

# A re-evaluation of *Melanospora* Corda and similar Pyrenomycetes, with a revision of the British species

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A re-evaluation of *Melanospora* Corda and similar genera is presented, based mainly on new data obtained by SEM examination of the ascospores. Eight genera are accepted: *Melanospora* (nine British species, including *M. longisetosa* P. Cannon & D. Hawksw.), *Persiciospora* P. Cannon & D. Hawksw. (including *P. moreaui* P. Cannon & D. Hawksw. and *P. masonii* (Kirschst.) P. Cannon & D. Hawksw.), *Phaeostoma* (one species), *Scopinella* (four species; two in the British Isles), *Sphaerodes* (six species, including *S. beatonii* (D. Hawksw.) P. Cannon & D. Hawksw., *S. compressa* (Udagawa & Cain) P. Cannon & D. Hawksw., *S. fmicola* (Hansen) P. Cannon & D. Hawksw., *S. perplexa* (D. Hawksw.) P. Cannon & D. Hawksw., *S. retispora* (Udagawa & Cain) P. Cannon & D. Hawksw., *S. retispora* var. *inferior* (Udagawa & Cain) P. Cannon & D. Hawksw.; two in the British Isles), *Sphaeronaemella* (one species, not known in Britain), *Syspastospora* P. Cannon & D. Hawksw. (one species, *S. parasitica* (Tul.) P. Cannon & D. Hawksw.) and *Viennotidea* P. Cannon & D. Hawksw. (four species, including *V. fmicola* (Marchal) P. Cannon & D. Hawksw., *V. humicola* (Samson & W. Gams) P. Cannon & D. Hawksw., *V. spherospaerici* (Malloch) P. Cannon & D. Hawksw., and *V. raphani* (Malloch) P. Cannon & D. Hawksw.; one in the British Isles).

KEY WORDS:—Fungi – *Melanospora* – *Persiciospora* – *Phaeostoma* – Pyrenomycetes – *Scopinella* – *Sphaerodes* – *Sphaeronaemella* – *Syspastospora* – *Viennotidea*.

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## INTRODUCTION

In the last comprehensive survey of *Melanospora* Corda (Pyrenomycetes, Sphaeriales/Hypocreales), Doguet (1955) adopted an extremely broad generic concept, informally arranging the species into four groups based on the shape and ornamentation of the ascospores. Investigations during the last two decades have made it clear that this approach results in an unacceptably heterogeneous assemblage of species under a single generic name. As a consequence of this, a number of genera have been segregated from the broad concept of *Melanospora* (von Arx & Müller, 1954; Udagawa & Cain, 1969; Hawksworth, 1975a; Hawksworth & Udagawa, 1977; Jeng & Cain, 1977; von Arx, 1981). No overall re-evaluation of generic concepts in this group according to modern taxonomic principles has hitherto been published.

The last detailed account of the British members of *Melanospora* and allied genera was that of Petch (1938). In the course of preparation of a new checklist of British ascomycetes, it became clear that in order to provide a satisfactory treatment of the British representatives of the group it would be necessary to reconsider the delimitation of the genera as well as the identities of the taxa recorded from the British Isles.

This paper aims first to clarify generic concepts in the group, and secondly to review the genera and species reported from the British Isles.

An SEM study was undertaken as, although spore shape and ornamentation have been considered as of paramount importance in the group, SEM illustrations of few species of the genera involved have previously been published. Representatives of as many pertinent genera and species as possible were examined with the SEM in order to provide a firm base for a revision of the British taxa. This yielded a considerable amount of new information which, when taken in conjunction with evidence from other sources, enabled a more satisfactory generic system for the group to be constructed (Table 1). The nature of the germ apertures proved to be of particular importance and unequivocally demonstrated the heterogeneity of Doguet's broad concept of the genus.

KEY TO *MELANOSPORA* AND SIMILAR GENERA

- |    |  |                        |
|----|--|------------------------|
| 1. | Spores with longitudinal germ slits . . . . .  | 2                      |
| 1' | Spores with germ pores . . . . .   | 4                      |
| 2. | Spores smooth-walled . . . . .   | 3                      |
| 2' | Spores with pitted walls . . . . .   | <i>Poroconiochaeta</i> |
| 3. | Spores yellow-brown; germ slits triangular in section . . . . .                            | <i>Scopinella</i>      |
| 3' | Spores $\pm$ hyaline; germ slits very narrow . . . . .                                     | <i>Sphaeronaemella</i> |
| 4. | Spores with one broad germ pore with a basal appendage<br>. . . . .                        | <i>Phaeostoma</i>      |
| 4' | Spores with two germ pores (sometimes inconspicuous)<br>without basal appendages . . . . . | 5                      |
| 5. | Spores oblong or cylindrical-fusiform . . . . .  | 6                      |
| 5' | Spores ellipsoid to citriform . . . . .  | 7                      |

Table 1. Synopsis of characters separating the genera treated

Character	<i>Melanospora</i>	<i>Peziziospora</i>	<i>Phaeostoma</i>	<i>Scopinella</i>	<i>Sphaerodes</i>	<i>Sphaeromacella</i>	<i>Syspastospora</i>	<i>Viennotidea</i>
Stroma	Absent (rarely present)	Absent	Present	Absent	Absent	Absent	Absent	Absent
Position of ascoma	Superficial	Immersed to superficial	Superficial	Superficial	Superficial to immersed	Superficial to subimmersed	Superficial	Superficial to immersed
Ostiole	Usually present	Present	Present	Present	Usually absent	Present	Present	Present
Perithecial neck	Absent to long, cellular	Short, cellular	Long, cellular	Long, hyphal	Absent to very short, cellular	Long, hyphal	Long, hyphal	Long, hyphal
Ostiolar setae	Present	Absent to very short	Absent	Absent to present	Absent (rarely present)	Present	Absent	Present
Ascus shape	Clavate (rarely ellipsoid)	Clavate to cylindrical	Ovoid	Clavate	Clavate to ellipsoid	Clavate to ovoid	Clavate	Sphaeroid to ovoid
Ascospore colour	Brown	Brown	Brown	Brown	Dark brown to black	Hyaline	Brown	Hyaline to pale brown
Ascospore shape	Citriform to ellipsoid (to discoid)	Ellipsoid-fusifiform	Ovoid-ellipsoid	Oblong-ellipsoid to quadrangular	Citriform	Ellipsoid	± cylindrical	Oblong to allantoid
Ascospore apertures	2 not or slightly apiculate pores	2 slightly apiculate pores	1 sunken pore	2 wide slits	2 terminal, strongly apiculate pores	1 narrow slit developing late	2 terminal, crateriform pores	1 small subterminal pore
Ascospore ornamentation	Smooth	Weakly pitted	Smooth	Smooth	Usually coarsely reticulate	Smooth	Smooth	Smooth

6. Germ pores large, terminal, crateriform; spores brown . . . . . *Syspastospora*  
 6': Germ pores subterminal, small, very inconspicuous; spores  
 hyaline to greenish . . . . . *Viennotidea*
7. Spores smooth-walled, with depressed germ pores . . . . . *Melanospora*  
 7': Spores not smooth-walled, with sessile to umbonate, sometimes . .  
 tuberculate, germ pores . . . . . 8
8. Spores with longitudinal  $\pm$  hyaline wing-like appendages  
 . . . . . *Pteridiosperma*  
 8': Spores without wing-like appendages . . . . . 9
9. Spores usually coarsely reticulate; germ pores  $\pm$  conspicuously  
 umbonate . . . . . *Sphaerodes*  
 9': Spores always with indistinct ornamentation; germ pores only  
 slightly apiculate . . . . . 10
10. Ascomata cleistothecial; peridium cephalothecoid; spores  
 rugulose . . . . . *Rhytidospora*  
 10': Ascomata perithecial; peridium pseudoparenchymatous;  
 spores faintly pitted . . . . . *Persiciospora*

*Poroconiochaeta* Udagawa & Furuya (1979), *Pteridiosperma* Krug & Jeng (1979) and *Rhytidospora* Jeng & Cain (1977) are not known in Britain and not considered further in this paper.

#### MELANOSPORA CORDA

*Melanospora* Corda, *Icones Fungorum*, 1: 24 (1837).

SYNONYMS: *Microthecium* Corda, *Icones Fungorum*, 5: 74 (1842).

*Ceratostoma* Fr., *Summa Vegetabilium Scandinaviae*, 2: 396 (1849).

*Sphaeroderma* Fuckel, *Jahrbücher des Nassauischen Vereins für Naturkunde*, 29/30: 23 (1875).

*Ampullaria* A.L.Sm., *Journal of Botany, British and Foreign*, 41: 258 (1903) [*vide* Mason (1933)].

?*Gibsonia* Masee in Gibson, *Annals of Botany*, 23: 336 (1909) [*vide* Petch (1938)].

ASCOMATA perithecial, rarely cleistothecial, superficial, rarely immersed, solitary to gregarious, usually  $\pm$  globose, glabrous to strongly tomentose; wall membranous, translucent, usually rather thin, pale yellow to reddish brown, appearing dark brown or black when mature due to spore mass; wall composed of polyhedral pseudoparenchymatous cells forming a *textura angularis*, beak long to absent, with a ring of rigid hyaline smooth-walled setae around the ostiole, if this is present. PARAPHYSES absent. ASCI usually clavate, thin-walled, lacking any distinct apical apparatus, evanescent, usually 8-spored. ASCOSPORES ellipsoidal to citriform, rarely discoid or fusiform, with 2 apical germ pores, not or only slightly apiculate, pores depressed, without a raised rim, brown prior to release from the ascus, smooth-walled.

ANAMORPHS: These have been reported as belonging to a wide range of genera (*vide* Kendrick & Di Cosmo, 1979), including *Acremonium* Link ex Fr., *Chlamydomyces* Bain., *Harzia* Cost., *Paecilomyces* Bain. and *Proteophiala* R. Ciferri. We have not

attempted to investigate the anamorphs of the genus, but this is clearly required and needs the use of single-ascospore cultures to satisfactorily resolve the question of their identity.

TYPE: *Melanospora zamiae* Corda.

Members of this genus have been reported from almost all parts of the world. The genus is represented in the British Isles by nine species, and a further one is excluded pending confirmation. Several species, including *Melanospora caprina* and *M. chionea*, appear to be widespread in this country.

Most species are parasitic on other fungi. Those which have not been shown to be parasitic are nevertheless often associated with other fungi; cultural work has not been carried out to confirm the mode of life of the putatively saprophytic taxa.

*Melanospora*, as circumscribed here, is a well-defined genus with translucent ascomata, often with a long beak and with a well-developed ring of coronal setae around the ostiole, and smooth brown ascospores with two  $\pm$  depressed germ pores. The ascospores accumulate in a cirrhus supported by the ostiolar setae, giving the fungus the appearance of a black head.

Of the synonyms cited above, *Sphaeroderma* Fuckel and *Microthecium* Corda are the only ones to have received widespread acceptance this century. *Sphaeroderma* was distinguished from *Melanospora* on the absence of an ostiolar beak, but this feature proves to be highly variable. Doguet (1955) considered that the production of a beak was significantly affected by cultural conditions. Petch (1938) stated that the genus additionally differed from *Melanospora* by the absence of coronal setae around the ostiole, but of the three species that he accepted, two in fact have setae and the third is cleistothecial.

*Microthecium* Corda was retained for non-ostiolate species otherwise similar to *Melanospora* by Udagawa & Cain (1969) and additional species were added to it by Hawksworth & Udagawa (1977), who also provided a key to the then known species. Subsequent studies on germ pores with the SEM have substantiated the suggestion of von Arx (1973) that both ostiolate and non-ostiolate species with reticulately-ornamented spores constitute a distinct genus, for which the name *Sphaerodes* Clem. is available (von Arx, 1981). As *Microthecium* is typified by a smooth-spored species with depressed germ pores, that generic name has to be placed as a synonym of *Melanospora*, while the species with reticulately ornamented spores formerly placed there are here referred to *Sphaerodes* (see below).

The present study has involved the examination of both living cultures and herbarium material but single spore isolates were not prepared. Data on anamorphs is therefore generally omitted. The evanescent asci in this genus are invariably difficult to observe: in many cases the descriptions and measurements of these given below have been taken from earlier reliable publications.

#### Key to the British species of *Melanospora*

- |    |  |   |
|----|--|---|
| 1. | Beak < 100 $\mu$ m, usually much shorter than perithecial diameter . | 2 |
| 1' | Beak > 100 $\mu$ m, length more than half perithecial diameter . . . | 7 |
| 2. | Spores ellipsoid to citriform, often somewhat plataniform .          | 3 |
| 2' | Spores not this shape . . . . .                                      | 5 |

3. Perithecial body 45–50  $\mu\text{m}$  diameter, reddish; spores 18–22  $\mu\text{m}$  long . . . . . *M. fimbriata*
- 3': Perithecial body 125–400  $\mu\text{m}$  diameter, variously coloured, spores 21–34  $\mu\text{m}$  long . . . . . 4
4. Bulbils present, 40–70  $\mu\text{m}$  diameter . . . . . *M. fallax*
- 4'. Bulbils absent . . . . . *M. brevirostris*
5. Spores ellipsoid-fusiform, 20–25  $\mu\text{m}$  long . . . . . *M. fusispora*
- 5'. Spores discoid- or rhomboid-ellipsoid . . . . . 6
6. Perithecia superficial; coronal setae 50–60 (–120)  $\mu\text{m}$  long; asci 8-spored; spores rhomboid-ellipsoid, 18–25  $\times$  10–14  $\mu\text{m}$  . . . . . *M. damnosa*
- 6'. Perithecia immersed to erumpent; coronal setae 250–350  $\mu\text{m}$  long asci 4-spored; spores discoid-ellipsoid, 14–19  $\times$  12–14  $\times$  8–9  $\mu\text{m}$  . . . . . *M. longisetosa*
7. Beak (400–)600–2000  $\mu\text{m}$  . . . . . 8
- 7'. Beak 100–400  $\mu\text{m}$  . . . . . 9
8. Body strongly tomentose . . . . . *M. caprina*
- 8'. Body hispid to very weakly tomentose . . . . . *M. lagenaria*
9. Body glabrous or almost so . . . . . 10
- 9'. Body weakly to strongly tomentose . . . . . 11
10. Beak 20–50(–150)  $\mu\text{m}$ ; some spores plataniform. . . . . *M. brevirostris*
- 10'. Beak (80–)150–250  $\mu\text{m}$ ; spores all ellipsoid-citriform . . . . . *M. zamiae*
11. Spores discoid-ellipsoid, 7.5–16  $\mu\text{m}$  long; body usually strongly tomentose . . . . . *M. chionea*
- 11'. Spores rhomboid-ellipsoid, 18–25  $\mu\text{m}$  long; body weakly tomentose . . . . . *M. damnosa*

*Melanospora brevirostris* (Fuckel) Höhnel

*Melanospora brevirostris* (Fuckel) Höhnel, *Sitzungsberichte der Akademie der Wissenschaften, Wien, Mathematisch-naturwissenschaftliche Klasse, I*, 123: 94 (1914).

SYNONYMS: *Ceratostoma brevirostre* Fuckel, *Botanische Zeitung*, 19: 250 (1861).

*C. helvellae* Cooke, *Grevillea*, 1: 175 (1873).

*Melanospora helvellae* (Cooke) Sacc., *Michelia*, 1: 283 (1878).

*M. sphaerodermoides* Grove, *Journal of Botany, British and Foreign*, 23: 132 (1885).

*Thielavia soppittii* Crossland, *The Naturalist (Hull)*, 1900: 7 (1900).

*Melanospora tulasnei* Udagawa & Cain, *Canadian Journal of Botany*, 47: 1932 (1969).

*M. zobeli* auct. angl. [fide Udagawa & Cain (1969)].

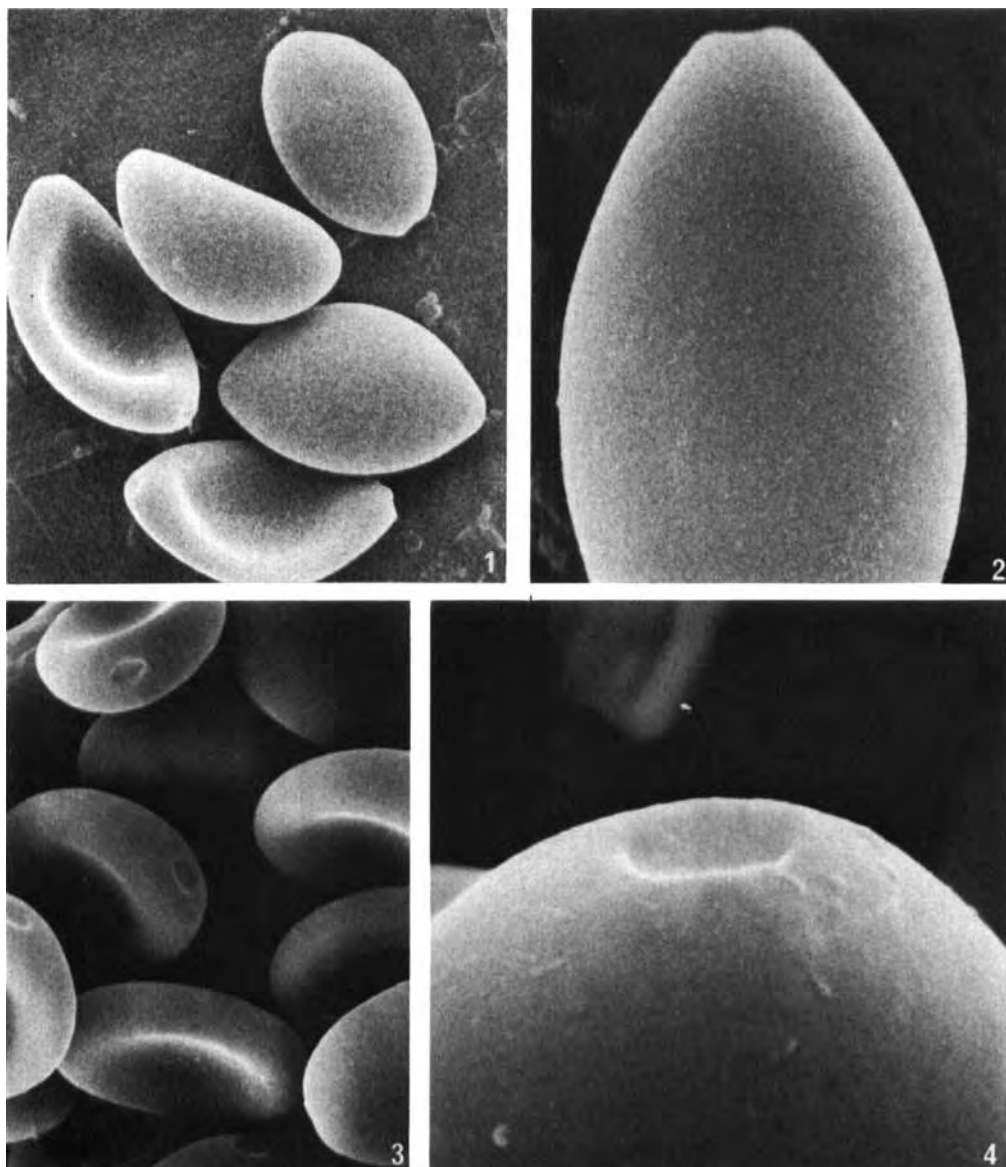
PERITHECIA superficial to half-immersed, (solitary to) gregarious,  $\pm$  globose, 125–400  $\mu\text{m}$  diameter, glabrous or very sparsely hairy, pale yellow to brown; ostiolate, beak short,  $\pm$  conical, 20–50(–150)  $\mu\text{m}$  long, crowned with a ring of hyaline setae 40–60(–100)  $\mu\text{m}$  long. ASCI clavate (to ovoid), 50–90  $\times$  25–35  $\mu\text{m}$ ,

evanescent at an early stage, 8-spored. ASCOSPORES ellipsoid-citriform, often somewhat plataniform, smooth-walled, dark brown, with two terminal, usually slightly apiculate, pores  $c.$   $1.5 \mu\text{m}$  diameter,  $21\text{--}34 \times 11\text{--}17 \mu\text{m}$ .

ILLUSTRATIONS: Kers (1974: 349; fig. 1).

Figures 1–2, 10.

HOSTS: Parasitic on various Discomycetes, usually *Sepultaria* (Cooke) Boud. species but also recorded from decaying truffles (*Hydnocystis* Tul. species) and from dead plant stems.



