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MYXOMYCETICOLOUS FUNGI

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ABSTRACT

Host records are provided for nine ascomycetes and 26 hyphomycetes known to colonize the fructifications of myxomycetes. Among these are 11 taxa (*Acremonium bacillisporum, Gliocladium roseum, Hansfordia* sp., *Hormiactis alba, Hyalodendron* sp., *Mariannaea elegans, Melanospora zamiae, Olpitrichum macrosporum, Pleurothecium recurvatum, Verticillium fungicola,* and *V. lamellicola*) not previously reported in the literature as occurring on myxomycetes. In addition, the nomenclature of these myxomycetes is reviewed, keys for their identification are provided, and aspects of their ecology and host relationships are discussed.

Key Words: ascomycetes, colonization, ecology, hyphomycetes, identification, myxomycetes, taxonomy

The fructifications of myxomycetes (plasmodial slime molds) provide an organic substrate open to colonization by various fungi. The majority of these fungi also occur on other types of substrates, but a few species appear to be restricted to myxomycetes and thus are apparently obligately myxomycetes. Although commonly encountered in nature, the myxomycetes have received relatively little attention. They have been treated in a number of previous publications (e.g., Gams, **1971**; Samuels, **1973**, **1988**; Ing, **1974**, **1976**; Ellis and Ellis, **1988**; Helfer, **1991**), but all of these have been either limited in scope or have considered only certain taxa. The present paper represents an effort to bring together all known records of ascomycetes and hyphomycetes reported to colonize the fructifications of myxomycetes in order to develop a single fairly comprehensive source of information on this group of fungi. The records reported herein include those from the literature as well as a number of new records represented by collections made by the second author during the period from 1982 to 1992. The majority of these collections are from the eastern United States, but some collections are from several other regions of the world [i.e., the western United States (including Alaska), France, northwestern India, and New Zealand]. Collections have been included under ascomycetes when the teleomorph is present but under hyphomycetes when only the anamorph is present. In addition, keys to myxomycetes and ascomycetes are provided, the nomenclature of these fungi is reviewed, and aspects of their ecology and host relationships are discussed.

MATERIALS AND METHODS

Field collections of myxomycetes were air dried at room temperature (ca 20–25 C). Myxomyceticolous fungi were mounted and studied primarily in KOH-phloxine (3% KOH, 1% phloxine) and acid fuchsin in lactic acid. For a few taxa, field collections were used as sources of material for laboratory cultures. For collections of ascomycetes, solitary ascospores were isolated with a micromanipulator and placed on corn meal agar (Difco). Conidia of hyphomycetes were touched with a sterile needle and placed on the same medium. Isolates were incubated at 20 C under laboratory conditions of light and dark. Nomenclature used for myxomycetes is essentially that of Martin and Alexopoulos (**1969**). All collections have been deposited in NY.

Keys and other information on myxomyceticolous ascomycetes and hyphomycetes follow. The information provided for each species includes, under the heading Description, a recent reference that gives a detailed description and illustration for the species in question. The generic key to hyphomycetes is adapted in part from Barron (**1968**).

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KEY TO MYXOMYCETICOLOUS ASOMYCETES

1. Ascospores filiform; multicellular, breaking apart in the ascus ..... *Byssostilbe stilbigera*
1. Ascospores oblong, cylindrical, or elliptical; one-celled or equally two-celled, not breaking apart in the ascus 2
2. Ascospores dark, black or brown, one-celled, citriform with apical pores; perithecia beaked (rostrate), soft, fleshy, yellowish brown ..... *Melanospora zamiae*
2. Ascospores hyaline, two-celled 3
3. Perithecia elongated to beaked (rostrate), soft; ascospores fusiform, ciliate at each end or only at the basal end ..... *Rhynchonectria longispora*
3. Perithecia not beaked, typically globose with a papilla 4
4. Perithecia violet to purple ..... *Nectriopsis violacea*
4. Perithecia colorless, white, yellow, buff or yellow brown 5
5. Ascospores averaging 9–13 × 4–5 μm ..... *Nectriopsis hirsuta*
5. Ascospores shorter, averaging less than 10 μm long 6
6. Ascospores (7–)8–9(–10) × 2–3.5 μm ..... *Nectriopsis sporangiicola*
6. Ascospores shorter 7
7. Perithecial wall with aculeolate, spinulose processes arising from the surface; ascospores (4–)4.7–5.5(–7) × 2–3 μm, smooth ..... *Nectriopsis exigua*
7. Perithecial wall covered with hyphae but without distinct aculeolate processes; ascospores smooth or spinulose 8
8. Ascospores smooth, (5–)6–7.5(–8.7) × 2–3 μm, with a colorless cap-like appendage at each end while in the ascus ..... *Nectriopsis candicans*
8. Ascospores distinctly spinulose, (4.5–)5.3–6.7(–8) × (2.5–)2.8–3.4(–4) μm, lacking a distinct cap-like appendage ..... *Nectriopsis oropensoides*

LIST OF ASCOMYCETES WITH NOTES

Byssostilbe stilbigera (Berk. & Br.) Petch, Ann. Roy. Bot. Gard. Peradeniya **5**: 297. 1912.

≡ *Hypomyces stilbiger* Berk. & Br., J. Linn. Soc., Bot. **14**: 113. 1875.
≡ *Berkelella stilbigera* (Berk. & Br.) Sacc., Syll. Fung. **9**: 998. 1891.
= *Ophionectria trichiae* Penz. & Sacc., Malpighia **11**: 516. 1897.

DESCRIPTION. Seifert (**1985**).
ANAMORPH. Presumed to be *Polycephalomyces tomentosus* (Schrad.: Fr.) Seifert, but not yet proven (Seifert, **1985**).
COLLECTIONS EXAMINED. *Hemitrichia serpula* (Scop.) Rost. (New Zealand), *Trichia favoginea* (Batsch) Pers. (New Zealand), and *T. floriformis* (Schw.) G. Lister (New Zealand).

NOTES. Petch (**1912**) listed *Hemitrichia serpula, Trichia affinis* de Bary (= *T. favoginea*), and *T. botrytis* (J. F. Gmel.) Pers. as hosts in Ceylon. Seifert (**1985**) accepted the genus and species and cited ascus material on *Trichia botrytis* from Ceylon, *Trichia* sp. from New Zealand, and (as *Ophionectria trichiae*) on *Trichia* sp. from Java.

Melanospora zamiae Corda, Icones Fungorum **1**: 24, 1837.

DESCRIPTION. Cannon and Hawksworth (**1982**).
ANAMORPH. None known.
COLLECTION EXAMINED. *Fuligo septica* (L.) Wiggers. (Florida).

NOTES. According to Cannon and Hawksworth (**1982**), this species has been recorded on many substrates and is parasitic on a wide range of fungi. However, it has not been previously reported as occurring on myxomycetes.

Nectriopsis candicans (Plowr.) Maire, Ann. Mycol. **9**: 324. 1911.

≡ *Hypomyces candicans* Plowr., Grevillea **11**: 50. 1882.
≡ *Nectria candicans* (Plowr.) Samuels, Mycologia **65**: 412. 1973.

DESCRIPTION. Samuels (**1988**).
ANAMORPH. *Acremonium* sp. (Samuels, **1988**).
COLLECTIONS EXAMINED. *Arcyria denudata* (L.) Wettst. (India), *Badhamia ?macrocarpa* (Ces.) Rost. (Virginia), *Didymium nigripes* (Link) Fr. (Virginia), *Fuligo septica* (Virginia, Alaska), *Leocarpus fragilis* (Dick.) Rost. (West Virginia), *Physarum murinum* A. Lister (Virginia), *P. virescens* Ditmar (France), *Physarum* sp. (France), *Trichia favoginea* (Virginia), and *T. floriformis* (France).

