everhart N. Am. Fungi 2748; 129625, *Cirsium lanceolatum* (*C. vulgare*) NE corner London Township, Middlesex County, J. Dearness, 28 May 1891, sent to Rehm as *O. acuminatus*, who determined it as *O. cirsii* (Karsten) Sacc. 6.I.1913 and distributed it in Rehm: Asco. #1848; 129676, large Scotch thistle stems, Wonnacotts, J. Dearness, 30.V.1936; 129672, *Lappa* sp., Granton (Biddulph Township, Middlesex County) J. Dearness, 23.VIII.1895, det. J. B. Ellis, 18.IX.1895; 129686 *Osmodium* sp. London, J. Dearness, VIII.1895, Ellis & Everhart F. Col. 830(a); 41043, *Solidago* sp. New Durham, Brant County, R. F. Cain, 29.V.1943, TRTC 31155. BRITISH COLUMBIA: 37023, *Cirsium lanceolatum* (*C. vulgare* (Savi) Tenore) Vancouver Island, J. Macoun 926, 1915; 114075, *Cirsium* sp. Eagle River Valley, 5 mi W of Malakwa 50°53' N, 118°52' W, R. A. Shoemaker, 30 May 1966; 34171(a), *Cirsium* sp. Saanichton, M. E. Barr, 14.VI.1950, UBC 1969; U.S.A.: NEW YORK: 129678, *Cnicus arvensis* (*Cirsium arvense*), near Vaughn's Schoolhouse, N of Hudson Falls, Wash. County, Stewart H. Burnham 115 ex Herb. J. Dearness. AUSTRIA: 129615, *Lappa*

majoris, pr. Tulln, Niessl, 12.V.1911. ENGLAND: 121685, *Arctium lappa*, Shelsley Beauchamp, Worcestershire, P. G. M. Rhodes 2949, 7.VI.1927, conf. W. B. Grove. FINLAND: 105465, *Cirsium arvense* L., Nylandia, Helsinki, Lauttasaari, Viljo Kujala 830, 30.IV.1947. SWEDEN: 37025, *Cirsium* sp., Holmia, H. Hamberg, VI.1891; 37027, *Lappa* sp., Holmia, H. Hamberg, 25.IX.-1891; 37028, *Cirsium lanceolatum*, Stockholm, Lars Romell, VII.1888; 37029, *Cirsium arvense*, Gotl. Visby d. L. Romell, 6.VII.1887.

This species occurs mainly on stems of Compositae. It is one of the commonest species in Sweden (Holm 1957) and is well represented in Canada, probably having been introduced with the weedy hosts.

Ophiobolus acuminatus, the type of the genus *Ophiobolus* Riess, has the character of disarticulation into two subequal part spores, which is found again only in the shorter-spored *O. ophioboloides* (Sacc.) L. Holm among the species included in *Ophiobolus*. However, some spores of *O. acuminatus* are discharged intact without separation (Shoemaker *et al.* 1974) and I am reluctant to use the character of disarticulation to restrict *Ophiobolus* to a genus consisting of only two species. Moreover, disarticulation by single cells occurs in other species.

The spores of *O. acuminatus* and *O. ophioboloides* would provide an interesting study of forcible discharge mechanisms because of the two enlarged cells on each spore.

A conidial state referable to *Coniothyrium* was found associated in one collection and is illustrated as Fig. 33. It is similar to the conidial states found by Drechsler (1934).

Ophiobolus anguillidus (Cooke in Cooke & Ellis) Sacc. Syll. Fung. 2: 341. 1883. As 'anguillides.' Figs. 1, 35, 36, 53, 61
≡ *Sphaeria anguillida* Cooke in Cooke & Ellis, Grevillea, 6: 15. 1877.

Ascocarps clustered, erumpent, spherical, smooth, 500–600 μm diam, with a short terete beak 100–150 × 40–60 μm internally lined with hyaline paraphyses; wall 40–80 μm thick of four–seven layers of thick-walled isodiametric brown cells 6–15 μm diam. Asci in a broad basal hymenium, 120–140 × 12–15 μm, bearing eight spores in a fascicle, interspersed with pseudoparaphyses 1.5–2.0 μm wide and septate at 10- to 20-μm intervals. Ascospores yellowish, with apical cell enlarged and shaped like a snake's head,

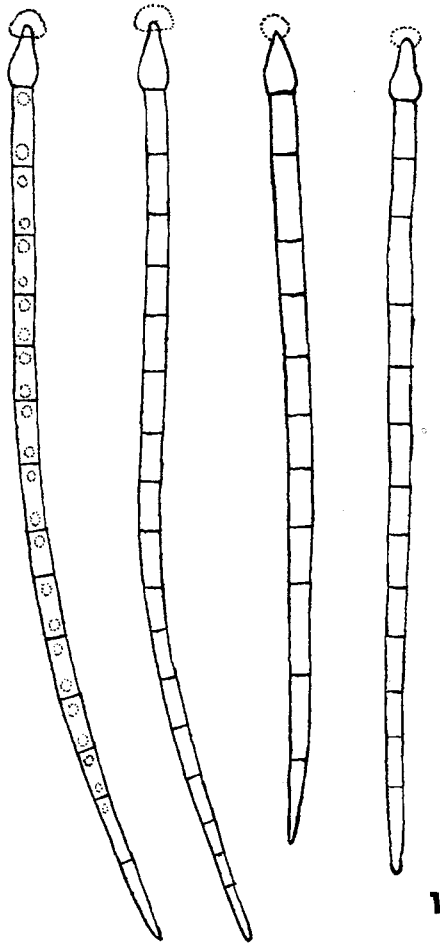


FIG. 1. *O. anguillidus*, 129705, 129708, 97800, 121790.

14- to 17-septate, 120–130 × 2.5–3.0 μm, (apical cell 3.5–4.5 μm wide) cells biguttulate, apex with a readily demonstrable mucilaginous hemispherical appendage.

COLLECTIONS EXAMINED: CANADA: ONTARIO: 129607, *Ambrosia* sp. stem, James St. London, 2.VIII.1904; 129608, ? *Ambrosia* sp. stem, Grosvenor St. London, (cf. *Fungi Columbiani* 1547) 1.VIII.1904; 129609, *Ambrosia artemisiifolia* L. dead stems, London Street Railway Crossing at West City Limits, London, 26.VIII.-1910, verified by Rehm, 27.I.1911; 129611, same data except part sent to *Fungi Columbiani* in March 1911; 129612, *Ambrosia trifida* L. stems, under Oxford Bridge, London, May–3 June 1911; 129634, *Ambrosia artemisiifolia* L. stems, Port Stanley, 17.VII.1912; 129636, dead herb stem, London Street Railway Crossing at West

City Limits, London, 6.IX.1923; 129643, *Achillea millefolium* L. dead stem, Lucan Crossing, Biddulph Township, Middlesex County, 12 July 1893, all ex Herb. Dearness; 136348, *Ambrosia* sp. overwintered stem, Nashville, York County, D. Malloch, 18.V.1968; 85057, *Arctium* sp. old stems, New Durham, Brant County, R. F. Cain TRTC 18371, 1.VI.1941; 86097, *Cerastium vulgatum* L., New Durham, Brant County, R. F. Cain TRTC 19003, 12.VI.1943; 86083, *Phryma leptostachya* L., New Durham, Brant County, R. F. Cain TRTC 4592, 3.VI.1933; 86084 *Solidago* sp. decaying stems, New Durham, Brant County, R. F. Cain TRTC 6144, 7.VII.-1932; 29636 (=85058), *Solidago* sp. New Durham, Brant County, R. F. Cain TRTC 23143, 25.V.1943; 86085, *Verbena hastata* L. decaying stems, New Durham, Brant County, R. F. Cain TRTC 6143, 7.VII.1932; 14770 (=85056), decaying herbaceous stem, New Durham, Brant County, R. F. Cain TRTC 18373, 1.VI.1941; 29638 (=85060), on overwintered herbaceous stems, New Durham, Brant County, R. F. Cain TRTC 23137, 25.V.1943. U.S.A.: ILLINOIS: 121773, *Cirsium* sp. Walton's Heights, Quincy, L. E. Wehmeyer 3308, 18.VII.1925; 97797, probably *Ambrosia trifida* L. or *Helianthus* sp. Vulcan, St. Clair County, G. D. Darker 8244, 31.I.1941. MICHIGAN: 121790, *Ambrosia* sp. Whitmore Lake, W. A. Archer, det. L. E. Wehmeyer 3304, 29.IV.1922; 121738, *Arctium* sp. Cedar Bend, Ann Arbor, L. E. Wehmeyer 3309, 22.IV.1922. MISSISSIPPI: 37026, *Ambrosia artemisiifolia*, Starkville, J. S. Moore 5007, 14 June 1895. MISSOURI: 97800, *Compositae* indet., Crow's Nest Stop, Creve-Coeur-St. Louis Line, St. Louis, G. D. Darker 6784, 25.IV.1941; 92171, dead herbaceous stems, Creve-Coeur Creek, end of Ladue Road, St. Louis County, G. D. Darker 7301, 9.V.1942; 97774, on overwintered stems of some herbaceous plant, Maramac River, near St. Clair, G. D. Darker 6888, 19 July 1941. NEW JERSEY: 129705, ex Ellis Collection, NYBG, *Bidens* sp. stem, Newfield (Gloucester County) (Ellis) 2390, Aug. 1876. TYPE: NEW YORK: 129610, ex Herb. Dearness *Artemesia artemisaefolia* (*Ambrosia artemisiifolia* L.), Vaughns to Kingsberry, 5 mi N of Hudson Falls, Wash. County, Stewart H. Burnham 116, 20.VI.1916. NORTH DAKOTA: 86082, ex Herb. R. F. Cain 1806 *Iva xanthifolia* Nutt., Kulm, F. J. Seaver F. Dak. 38, VII.1908.

This is one of the most striking and easily

recognized species of *Ophiobolus* because of the characteristic wider and acuminate apical cell with its persistent, readily demonstrated hemispherical appendage. It is reasonably common in North America but has not been recorded in the major European monographs.

On transfer to the genus *Ophiobolus*, the epithet was spelled *anguillides* by Saccardo, which may have been a typographic error for the masculine ending '-idus' or a deliberate change to the Greek termination '-ides.' The latter course would result in an epithet derived from Latin and Greek. It seems better to me to retain the original suffix '-idus, a, um' and use the spelling *O. anguillidus*.

Ophiobolus anthrisci (L. Holm) L. Holm, Symb. Bot. Upsal. 14(3): 77. 1957. Figs. 24, 37, 38
 ≡ *Ophiobolus nigromaculatus* Rehm f. *anthrisci* L. Holm, Sven. Bot. Tidskr. 42: 345. 1948.

Ascocarps scattered immersed to partially erumpent, pyriform, 400–600 µm diam, lightly covered with mycelium, beak very broad but short, 150–200 µm diam, 75–150 µm long, lined internally with hyaline periphyses 1.5–2.5 µm wide, 30–50 µm long, lacking apical mycelium or setae; wall 30–50 µm of 6–10 layers of subglobose cells 7–12 µm diam, externally a thick-walled dark brown scleroplectenchyma, internally thin-walled and light brown. Asci numerous from a broad hymenium, cylindrical, 180–250(300) × 6–7 µm, eight-spored, interspersed with hyaline 1.5- to 2.5-µm wide pseudoperiphyses septate at 20- to 40-µm intervals. Ascospores parallel in one fascicle, cylindrical, 160–230 × 1.5 µm, 35- to 40-septate, yellow-brown, not guttulate, readily separating into cells 4–10 µm long, without sheath, appendages, enlargements, or before disarticulation, conspicuous constrictions.

COLLECTIONS EXAMINED: U.S.A.: UTAH: 121785, *Rudbeckia occidentalis* Nutt., Perish Canyon, Davis County, 9000 ft, *S. Flowers* 10, 10.VI.1950; 121786, *Rudbeckia occidentalis* Nutt., Wasatch Mountains, Perish Canyon, Davis County, 9000 ft, *S. Flowers* 4, 20.VI.1950, Wehmeyer Herb. sub *Ophiobolus nigromaculans* [sic] Rehm??.

Ophiobolus anthrisci has not yet been found in Canada. The ascocarps are reasonably distinctive because of their size and the broad, short beak. The ascospores are relatively narrow and separate into individual cells like those of *O. rudis*.

Ophiobolus rudis is easily distinguished by the long prominent beak and clustered ascocarps. *Ophiobolus anthrisci* differs from the description of *O. nigromaculatus* Rehm. The latter has broader asci (12 µm) and broader ascospores (2.5–3.0 µm) that remain hyaline.

Wehmeyer had referred the two collections doubtfully to *O. nigromaculans* Rehm, which I take to mean *O. nigromaculatus* Rehm. There is no indication that he considered *O. nigromaculatus* f. *anthrisci* L. Holm published in 1948. I believe the two Utah collections are a good match to the description given by Dr. Holm. The Utah collections are described with illustrations to aid in the search for this species in Canada.

Ophiobolus castillejae Tracy & Earl in E. L. Greene, *Plantae Bakerianae*, 1(1): 34. 1901.

Fig. 2

Ascocarps scattered, erumpent, globose, 200–250 µm diam, beak terete, 90–140 µm diam, 60–90 µm long, lined with hyaline periphyses 10–15 × 2–3 µm; wall 30–35 µm of six–eight layers of dark brown, thin-walled polygonal to rectangular cells 8–12 × 4–6 µm. Asci numerous in a broad hymenium, cylindric to clavate, 90–

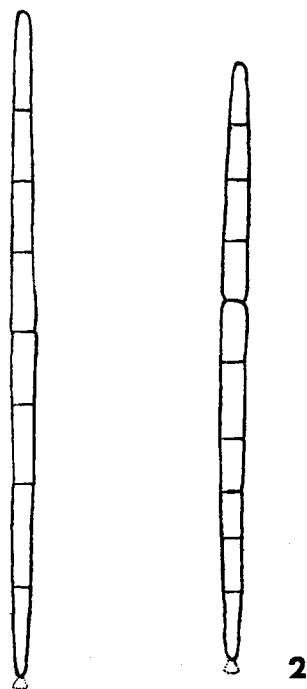


FIG. 2. *O. castillejae*, 129616, 129617.

120 × 10–14 μm, eight-spored, interspersed with mucilage-coated 2- to 3-μm-wide pseudoparaphyses septate at 20- to 30-μm intervals. Ascospores parallel in one fascicle, straight, widest near middle, tapered slightly to apex and strongly to narrower base, 50–80 × 3–4(5) μm, seven (nine)-septate, slightly constricted at first-formed septum near middle, yellow, guttulate, with cushion-like basal mucilaginous appendage.

COLLECTIONS EXAMINED: on *Castilleja miniata* Dougl.: U.S.A.: WASHINGTON: 129616, 5.5 mi SW of Ione, *G. G. Hedcock* 67418, 11.VII.1935; 129617, 8 mi SW of Ione, *G.G.H.* 54605, 15.VII.1931; 129618, 4.5 mi W of Ione, *G.G.H.* 63446, 17.VI.1934, all ex Herb. Dearness sub *O. consimilis* Ell. & Ev.

Ophiobolus castillejæ has not been reported in Canada, though the host occurs here. The fungus is inconspicuous on overwintered stems and might easily be overlooked. It is unusual and should be easily recognized if the ascospore appendage is seen.

The easiest character to separate *O. castillejæ* is the basal appendage. *Ophiobolus anguillidus* has a single apical appendage. *Ophiobolus castillejæ* is the only species of *Ophiobolus* I know with a solitary basal appendage. In a number of features it is like *O. vermisporus*, which has appendages on both ends of the slightly curved, more nearly colorless ascospores.

Ophiobolus cesatianus (Mont. ex Ces. & De Not).
Sacc. Syll. Fung. 2: 339. 1883.

Figs. 3, 39, 54, 64
≡ *Rhaphidospora cesatiana* Mont. ex Ces. & De Not. Coment. Soc. Crittogam. Ital. 1: 234. 1863.

≡ *Leptosphaeria cesatiana* (Mont. ex Ces. & De Not). L. Holm, Symb. Bot. Upsal. 14(3): 39. 1957.

Ascocarps clustered or in rows, immersed, pyriform, 300–400 μm diam, surrounded by dark brown mycelium that penetrates and blackens the host cells, beak erumpent, terete, broad and evident 130–170 μm long, 125–180 μm diam; wall of two kinds of cells, externally thick-walled, polygonal 4–6 μm diam, pale brown, in five-seven layers, internally of larger globose thin-walled hyaline cells 8–12 μm diam with some rectangular cells 9–12 × 3–5 μm. Asci numerous in a broad hymenium (80)120–150 × 10–16 μm interspersed with hyaline 1- to 2-μm-wide pseudoparaphyses septate at 15- to 20-μm

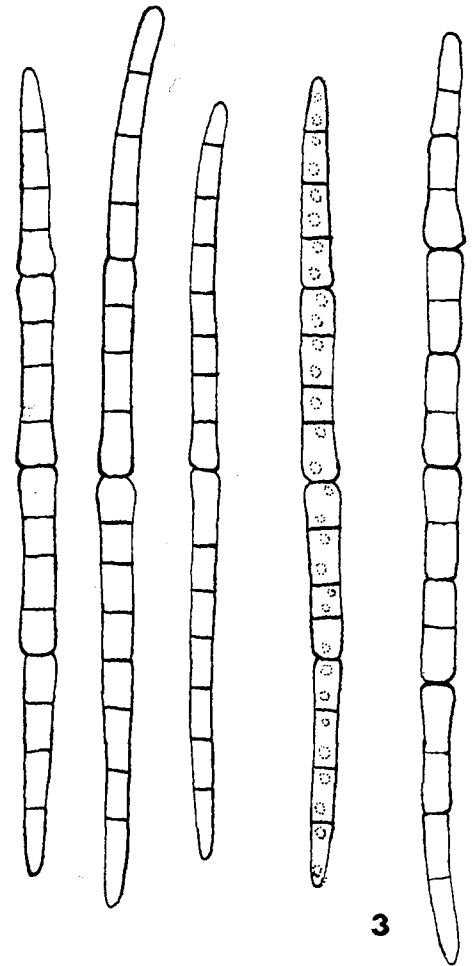


FIG. 3. *O. cesatianus*, 129620, 129672 (three spores), 129644.

intervals, four-spored. Ascospores parallel in one fascicle (100)110–120(135) × 3–4 μm, 15-septate yellow-brown, guttulate, constricted at first-formed septum fractionally above the middle with slight rounded enlargement at each side of the constriction, sometimes with similar formations at the second-formed septum between cells 4 and 5 and 12 and 13, without sheath or appendages.

COLLECTIONS EXAMINED: CANADA: ONTARIO: 129620, *Echium vulgare* L. E of Redmond's Bog, London, *J. Dearness*, 6.V.1911, det. Rehm; 129621, *Echium*, N end of Maitland St. at River Thames, London, *J. Dearness*, 31.VII.1911; 129622, *Echium vulgare* L. E of Redmond's Bog, London, *J. Dearness*, V.1911, sent gathering to F. Col. (see 3440) June 1911; 129644, *Onos-*

modium carol., (? *O. molle*) Oliver's pasture, Concession IV, London, *J. Dearness*, 1.VIII.1895. GERMANY: 129624, Johs Kunze, Fungi selecti exsiccati 81. *Echium vulgare* L. Neckendorfer Thal, pr. Islebia, Sax. Bor. rarissime, *Johs Kunze*, VII.1875 ex Herb. Dearness.

Ophiobolus cesatianus is fairly distinctive with the dark clypeus-like mycelium around the strong beaks, the four-spored asci, and the regularly 16-celled ascospores with a constriction just above the middle and less often at $\frac{1}{4}$ and $\frac{3}{4}$ points. The ascospores might be confused with those of *O. fruticum*, which are sometimes 16-celled but with enlargements lacking constrictions at 0.4 of the length and as well as at points intermediate between 0.4 and the base and between 0.4 and the apex.