Figures 1–4. *Melanospora breviostris* and *M. chionea* (SEM). Figs 1–2. *M. breviostris* (IMI 16559). Fig. 1. Ascospores,  $\times 2000$ . Fig. 2. Ascospore apex, showing depressed germ pore,  $\times 6500$ . Figs 3–4. *M. chionea* (IMI 229732). Fig. 3. Ascospores,  $\times 3500$ . Fig. 4. Ascospore apex with depressed germ pore,  $\times 18500$ .

DISTRIBUTION: Most common on coastal dunes; recorded from N.E. England and N. Wales in these habitats. Otherwise scattered throughout Britain, but rarely recorded. Reported from a number of countries in northern Europe.

*Melanospora tulasnei* Udagawa & Cain only differs from *M. breviostris* as originally described by being half-immersed in the substrate rather than superficial. A study of the specimens available has revealed a gradation from one habit to the other, and colonies of the fungus which are densely crowded give the impression of being partially sunken, as only the upper halves of the perithecia are then visible. *M. tulasnei* has had an unstable taxonomic history due to confusion with *Microthecium zobelii* Corda (see Udagawa & Cain, 1969). Fuckel (1870) placed *M. tulasnei* (as *Melanospora zobelii*) in synonymy with *M. breviostris*, and Petch (1938) suspected that the two taxa were the same, though he had not seen specimens of *M. tulasnei*. *Melanospora tulasnei* was first described from the truffle *Hydnocystis arenaria* Tul., but Udagawa & Cain (1969) also reported it as occurring on *Sepultaria*.

*Melanospora sphaerodermoides* Grove was reported from markedly different substrates, including dead stalks of *Heracleum* L. (Umbelliferae) and *Brassica* L. (Cruciferae), but this is its only distinguishing feature, although the perithecia and ascospores are at the upper end of their size ranges in *M. breviostris sensu lato*. There are several other microfungi present on the type specimen, and the fungus may in fact have been parasitic on one of these.

Some tendency towards intergradation with *Melanospora zamiae* (p. 132) occurs, but the two species are unlikely to be confused.

A recent account of *Melanospora breviostris* is provided by Kers (1974).

SPECIMENS EXAMINED: BRITISH ISLES: Anglesey: Newborough Warren, on *Sepultaria arenosa* (Fuckel) Rehm, 5 xi 1974, *Dodds* (K); Newborough Warren, on *S. arenosa*, xi 1972, *Reid* (K). Lancashire: Southport, on *Sepultaria* on sand dunes, ix 1936, *Broadhead* (K); Hightown, on *S. arenosa* by damp slack, 8 ix 1963, *Palmer 11722* (K); Ainsdale, on *S. arenosa* by damp slack, 8 ix 1963, *Palmer 11760* (K); S. Lancashire, on sand hills, vi 1920, *Travis* (K). Norfolk: North Wootton, on decaying stalks of *Brassica*, xi 1935, *Petch* (K). Nottinghamshire: Annerley Hall, on wheat straw in potato clamp, 10 i 1953, *Webster* (IMI 51449). Warwickshire: Bradnock's Marsh, on herbaceous stem (*Heracleum*), 13 viii 1884, *Grove* (K). Yorkshire: Halifax, Morland, on *Cardus palustris* L., xi 1889 *Soppitt* (KIMI 89406); TYPE of *Thielavia soppittii*. *Sine loc.*, on *Peziza sepulta* Fr. [collector not cited] (K).—EGYPT: *Sine loc.*, isol. ex *Narcissus* L., 18 iv 1972, *Shehata 14* (IMI 165591).—GERMANY: near Budenheim, in pinewoods on *S. arenosa* [collector not cited] [Fuckel, *Fungi Rhen.* no. 809, 1864.] (IMI).

*Melanospora caprina* (Fr. ex Hornem.) Sacc.

*Melanospora caprina* (Fr. ex Hornem.) Sacc., *Sylloge Fungorum*, 2: 462 (1883).

SYNONYMS: *Sphaeria caprina* Fr. ex Hornem. in Oeder, *Flora Danica*, 11: fasc. 31, no. 1829, fig. 2 (1825).

*Ceratostoma caprinum* (Fr. ex Hornem.) Fr., *Summa Vegetabilium Scandinaviae*, 2: 396 (1849).

*Sphaeria vervecina* Desm., *Annales des Sciences Naturelles, Botanique, série 2*, 17: 103 (1842).



*Melanospora vervecina* (Desm.) Fuckel, *Jahrbücher des Nassauischen Vereins für Naturkunde*, 23/24: 126 (1870).

PERITHECIA superficial, usually gregarious, on a usually persistent brown-tomentose subiculum, 600–800  $\mu\text{m}$  diameter, globose to depressed-globose, strongly white-tomentose, wall yellow to dark red-brown, rather hard, often slightly carbonaceous; ostiolar neck 1500–2000  $\mu\text{m}$  in length, slightly tapering, with occasional short adpressed hairs, arising rather abruptly from the perithecial body and with a terminal ring of setae 150–200  $\mu\text{m}$  in length, these often being broken off. ASCI clavate, soon evanescent, 50–70(–100)  $\times$  20–25  $\mu\text{m}$ , 8-spored. ASCOSPORES ellipsoid to citriform, brown, smooth-walled with two terminal, slightly apiculate, pores, 16–23  $\times$  9–16  $\mu\text{m}$ .

ILLUSTRATIONS: Figure 10.

HOSTS: On dead wood, particularly of coniferous trees, and on decaying fungi; usually in areas of acid soil.

DISTRIBUTION: Evidently widely distributed and commonly encountered in suitable habitats throughout the British Isles.

A distinctive species, only likely to be confused with *Melanospora lagenaria*, these both having a very long neck emanating rather abruptly from the perithecial body. *M. caprina* is much more strongly tomentose than *M. lagenaria*. Hornemann attributed the species to Fries; there is apparently no record of this species in Fries's earlier publications.

SPECIMENS EXAMINED: BRITISH ISLES: Angus: Glamis, on dead wood, i 1874, *Stevenson* (K); Glamis, 1885 [collector not cited] (K). Argyll: Mull, Gruline, on decayed *Tomentella* Pat. sp., 30 ix 1972 [collector not cited] (K). Cumbria: Carlisle, 16 xii 1883, *Carlyle* (K). Moray: Forres, on larch [collector not cited] (K). Warwickshire: Stratford-upon-Avon, Oversley Wood, on dead *Betula* L. sp., 18 iii 1968, *Evans* (K); Hay Wood, on birch branch, 2 v 1968, *Evans* (K); Mays Wood, on *Tomentella tristis* (Karst.) Höhnelt & Litsch., 28 viii 1973, *Evans* 1233 (K); Wellesbourne Wood, *Evans* (IMI 194371); Alcester, Oversley Wood, "on some resupinated hyphal mat", 13 iv 1969, *Reid* (K). Wiltshire: Rudloe, xi 1842, *Berkeley* (K); Rudloe, on soil, 1843, *Berkeley* (K); Shirlett, 29 ii 1904, *Rea* (K); near Rudloe, 11 ii 1842 [collector not cited] (K); Rudloe, on soil, 23 xi 1843 [collector not cited] (K). Worcestershire: near Stanton, on decaying ?*Stereum* Pers. sp., 7 ii 1971, *Clark* (K); Wyre Forest, on fallen, rotten *Betula* branch, on decaying *Stereum* sp., also on rhizomorphs of *Armillaria mellea* Vahl, 25 v 1968, *Evans* (K); Wyre Forest, on decaying resupinated fungus on old stump, vii 1968, *Evans* (K). *Sine loc.*, xii 1873, *Keith* (K). *Sine loc.*, on furze, *Reeth* (K). *Sine loc.*, on bark, v 1874, *Stevenson* (K). *Sine loc.*, *Stevenson* (K). *Sine loc.*, 4 v 1899 [collector not cited] (K).—SWEDEN(?): *Sine loc.*, *Fries* (K—? isotype).

*Melanospora chionea* (Fr.) Corda

*Melanospora chionea* (Fr.) Corda, *Icones Fungorum*, 1: 25 (1837).

SYNONYMS: *Sphaeria chionea* Fr., *Systema Mycologicum*, 2: 446 (1823).

*Ceratostoma chioneum* (Fr.) Fr., *Summa Vegetabilium Scandinaviae*, 2: 396 (1849).

PERITHECIA superficial, solitary to gregarious, subglobose to globose, 200–400(–500)  $\mu\text{m}$  diameter, yellow to pale brown, sparsely to densely white-

tomentose; ostiolate, beak 250–400  $\mu\text{m}$ , slightly tapering, 35–40  $\mu\text{m}$  diameter at base, 25–30  $\mu\text{m}$  at tip, with a terminal ring of hyaline setae 35–80(–100)  $\mu\text{m}$  long. ASCI clavate, long-stalked, evanescent at an early stage, 35–55  $\times$  14–18  $\mu\text{m}$ , 8-spored. ASCOSPORES ellipsoidal, discoid (flattened along one polar plane), smooth-walled, dark brown, with two terminal sessile pores  $c.$  1.5  $\mu\text{m}$  diameter, 7.5–16  $\times$  6–12  $\times$  4–7  $\mu\text{m}$ .

ILLUSTRATIONS: von Arx & Müller (1954: 143; fig. 43).

Figures 3–4, 10.

HOSTS: On *Pinus* L. spp.; usually on the needles, but occasionally found on the cones. Once collected from *Fraxinus* L. According to Minter (personal communication) the fungus is typically found in, spring on the underside of dead pine needles which are still attached to old fallen branches lying in drier locations. DISTRIBUTION: Common throughout the British Isles, particularly in the north.

*Melanospora chionea* is a distinctive species, with an unusual spore form for the genus, which is only paralleled by that of *M. longisetosa*. No confusion with other taxa is likely.

SPECIMENS EXAMINED: BRITISH ISLES: Aberdeenshire: Strathdon, on *Pinus sylvestris* L., 26 xi 1976, Minter (IMI 223412); Braemer, Glen Quoich, on dead needles of *Pinus sylvestris*, 11 iv 1977, Minter (IMI 223411); Glen Quoich, on *Pinus sylvestris* needles, 11 iv 1977, Minter (IMI 223590); Ballater, Craigandarroch, on *Pinus sylvestris*, 8 v 1977, Minter (K). Cumbria: Orton Moss, decaying fir leaves, iv 1884, Carlyle (K). Inverness-shire: Aviemore, Glen More, on *Pine sylvestris*, 27 vi 1978, Minter (IMI 229732. Norfolk: North Wootton, on *Pinus sylvestris*, iii 1942, Petch (K). Perthshire: Dunkeld, 23 iv 1914, Rea (K). Dunkeld, on *Pinus sylvestris*, 19 iv 1914, Rea (K). Stirlingshire: Callander, on *Pinus sylvestris* cone, 22 vi 1978, Minter (IMI 229722). Surrey: Esher Common, on *Pinus sylvestris* cone, 30 iv 1978, Spooner (IMI 228422). Warwickshire: Tapster Valley, "on inside of loose bark of old log of *Fraxinus* with decayed *Stereum* etc", 11 i 1976, Clark MC1892 (IMI 200172).—SWEDEN(?): *Sine loc.*, 1819–22, [collector not cited] [Fries, *Scler. Suec.* no. 24] (K—ISOTYPE).

*Melanospora damnosa* (Sacc. & Berl.) Lindau

*Melanospora damnosa* (Sacc. & Berl.) Lindau in Engler & Prantl, *Die Natürlichen Pflanzenfamilien*, 1 (1\*): 353 (1897).

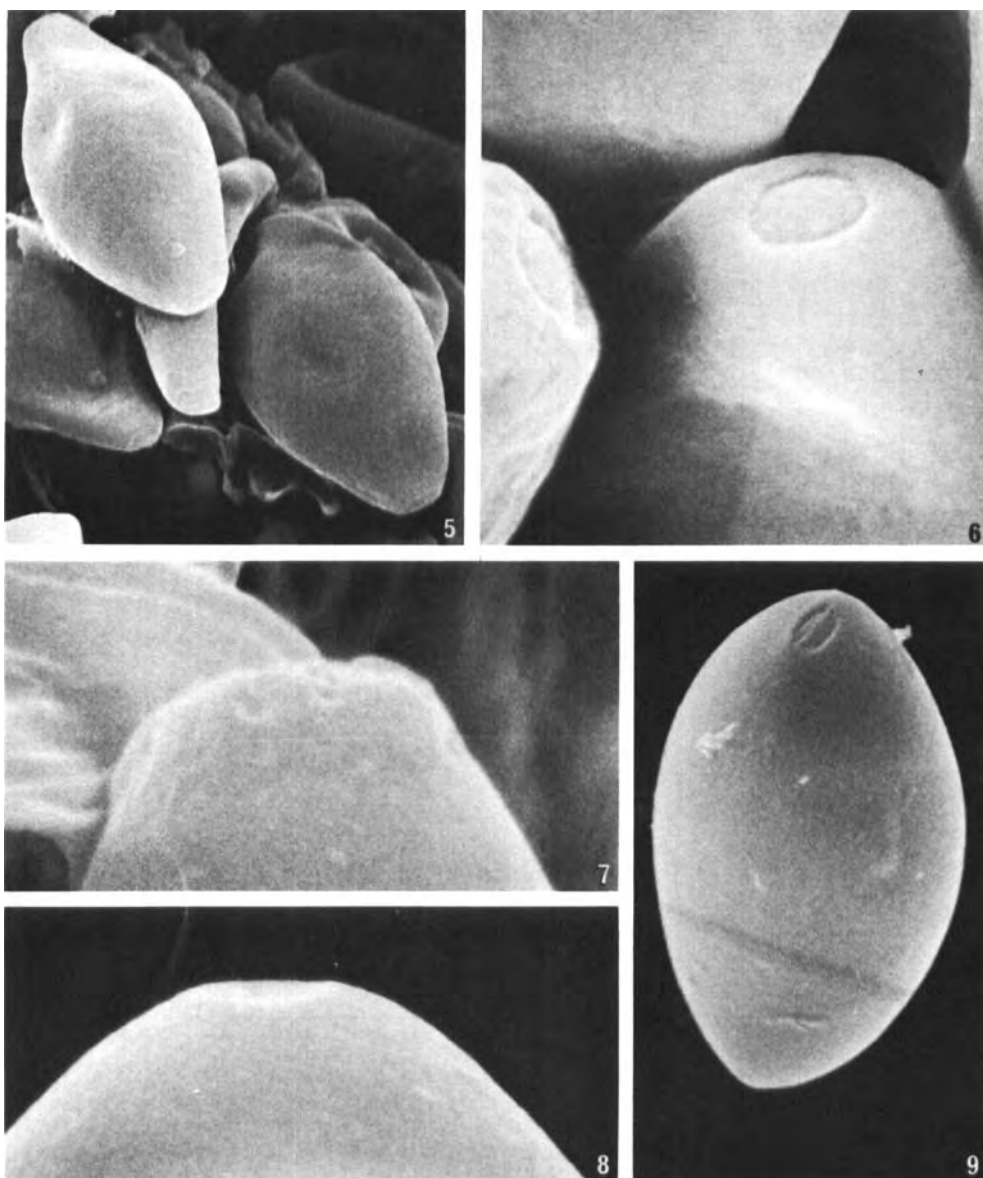
SYNONYM: *Sphaeroderma damnosum* Sacc. & Berl., *Rivista di Patologia Vegetale, Padova*, 4: 56 (1895).

PERITHECIA superficial, usually solitary,  $\pm$  globose, 150–400  $\mu\text{m}$  diameter, sparsely tomentose, pale yellow to orange-brown; ostiolate, neck 20–70(–170)  $\mu\text{m}$ , shortly conical, 30–60  $\mu\text{m}$  diameter at base, 25–40  $\mu\text{m}$  at tip, crowned with a ring of hyaline setae 50–60(–120)  $\mu\text{m}$  long. ASCI obpyriform or widely clavate, 34–38  $\times$  25–30  $\mu\text{m}$ , soon evanescent, 8-spored. ASCOSPORES citriform to rhomboid-ellipsoidal, brown, smooth-walled, with two terminal, obtuse to slightly apiculate, pores 1–1.5  $\mu\text{m}$  diameter, 18–25  $\times$  10–14  $\mu\text{m}$ .

ILLUSTRATIONS: Saccardo & Berlese (1895: 56–66; pl. 7–8); Doguet (1955: 268–271; figs 9–10).

Figures 5–6, 10.

HOSTS: On the dead stems of cereal crops, and from potato plants. Commonly



Figures 5-9. *Melanospora damnosa*, *M. fimbriata* and *M. lagenaria* (SEM). Figs 5-6. *M. damnosa* (IMI 87861a). Fig. 5. Ascospores,  $\times 3330$ . Fig. 6. Ascospore apices showing the depressed germ pore,  $\times 16650$ . Fig. 7. *M. fimbriata* (IMI 149521), ascospore apex,  $\times 16650$ . Figs 8-9. *M. lagenaria* (IMI 22941). Fig. 8. Ascospore apex with depressed germ pore,  $\times 16650$ . Fig. 9. Ascospore showing an apical depressed germ pore,  $\times 6500$ .

associated with *Fusarium culmorum* (W.G. Sm.) Sacc., and almost certainly parasitic on it.

**DISTRIBUTION:** Rarely reported in the British Isles, but perhaps more widespread than the few records imply. Evidently widely distributed in Europe, and in addition we have seen material from Bangladesh and Tunisia.

*Melanospora damnosa* is similar to *M. breviostris* but is usually more densely

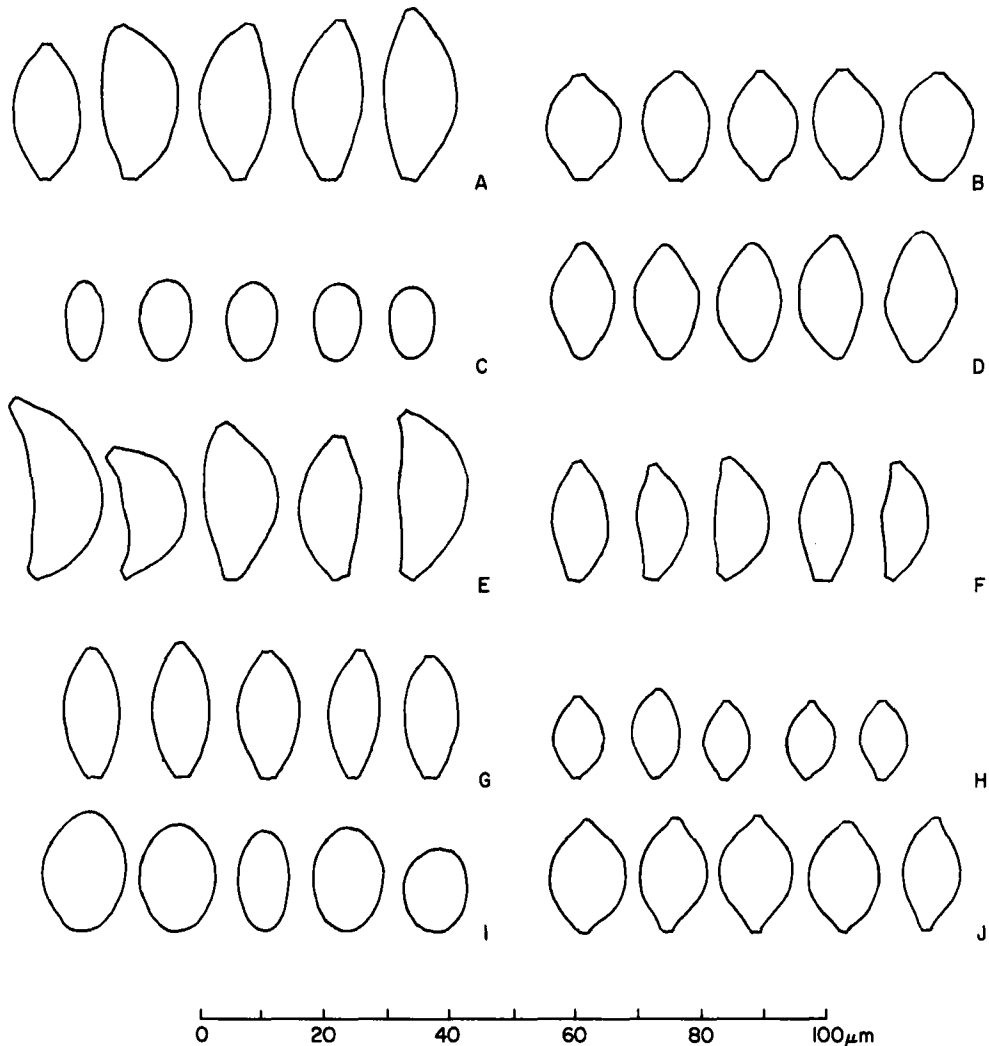


Figure 10. Outlines of the ascospores of *Melanospora* species recorded in the British Isles. A. *M. brevirostris* (Fuckel, *Fungi rhen.* no. 809 (IMI)). B. *M. caprina* (Fries, K—? isotype). C. *M. chionea* (Fries, *Scler. suec.* no. 24, K—isotype). D. *M. damnosa* (IMI 87861). E. *M. fallax* (IMI 16922). F. *M. fimbriata* (IMI 149521). G. *M. fusispora* (Petch R.1236, K). H. *M. lagenaria* (IMI 63931). I. *M. longisetosa* (IMI 16915—holotype). J. *M. zamiae* (IMI 70586).

tomentose, and has citriform to rhomboid-ellipsoidal rather than citriform to plataniform spores. Occasional specimens of this species have the relatively long necks characteristic of *M. zamiae* but these can again be distinguished by their unusual spore shape.

