

A SYNOPSIS OF THE GENUS *POLYCOCCUM* (DOTHIDEALES), WITH A KEY TO ACCEPTED SPECIES

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The genus *Polycoccum* (Dothideales) is referred to an extended concept of the Dacampiaceae rather than to the Pleosporaceae. It is distinguished from *Didymosphaeria* by the structure of the ascomata. A key to, spore outlines of, and notes on the 23 accepted species are provided, including *P. cladoniae* sp.nov.; they are primarily lichenicolous and often gall-forming. Notes on 29 epithets excluded from the genus, including all lichenicolous taxa referred to *Didymosphaeria*, are provided, and the following combination made: *Endococcus gyrophorarum* (Arnold) comb.nov. Attention is also drawn to problems in the lectotypification of the generic name *Didymosphaeria*.

The genus *Polycoccum* Sauter ex Körber was introduced by Körber (1865, p. 470) for the single species *P. sauteri* Körber, discovered on *Stereocaulon condensatum* Hoffm., in the Pinzgau area of Austria. The genus was regarded as a synonym of *Didymosphaeria* Fuckel by Saccardo (1882) and this interpretation was followed by most students of lichenicolous fungi, e.g. Vouaux (1913) and Keissler (1930), until the generic name was reintroduced by Santesson (1960, p. 505). Vězda (1969, pp. 108-109) provided a key to 10 lichenicolous species referred to *Polycoccum*. Since that time many other names have been added to the genus and a synopsis of these was required. The present paper endeavours to provide such a survey by means of a key and notes on all names referred to the genus, and further all lichenicolous taxa attributed to *Didymosphaeria*.

Polycoccum is the second oldest name to be used for *Didymosphaeria*-like fungi. As a part of a revision of these fungi, names referred to the earlier *Microthelia* Körber were considered by Hawksworth (1985a). In dealing with names referred to *Polycoccum* this paper is also to be considered the second part of that revision.

The separation of *Polycoccum* from the now generally accepted concept of *Didymosphaeria*, exemplified by *D. futilis* (Berk. & Broome) Rehm, is clear and discussed further below. However, attention is drawn to a problem concerning the typification of the generic name *Didymosphaeria*. Clements & Shear (1931, p. 268) have generally been accepted as the first authors to lectotypify Fuckel's name (Holm, 1957; Scheinpflug, 1958; Farr, Leeusink & Stafleu, 1979), selecting *D.*

epidermidis Fuckel, i.e. *D. futilis*. However, Theissen & Sydow (1918, p. 28) were discovered to have previously selected another of Fuckel's original species, *D. peltigerae* Fuckel: 'deren Typ *D. peltigerae* Fuck. ist!'. If that typification were to be accepted, *Didymosphaeria* would become a synonym of *Polycoccum*. If the proposal to reject all lectotypifications prior to 1935 is not accepted at the 1987 International Botanical Congress (McNeill, 1986), we consider that in the interests of nomenclatural stability for both generic names *Didymosphaeria* should be proposed for conservation with *D. epidermidis* as lectotype. The generic synonymy presented below assumes that *Didymosphaeria* will continue to be treated as typified by the species now called *D. futilis*.

POLYCOCCUM Sauter ex Körber, *Parerga Lich.*: 470 (1865).

Lophothelium Stirton, *Scott. Naturalist* 9: 37 (1887).

Mycelium immersed in the thallus of the host, subhyaline to pale brown. *Ascomata* arising singly, immersed with only the ostiole visible to erumpent and the upper $\frac{1}{2}$ - $\frac{2}{3}$ exposed when mature, perithecioid, subglobose to obpyriform, dark brown to black, ostiolate, neck not extended and scarcely distinguishable from the ascomatal wall; wall even in thickness or somewhat broader in the vicinity of the ostiole, composed of 3-6 layers of polyhedral pseudoparenchymatous cells, radially compressed in vertical sections and roughly isodiametric in surface view, forming a *textura angularis*; outer layers of cells with \pm evenly thickened walls,