Ophiobolus cirsii (Karsten) Sacc. Syll. Fung. 2: 341. 1883. Figs. 25, 40, 41, 63

≡ *Rhaphidospora cirsii* Karsten, Medd. Soc. Fauna Fl. Fenn. 5: 49. 1880.

≡ *Nodulosphaeria cirsii* (Karsten) L. Holm, Symb. Bot. Upsal. 14(3): 92. 1957.

Asocarps scattered, immersed, becoming erumpent, often covered with brown mycelium, or setae on the beak, pyriform, 350–400 μ m diam, 500–550 μ m high, with a terete beak 150–200 μ m long, 120–160 μ m wide, beak terminating in straight brown hairs 30–50 \times 5–7 μ m and lined internally with similar periphyses; wall 30–50 μ m of five–eight layers, externally of polygonal cells 7–10 μ m diam, thick-walled and finally brown, internally of rectangular cells 15–20 \times 4–7 μ m. Asci numerous from a broad hymenium, eight-spored, 170–200 \times 10–14 μ m, interspersed with pseudoparaphyses 3–4 μ m wide septate at intervals of 14–30 μ m. Ascospores parallel in one fascicle, cylindrical (120)140–170 \times 4–5 μ m 15- to 23-septate, greenish-yellow, without sheath or appendages, inflated at 10th cell, the inflation more pronounced near the ninth septum, apical part bent or curved and about $\frac{2}{3}$ of the length of the 9- to 11-septate lower part of the spore.

COLLECTIONS EXAMINED: CZECHOSLOVAKIA: 51746, *Cirsium* sp. Jěstěd, prope Liberec, *S. J. Hughes*, 10.V.1955. LATVIA: 121664, *Cirsium palustre* (L.) Scop., Lettland, Prov. Vidzeme, Viskiena, *K. Starcs* 0346, 18.VII.1932, ex Herb. Wehmeyer. SWEDEN: 14519, *Cirsium palustre*, Hälsingland, Los, Ryggskog, *J. Ax. Nannfeldt*, *Fungi Suecici* 14519, 21.VII.1956, det. L. Holm.

SWITZERLAND: 90405, *Cirsium* sp. Airolo-Nante, Tessin, 1140–1500 m, *E. Müller*, *S. Blumer*, *R. A. Shoemaker*, 8.VI.1961.

Ophiobolus cirsii might reasonably be expected in North America since some of the hosts occur here. The fungus was recorded on the basis of spore trappings (Shoemaker *et al.* 1974), but I have not seen collections of ascocarps, and the species must still be sought. To aid the search, a description and illustrations are included from some European collections.

The species is recognized by the setose ascocarps, the brown projecting beak hyphae and internal periphyses, and the apically bent ascospores with the enlarged cell at 0.40 of the length.

Ophiobolus collapsus Ellis & Sacc. in Sacc. *Michelia*, 2: 374. 1881. Figs. 4, 42, 43, 65

Asocarps clustered, erumpent, depressed-globose to cupulate, 400–600 μ m diam, 250–350 μ m high (when collapsed); beak erumpent, terete, 70–90 μ m diam 30–50 μ m long, lined with periphyses 2–3 μ m wide 15–20 μ m long, lacking terminal hyphae or setae, filled by hyaline pseudoparenchyma when young; wall 30–40(50) μ m of four–seven layers of cells, externally sub-

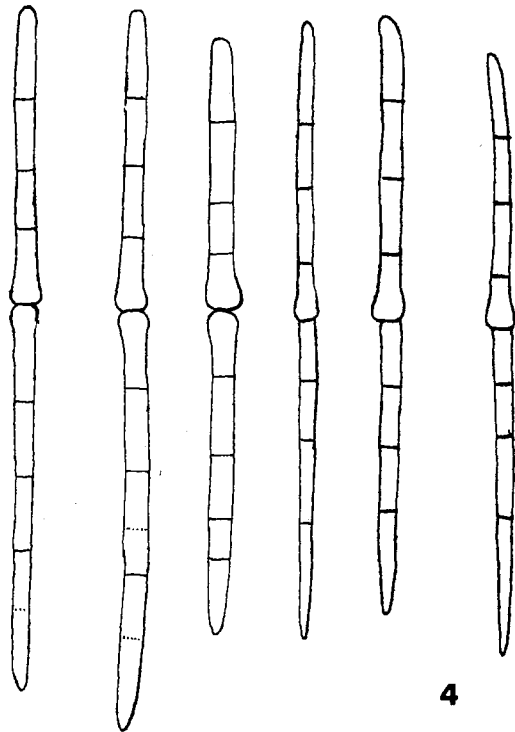


FIG. 4. *O. collapsus*, 129675 (three spores), 128731.

globose thick-walled, dark brown, 4–7 μm diam, internally rectangular, thin-walled, pale brown, 6–10 \times 2–4 μm . Asci numerous in a broad hymenium, cylindrical 80–120 \times 8–12 μm , eight-spored, interspersed with numerous 2- to 3- μm -wide mucilage-coated pseudoparaphyses septate at 10- to 15- μm intervals. Ascospores parallel in one overlapping fascicle, approaching two distinct fascicles, subcylindric, constricted at median (first-formed) septum, and fourth cell enlarged adjacent to this septum, 70–85 \times 2.0–3.0 μm , seven-septate, yellow, cells biguttulate, without sheath or appendages.

COLLECTIONS EXAMINED: CANADA: NEWFOUNDLAND: 74260(c), *Dryas integrifolia* Vahl f. *canescens* (Simmons) Fern., Port au Port, Table Mountain, E. Rouleau 3743, 25.VII.1953. ONTARIO: 129675, *Erigeron*, Grosvenor Street, London, J. Dearness, 2.VIII.1904. U.S.A.: NEW JERSEY: 128731, *Trifolium pratense* L., Newfield, J. B. Ellis, V.1880, Ellis, N. Am. Fungi 584, part of type.

Ophiobolus collapsus is well-named, the epithet denoting the collapsed cupulate form of the ascocarps. The ascocarps are mostly eight-celled, constricted at the first-formed septum, which is near the midpoint, and inflated just above the septum. As Holm (1957, p. 95) noted, the species concept was confused by Berlese's incorrect rendering of the ascospores and Müller's consequent application of *O. collapsus* to specimens referable to *O. ponticus* or *O. niesslii*.

One Canadian record and the only one published by Connors (1967, p. 104) was apparently affected by the confused concept. Barr (1959, pp. 351, 352) reported *O. collapsus* on *Dryas integrifolia* f. *canescens* from Newfoundland. Part of the collection was examined to see if the record could be settled. No *Ophiobolus* was found. From Barr's (1959, Fig. 89) drawing and description it seems more likely the fungus was *O. niesslii*. At the moment the record of *O. collapsus* from Newfoundland seems to be based on some other species. The species does occur in Ontario based on the 1904 Dearness collection which he had determined as *O. acuminatus*.

Ophiobolus compressus Rehm, Ber. Naturhist. Ver. Augsburg, 26: 49. 1881.

Figs. 5, 44, 66
= *Leptosphaeria compressa* (Rehm) L. Holm,
Symb. Bot. Upsal. 14(3): 29. 1957.

Ascocarps clustered, erumpent to superficial,

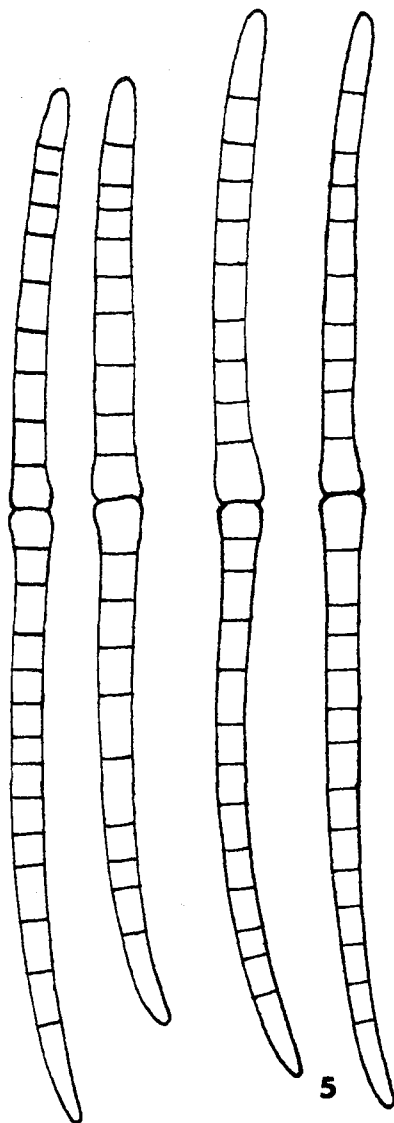


FIG. 5. *O. compressus*, 152138.

pyriform, often flattened laterally, 300–350 μm diam, smooth; beak terete, 125–140 μm diam, 20–40 μm long, lined with hyaline periphyses 10–18 \times 1.5–2.0 μm ; wall 25–40 μm of four-seven layers of rectangular cells, externally dark brown, thick-walled, 8–12 \times 5–7 μm internally brown, thin-walled 7–10 \times 3–6 μm . Asci numerous in a broad hymenium, subcylindric 110–145 \times 10–14 μm , eight-spored, interspersed with 2.0- to 3.0- μm -wide, mucilage-coated pseudoparaphyses septate at 10- to 25- μm intervals. Ascospores parallel in one fascicle, subcylindric,

102–136 × 4.0–5.0 μm, (13)15(19)-septate, constricted at first-formed septum at 0.40, enlarged immediately above and often slightly enlarged below, dark reddish brown, guttulate, end cells longer and lighter colored, without sheath or appendages.

COLLECTION EXAMINED: AUSTRIA: 152138, *Artemisia austriaca*, Niederdonau, Bisamberg bei Wien, F. Petrak, V.1940, F. Petrak Mycotheca Generalis. 463.

Ophiobolus compressus was redescribed and illustrated by Holm (1957). Its distribution records are scanty, a few collections in Europe and one in U.S.A. (Georgia) on the basis of authenticated but not type material of *O. cirsii-altissimi* Miller & Burton (Holm 1957).

I have seen one collection (85059) from Newark, Delaware, U.S.A., that was identified as *O. compressus*, but the record was not published. The fungus is *O. fulgidus* q.v.

***Ophiobolus crassus* n.sp.**

Fig. 6

Ascomata remota vel seriata, erumpentia, semiorbiculata, 300–600 μm lata, 400–700 μm alta. Rostrum teres, 120–160 μm latum, 140–200 μm longum; periphyses hyalina, 10–15 μm longa, 2–3 μm lata. Paries 70–100 μm crassus, e 4 vel 7 stratis compositus; cellulae atro-brunneae, multangulatae, 14–20 μm latae. Asci cylindrici, octospori, pseudoparaphysati, 140–170 μm longi, 10–14 μm lati. Ascospores fasciculatae, 130–160 μm longae, 4–5 μm latae, 11- vel 15-septatae, fusiformes, avellanae, guttulate, nec constrictae, nec inflatae, nec vaginatae, necque appendiculatae.

Ascocarps scattered or clustered in lines, erumpent, hemispheric to conical, 300–600 μm diam 400–700 μm high; beak terete, 120–160 μm wide 140–200 μm long, lined with a few hyaline periphyses 10–15 × 2–3 μm; wall 70–100 μm of four–seven layers of thick-walled dark brown polygonal cells 14–20 μm diam. Asci numerous in a basal hymenium, cylindrical, 140–170 × 10–14 μm, eight-spored, interspersed with mucilage-coated 2.0- to 3.0-μm-wide pseudoparaphyses septate at 5- to 10-μm intervals. Ascospores parallel in one fascicle, 130–160 × 4.0–5.0 μm, 11- to 15-septate, widest at the middle and tapered evenly to each end, pale yellow-brown, guttulate, without sheath, appendages, inflated cells or constrictions.

COLLECTIONS EXAMINED: U.S.A.: NORTH CAROLINA: 129613, *Aster puniceus* L. Carr Creek,

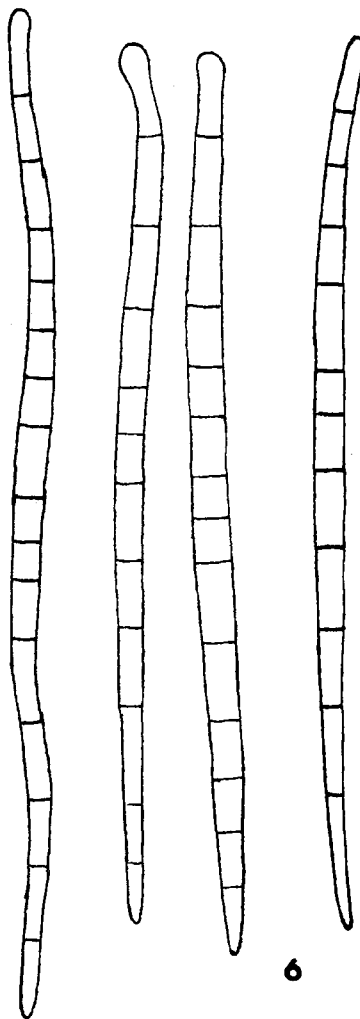


FIG. 6. *O. crassus*, 129613 (three spores), 152159.

Waynesville, elevation 4000 ft, G. G. Hedgcock 48947, 16.VII.1928, ex Herb. Dearness 3210, Type; 152159, *Verbesina virginica* L., Carr Creek, Waynesville, elev. 4000 ft, G. G. Hedgcock 48491, 16.VII.1928, ex Herb. Dearness 7668, as *O. verbesinae* Dearness n s pro tem segregated as 129670 under *O. rubellus* q.v., and present as *O. fulgidus* C. & P. segregated as 129671 under *O. drechsleri* q.v.

These two gatherings were sent to Dr. Dearness by the prolific collector George G. Hedgcock. The type, G.G.H. 48947, seems to be fairly pure *O. crassus*. The other collection bears at least three species of *Ophiobolus*.

Ophiobolus crassus is named for its thick

ascocarp wall. The species resembles to some degree *O. compressus* Rehm, which has a thick wall but has ascospores with a central constriction. *Ophiobolus drechsleri* has a thinner wall and shorter ascospores that are reddish brown, except for the lighter colored end cells, and widest at the fourth or fifth cell. The ascospores of *O. crassus* are longer, pale yellow-brown, and widest at the middle.

Ophiobolus crassus has not yet been found in Canada and is known to me only from the two gatherings near Waynesville, North Carolina.

Ophiobolus dictamni (Fuckel) Sacc. Syll. Fung. 2: 343. 1883.

Figs. 26, 45, 67, 75, 76
 ≡ *Rhaphidospora dictamni* Fuckel, Jahrb. Nass. Ver. Naturk. 23,24: 125. 1869 (1870).

Ascocarps scattered, immersed, globose to pyriform, 300–500 μm diam, 300–450 μm high, with some brown mycelium around base; beak erumpent, terete, 130–160 μm diam 60–280 μm long, filled with hyaline 2-μm-wide 25- to 40-μm-long periphyses when mature that give the black beak a white central dot in surface view; wall 30–50 μm of five–nine layers of rectangular cells 12–19 × 6–9 μm, outer cells more nearly globose, and thicker walled and darker brown. Asci very numerous from a very broad hymenium, cylindrical, eight-spored, 160–180 × 9–11 μm, interspersed with hyaline 2-μm-wide pseudoparaphyses septate at 8- to 20-μm intervals, resembling the periphyses. Ascospores parallel to slightly twisted in one fascicle, yellow, 130–150 × 2.0–2.5(3.0) μm 15- to 17-septate, inflated at the middle of the second or third cell, without sheath or appendages, first septum at 0.40 giving an eight-celled apical part and an 8- to 10-celled, longer more tapered basal part.

COLLECTION EXAMINED: GERMANY: 119811, Herbarium Fuckel 1894. #393. *Dictamnus fraxinella* Pers. [*D. albus* L.], Gausalgesheim, Nassau, Fuckel.

Ophiobolus dictamni ascospores are fairly distinctive in having the midpart of the third cell from the apex inflated. The apex is hemispheric and in young spores slightly broader than most of the cells. The spores are typically 16-celled, eight cells above the first septum, which is at 0.40 of length, and eight longer cells in the narrowed basal part.

Ophiobolus dictamni was not recorded by Müller (1952) although described from Germany in 1870 on a host that occurs also in Switzerland.

The fungus on the collection I examined bears a very close resemblance to *Nodulosphaeria valesiaca* Holm & Müller (1963) described on *Ononis repens* L. Examination of the type in Europe should confirm or deny my suggestion that *O. dictamni* provides an earlier name for *N. valesiaca*.

Ophiobolus drechsleri n. sp. Figs. 7, 57, 68, 71

Ascomata seriata, exposita, globosa, glabra, nitida, 350–600 μm lata, 300–400 μm alta. Rostrum teres, 120–150 μm latum, 90–140 μm longum; periphyses hyalina, 25–40 μm longa, 2–3 μm lata. Parietes 80–110 μm crassus, e 10 vel 14 stratis compositus; cellulae externae atro-brunneae globosae, 10–12 μm latae, cum membrana crassa; cellulae internae brunneae, oblongae, 10–12 μm longae, 6–8 μm latae, cum membrana tenui. Asci cylindrici vel clavati, 110–150 μm longi, 15–17 μm lati, octospori, pseudoparaphysati. Ascospores fasciculatae, rectae, cylindricae vel fusiformes, 85–125 μm longae, 4.0–4.5 μm latae, plerumque 15-septatae, brunneae vel badiae, guttulate, nec constrictae, nec inflatae, nec vaginatae, necque appendiculatae.

Ascocarps clustered in lines, superficial, globose, smooth, shining, 350–600 μm diam,

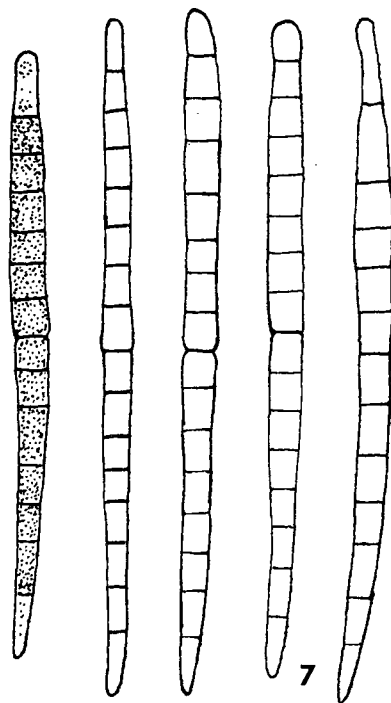


FIG. 7. *O. drechsleri*, 129635 (two spores), 129632 (two spores), 128733.

350–400 μm high, beak terete, 120–150 μm diam 90–140 μm long, lined with hyaline periphyses 25–40 \times 2.0–3.0 μm , wall 80–110 μm of 10–14 layers of cells externally subglobose dark brown, thick-walled 10–12 μm diam, internally rectangular, brown, thin-walled 10–12 \times 6–8 μm . Asci numerous in a broad hymenium, subcylindric to clavate 110–150 \times 15–17 μm , eight-spored, interspersed with 2- to 3- μm -wide pseudoparaphyses septate at intervals of 15–25 μm . Ascospores parallel in one fascicle, subcylindric, widest at about 0.30, tapered gradually to each end, 85–125 \times 4.0–4.5 μm , usually 15-septate, medium to dark reddish brown, guttulate, without sheath, appendages, obvious enlargements or constrictions.