NOTES. Samuels (**1973**) listed *Amaurochaete ?ferruginea* Macbr. & Martin, *A. fuliginosa* (Sow.) Macbr. [= *A. atra* (Alb & Schw.) Rost.], *Diachea ?subsessilis* Peck, *Didymium megalosporum* Berk & Curt., *D. melanospermum* (Pers.) Macbr., *Diderma simplex* (Schroet.) G. Lister, *Fuligo intermedia* Macbr., *F. muscorum* Alb. & Schw., *F. septica, Physarum* sp., *Stemonitis fusca* Roth, and *S. trechispora* (Berk.) Macbr. as hosts. Ing (**1974, 1976**) added *Arcyria denudata, Badhamia* sp., *Diderma globosum* Pers., *D. spumarioides* (Fr.)

Fr., *Didymium clavus* (Alb. & Schw.) Rab., *Lycogala epidendrum* (L.) Fr., *Mucilago crustacea* Wiggers, *Physarum didermoides* (Pers.) Rost., *P. psittacinum* Ditmar, *Stemonitis flavogenita* Jahn, and *Trichia floriformis*. Ellis and Ellis (**1988**) noted *Physarum pusillum* (Berk. & Curt.) G. Lister as an additional host record. Samuels (**1988**) reported the species on *Physarum* sp. from New Zealand and on an unidentified mxyomycete from Australia, and Rogerson et al. (**1990**) recorded it on *Cribraria intricata* Schrad. from Venezuela.

Nectriopsis exigua (Pat.) W. Gams in W. Gams & van Zaayen, Neth. J. Pl. Pathol. **88**: 73. 1982.

≡ *Hypomyces exiguus* Patouillard, Bull. Soc. Mycol. France **18**: 180. 1902.
= *Nectria myxomyceticola* Samuels, Mycologia **65**: 409. 1973.

DESCRIPTION. Samuels (**1988**).
ANAMORPH. *Verticillium rexianum* (Sacc.) Sacc. (Samuels, **1988**).
COLLECTIONS EXAMINED. *Stemonitis* sp. (New Zealand).

NOTES. The type is on *Stemonitis* sp. The species has also been recorded from *Arcyria cinerea* (Bull.) Pers., *A. nutans* (Bull.) Grev., *Fuligo septica, Stemonitis fusca,* and *S. nigrescens* Rex (Samuels, **1973**).

Nectriopsis hirsuta (Samuels) Samuels, Mem. N.Y. Bot. Gard. **48**: 49. 1988.

≡ *Nectria hirsuta* Samuels, Mycologia **65**: 408. 1973.

DESCRIPTION. Samuels (**1988**).
ANAMORPH. None known.
COLLECTIONS EXAMINED. None.

NOTES. The type is on an unidentified myxomycete.

Nectriopsis oropensoides (Rehm) Samuels, Mem. N.Y. Bot. Gard. **48**: 47. 1988.

≡ *Nectria oropensoides* Rehm in Tavel, Unters. Gesammt. Mykol. X. Hefte Ascom. **2**: 175. 1891.
≡ *Cucurbitaria oropensoides* (Rehm) Kuntze, Rev. Gen. Pl. **3**(2): 461. 1898.
= *Nectria lactea* Ell. & Ev., N. Amer. Pyrenomycetes 110. 1982.

DESCRIPTION. Samuels (**1988**).
ANAMORPH. *Acremonium* sp. (Samuels, **1988**).
COLLECTIONS EXAMINED. None.

NOTES. Samuels (**1973**) recorded this species on *Badhamia obovata* (Peck) S. J. Smith.

Nectriopsis sporangiicola (Samuels) Samuels, Mem. N.Y. Bot. Gard. **48**: 49. 1988.

≡ *Nectria sporangiicola* Samuels, Mycologia **65**: 416. 1973.

DESCRIPTION. Samuels (**1988**).
ANAMORPH. *Gliocladium* sp. (Samuels, **1988**).
COLLECTIONS EXAMINED. *Fuligo septica* (New Jersey).

NOTES. The type is on *Physarum polycephalum* Schw. collected in New Jersey. The species is also known on *Fuligo* sp. from Brazil (Samuels, **1988**).

Nectriopsis violacea (Fr.) Maire, Ann. Mycol. **9**: 323. 1911.

≡ *Sphaeria violacea* Schmidt: Fries, Syst. Mycol. **2**: 441. 1822.
≡ *Hypomyces violaceus* (Fr.) Tulasne, Ann. Sci. Nat. Bot. Ser. 4, **13**: 14. 1860.
≡ *Peckiella violacea* (Fr.) Saccardo, Syll. Fung. **9**: 945. 1891.
≡ *Byssonectria violacea* (Fr.) Seaver, Mycologia **2**: 65. 1910.
≡ *Hyphonectria violacea* (Fr.) Petch, J. Bot. **75**: 220. 1937.

DESCRIPTION. Samuels (**1988**).
ANAMORPH. *Acremonium fungicola* (Sacc.) Samuels (Samuels, **1988**).
COLLECTIONS EXAMINED. *Fuligo septica* (Alaska, Virginia, North Carolina).

NOTES. This species has been recorded only from *Fuligo septica* (Petch, **1938**; Samuels, **1973**, **1988**; Helfer, **1991**).

Rhynchonectria longispora (Phill. & Plowr.) Höhnel, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, **111**: 1023. 1902.

≡ *Eleutheromyces longispora* Phill. & Plowr. in Saccardo, Syll. Fung. **9**: 942. 1891.

DESCRIPTION. Petch (**1938**).
ANAMORPH. None known.
COLLECTIONS EXAMINED. None.

NOTES. Petch (**1938**) reported *Cribraria* sp. as a host for this fungus.

KEY TO MYXOMYCETICOLOUS HYPHOMYCETES

1. Conidia phialosporous, produced basipetally in chains or balls from a phialide that does not increase in length with successive spore production 2