brown to dark brown and continuing below the centrum; inner layers less intensely pigmented to hyaline and thin-walled. *Hamathecium* composed of a branched and anastomosing net of thin and regularly septate to remotely septate narrow hyphal filaments, probably trabeculate pseudo-paraphyses (paraphysoids?), paraphyses absent; hymenial gelatine blue to violet or unchanged in iodine. *Asci* arising from the base of the ascomatal cavity, subcylindrical to elongate-clavate, short-stalked, thick-walled with two functional wall layers (bitunicate) and a small internal apical beak, annulus absent, discharge fissitunicate, 2- to 8-spored. *Ascospores* \pm irregularly monostichous to irregularly distichously arranged in the asci, ellipsoid, 1(-2)-septate (euseptate), cells \pm equal in size or the upper larger and broader, apices generally rounded or rarely slightly attenuated, somewhat constricted at the septum, brown to dark brown before release from the asci, walls generally rather thin, smooth or delicately to coarsely verruculose, most species lacking a conspicuous gelatinous sheath. *Anamorph* unknown.

Type species. *Polycoccum trypetelioides* (Th. Fr.) R. Sant. (syn. *P. sauteri* Körber, holotype).

The genus as circumscribed above appears to be relatively homogeneous with respect to both morphology and biology and so appears to represent a monophyletic group. Most of the variation between the species is with respect to ascomatal sizes, iodine reaction of the hymenial gelatine, ascus shape, ascospore numbers, ascospore dimensions, and ascospore ornamentation. Most of the 23 species accepted here are definitely lichenicolous, the majority are restricted to individual genera or species of host lichens, and many produce characteristic galls in commensalistic rather than parasitic symbioses. This situation contrasts with that encountered in several other genera of lichenicolous fungi where species adversely affect their hosts and have relatively wide host ranges, as in some species of *Endococcus* Nyl., *Licheniconium* Petrak & H. Sydow, *Muellerella* Hepp ex Müll. Arg. and *Pyrenidium* Nyl. (Hawksworth, 1977, 1979, 1983a).

All but one of the species (*P. innatum*) are associated with saxicolous or terricolous, and not corticolous lichens.

Ontogenetic studies are required to resolve the nature of the hamathecial elements in *Polycoccum*; they are paraphysoid-like in most species, but tend to be more septate and slightly broader than is usual for paraphysoids as seen in other fungi.

The genus is currently referred to the Pleosporaceae Nitschke (Eriksson & Hawksworth, 1986), but in the absence of ontogenetic studies any placement must be regarded as speculative. However, the nature of the hamathecial tissues and the lack of a dematiaceous hyphomycete anamorph preclude a disposition in the Pleosporaceae *sensu stricto*. Crivelli (1983, p. 193) suggested that *Dacampia* Massal., *Polycoccum* and *Pyrenidium* Nyl. (as *Dacampiosphaeria* D. Hawksw.) were closely allied. We concur with this view and suggest that these three genera may most appropriately be treated with *Byssothecium* Fuckel, *Clypeococcum* D. Hawksw. and *Weddellomyces* D. Hawksw. as belonging to a single family of the Dothideales, for which the earliest name is the Dacampiaceae Körber (syn. Pyrenidiaceae Zahlbr.), until the affinities of this group with other families of the Dothideales can be clearly determined.

Didymosphaeria sensu stricto, i.e. the *D. fulvis* group, is distinguished from *Polycoccum* on the basis of the structure of the ascomata. In *D. fulvis* and related species, occurring mainly on dead herbaceous material and wood, the ascomatal wall is almost entirely composed of strongly interwoven \pm hyaline hyphae (*textura intricata*) with a pigmented region in the vicinity of the ostiole. The group is further distinguished by narrowly cylindrical asci with monostichously arranged ascospores. Illustrations of *D. fulvis* showing the ascomata structure are provided by Hawksworth (1985a, p. 55) and Scheinpflug (1958, p. 343). The hamathecium is clearly composed of trabeculate pseudoparaphyses (paraphysoids) which led Barr (1979) to retain it in a separate family, the Didymosphaeriaceae Munk, which she placed in the Melanommatales (Didymosphaerineae Barr) along with the Microglaenaceae Servit and Trypeteliaceae Eschw.

Several other lichenicolous dothidealean genera produce brown 1-septate ascospores. In *Endococcus* Nyl. and *Muellerella* Hepp ex Müll. Arg. no hamathecial filaments are present between the asci at maturity and the ascospores in all known species of these two genera are smooth (Hawksworth, 1979). *Clypeococcum* D. Hawksw. includes species with similar hamathecial tissues to *Polycoccum*, but is distinguished both by the hyphal rather than pseudoparenchymatous ascomatal walls which are massively thickened around the ostiole, and the ascomata occurring in groups united by a common clypeus; four *Clypeococcum* species are currently accepted (Øvstedal & Hawksworth, 1986).