COLLECTIONS EXAMINED: CANADA: ONTARIO: 129632, *Ambrosia trifida* L., London West City Limits at London Street Railway, J. Dearness, 8.IX.1923, sent collection to Sydow, type; 129635, dead herb, London West City Limits at London Street Railway, J.D., 6.IX.1923; 129638, dead herb, Grand Trunk Railway Crossing at London West City Limits Bridge, J.D., IX.1923. U.S.A.: DELAWARE: 85059, *Ambrosia trifida* L., Newark, H. S. Jackson, 2.VII.1907. ILLINOIS: 129640, *Ambrosia trifida* L., Falling Springs, L. O. Overholts, 11.III.1926; 121788, *Ambrosia trifida*, C.B. & Q.R.R., North of Quincy, L. E. Wehmeyer 3300, 29.VII.1925; 121746, *Heleopsis* sp., Soldier's Home, Quincy, L. E. W. 3303, 29.VII.1925; 105215, dicot, Vulcan, St. Clair County, G. D. Darker 8257, 31.I.1941; 92278, dead herb, Vulcan, St. Clair County, G. D. Darker 6835, 31.I.1941. IOWA: 37032, *Ambrosia trifida*, Ames, H. Harold Huma, 19.VIII.1899. KANSAS: 129642, *Helianthus annuus* L., Ellsworth, E. Bartholemew 11002, 13.VI.1930; 86087, *Helianthus annuus*, Rooks County, E.B., 17.V.1899; 37033, *Helianthus annuus*, Rockport, E.B., I.1893, Ellis & Everhart, Fungi Col. 631; 129641, *Helianthus grosseserratus*, Leavenworth, E.B. 9674, 6.VI.1927. KENTUCKY: 129639, *Ambrosia trifida*, Clinton, E.B. 9252, 24.IX.1925. MISSOURI: 105001, Compositae, Kirkwood, St. Louis County, G. D. Darker 7268, 5.IV.1942; 97772, dead herb, near Bridgetown, St. Louis County, G. D. Darker 7867, 26.VII.1941. NEBRASKA: 86086, *Ambrosia trifida*, Lincoln, C. L. Shear, IV.1896, ex BPI 64212. NEW YORK: 128733, '*Artemisia trifida*' (*Ambrosia trifida* L.), Albany, C. H. Peck, Ellis, N. Am. Fungi 583(a), as *Sphaeria fulgida* C. & P., but a second species

also present and segregated as 128733. NORTH CAROLINA: 129671, *Verbesina virginica*, Carr Creek, Waynesville, elev. 4000 ft, G. G. Hedgcock 48491, 16.VII.1928, ex Herb. Dearness as *O. fulgidus* C. & P.

Ophiobolus drechsleri occurs on *Ambrosia* and other compositae. It was frequently misidentified as *O. fulgidus* because some early exsiccati bore both species and the concept of *O. fulgidus* was confused. Drechsler (1934) cleared up the confusion relative to the two species but did not provide or suggest a name for the second species, which is here described and named for him.

The distinctive features are the relatively large, thick-walled ascocarps and the reddish-brown evenly tapered ascospores. *Ophiobolus compressus* Rehm (on *Artemisia*) is distinguished by the laterally collapsed ascocarps and the ascospores with a prominent constriction between two slight enlargements.

Ophiobolus erythrosporus (Riess in Rab.) Winter in Rab. Kryptogamen—Flora von Deutschland, Oesterreich. und der Schweiz, 1: 2: 525. 1885. Figs. 8, 74

\equiv *Sphaeria erythrospora* Riess in Rab. Herb. Myc. I, 1827. 1854, Hedwigia, 1: 6. 1854.

\equiv *Nodulosphaeria erythrospora* (Riess in Rab.) L. Holm, Symb. Bot. Upsal. 14(3): 97. 1957.

Ascocarps scattered, immersed, hemispheric later collapsing cupulate, 300–400 μm diam, 150–250 μm high, smooth to covered with loose mycelium; beak erumpent, terete, 90–120 μm diam, 80–140(200) μm long, lined with hyaline periphyses 20–25 \times 2.0–2.5 μm , without apical mycelium or setae; wall 20–25 μm of five or six layers of cells, externally dark brown thick-walled, subglobose, 7–10 μm diam, internally pale brown, thin-walled, rectangular, 12–16 \times 4–6 μm . Asci numerous in a broad hymenium, cylindric, 120–160 \times 7–10(13) μm , eight-spored, interspersed with pseudoparaphyses 1.5–2.0 μm wide septate at 15- to 25- μm intervals. Ascospores parallel in one fascicle, cylindrical (75)100–130(145) \times 3.0–3.5 μm , 16(20)-septate pale yellow, guttulate, one cell enlarged at 0.45, scarcely narrowed to the hemispheric apex, gradually narrowed to the base, without sheath appendages or constrictions.

COLLECTIONS EXAMINED: CANADA: QUEBEC: 74284(c), *Aster* sp., Lac Cascapedia, H.E. & M. E. Bigelow, M. E. Barr 2253, 21.VIII.1957; 74318(c) (see under *O. mathieui*). ONTARIO:

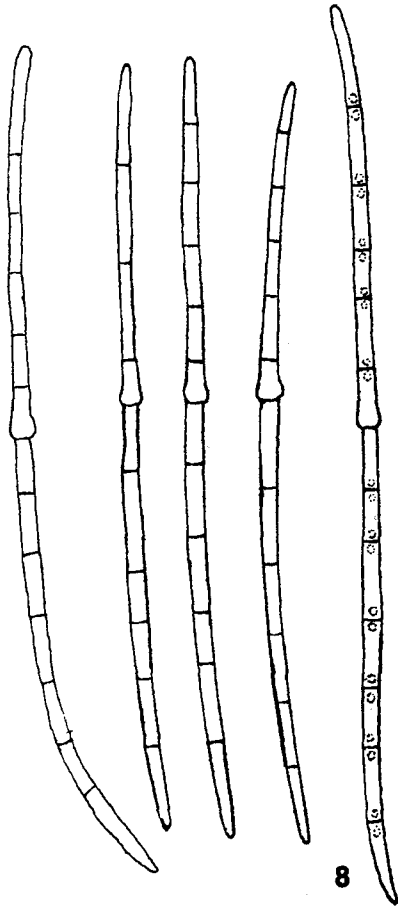


FIG. 8. *O. erythrosporus*, 86092, 105939 (three spores), 106153.

86096, *Aster macrophyllus* L., S of Timagami Station, H. S. Jackson & R. F. Cain 1628, 16.VI.1932, TRTC 3923; 86092, *Solanum tuberosum* L., Bear Island, Lake Timagami, H. S. Jackson & J. W. Groves, 30.VII.1934, TRTC 9245; 106153, *Solidago* sp. 102 Saugeen Beach, near Port Elgin, Bruce County, R. A. Shoemaker, 23.VIII.1963; 129674, *Marrubium vulgare* L. E of McGrady's Bank on roadside, (London), J. Dearness, 1.VIII.1895; 129673, *Urtica procera*, NE of Kelly's Siding (Middlesex County), J. D. 27.IV.1892, det. J. B. Ellis 19.V.1892 as *O. acuminatus*; 129669, herb, McGrady's (London), J. D., III.1890; 105939, *Verbascum thapsus* L., 2 mi W of Munster, Carleton County, G. D. Darker 7917, 14.V.1961. GERMANY: 20263, *Buphthalmum salicifolium* L. Mittelfranken; Hersbruck, Happurg, K. Starcs 1453, 30.VI.1946.

NETHERLANDS: 152153, *Urtica*, Harlem, C.A.J.A. Oudemans, VI.1871, Rabenhorst Fungi Europaei #1555. SWITZERLAND: 123655, *Clematis vitalba*, St. Gallen, Ruine Wartam, E. Müller, 4.VI.1950; 90218, *Pedicularis* sp., Graubünden, Tuors Davant, R.A.S., 8.VI.1962. U.S.A.: NEW YORK: 129628, *Scrophularia lanceolata* Pursh, (as *S. leporella* Bicknell), Newcomb, Essex County, H. D. House, 23.VI.1923.

Ophiobolus erythrosporus was reported once in Canada (Connors 1967) on the basis of the publication by Barr (1961, p. 312) on *Achillea* sp. and *Aster* sp. I found only *O. mathieui* on collection 74318(c). The gathering 74284(c) on *Aster* did not reveal an *Ophiobolus* on re-examination. The Ontario collections cited are good examples of this species and confirm its presence in Ontario as early as 1890. The fungus has a broad host range and might be much more prevalent than the present collections indicate.

The distinctive features of *O. erythrosporus* can be found mainly in the ascospores. As the epithet denotes, the spores are sometimes reddish en masse. They are enlarged just above the first-formed septum at 0.45, and the enlargement involves only the basal part of the (usually) eighth cell. The basal part of the spore is often 12-celled. No sheath, appendages, or constrictions were noted.

***Ophiobolus filiformis* (Wehmeyer) n. comb.**

Figs. 27, 46, 72

≡ *Leptosphaeria filiformis* Wehmeyer, Mycologia, 44: 641. 1952.

Ascocarps scattered, erumpent, exposed, hemispherical, smooth, 300–500 µm diam, 250–300 µm high; beak short terete, 70–90 µm diam, 40–60 µm long, periphyses and apical setae lacking; wall 40–60 µm of four–six layers of pseudoparenchyma 10–18 µm diam, thicker near base. Asci numerous from a broad hymenium, cylindrical, eight-spored, 130–200 × 14–20 µm, interspersed with 3- to 5-µm-wide pseudoparaphyses septate at 7- to 20-µm intervals. Ascospores parallel or slightly coiled in one fascicle, subcylindric with taper to base, 140–155 × 5–6 µm, (8)10 or 11-septate, yellow-brown, guttulate, enlarged only at the fourth (rarely fifth) cell from apex at 0.35 of length, enlarged cell short, wider near base, apical part of spore three(four)-celled, basal part six(seven)-celled, with one cushion-shaped appendage at apex and base.

COLLECTION EXAMINED: U.S.A.: 150797 *Compositae*, Indian Henry's Hunting Ground, Mount Rainier National Park, 5500 ft, *E. G. Simmons 1746*, 3.VIII.1948. det. L. E. Wehmeyer, R1764a, type.

Ophiobolus filiformis when described was placed in *Leptosphaeria*, but Wehmeyer noted it might be placed in *Ophiobolus*. The species might be found in alpine regions of western Canada. It is larger-spored than *O. niesslii* but has obvious similarities in ascospore form, including the appendages.

Ophiobolus fruticum (Rob. ex Desm.) Sacc. Syll. Fung. 2: 347. 1883. Fig. 28
 ≡ *Sphaeria fruticum* Rob. ex Desm. Ann. Sci. Nat., Bot. Sér. 3, 16: 308. 1851.
 ≡ *Nodulosphaeria fruticum* (Rob. ex Desm.) L. Holm, Symb. Bot. Upsal. 14(3): 102. 1957.

Ascocarps immersed, scattered or aligned in rows, pyriform, sometimes with loosely interwoven covering hyphae, 300–400 μm diam, with an erumpent terete beak 125–150 μm long and 90–130 μm diam without lining periphyses; wall 15–25 μm of four–six layers, external cells polygonal, light brown, 8–10 μm diam, internal cells rectangular, hyaline, 10–14 \times 6–9 μm . Asci numerous in a broad hymenium, eight-spored 140–190 \times 12–15 μm , interspersed with pseudoparaphyses 1.5–2.5 μm wide septate at intervals of 12–20 μm . Ascospores in one fascicle, parallel to interwoven, subcylindric 130–150(180) \times 4–6 μm , 15- to 19-septate, greenish yellow, guttulate, enlarged without a constriction at three points, typically the septum between cells 4 and 5, 8 and 9, and 12 and 13, with the first-formed septum (between cells 8 and 9) at a point 0.4 of length.

COLLECTIONS EXAMINED: DENMARK: 37030, *Ononis spinosa* L. Jyll., Nebsager, *O. Rostrup*, 15.VII.1891. ENGLAND: 121730, *Ononis spinosa* L., Haselor Hill, Evesham, Worcestershire, *P. G. M. Rhodes 4576*, 14.VIII.1930, ex Herb. Wehmeyer. GERMANY: 129683, Johs Kunze, *Fungi sel. exs. 80. Ononis spinosa* L. Katharinenholz, pr. Islebia, *Johs Kunze*, VIII.1875.

Ophiobolus fruticum appears to be restricted to the legume genus *Ononis*. I have not seen collections of the fungus from North America but include it for comparison.

The distinguishing features of the ascospores are the three enlargements near the first-formed septum and the two second-formed septa. It

superficially resembles *O. cesatianus* but has the first septum at 0.40 rather than about 0.50 and is eight-spored rather than four-spored like *O. cesatianus*.

Ophiobolus fulgidus (Clinton & Peck in Peck) Sacc. Syll. Fung. 2: 346. 1883. Figs. 9, 47
 ≡ *Sphaeria fulgida* Clinton & Peck in Peck, New York State Mus. Nat. Hist. Ann. Rep. for 1875, 29: 62. 1878.

Ascocarps clustered often in lines, erumpent, soon superficial, globose, later collapsed cupulate, smooth, shining, 250–300 μm diam, 150–200 μm high, beak terete, 50–60 μm wide, 20–30 μm high, lined with hyaline, mucilage-coated periphyses 8–12 \times 1.5–2.0 μm ; wall 30–35 μm of four or five layers of cells, externally subglobose, thick-walled dark brown, 5–7 μm diam, internally rectangular, thin-walled pale brown 10–18 \times 3–4 μm . Asci numerous in a broad hymenium, subcylindric, 90–115 \times 12–15 μm , eight-spored, interspersed with 2.0- to 2.5- μm -wide mucilage-coated pseudoparaphyses septate at 10- to 20- μm intervals. Ascospores parallel to slightly twisted in one fascicle or rarely partly overlapping, subcylindric, widest near the middle and tapered slightly and evenly to both ends 60–95 \times 3.0–3.5 μm mostly seven-septate,

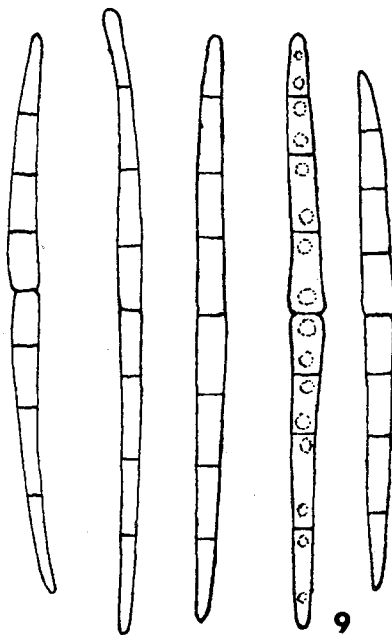


FIG. 9. *O. fulgidus*, 129631, 129619, 129645 (two spores), 129631.

pale yellow, guttulate, without sheath, appendages, obviously enlarged cells or constrictions.

COLLECTIONS EXAMINED: CANADA: ONTARIO: 110374, 110511, *Aster* sp., 2 mi W of Dryden, Kenora District, R. A. Shoemaker, 9.VIII.1964; 129631, *Ambrosia trifida* L., Peter's River Bank, London, J. Dearnness, 28.VIII.1890; 129633, *Ambrosia trifida* L., C.P.R. Bridge, Oxford Street, London, J.D., 19.V.1911, Sent Fungi Col. 200+ good specimens 17.III.1912 (F. Col. 3824). MANITOBA: 129645, *Solidago* sp. Winnipeg, G. R. Bisby 2853-57, 27.VII.1926. U.S.A.: NEW YORK: 129619, *Ambrosia trifida* L., Albany, C. H. Peck, VI., authenticated from the type locality but not part of type which was given as 'Dead stems of herbs. Albany. May'; 152140, '*Artemisia trifida*' (*Ambrosia trifida* L.), Albany, (C. H. Peck), Ellis, N. Am. Fungi 583(a).

Three of the four records of *O. fulgidus* in Canada (Connors 1967) were based on misidentifications. It does occur on *Ambrosia* and *Aster* in Ontario and on *Solidago* in Manitoba. The misidentifications were the result of confusion of *O. fulgidus* and another species with larger 16-septate brown ascospores. This situation was thoroughly reviewed by Drechsler (1934). The second species is treated here as *O. drechsleri*.

Berlese (1899, p. 133) examined a specimen from Cooke which Berlese thought was authenticated because he assumed the species was described by Cooke and Peck. The abbreviation 'C. & P' meant W. P. Clinton and Peck, the form 'Ck.' being used by Peck in that paper to denote Cooke. The illustration Berlese published (1899, Plate 159, Fig. 1) is certainly not *O. fulgidus*.

As Drechsler (1934) noted, the confusion was compounded by the presence of both *O. fulgidus* and the larger, more conspicuous *O. drechsleri* on certain exsiccati. Drechsler also clarified the host determination of *O. fulgidus* given erroneously as *Artemisia trifida* Nutt. a western North American species and subsequently revised on some labels to *Ambrosia trifida* L., which occurs in New York.

Ophiobolus galii Richon, Cat. Champ. Marne, 1418. 1889. Soc. Sci. Arts, Vitry-le-François XIV + 587 pp. Fig. 31

Ascocarps scattered, immersed, globose, smooth, 200-300 μm diam, 175-260 μm high, beak erumpent, terete, 90-120 μm diam, 100-

150 μm long, filled with hyaline 15-30 \times 1.5-2.5 μm slime-coated periphyses; wall 20-30 μm of six-eight layers of polygonal brown cells 6-9 μm diam. Asci in a broad hymenium, cylindrical, 100-130 \times 8-10 μm , eight-spored, interspersed with 1.5- to 2.5- μm -wide slime-coated pseudoparaphyses septate at 14- to 27- μm intervals. Ascospores twisted to coiled in one fascicle, cylindrical, yellow, 85-130 \times 1.5-2.0 μm , 11- to 16-septate, without sheath, appendages, enlargements, or constrictions.

COLLECTION EXAMINED: CANADA: 129647, *Galium asprellum* Michx, opposite Wishing Well, London, Ontario, J. Dearnness, VI.1913 det. Rehm 10.VII.1913.

Ophiobolus galii is not particularly distinctive. The original description was brief but accords with the Dearnness collection. The fungus might be sought on overwintered stems of other species of *Galium*.

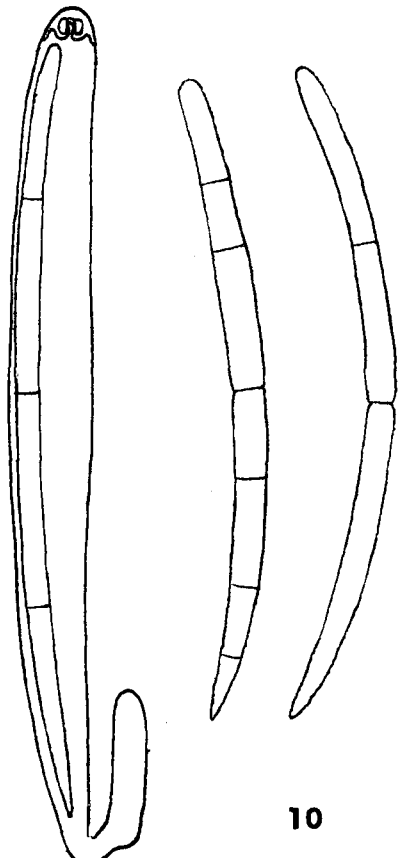


FIG. 10. *G. graminis* var. *tritici*, 19596.

Gaeumannomyces graminis (Sacc.) von Arx & Olivier var. *tritici* Walker, Trans. Br. Mycol. Soc. 58: 439. 1972. Fig. 10

This organism which causes take-all of wheat was recently described (Shoemaker 1974). It does not belong in *Ophiobolus* for reasons given above in the section dealing with genera allied to *Ophiobolus*. Line drawings (Fig. 10) are included here for comparison.

Lulworthia halima (Diehl & Mounce in Mounce & Diehl) Cribb & Cribb, Pap. Univ. Queensland Dep. Bot. 3(10): 80. 1955.

Fig. 29

≡ *Ophiobolus halimus* Diehl & Mounce in Mounce & Diehl, Can. J. Res. 11: 246. 1934.

≡ *Halophiogolus halimus* (Diehl & Mounce in Mounce & Diehl) Linder in Barghoorn & Linder, Farlowia, 1: 419. 1944.

≡ *Linocarpon halimum* (Diehl & Mounce in Mounce & Diehl) Petrak, Sydowia, 6: 388. 1952.