1. Conidia blastosporous, sympodulosporous or porosporous 19
   2. Phialides with swollen base, some reduced to small denticles without a basal septum, grouped around conidiophore; conidia ovoid, hyaline, 2.8–4.2(–5.5) × 1.7–3(–3.7) μm ..... *Aphanocladium album*
   2. Phialides cylindrical, basal part hardly inflated 3
3. Fructification a synnema 4
3. Fructification not a synnema 5
   4. Stalk of synnema ornamented with terminal or lateral, globose, verrucose cells; conidia globose, 1–2.5(–3) μm, or ovoid to ellipsoid, (0.7–)1–6(–9) × 1.5–2 μm ..... *Polycephalomyces tomentosus*
   4. Stalk of synemma without verrucose cells; conidia cylindrical to ellipsoid, (3.5–)4.5–8(–11) × 2–2.5 μm ..... *Stilbella byssiseda*
5. Conidiophores sparsely and irregularly branched, always near the base; phialide wall scarcely thicker than that of the vegetative hyphae 6
5. Conidiophores branched at middle or toward tip, typically with whorls of phialides 8
   6. Conidia 4.5–5.9 × 0.9–1.2 μm, in chains ..... *Acremonium bacillisporum*
   6. Conidia in heads 7
7. Conidia ellipsoid, (5–)7.5–9.5(–14) × 3–4 μm ..... *Acremonium* anamorph of *Nectriopsis candicans*
7. Conidia ellipsoid to rod-shaped, 8.5–9.5(–17) × 2–3 μm ..... *Acremonium fungicola*
   8. Conidiophores verticillately branched, each branch terminating in a phialide with a pleurophialide below ..... *Sesquicillium microsporum*
   8. Conidiophores bearing whorls of phialides, pleurophialides absent 9
9. Whorls of phialides compacted, *Penicillium*-like; conidia united into slime heads 10
9. Whorls of phialides divergent 12
   10. Conidia small, 2.5–3.7(–4) × 1.8–2 μm ..... *Gliocladium album*
   10. Conidia larger, typically more than 5 μm in length 11
11. Conidia (4–)5–6(–7.5) × 1.5–2 μm ..... *Gliocladium* anamorph of *Nectriopsis sporangiicola*
11. Conidia (3.2–)5–7(–8.4) × 3–4(–4.8) μm ..... *Gliocladium roseum*
   12. Conidia in imbricate chains, sometimes sliming down into heads; phialides slender, flask-shaped ..... *Mariannaea elegans*
   12. Conidia not forming imbricate chains 13
13. Conidia dry, in divergent chains; cylindrical, smooth-walled, hyaline, one-celled, 8–9 × 1.4–2 μm; phialides cylindrical with a distinct neck ..... *Paecilomyces penicillatus*
13. Conidia united into slimy heads, phialides awl-shaped 14
   14. Chlamydospores present ..... *Verticillium catenulatum*
   14. Chlamydospores absent 15
15. Conidia oval to elongated to cylindrical 16
15. Conidia globose to subglobose, 2.2–2.9 μm diam ..... *Verticillium lindauianum*
   16. Conidia long ellipsoid to cylindrical, 3.8–7.2 × 1.2–3.4 μm ..... *Verticillium fungicola*
   16. Conidia oval to ellipsoid 17
17. Conidia more than 8 μm in length ..... *Verticillium lamellicola*
17. Conidia less than 8 μm in length 18
   18. Conidia 3.9–5.7 × 2.1–3 μm ..... *Verticillium rexianum*
   18. Conidia 3–5.8 × 0.8–1.1 μm ..... *Verticillium insectorum*
19. Conidia blastosporous, produced apically or laterally by budding from a conidiogenous cell 20
19. Conidia sympodulosporous or porosporous 21
   20. Conidia with isthmus-like connections between spores; conidia two-celled ..... *Hormiactis alba*
   20. Conidia in branching chains, hyaline, typically one-celled ..... *Hyalodendron* sp.
21. Conidia porosporous, developing from pores in conidiogenous cells on erect, pigmented conidiophores ..... *Dendryphiella infuscans*
21. Conidia typically sympodulosporous, produced on narrow denticles or blunt teeth 22
   22. Conidiophores hyaline, erect, stout with pronounced, broadly truncate denticles, typically at apex; conidia globose to ellipsoid, hyaline ..... *Olpitrichum macrosporum*
   22. Conidiophores absent or less well-developed, hyaline or pigmented; conidiogenous cells narrow, with pointed denticles or blunt teeth 23
23. Conidiophores pigmented, at least in part 24
23. Conidiophores hyaline throughout, usually well developed; conidiogenous cells long and tapering; conidia ovoid to ellipsoid ..... *Calcarisporium pallidum*
   24. Conidia hyaline, four-celled, borne on blunt teeth, (15–)18–23(–30) × (4–)5–7(–9) μm ..... *Pleurothecium recurvatum*
   24. Conidia pigmented, subhyaline or hyaline, one-celled 25
25. Conidiophores branched, verticillate or dichotomous; conidiogenous cells tapering toward tip with slender rachis and narrow denticles ..... *Acrodontium myxomyceticola*
25. Conidiophores not verticillate or dichotomous; rachis short, of equal width at base ..... *Hansfordia* sp.

LIST OF HYPHOMYCETES WITH NOTES

Acremonium bacillisporum (Onions & Barron) W. Gams, *Cephalosporium*-artige Schimmelpilze. p. 27. 1971.

≡ *Paecilomyces bacillisporus* Onions & Barron, Mycol. Pap. **107**: 11. 1967.

DESCRIPTION. Gams (**1971**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Dictydium cancellatum* (Batsch) Macbr. (Virginia), *Enerthenema papillatum* (Pers.) Rost. (Virginia), *Lamproderma arcyrionema* Rost. (West Virginia, India), *Stemonitis fusca* (West Virginia), and *Tubifera ferruginosa* (Batsch) J. F. Gmel. (Virginia).

NOTES. This species has not been previously reported as occurring on myxomycetes.

Acremonium fungicola (Sacc.) Samuels, Mycologia **65**: 404. 1973.

≡ *Diplosporium album* Bonorden var. *fungicolum* Saccardo, Syll. Fung. **4**: 178. 1886.

DESCRIPTION. Gams (**1971**).
TELEOMORPH. *Nectriopsis violacea* (Samuels, **1988**).
COLLECTIONS EXAMINED. None.

NOTES. Samuels (**1973**) and Ing (**1974**) reported this species only on *Fuligo septica.*

Acremonium anamorph of *Nectriopsis candicans* (Plowright) Maire.

DESCRIPTION. Samuels (**1988**).
TELEOMORPH. *Nectriopsis candicans.*
COLLECTIONS EXAMINED. *Arcyria cinerea* (India), *Dictydium cancellatum* (Virginia), *Diderma radiatum* (L.) Morgan (Colorado), *Lycogala epidendrum* (Alaska), *Metatrichia vesparium* (Batsch) Nann.-Brem. (West Virginia), *Physarum flavicomum* Berk. (Virginia), *Physarum notabile* Macbr. (Colorado), *Stemonitis axifera* (Virginia), *S. fusca* (West Virginia), *Trichia decipiens* (Pers.) Macbr. (Colorado), and *T. floriformis* (India).

NOTES. Published records of this fungus (e.g., Ing, **1974**) almost invariably refer to the telomorph, but the anamorph alone was recorded from the collections listed above.

Acrodontium myxomyceticola Crane & Schoknecht, Trans. Brit. Mycol. Soc. **79**: 346. 1982.

DESCRIPTION. Crane and Schoknecht (**1982**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. None.

NOTES. This species was reported on *Stemonitis fusca* in Brazil by Crane and Schoknecht (**1982**).

Aphanocladium album (Preuss) W. Gams, *Cephalosporium*-artige Schimmelpilze. p. 196. 1971.

≡ *Acremonium album* Preuss in Sturm, Deutschl. Fl. Pilze **6**: 17. 1848.
= *Botrytis rhinotrichoides* Sacc. & Ell., J. Mycol. **4**: 105. 1888.

DESCRIPTION. Gams (**1971**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Arcyria cinerea* (West Virginia, India), *Barbeyella minutissima* Meylan (North Carolina), *Comatricha aequalis* Peck (West Virginia), *C. elegans* (Racib.) G. Lister (Virginia), *C. nigra* (Pers.) Schroet. (Alaska, Virginia), *C. suksdorfii* Ellis & Ev. (Colorado), *C. typhoides* (Bull.) Rost. (Alaska, Montana, Virginia, India), *Cribraria ?aurantiaca* Schrad. (India), *C. atrofusca* Martin & Lovejoy (Colorado), *C. meylanii* Brandza (France), *C. oregana* H. C. Gilbert (Virginia), *C. purpurea* Schrad. (West Virginia), *Cribraria* sp. (California, Colorado, India, New Zealand), *Dictydium cancellatum* (Alaska, Virginia, West Virginia, India, New Zealand), *D. mirabilis* (Rost.) Meylan (Colorado), *Enteridium lycoperdon* (Bull.) Farr (Virginia), *Hemitrichia calyculata* (Speg.) Farr (Virginia), *Lamproderma arcyrionema* (Virginia, India), *L. columbinum* (Pers.) Rost. (North Carolina, West Virginia, India), *Lamproderma* sp. (California), *Lepidoderma tigrinum* (Schrad.) Rost. (India), *Lycogala conicum* Pers. (India), *L. epidendrum* (India), *Physarum globuliferum* (Bull.) Pers. (New Zealand), *Physarum* sp. (Alaska, Colorado), *Stemonitis axifera* (India), *S. fusca* (Virginia, India), *Stemonitis* sp. (California, Colorado), *Trichia botrytis* (Montana, North Carolina, Virginia, West Virginia), *T. decipiens* (Colorado, Virginia, West Virginia), *T. erecta* Rex (West Virginia), *T. varia* (Pers.) Pers. (Virginia), *T. verrucosa* Berk. (New Zealand), and *Tubifera ferruginosa* (North Carolina).