The specimen described by Mason (1933) and Petch (1938) under this name is referable to *Melanospora longisetosa* (p. 130).

**SPECIMENS EXAMINED:** BANGLADESH: isolated from stem of potato plant, 8 ix 1958, *Ishaque* (IMI 74744).—BRITISH ISLES: Ayr: Auchaninine (?), on oats with *Fusarium culmorum*, 27 xi 1944, *Douston* (K). Hertfordshire: Broadbank, Rothamsted, on wheat with *Fusarium culmorum*, 17 vii 1961, *Glynne* (IMI 87860); Rothamsted, on oats with *Fusarium culmorum*, 30 vi 1961, *Glynne* (IMI 87861a). Sussex: Chichester,

South Mundham, on oats with *Fusarium culmorum*, 17 vii 1961, Glynne (IMI 87858); South Mundham, on oats with *Fusarium culmorum*, 24 vi 1961, Glynne (IMI 87859).—TUNISIA: Isle of Djerba, on barley with *Fusarium culmorum*, 17 iv 1962, Glynne (IMI 96261).

*Melanospora fallax* Zukal

*Melanospora fallax* Zukal, *Sitzungsberichte der Akademie der Wissenschaften, Wien, Mathematisch-Naturwissenschaftliche Klasse, I, 98*: 549 (1889).

SYNONYM: *M. papillata* Hotson, *Proceedings of the American Academy of Arts and Sciences, 1912*: 251 (1912).

Similar to *Melanospora brevisporis*, but sometimes larger (perithecia 250–600 µm diameter) and accompanied by numerous bulbils 40–70 µm diameter, consisting of aggregations of thick-walled orange-brown cells.

ILLUSTRATIONS: Doguet (1955 : 272–275; figs. 11–12); Calviello (1976 : 99; fig. 3). Figures 10–12.

HOSTS: Originally described as parasitic on *Botrytis acinorum* Pers. but recorded in Britain from monocotyledonous bulbils; also isolated from dung and from *Picea* Dietr. seed.

DISTRIBUTION: Recorded only from Surrey (and an unknown locality) in the British Isles. Widespread in temperate areas.

The presence of bulbils, the only feature reliably distinguishing *Melanospora fallax* from *M. brevisporis*, may well be a function of the environmental conditions but cultural studies are needed to confirm this. The spores of this species tend to be more strongly plataniform than those of *M. brevisporis*, but this distinction is not marked enough to be of use in identification. The original descriptions of *M. fallax* and *M. papillata* are almost identical, but type material has not been seen, so precluding the definite establishment of synonymy.

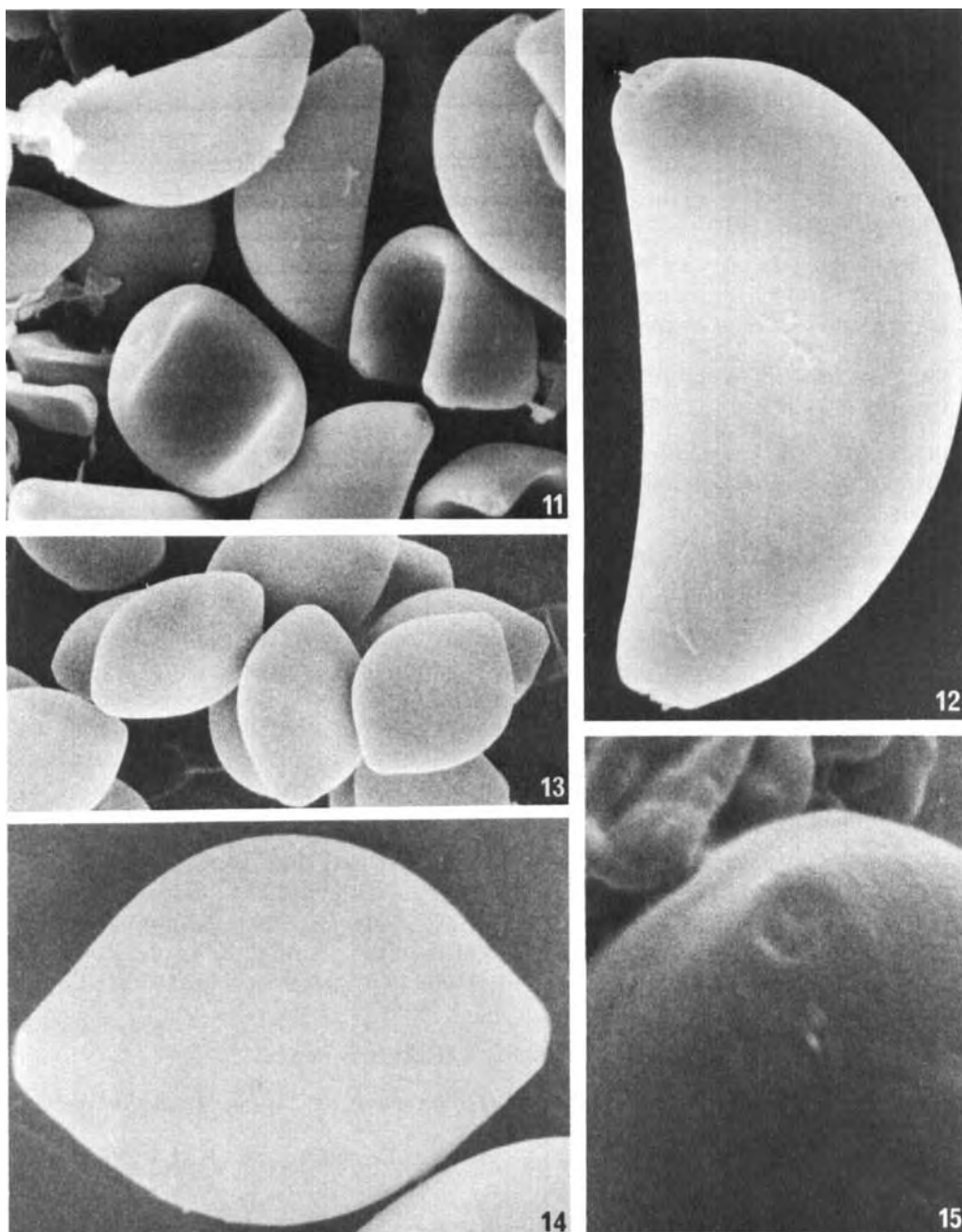
SPECIMENS EXAMINED: ARGENTINA: Carlos Paz, isolated from hare dung, vii 1973, Calviello (IMI 194430).—BRITISH ISLES: Surrey: Wisley, R.H.S. Garden, isolated from onion bulbils, vi 1944, Ashworth (IMI 16922). *Sine loc.*, *Picea sitchensis* Trautv. & Mey. seed, 1963 Balt T194 (IMI 102989).—EIRE: Dublin, Kinsealy Research Centre, isolated from unknown source, 31 viii 1978, McDonnell (IMI 231395).

*Melanospora fimbriata* (Rostrup) Petch

*Melanospora fimbriata* (Rostrup) Petch, *Transactions of the British Mycological Society, 21*: 253 (1938).

SYNONYM: *Sphaeroderma fimbriatum* Rostrup, *Meddelelser om Grønland, 18*: 67 [“1894”] (1896).

No British specimen of this species has been seen. Masee & Salmon (1901) reported the taxon from guinea-pig dung at Kew, but no specimen could be located in either K or IMI; Petch (1938) also failed to trace one. Rostrup's original description gives little indication of the size of the perithecia, simply describing them as very small, and the species is probably closely related to *Melanospora brevisporis*, if not in fact synonymous with it. Masee & Salmon's specimen had perithecia about 330 µm diameter, with inaequilateral, somewhat



Figures 11-15. *Melanospora fallax* and *M. zamiae* (SEM). Figs 11-12. *M. fallax* (IMI 16922). Fig. 11. Ascospores,  $\times 2000$ . Fig. 12. Ascospore showing the depressed apical germ pores,  $\times 5000$ . Figs 13-15. *M. zamiae* (IMI 62569a). Fig. 13. Ascospores,  $\times 2000$ . Fig. 14. Ascospore,  $\times 6500$ . Fig. 15. Ascospore apex showing a depressed germ pore,  $\times 11500$ .

citriform, spores; it is therefore likely that their specimen did in fact belong to *M. brevirostris*. A Canadian specimen named as this species has very small reddish perithecia, 45–50  $\mu\text{m}$  diameter, with a short truncate-conical neck 30–50  $\mu\text{m}$  in length crowned with a ring of setae 130–160  $\mu\text{m}$  in length, and with golden-brown, smooth-walled, citriform to plataniform spores 18–22  $\times$  9–11  $\mu\text{m}$ . This isolate seems to conform more closely with Rostrup's description than that of Masee & Salmon. The species should therefore be excluded from the British list until further material is discovered.

ILLUSTRATIONS: Figures 7, 10.

SPECIMEN EXAMINED: CANADA: Ontario: Petawawa, isol. ex *Populus tremula* L. soil, 7 vi 1968, Bhatt (IMI 149521).

*Melanospora fuispora* (Petch) Doguet

*Melanospora fuispora* (Petch) Doguet, *Le Botaniste*, 39: 215 (1955).

SYNONYM: *Sphaeroderma fuispora* Petch, *The Naturalist* (Hull), 1936: 58 (1936).

PERITHECIA superficial, solitary, globose, 200–300  $\mu\text{m}$  diameter, yellow to orange but appearing dark brown when mature due to spore mass, glabrous or with a few adpressed hyphae; ostiolate, neck absent or very short, coronal setae to *c.* 125  $\mu\text{m}$ . ASCI clavate, *c.* 66  $\times$  12  $\mu\text{m}$ , evanescent at an early stage, 8-spored. ASCOSPORES fusiform to ellipsoidal (to citriform), smooth-walled, brown, rather thin-walled, with two terminal pores 2.5–3  $\mu\text{m}$  diameter, 20–25  $\times$  7–12  $\mu\text{m}$ .

ILLUSTRATIONS: Udagawa (1970: 107–8; figs 5, 10).  
Figure 10.

HOSTS: Parasitic on *Paecilomyces farinosus* (Holm) A. H. S. Brown & G. Sm. and *Beauveria bassiana* (Bals.) Vuill.

DISTRIBUTION: Only known from three collections in eastern Britain (see below), and from two in Japan (see Udagawa, 1970).

The spore shape in this species is somewhat intermediate between the ellipsoidal-citriform shape typical of most of the genus and the cylindrical-fusiform spores of *Syspastospora parasitica*, which shares its unusual habitat, both being parasitic on entomogenous fungi. It differs from *S. parasitica* in the absence of a long neck, which is hyphal in structure in the former species but apparently cellular in the latter (in common with the other species of *Melanospora*), and further in the size of the ascospores and especially in the nature of the germ pores.

Petch (1938) separated the genus *Sphaeroderma* from *Melanospora* by its reputed absence of a beak and of coronal setae, but he described *S. fuispora* as developing a collar round the ostiole, which is entirely analogous with the short necks characteristic of, among other species, *M. brevirostris*; well-developed coronal setae were found on examination of the type specimen. In any case, Doguet (1955) considered that the length of the neck varied markedly under different cultural conditions, and consequently did not recognize the genus *Sphaeroderma*.

SPECIMENS EXAMINED: BRITISH ISLES: Hertfordshire: Rothamsted, on *Beauveria bassiana* on wireworm, ii 1941, Petch R. 1236 (K). Norfolk: North Wootton, on *Paecilomyces farinosus*, x 1936, Petch (K). Yorkshire: Saltaire, on *P. farinosus*, ix 1935, Winter (K—HOLOTYPE).

*Melanospora lagenaria* (Pers.) Fuckel

*Melanospora lagenaria* (Pers.) Fuckel, *Jahrbücher des Nassauischen Vereins für Naturkunde*, 23/24: 126 (1870).

SYNONYMS: *Sphaeria lagenaria* Pers., *Synopsis Methodicum Fungorum*, 58 (1801).

*Ceratostoma lagenarium* (Pers.) Fr., *Summa Vegetabilium Scandinaviae*, 2: 396 (1849).

*Phaeostoma lagenarium* (Pers.) Munk, *Dansk Botanisk Arkiv*, 17 (1): 82 (1957).

*Melanospora lagenaria* var. *tetraspora* Rehm, *Hedwigia*, 30: 259 (1891).

Similar to *M. caprina*, but the perithecial body much less strongly tomentose, neck 800–1500  $\mu\text{m}$  tall, glabrous, with a poorly developed crown of hyaline setae to 50  $\mu\text{m}$  long; spores ellipsoid to citriform, 12–22  $\times$  7–14  $\mu\text{m}$ .

ILLUSTRATIONS: Figures 8–10.

HOSTS: On decaying polypores, including *Bjerkandera adusta* (Willd.) P. Karsten, *Coriolus versicolor* (L.) Quélet and species of *Polyporus* Micheli and *Stereum* Gray.

DISTRIBUTION: Scattered throughout the British Isles; known from as far north as S.W. Scotland. Evidently widespread in Europe.

This species is only reliably distinguished from *Melanospora caprina* by the difference in density of the indumentum. Doguet (1955) stated that the two species were very closely related, and he found intermediate specimens with a dense indumentum but lacking the felted appearance typical of *M. caprina*. No such intermediates were seen in this study and so the two species are therefore retained here for the present. Petch (1938) was under the impression that the two species could be distinguished by their substrate, but *M. caprina* also commonly occurs on rotting fungi.

SPECIMENS EXAMINED: BRITISH ISLES: Ayrshire: Eglinton Wood, on *Coriolus versicolor*, viii 1917, Boyd (K). Essex: Epping Forest, on decaying fungus, ix 1918 [collector not cited] (K); Epping Forest, on old *Polyporus*, 19 x 1918 [collector not cited] (K). Hertfordshire: Bushey Park, on ?*Stereum*, xi 1904, Williams (K). Nottinghamshire: Nottingham, University Park, on *Coriolus versicolor*, 22 x 1950, Chesters 56.198 (IMI). Surrey: Kew, Queens Cottage, on old *Bjerkandera adusta*, iv 1888 [collector not cited] (K).—GERMANY: Moravia, nr. Weisskirchen (?), on *Bjerkandera adusta*, xii 1920, Petrak (IMI 22941).

*Melanospora longisetosa* P. Cannon & D. Hawksw.***Melanospora longisetosa* P. Cannon & D. Hawksw. sp. nova**

PERITHECIA immersa, erumpescentes, plus minusve gregaria,  $\pm$  globosa, 250–400  $\mu\text{m}$  in diametro, membranacea, ochracea vel badia; ostiolata, cum collis brevibus cylindraceis 50–70  $\mu\text{m}$  longis, c. 100  $\mu\text{m}$  in diametro et setis coronatis effectissimis 250–350  $\mu\text{m}$  longis, 3.5–5  $\mu\text{m}$  latis, hyalinis, convergentibus instructae, colla aspecta conorum. ASCI late clavati, fasciculati, corpori 35–40  $\times$  15–18  $\mu\text{m}$ , pedicelli 5–10  $\mu\text{m}$ , celeriter evanescenti, 4-spори. ASCOSPORAЕ late ellipsoideae, parum complanati, fuscii, cum parietibus laevibus, et duo poribus terminalibus c. 2  $\mu\text{m}$ , in diametro, non vel interdum parissime apiculatae, 14–19  $\times$  12–14  $\times$  8–9  $\mu\text{m}$ .

PERITHECIA immersed, becoming erumpent, somewhat gregarious,  $\pm$  globose,



250–400  $\mu\text{m}$  diameter, membranous, yellow-brown to reddish; ostiolate, with a short cylindrical beak 50–70  $\mu\text{m}$  long and *c.* 100  $\mu\text{m}$  diameter, with very well-developed coronal setae 250–350  $\mu\text{m}$  long, 3.5–5  $\mu\text{m}$  wide, hyaline, thick-walled, convergent, giving the beak a conical appearance. ASCI broadly clavate, clustered in a fascicle, body 35–40  $\times$  15–18  $\mu\text{m}$ , stalk 5–10  $\mu\text{m}$ , quickly evanescent, 4-spored. ASCOSPORES broadly ellipsoid, slightly flattened along one polar plane, brown, smooth-walled, with two terminal pores *c.* 2  $\mu\text{m}$  diameter, not or occasionally very slightly apiculate, 14–29  $\times$  12–14  $\times$  8–9  $\mu\text{m}$ .

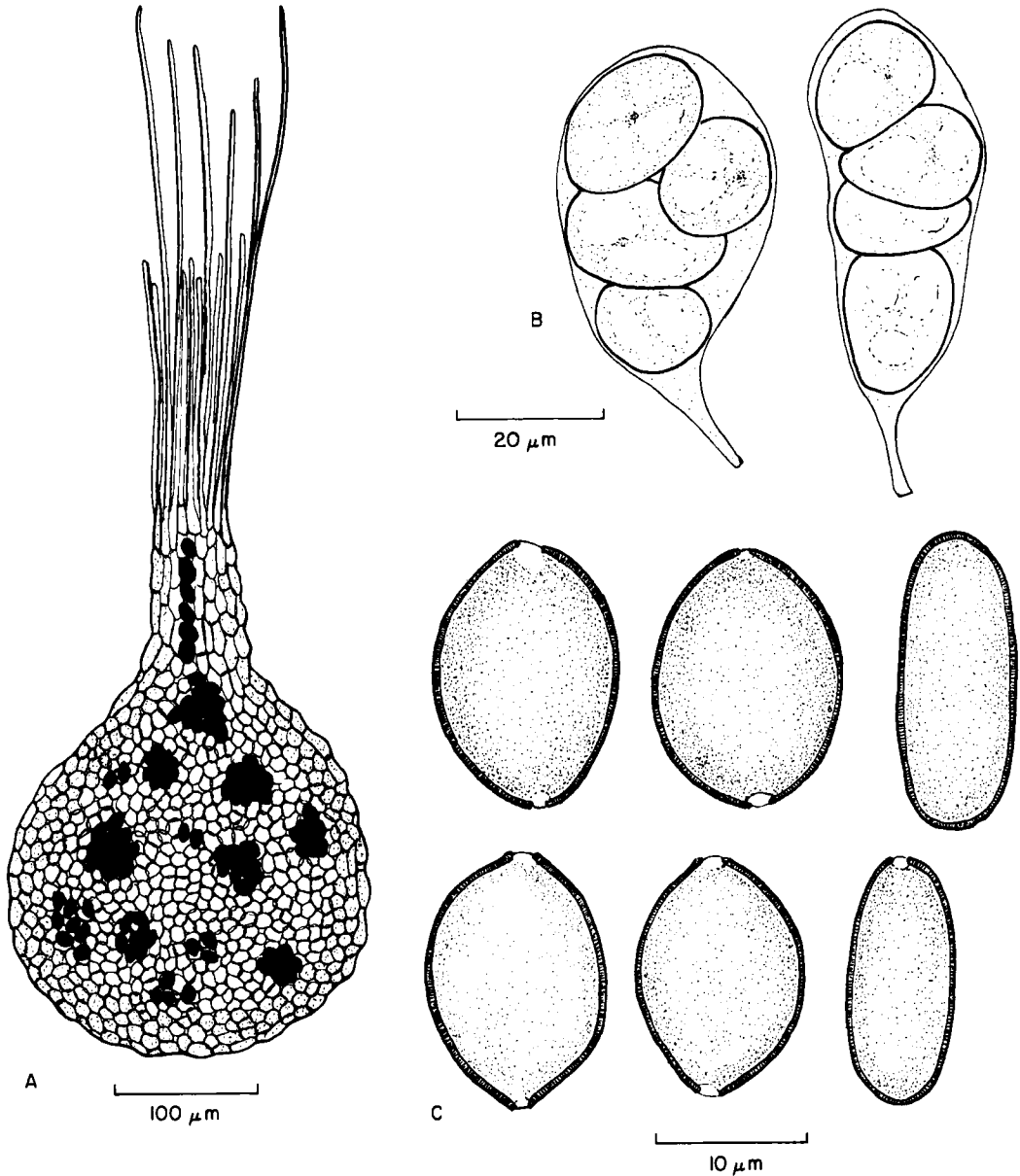


Figure 16. *Melanospora longisetosa* (IMI 16915—holotype). A, Perithecium. B, Young asci each containing four ascospores. C, Ascospores in face view (left and centre) and side view (right).