Ascocarps scattered, subepidermal, spherical, 250–450 µm diam, smooth, without hairs, beak erumpent, terete, 85–100(260) µm diam, 120–280 µm long, not lined with periphyses; wall 9–15 µm of four–seven layers of dark brown, thin-walled, laterally compressed rectangular cells 12–17 × 1.5–2.0 µm. Asci cylindrical, arcuate-fusoid, 270–330 × 12–15 µm, eight-spored; ascospores parallel, slightly twisted in one fascicle, lacking pseudoparaphyses. Ascospores acicular arcuate to spiralled, widest at the middle, tapering evenly to each end, 260–310 × 2.0–4.0 µm, nonseptate, with one hyaline conical non-mucilaginous rigid appendage 3–5.5 × 1.3–2.0 µm at each end, lacking sheath, enlarged cells, or constrictions.

COLLECTIONS EXAMINED: on *Zostera marina* L.: CANADA: NEW BRUNSWICK: 3584, Tidal Cove, St. Andrews, kept in sea water at Ottawa 5.I.1934 to 13.III.1934, *I. Mounce*, type; 152168, Tidal Cove, St. Andrews, *I.M.*, 28.VIII.1933; 152167, Tidal Cove, St. Andrews, *I.M.*, 28.IX.1933; 114061, St. Andrews, R-18 set up 23.VIII.1934, brought to Ottawa 15.IX.1934, dried 5.III.34(35); 114062, same data, cultures S 1–4. NOVA SCOTIA: 114060, Cole Harbour, Halifax County, sent in 21.XI.1934, dried 5.III.1935. QUEBEC: 114059, Kecarpoui, Saguenay County, received 29.VIII.1934, dried 5.III.1935.

Once an ample description of *O. halimus* was

published, additional records soon followed (Petersen 1934; Tutin 1934), but the reports in Canada seem limited to the original study (Conners 1967). Collections cited herein extend the range to Nova Scotia and Quebec.

The distinctions between *L. halimus* and *L. medusa* seem to be as follows: beak long erumpent versus barely emergent, ascocarp wall thin (9–15 µm) and glabrous versus thicker and covered by mycelium, asci up to 330 µm versus exceeding 400 µm, ascospores with conical appendages and without a central deeply stained cell versus ascospores with turbinate appendages and with a central cell taking up stain. The hosts are *Zostera marina* L. and *Spartina cynosuroides* (L.) Roth. respectively. Meyers (1957) has shown additional distinctions. *Ophiobolus maritimus* Sacc. is clearly different with septate, disarticulating ascospores.

Various generic dispositions were proposed for *O. halimus*. It is unlike *Ophiobolus* in the lack of pseudoparaphyses and lack of septa in ascospores and has its affinities with aquatic rather than terrestrial species (see Meyers 1957). Because the original record in Canada was under *Ophiobolus*, I included the eelgrass parasite. It is certainly bizarre and easily segregated.

Ophiobolus herpotrichus (Fries) Sacc. in Roum. & Sacc. Rev. Mycol. 3: 45. 1881. Figs. 11, 56
≡ *Sphaeria herpotricha* Fries, Syst. Mycol. 2: 504. 1823.

≡ *Phaeosphaeria herpotricha* (Fries) L. Holm, Symb. Bot. Upsal. 14(3): 119. 1957.

= *Ophiobolus zaeae* Saccas, Rév. Pathol. Vég. Entom. Agric. 30(3):183. 1951.

= *Ophiobolus medusae* Ell. & Ev. var. *minor* Ellis. & Ev. Proc. Acad. Nat. Sci., Philadelphia, 1890: 239. 1890.

Ascocarps in rows or scattered, immersed, surrounded by brown 3- to 6-µm-wide mycelium, pyriform, 200–400 µm diam, 300–400 µm high, with an erumpent terete beak 150–300 µm long, 60–80 µm diam, lined with hyaline pseudoparenchyma, without periphyses; wall 20–40 µm of five–nine layers of cells, external cells subglobose, brown, slightly thick-walled, 10–15 µm diam, internal cells flattened, hyaline, thin-walled, 10–15 × 4–7 µm. Asci numerous from a broad hymenium, subcylindric, 150–180 × 8–10 µm, eight-spored, interspersed with 1.5- to 2.5-µm-wide pseudoparaphyses septate at 20- to 35-µm-intervals. Ascospores parallel to

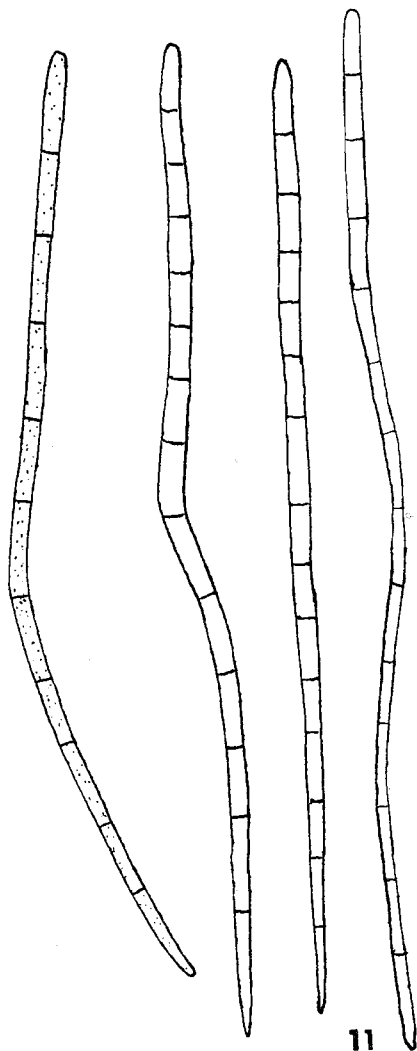


FIG. 11. *O. herpotrichus*, 113212, 128729, 59724 (two spores).

slightly coiled in one fascicle, subcylindric, gradually tapering to base, $140\text{--}200 \times 1.5\text{--}2.5\text{--}(3.0) \mu\text{m}$, (8)16- to 20-septate, yellow, each cell biguttulate, without sheath, appendages, enlargement, or constrictions.

Pycnidia resemble ascocarps. Conidia $70\text{--}90(110) \times 3\text{--}4 \mu\text{m}$, three- to seven-septate with a slender elongated apical cell, cells biguttulate, base truncate.

COLLECTIONS EXAMINED: CANADA: SASKATCHEWAN: 133205, 133206, *Bromus inermis* Leyss, Saskatoon Forestry Farm, W. Reiter, 25.VI.-1970; 133207, 133208, same 25.V.1970; 133209,

133210, same 25.IV.1970; 129792, same 18.III.-1970. Central African Republic (French Equatorial Africa, Ubangi-Shari): 59724, *Zea mays* L., Boukoko-Oubangui Chari, A. M. Saccas, VIII.1958, authenticated, not type. FIJI: 113212, *Oryza sativa* L., Koronivia, Nausori, K. M. Graham, 28.I.1966. HUNGARY: 130767, *Dactylis glomerata* L., In pratis Nagymező pr. pag. Omassa montium "Bükk hegység, S. Toth, 19.IX.1957. PUNJAB: 124006, *Bromus ramosus* Huds., Jispa, Lahul, 12 000 ft, W. Koelz, 11.VIII.1930. SWITZERLAND: 89631, *Dactylis glomerata* L., Tuors Davant, 1800 m, near Bergun, Graubünden, R. A. Shoemaker, 4.VI.-1962. U.S.A.: MICHIGAN: 107231, grass culm, Kellogg Forest, R. A. Shoemaker (T192), 3.IX.1955. LOUISIANA: 128729, *Andropogon muricatus*, St. Martinsville, J. B. Langlois 2343, 5.IV.1892.

Ophiobolus herpotrichus and its conidial state were studied by Webster and Hudson (1957) from collections in England. Holm (1957) recorded it from Czechoslovakia, Finland, France, Germany, Sweden, and U.S.A. (New York). It was recently reported from Saskatchewan (Shoemaker *et al.* 1974). Eriksson (1967, p. 418) indicated certain distinctions that would exclude *O. herpotrichus* from *Phaeosphaeria* and suggested that a new genus might be required for this species.

The species is fairly distinctive with a prominent beak, usually heavy mycelium around the ascocarp, and the long slender ascospores lacking enlargements, constrictions, appendages, or a sheath. The ascospores exhibit a wide range in length and septation even within the same ascocarp.

Ophiobolus zeae Saccas is a synonym judged from an examination of authenticated material and the original description and illustrations. It seems likely to me that *Ophiobolus oryzae* Miyake (J. Coll. Agric. Imp. Univ. Tokyo, 2: 249. 1910.) is also a synonym. Material on *Oryza sativa* from Fiji matched the description and illustration of *O. oryzae* which is within the range of variation of *O. herpotrichus*. Collection 128729 was determined by J. B. Ellis as *Ophiobolus medusae* Ell. & Ev. var. *minor* Ellis & Ev. (Proc. Acad. Nat. Sci., Philadelphia, 1890: 239. 1890), but it is not the type. It is a later collection on the same host from the locus classicus and is a good match to the description. This variety is reduced to a synonym.

Ophiobolus loniceræ Fabre, Ann. Sci. Nat., Sér. 6, 15: 62. 1883. Fig. 30

Ascocarps scattered, gradually erumpent, pyriform, slightly roughened, 500–600 µm diam, 550–650 µm high, gradually changing into beak, beak terete, 100–150 µm wide, 150–200 µm long; wall 25–35 µm and up to 60 µm at protuberances, mostly of six–nine layers of rectangular cells 8–12 × 4–6 µm, reddish brown. Asci in a broad hymenium, cylindric, 180–220 × 12–14 µm, eight-spored, interspersed with and much exceeded by profuse, 1.5- to 2.0-µm-wide slime-coated pseudoparaphyses septate at 20- to 30-µm intervals. Ascospores in one parallel fascicle, long cylindric, apex hemispheric, tapered gradually to base, 180–200 × 4–5 µm, divided into about 40–50 cells, each as long as wide and uniguttulate, without sheath or appendages, pale yellow.

COLLECTIONS EXAMINED: U.S.A.: CALIFORNIA: 134951, *Lonicera hispidula* Dougl. ex Lindl., Crystal Springs Reservoir, San Mateo County, D. Malloch, 30.XII.1969.

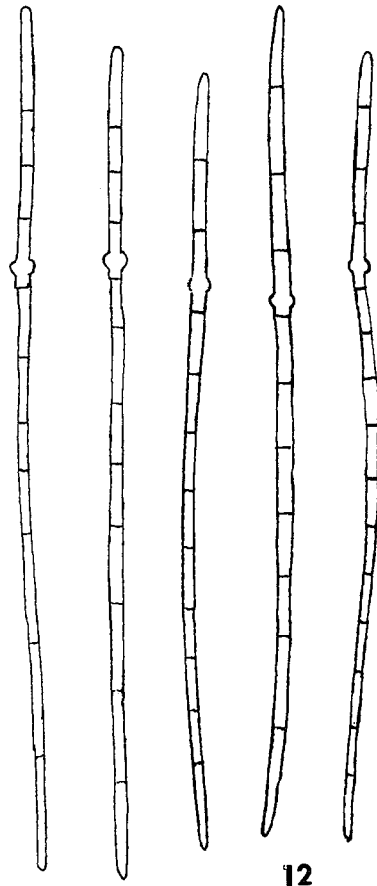
The specimen accords well with Fabre's description of *O. loniceræ* and also with Berlese's Fig. 167, 2 (1900) of *Acerbia bacillata* (Cooke) Sacc. with which he suggested tentatively that *O. loniceræ* might be synonymous. *Ophiobolus loniceræ* has not yet been found in Canada but might be encountered in the future so a brief description and some illustrations are included.

Ophiobolus mathieui (West.) Sacc. Syll. Fung. 2: 342. 1883. Figs. 12, 58

≡ *Sphaeria mathieui* West. Bull. Acad. R. Sci. Lett. Beaux-Arts Belg. Sér. 2, 7: 85. 1859.

≡ *Nodosphaeria mathieui* (West.) L. Holm. Symb. Bot. Upsal. 14(3): 96. 1957.

Ascocarps scattered, immersed, conical, smooth, 250–400 µm diam, 300–350 µm high, beak erumpent, terete, conspicuous 100–200 µm long, 70–90 µm wide without projecting hyphae or periphyses; wall 12–18 µm of four–six layers, external cells brown, thick-walled, subglobose 5–8 µm diam, internal cells hyaline or tardily brown almost rectangular 12–17 × 3–5 µm. Asci numerous from a broad hymenium, 110–140 × 6–8 µm, eight-spored, interspersed with hyaline pseudoparaphyses 2–3 µm wide, septate at intervals of 9–14 µm. Ascospores parallel in one fascicle, subcylindric with a very gradual taper to the lower end, without sheath or appendages,



12

FIG. 12. *O. mathieui*, 150707, 129655, 123665, 129623, 151304.

(90)100–120 × 1.5–2.0 µm, (9)11- to 13(14)-septate, guttulate, pale yellow, enlarged with a slight annular widening just below the middle of the cell of usually the fourth cell from the apex at 0.25 of length, the lower part often eight-celled.

COLLECTIONS EXAMINED: CANADA: QUEBEC: 74318(c), *Achillea millefolium* L. Mt. Albert, H.E. & M. E. Bigelow, M. E. Barr 1997, 10.VII.1957. ONTARIO: 129623, *Echium vulgare*, E of Springbank Park, London, J. Dearness, 17.VIII.1904; 151304, *Verbascum* sp. NW of Nashville, York County, D. Malloch, 10.VIII.1969 (second species, ex DAOM 136842); MANITOBA: 129665, *Melilotus* sp. Manitoba Agricultural College, Winnipeg, G. R. Bisby 3114, 31.VIII.1926, ex Herb. Dearness sub *O. porphyrogonus* Tode. BRITISH COLUMBIA: 105516, *Apocynum androsaemifolium* L., Eagle Pass, 1800 ft, R. A. Shoemaker, 23.VII.1963; 128720, *Anaphalis margaritacea* (L.) Benth. & Hook.,

Eagle Pass, R.A.S., 25.VII.1963; 105310, *Chrysanthemum leucanthemum* L., Eagle Pass, R.A.S., 23.VII.1963; 128722, *Oplopanax horridum* (Sm.) Miq., Glacier Crest Trail, 5000 ft, Glacier, R.A.S., 4.VIII.1963. GERMANY: 150707, *Dipsacus sylvestris*, bei Erking in Oberbayern, Rehm, IX.1901, Rehm Asco. #1444 sub *O. niesslii* Bäumler (see Holm 1957, p. 96). LATVIA: 121662, *Cirsium palustre* (L.) Scop., Lettland, Prov. Vidzema, Veskieva, K. Starcs 0317, 13.VII.1932, sub *O. bardanae* Fuckel. NORWAY: 123665, *Mentha* sp. Øye, Larungsfjord, L. E. Wehmeyer 9289, 30.VII.1950 sub *O. tenellus* (Awd.) Sacc.

Ophiobolus mathieui occurs on a wide range of hosts in Europe but apparently was not reported previously in Canada. The fungus was collected here as early as 1904 but not correctly identified. Two Canadian collections should be mentioned: 129665, which served as the basis for the incorrect record of *O. porphyrogonus* on *Melilotus* in Manitoba (Bisby *et al.* 1929, p. 75), and 74318(c), which was published as *O. erythrosporus* on *Achillea millefolium* from Quebec (Barr 1961, p. 313).

The key distinguishing feature of this species can be easily overlooked. The spores are narrow and the slight enlargement in the central region of the fourth cell from the apex is easily missed. Spores free from the asci and mounted in water or revived in dilute (2%) sodium hydroxide show the feature best, but it is a subtle though consistent character.

Collection 123665 on *Mentha* sp. is of interest because *Mentha* is the host of both *Ophiobolus mathieui* and *Ophiobolus pseudoaffinis* Petrak (\equiv *Nodulosphaeria pseudoaffinis* (Petrak) L. Holm 1961, p. 78). This latter species differs from *O. mathieui* in having the enlargement of the ascospore cell in a subapical position on the third or fourth cell rather than near the midpoint as in *O. mathieui*. Collection 123665 has the cell enlargement at the midpoint or below and is *O. mathieui*. However, all collections on *Mentha* should be carefully examined for the presence of the critically distinct *O. pseudoaffinis* recently redescribed and illustrated by Holm (1961).

Lulworthia medusa (Ellis & Ev.) Cribb & Cribb, Pap. Univ. Queensland Bot. Dep. 3(10): 80. 1955.

\equiv *Ophiobolus medusa* Ellis & Ev. J. Mycol. 1: 150. 1885.

\equiv *Halophiobolus medusa* (Ellis & Ev.) Linder

in Barghoorn & Linder, Farlowia, 1: 419. 1944.

\equiv *Linocarpon medusa* (Ellis & Ev.) Petrak, Sydowia, 6: 388. 1952.

Ascocarps scattered, subepidermal, depressed-globose, 100–350 μ m diam, with brown mycelial strands 200–400 \times 3 μ m, beak erumpent, terete, 50–70 μ m diam, 80–100 μ m long; wall 20–30 μ m of seven–nine layers of rectangular brown cells. Asci cylindrical 290–400 \times 12–15 μ m, eight-spored. Ascospores parallel to twisted in one fascicle (280)320–400 \times 3.0–3.5 μ m, nonseptate, widest near middle, tapered evenly to each end, yellow, guttulate, with a hyaline turbinate appendage 7.0–8.5 \times 2.0–3.0 μ m at each end and a central cell that stains densely with cotton blue.

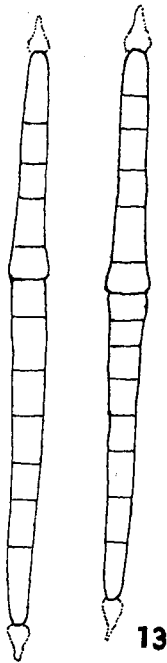
COLLECTIONS EXAMINED: U.S.A.: NEW JERSEY: dead culms of *Spartina*, sea beach, Cape May, New Jersey, 1884, ex herb. Ellis, ex NY, as *Ophiobolus medusa*, E. & E. scr. Ellis; part of type ex FH, photos by M. L. F. Faubert from microscope slide in Ammans solution by G. D. Darker.

The material examined consists of photographs and photomicrographs prepared from the two collections by M. L. F. Faubert for Mounce and Diehl in their investigation preliminary to describing *Ophiobolus halimus* Diehl & Mounce in Mounce and Diehl (1934). These authors concluded the host is *Spartina cynosuroides* (L.) Roth. They amplified the description of *O. medusa* and supplied some illustrations. This information was incorporated in the description given above. The distinctions of *O. medusa* and *O. halimus* are given with the latter species.

Ophiobolus maritimus Sacc. was also discussed by Mounce and Diehl because it was thought to occur on *Zostera*. Shortly after their work was published, a letter was received from E. Ulbrich of the Berlin-Dahlem Museum. It stated that *O. maritimus* occurred "auf der Lister Rheede unter *Zostera*." The suggestion was made that the host might be *Elymus arenarius*. In any case the host of *O. maritimus* is not *Zostera marina* as noted by Tutin (1934). *Ophiobolus maritimus* with septate, disarticulating ascospores is clearly distinct from *O. halimus*.

Ophiobolus megalosporus (Auersw. & Niessl in Niessl) n. comb. Figs. 13, 59, 73

\equiv *Leptosphaeria megalospora* Auersw. & Niessl in Niessl, Verh. Naturf. Ver. Brünn, 10: 180. 1872.

FIG. 13. *O. megalosporus*, 151574.

≡ *Nodulosphaeria megalospora* (Auersw. & Niessl in Niessl) L. Holm, Svén. Bot. Tidskr. 55: 74. 1961.