NOTES. The type collection was on *Cribraria vulgaris* Schrad., whereas *Botrytis rhinotrichoides* was described from *Stemonitis* sp. Gams (**1971**) reported the species on *Cribraria* sp., *Comatricha* sp. and *Trichia* sp. Ing (**1974, 1976**) added *Arcyria cinerea, Comatricha nigra, C. pulchella* (C. Bab.) Rost., *C. typhoides, Craterium minutum* (Leers) Fr., *Cribraria aurantiaca, C. rufa* (Roth) Rost., *C. vulgaris, Didymium nigripes* (Link) Fr., *Enerthenema papillatum, Leocarpus fragilis* (Dick.) Rost., *Trichia affinis* (= *T. favoginea*) and *T. varia* as host records.

Calcarisporium pallidum Tubaki, Nagaoa **5**: 13. 1955.

DESCRIPTION. Tubaki (**1955**).
TELEOMORPH. None proven.
COLLECTIONS EXAMINED. None.

NOTES. Tubaki recorded this species on *Stemonitis fusca* from Japan. Matsushima (**1975**) placed the species in *Sporothrix* as *S. pallida* (Tu-

baki) Matsushima and recorded it from dying stems of *Arctium lappa* L. De Hoog (**1974**) placed the species in synonymy with *Sporothrix schenckii* Hektonen & Perkins, which was reported to be the anamorph of *Ophiostoma stenoceras* (Robak) Melin & Nannfeldt. He listed a wide range of substrates (pine needles, tanning liquor, hair and skin of man, wood pulp, human eye abscess, rotten grass, and soil). Domsch et al. (**1980**) indicated that *S. pallida* is different from *S. schenckii* in several features and accepted *S. pallida* as distinct. Dixon et al. (**1991**) studied a large number of isolates of *S. schenckii* and concluded that the anamorph of *Ohiostoma stenoceras,* although a *Sporothrix,* is not *S. schenckii.* Only Tubaki's record is from a myxomycete.

Dendryphiella infuscans (Thümen) M. B. Ellis, Dematiaceous Hyphomycetes. p. 500. 1971.

≡ *Cladosporium infuscans* Thümen, Rev. Mycol. (Paris) **1**: 59. 1879.

DESCRIPTION. Ellis (**1971**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. None.

NOTES. Ellis and Ellis (**1988**) reported that this species is found occasionally on old myxomycetes.

Gliocladium album (Preuss) Petch, Trans. Brit. Mycol. Soc. **22**: 251. 1939.

≡ *Penicillium album* Preuss, Linnaea **24**: 135. 1851.

DESCRIPTION. Gams (**1971**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Arcyria cinerea* (India), *Badhamia ?macrocarpa* (Virginia), *B. utricularis* (Bull.) Berk. (France), *Comatricha* sp. (Colorado), *Diderma floriforme* (Bull.) Pers. (Virginia), *D. ochraceum* Hoffm. (North Carolina), *D. trevelyani* (Grev.) Fr., (California), *Didymium squamulosum* (Alb. & Schw.) Fr., (Colorado), *Lepidoderma tigrinum* (West Virginia), *Physarum leucophaeum* Fr., (Virginia, France), *P. globuliferum* (North Carolina, Virginia), *P. murinum* (Virginia), *P. nutans* Pers. (Virginia), *P. pulcherrimum* Berk. & Rav. (North Carolina), *P. rubiginosum* Fr. (Virginia), *P. viride* (Bull.) Pers. (North Carolina, Virginia), *Physarum* sp. (France, India), and *Stemonitis hyperopta* Meylan (West Virginia).

NOTES. Gams (**1971**) studied the type at B on *Dictydium venosum* Schrad. (= *D. cancellatum*) but indicated that no fungus was present. He studied several of Petch's specimens (BM) and recorded the species on *Physarum nutans* and *Stemonitis* sp. Gams quoted Ing (pers. comm., 1965) for several hosts. Ing (**1974**, **1976**) cited the species from *Arcyria cinerea, Badhamia* sp., *Comatricha nigra, Craterium minutum, Cribraria aurantiaca, C. cancellata* (Batsch) Nann.-Brem. (= *Dictydium cancellatum*), *C. rufa, Didymium squamulosum, Physarum leucophaeum, P. nutans, Stemonitis fusca, Trichia affinis* (= *T. favoginea*), and *T. varia.* Helfer (**1991**) reported it on *Fuligo septica* and *Stemonitis* sp. (both from Germany).

Gliocladium roseum Bainier, Bull. Soc. Mycol. France **23**: 111. 1907.

DESCRIPTION. Samuels (**1976**).
TELEOMORPH. *Nectria ochroleuca* (Schw.) Berk. (Samuels, **1976**).
COLLECTIONS EXAMINED. *Dictydium cancellatum* (India), *Lycogala epidendrum* (India), and *Stemonitis axifera* (India).

NOTES. This species has not been previously reported as occurring on myxomycetes.

Gliocladium anamorph of *Nectriopsis sporangiicola* Samuels.

DESCRIPTION. Samuels (**1973**).
TELEOMORPH. *Nectriopsis sporangiicola* (Samuels, **1973**).
COLLECTION EXAMINED. *Fuligo septica* (New Jersey).

NOTES. Samuels (**1973**) recorded this only from the type (New Jersey) on *Physarum polycephalum.* He indicated that the *Gliocladium* might be the same as *G. africanum* Eichelbaum which was described from Africa on "*Arcyria nutans*" (= *Physarum nutans* fide Ing).

Hansfordia sp.

DESCRIPTION. Barron (**1968**).
TELEOMORPH. None known.
COLLECTION EXAMINED. Unidentified myxomycete (Maine).

NOTES. No species of *Hansfordia* has been previously reported as occurring on myxomycetes.

Hormiactis alba Preuss, Fungi Hoyerswerda. p. 128. 1851.

DESCRIPTION. Barron (**1968**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Craterium leucocephalum* (Pers.) Ditmar (Colorado) and *Didymium squamulosum* (California).

NOTES. This species has not been previously reported as occurring on myxomycetes.

Hyalodendron sp.

DESCRIPTION. Barron (**1968**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Comatricha typhoides* (India), *Cribraria aurantiaca* (West Virginia), and *C. rufa* (Virginia).

NOTES. No species of *Hyalodendron* has been previously reported as occurring on myxomycetes.

Mariannaea elegans (Corda) Samson, Stud. Mycol. **6**: 75. 1974.

≡ *Penicillium elegans* Corda, Icones Fung. **2**: 17. 1838.
≡ *Hormodendron elegans* (Corda) Bonorden, Handb. allg. Mycol. 76. 1851.
≡ *Spicaria elegans* (Corda) Harz, Bull. Soc. Imp. Nat. Moscou **44**: 238. 1871.
≡ *Paecilomyces elegans* (Corda) Mason & Hughes in Hughes, Mycol. Pap. **45**: 27. 1951.

DESCRIPTION. Samson (**1974**).
TELEOMORPH. *Mariannaea* cf. *elegans* has been reported to be the anamorph of *Nectria mariannaeae* Samuels & Seifert (**1991**).
COLLECTIONS EXAMINED. *Physarum ?leucophaeum* (France) and *Trichia botrytis* (Connecticut).

NOTES. This species has not been previously reported as occurring on myxomycetes.

Olpitrichum macrosporum (Farl. ex Sacc.) Sumstine, Mycologia **3**: 55. 1911.

≡ *Rhinotrichum macrosporum* Farl. ex Sacc., Michelia **2**: 148. 1880.

DESCRIPTION. Holubová-Jecková (**1974**).
TELEOMORPH. None known.
COLLECTION EXAMINED. *Stemonitis splendens* Rost. (New York).

NOTES. This species has not been previously reported as occurring on myxomycetes.

Paecilomyces penicillatus (Höhnel) Samson, Stud. Mycol. **6**: 72. 1974.