TYPE: BRITISH ISLES: Surrey: Kew, CMI garden, on elm twigs kept in damp chamber, 3 vi 1931, *Mason 1211* (IMI 16915—HOLOTYPE).

ILLUSTRATIONS: Figures 10, 16.

HOST: On *Ulmus* L. sp.; growing in close association with, and probably parasitic on, the *Tubercularia* anamorph of *Nectria cinnabarina* (Tode) Fr.

DISTRIBUTION: Only known from the type collection.

The flattened-ellipsoid spores found in this species are only paralleled in *Melanospora* by those of *M. chionea*, from which *M. longisetosa* differs by its short neck and extremely long coronal setae, and from all other known *Melanospora* species by its immersed to erumpent habit. Its asci are four-spored, which is a further unusual feature of the species, though this condition also occurs in *M. lagenaria* and *M. zamiae*.

The type specimen was first reported upon by Mason (1933) as *Melanospora damnosa*, and Petch (1938) described it under this name in his work on the British Hypocreales. Judging from a letter sent by Petch to Mason (now attached to the herbarium sheet in IMI) he accepted Mason's determination without formality, and, as he had not seen (other) specimens of *M. damnosa* in Britain, his description was based entirely on this collection. *Melanospora damnosa* differs markedly from *M. longisetosa* in its much shorter setae, superficial habit, eight-spored asci, and the shape of the spores, which are rhomboid-ellipsoid rather than discoid-ellipsoid. *M. damnosa* has subsequently been correctly reported from the British Isles (see above).

Mason (1933) mentioned two anamorphic fungi which he found in association with his culture of *Melanospora longisetosa*. The first of these was *Harzia acremonioides* (Harz) Cost. (syn. *Acremoniella atra* auct.) which is a very common culture contaminant, and is unlikely to be connected with *M. longisetosa*. The other was an unnamed phialosporic fungus, which may have been a genuine anamorph of the *Melanospora*, but it is likely that it was in fact the *Tubercularia* on which *M. longisetosa* is putatively parasitic.

#### *Melanospora zamiae* Corda

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

SYNONYMS: *M. leucotricha* Corda, *loc. cit.* 1: 25 (1837) [*fide* Doguet (1955)].

*M. cirrhata* Berk., *British Fungi exs.*, no. 325 (1843); *nom. inval.* (Art. 32).

*Ampullaria aurea* A. L. Sm., *Journal of Botany, British and Foreign*, 41: 258 (1903) [*fide* Petch (1938)].

?*Gibsonia phaeospora* Massee in Gibson, *Annals of Botany*, 23: 336 (1909) [*fide* Petch (1938)].

PERITHECIA superficial, solitary to gregarious, 150–300(–400)  $\mu\text{m}$  diameter,  $\pm$  globose, reddish to yellow-brown, glabrous to sparsely hairy; ostiolate, neck (80–)150–250  $\mu\text{m}$ , cylindrical to conical, 60–80  $\mu\text{m}$  diameter at base, 30–50  $\mu\text{m}$  at tip, with a terminal ring of hyaline setae 40–80(–200)  $\mu\text{m}$  in length. ASCI broadly clavate, 40–70  $\times$  20–35  $\mu\text{m}$ , evanescent at an early stage, 4- to 8-spored. ASCOSPORES ellipsoidal to citriform, brown, smooth-walled, with two terminal, usually slightly apiculate, pores *c.* 2  $\mu\text{m}$  diameter, 15–23  $\times$  10–16  $\mu\text{m}$ .

ILLUSTRATIONS: von Arx & Müller (1954: 142; fig. 42); Doguet (1955: 252–267; figs 1–8); Calviello (1973: 37; fig. 3).

Figures 10, 13–15, 48.

HOSTS: Common on many kinds of rotting vegetation; it has recently been shown (Jordan & Barnett, 1978) to be parasitic on a wide range of fungi.

DISTRIBUTION: Very widespread in the tropics and warm temperate regions; recorded occasionally in the British Isles, often on imported material.

This is the type species of *Melanospora*. It is quite similar to *M. brevirostris*, but can be distinguished by its longer neck and smaller spores, which are never plataniform. Occasional individuals (e.g. IMI 182100, 202257) occur with necks intermediate in length between the two species, and more intensive study may show a gradation from one form to the other. However, the intermediates are relatively uncommon and most specimens are easily assignable to one or other taxon.

A recent description of this species is provided by Calviello (1973).

SPECIMENS EXAMINED: BRITISH ISLES: Dyfed: Aberystwyth, on seed of *Phleum pratense* L., 26 iii 1927, *Sampson* (IMI 7058b); Aberystwyth, isol. ex rotten vegetable materials, 22 xii 1966, *Seth* (IMI 124057). Sussex: Glasshouse Crops Research Institute, on *Chrysanthemum morifolium* Ramat., 7 iv 1960, *Ebben* (IMI 80284b); Welche Common, on deer dung, 1972, *Reed* (K). Warwickshire: Edgbaston, on dead stems of *Urtica dioica* L., ii 1951, *Hickman* (IMI 44931). Yorkshire: North Riding Laboratory of Pathology and Public Health, on banana, x 1931, [collector not cited] (IMI 34819). *Sin loc.*, xii 1940, *Petch R. 1233* (K).—EGYPT: isol. ex *Gossypium* L., 2 iii 1976, *Salem* (IMI 202257).—GERMANY: Leipzig, “ad folia putrida varia in hortis”, *Winter* [Rabenhorst, *Fungi Eur.* no. 2757] (IMI 54670).—GILBERT & ELLICE ISLANDS: on *Carica papaya* L., 13 ii 1974, *Williamson* (IMI 182100).—INDIA: Bihar, isol. ex paper or textile, 30 xi 1969, *Bose 72* (IMI 144974). Varanasi, Banaras Hindu University, isol. ex chillies or millet, on *Fusarium oxysporum* Schlecht., 16 iii 1979, *Chaudhary 13* (IMI 238874). *Sine loc.*, isol. ex sugar cane, 13 ii 1956, *Kamat* (IMI 62569a).—LIBYA: Tripolitania, on *Arachis hypogaea* L., x 1959, *Kranz 179* (IMI 82661).

There is a large additional number of specimens in the CMI herbarium (IMI); these have not been examined in detail.

*PERSICIOSPORA* P. CANNON & D. HAWKSW.

***Persiciospora*** P. Cannon & D. Hawksw. **gen. novum**

DERIVATION: from “*Persicum*”, the Latin name for the peach, referring to the similarity of the spores to peach stones.

*Ab Melanospora* differt: parietibus ascosporarum cum leviter reticulatis, similis semen persicum.

Differs from *Melanospora* by the walls of the ascospores, which are ornamented with a faint reticulation similar to that found on a peach stone.

TYPE SPECIES: *Persiciospora moreaui* P. Cannon & D. Hawksw. (HOLOTYPE).

This new genus is probably closely related to *Melanospora* and *Sphaerodes*, sharing many features including an apparent parasitism on other microfungi, but differing essentially in the ornamentation of the spore wall. *Poroconiochaeta* Udagawa &

Furuya (1979) appears to have a broadly similar spore wall ornamentation, but the spores of this genus have longitudinal germ furrows, contrasting with the terminal germ pores in *Persiciospora*. No material of *Poroconiochaeta* has been seen.

The genus contains two species, *Persiciospora moreaui* P. Cannon & D. Hawksw. and *P. masonii* (Kirschst.) P. Cannon & D. Hawksw. They are easily distinguished by differences in habit, and in spore size and shape.

*Key to the species of Persiciospora*

1. Perithecia superficial; ascospores ellipsoid, 20–24 × 8–10 μm  
    . . . . . *P. moreaui*
- 1'. Perithecia immersed to erumpent; ascospores ellipsoid-fusiform,  
    26–36 × 13–17 μm . . . . . *P. masonii*

*Persiciospora moreaui* P. Cannon & D. Hawksw.

***Persiciospora moreaui* P. Cannon & D. Hawksw. sp. nova**

SYNONYMS: *Melanospora moreaui* Doguet, *Le Botaniste*, 39: 185 (1955); *nom. inval.* (Art. 36).

*Sphaerodes moreaui* (Doguet) v. Arx, *Genera of Fungi Sporulating in Pure Culture*, 3rd ed.: 156 (1981); *nom. inval.* (Art. 36).

PERITHECIA superficialia, sphaeroidea, flava vel aurantia, 200–350 μm in diametro, cum pilis usque ad 100 μm longis instructae; ostiolata, collum 20–100 μm longum, cum setis coroniformis hyalinis instructae. ASCI clavati, evanescenti, 65–75 × 20–25 μm, 8 spori. ASCOSPORAE ellipsoideae, fuscae, parietes cum leviter reticulati similis semen persicum, cum duo poris germinationis parvis terminalibus, 20–24 × 8–10 μm.

PERITHECIA superficial, sphaeroidal, pale to golden yellow, 250–350 μm diameter, covered with hairs to 100 μm long; ostiolate, neck 20–100 μm long, with a terminal ring of hyaline coronal setae. ASCI clavate, evanescent, 65–75 × 20–25 μm, 8-spored. ASCOSPORES ellipsoid, brown, the walls delicately pitted like a peach stone, with two small terminal germ pores, 20–24 × 8–10 μm.

TYPE: NEW ZEALAND: Wellington, isol. ex *Pinus* seedling with *Fusarium oxysporum* Schlecht., 15 v 1979, *Sheridan WU 9/79* (IMI 238745—HOLOTYPE).

ILLUSTRATIONS: Doguet (1955: 288–293; figs 19–21); Udagawa & Cain (1969: figs 33, 34).

Figures 17, 18.

HOSTS: Probably parasitic on *Fusarium oxysporum*; reported from pine seedlings and *Dianthus* L. plants in conjunction with this fungus.

DISTRIBUTION: France (?) and New Zealand; not recorded from the British Isles.

This species was first described by Doguet (1955) as *Melanospora moreaui*, but was invalidly published by him as no Latin diagnosis was provided. Von Arx (1981) transferred the species to *Sphaerodes*, but as the spore ornamentation is very distinct from the constituent members of both these genera, it is appropriate to separate it at the generic level, along with *P. masonii*, from these otherwise well-circumscribed genera.

As far as we know, the fungus has only been found once since the original collection, which was by Moreau from *Dianthus* plants infected with *Fusarium*

*oxysporum*, and reported by Doguet (1955). No locality was given for this collection; it is assumed that it came from France. The second collection is from New Zealand, and is designated the holotype for the species, as Moreau's collection was not seen by us. The conspecificity of the two specimens is not in doubt, Doguet having provided a detailed description and a number of illustrations in his work; the epithet is attributed to ourselves alone as Doguet did not see the New Zealand isolate. It is likely to be more widespread than the two records suggest, bearing in mind the markedly disjunct nature of its distribution as presently known. Udagawa & Cain (1969) included light micrographs of the spores of this species in their work, but gave no indication of the provenance of their material.

Doguet described a conidial state for his species, but he did not make single spore isolates, and consequently it is possible that this is a microconidial anamorph of the *Fusarium* host rather than of the *Persiciospora*. The conidia were described as ovoid, hyaline, about  $4 \times 2.5 \mu\text{m}$  in size, borne in chains on phialides  $5-12 \times 3-5 \mu\text{m}$  in size. He also reported the presence of bulbils, as found in *Melanospora fallax* (see above); these are probably a response to unfavourable environmental conditions, and are not present in the type collection.

*Persiciospora masonii* (Kirschst.) P. Cannon & D. Hawksw.

***Persiciospora masonii*** (Kirschst.) P. Cannon & D. Hawksw. **comb. nova**

SYNONYM: *Ceratostoma masonii* Kirschst., *Transactions of the British Mycological Society*, 18: 306 (1934); as "*masonii*".

PERITHECIA somewhat gregarious, immersed to erumpent,  $\pm$  globose, blackish, coriaceous, clothed with hyaline hyphae, 250–350  $\mu\text{m}$  diameter; ostiolate, neck cylindrical, 100–200  $\mu\text{m}$ , coronal setae apparently lacking. ASCI clavate to cylindrical-fusiform, evanescent,  $180-200 \times 20-25 \mu\text{m}$ , 8-spored. ASCOSPORES ellipsoid-fusiform, faintly striate-reticulate, dark brown, with two terminal, rather small, slightly apiculate, pores,  $26-36 \times 13-17 \mu\text{m}$ .

ILLUSTRATIONS: Figures 19–22.

HOSTS: Growing in the bark of a diseased oak tree.

DISTRIBUTION: Only known from the type collection (see below).

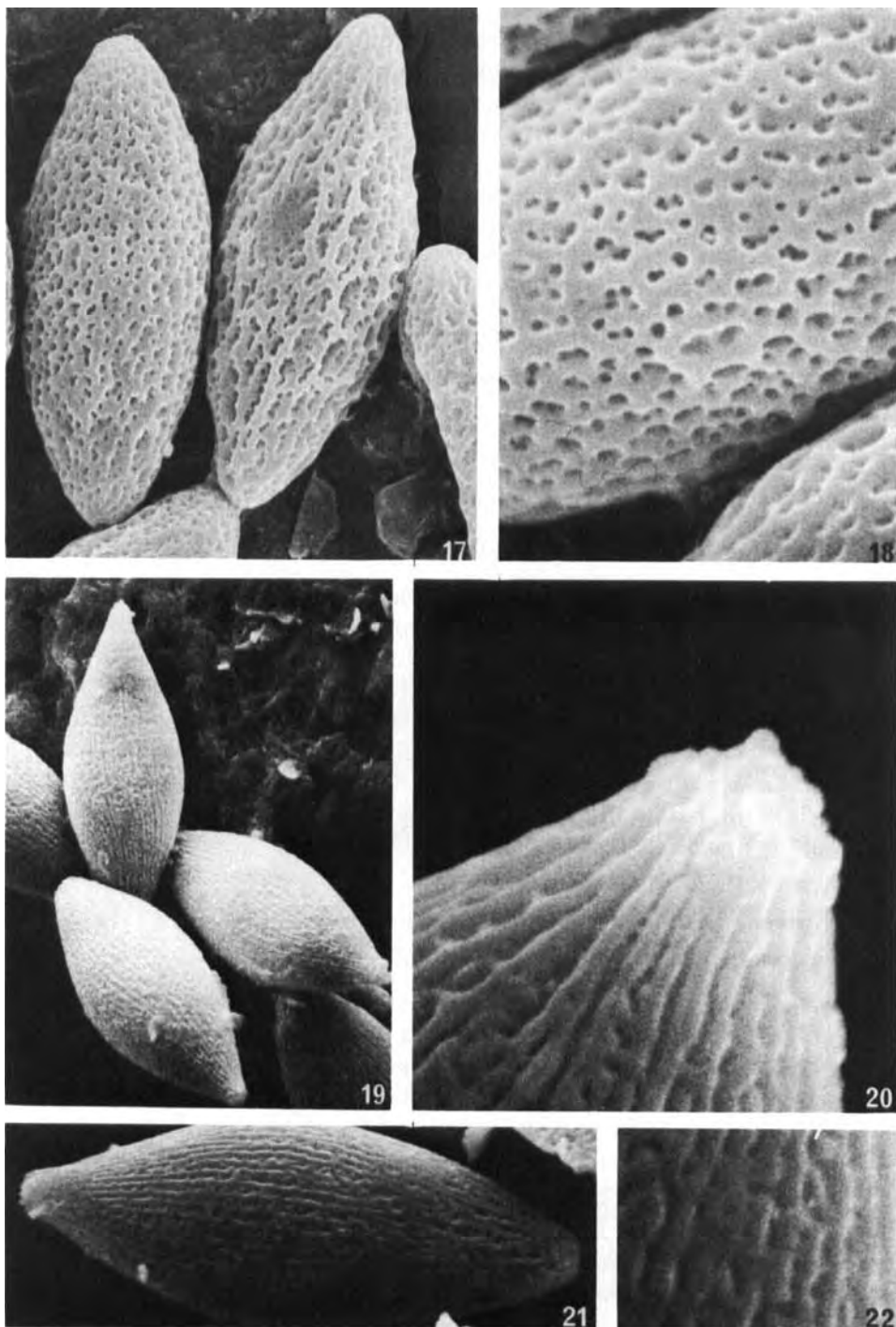
The genus *Ceratostoma* was introduced by Fries (1818) but was not validated until 31 years later (Fries, 1849), with *C. chioneum* as type, and is therefore a synonym of *Melanospora* Corda (1837). The genus served as a repository for numerous necked pyrenomycetes in the last century (Mason, 1933), and its constituent members are now widely dispersed throughout the Pyrenomycetes.

*Persiciospora masonii* is closely related to *P. moreaui*, sharing a broadly similar spore ornamentation, but differing in habit, in colour, in spore shape and size, and in ascus size.

SPECIMEN EXAMINED: BRITISH ISLES: Surrey: Richmond Park, on *Quercus* L. sp., 24 viii 1930, Mason (IMI 16002—HOLOTYPE).

*PHAEOSTOMA* v. ARX & E. MÜLLER

*Phaeostoma* v. Arx & E. Müller, *Beiträge zur Kryptogamenflora der Schweiz*, 11 (1): 148 (1954); *nom. cons. prop.* (Hawksworth & Sherwood, 1981). *Non Phaeostoma* Spach, *Histoire naturelle des végétaux. Phanérogames*, 4: 392 (1835); *nom. rej. prop.* [Onagraceae].



Figures 17-22. *Persiciospora moreaui* and *P. masonii* (SEM). Figs 17-18. *P. moreaui* (IMI 238745)—holotype). Fig. 17. Ascospores,  $\times 3500$ . Fig. 18. Portion of the ascospore wall showing the irregular pitted sculpturing,  $\times 8500$ . Figs 19-22. *P. masonii* (IMI 16002—holotype). Fig. 19. Ascospores,  $\times 3000$ . Fig. 20. Ascospore apex,  $\times 15000$ . Fig. 21. Ascospore,  $\times 6500$ . Fig. 22. Portion of the ascospore wall showing the sculpturing,  $\times 15000$ .

Similar to *Melanospora*, but perithecia dark, coriaceous, set on a crustose stroma; ascospores ellipsoid, rounded at the apex, truncate at the base with a small basal appendage.

TYPE: *Phaeostoma vitis* (Fuckel) v. Arx & E. Müller.

*Phaeostoma vitis* (Fuckel) v. Arx & E. Müller

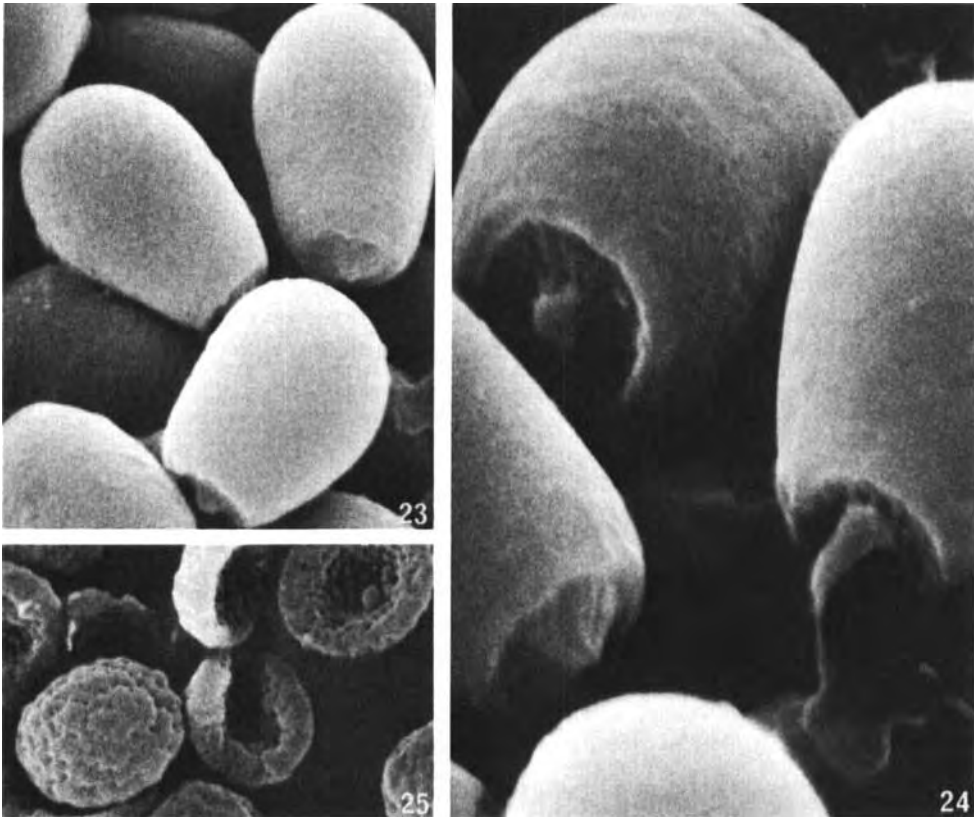
*Phaeostoma vitis* (Fuckel) v. Arx & E. Müller, *Beiträge zur Kryptogamenflora der Schweiz*, 11 (1): 150 (1954).