KEY TO *POLYCOCCUM* SPECIES

1. Ascospores exceeding 25 μm in length	2
1. Ascospores less than 25 μm in length	7
2. Asci 4-8-spored	3
2. Asci 2-spored; ascospores 25-35 (-44) \times 8-10 (-14) μm	<i>P. dzieduszyckii</i>
3. Asci 4-spored	4
3. Asci 8-spored	5
4. Ascospores narrowly ellipsoid, (25-) 30-32 (-36) \times 8-10 (-11) μm	<i>P. crassum</i>
4. Ascospores broadly ellipsoid, 28-32 \times 11-12 μm	<i>P. versisporum</i>
5. Hymenial gelatine I+blue	6
5. Hymenial gelatine not I+blue; ascospores 25-30 (-34) \times 12-14 (-15) μm .	<i>P. cartilaginatum</i>
6. Ascomata 100-150 μm diam; ascospores with a gelatinous sheath, 25-28 \times 11-14 μm	<i>P. opulentum</i>
6. Ascomata 200-250 μm diam; ascospores lacking a gelatinous sheath, (20-) 25-30 (-36) \times 14-18 μm	<i>P. marmoratum</i>
7. Ascospores mainly exceeding 14 μm in length	8
7. Ascospores mainly less than 14 μm in length	20
8. Ascospores mainly less than 10 μm broad.	9
8. Ascospores 18 \times 10.5 μm ; asci 4-spored	<i>P. gelidarium</i>
9. Ascomata mainly exceeding 150 μm diam.	10
9. Ascomata mainly less than 150 μm diam	14
10. Ascospore cells \pm equal in size	11
10. Ascospore cells unequal in size, the lower $\frac{1}{3}$ of the length of the ascospore; ascospores 14-22 \times 8-10 μm	<i>P. tryphethelioides</i>
11. Ascospores mainly exceeding 6 μm in breadth	12
11. Ascospores (12-) 13.5-16 (-18) \times 4-6 (-7) μm ; smooth	<i>P. peltigerae</i>
12. Ascospores rarely exceeding 20 μm in length.	13
12. Ascospores 16-23 (-25) \times 6-9.5 (-12) μm ; asci 4-8-spored	<i>P. sporastatae</i>
13. Ascomata flattened at the apex; ostiole broad; asci 40-60 (-80) \times 9-12 (-14) μm ; ascospores (13.5-) 14-16.5 (-20) \times (5-) 6.5-8 (-9); not forming galls	<i>P. cladoniae</i>
13. Ascomata not flattened at the apex; ostiole narrow; asci 75-100 \times 10-16 μm ; ascospores 14-18 (-21) \times 7-9 μm ; forming galls	<i>P. galligenum</i>
14. Ascospores mainly exceeding 18 μm in length	15
14. Ascospores mainly less than 18 μm in length	16
15. Ascospores (15-) 19-22 (-26) \times (6-) 7-9 (-10) μm , upper cell somewhat larger	<i>P. epicrassum</i>
15. Ascospores (18-) 19-26 \times (5.5-) 6-7 (-8) μm , cells \pm equal in size	<i>P. squamarioides</i>
16. Ascospores mainly exceeding 6 μm in width	17
16. Ascospores (10-) 12-15 (-16) \times (4-) 4.5-6 (-6.5) μm	<i>P. rugulosarium</i>
17. Ascospores with verruculose ornamentation	18
17. Ascospores smooth, 13.5-15 \times (6-) 6.5-7.5 μm .	<i>P. umbilicariae</i>
18. Ascoma wall entire, continuous at the base	19
18. Ascoma wall strongly thickened in the upper parts, poorly developed at the base; ascospores (15-) 16-18 (-19) \times (6.5-) 7-8 (-8.5) μm	<i>P. innatum</i>
19. Ascomata (50-) 100-150 μm diam; asci 4- to 8-spored, subcylindrical; ascospores 14-18 \times 7-8.5 μm	<i>P. microsticticum</i>
19. Ascomata (60-) 75-95 (-100) μm diam; asci 8-spored, elongate-clavate; ascospores 14-18 \times 7-9 μm	<i>P. vermicularium</i>
20. Asci elongate-clavate; ascospores \pm distichously arranged	21
20. Asci cylindrical; ascospores \pm monostichously arranged; ascospores (10-) 11-13 (-15) \times (4-) 4.5-6 μm , rarely 2-septate	<i>P. bryoniae</i>
21. Ascomata 200-300 μm diam; ascospores 11-14 \times 8-9 μm	<i>P. kernerii</i>
22. Ascospores 10-12 (-13) \times 6.5-7.5 (8.5) μm	<i>P. jamesii</i>
22. Ascospores 9-11.5 (-13) \times 4.5-6.5 (-7) μm	<i>P. arnoldii</i>
22. Ascospores (10-) 12-15 (-16) \times (4-) 4.5-6 (-6.5) μm	<i>P. rugulosarum</i>