Ascocarps scattered, immersed, depressed-globose, 250–400 μm diam, 250–350 μm high, with a few brown hyphae around the base; beak erumpent, terete 100–140 μm long, 70–90 μm diam, with brown periphyses 3–5 μm wide projecting beyond the regular beak cells but not seen lining the interior of the beak; wall 10–15 μm of two–three layers of brown, thin-walled rhomboidal cells 10–15 μm long, 4–6 μm wide. Asci in a broad hymenium, interspersed with 2- to 4- μm -wide pseudoparaphyses septate at 10- to 20- μm intervals, broadly elliptical, eight-spored, 85–110 \times 16–20 μm . Ascospores in one parallel fascicle, with one short enlarged cell just above the middle and narrowed to each end 70–80 \times 5–6 μm , 11- to 13-septate, olive-brown, without a sheath but with turbinate to conical terminal appendages 2–3 μm wide and 3–5 μm long.

COLLECTION STUDIED: CZECHOSLOVAKIA: 151574, Rabenhorst. F. Eur. 2049 ex DAOM, *Sambucus ebulus* pr. Brünn, *G de Niessl*, aestate.

This species may be more appropriately placed in *Nodulosphaeria* as proposed by Holm (1961). It has conspicuous brown terminal beak bristles,

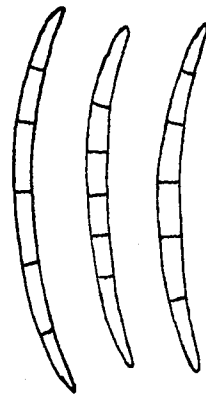
a feature he stresses for *Nodulosphaeria*. The ascospores are furnished with terminal appendages, as is *N. modesta* the type of *Nodulosphaeria*. However, the lack of consistency of these features, periphyses and ascospore appendages, in otherwise similar species pairs as recorded by Holm (1961) makes me reluctant to use *Nodulosphaeria* until a more consistent pattern of correlated characters for the separation of this genus becomes generally known.

Ophiobolus megalosporus has not yet been found in Canada, though a number of species of *Sambucus* occur here. The fungus is quite distinctive and the publication of a description and illustration may call attention to this species and perhaps lead to its discovery in North America. It bears a slight resemblance to *O. ponticus*, *O. niesslii*, and *O. filiformis* but can be separated on the basis of spore characteristics.

Ophiobolus minor Bubak, Ann. Mycol. 4: 110. 1906.

Fig. 14

Ascocarps scattered, immersed, globose, 200–300 μm diam, smooth; beak erumpent, terete 30–50 μm diam, 20–40 μm long; wall 12–19 μm of four–six layers of thick-walled dark brown, polygonal to collapsed cells. Asci numerous in a broad hymenium, cylindrical, 65–90 \times 7–9 μm , eight-spored, interspersed with mucilage-coated 1.5- to 2.0- μm -wide pseudoparaphyses septate at 10- to 17- μm intervals. Ascospores parallel in one fascicle, 55–70 \times 2.0–3.0 μm , five-septate, curved, tapered to each end from widest point near middle, guttulate, colorless, without sheath, appendages, enlargements, or constrictions.

FIG. 14. *O. minor*, 34170(b), 110724 (two spores).

COLLECTIONS EXAMINED: CANADA: BRITISH COLUMBIA: 34170(b), *Lonicera involucrata* (Rick.) Banks, Harrison Lake, *M. E. Barr*, 21.VII.1951, UBC 1971; 110724, *Lonicera involucrata*, Williamsons Lake, near Revelstoke, elev. 1500 ft, *R. A. Shoemaker*, 19.VII.1963.

Ophiobolus minor was reported by Barr (1953, p. 818) on the basis of collection 34170(b). I refer one additional collection to this name but note that the ascospores are at the low end of the range in length given by Bubak from the type in Bohemia, Czechoslovakia. On the basis of the Canadian collections, the species might not belong in *Ophiobolus*.

Ophiobolus niesslii Bäumler, Verhandl. Ver. Nat.-Heilkunde Presburg, Neue Folge, 6: 120. 1887. Figs. 15, 50

≡ *Ophiobolus incomptus* Niessl ex Linhart, F. Hung. 472. 1886 non *O. incomptus* (Ces. & De Not.) Sacc. Syll. Fung. 2: 353. 1883.

= *Ophiobolus stenosporus* Dearness & House, an unpublished herbarium name, non *O. stenosporus* Karsten, Hedwigia, 22: 179. 1883.

= *Ophiobolus lythri* Dearness, an unpublished herbarium name.

Ascocarps scattered, immersed, globose, smooth, 200–300 µm diam, 200–270 µm high, beak erumpent, terete, 75–100 µm diam, 100–125 µm long, lined with hyaline periphyses 15–20 × 2.0–3.0 µm, without projecting terminal hyphae; wall 10–15 µm of three layers of cells, external ones brown, subglobose 6–8 µm diam, internal ones 6–10 × 3–4 µm pale brown. Asci numerous in a broad hymenium, subcylindric, 90–100 × 6–8(9) µm, eight-spored, interspersed with pseudoparaphyses 2.0–3.5 µm wide, septate at 10- to 20-µm intervals. Ascospores parallel in one fascicle, subcylindric, 70–90(105) × 2.5–3.5 µm, 11(12)-septate, yellow, guttulate, fourth cell enlarged near the base, at 0.30 of length, with one cushion-shaped appendage at each end, without sheath, without constrictions.

COLLECTIONS EXAMINED: CANADA: ONTARIO: 129685, *Onosmodium*, London, *J. Dearness*, VIII.1895, Ellis & Everhart Fungi Col. 830a, as *O. acuminatus* [The host determination is very doubtful, stems not square, leaves alternate not opposite]; 105872, *Solidago* sp., New Durham, Brant County, *R. F. Cain* 8136, 15.VI.1935; 136842, *Verbascum* sp., NW of Nashville, York County, *D. Malloch*. 10.VIII.1969; 105000,

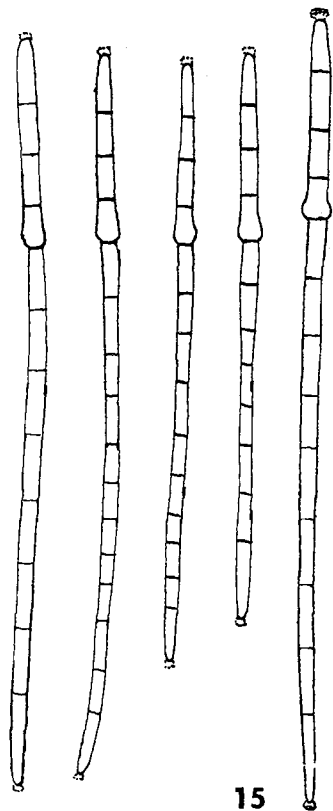


FIG. 15. *O. niesslii*, 105078, 136842 (three spores), 129677.

Thalictrum sp., 2 mi S of Pierces Corners, Carleton County, *G. D. Darker* 7997, 24.VII.1961; 144594, dicot, 3 mi NW of Bells Corners on National Capital Commission land, Ottawa, *D. Malloch*, 26.VI.1973. MANITOBA: 129677, *Castilleja coccinea* (L.) Spreng., W of Grandview, *G. R. Bisby* 4052, 20.VII.1928. SWITZERLAND: 151299, *Daucus carota* L. ad pedem montis "Utl" prope Zürich, *G. Winter*, VIII.-1878, *J. Kunze Fungi Sel. Exs.* 330 as *Rhaphidospora tenella* Auerswald which is also present and filed as DAOM 151298 under *O. rubellus* (Pers. ex Fries) Sacc. U.S.A.: ? NEW YORK: 129648, *Lythrum salicaria* L. *C. H. Peck*, ex Herb. Dearness as *O. lythri* n. sp. pro tem. [not published, no place or date of collection given]; 129665, *Aralia racemosa* L., Newcomb, N.Y., *H. D. House* 761, 1.VII.1925 ex Herb. Dearness as *Ophiobolus stenosporus* Dearness & House n.s., "First proof seen." HUNGARY: 150708, *Dipsacus silvestris* Huds., Petrozsény Erdélyben, *Linhart*, VIII.1885, *Linhart Fungi Hungarici* 472 as

O. incomptus, part of type. Also found on the same collection was *O. fruticum* (Rob. ex Desm.) Sacc. segregated as DAOM 151303.

Ophiobolus niesslii is now recorded in North America from collections dating back to 1895. Holm (1957) distinguished it from *O. ponticus*, which has broader ascospores and a thicker ascocarp wall. An additional feature is the presence of appendages on both ends of the ascospores of *O. niesslii*.

The Linhart exsiccatus, Fungi Hungarici 472, bears an ample description that applies well to *O. niesslii* with one minor exception. The ascospores were described as (15)16(17)-septate. This characteristic applies to the ascospores of *O. fruticum*, which is also present on the type of *O. niesslii*. There is no need to reject the name because it is based on a mixed collection because Holm (1957) clearly based his redescription on the fungus to which the major part of the description applies. The presence of *O. fruticum* with *O. niesslii* on the portion of the type in DAOM is mentioned to clarify the septation mentioned on the label and hopefully to prevent any confusion in the future.

Some confusion may be caused by the exsiccatus, Rehm, Asco. 1444, which is labelled *O. niesslii* but which Holm found to be *O. mathieui* (West.) Sacc. My examination of the set in DAOM confirms his determination.

Collection 129648 labelled *O. lythri* matches *O. niesslii* in every respect. Collection 129665 is a good match, but the scanty material did not reveal the appendages on the ascospores. More abundant fresh collections might reveal that the fungus on *Aralia* is critically distinct.

Ophiobolus ophioboloides (Sacc.) L. Holm, Sven.

Bot. Tidskr. 42: 345. 1948. Fig. 16

≡ *Leptosphaeria ophioboloides* Sacc. Atti R.

Īstit. Veneto Sci. Lett. Arti, Ser. 6, 2: 457. 1884.

≡ *Leptosphaeriopsis ophioboloides* (Sacc.) Berlese, Icones Fungorum. 1. Fasc. 2: 89. 1892.

= *Leptosphaeria chrysanthemi* Clements, Crypt. Form. Colorad. 24. nom. nud.

Ascocarps closely scattered, immersed, depressed-globose, dark brown, with some brown 5- μ m-wide mycelium around base, 300-500 μ m diam, with erumpent short terete beak 50-70 μ m long, 80-100 μ m wide near base and lined internally with hyaline 1- μ m-wide periphyses; wall 30-50 μ m thick of two intergrading cell types,

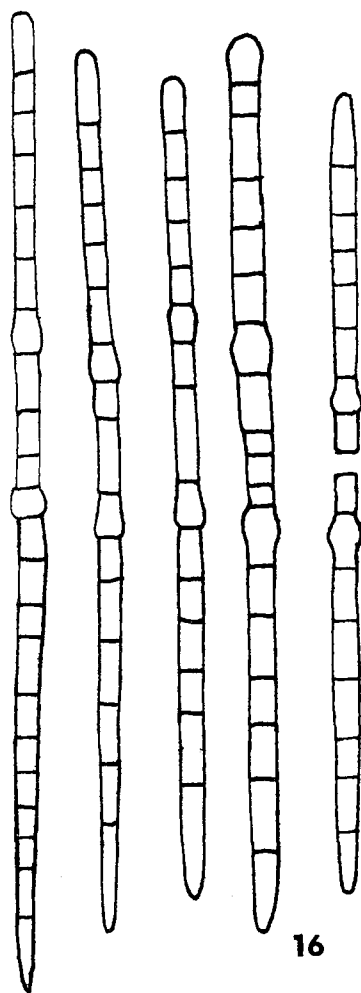


FIG. 16. *O. ophioboloides*, 150792.

outer five layers dark brown, globose 10- to 13- μ m-diam cells, inner five layers of pale brown rectangular cells 7-10 \times 3-5 μ m. Asci in a broad hymenium, cylindric 115-135 \times 8-14 μ m, eight-spored, interspersed with pseudoparaphyses 1.0-1.5 μ m wide and septate at 15- to 25- μ m intervals. Ascospores parallel in one fascicle, subcylindric, narrowed to lower end, dark reddish brown, 115-125 \times 3.0-4.5 μ m, 11- to 17-, mainly 15-septate, separating into two subequal part spores with an inflated cell one or two cells from the disarticulation septum, cells inflated near a septum, no sheath or appendage observed on ascospores.

COLLECTION EXAMINED: U.S.A.: 150792, Clements Crypt. Form. Colorad. 24. *Carduus scopulorum*, Cabin Canyon, Colorado, 2700 m, Clem-

ents 12 July 1905; type of *Leptosphaeria chrysanthemi* Clements (nom. nud.) ex Herb. Wehmer.

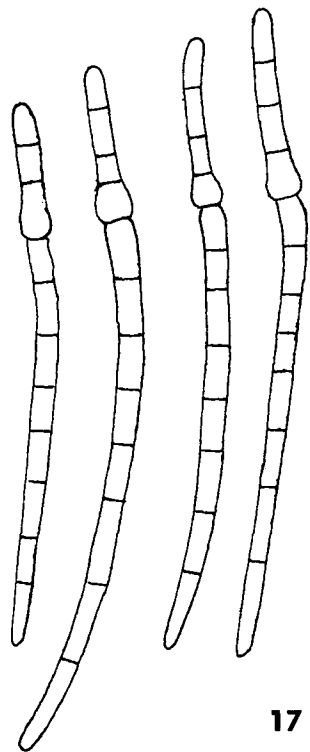
Ophiobolus ophioboloides is distinct from *O. acuminatus* mainly on ascospore septation, 17 being the maximum for the former versus 25 for the latter. Immature collections of *O. acuminatus* might pose a problem but should be recognizable by the generally greater spore length.

This species is, apparently, rarely collected either in Europe or in North America, for which the Clements collection appears to be a new record.

Ophiobolus ponticus Petrak, Ann. Mycol. 29: 371. 1931. Figs. 17, 48, 49, 70

≡ *Nodulosphaeria pontica* (Petrak) L. Holm, Symb. Bot. Upsal. 14(3): 94. 1957.

Ascocarps scattered to loosely clustered, erumpent, pyriform, smooth, 200–320 µm diam, 250–375 µm high; beak terete, 90–130 µm diam, 80–90 µm long, with hyaline internal lining periphyses 30–60 × 2–3 µm without terminal projecting brown hyphae; wall 20–25 µm of four–six layers, externally subglobose 7–10 µm diam,



17

FIG. 17. *O. ponticus*, 128732.

internally rectangular 10–16 × 3–5 µm. Asci numerous in a broad hymenium, subcylindric to clavate, 100–130 × 8–10 µm, eight-spored, interspersed with 2- to 3-µm-wide pseudoparaphyses septate at 15- to 25-µm intervals. Ascospores parallel to slightly spiralled in one fascicle, subcylindric, greenish yellow 70–90 × 4.0–4.5 µm, 11(13)-septate, fourth cell basally enlarged, constricted at fourth (first-formed) septum at 0.27 of length, the usually eight-celled basal part tapered and sometimes bent, without sheath or appendages.

COLLECTION EXAMINED: SWEDEN: 128732, *Centaurea jacea* L., Upland, Upsala, Renhållningssverkt, L. Holm 220, 19.V.1946, Fungi Exs. Suecici 2283.

Ophiobolus ponticus has not yet been found in Canada, though the host occurs here by introduction. *Ophiobolus ponticus* is similar to *O. niesslii* and might be confused with the larger-spored *O. filiformis*. Both of these species have appendaged ascospores.

Ophiobolus prunellae (Ellis & Ev.) n. comb.

Figs. 18, 51

≡ *Linospora prunellae* Ellis & Ev. Proc. Acad. Nat. Sci. Phila. 1894, 46: 337. 1895.

≡ *Leptosphaeria hesperia* Barr, Can. J. Bot. 45: 1044. 1967.

= *Hypospila prunellae* Ellis & Ev. Proc. Acad. Nat. Sci. Phila. 1894, 46: 338. 1895.

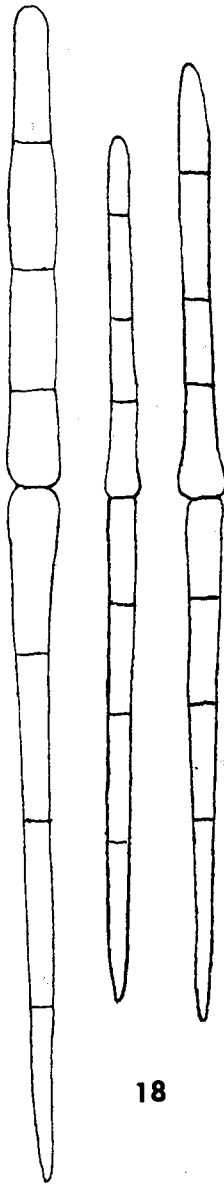
≡ *Phoma prunellae* (Ellis & Ev.) Kuntze, Rev. Gen. Pl. 3: 502. 1898.

≡ *Ceuthocarpon prunellae* (Ellis & Ev.) Berl. Icones Fung. 2: 149. 1899.

= *Ophiobolus rostrupii* Ferd. & Winge, Bot. Tidsskr. 29: 317. 1909.

≡ *Leptosporopsis rostrupii* (Ferd. & Winge) v. Höhnelt in Clements and Shear, The Genera of Fungi, p. 277. 1931.

Ascocarps scattered, immersed, epiphyllous, subglobose, 250–400(500) µm diam, 200–300 µm high, surrounded by brown mycelium in leaf tissue; beak erumpent, terete, 40–50 µm wide, 30–40 µm long, filled with polygonal cells, lacking periphyses and apical hyphae; wall 20–30 µm wide of three or four layers of polygonal to prismatic cells 13–16 × 6–10 µm, outer cells dark brown, thick-walled, inner cells nearly hyaline, thin-walled, and flattened to nearly rectangular outline. Asci in a broad basal hymenium, cylindrical, 100–170 × 12–18 µm, eight-spored, interspersed with 2.0- to 3.5-µm-



18

FIG. 18. *O. prunellae*, 118291, 118292 (two spores).

wide pseudoparaphyses septate at 15- to 30- μ m intervals. Ascospores parallel to slightly coiled in one fascicle, 95–155 \times 3–5(6) μ m, seven-septate, fusoid, tapering to both ends but more so to base, constricted at primary septum at 0.4 of length, with slight inflation of parts of cells adjacent the primary septum, yellow to pale brown, cells biguttulate, finely roughened on outer wall surface, without sheath or appendages.

COLLECTIONS EXAMINED: ON *Prunella vulgaris* L. leaf spots: CANADA: BRITISH COLUMBIA: 118291,

North Saanich, *W. Jones*, 20.V.1946, SBC 935; 118292, North Saanich, *W. Jones*, VI.1941, SBC 578; 71512, Cordova Bay, Vancouver Island, *W. G. Ziller*, 28.V.1960, DAVFP 12052; 118285, Saanich, *W. Jones*, VII.1932, SBC 22; 118286, Patricia Bay, Vancouver Island, *W. Jones*, 12.VI.1942, SBC 656; 118287, Rocky Point, Vancouver Island, *W. Jones*, VII.1932, SBC 21; 118288, Bradner, *W. Jones*, V.1934, SBC 103; 15328, Patricia Bay, Vancouver Island, *W. Jones*, 2.VI.1942; 19994, Parksville, *W. Jones*, 16.VII.1947; 106013, Little Fort, *W. G. Ziller*, 5.VIII.1963, DAVFP 15575. U.S.A.: OREGON: 85183, Sheridan Hills, *H. S. Jackson*, 7.VII.1914.

Ophiobolus prunellae appears to be host specific, occurring on *Prunella vulgaris* L. The collections I have seen are from western Canada and U.S.A. This western distribution of the fungus is reflected in the epithet *hesperia* used by Barr (1967) when she proposed the name *Leptosphaeria hesperia* because of the earlier homonym *L. prunellae* Ellis & Ev. The epithet *prunellae* can be used in a combination with *Ophiobolus*.

The ascospores are fairly large, usually eight-celled and quite distinctive. This coupled with the parasitic habit on leaves of *Prunella vulgaris* makes the species easy to recognize. It should be sought east of British Columbia.

The orthography of the epithet is changed to *prunellae* from *brunellae* as recommended in Article 73H (Staffeu 1972) to conform with the accepted spelling of the host generic name, *Prunella*, covered in Article 74 (Staffeu 1972).

Ophiobolus pseudoaffinis Petrak, Ber. Bayer, Bot. Ges. 23: 173. 1938.