SYNONYMS: *Ceratostoma vitis* Fuckel, *Jahrbücher des Nassauischen Vereins für Naturkunde*, 23/24: 129 (1870).

*Ceratostoma graphioides* Sacc., *Michelia*, 1: 246 (1878).

*Chaetoceratostoma graphioides* (Sacc.) C. Booth & Dennis in Dennis, *Kew Bulletin*, 29: 171 (1974).

PERITHECIA gregarious, situated on a subicular hyphal layer,  $\pm$  globose, 300–400  $\mu\text{m}$  diameter, dark brown to black, coriaceous to carbonaceous, glabrous or slightly hairy; ostiolate, beak long, cylindrical, often curved, 800–2000  $\mu\text{m}$  in length. ASCI ovoid, 14–18  $\times$  10–14  $\mu\text{m}$ , quickly evanescent, 4- or 8-spored. ASCOSPORES ovoid-ellipsoid, brown, smooth-walled, the apex rounded, the base



Figures 23–25. *Phaeostoma vitis* and *P. juniperinum* (SEM). Figs 23–24. *P. vitis* (IMI 187032). Fig. 23. Ascospores,  $\times$  6500. Fig. 24. Ascospores showing the base with collapsed appendages,  $\times$  12000. Fig. 25. *P. juniperinum* (Saccardo, *Mycoth. Ital.* no. 1297, K), ascospores,  $\times$  5500.

truncate and with a large sunken germ pore and small basal appendage collapsing as a central conical protuberance in SEM,  $5\text{--}6 \times 3\text{--}4 \mu\text{m}$ .

ILLUSTRATIONS: von Arx & Müller (1954: 149; fig. 45).  
Figures 23–24.

HOSTS: Recorded on the bark of *Vitis* L., *Humulus* L., *Juglans* L. and *Betula* L.

DISTRIBUTION: Known from the British Isles, Germany, Italy and Switzerland.

The only British gathering of this species to date was reported by Dennis (1974), as *Chaetocerotostoma graphioides*, on *Betula*, and found to belong here during a re-appraisal of *Chaetocerotostoma* Turc. & Maffei by Hawksworth (1975a).

SPECIMENS EXAMINED: BRITISH ISLES: Warwickshire: Wolford Wood, on *Betula*, ii 1973, *Evans 1110* (K, IMI 187032).—GERMANY: Königstein, Kirchöfe, on *Humulus*, 2 iv 1886, *Krieger 580* (K).—ITALY: Padova, “in ligno Juglandis regiae humo instrato”, January 1878, *Bizzozero & Spegazzini* [Saccardo, *Mycotheca Veneta* no. 1264] (K).

*Phaeostoma juniperinum* (Ell. & Ev.) v. Arx & E. Müller

*Phaeostoma juniperinum* (Ell. & Ev.) v. Arx & E. Müller, *Beiträge zur Kryptogamenflora der Schweiz*, 11 (1): 150 (1954).

SYNONYM: *Ceratostoma juniperinum* Ell. & Ev., *Proceedings of the Academy of Natural Sciences, Philadelphia*, 1890: 226 (1890).

This species does not appear to be closely related to *Phaeostoma vitis*, and should be removed from the genus. Arnaud (1930) regarded the taxon as synonymous with *Lagenula nigra* (Schrader) Arnaud, as did Fitzpatrick (1942) when he subsumed the genus into *Caliciopsis*. This possible relationship has not been investigated during the present study.

A collection on *Juniperus* L. distributed by Saccardo (*Mycotheca Italica*, no. 1297, K) which conforms both to the type description and that of von Arx & Müller, has concavo-convex spores  $3\text{--}4 \mu\text{m}$  diameter, with a verrucose convex surface and a verruculose concave surface (see Fig. 25),—completely different from those of *Phaeostoma vitis*.

The taxon has not been reported from the British Isles.

SCOPINELLA LÉV.

*Scopinella* Lév. in Orbigny, *Dictionnaire Universel d'Histoire Naturelle, Nouv. edn*, 9: 300 (1847).

SYNONYMS: *Scopulina* Lév., *Annales des Sciences Naturelles, Botanique, série 3*, 5: 287 (1846). *Non Scopulina* Dumort. (1822) [Hepaticae].

*Chaetocerotostoma* Turc. & Maffei, *Atti del Reale Istituto Botanico dell'Università di Pavia, seria 2*, 15: 144 (1912).

*Chaetocercis* Clem. & Shear, *Genera of Fungi*: 262 (1931).

See Hawksworth (1975a) for details of synonymy.

TYPE: *Scopinella barbata* (Pers.) Lév. ex Sacc.

The genus *Scopinella* was first proposed by Lévillé (1847) to accommodate the single species *S. barbata* (Pers.) Lév. ex Sacc., but it was ignored by other authors until its resurrection in 1975 (Hawksworth, 1975a), when a synonymy was



established between *S. barbata* and *Chaetocerotostoma hispidum* Turc. & Maffei. Malloch (1976 a, b) included three more species in the genus, *S. caulicola* (Fuckel) Malloch, *S. solani* (Zukal) Malloch and *S. sphaerophila* (Peck) Malloch. The genus was then characterized by a long-necked perithecium with quickly-evanescent asci containing cuboid-ellipsoidal spores with two prominent longitudinal germ slits. Two species occur in the British Isles, *S. caulicola* and *S. solani*. They are distinguished by differences in spore size and shape, and in the presence or absence of a (weakly developed) stroma.

The genus is superficially similar to *Melanospora*, but the major differences in spore form suggest that the two genera are only distantly related.

#### Key to the species of *Scopinella*

1. Perithecial neck terminated by short setae; ascospores with  
± straight lateral germ slits . . . . . 2
- 1'. Perithecial neck spreading into a mass of hairs extending 700–850  
µm beyond the fused portion and often re-fusing over the spore  
mass; ascospores with diagonal germ slits, (5.5–)6–8.5  
(–9) × 6–7 × 5–5.5 µm . . . . . *S. barbata*
2. Ascospores exceeding 7 µm in length . . . . . 3
- 2'. Ascospores (4.5–) 5–6(–7) × 4–5 × 3–4.5 µm . . . . . *S. solani*
3. Asci 2-spored; ascospores 8–9 × 5–6.5 µm . . . . . *S. sphaerophila*
- 3'. Asci 8-spored; ascospores 7–10 × 5–8 × 4–7(–8) µm . . . . . *S. caulicola*

#### *Scopinella barbata* (Pers.) Lév. ex Sacc.

*Scopinella barbata* (Pers.) Lév. ex Sacc., *Michelia*, 1: 284 (1878).

SYNONYMS: *Sphaeria barbata* Pers., *Usteri's Annalen der Botanik*, 11: 24 (1794).

*Exormatostoma barbata* (Pers.) Gray, *Natural Arrangement of British Plants*, 1: 523 (1821).

For a detailed description, drawings, and further synonyms see Hawksworth (1975a). The ascospores of this species were found to have diagonal germ slits when studied by SEM (Figs 26–28).

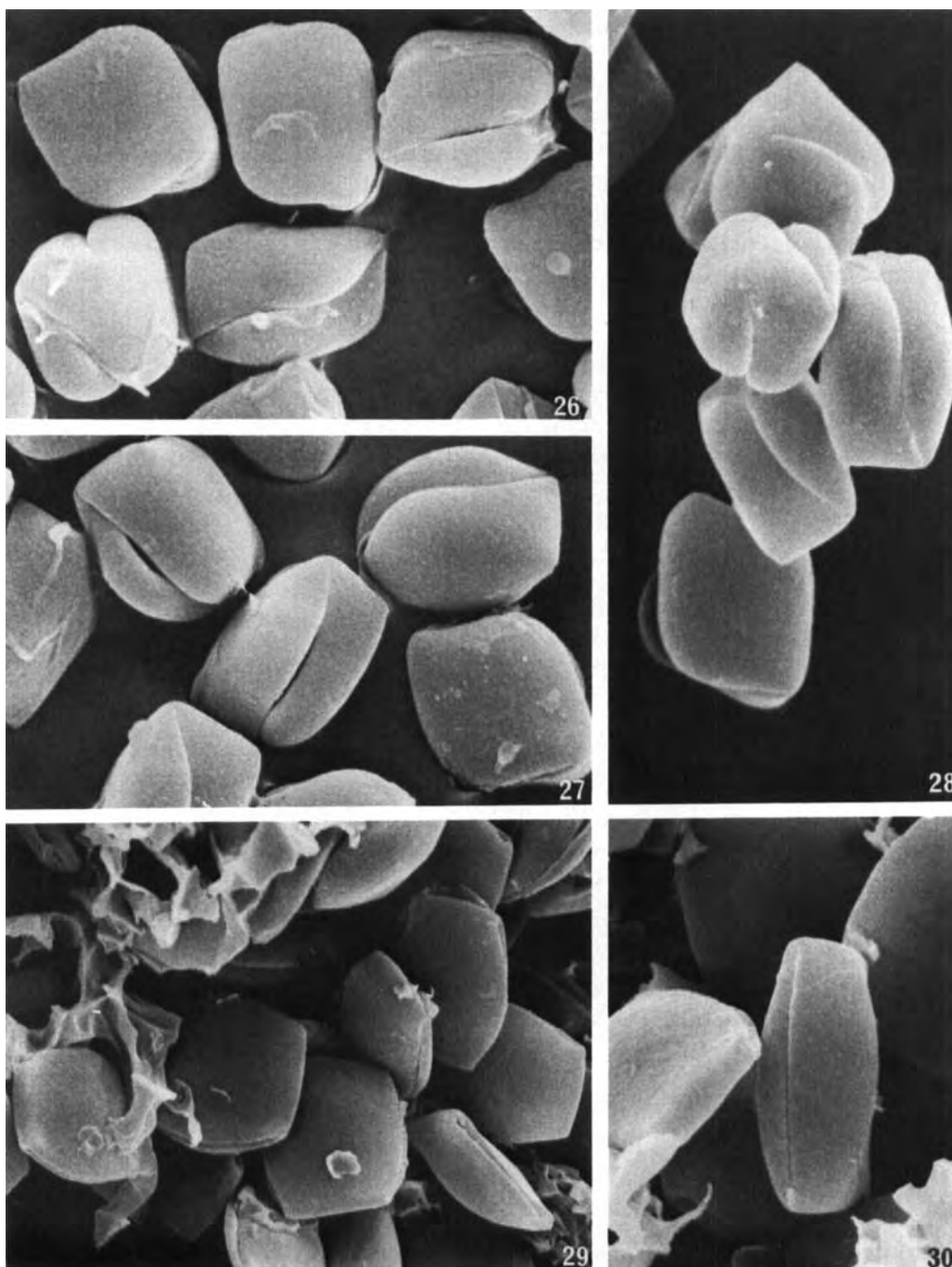
ILLUSTRATIONS: See Hawksworth (1975a).

Figures 26–28.

HOSTS: On fallen leaves of *Castanea sativa* Miller, *Quercus* L. and *Rhododendron ponticum* L.

DISTRIBUTION: Algeria, Canada, France, Germany, Italy, Pakistan and Switzerland. Mentioned as if British by Gray (1821: 523) "on the fallen leaves of oak trees", but without a precise locality; no British material has been located by later workers.

SPECIMEN EXAMINED: PAKISTAN: Ghora Gali, Murree Hills, Lawrence College, on fallen *Quercus incana* Roxb. leaves, 30 viii 1960, *S. Ahmad 14768* (IMI 82632).



Figures 26–30. *Scopinella barbata* and *S. caulicola* (SEM). Figs 26–28. *S. barbata* (IMI 82632), ascospores showing the diagonal germ slits,  $\times 6500$ . Figs 29–30. *S. caulicola* (Fuckel, *Fungi rhen.* no. 810, IMI). Fig. 29. Ascospores, showing the vertical germ slits on the edges of the spores,  $\times 3500$ . Fig. 30. Ascospore, showing a vertical germ slit on the edge of the spore,  $\times 6500$ .

*Scopinella caulicola* (Fuckel) Malloch

*Scopinella caulicola* (Fuckel) Malloch, *Fungi Canadenses*, no. 82 (1976).

SYNONYMS: *Ceratostoma caulincolum* Fuckel, *Fungi Rhenani*, no. 810 (1864).

*Ophiostomella caulicola* (Fuckel) Petrak, *Hedwigia*, 65: 236 (1925).

*Melanospora caulicola* (Fuckel) v. Arx & E. Müller, *Beiträge zur Kryptogamenflora der Schweiz*, 11 (1): 146 (1954).

PERITHECIA superficial, scattered, 200–250 µm diameter, ± globose, brown to dark brown, subglabrous or with frequent hyaline hyphae; ostiolate, neck 600–800 µm, cylindrical, glabrous or with occasional adpressed hyphae, neck cells hyphal, with remote septa; terminal setae absent or poorly developed, 0–50 µm in length, weakly diverging. ASCI clavate, 15–20 × 8–12 µm, quickly evanescent, 8-spored. ASCOSPORES elliptical to oblong-elliptical in equatorial view, rectangular in polar view, brown, smooth-walled, with two prominent longitudinal germ slits, triangular in section, often giving the spore the appearance of a Z-shaped structure, 7–10 × 5–8 × 4–7.5(–8) µm.

ILLUSTRATIONS: v. Arx & Müller (1954: 147; fig. 44); Malloch (1976a); Spooner (1981).

Figures 29, 30.

HOSTS: On decaying vegetation.

DISTRIBUTION: First reported from the British Isles by Spooner (1981: 273) who also gave a description and illustration of the fungus. Probably widespread in Europe but apparently rarely collected.

Malloch (1976a) gave the basionym of this taxon as Fuckel (1870: 130) but the name was validly published six years earlier on the exsiccatum label cited above which included a short description.

SPECIMENS EXAMINED: BRITISH ISLES: Devon: Exeter, Killerton House, on *Quercus suber* L. leaf, 3 ix 1978, *Kirk* 215, 216 (IMI 232000, 232001).—GERMANY: Hostrichia, on decaying *Tanacetum* L. sp. stem, *Fuckel* [*Fungi Rhen.* no. 810] (K, IMI—*isotypes*).

*Scopinella solani* (Zukal) Malloch

*Scopinella solani* (Zukal) Malloch, *Fungi Canadenses*, no. 82 (1976).

SYNONYMS: *Melanospora solani* Zukal, *Verhandlungen der Kaiserlich-Königlich Zoologisch-Botanisch Gesellschaft in Wien*, 35: 340 (1885).

*Melanospora poae* Griffiths, *Bulletin of the Torrey Botanical Club*, 26: 433 (1899) [*vide* Malloch (1976a)].

*Ceratostoma melanosporoides* Winter in Rabenhorst, *Kryptogamenflora von Deutschland, Oesterreich und der Schweiz*, 1 (2): 254 (1887) [*vide* Malloch (1976a)].

*Ophiostomella melanosporoides* (Winter) Petrak, *Hedwigia*, 55: 236 (1925).

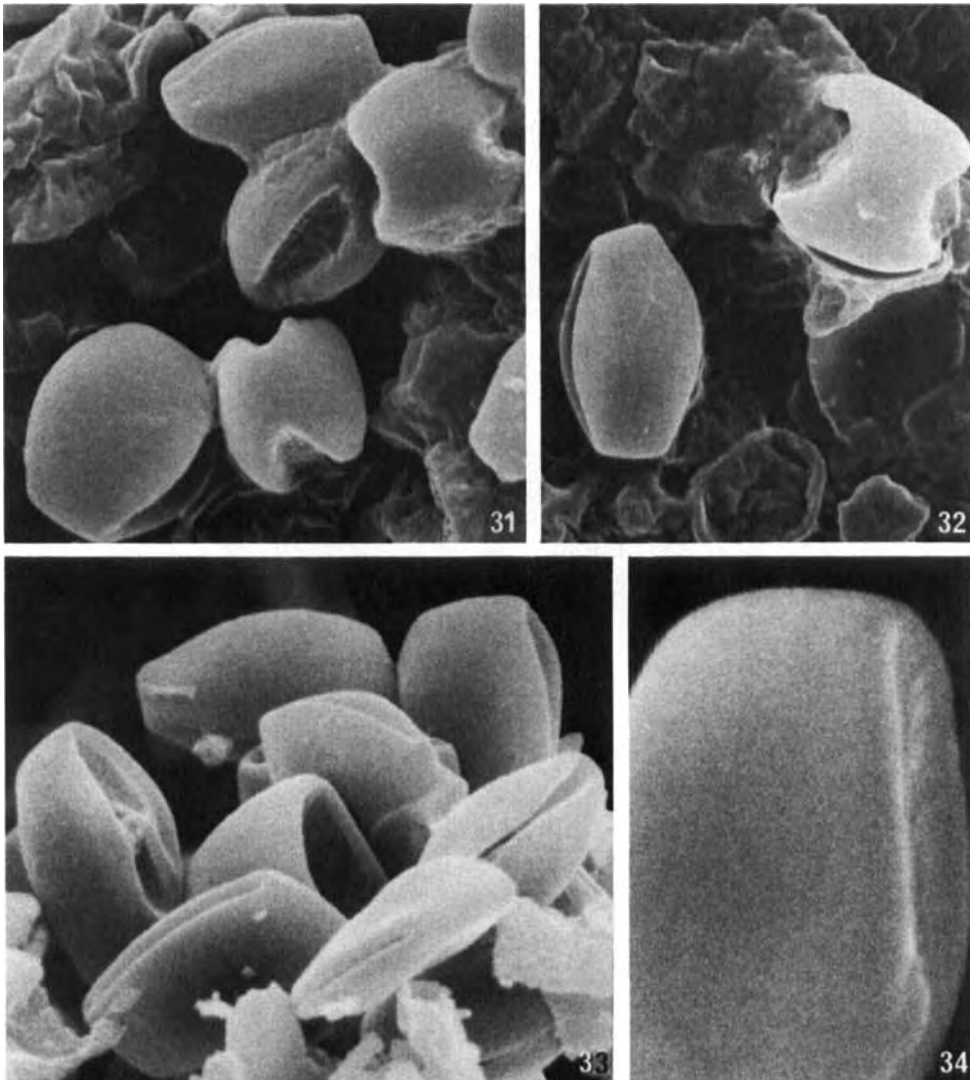
PERITHECIA superficial to erumpent, often gregarious, on a weekly developed black stroma, (130–)200–300 µm diameter, ± globose, reddish brown, ± glabrous; ostiolate, neck (300–)500–600 µm, cylindrical, glabrous or with adpressed hairs near the sometimes swollen tip, terminal setae absent or poorly developed, 10–30 µm in length, not diverging. ASCI widely clavate, 13–25 × 7–12 µm, quickly

evanescent, 8-spored. ASCOSPORES elliptical to elliptic-hexagonal in equatorial view, rectangular in polar view, brown, smooth-walled, with two prominent longitudinal germ slits,  $(4.5-5-6(-7) \times 4-5 \times 3-4.5 \mu\text{m})$ .

ILLUSTRATIONS: See Malloch (1976a).  
Figures 31-32.

HOSTS: On decaying plant material, but originally described as a culture contaminant.

DISTRIBUTION: Probably widespread in the cool temperate to subboreal zone. Not previously published as occurring in the British Isles.



Figures 31-34. *Scopinella solani* and *S. sphaerophila* (SEM). Figs 31-32. *S. solani* (IMI 241512), ascospores showing the vertical germ slits on the edges of the spores which appear like broad notches when viewed from above,  $\times 6500$ . Figs 33-34. *S. sphaerophila* (IMI 175139). Fig. 33. Ascospores showing the vertical germ slits on the edges of the spores,  $\times 6500$ . Fig. 34. Ascospore edge showing a vertical germ slit,  $\times 18\,500$ .

SPECIMENS EXAMINED: BRITISH ISLES: Aberdeenshire: Strathdon, on *Pinus sylvestris* cone, 28 iv 1976, *Minter* (IMI 223379); Tarland, on *Pinus sylvestris* cone, 1 vii 1978, *Minter* (IMI 241513). Perthshire: Dunkeld, on *Pinus sylvestris*, 27 xii 1978, *Minter* (IMI 241512).