ACCEPTED SPECIES

Notes on the nomenclature, host range and distribution of the 23 currently accepted species of *Polycoccum* are given, together with details of specimens examined. While all accepted species appear to be separable on morphological criteria,

we wish to stress that as few collections of most are available the full extent of variation within a species may in some cases exceed that documented here. Obligatory synonyms other than those in *Didymosphaeria* and *Polycoccum* are only cited in the synonymics here or under 'Excluded species' if they have been adopted in recent years.

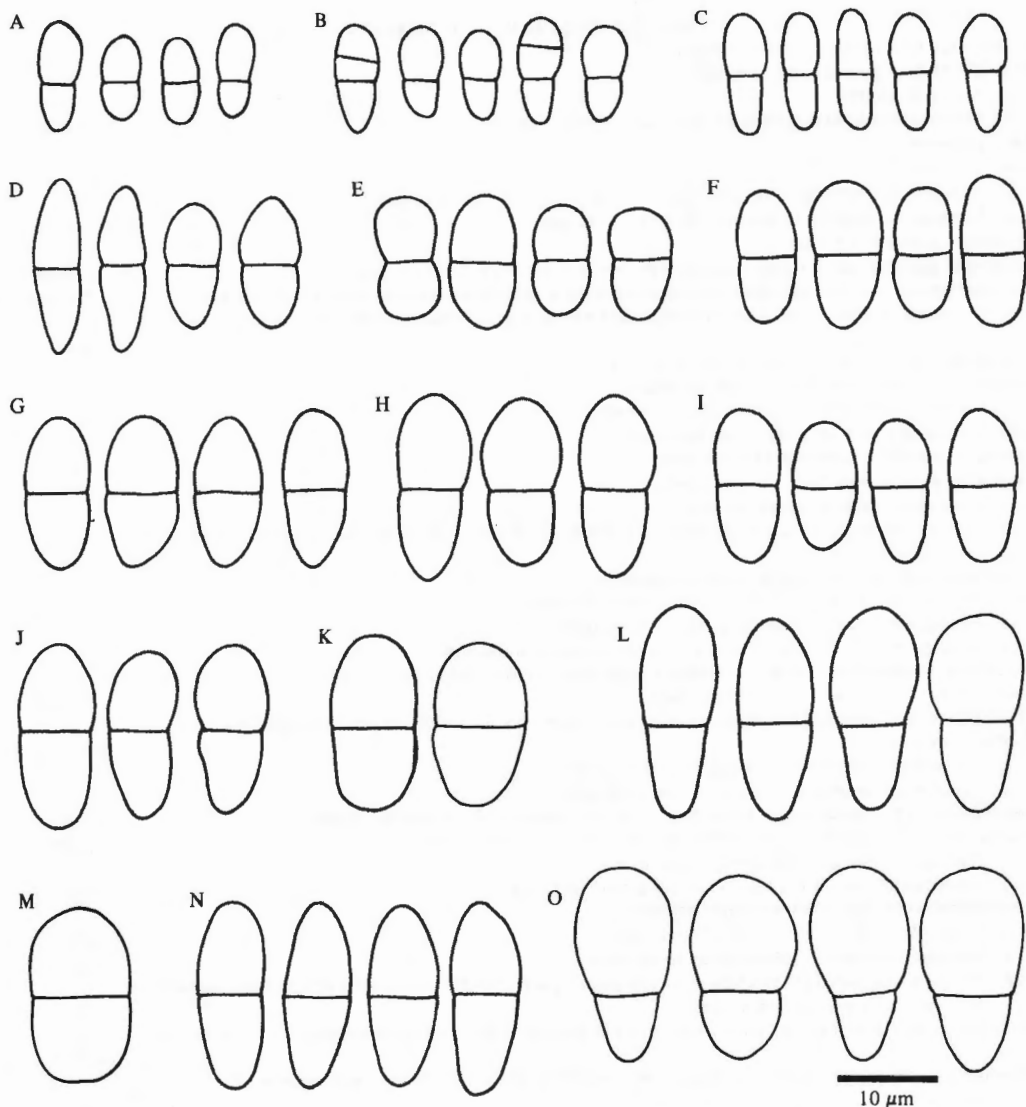


Fig. 1. Ascospore outlines of *Polycoccum* species with ascospores less than 25 μm in length. (A) *P. arnoldii* (K - isotype); (B) *P. bryonthae* (K - isotype); (C) *P. rugulosarium* (BM - holotype); (D) *D. peltigerae* (Diederich 7856), two pairs of spores from different asci inside a single ascoma; (E) *P. jamesii* (IMI 288325 - holotype); (F) *P. microsticticum* (Leighton, K); (G) *P. galligenum* (BM - paratype); (H) *P. innatum* (G - holotype); (I) *P. umbilicariae* (E - holotype); (J) *P. vermicularium* (E - holotype); (K) *P. cladoniae* (POLL - holotype); (L) *P. epicrassum* (IMI 286819); (M) *P. gelidarium* (BM - holotype); (N) *P. squamarioides* (E - isotype); (O) *P. tryptelioides* (K - holotype of *Lophothelium acervatum*).

POLYCOCCUM ARNOLDII (Hepp) D. Hawksw., *Bot. Notiser* 132: 289 (1979). (Fig. 1A)

Phaeospora arnoldii Hepp, *Flecht. Eur.* no. 701 (1860).

?*Didymosphaeria bryonthae* var. *stellulatae* Vouaux, *Bull. Soc. mycol. Fr.* 29: 111 (1913).

Ascomata ca 100 μm tall and 80 μm broad, immersed in the hymenium or thallus of the host. *Hamathecial* filaments 1.5-2.5 μm thick. *Asci* elongate clavate, 35-50 \times 10-5 μm , 8-spored. *Ascospores* ellipsoid, rounded at the apices, brown, smooth, the lower cell often somewhat tapered, 9-11.5 (-13) \times 4.5-6.5 (-7) μm .