\equiv *Nodulosphaeria pseudoaffinis* (Petrak) L. Holm, Sven. Bot. Tidskr. 55: 78. 1961.

This species was not encountered in the present study. It was fully redescribed and illustrated by Holm (1961). It is similar to *O. mathieui*. The distinctions are discussed above with that species.

Ophiobolus robustus (Strasser) n. comb. Fig. 19
 \equiv *Leptosphaeria derasa* f. *robusta* Strasser, Verhandl. K.-Zool.-Bot. Ges. Wien, 57: 315. 1907.

\equiv *Leptosphaeria robusta* (Strasser) E. Müller, Sydowia, 4: 298. 1950.

\equiv *Nodulosphaeria robusta* (Strasser) L. Holm, Symb. Bot. Upsal. 14(3): 90. 1957.

\equiv *Sphaeria pellita* Fries, Syst. Mycol. 2(2): 503. 1823.

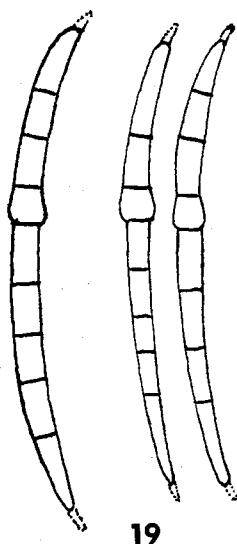


FIG. 19. *O. robustus*, 105092.

- ≡ *Pleospora pellita* (Fries) Rab. Herb. Myc. 2: 749.
- ≡ *Pyrenophora pellita* (Fries) Sacc. Syll. Fung. 2: 280. 1883.
- ≡ *Ampullina pellita* (Fries) Quélet, Champ. du Jura et des Vosges, Part III, p. 525. 1875.
- ≡ *Nodulosphaeria pellita* (Fries) Shoemaker, Can. J. Bot. 44: 1144. 1968. non *Ophiobolus pellitus* (Fuckel) Sacc. Syll. Fung. 2: 352. 1883.

Ascocarps scattered, immersed, globose, later collapsing downward, 200–500 μm diam, lightly covered with brown mycelium 100–150 \times 5 μm ; beak terete, 50–100 μm long, 80–130 μm wide, lined with brown periphyses 30–40 \times 3 μm ; wall 25–35 μm of three–five layers of brown prismatic cells. Asci in a broad hymenium, long elliptical, 100–120 \times 10–14 μm , eight-spored, interspersed with 3- μm -wide pseudoparaphyses septate at 15- to 20- μm intervals. Ascospores four-seriate above and reducing to uniseriate in ascus base, slightly curved, 45–60 \times 4–5 μm , eight-septate, fourth cell from apex short and slightly enlarged, basal part characteristically five-celled, yellow, with a conical appendage 3 \times 1 μm at each end.

COLLECTIONS EXAMINED: U.S.A.: UTAH: 105092, dicot, Lake Mary Trail, Brighton, Salt Lake County, elev. 9000 ft, G.D. Darker 8250, 29.VII.1936.

Ophiobolus robustus has not yet been found in Canada. Holm (1957, p. 90) recorded this fungus

from various parts of Europe (as *N. robusta* (Strasser) L. Holm). It may eventually be found in Canada.

Ophiobolus robustus has many points of similarity with *O. filiformis* which differs in the larger, more frequently septate ascospores with cushion-shaped appendages.

Ophiobolus rubellus (Pers. ex Fries) Sacc. Fungi Gallici III: 324. 1881. Fig. 32

≡ *Sphaeria rubella* Pers. ex Fries, Syst. Mycol. 2: 506. 1823.

≡ *Leptospora rubella* (Pers. ex Fries) Rabenh. Herb. Myc. ed. 2. 532. 1857.

= *Ophiobolus trichisporus* Ellis & Ev. Proc. Acad. Phila. 1890: 239. 1890.

Ascocarps scattered, erumpent to superficial, pyriform, often collapsed laterally, lightly covered with mycelium, 200–340 μm diam, 300–400 μm high; beak terete, 60–100 μm diam, 150–200 μm long, reddish at tip, from red external cells over top half, filled with hyaline pseudoparenchyma, lacking periphyses or apical hairs; wall 15–25 μm of three–five layers of cells, externally subglobose, thick-walled, brown, 7–9 μm diam, internally almost rectangular, thin-walled, hyaline 10–12 \times 2–4 μm . Asci numerous in a broad hymenium, cylindrical, 170–225 \times 4–5 μm , eight-spored, interspersed with sparse pseudoparaphyses 2–3 μm wide above and 3–7 μm wide below, septate at intervals of 20–30 μm . Ascospores parallel to coiled in one fascicle, cylindrical, 220–270 \times 1.0(1.5) μm , 15- to 25-septate, yellow, guttulate without sheath, appendages, constrictions, enlargements, or disarticulations.

COLLECTIONS EXAMINED: CANADA: QUEBEC: 74332(c), *Heracleum maximum* Bartr. (*H. lanatum* Michx.) Lac Diable, Mount Albert H.E. & M.E. Bigelow, M.E. Barr 2198, 19.VIII.1969; 74343(b), *Heracleum maximum* Bartr. (*H. lanatum* Michx.), near top of Mount Albert, H.E. & M.E. Bigelow, M.E. Barr 1951, 8.VII.1957. ONTARIO: 129658, *Acer negundo* L., Railway Bridge, near Thamesville, J. Dearness, 15.VIII.1892; 129661, *Apocynum androsaemifolium* L., W side Oakland Cemetery, London, J.D., 11.VIII.1910; 129662, *Asclepias syriaca* L. (*A. cornutii* Decne.), N bank of Oakland Cemetery, London, J.D., 22.VII.1911; 86089, *Asclepias syriaca* L., E of Wilcox Lake, York County, R.F. Cain 8901, 14.VI.1936; 29619 (=85062), *Bidens* sp. New Durham, Brant

County, *R.F.C.*, 25.V.1943, TRTC 23149; 29635 (=85055), *Cirsium arvense* (L.) Scop., New Durham, Brant County, *R.F.C.*, 25.VI.1943, TRTC 23134; 129649, *Echinosperrum virginicum* Lehm. Wm. Grant's Woods, Biddulph Township, Middlesex County, *J.D.*, 28.V.1895; 91478, *Galeopsis tetrahit* L., Bear Island, Lake Timagami, Nipissing District, *G.D. Darker* 2381, 29.VIII.1928; 129656, *Helianthus annuus* L., London, *J.D.*, 27.VII.1904, 150 pieces to Fungi Col. (#2044); 86091, *Helianthus* sp., Humber, Toronto, *R.F.C.* 8259, 8.VI.1934; 129646, *Impatiens* sp., McGrady's, London, *J.D.*, 12.VIII.1895; 129657, *Impatiens* sp. Gerry's Flats, *J.D.*, 5.VI.1911, sent Fungi Col. 100-bits (#3825); 129659, *Linaria vulgaris* Mill., opposite Saunby's Mill, *J.D.*, V.VI.1911, sent Rehm spec. 3.VII.1911; 129663, *Pastinaca sativa* L., Mount Pleasant Cemetery, London, *J.D.*, VII.VIII.1910, sent to Rehm for identification, March 1911; 108188, *Rosa palustris* Marsh. 2 mi N of Nipigon on Highway 11, near Lake Helen, Thunder Bay District, *R.A.S.*, 6.VIII.1964; 129653, *Solanum dulcamara* L., Woods straight back from Ontario Agricultural College, Guelph, *J.D.* 6.VIII.1914; 86093, *Thalictrum* sp., North of Mount Albert, York County, *R.F.C.* 8912, 16.VI.1936; 129668, on stem of dead herb, not a grass, Luke's, London, *J.D.*, VIII.1895, sent part of gathering to J. B. Ellis, [not part of type of *Ophiobolus trichisporus* Ellis & Ev.]; 129666, on grass, foot of McGrady's Bank, London, *J.D.*, 9.VI.1890, [part of type of *Ophiobolus trichisporus* Ellis & Ev.]; 29640 (=85061), herb, New Durham, Brant County, *R.F.C.*, 25.V.1943, TRTC 23138; 86094, old stem, Humber Valley, Toronto, *R.F.C.* 8909, 8.VI.1936; 114689(c), dicot. herb, Bell's Swamp, 2 mi N of Kingston, *R.A.S.*, 11.IX.1966. MANITOBA: 129654, *Cirsium arvense* (L.) Scop., Manitoba Agricultural College, Winnipeg, *G.R. Bisby* 2885, 10.VII.1926; 129667, on old straw, Manitoba Agricultural College, Winnipeg, *G.R. Bisby* 4409, 21.VI.1928. SWEDEN: 130243, ex UPS exsiccati, S.S. 240. [ed. I.] *Sphaeria rubella* Pers. *S. porphyrog.* Tod.; 130054 ex UPS general collections S.S. 240. [ed. II] *S. rubella* Pers.; 37034, *Solanum tuberosum* L. Vastergotland, Wenersborg, Botered, *A. G. Eliasson*, 28.VII.1892. U.S.A.: DELAWARE: 86090, *Cryptotaenia canadensis* (L.) DC (*Deringia c.*) Newark, *H. S. Jackson*, VI.1908; 85066, *Lycopersicon* sp. Newark, *H. S. Jackson*, *R. F. Cain*, V.1908. MASSACHUSETTS: 121753, herb, Waverley, *L. E.*

Wehmeyer 3298, 26.VII.1926. MICHIGAN: 121756, herb, 381 Orchard Hill Dr., Ann Arbor, *L.E.W.* 9260, 4.X.1945. OHIO: 121689, composite, Heuston's Woods, Oxford, *L.E.W.* 3305, 14.VII.1924; 121752, *Lappula* sp., Heuston's Woods, Oxford, *L.E.W.* 3301, 15.VII.1924. NEW YORK: 129651, *Arctium* sp., Vaughns, 5 mi N of Hudson Falls, Wash. County, *Stewart H. Burnham* 106, 23.VI.1916; 129650, *Lactuca* sp., Cooper's, Steuben County, *C. H. Peck*, 7.VIII.1908; 129660, *Leonurus* sp., Hudson Falls, *S. H. Burnham* 110, 26.VI.1916; 129629, *Veratrum viride* Ait., Peterboro, Madison County, *H. D. House*, 9.VI.1923. NORTH CAROLINA: 129670, *Verbesina virginica* L., Carr Creek, Waynesville, *G. G. Hedgcock* FP48491, 16.VII.1928, as *O. verbesinae* Dearness n. sp. pro tem. PENNSYLVANIA: 129652, *Amaranthus retroflexus* L., State College, *W. L. White*, 8.X.1932; 1960, *Amaranthus* sp. State College, Center County, *W. L. White*, IX.1932, ex Herb. L. O. Overholts 14930.

Ophiobolus rubellus is the species of *Ophiobolus* most commonly found in Canada. It is thought to be the perfect state of *Phoma exigua* Desm. var. *foveata* Foister (Popkova and Kovalova 1973). The connection appears to be based on association on affected plants rather than by connections established in pure culture. In view of the importance of the potato gangrene fungus there should be a concerted effort to examine the apparent connection on the bases of Canadian collections and of pure culture work on *Phoma exigua* and its varieties.

Ophiobolus rubellus is often recognized by a red to purple stain of the host substrate and a red color of the top quarter of the ascocarp beak. These color features are often present but are not invariable. The most certain features are the long slender ascospores $220-270 \times 1.0(1.5) \mu\text{m}$.

Ophiobolus rudis (Riess) Rehm, Ber. Naturhist Ver. Augsburg, 26: 48. 1881. Fig. 20
= *Entodesmium rude* Riess, Hedwigia, 1: 28. 1854.

= *Rhaphidospora rudis* (Riess) Fuckel, Jahrb. Nass, Ver. Naturk. 23,24: 125. 1869 (1870).

Ascocarps clustered in several rows, immersed, conical, 200–250 μm diam, 300–400 μm high, interconnected by loose brown 3- to 5- μm -wide mycelium; beak terete, erumpent at an angle, 95–150 μm diam, 200–300 μm long, lined internally with hyaline periphyses 25–30 \times 2–3 μm ; wall 20–35 μm of four-six layers of polygonal

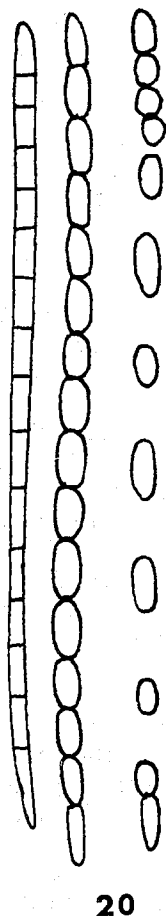


FIG. 20. *O. rudis*, 151642.

cells 9–16 μm diam, external cells darker brown and thicker walled than internal cells. Asci numerous in a broad hymenium, 120–160 \times 9–14 μm , eight-spored, interspersed with pseudoparaphyses 6–9 μm wide and septate at intervals of 17–30 μm . Ascospores parallel in one fascicle, cylindrical, 100–120 \times 3.0–3.5 μm , 15- to 19-septate, yellowish brown, not enlarged or constricted or furnished with sheath or appendages, separating in the ascus into individual cells 6–8 μm long.

COLLECTIONS EXAMINED: CANADA: BRITISH COLUMBIA: 34155, *Phacelia leptosepala* Rydb., Sage Pass, 7500 ft, *T. M. C. Taylor*, 10.VIII.1951, U.B.C. 1968. CZECHOSLOVAKIA: 151642, *Astragalus glycopyllos*, Mahren, Usti bei Mahr.-Weisskirchen, *F. Petrak*, VII. 1924, *Mycotheca generalis* 549.

The only Canadian collection under this name

in DAOM did not bear *O. rudis* or, for that matter, any species of *Ophiobolus*. The published record (Barr 1953, p. 818) noted that the spores separate at the septa into short cylindrical sections. However, the asci were noted to be up to 210 μm long, longer than in the description. There is a possibility that the fungus from B.C. might be *O. anthrisci* (L. Holm) L. Holm or *O. nigromaculatus* Rehm, both of which have separating ascospores that are longer than for *O. rudis*.

Ophiobolus tanacetii (Fuckel) Sacc. Syll. Fung. 2: 348. 1883. Figs. 21, 60, 77, 78, 79

\equiv *Sphaerulina tanacetii* Fuckel, Jahrb. Ver. Naturkunde Nassau, 15: 77. 1860.

\equiv *Leptosphaeria tanacetii* (Fuckel) L. Holm, Symb. Bot. Upsal. 14(3): 49. 1957.

Ascocarps scattered, immersed, pyriform to globose, 200–300 μm diam, 250–300 μm high, smooth, with a terete beak lacking periphyses and apical bristles, 50–85 μm wide, 40–70 μm high; wall 15–25 μm of two external rows of scleroplectenchyma 10–14 μm diam, and two or three internal layers of thin-walled rectangular cells 13–20 \times 3–5 μm . Asci few from a basal hymenium 100–120 \times 15–17 μm , cylindrical to long elliptical, eight-spored, interspersed with hyaline 5- to 6- μm -wide pseudoparaphyses septate at 10- to 15- μm intervals. Ascospores subcylindrical 90–120(130) \times 4.5–5.0 μm , 13-septate, yellow, guttulate lacking sheath and appendages, third and fourth cell slightly inflated.

COLLECTIONS EXAMINED: CANADA: ONTARIO: 115099, Compositae, Nashville, York County, *R. F. Cain*, 10.VI.1951, TRTC 35670; 129627, *Lactuca scariola* L., near St. Joseph's, Guelph, *J. Dearness*, VII.1913. SASKATCHEWAN: 2255, *Artemisia biennis* Willd., Indian Head, *P. M. Simmonds*, 4.IX.1924 as *O. acuminatus*. GERMANY: 119813, *Tanacetum*, *Achillea ptarmica*, Oestrich. Nassau, *Fuckel*; 121728, *Achillea ptarmica*. Kr. Siegen, Gerusdorf, *A. Ludwig*, 13.IV.1929, as *O. ptarmicae*. U.S.A.: 129626, *Artemisia biennis* Willd. Kulm, N. Dakota, *Brenckle*. VIII.1913, Rehm, Asco. 2085, as *O. claviger* Harkn.

Ophiobolus tanacetii has some subtle distinctions that are now well recognized but which previously escaped attention. The ascocarps are small and not particularly diagnostic. The ascospores provide the main clues being regularly 14-celled with typical enlargements of the third

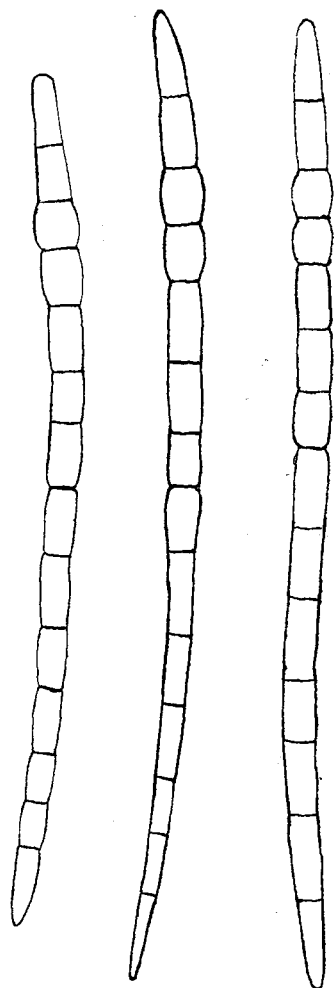


FIG. 21. *O. tanaceti*, 121728, 129626, 2255.

and fourth cells but lacking any appendage or sheath. It was erroneously reported on *Artemisia biennis* from Saskatchewan by Bisby *et al.* (1938, p. 55), and this published record was subsequently included in a checklist by Conners (1967, p. 44).

Ophiobolus vermisporus (Ellis) n. comb.

Figs. 22, 55, 69

≡ *Lophiostoma vermisporum* Ellis, Bull. Torrey Bot. Club, 9: 19. 1882. As '*vermispora*.'

≡ *Lophionema vermisporum* (Ellis) Sacc. Syll.

Fung. 2: 717. 1883.