*Scopinella sphaerophila* (Peck) Malloch

*Scopinella sphaerophila* (Peck) Malloch, *Fungi Canadenses*, no. 83 (1976).

SYNONYMS: *Periconia sphaerophila* Peck, *Annals of the New York State Museum*, 34: 50 (1880).

*Phaeostoma sphaerophila* (Peck) Barr, *Rhodora*, 64: 134 (1962).

For further synonyms and a detailed description see Malloch (1976b).

ILLUSTRATIONS: See Malloch (1976b).

Figures 33–34.

HOSTS: On stromata of *Apiosporina morbosa* (Schw.) v. Arx.

DISTRIBUTION: Apparently restricted to Canada where Malloch (1976b) recorded it from Newfoundland, Nova Scotia, Ontario and Quebec.

SPHAERODES CLEM.

*Sphaerodes* Clem., *Genera of Fungi*: 173 (1909).

SYNONYMS: *Sphaeroderma* subgen. *Vittadinula* Sacc., *Sylloge Fungorum*, 2: 460 (1883).

*Vittadinula* (Sacc.) Clem. & Shear, *Genera of Fungi*: 281 (1931).

Similar to *Melanospora*, but often cleistothecial; neck very short or absent, and ascospores very dark brown to black, coarsely reticulate with strongly apiculate to umbonate or tuberculate pores.

TYPE: *Sphaerodes episphaeria* (Phill. & Plowr.) Clem.

The genus *Sphaerodes* was erected by Clements (1909) to contain *S. episphaeria*, and was distinguished from *Sphaeroderma* by the lack of a subiculum. He also (erroneously) stated that *S. episphaeria* had smooth spores, while contrasting it with *Neocosmospora*, which has verruculose spores. The genus was not adopted by later authors, and indeed Clements & Shear (1931) incorrectly suppressed the name in favour of *Vittadinula* (Sacc.) Clem. & Shear, which Saccardo (1883) had recognized as a subgenus of *Sphaeroderma* with the same diagnostic feature as *Sphaerodes*. Other authors combined the genus with *Sphaeroderma* (e.g. Petch, 1938), *Melanospora* (e.g. Doguet, 1955) or *Microthecium* (e.g. Hawksworth & Udagawa, 1977), but von Arx (1981) recently re-introduced it for *Melanospora*-like fungi with reticulations on the ascospores.

Apart from the coarsely reticulate spores (see Figs 35–40), the structure of their germ pores differs from that in *Melanospora*. *Sphaerodes* has strongly protruding tuberculate pores, the walls of which usually support a net-like growth (see Figs 36–37, right), while those in *Melanospora* are either level with the spore surface, or slightly sunken, and always lack the net-like surface structure.

A number of non-British taxa with reticulately-ornamented spores, previously placed in the genus *Microthecium*, are also referable to *Sphaerodes*. For completeness these are briefly described below, keyed, and the necessary new combinations

made; more detailed accounts may be found in Udagawa & Cain (1969) and Hawksworth & Udagawa (1977).

The smooth-spored, cleistocarpic representatives formerly referred to *Microthecium* (including the type species *M. zobellii* Corda) should be placed in *Melanospora*, the only distinction between these two genera being the presence or absence of an ostiole. *Microthecium ciliatum* Udagawa & Cain and *M. foveolatum* Udagawa & Horie have spores with almost hyaline longitudinal wing-like appendages, and have consequently been placed in a separate genus, *Pteridiosperma*, by Krug & Jeng (1979). *Microthecium inordinatum* Malloch & Cain (Malloch & Cain, 1972) has a rugulose ornamentation which, according to a drawing in the original publication, is longitudinally orientated and so may belong with the two previously-mentioned species, but we have seen no material of that taxon. Similarly, *Leuconeurospora pulcherrimum* (Winter) Malloch & Cain (Malloch & Cain, 1970) may belong in this group, as it has spores with wing-like appendages, but the whole spore is hyaline, germ pores are lacking, and the asci are apparently persistent. Malloch & Cain (1970) provisionally placed this genus in the Pseudeurotiaceae; again no material has been seen during this study.

According to the original descriptions, *Melanospora singaporensis* Morinaga *et al.* (Morinaga *et al.*, 1978: 142), *Microthecium ellipsosporum* Takada (Takada, 1973: 527) and *M. levitum* Udagawa & Cain (Udagawa & Cain, 1969: 1917) may also belong to *Sphaerodes* as although the ascospores are evidently entirely smooth their germ pores are apparently surrounded by a raised annulus as is usual in *Sphaerodes*. As we have seen no authentic material of these species we refrain from transferring them to that genus here.

#### Key to the accepted species of *Sphaerodes*

- |    |  |   |
|----|--|---|
| 1. | Fruit bodies ostiolate . . . . .   | <i>S. fmicola</i>                         |
| 1' | Fruit bodies cleistothecial . . . . .  | 2   |
| 2. | Ascospores exceeding 20 $\mu\text{m}$ in length . . . . .  | 3   |
| 2' | Ascospores not exceeding 20 $\mu\text{m}$ in length . . . . .  | 5   |
| 3. | Asci 8-spored; apices of ascospores abruptly constricted and umbonate at the germ pore . . . . .                               | <i>S. episphaeria</i>                     |
| 3' | Asci 4-spored; apices of ascospores mainly tapered to the germ pore . . . . .  | 4   |
| 4. | Ascospores (25-)28-34 $\times$ 14-16(-18) $\mu\text{m}$ ; all coarsely reticulate when mature . . . . .                        | <i>S. beatonii</i>                        |
| 4' | Ascospores 22-28 $\times$ 12-15 $\times$ 9-11 $\mu\text{m}$ ; about one-third coarsely reticulate, the others smooth . . . . . | <i>S. perplexa</i>                        |
| 5. | Ascospore reticulation covering the whole of the spore . . . . .   | 6   |
| 5' | Ascospore reticulation only on narrow sides of the spore, wide sides $\pm$ smooth . . . . .                                    | <i>S. compressa</i>                       |
| 6. | Ascospore reticulations prominent, with 10-12 deep lumina 3-6.5 $\mu\text{m}$ wide on each face . . . . .                      | <i>S. retispora</i> var. <i>retispora</i> |
| 6' | Ascospore reticulations inconspicuous, with about 15 shallow lumina 3-4 $\mu\text{m}$ wide on each face . . . . .              | <i>S. retispora</i> var. <i>inferior</i>  |

*Sphaerodes beatonii* (D. Hawksw.) P. Cannon & D. Hawksw.

***Sphaerodes beatonii*** (D. Hawksw.) P. Cannon & D. Hawksw. **comb. nova**  
 SYNONYM: *Microthecium beatonii* D. Hawksw. in Hawksworth & Udagawa,  
*Transactions of the Mycological Society of Japan*, 18: 145 (1977).

ASCOMATA cleistothecial, superficial or immersed in the hymenium of the host, scattered to gregarious,  $\pm$  globose, (80–)100–200(–225)  $\mu\text{m}$  diameter, pale ochraceous, appearing black when mature due to spore mass. ASCI clavate, 40–65  $\times$  15–33  $\mu\text{m}$ , evanescent, 4-spored. ASCOSPORES citriform, very dark brown, very coarsely reticulate, with two terminal germ pores 1.5–2(–3)  $\mu\text{m}$  diameter, (25–)28–34(–40)  $\times$  14–18(–20)  $\mu\text{m}$ .

HOST: On or in the hymenium of the truffle *Labyrinthomyces tessellatus* Beaton & Weste.

DISTRIBUTION: Only recorded from Australia.

*Sphaerodes compressa* (Udagawa & Cain) P. Cannon & D. Hawksw.

***Sphaerodes compressa*** (Udagawa & Cain) P. Cannon & D. Hawksw. **comb. nova**

SYNONYM: *Microthecium compressum* Udagawa & Cain, *Canadian Journal of Botany*, 47: 121 (1966).

ASCOMATA cleistothecial,  $\pm$  embedded, globose, 150–400  $\mu\text{m}$  diameter, glabrous, pale yellow-brown, appearing black when mature due to spore mass. ASCI broadly clavate to ellipsoidal, 50–60  $\times$  20–25  $\mu\text{m}$  evanescent, 8-spored. ASCOSPORES citriform, compressed on two sides, the narrow faces coarsely reticulate and the wide faces  $\pm$  smooth; olivaceous-brown, with two terminal germ pores 1–2  $\mu\text{m}$  diameter, 15–19  $\times$  11–13  $\times$  8–9  $\mu\text{m}$ .

HABITAT: Isolated in culture from soil, cow dung, dead leaves and as an aerial contaminant.

DISTRIBUTION: Canada, U.S.A., Japan and New Caledonia.

The New Caledonian collection agrees in all details with authentic cultures kindly supplied by Dr Udagawa (*IMI 212200*) and studied with SEM.

SPECIMENS EXAMINED: JAPAN: Chiba, *Y. Horie* (IFM 4519, IMI 212200).—NEW CALEDONIA: Plateau de la Chute de la Rivière de Lacs, isol. ex dead leaves of *Dacrydium araucarioides* Brongn. & Gris., 15 xi 1966, *Huguenin 75* (IMI 123503).

*Sphaerodes episphaeria* (Phill. & Plowr.) Clem.

*Sphaerodes episphaeria* (Phill. & Plowr.) Clem., *Genera of Fungi*: 173 (1909).

SYNONYMS: *Melanospora episphaeria* Phill. & Plowr., *Grevillea*, 10: 71 (1881).

*Sphaeroderma episphaerium* (Phill. & Plowr.) Sacc., *Sylloge Fungorum*, 2: 460 (1883).

*Microthecium episphaerium* (Phill. & Plowr.) Höhnelt, *Sitzungsberichte der Akademie der Wissenschaften Wien, Abt. 1*, 123: 50 (1914).

*Vittadinula episphaeria* (Phill. & Plowr.) Clem. & Shear, *Genera of Fungi*: 281 (1931).

*Sphaeroderma epimyces* Höhnel, *Sitzungsberichte der Akademie der Wissenschaften Wien, Abt. 1*, 116: 103 (1907).

*Microthecium epimyces* (Höhnel) Höhnel, *Sitzungsberichte der Akademie der Wissenschaften Wien, Abt. 1*, 123: 50 (1914).

*Melanospora epimyces* (Höhnel) Doguet, *Le Botaniste*, 39: 125 (1955).

ASCOMATA cleistothecial, superficial, often somewhat gregarious,  $\pm$  globose, 250–350  $\mu\text{m}$  diameter, yellow to brown. ASCI pyriform, *c.* 70  $\times$  40  $\mu\text{m}$ , quickly evanescent, 8-spored. ASCOSPORES citriform, dark brown to black, very coarsely reticulate, with two terminal, apiculate, pores, 25–34  $\times$  12–18  $\mu\text{m}$ .

ILLUSTRATIONS: Hawksworth & Udagawa (1977: 148; fig. 2).

HOSTS: Parasitic on *Hypomyces ochraceus* (Pers.) Tul. (Hypocreales).

DISTRIBUTION: We have seen material from Austria, the British Isles and France.

Various authors (e.g. Petch, 1938; Udagawa & Cain, 1969) have regarded this species as ostiolate, but Hawksworth & Udagawa (1977) examined the original collection and found it to be cleistothecial in nature, and so assigned it on this basis to the genus *Microthecium*. It has been shown, however (von Arx, 1973), that under certain cultural conditions the development of the ostiole can be suppressed.

Martin (1955) reported an isolate from beech litter from Box Hill, Surrey, which he identified as *Sphaeroderma* (= *Sphaerodes*) *episphaerium*, but his account was at variance with the original description in spore size and in the presence of an ostiole. Udagawa & Cain (1969) re-examined his specimen and referred it to *Melanospora ornata* (= *Sphaerodes fimicola*).

SPECIMENS EXAMINED: AUSTRIA: Wiener Wald, Sauerbrunnleiten, on *Hypomyces ochraceus*, 23 vii 1906, von Höhnel (K).—BRITISH ISLES: Norfolk: North Wootton & Holt House Wood, near King's Lynn, on *H. ochraceus*, x 1880, Plowright (K—holotype of *Melanospora episphaeria*).—FRANCE: Montmorency, on *H. ochraceus*, xi 1880, Boudier (K).

*Sphaerodes fimicola* (Hansen) P. Cannon & D. Hawksw.

***Sphaerodes fimicola*** (Hansen) P. Cannon & D. Hawksw. **comb. nova**

SYNONYMS: *Melanospora fimicola* Hansen, *Aftryk af Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjøbenhavn*, 1876: 305 (1876).

*Sphaeroderma fimicolum* (Hansen) Sacc., *Sylloge Fungorum*, 2: 460 (1883).

*Melanospora ornata* Zukal, *Verhandlungen der Kaiserlich-Königlich Zoologisch-Botanisch Gesellschaft in Wien*, 35: 340 (1885).

*Sphaerodes ornata* (Zukal) v. Arx, *Genera of fungi sporulating in pur culture*, 3rd ed.: 156 (1981).

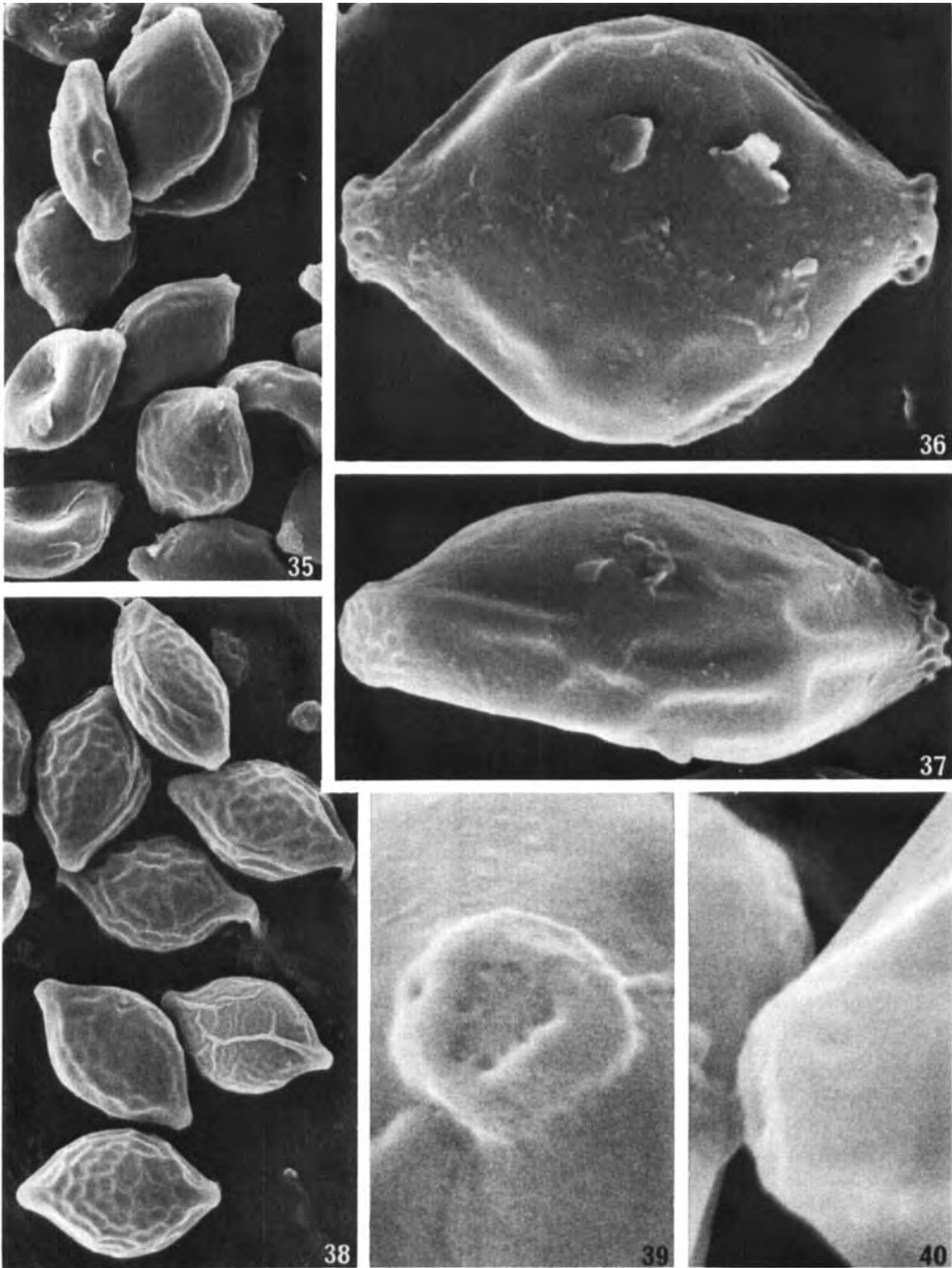
*Sphaeroderma hulseboshii* Oudem., *Contributions à la Flore Mycologique des Pays Bas*, 11: 23 (1886).

*Melanospora hulseboshii* (Oudem.) Doguet, *Le Botaniste*, 39: 121 (1955).

?*Melanospora manginii* Vincens, *Bulletin de la Société Mycologique de France*, 33: 67 (1917); as 'mangini'.

?*Sphaerodes manginii* (Vincens) v. Arx, *Genera of fungi sporulating in pure culture*, 3rd ed.: 156 (1981).





Figures 35- 40. *Sphaerodes compressa* and *S. fimicola* (SEM). Figs 35-37. *S. compressa* (IMI 212200). Fig. 35. Ascospores,  $\times 2000$ . Fig. 36. Ascospore, face view, showing the almost smooth surface and tuberculate germ pores,  $\times 6500$ . Fig. 37. Ascospore, side view, showing reticulate depressions,  $\times 6500$ . Figs 38- 40. *S. fimicola* (IMI 105411). Fig. 38. Ascospores,  $\times 2000$ . Fig. 39. Ascospore apex, viewed from above, showing the tuberculate margin around the germ pore,  $\times 18\ 500$ . Fig. 40. Ascospore apex, side view,  $\times 18\ 500$ .

ASCOMATA perithecial, superficial, often gregarious,  $\pm$  globose, (200–)250–500  $\mu\text{m}$  diameter, rather thin-walled, glabrous or sparsely hairy, orange to golden-brown; ostiolate, neck very short or absent, to 40  $\mu\text{m}$  in length, ostiole 40–80  $\mu\text{m}$  wide, coronal setae absent or poorly developed, few and 30–50  $\mu\text{m}$  long if present. ASCI oblong to clavate, 40–55  $\times$  25–30  $\mu\text{m}$ , quickly evanescent, 4- to 8-spored. ASCOSPORES citriform, dark brown to almost black, coarsely reticulate, with two terminal, strongly apiculate, pores, 14–26  $\times$  10–17  $\mu\text{m}$ .

ILLUSTRATIONS: Doguet (1955: 276–287; figs 13–18); Martin (1955: 607; fig. 1); Udagawa & Cain (1969: figs 35–36).

Figures 38–40.

HOSTS: Reported from dung, isolated from surface litter and soil, and also found on other fungi, including *Sclerotinia sclerotiorum* (Libert) de Bary (see below) and *Polyporus zonatus* Berk. (fide Zukal, 1885).

DISTRIBUTION: Fairly widespread and not uncommonly isolated in the British Isles. It has been reported from a number of countries in central and western Europe, and we have also seen material from Madeira and the U.S.A.

*Sphaerodes fimicola* is distinguished from *S. episphaeria* by its possession of an ostiole, usually surrounded by a poorly-developed corona of hyaline setae; and by its smaller spores.

*Sphaerodes hulseboschii* is only separable from *S. fimicola* as originally circumscribed by its slightly larger size, and by its eight-spored rather than four-spored asci; Petch (1938) suspected that the two taxa were conspecific. *Melanospora ornata* is simply a small-spored morph of the species, also with 8-spored asci. Judging from the descriptions given by its author and by Doguet (1955), *M. manginii* is also conspecific with *Sphaerodes fimicola*. We have seen no material of this taxon.

SPECIMENS EXAMINED: BRITISH ISLES: Cambridgeshire: Cambridge, Botany School, isol. ex soil, 12 v 1966, *Dwivedi* (IMI 119361). Devon: Exeter, Stoke Woods, isol. ex mineral soil, *Webster* (IMI 182053). Kent: Temple Ewell, 3 miles NW of Dover, cow dung, 12 viii 1978, *Wilberforce* (IMI 231096). Lancashire: University of Liverpool, 16 vi 1965, *Hodkinson 8* (IMI 114063), Bogle Crag Wood, isol. ex deep litter, 3 xii 1964, *Hering 5739* (IMI 112922). Nottinghamshire: Attenborough, isol. ex plant debris of *Glyceria maxima* Holmberg swamp, 15 iii 1952, *Apinis BDUN 295* (K, IMI 105411). N. Scotland, isol. ex sclerotia of *Sclerotinia sclerotiorum*, from soil, *Jones 3* (IMI 137980). Wales: flower bed soil, 24 vii 1961, *Wilson* (IMI 87725).—MADEIRA: isol. ex maritime pine, 15 x 1954, *Batko* (IMI 58049).—GERMANY: Tamsel, on siskin dung, 16 iii 1935, *Vogel* (IMI 73239).—U.S.A.: Bainbridge, isol. ex pine forest soil, i 1967, *Hodges 400* (IMI 126298).