≡ *Spicaria elegans* (Corda) Harz sensu Grove, J. Bot. Lond. **23**: 165. 1885.
≡ *Spicaria penicillatus* Höhnel, Ann. Mycol. **2**: 56. 1904.
= *Spicaria elegans* var. *muscorum* Grove in Saccardo, Syll. Fung. **4**: 167. 1886.
= ?*Spicaria fuligonis* F. Moreau, Bull. Soc. Mycol. France **32**: 36. 1916.

DESCRIPTION. Samson (**1974**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Arcyria denudata* (West Virginia), *Hemitrichia calyculata* (West Virginia), *Lamproderma scintillans* (Berk. & Br.) Morgan (Virginia), *Metatrichia vesparium* (West Virginia), *Physarum globuliferum* (Virginia), *P. nucleatum* Rex (West Virginia), and *P. penetrale* Rex (Virginia).

NOTES. Samson (**1974**), from whom the above synonymy was derived, cited the type of *S. penicillatus* on *Arcyria punicea* Pers. (= *A. denudata*) and another Höhnel collection on *Arcyria cinerea.* Helfer (**1991**) reported the species on *Lygogala epidendrum* (Germany). The Grove specimen was on a dead moss and on rotting wood. Arnold (**1971**) described a new genus and species, *Leucopenicillifer gracilis,* on *Fuligo septica* from Leningrad (St. Petersburg), Russia. From the published description it appears to be the same as *Paecilomyces penicillatus,* as indicated by Carmichael et al. (**1980**).

Pleurothecium recurvatum (Morgan) Höhnel, Ber. Deutsch. Bot. Ges. **37**: 154. 1919.

≡ *Acrothecium recurvatum* Morgan, J. Cincinnati Soc. Nat. Hist. **18**: 44. 1895.

DESCRIPTION. Ellis and Ellis (**1985**).
TELEOMORPH. None known.
COLLECTION EXAMINED. *Metatrichia vesparium* (West Virginia).

NOTES. This species has not been previously reported in as occurring on myxomycetes.

Polycephalomyces tomentosus (Schrad. : Fr.) Seifert, Stud. Mycol. **27**: 175. 1985.

≡ *Stilbum tomentosum* Schrad. : Fr., Syst. Mycol. **3**: 301. 1832.
≡ *Stilbella tomentosa* (Schrad. : Fr.) Bresadola, Ann. Mycol. **1**: 129. 1903.
≡ *Tilachlidium tomentosum* (Schrad. : Fr.) Lindau, Rabenh. Krypt.-Fl. 1, Pilze **9**: 306. 1910.
≡ *Blistum tomentosum* (Schrad. : Fr.) Sutton, Mycol. Pap. **132**: 19. 1973.
= *Stilbum tomentosum* var. *ovalisporum* A. L. Smith, Trans. Brit. Mycol. Soc. **2**: 26. 1903.
≡ *Stilbella tomentosa* var. *ovalispora* (A. L. Smith) Rogerson in Samuels, Mycologia **65**: 409. 1973.
≡ *Blistum ovalisporum* (A. L. Smith) Sutton, Mycol. Pap. **132**: 17. 1973.

For further synonymy see Seifert (**1985**, p. 175).
DESCRIPTION. Seifert (**1985**).
TELEOMORPH. Reported to be *Byssostilbe stilbigera,* but not yet proven (Seifert, **1985**).
COLLECTIONS EXAMINED. *Arcyria cinerea* (Virginia,

France), *Cribraria argillacea* (Pers.) Pers. (West Virginia), *C. ?macrocarpa* (India), *Hemitrichia calyculata* (West Virginia, Ohio), *H. clavata* (Pers.) Rost. (Alaska, Pennsylvania, West Virginia), *H. serpula* (West Virginia, France, India), *Metatrichia vesparium* (West Virginia), *Perichaena depressa* Libert (New Zealand), *Trichia botrytis* (Virginia, New Zealand), *T. erecta* (North Carolina), *T. favoginea* (Montana, Virginia, West Virginia, New Zealand), *T. floriformis* (New Zealand), *T. scabra* Rost. (Montana), *T. subfusca* Rex (France), *T. varia* (Alaska, France), and *T. verrucosa* (New Zealand).

NOTES. Petch (**1945**), who reviewed literature reports of *Stilbum tomentosum* and studied specimens at K as well as his own collections, indicated that most of the collections had the large, oval conidia characteristic of var. *ovalisporum*. Only collections on *Trichia affinis* (= *T. favoginea*), *T. botrytis*, *T. chrysosperma* (Bull.) Lam. & DC. (= *T. favoginea*), *T. decipiens*, and *T. persimilis* Karst. (= *T. favoginea*) had the small conidia associated with *Stilbum tomentosum*. He recorded the form with large, oval conidia on *Comatricha pulchella, Cribraria argillacea, C. rufa, Hemitrichia serpula, Perichaena populina* Fr. (= *P. corticalis* [Batsch] Rost.), *Trichia affinis* (= *T. favoginea*), and *T. varia*. Sutton (**1973**) accepted the two forms as distinct species and described the genus *Blistum* for them. He recorded *B. tomentosum* on *Trichia botrytis* and *T. varia*, and *B. ovalisporum* on *Diderma effusum* (Schw.) Morgan, *Trichia ?affinis* (= *T. favoginea*), *T. varia*, and *Trichia* sp. As *Stilbella tomentosum* var. *ovalisporum*, Samuels (**1973**) reported a collection associated with *Nectria* (*Nectriopsis*) *hirsuta*. Ing (**1974**, **1976**) listed the *ovalispora* form on *Hemitrichia serpula, Perichaena corticalis, Trichia botrytis, T. persimilis* (= *T. favoginea*), and *T. varia* and recorded the *tomentosum* form from *Comatricha pulchella, Cribraria argillacea, C. aurantiaca, C. persoonii* Nann.-Brem., *C. rufa, Diderma effusum, Perichaena corticalis, P. depressa, Trichia affinis* (= *T. favoginea*), *T. decipiens, T. favoginea, T. floriformis, T. lutescens* (A. Lister) A. Lister, *T. persimilis* (= *T. favoginea*), and *T. verrucosa*.

Seifert (**1985**) reported that both small and large spored forms occurred in the same collection, even in the same synemma, and intermediates were common in culture. He combined the two species under *Polycephalomyces tomentosum*. According to Seifert (**1985**) the fungus occurs on representatives of the family Trichiaceae, particularly on species of *Trichia* and *Arcyria*. Seifert (**1985**) synonymized *Stilbum capillare* Ell. & Ev. (recorded on *Trichia varia*), *Stilbum echinatum* Ell. & Ev. (recorded on *Arcyria cinerea* and *Trichia* sp.), and *Stilbum parasiticium* Pers. (recorded on *?Arcyria* sp.). Helfer (**1991**) reported *P. tomentosum* on *Metatrichia vesparium* and *Trichia scabra* (both from Germany).

Sesquicillium microsporum (Jaap) Veenbaas-Rijks & W. Gams *in* Gams, *Cephalosporium*-artige Schimmelpilze. p. 226. 1971.

≡ *Verticillium microsporum* Jaap, Verh. Bot. Ver. Prov. Brandenb. **58**: 38. 1916.
= *Verticillium capitatum* (Ehrenb. in Pers.) Link **V. botryoides* Sacc., Michelia **2**: 577. 1882, Syll. Fung. **4**: 152. 1886.
= *Verticillium botryoides* Sacc., vide Ing.
= *Sesquicillium parvulum* Veenbaas-Rijks, Acta Bot. Neerl. **19**: 323. 1970.

DESCRIPTION. Bissett (**1983**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Comatricha typhoides* (India), *Craterium aureum* (Schum.) Rost. (India), *Diderma floriforme* (Virginia), *Didymium melanospermum* (Pers.) Macbr. (Virginia), *D. nigripes* (Virginia), *Lamproderma sauteri* Rost. (Montana), *Physarum bivalve* Pers. (France), *P. cinereum* (Batsch) Pers. (Virginia), *P. globuliferum* (Virginia, West Virginia), *P. leucophaeum* (Virginia), *P. melleum* (Berk. & Br.) Massee (India), *P. nutans* (Virginia, West Virginia), *P. penetrale* (Virginia, West Virginia), *P. rubiginosum* (Virginia), *P. tenerum* Rex (Virginia), and *P. viride* (Virginia, West Virginia).