Hosts. *Diploschistes cinereoaesius* (Swartz) Vainio, *D. scruposus* (Schreber) Norman (thallus) and *Rhizocarpon obscuratum* (Ach.) Massal. (incl. *R. reductum* Th. Fr.).

Distribution. We have seen material from the British Isles, Germany and Venezuela. It has also been reported from Italy and France (Keissler, 1930), Denmark (Christiansen, 1986) and Luxembourg (Koltz, 1897).

This species recalls *P. rugulosarium* in the narrow ascospores but they are consistently shorter than in that species. Care is needed to avoid confusion with *Lichenostigma rugosa* Thor which has rather similar ascospores and occurs on *Diploschistes* species; however, the structure of the ascomata in *L. rugosa* is quite different as these are not perithecioid (Thor, 1985). *D. bryonothae* var. *stellulatae* is tentatively included as a synonym of this species on the basis of the published description and as the species was said to occur on *Buellia stellulata* (Taylor) Mudd, *Diploschistes actinostomus* (Pers. ex Ach.) Zahlbr. and *Rinodina exigua* (Ach.) Gray; the number of spores per ascus and spore dimensions given differ from those of *P. microsticticum* which is recorded on *B. stellulata* below. No material of this taxon is present amongst the remnants of Vouaux's herbarium (Rondon, 1970).

Specimens examined: British Isles: Cumbria, Langdale, ? on *Rhizocarpon obscuratum*, July 1966, B. J. Coppins & A. Pentecost (E); Angus, Clova, above Loch Brandy, on *Diploschistes scruposus*, Oct. 1954, U. K. Duncan (E). Italy: Eichstädt, zwischen Winterhof u. Ruppertsbuch, on *D. scruposus*. F. Arnold (Hepp, *Fl. Eur.* no. 701) (K-isotype of *Tichothecium arnoldii*). Venezuela: Paramo El Turmal, cercanias de Carache, 2400–2800 m, on *Diploschistes cinereoaesius*, 12 Sept. 1978, L. Figueirras 1685 (herb. Lumbsch, IMI 294679).