*Sphaerodes perplexa* (D. Hawksw.) P. Cannon & D. Hawksw.

***Sphaerodes perplexa*** (D. Hawksw.) P. Cannon & D. Hawksw. **comb. nova**  
SYNONYM: *Microthecium perplexum* D. Hawksw., in Hawksworth & Udagawa,  
*Transactions of the Mycological Society of Japan*, 18: 151 (1977).

ASCOMATA cleistothecial, superficial or immersed in the hymenium of the host,  $\pm$  globose, (75–)100–150(–200)  $\mu\text{m}$  diameter, pale yellowish, appearing black when mature due to spore mass. ASCI clavate, 40–55  $\times$  15–25  $\mu\text{m}$ , evanescent, 4-

spored. ASCOSPORES citriform, very dark brown, with two terminal germ pores 1.5–2  $\mu\text{m}$  diameter, about one-third of the spores with a coarsely reticulate ornamentation, the other two-thirds  $\pm$  smooth, 22–28  $\times$  12–15  $\times$  9–11  $\mu\text{m}$ .

HOST: On or in the hymenium of a truffle, *Sphaerozone echinulatum* G. Beaton.

DISTRIBUTION: Only known from Australia.

*Sphaerodes retispora* (Udagawa & Cain) P. Cannon & D. Hawksw.

***Sphaerodes retispora*** (Udagawa & Cain) P. Cannon & D. Hawksw. **comb. nova**

SYNONYM: *Microthecium retisporum* Udagawa & Cain, *Canadian Journal of Botany*, 47: 1926 (1966).

*Sphaerodes retispora* var. *retispora*

ASCOMATA cleistothecial, superficial to immersed,  $\pm$  globose, 80–230  $\mu\text{m}$  diameter, glabrous, flesh-coloured to yellowish-orange, appearing black when mature due to spore mass. ASCI broadly clavate, 37–65  $\times$  18.5–21.5  $\mu\text{m}$ , evanescent, 8-spored. ASCOSPORES citriform, dark olive-brown, very coarsely reticulate, with 10–12 deep lumina 3–6.5  $\mu\text{m}$  in width on each face of the spore, 17.5–20  $\times$  10–12  $\times$  7.5–9  $\mu\text{m}$ .

HABITAT: Isolated from soil, from *Coriolus hirsutus* (Wulfen) Quélet and from an unnamed polypore.

DISTRIBUTION: Known from Japan and New Guinea.

*Sphaerodes retispora* var. ***inferior*** (Udagawa & Cain) P. Cannon & D. Hawksw. **comb. nova**

SYNONYM: *Microthecium retisporum* var. *inferior* Udagawa & Cain, *Canadian Journal of Botany*, 47: 1928 (1966).

Differs from var. *retispora* by having spores which are indistinctly reticulate, with about 15 shallow lumina 3–4  $\mu\text{m}$  wide on each face.

HABITAT: Isolated from soil.

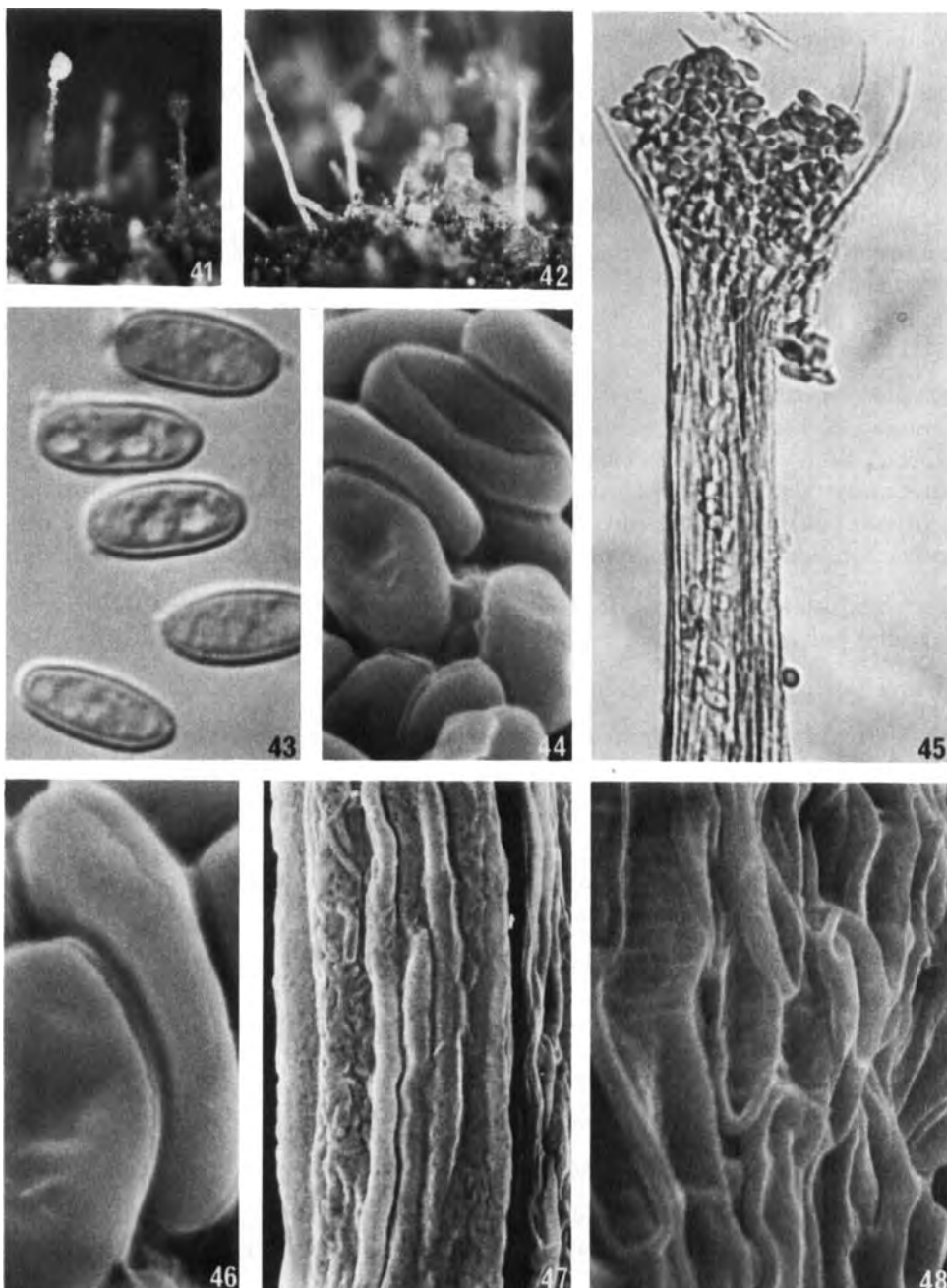
DISTRIBUTION: Japan.

#### SPHAERONAEMELLA P. KARSTEN

*Sphaeronaemella* P. Karsten, *Hedwigia*, 23: 17 (1884).

This genus is rather close to *Scopinella*, but differs in the much paler, translucent perithecia and hyaline ellipsoid ascospores. It is not closely related to *Melanospora*. TYPE: *Sphaeronaemella helvella* (P. Karsten) P. Karsten.

*Sphaeronaemella* is considered here to be monotypic, containing only *S. helvella* (P. Karsten) P. Karsten. The only other species commonly placed in this genus, *Sphaeronaemella fimicola* Marchal, is transferred to the genus *Viennotidea* in this revision (see below); it has subapical germ pores rather than germ slits and has a *Gabarnaudia* anamorph. No anamorph has been definitely connected with *S. helvella*; Seeler (1943) described a conidial fungus recalling *Gabarnaudia* associated with a collection of the teleomorph, but Samson (1974) did not confirm this



Figures 41-48. *Sphaeronaemella helvellae* and *Melanospora zamiae*. Figs 41-47. *S. helvellae* (H-KARST 1106—? holotype). Figs 41-42. Perithecia on the host showing their superficial nature, long necks, and drop-like spore masses,  $\times 50$ . Fig. 43. Ascospores, interference contrast,  $\times 2500$ . Fig. 44. Ascospores (SEM) showing the germ slits on the edges of the spores,  $\times 6500$ . Fig. 45. Perithecial neck showing the coronal setae supporting a mass of ascospores,  $\times 500$ . Fig. 46. Ascospore edges showing the germ slit (SEM),  $\times 12750$ . Fig. 47. Perithecial neck showing that it is made of vertically orientated parallel hyphae (SEM),  $\times 3500$ . Fig. 48. *Melanospora zamiae* (IMI 62569a), portion of perithecial neck (below the setae), showing the elongate pseudoparenchymatous cells of which it is composed (SEM),  $\times 3300$ .

connection. *Sphaeronaemella helvella* is obligately fungicolons, while those referred to *Viennotidea* are dung, soil and plant saprophytic fungi.

*Sphaeronaemella subulata* (Grev.) Grove (syn. *S. oxyspora* (Berk.) Sacc.) is a synonym of *Eleutheromyces subulatus* (Tode) Fuckel, and the identity of *S. glomerata* Grove, described from Birmingham as a culture contaminant, is obscure. No material of this species could be found in the Kew herbarium (K).

*Sphaeronaemella helvella* (P. Karsten) P. Karsten

*Sphaeronaemella helvella* (P. Karsten) P. Karsten, *Hedwigia*, 23: 17 (1884).

SYNONYMS: *Sphaeria helvella* P. Karsten, *Fungi Fenniae exs.*, no. 674 (1867).

*Sphaeronema helvella* (P. Karsten) Jacz., *Nouveaux Mémoires de la Société Impériale des Naturalistes de Moscou*, 15: 302 (1898).

*Ceratocystis helvella* (P. Karsten) Upadhyay, *A monograph of Ceratocystis and Ceratocystiopsis*, 97 (1981).

*Melanospora karstenii* v. Arx & E. Müller, *Beiträge zur Kryptogamenflora der Schweiz*, 11 (1): 146 (1954).

Non *Melanospora helvella* (Cooke) Sacc., *Sylloge Fungorum*, 2: 462 (1883).

PERITHECIA superficial to partially immersed, densely gregarious,  $\pm$  globose, 90–250  $\mu$ m diameter, glabrous; ostiolate, beak  $\pm$  cylindrical, to 600  $\mu$ m, with a ring of coronal setae 20–50  $\mu$ m in length. PARAPHYSES absent. ASCI clavate to ovoid, 14–25  $\times$  10.5–16  $\mu$ m, evanescent at an early stage, 8-spored, ASCOSPORES elliptical in face view, flattened-elliptical in side view, smooth-walled,  $\pm$  hyaline, with narrow longitudinal germ slits, 8–11  $\times$  3–4.5  $\mu$ m.

ILLUSTRATIONS: See Malloch (1974).

Figures 41–47.

HOST: On decaying apothecia of *Gyromitra infula* (Schaeffer) Quélet.

DISTRIBUTION: Known from various locations in the northern U.S.A., from Canada (Ontario), Alaska, and North and Central Europe (Finland and Switzerland). Not correctly reported from the British Isles (see below).

This species was reported by Clark (1980: 113—as *Melanospora karstenii*) as occurring in Britain, but a re-examination of his material, on *Fraxinus* from Warwickshire (IMI 200172) showed it to be in fact *Melanospora chionea* (Fr.) Corda (see above). *Sphaeronaemella helvella* appears to be widespread, but is rarely found. It was described in detail by Malloch (1974), from which the above description has largely been adapted. However, in common with all previous authors, he failed to notice the longitudinal germ slits (see Fig. 44). These are narrow, develop just before the spores are ready to germinate, and are very difficult to see without the aid of SEM. The slits suggest a close affinity with *Scopinella* (see above), but the two genera can be distinguished by the form of the germ slits, the peridium pigmentation, and the colour of, and the presence or absence of thickened regions in, the spores.

Karsten's epithet is usually cited as first validly published in 1884 but as a description was printed on the exsiccatum label issued in 1867 it dates from the latter. The date 24 ix 1867 is given on the printed exsiccatum labels. The collection dated 25 ix (cited below) is presumed to be part of the collection sent out by Karsten, as there is no material of the exsiccatum in H-KARST.

SPECIMENS EXAMINED: FINLAND: Tavastia Australis, Tammela, Mustiala, on *Gyromitra infula*, 25 ix 1867, *Karsten* (H-KARST 1106—?isotype). *Loc. cit.*, viii 1883, *Karsten* (H-KARST 1105).

*SYSPASTOSPORA* P. CANNON & D. HAWKSW.

***Sypastospora*** P. Cannon & D. Hawksw. **gen. novum**

DERIVATION: From *συσπαστος*, the Greek word for "to draw tight", referring to the form of the ends of the spores.

Ab *Melanospora* differt: collis longis hypharum parallelarum adhaerentium cum septis remotis instructae; setis coroniformis absentes; ascosporis cylindricis vel cylindrico-fusiformis, poris germinationis magnis leviter depressis cum parietibus cingentibus crispis, interdum parum constrictis, instructae.

Differs from *Melanospora* in the long neck composed of parallel adhering hyphae with remote septa; the absence of coronal setae; the cylindrical to cylindrical-fusiform spores, with large terminal slightly sunken germ pores, the surrounding walls being crinkled and sometimes slightly constricted.

TYPE: *Sypastospora parasitica* (Tul.) P. Cannon & D. Hawksw. (HOLOTYPE).

*Sypastospora parasitica* (Tul.) P. Cannon & D. Hawksw.

***Sypastospora parasitica*** (Tul.) P. Cannon & D. Hawksw. **comb. nova**

SYNONYMS: *Sphaeronema parasitica* Tul., *Annales des Sciences Naturelles, Botanique, série 4*, 8: 40 (1857).

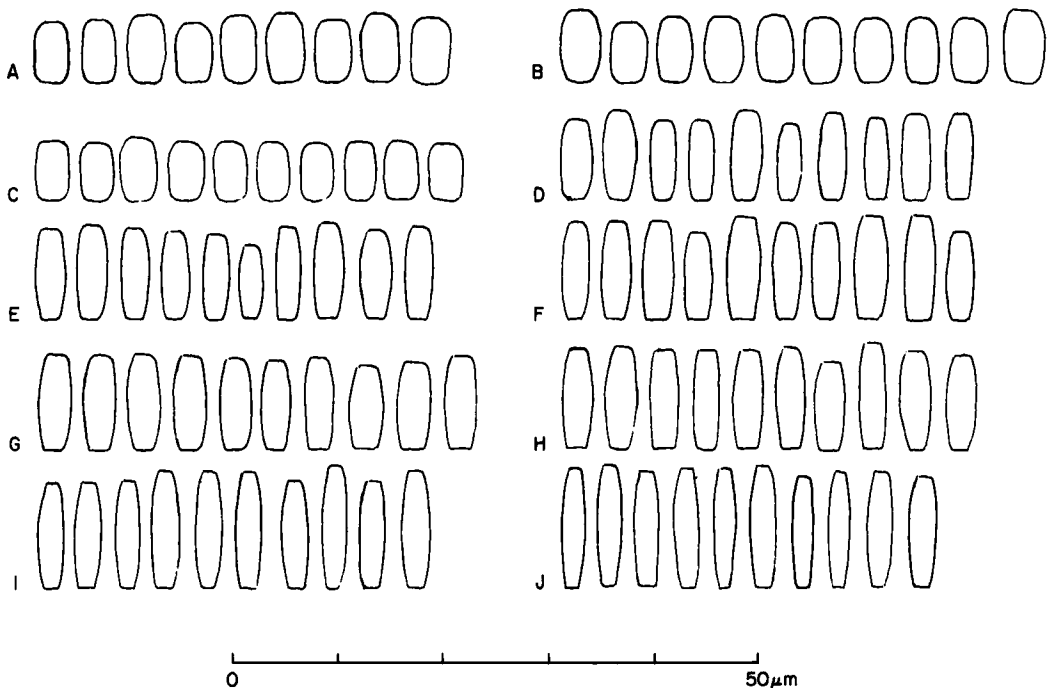
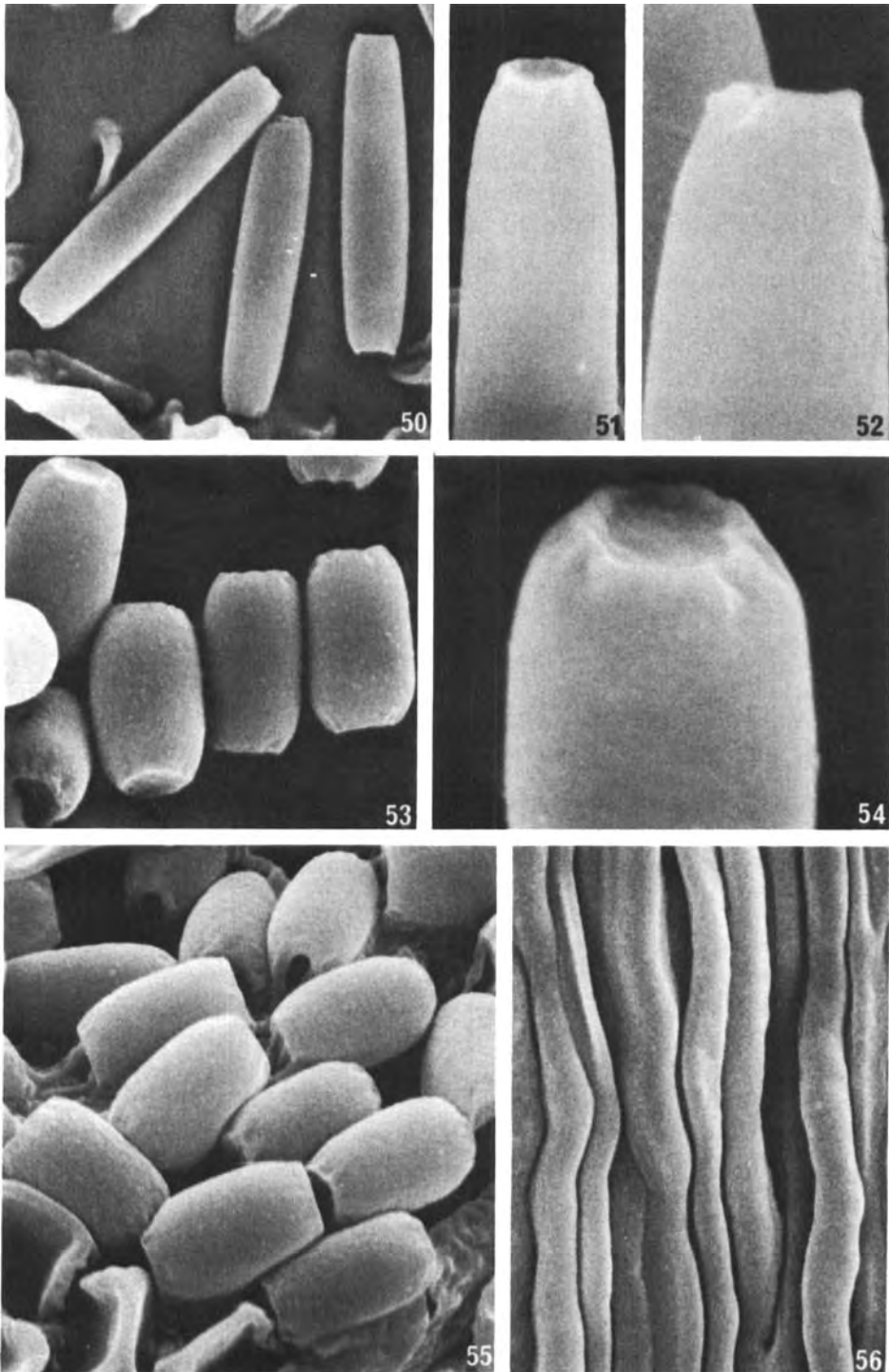


Figure 49. *Sypastospora parasitica*, ascospore outlines to show the variation in spore shape. A. (Clark 1169, K). B. (IMI 147185). C. (IMI 27465). D. (Petch, Regalla, K). E. (Petch R.8616, K). F. (Ellis, K). G. (Petch R.1155, K). H. (Petch R.1063, K). I. (Plowright, K). J. (IMI 82086).