NOTES. Gams (**1971**) cited a collection on *Physarum* sp. as *Verticillium capitatum* [= *V. botryoides* Sacc., *J. B. Ellis 3674*, Newfield, New Jersey (PAD)] as this species. A collection similarly labelled is at NY and is *S. microsporum*. Gams reported the species on *Craterium leucocephalum, Craterium* sp., *Didymium melanospermum, Physarum* sp. as well as on wood of *Alnus* sp., *Thuja occidentalis* L., and *Populus tremuloides* Michx. Ing (**1974**) cited these records and noted *Leocarpus fragilis* as an additional host record.

Bissett (**1983**) synonymized *Sesquicillium* with *Tolypocladium* and made the combination *Tolypocladium microsporum* (Jaap) Bissett. Arx (**1986**) placed *Tolypocladium* as a synonym of *Beauveria*, but the species *T. microsporum* equals *Gliocladium microsporum* (Jaap) Arx. Sigler et al. (**1987**) accept *Tolypoclaaium* as distinct from

Beauveria. Samuels (**1989**) accepts *Sesquicillium microsporum*.

Stilbella byssiseda (Pers.) Seifert, Stud. Mycol. **27**: 61. 1985.

≡ *Stilbum byssisedum* Pers., Mycol. Eur. **1**: 347. 1822.
= *Stilbum orbiculare* Berk. & Br., Ann. Mag. Nat. Hist., Ser. 5, **1**: 28. 1878.
≡ *Stilbella orbiculare* (Berk. & Br.) W. Gams, *Cephalosporium*-artige Schimmelpilze. P. 230. 1976.
≡ *Blistum orbiculare* (Berk. & Br.) Ing, Bull. Brit. Mycol. Soc. **10**: 30. 1976.

The synonymy given above is from Seifert (**1985**); he also included a number of other synonyms.

DESCRIPTION. Seifert (**1985**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Comatricha* sp. (India), *Cribraria argillacea* (Colorado), *C. intricata* (West Virginia), *C. macrocarpa* (France), and *Cribraria* sp. (India).

NOTES. The type is on *Lindbladia effusa* (Ehrenb.) Rost. (= *L. tubulina* Fr.). Gams (**1971**) recorded the species on *Cribraria argillacea, Fuligo* sp., and *Trichia* sp. He also cited specimens for synonyms. Seifert (**1985**) indicated that this species occurs on sporangiate and pseudoaethaliate myxomycetes and cited *Cribraria* sp., *Didymium farinaceum* Schrad. (= *D. melanospermum*), *Fuligo septica,* and *Lindbladia effusa* (= *L. tubulina*) as hosts. Ellis and Ellis (**1988**) listed records of *Blistum orbiculare* on *Cribraria argillacea* and *Lindbladia tubulina*. Helfer (**1991**) reported it on *Stemonitis* sp. (Germany).

Verticillium catenulatum (Kamyschko ex Barron & Onions) W. Gams, *Cephalosporium*-artige Schimmelpilze. p. 190. 1971.

≡ *Diheterospora catenulata* Kamyschko, Bot. Mater. (Not. Syst. Sect. Crypt. Inst. Bot. Acad. Sci. USSR) **15**: 138. 1962, ex Barron & Onions, Canad. J. Bot. **44**: 861. 1966.
= ?*Spicaria simplex* Petch, Naturalist Lond. **1936**: 59. 1936.
= *Paecilomyces simplex* (Petch) Brown & G. Smith, Trans. Brit. Mycol. Soc. **40**: 76. 1957.

DESCRIPTION. Gams (**1971**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. None.

NOTES. Gams (**1971**) cited the type collection (K) of *Spicaria simplex* on *Trichia affinis* (= *T. favoginea*). The typical substrate given by Gams is soil. Ellis and Ellis (**1988**) added *Physarum psittacinum* as an additional host.

Verticillium fungicola (Preuss) Hassebrauk, Phytopathol. Z. **9**: 514. 1936.

≡ *Acrostalagmus fungicola* Preuss, Linnaea **24**: 124. 1851.

DESCRIPTION. Gams (**1971**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Dictydium cancellatum* (Alaska), *Didymium squamulosum* (New Zealand), *Hemitrichia calyculata* (Virginia), *Metatrichia vesparium* (West Virginia), *Physarum viride* (New Zealand), and *Trichia floriformis* (New Zealand).

NOTES. This species occurs mostly on members of the Agaricales. It has not been previously reported as occurring on myxomycetes.

Verticillium insectorum (Petch) W. Gams, *Cephalosporium*-artige Schimmelpilze. p. 193. 1971.

≡ *Oospora insectorum* Petch, Trans. Brit. Mycol. Soc. **16**: 63. 1931.
= *Oospora trichiae* Petch, Naturalist Lond. **1936**: 59. 1936.

DESCRIPTION. Gams (**1971**).
TELEOMORPH. None known.
COLLECTIONS EXAMINED. *Comatricha elegans* (Virginia), *C. nigra* (France, India), *Dictydium cancellatum* (Virginia, India, New Zealand), *Enerthenema papillatum* (Virginia), *Hemitrichia calyculata* (West Virginia), *Physarum flavicomum* (Virginia), *Stemonitis fusca* (Virginia), *S. hyperopta* (West Virginia), and *Stemonitis* sp. (Alaska).

NOTES. Gams (**1971**) studied the type of *Oospora trichiae* on *Trichia verrucosa* and synonymized the name with *V. insectorum*. Additional substrates given by Gams are spiders, ?*Aleurodes, Mucor* on flies, thrips, and *Oidium aureum* Link.

Verticillium lamellicola (F. E. V. Smith) W. Gams, *Cephalosporium*-artige Schimmelpilze. p. 183. 1971.

≡ *Cephalosporium lamellicola* F. E. V. Smith, Trans. Brit. Mycol. Soc. **10**: 93. 1924.
= ?*Oospora pucciniophila* Sydow, Anal. Mycol. **15**: 203. 1917.

DESCRIPTION. Gams (**1971**).
TELEOMORPH. None known.
COLLECTION EXAMINED. *Stemonitis smithii* Macbr. (France).

NOTES. This species has not been previously reported as occurring on myxomycetes.

Verticillium lindauianum Bubak, Anal. Mycol. **12**: 210. 1914.

DESCRIPTION. Gams (1971).
TELEOMORPH. None known.
COLLECTION EXAMINED. *Lepidoderma carestianum* (Rab.) Rost. (Colorado).

NOTES. Gams (**1971**) reported this species on *Fuligo septica* and *Didymium melanospermum*. Ing (**1974**) added *Physarum cinereum*. Helfer (**1991**) listed *Fuligo septica* (Germany) as an additional host record.

Verticillium rexianum (Sacc.) Sacc., Syll. Fung. **4**: 153. 1886.