Ascocarps clustered, erumpent, globose, smooth 300–400 μm diam, 300–400 μm high, beak terete to laterally flattened by host vascular

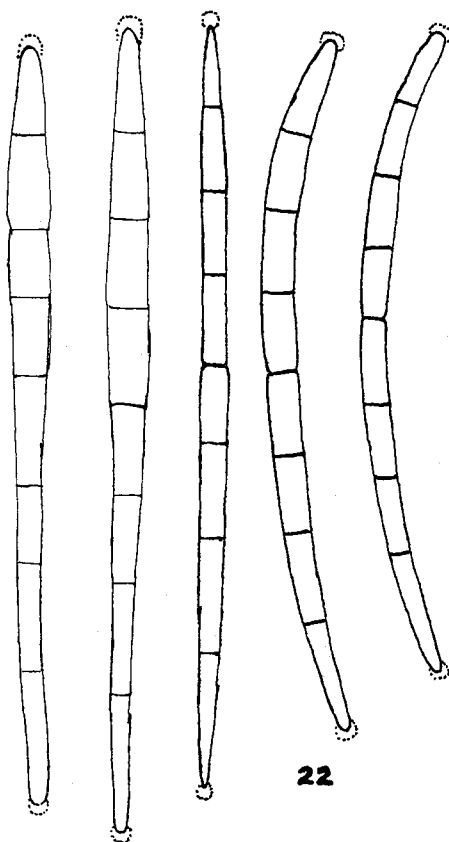
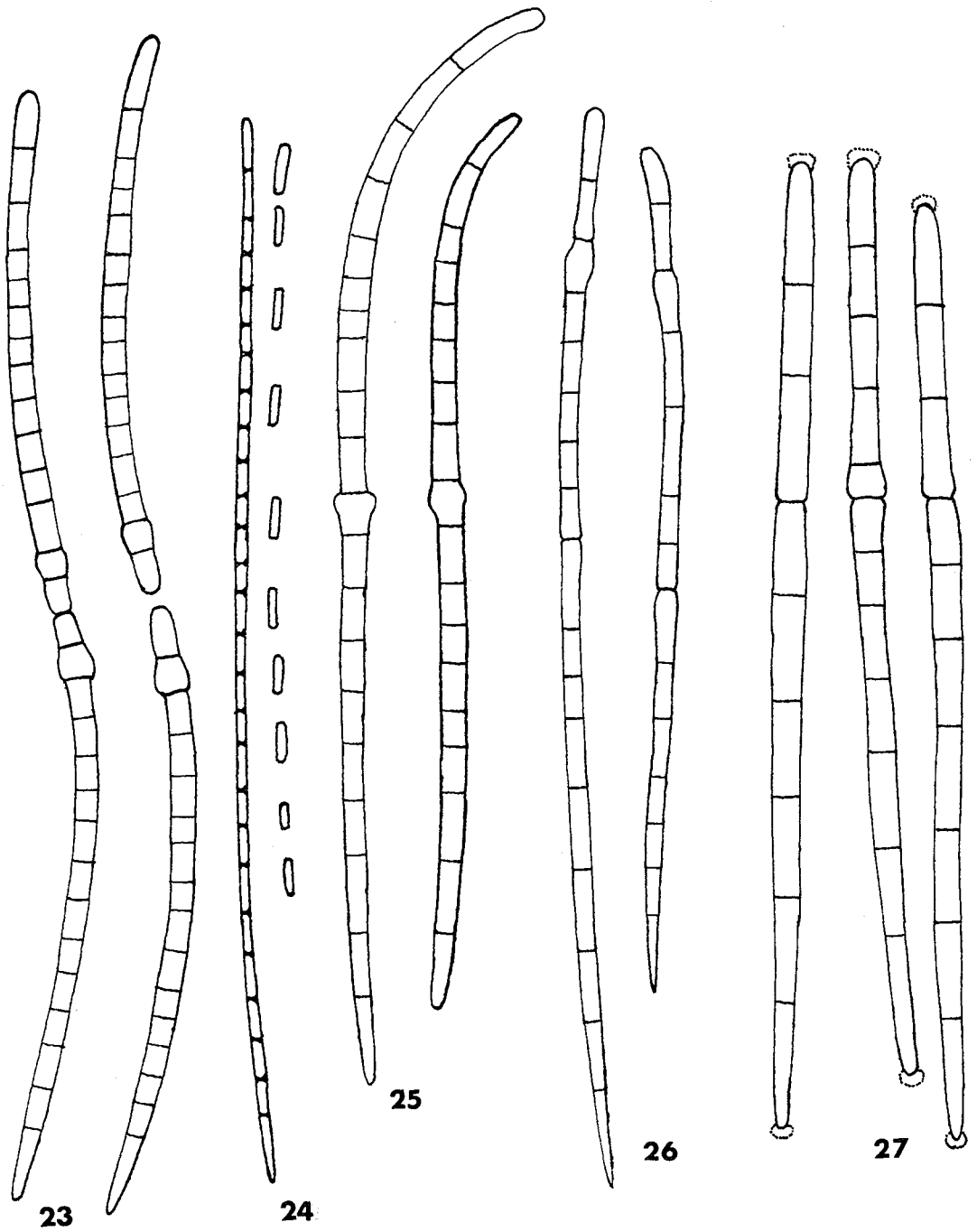


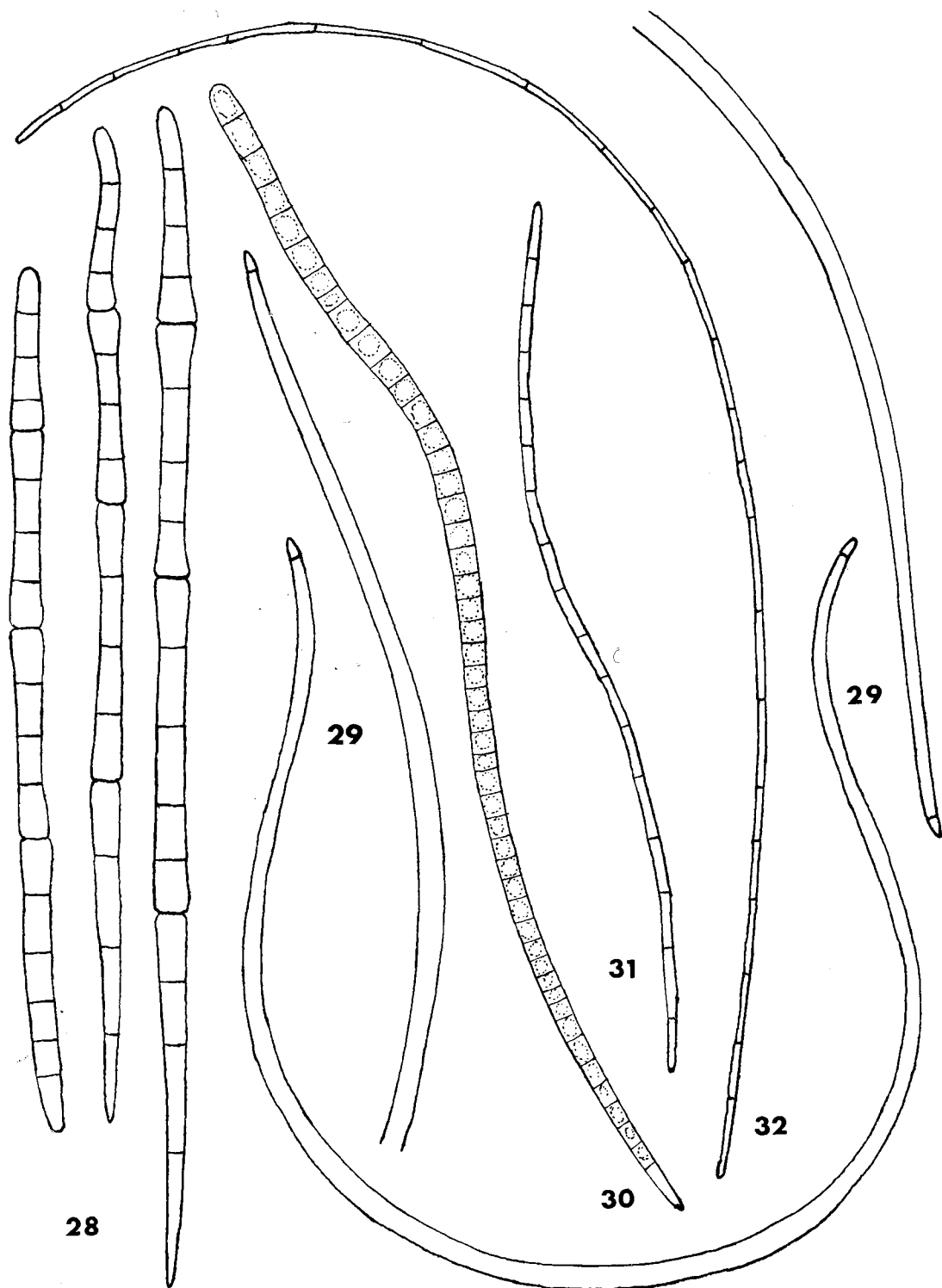
FIG. 22. *O. vermisporus*, 97782.

tissue 120–150 μm diam, 135–180 long, lined with hyaline periphyses 15–25 × 2.5–3.5 μm; wall 25–35 μm of 7–10 layers of cells, externally very dark brown, thick-walled, polygonal, 3–5 μm, internally, nearly hyaline, thin-walled, rectangular, 6–9 × 3–4 μm. Asci numerous in a broad hymenium, cylindrical to slightly clavate 110–130 × 11–14 μm, eight-spored interspersed with 1.0- to 1.5-μm-wide pseudoparaphyses septate at 15- to 20-μm intervals. Ascospores parallel to slightly twisted in one fascicle, cylindrical with slight tendency to clavate, 90–110 × 5–6 μm, seven-septate, widest at 0.30, tapered slightly to hemispheric apex, narrowed more to base, slightly curved, nearly colorless, guttulate, furnished with terminal mucilaginous cushion-shaped appendages, without constriction, obvious enlargements or sheath.

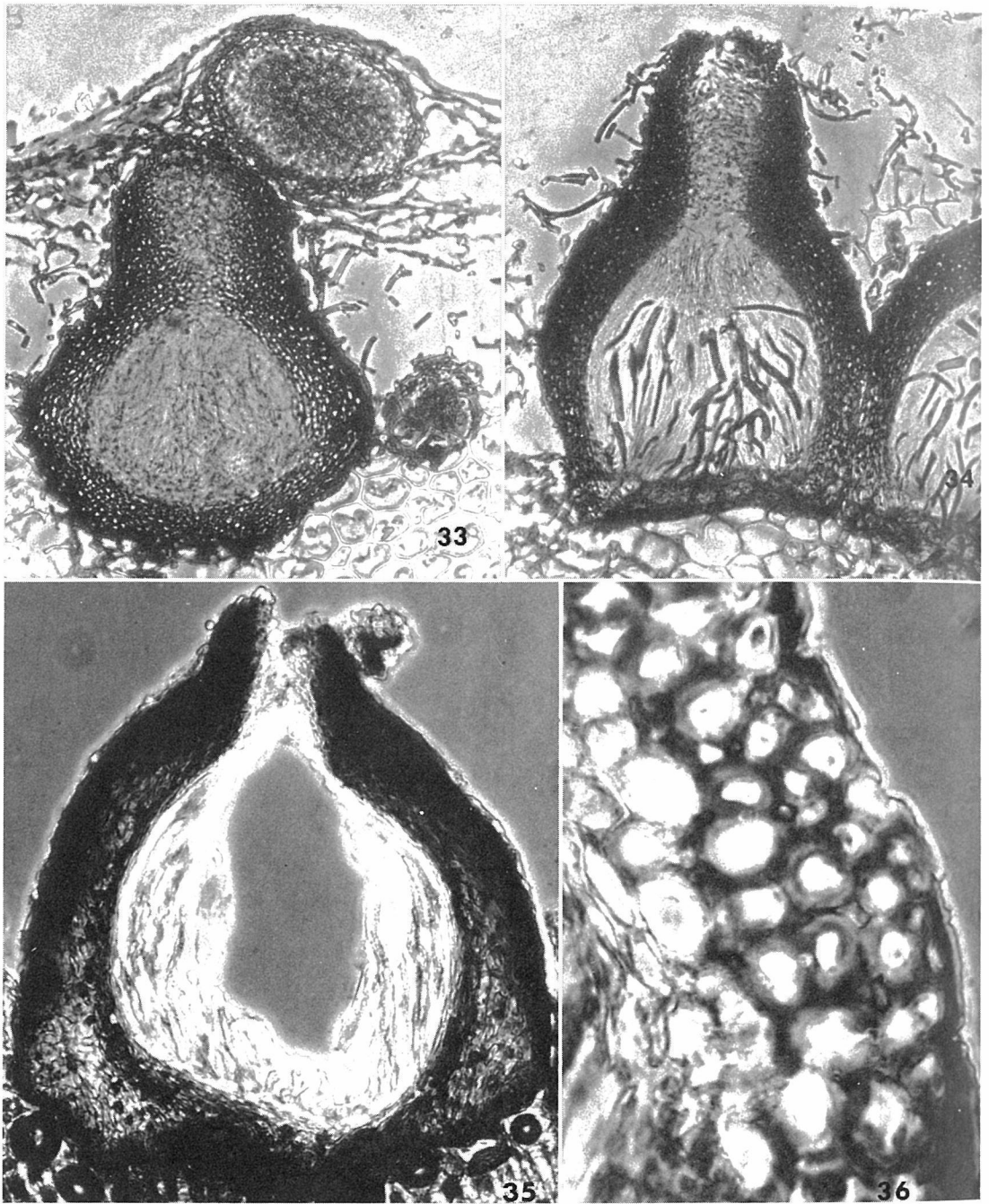
COLLECTIONS EXAMINED: U.S.A.: MISSOURI: 97782, *Oenothera* sp., Creve Coeur Creek, end of Ladue Road, St. Louis County, G. D. Darker 7311, 9.V.1942. NEW JERSEY: 155522, *Oenothera*



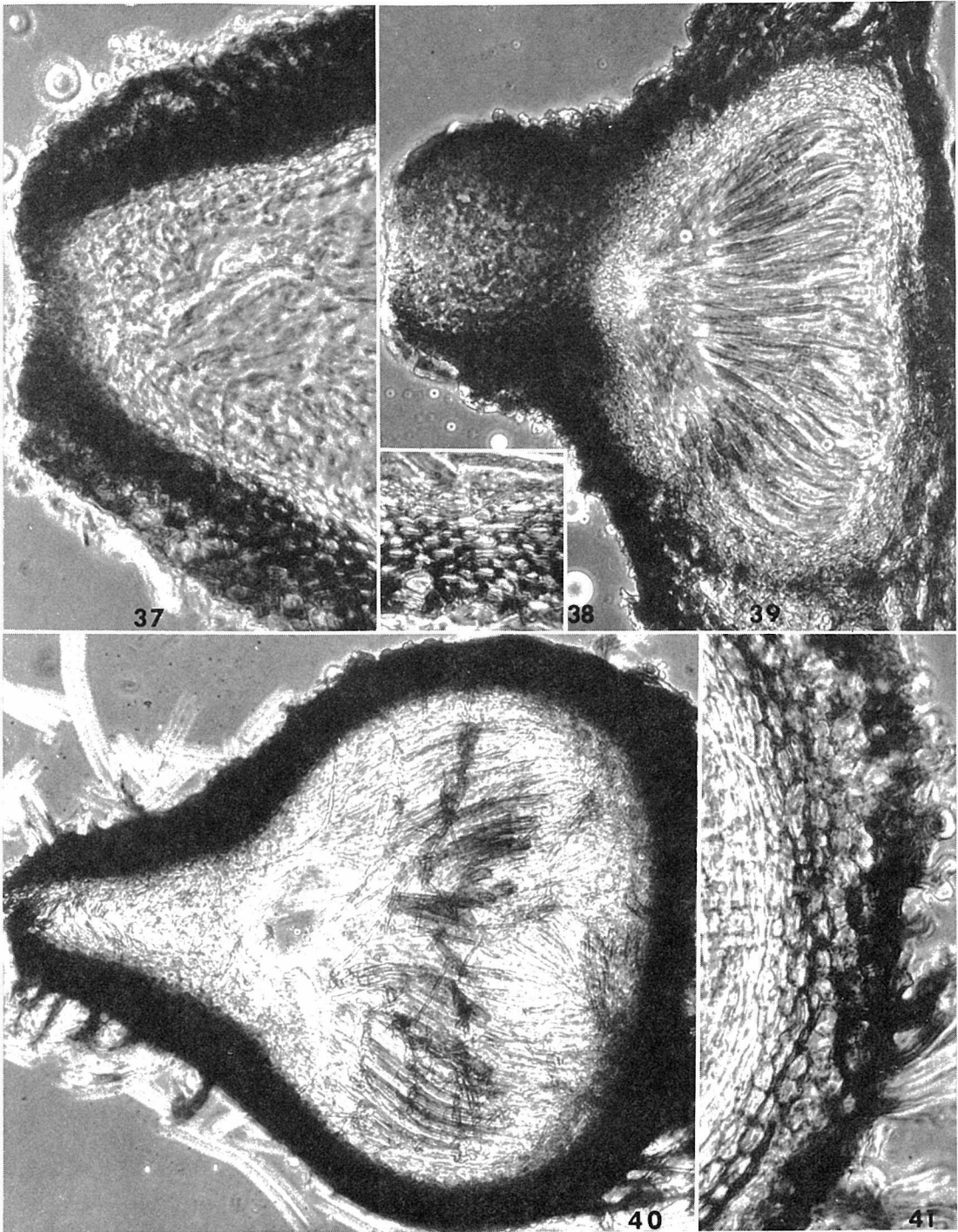
FIGS. 23-27. $\times 1000$. Fig. 23. *O. acuminatus*, 129676. Fig. 24. *O. anthrisci*, 121786. Fig. 25. *O. cirsii*, 57107. Fig. 26. *O. dictamnii*, 119811. Fig. 27. *O. filiformis*, 120192.



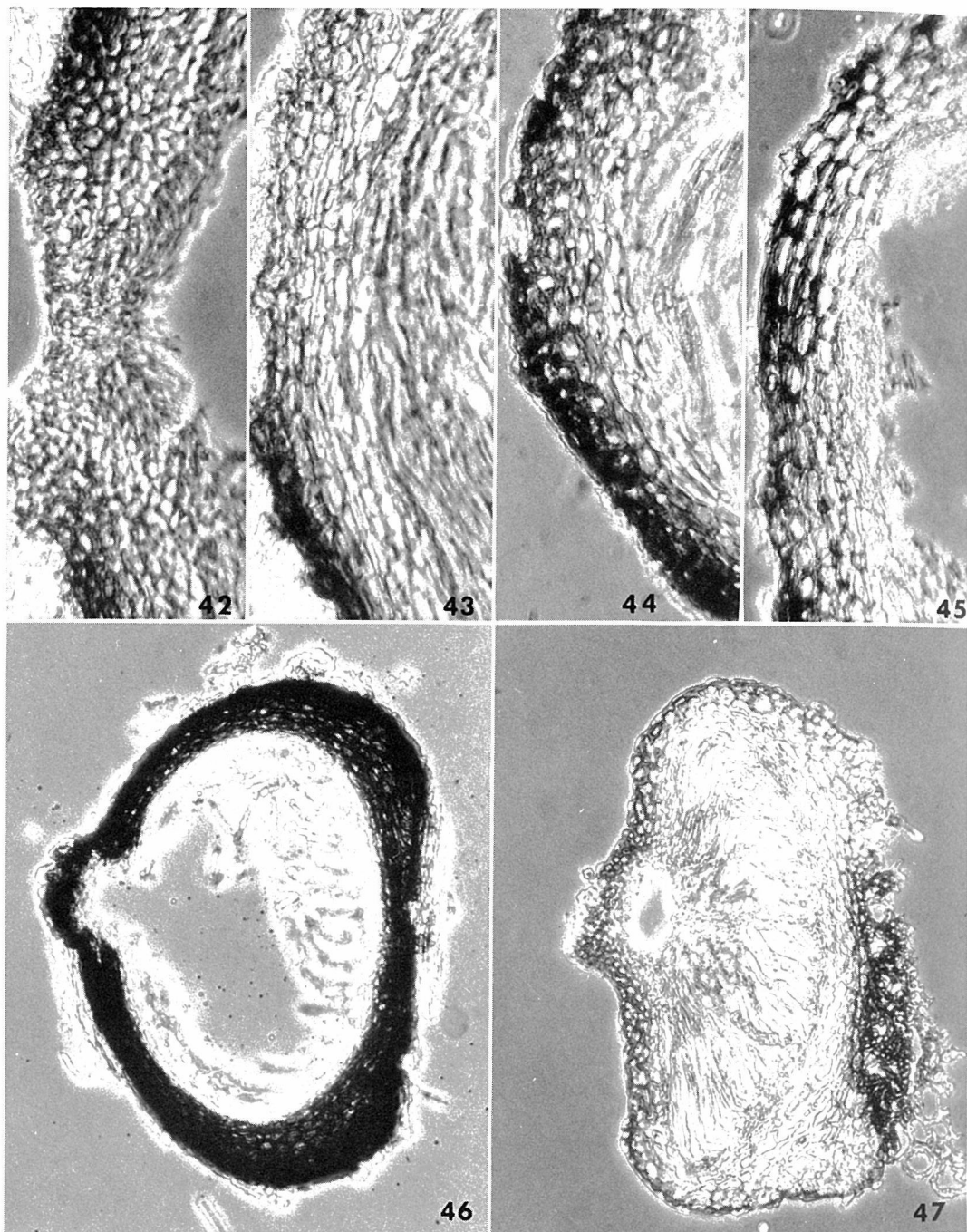
FIGS. 28-32. $\times 1000$. Fig. 28. *O. fruticum*, 121730, 37030 (two spores). Fig. 29. *Lulworthia halima*, 3584. Fig. 30. *O. loniceræ*, 134951. Fig. 31. *Q. galii*, 129647. Fig. 32. *O. rubellus*, 150791.