Figures 50 - 56. *Sypastospora parasitica* (SEM). Figs 50 - 52 (IMI 82086), cylindrical-spored morph. Fig. 50. Ascospores,  $\times 6500$ . Fig. 51. Ascospore apex showing the puckered rim to the germ pore,  $\times 18\ 500$ . Fig. 52. Ascospore apex,  $\times 30\ 000$ . Figs 53 - 55. (IMI 147185), doliform-spored morph. Fig. 53. Ascospores,  $\times 6500$ . Fig. 54. Ascospore apex showing the puckered margin round a broad apical germ pore,  $\times 18\ 500$ . Fig. 55. Ascospores,  $\times 6500$ . Fig. 56. (IMI 82086), portion of the perithecial neck showing that it is made up of vertically orientated parallel hyphae,  $\times 3300$ .

*Melanospora parasitica* (Tul.) Tul. & C. Tul., *Selecta Carpologia Fungorum*, 3: 10 (1865).

*Ceratostoma biparasiticum* Ell. & Ev., *Bulletin of the Torrey Botanical Club*, 24: 127 (1897) [fide Wilson (1907)].

*Naemosphaerella chalaroides* Keissler, *Annalen des Naturhistorischen Museums, Wien*, 45: 295 (1931) [fide Petrak (1934)].

PERITHECIA scattered, superficial to partially immersed, 110–200 (–230) × 120–210 μm, pyriform to sphaeroidal, pale to dark brown, usually appearing darker due to spore mass, glabrous or with occasional hyphae emanating from body wall; membranous, rather thin walled, composed of a *textura angularis*; ostiolate, beak 400–1800(–3000) μm, straight or slightly curved, glabrous, occasionally with a few vertically-orientated hairs near the tip, 45–60 μm diameter at base, 20–30 μm at tip, tip truncate to obtuse, without coronal setae; beak cells hyphoid, 25–40 μm in length, 3–4 μm diameter. ASCI (fide Doguet, 1955) clavate, ± pedicellate, 25–30 × 6–10 μm, quickly evanescent, 8-spored. ASCOSPORES widely to narrowly cylindrical or fusiform-cylindrical, pale to dark brown, smooth-walled, sometimes 1- to 2-guttulate; germ pores 2, terminal, 1–2 μm diameter, the spore walls slightly convoluted around the pore and sometimes slightly constricted just behind it; spores variable in size, ranging from 4 × 2.5 μm to 9(–10.5) × 2 μm.

ILLUSTRATIONS: Doguet (1955 : 294–299; figs 22–24).

Figures 49–56.

HOSTS: Parasitic on various moniliaceous hyphomycetes; particularly common on *Paecilomyces* Bain. species, but also known on *Beauveria bassiana* (Bals.) Vuill., *Hirsutella floccosa* Speare and *Verticillium lecanii* (Zimm.) Viégas (syn. *Cephalosporium longisporum* Petch).

DISTRIBUTION: Widely distributed; common in the British Isles, recorded from several countries in Europe, and from Sri Lanka, Kenya, South Africa, Trinidad, U.S.A. and Canada.

The fungus was first described by Tulasne (1857) as *Sphaeronema parasitica*, but only eight years later, he and his brother transferred it to the genus *Melanospora* (Tulasne & Tulasne, 1865). It has consistently been allied with the members of *Melanospora* since then, though several workers have recognized it as an outlying member of the group. Doguet (1955), in his monograph of *Melanospora*, separated the species informally on the shape of its spores, and Malloch (1976a) considered removing it from *Melanospora* to *Scopinella* on spore morphology, but rightly refrained from this action as the spores are distinct from this genus also.

A number of features link *Syspastospora* with *Melanospora*. These include the possession of a perithecium which is membranaceous rather than carbonaceous, with a globose body and a long neck, and the asci, which are evanescent at an early stage, liberate the immature ascospores into the perithecial cavity. None of these features, however, is confined to these two genera, being also found in other members of the Melanosporaceae and Chaetomiaceae.

Distinctions between *Melanospora* and *Syspastospora* are as follows: the neck structure, which in *Syspastospora* consists of more or less parallel hyphae with remote septa, and in *Melanospora* is made up of relatively short pseudoparenchymatous cells similar to those of the body wall, though they are usually longer and narrower; the ring of hyaline setae around the ostiole which is



universally present in *Melanospora*, though it is poorly developed in some species, is lacking in *Syspastospora*; the ascospores, which in *Syspastospora* are cylindrical or fusiform-cylindrical with truncate ends, with large terminal germ pores round which the wall is crinkled and sometimes slightly constricted, while in *Melanospora* they are usually ellipsoid or citriform, but never cylindrical, the two extremities containing small, slightly sunken, germ pores. In addition, *Melanospora* species commonly have simple phialidic anamorphs whereas this does not seem to be so in *Syspastospora*.

No conidia were seen in the present study. However, Kihlman (1885) found verticillate phialides bearing ovoid hyaline conidia, and Doguet (1955) reported similar phialides but with ovoid-globose conidia arranged in chains. He was unable to establish a definite link between these and the perithecial state, and judging from his illustration, the conidia are probably those of the host species (usually *Paecilomyces* spp.) rather than those of *Syspastospora*.

Spore size in *Syspastospora* has been recorded as  $6.5 \times 2.5 \mu\text{m}$  (Tulasne, 1857);  $5.8 \times 2.5 \mu\text{m}$  (Petch, 1938);  $4.5 \times 2.3 \mu\text{m}$  (von Arx & Müller, 1954), and  $6.8 \times 2.5 \mu\text{m}$  (Doguet, 1955). In the present study it was found that the taxon exhibits an unusual range of spore size, to the extent that, from the first specimens examined, it was thought that two distinct species were present, one with short cylindrical spores  $4.5 \times 2.5\text{--}3 \mu\text{m}$  in size, and the other with long fusiform-cylindrical spores with a size range of about  $8\text{--}10 \times 2\text{--}2.5 \mu\text{m}$ . However, upon further study, an almost complete gradation of spore size and shape was found between these two extremes. The range of variation is illustrated in Fig. 49.

SPECIMENS EXAMINED: BRITISH ISLES: Berkshire: Silwood Park, 13 vii 1970, *Wheeler* (IMI 147185). Devon: Dartington, on *Beauveria bassiana*, 25 ix 1935, *Petch R.1155* (K). Norfolk: Wheatfen Broad, on *Paecilomyces tenuipes* (Peck) Samson, 20 ix 1942, *Ellis* (K); Wheatfen, on *P. tenuipes*, 20 ix 1951, *Ellis* (IMI 47046; Middle Marsh, Wheatfen, 12 viii 1955, *Ellis* (IMI 61267); West Briggs, near King's Lynn, on *Paecilomyces farinosus* (Holm) Brown & Smith, 10 ix 1931, *Petch R.896* (K); North Wootton, x 1880, *Plowright* (K). Warwickshire: Beausale, 1 viii 1972, *Clark MC1169* (K). Yorkshire: Kingthorpe, near Pickering, on *P. farinosus*, 1 viii 1960, *Bramley C/60/24* (IMI 82086); Rawcliffe, on *P. farinosus*, 4 viii 1934, *Petch R.1063* (K).—KENYA: *Sine loc.*, on ?*Acremonium* Link sp., viii 1940, *Natrass* (IMI 27464). Limuru, x 1940, *Natrass* (IMI 27466).—SOUTH AFRICA: Natal, Cramond, on *P. farinosus*, vi 1943, *Ripley SA33981* (IMI 27465).—SRI LANKA: Nuwara Eliya, vii 1926, *Petch R.14* (K). Nuwara Eliya, 12 vi 1927, *Petch R.182* (K). Ambawela, i 1917, *Petch 5202* (K). Pallekelly, xii 1919, *Petch* (K). Garravale, 29 viii 1922, *Petch* (K). Ragalla, on *Verticillium lecanii*, i 1924, *Petch* (K).—TRINIDAD: on *Hirsutella floccosa*, *Rorer 6240* (K).—U.S.A.: New York, ix 1906, *Wilson* (K).

VIENNOTIDEA P. CANNON & D. HAWKSW.

***Viennotidea* P. Cannon & D. Hawksw. gen. novum**

SYNONYM: *Viennotidea* Negru & Verona, *Mycopathologia*, 30: 305 (1966); nom. inval. (Art. 37).

PERITHECIA solitaria ad gregaria, superficialia vel semi-immersa, glabra vel molliter pilosa, aurea vel badia, ostiolata, colla cylindrica, apicibus fimbriatis instructae. ASCI sphaeroidei vel ovoidei, evanescentes, 2- ad 8-sporiis instructae.

ASCOSPORAЕ sphaeroideae, ellipsoideae, pyriformes vel reniformes, interdum allantoideae, continuae.

PERITHECIA solitary to gregarious, superficial or half-immersed, glabrous or softly hairy, yellow or golden-red: ostiolate, beak cylindrical, fimbriate at the apex. ASCI sphaeroidal or ovoid, evanescent, 2- to 8-spored. ASCOSPORES sphaeroidal, ellipsoidal, pyriform or reniform, sometimes allantoid, hyaline, 1-celled.

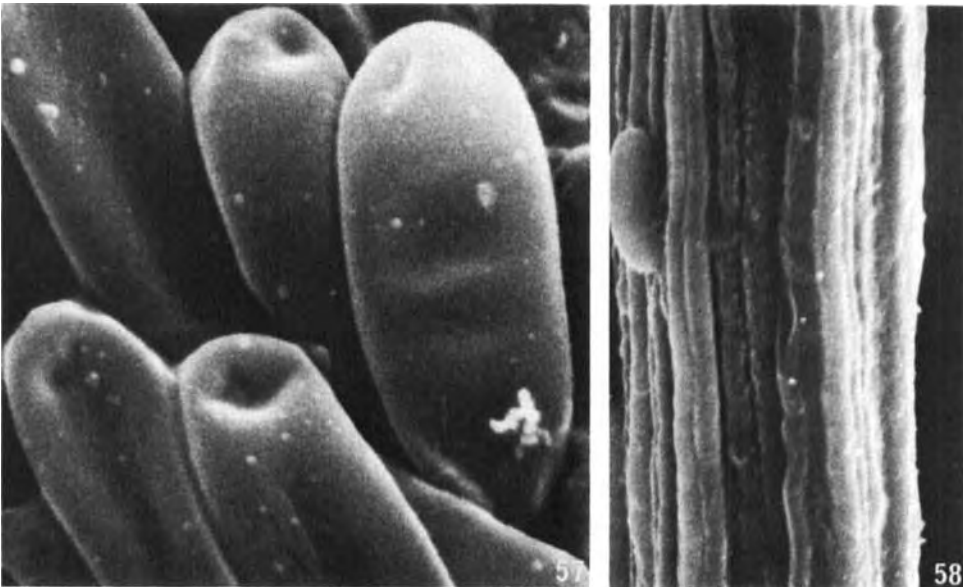
ANAMORPH: *Gabarnaudia* Samson & W. Gams (known in two species).

TYPE SPECIES: *Viennotidea fimicola* (Marchal) P. Cannon & D. Hawksw. (HOLOTYPE).

The genus *Viennotidea* was first erected by Negru & Verona (1966) to contain *V. spermosphaerici* and *V. raphani*. However, they failed to designate a type species for their genus, and it is accordingly invalid under Art. 37 of the Code. The species were combined with *V. fimicola* by Malloch (1974) into the genus *Sphaeronaemella*, and this constitutes the first valid publication of these species. However, as the type species of the genus *Sphaeronaemella*, *S. helvella* (P. Karsten) P. Karsten has markedly different spores from those of *S. fimicola* Marchal (see above), the genus *Viennotidea* is re-erected to contain this last species and *S. humicola* Samson & W. Gams, along with the two described by Negru & Verona.

We have attributed this generic name to ourselves alone as Negru & Verona were not familiar with the species we have selected as the holotype of *Viennotidea*.

The relationships of the genus are obscure; it may be fairly close to *Sphaeronaemella*, but exhibits major differences in spore form. It is not closely related to *Melanospora*.



Figures 57-58. *Viennotidea fimicola* (IMI 63872) (SEM). Fig. 57. Ascospore apices showing the massive, depressed, subterminal germ pores,  $\times 12000$ . Fig. 58. Portion of the perithecial neck showing that it is made up of vertically orientated parallel hyphae,  $\times 3000$ .

Key to the species of *Viennotidea*

1. Ascospores mainly exceeding 3  $\mu\text{m}$  wide . . . . . 2
- 1'. Ascospores 6–8  $\times$  2–3  $\mu\text{m}$  . . . . . *V. fimicola*
2. Ascomata always ostiolate with ostiolar setae . . . . . 3
- 2'. Ascomata usually not ostiolate, sometimes with a long tuft of ostiole-like hyphae . . . . . *V. humicola*
3. Ascomata superficial; ascospores ovoid to ellipsoid, pyriform or reniform, 5–7  $\times$  3–5  $\mu\text{m}$  . . . . . *V. spermosphaerici*
- 3'. Ascomata immersed to erumpent; ascospores spherical, ovoid or ellipsoid, 4–6.5  $\times$  4–4.5  $\mu\text{m}$  . . . . . *V. raphani*

*Viennotidea fimicola* (Marchal) P. Cannon & D. Hawksw.

***Viennotidea fimicola*** (Marchal) P. Cannon & D. Hawksw. **comb. nova**

SYNONYMS: *Sphaeronaemella fimicola* Marchal, *Bulletin de la Société Royale de Botanique de Belgique*, 30 (2): 143 (1891).

*S. fimicola* var. *minor* Marchal, *Bulletin de la Société Royale de Botanique de Belgique* 30 (2): 143 (1891).

*Ceratocystis fimicola* (Marchal) Upadhyay, *A monograph of Ceratocystis and Ceratocystiopsis*, 95 (1981).

PERITHECIA half-immersed or immersed to base of neck, scattered, 120–300  $\mu\text{m}$  diameter, globose to globose-pyriform, thin-walled, yellow to golden-brown, glabrous; ostiolate, neck cylindrical, 500–900  $\mu\text{m}$ , 25–30  $\mu\text{m}$  diameter at base, 10–15  $\mu\text{m}$  at tip, glabrous, composed of parallel hyphal elements, diverging at the tip to form a gently spreading corona of hyaline setae 50–70  $\mu\text{m}$  long. ASCI subglobose, 10–15  $\times$  10–12  $\mu\text{m}$ , quickly evanescent, 8-spored. ASCOSPORES oblong-ellipsoid, sometimes allantoid,  $\pm$  hyaline, 6–8  $\times$  2–3  $\mu\text{m}$ , with a crateriform germ pore near one end of the spore (see Fig. 57); spores aggregating at the tip of the neck giving the appearance of a white head.

ANAMORPH: *Gabarnaudia fimicola* Samson & W. Gams (see Samson, 1974).

ILLUSTRATIONS: Pease (1948: 114–124; figs 1–19); Cain & Weresub (1957: 119–131; figs 1–33); Samson (1974: 93; fig. 40).  
Figures 57–58.

HOSTS: On dung; recorded from cow, deer, rabbit, hare, dog, wolf, possum, and wallaby or kangaroo dung.

DISTRIBUTION: Evidently widely distributed; known from Europe (including the British Isles), Canada, and Australia.

SPECIMENS EXAMINED: AUSTRALIA: Victoria: Mount Pilot, on possum dung, 5 x 1963, *Dade V156Ac* (IMI 104305); Strathbogie Hills, on wallaby or kangaroo dung, 16 v 1964, *Dangerfield* (IMI 109611).—BRITISH ISLES: Surrey: Richmond Park, on deer dung, 1 x 1956, *Hawkins* (IMI 63872). Sussex: Bignor Hill, on rabbit dung, iv 1960, *Scott* (IMI 103655).—CANADA: Ontario: Peel County, N. of Bolton, on cow dung, 8 x 1955, *Cain 31350* (IMI 123067); Haliburton County, Grindstone Lake, on deer dung, 17 September 1965, *Cain 44843* (IMI 208321).

The last two specimens are immature, and no spores were seen. Identification is therefore tentative, but since the collector published a detailed study of high quality on the species (Cain & Weresub, 1957) it is very likely that the specimens are correctly determined.

*Viennotidea humicola* (Samson & W. Gams) P. Cannon & D. Hawksw.

***Viennotidea humicola*** (Samson & W. Gams) P. Cannon & D. Hawksw. **comb. nova**

SYNONYM: *Sphaeronaemella humicola* Samson & W. Gams, in Samson, *Studies in Mycology, Baarn*, 6: 94 (1974).

PERITHECIA superficial or immersed in agar, 80–250  $\mu\text{m}$  diameter, globose, yellow-brown or red-brown, glabrous; non-ostiolate, but with an ostiole-like elongate tuft of loose hyphae, 200–750  $\mu\text{m}$  long. ASCI  $\pm$  globose, 10–15  $\mu\text{m}$  diameter, evanescent, 8-spored. ASCOSPORES broadly ellipsoid, brownish, 5–6  $\times$  4–5  $\mu\text{m}$ .

ANAMORPH: *Gabarnaudia fimicola* Samson & W. Gams (see Samson, 1974).

ILLUSTRATIONS: Samson (1974: 95; fig. 41, pl. 2).

HOST: Isolated from agricultural soils.

DISTRIBUTION: Netherlands and Germany.

We have not seen any material of this fungus and the above description is based on the original account of the species, but as it has a *Gabarnaudia* anamorph and the ascoma wall and asci are typical of *Viennotidea* it is conveniently placed here.

*Viennotidea raphani* (Malloch) P. Cannon & D. Hawksw.

***Viennotidea raphani*** (Malloch) P. Cannon & D. Hawksw. **comb. nova**

SYNONYMS: *Viennotidea raphani* Negru & Verona, *Mycopathologia*, 30: 307 (1966); *nom. inval.* (Arts 37, 43).

*Sphaeronaemella raphani* Malloch, *Fungi Canadenses*, no. 53 (1974).

PERITHECIA immersed to erumpent, globose to depressed-globose, yellowish red, 75–120  $\mu\text{m}$  diameter; ostiolate, beak cylindrical, 300–600  $\mu\text{m}$ , terminated by a ring of hyaline setae. ASCI globose to ellipsoid, 15–25  $\times$  11–15  $\mu\text{m}$ , evanescent, 2- to 8-spored. ASCOSPORES sphaeroid, ovoid or ellipsoid, 1-celled, hyaline, sometimes 1- to 2-guttulate, 4–6.5  $\times$  4–4.5  $\mu\text{m}$ .

ILLUSTRATION: Negru & Verona (1966: 307; fig. 2).

HOST: On germinating seeds and in the seed cavities of *Raphanus sativus* L.

DISTRIBUTION: Roumania: Mures, Nazna.

As with *Viennotidea spermosphaerici*, type material is apparently not in existence, and Malloch's name is lectotypified by the illustration in the paper by Negru & Verona (1966). It is distinguished from *V. fimicola* and *V. spermosphaerici* by its spore size and shape, and from *V. spermosphaerici* by its immersed to erumpent, rather than superficial, habit.

*Viennotidea spermosphaerici* (Malloch) P. Cannon & D. Hawksw.

***Viennotidea spermosphaerici* (Malloch) P. Cannon & D. Hawksw. comb. nova**

SYNONYMS: *Viennotidea spermosphaerici* Negru & Verona, *Mycopathologia*, 30: 306 (1966); *nom. inval.* (Arts 37, 43).

*Sphaeronaemella spermosphaerici* Malloch, *Fungi Canadenses*, no. 53 (1974).

PERITHECIA  $\pm$  solitary, globose, yellow or golden, 95–150  $\mu$ m diameter; ostiolate, beak cylindrical, 600–1200  $\mu$ m, terminated by a ring of hyaline setae. ASCI sphaeroidal or ellipsoid, 10–20  $\mu$ m, evanescent, 4- or 8-spored. ASCOSPORES ovoid or ellipsoid, rarely pyriform or reniform, 1-celled, hyaline, usually 2-guttulate, 5–7  $\times$  3–5  $\mu$ m.

ILLUSTRATION: Negru & Verona (1966: 307; fig. 1).

HOSTS: In the seed cavity of fruits of *Capsicum annuum* L., *Cucurbita pepo* L. and *Vicia sativa* L.

DISTRIBUTION: Roumania: Tiges-Mures district.

No specimens have been seen of this species, and apparently (von Arx, personal communication) no type material is available. The epithet is accordingly lectotypified by the illustration cited above. There seems little doubt of this species' relationship with *V. fimicola*, the only difference of note being in the size of the spores. The two guttulae in the spores of *V. spermosphaerici* may correspond to the crateriform germ pores in those of *V. fimicola*, but these are difficult to see except with the scanning electron microscope.

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