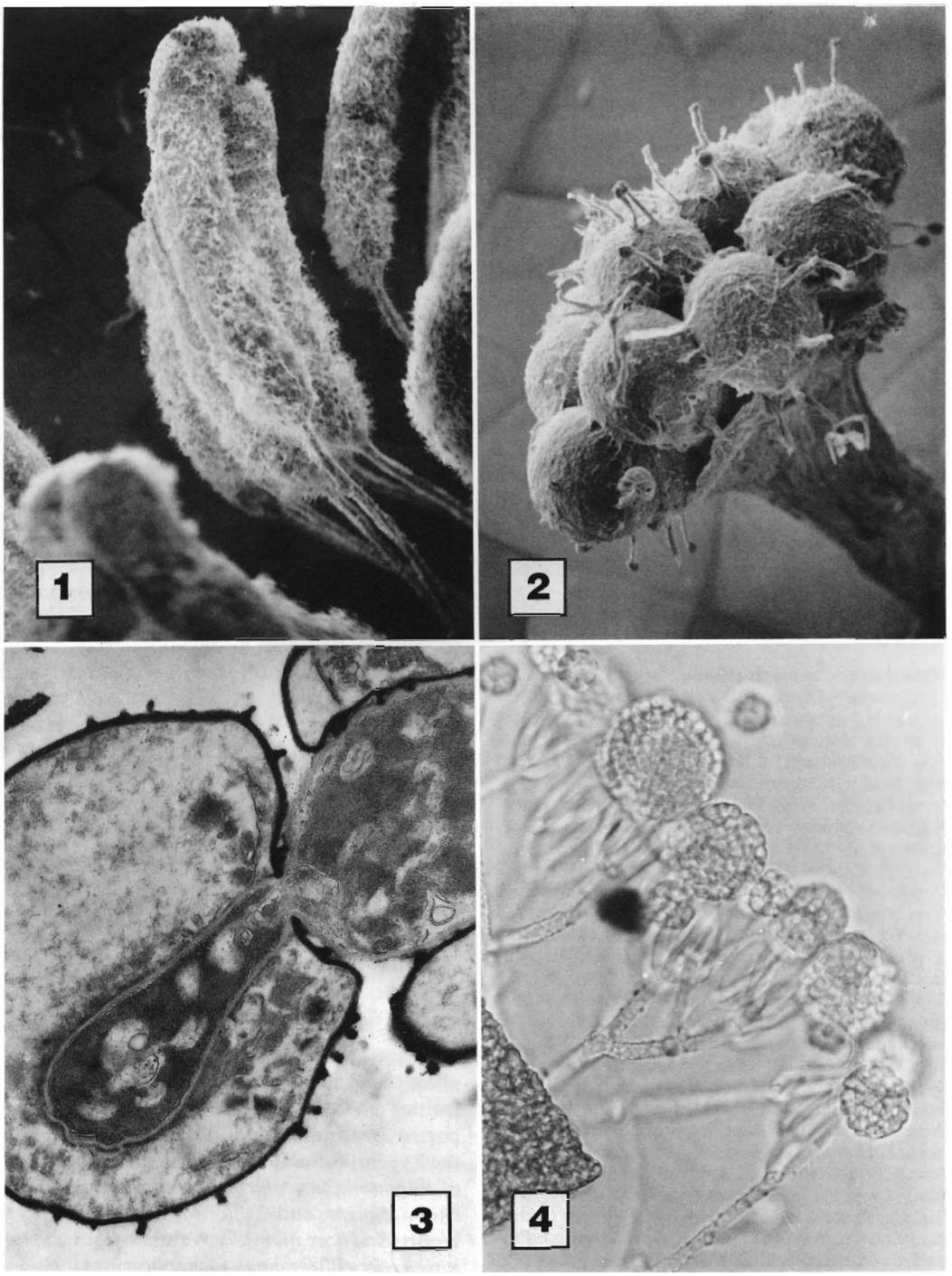
≡ *Verticillium nanum* Berk. **V. rexianum* Saccardo, Michelia **2**: 577. 1882.
= *Verticillium niveostratosum* Lindau, Verh. Bot. Ber. Prov. Brandenburg **45**: 158. 1903, **47**: 68. 1905.
= *Cephalosporium verticicolum* Petch, Naturalist Lond. **1936**: 275. 1936.
= *Cephalosporium acremonium* Corda f. *major* Penzig *sensu* W. B. Grove, J. Bot. **23**: 164. 1885.

DESCRIPTION. Samuels (**1988**).
TELEOMORPH. *Nectriopsis exigua* (Samuels, **1988**).
COLLECTIONS EXAMINED. *Amaurochaete ferruginea* (Montana), *Arcyria cinerea* (Virginia, West Virginia, India, New Zealand), *A. denudata* (Virginia, West Virginia, India), *A. incarnata* (Pers.) Pers. (Virginia), *A. nutans* (Alaska, West Virginia), *Ceratiomyxa fruticulosa* (Mull.) Macbr. (West Virginia), *Clastoderma debaryanum* Blytt (Virginia), *Comatricha aequalis* (West Virginia), *C. nigra* (Virginia), *C. pulchella* (Virginia), *C. rispaudii* Hagelst. (Virginia), *C. subcaespitosa* Peck (West Virginia), *C. typhoides* (Alaska, Colorado, Virginia, West Virginia, India, New Zealand), *Comatricha* sp. (France), *Cribraria intricata* (Virginia, West Virginia), *C. microcarpa* (Schrad.) Pers. (West Virginia), *C. piriformis* Schrad. (Virginia), *Dictydiaethalium plumbeum* (Schum.) Rost. (West Virginia), *Dictydium cancellatum* (Alaska, Colorado, Montana, Virginia, West Virginia, India), *Diderma montanum* (Meylan) Meylan (Colorado), *Didymium melanospermum* (Virginia), *Didymium* sp. (France), *Enteridium splendens* (West Virginia), *Fuligo septica* (Virginia, India), *Hemitrichia calyculata* (Virginia, West Virginia, India), *H. clavata* (Pennsylvania), *H. serpula* (Virginia, West Virginia), *Lycogala epidendrum* (Alaska, Virginia, West Virginia, France, India), *L. exiguum* Morgan (India), *Metatrichia vesparium* (Virginia, West Virginia), *Physarella oblonga* (Berk. & Curt.) Morgan (West Virginia), *Physarum flavicomum* (Virginia), *P. globuliferum* (Virginia, West Virginia), *P. leucophaeum* (Virginia, West Virginia), *P. murinum* (Virginia), *P. nucleatum* (West Virginia), *P. roseum* Berk. & Br. (India), *P. tenerum* (Virginia, West Virginia), *P. viride* (West Virginia, India, New Zealand), *Stemonitis axifera* (Alaska, Montana, Virginia, West Virginia, India), *S. fusca* (Alaska, Virginia, West Virginia, India), *S. hyperopta* (West Virginia), *S. splendens* (India), *Stemonitis* sp. (West Virginia, France), *Symphytocarpus impexus* B. Ing & Nann.-Brem. (France), *Trichia contorta* (Ditmar) Rost. (West Virginia), *T. favoginea* (West Virginia), *T. floriformis* (Virginia, West Virginia, France), *T. scabra* (Virginia), and *T. varia* (Alaska).

NOTES. Gams (**1971**) studied herbarium material on *Arcyria* sp. labeled *Verticillium nanum* var. *rexianum* from the Ellis herbarium, NY; from the Morgan collection, Ohio, 1882; and on *Dictydium* sp. from California and Gloucester Co., New Jersey. The type collection was not found. He also studied material of *V. niveostratosum* Lindau, 20 Aug. 1903 ex Herb. Sydow (S) on *Stemonitis fusca*, the Petch material of *Cephalosporium verticicolum* on *Trichia varia*, and the Grove material of *Cephalosporium acremonium* f. *major* on *Stemonitis fusca* and *Arcyria punicea* (= *A. denudata*). Additional records reported by Gams are *Ceratiomyxa mucida* (Pers.) Schroet. (= *C. fruticulosa*), *Comatricha typhoides*, *Fuligo septica*, *Lycogala epidendrum*, *Physarum nutans*, and *Trichia botrytis*. Samuels (**1973**) proved the connection between *V. rexianum* and *Nectria myxomyceticola* (now *Nectriopsis exigua*) and cited *Arcyria cinerea*, *A. nutans*, *Fuligo septica*, *Stemonitis fusca*, *S. nigrescens*, and *Stemonitis* sp. as hosts. Ing (**1974, 1976**) added *Arcyria denudata*, *Comatricha nigra*, *Cribraria argillacea*, *C. aurantiaca*, *C. cancellata* (= *Dictydium cancellatum*), *Didymium nigripes*, *Physarum compressum* Alb. & Schw., *P. leucopus* Link, *Stemonitis axifera*, *S. flavogenita* Jahn, and *Trichia floriformis* as host records. Helfer (**1991**) reported the species on *Lycogala epidendrum* and *Stemonitis axifera* (both from Germany).