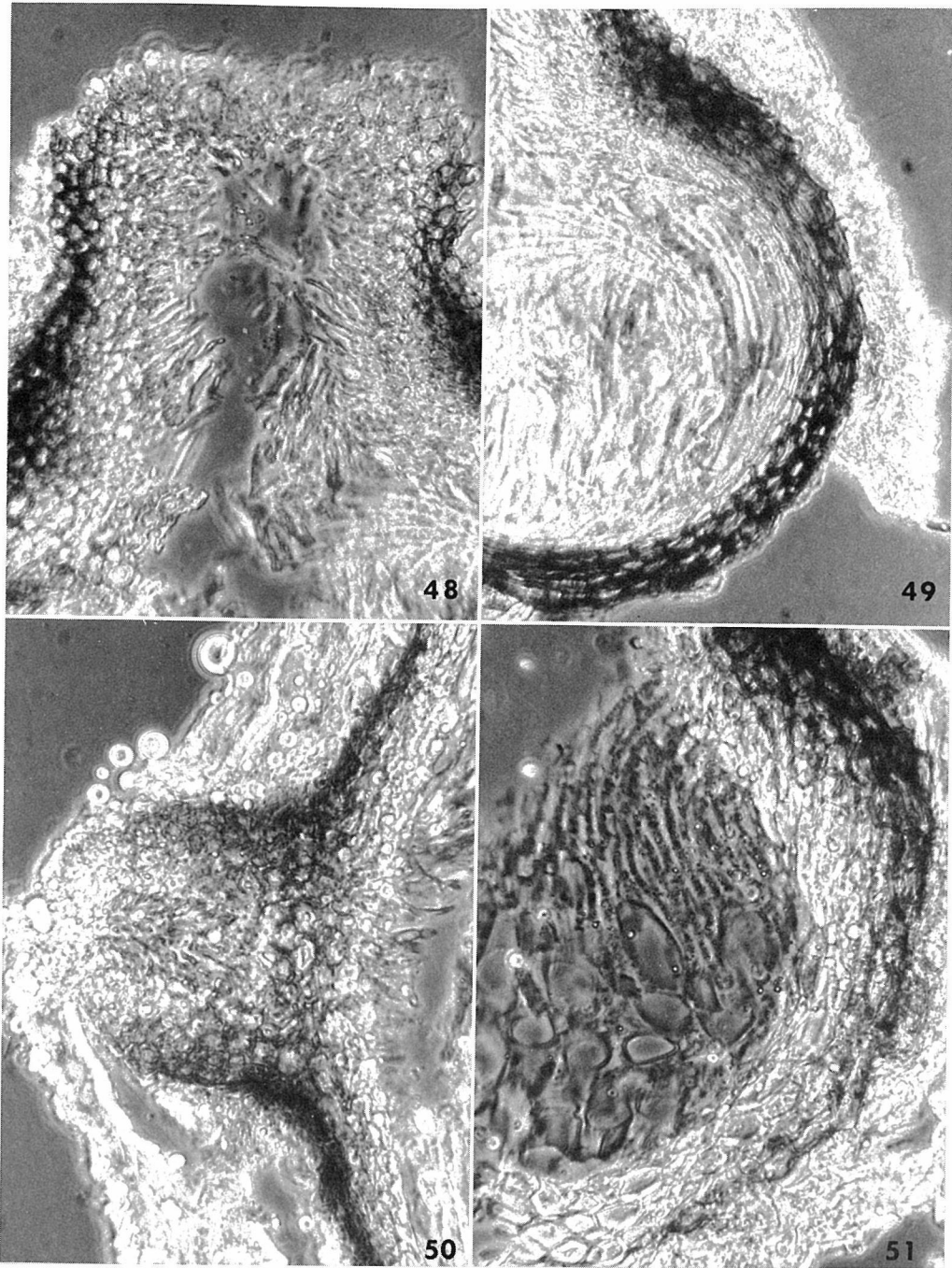
FIGS. 33, 34. *O. acuminatus*, 114075. $\times 200$. Fig. 33. Young ascocarp and pycnidium. Fig. 34. Mature ascocarp. FIGS. 35, 36. *O. anguillidus*, 129705. Fig. 35 ascocarp. $\times 250$. Fig. 36. Wall. $\times 1000$.



FIGS. 37, 38. *O. anthrisci*, 121785, beak and wall. $\times 500$. FIG. 39. *O. cesatianus*, 129621, ascocarp. $\times 200$. FIGS. 40, 41. *O. cirsii*, 51746, ascocarp, $\times 200$; wall, $\times 500$.



FIGS. 42, 43. *O. collapsus*, 128731, beak and wall. $\times 500$. FIG. 44. *O. compressus*, 152138, wall. $\times 500$. FIG. 45. *O. dictamni*, 119811, wall. $\times 500$. FIG. 46. *O. filiformis*, 105797, ascocarp. $\times 200$. FIG. 47. *O. fulgidus*, 152140, ascocarp. $\times 200$.



FIGS. 48, 49. *O. ponticus*, 128732, beak and wall. $\times 500$. FIG. 50. *O. niesslii*, 150708, beak, periphyses, and attachment of pseudoparaphyses. $\times 500$. FIG. 51. *O. prunellae*, 71512, wall and pseudoparaphyses. $\times 500$.

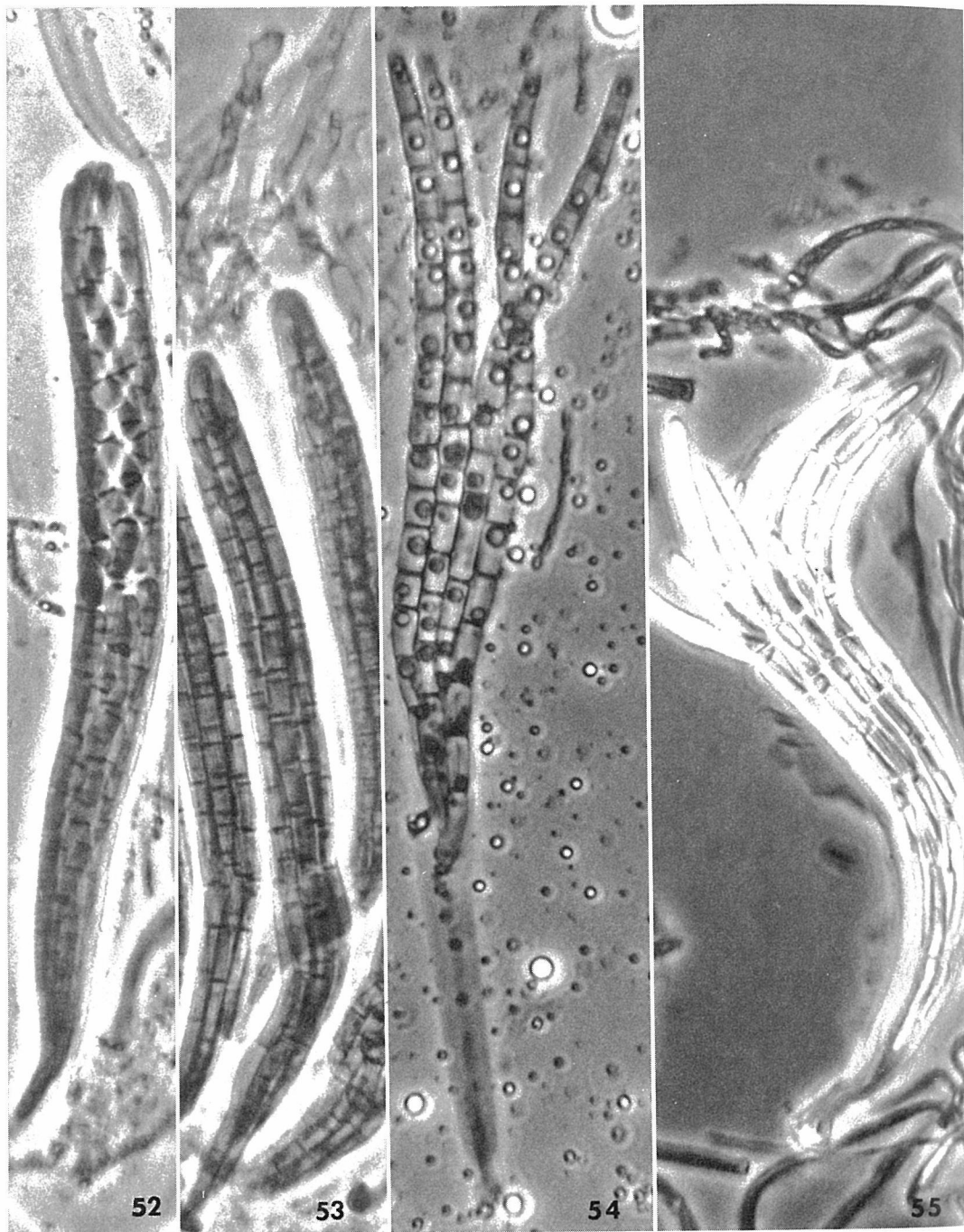


FIG. 52. *O. acuminatus*, 129676, ascus and separating part spores. $\times 1000$. FIG. 53. *O. anguillidus*, 86085, ascus and pseudoparaphyses. $\times 1000$. FIG. 54. *O. cesatianus*, 129121, four spores from ascus. $\times 1000$. FIG. 55. *O. vermisporus*, 97782, ascus. $\times 1000$.



FIG. 56. *O. herpotrichus*, 128729, ascus and free ascospores. $\times 1000$. FIG. 57. *O. drechsleri*, 85059, ascus and pseudoparaphyses. $\times 500$. FIG. 58. *O. mathieui*, 150707, emerging ascospores. $\times 1000$. FIG. 59. *O. megalosporus*, 151574, ascus. $\times 1000$. FIG. 60. *O. tanacetii*, 121728, ascus. $\times 1000$.

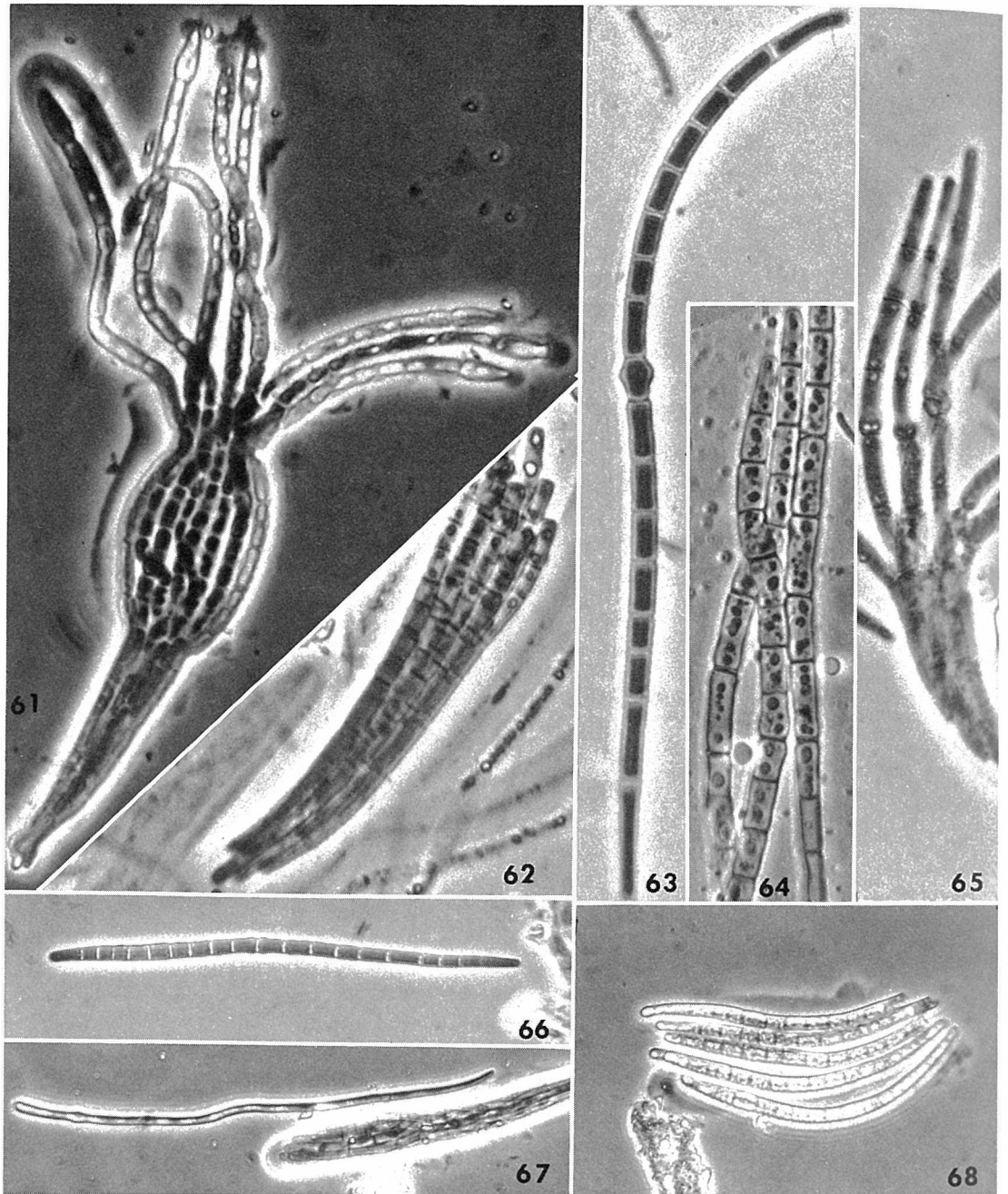


FIG. 61. *O. anguillidus*, 129705, apically appendaged spores. $\times 1000$. FIG. 62. *O. acuminatus*, 129676, fascicle of part spores. $\times 1000$. FIG. 63. *O. cirsii*, 57107, ascospore. $\times 1000$. FIG. 64. *O. cesatianus*, ascospores. $\times 1000$. FIG. 65. *O. collapsus*, 129675, ascospores. $\times 1000$. FIG. 66. *O. compressus*, 152138, ascospore. $\times 500$. FIG. 67. *O. dictamni*, 119811, ascospore. $\times 500$. FIG. 68. *O. drechleri*, 85059, ascospores. $\times 500$.

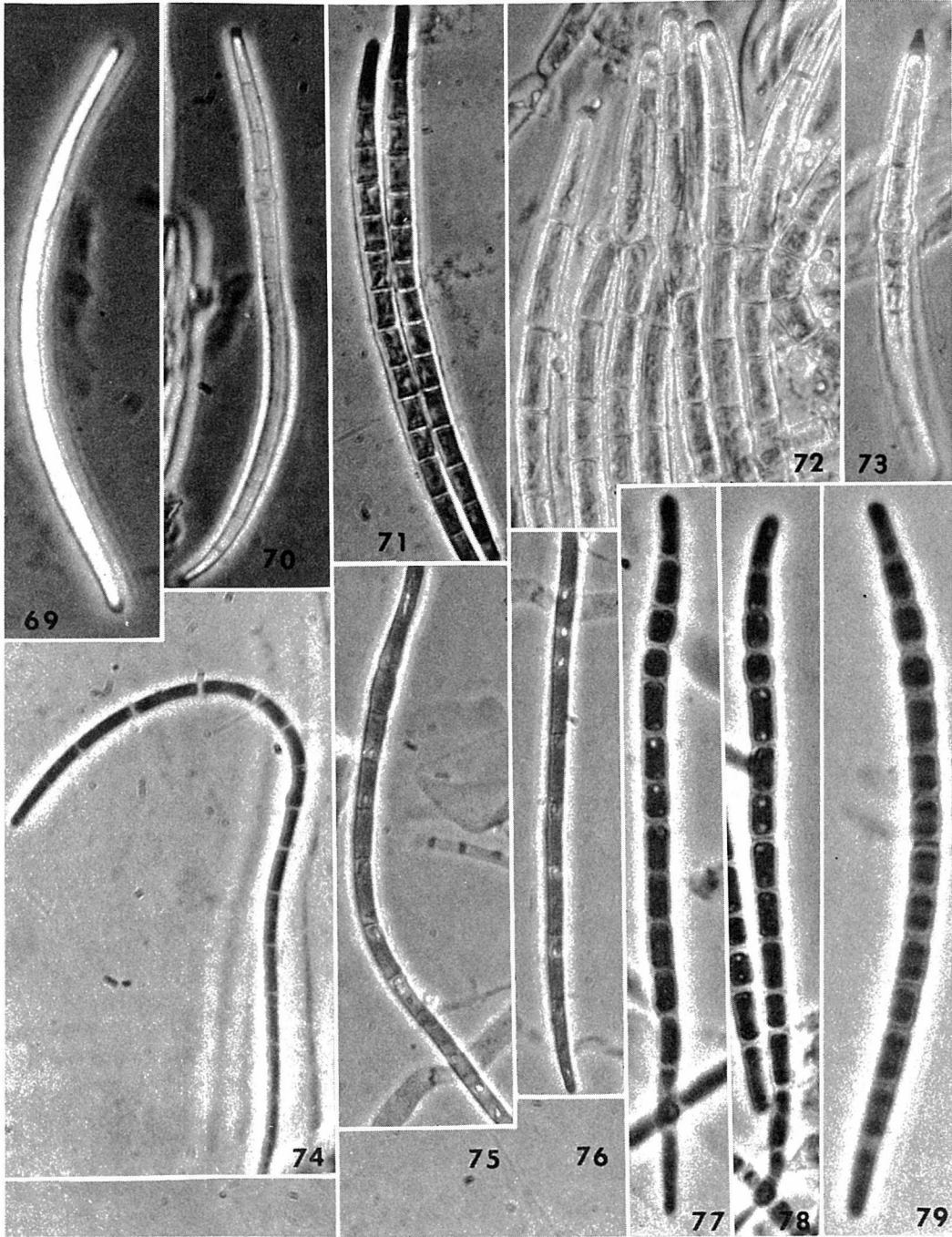


FIG. 69. *O. vermisporus*, 97782, appendaged ascospore. $\times 1000$. FIG. 70. *O. ponticus*, 105000, appendaged ascospore. $\times 1000$. FIG. 71. *O. drechsleri*, 85059, ascospores. $\times 1000$. FIG. 72. *O. filiiformis*, 150797, appendaged ascospore tips. $\times 1000$. FIG. 73. *O. megalosporus*, 151574, appendaged ascospore. $\times 1000$. FIG. 74. *O. erythrosporus*, 90218, ascospore. $\times 1000$. FIGS. 75, 76. *O. dictamni*, 119811, ascospore apex and base. FIGS. 77, 78, 79. *O. tanacetii*, ascospores. $\times 1000$. FIGS. 77, 78. 2738. FIG. 79. 121728.

biennis L., Newfield, VIII.1881. Ellis, North American Fungi 885, ex DAOM set.

This species was treated as doubtful for inclusion in *Lophiostoma* by Chesters and Bell (1970, p. 52). They examined the type, Number 643, 7/8/1881, and redescribed the fungus. The exsiccatus Number 885 was collected at Newfield in August 1881 and accords with the original description, and with most aspects of the re-description from the type. In 885, the ascospores are seven-septate when mature, though Chesters and Bell noted the range to be 2- to 10-septate in 643.

The ascocarp beak is only rarely flattened from pressure of the host vascular tissue in the collection Darker 7311, and this collection is readily placed in *Ophiobolus*. The Ellis collection, N.A.F. 885, has most beaks flattened, but nearly half are circular in outline. Because of the variation in beak form and because of characteristics of ascospores, I place the species in *Ophiobolus*.

Ophiobolus vermisporus resembles *Nodulosphaeria olivacea* (Ellis) L. Holm (1961) but has seven-septate ascospores and lacks the inflation of the third cell, characteristic of that species. *Ophiobolus vermisporus* can be distinguished from *O. filiformis*, which has appendaged ascospores but an inflated cell.

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