DISCUSSION

Various fungi other than ascomycetes and hyphomycetes are sometimes encountered on the fruiting bodies of myxomycetes. Ing (**1967**) reported *Mucor mucedo* (L.) Brefeld, a member of the Zygomycetes, from field-collected specimens of *Badhamia utricularis*, *Comatricha nigra*, *Trichia decipiens*, and *T. floriformis*. Helfer (**1991**) reported *Mucor hiemalis* Wehmer from *Stemonitis axifera* (Germany). Our collections included an unidentified species of *Mucor* on *Stemonitis* sp. from France, *Mortierella ramanniana* (Möller) Linnemann on a collection of *Ceratiomyxa fruticulosa* from West Virginia, and *Mortierella* spp. on *Arycria nutans* (Virginia), *Comatricha typhoides* (Virginia), *Stemonitis* sp. (New York), and an unidentified myxomycete (Ecuador).



FIGS. 1–4. Myxomyceticolous fungi. 1. Scanning electron micrograph (SEM) of *Comatricha typhoides* (SLS 2294) colonized by *Verticillium rexianum*, ca ×25. 2. SEM of *Metatrichia vesparium* (SLS 2935) colonized by *Polycephalomyces tomentosus*, ca ×50. 3. Transmission electron micrograph showing a spore of *Comatricha typhoides* (SLS 2919) that has been invaded by a hypha of *Verticillium rexianum*, ca ×8000. 4. Conidiophores and conidia of *Gliocladium album* colonizing *Diderma floriforme* (SLS 3002). This myxomyceticolous fungus occurs almost exclusively on fructifications produced by members of the order Physarales. Nomarski differential interference contrast optics, ca ×400.

TABLE I

RELATIVE ABUNDANCE (%) OF HOSTS WITHIN THE SIX ORDERS OF MYXOMYCETES FOR MYXOMYCETICOLOUS FUNGI REPRESENTED BY MORE THAN FIVE COLLECTIONS

Taxon	Order						Total number of collections
	C[a]	E	L	P	S	T	
Aphanocladium album		4	29	6	34	27	73
Acremonium bacillisporum			50		50		6
Polycephalomyces tomentosus			4			96	45
Gliocladium album				91	6	3	34
Nectriopsis candicans			14	57	7	22	28
Nectriopsis violacea				100			10
Paecilomyces penicillatus				43	14	43	7
Stilbella byssiseda			88		12		8
Sesquicillium microsporum				87	13		30
Verticillium fungicola			17	33		50	6
Verticillium insectorum			25	8	59	8	12
Verticillium rexianum	<1	1	17	13	43	25	201

[a] C = Ceratiomyxales, E = Echinosteliales, L = Liceales, P = Physarales, S = Stemonitales, and T = Trichiales.

Mortierella ramanniana is a common and widespread saprobic fungus that occurs on many substrates, particularly soil, litter, decaying plant debris, and dung. However, we are not aware of any previous reports of this species occurring on myxomycetes. In a very few instances, the hyphae of unidentified saprophytic or wood-decaying basidiomycetes were observed on myxomycete fructifications. However, the presence of such fungi is probably incidental, and results from nothing more than their co-occurrence on the substrate upon which the myxomycete fruited.

It is difficult to assess the ecological impact that myxomyceticolous fungi have upon myxomycetes, but on at least some occasions in certain habitats it is likely to be considerable. For example, myxomycetes appear to be much less common in tropical forests than in temperate forests, although the former would seem to offer nearly optimal conditions for the growth and development of these organisms. It has been hypothesized (Alexopoulos, **1970**) that one of the limiting factors for myxomycetes in tropical forests is the constant high humidity, which promotes the colonization of their fructifications by filamentous fungi. Although nearly all of the collections considered in the present study were from temperate forests, it is perhaps noteworthy that a very high proportion of field collections made by the second author in northwestern India during the monsoon season were colonized by fungi.

Myxomyceticolous fungi tend to "smother" a given fructification, producing a mycelium over its entire surface (FIGS. 1, 2). Fungal hyphae also rapidly penetrate the spore mass of the host, where they invade the protoplasts of the individual spores (FIG. 3). Ultimately, most if not all of the spores present in the fructification are adversely affected by the fungus (i.e., they are rendered nonviable and/or never liberated). Whether myxomyceticolous fungi should be considered as saprobes or parasites is somewhat problematic. However, in those instances in which a fructification with an intact or nearly intact spore mass is colonized (which is very often the case), it would seem much more appropriate to view the relationship involved as parasitic rather than saprobic.

Although it was sometimes observed that only a few fructifications in a given collection were colonized, the usual situation was for most (or even all) of them to be colonized to some extent. This was almost invariably the case for collections consisting of old specimens. Interestingly, only a single colonizing species was present in the vast majority (>97%) of the more than 470 collections of myxomyceticolous fungi examined.

The taxonomic distribution of myxomycete hosts for all myxomyceticolous fungi represented by more than five collections is given in TABLE I. As a general observation, the majority of myxomyceticolous fungi appear to fall into one of two groups: those that can tolerate the calcium-rich environment represented by the fructifications produced by members of the order Physarales and those that cannot. The most prominent examples of the former group are

TABLE II

RELATIVE ABUNDANCE (%) OF THE SIX ORDERS FOR FIELD COLLECTIONS OF MYXOMYCETES MADE IN THE MOUNTAIN LAKE AREA OF SOUTHWESTERN VIRGINIA DURING THE PERIOD 1982–1986

Order	All collections[a]	Colonized collections[b]
Ceratiomyxales	3.9	0
Echinosteliales	1.4	1.3
Liceales	18.9	11.5
Physarales	23.5	34.6
Stemonitales	22.9	35.3
Trichiales	29.5	17.3
Total	100.1	100.0

[a] All collections (a total of 1745), whether colonized or not (Stephenson, **1988**).

[b] Only those collections (a total of 145) colonized by myxomyceticolous fungi.

Gliocladium album (FIG. 4), *Nectriopsis violacea,* and *Sesquicillium microsporum,* whereas the latter group includes *Aphanocladium album* and *Polycephalomyces tomentosus.*

The degree of host specificity exhibited by the different species of myxomyceticolous fungi varies widely. *Nectriopsis violacea,* which has been recorded only from *Fuligo septica,* would seem particularly noteworthy in this respect. However, *Polycephalomyces tomentosus,* which occurs almost exclusively on members of the Trichiales, also displays a high degree of host specificity. In contrast, *Verticillium rexianum,* easily the most ubiquitous of the myxomyceticolous fungi, was recorded from all major groups of myxomycetes.

The taxonomic distribution of 1745 field collections of myxomycetes made from five permanent study areas in the Mountain Lake region of southwestern Virginia during the period 1982–1986 (Stephenson, **1988**) is summarized in TABLE II. The five study areas were visited on a regular basis during three different field seasons and an effort was made to collect all fruitings on each visit. As such, these data give some indication of the relative abundance of members of each taxonomic order in nature. TABLE II also presents data on the taxonomic distribution of the hosts represented in 145 collections of myxomyceticolous fungi made in the Mountain Lake area during the same period of time. Presumably, any order for which the relative abundance of colonized collections exceeds the figure recorded for its relative abundance in nature would seem to display evidence of having a greater susceptibility to being colonized by myxomyceticolous fungi than an order for which the reverse is true. Although this type of comparison is only a crude index, it would appear that members of the Ceratiomyxales, Liceales, and Trichiales are less subject to being colonized than members of the Physarales and Stemonitales.

It should be noted that the limited number of collections of myxomyceticolous fungi recorded from members of the orders Ceratiomyxales and Echinosteliales (TABLES I, II) may be partly attributed to the fact that the fructifications of the former usually do not persist in nature long enough to be colonized, whereas those of the latter are rarely collected because of their extremely small size.

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