POLYCOCCUM BRYONTHAE (Arnold) Vězda, *Česká Mykol.* 23: 109 (1969). (Fig. 1B)
Endococcus bryonothae Arnold, *Flora, Jena* 57: 141 (1874).

Didymosphaeria bryonothae (Arnold) Winter, Rabenh., *Krypt.-Fl.* 1(2): 430 (1885).

Ascomata 70–100 (–50) μm diam, erumpent from the apothecia of the host. *Hamathecial* filaments 1.5–2.5 μm wide. *Asci* cylindrical (60–) 70–80 \times 10–12 μm , 8-spored. *Ascospores* \pm monostichously arranged, ellipsoid, the upper cell slightly larger, olivaceous brown, slightly verruculose, sometimes developing a second septum in the upper cell, (10–) 11–13 (–15) \times (4–) 4.5–6 μm .

Hosts. *Caloplaca stillicidiorum* (Vahl) Lynge and *Pertusaria bryonotha* (Ach.) Nyl. (restricted to the apothecia).

Distribution. Austria, Czechoslovakia and Italy.

This species is unusual in that the ascospores are almost monostichously arranged in cylindrical asci and in that the spore may develop an extra septum; this last feature is otherwise only seen in the genus exceptionally in '*P. sauteri* var. *margarodes*' (see *P. tryptelioides* below).

Specimens examined: Austria: Oberösterreich, Hoher Sarstein, E vom Hallstätter See, Gipfelregion, 1800–1975 m, on *C. stillicidiorum*, 6 July 1983, R. Türk 5302 (herb. Türk). Czechoslovakia: Carpati, Tatra Minor, in alpe Kozi chrbty, 1700 m, on *C. stillicidiorum*, 10 Aug. 1957, A. Vězda (LG): Tatra Minor, Velky Gapel, 1700 m, on *C. stillicidiorum*, Aug. 1957, A. Vězda (K). Italy: Waldrast, Matrier Grube, on *Pertusaria bryonothae*, 4 Sept. 1874, F. Arnold (Arnold, *Lich. Exs.* no. 615) (K-isotypes?).

POLYCOCCUM CARTILAGINOSUM (Arnold) D. Hawksw., *Bull. Br. Mus. nat. Hist. (Bot.)* 14: 141 (1985). (Fig. 2A)

Microthelia cartilaginosa Arnold, *Verh. zool.-bot. Ges. Wien* 36: 83 (1886).

Microthelia marmorata forma *cartilaginosa* (Arnold) Keissler, Rabenh., *Krypt.-Fl.* 9, 1(2): 44 (1936).

Ascomata immersed in the substratum, to ca 200 μm diam, opening irregularly. *Asci* subcylindrical, 8-spored. *Hamathecial* gelatine not turning blue with iodine. *Ascospores* broadly ellipsoid, apices rounded, dark brown to almost black, verruculose, lower cell often slightly smaller, 25–30 (–34) \times 12–14 (–15) μm .

Host. The biological status of this species is obscure.

Distribution. Italy.

This species is close to *P. marmoratum* from which it differs in that the hymenial gelatine does not turn blue in iodine and in the somewhat narrower ascospores.

Specimens examined: Italy: Griethalglletscher bei Schludersbach, auf Kalksteingerölle, 17 July 1882, F. Arnold (Arnold, *Lich. Exs.* no. 958) (M – lectotype of *Microthelia cartilaginosa*).

POLYCOCCUM CLADONIAE Diederich & D. Hawksw. sp. nov. (Figs 1K, 3)

Ascomata lichenicola, in thallo *Cladoniae* crescentia, prime immersa, maturitate erumpentia, dispersa, subglobosa, ostiolata, atra, 100–250 μm diam. *Paries* brunneus, cellulis pseudoparenchymatis, 2–7 μm diam. Pseudoparaphyses ramosae et anastomosantes, 1.5–2 μm crassae; centrum cum iodo non reagens. *Asci* elongato-clavati, bitunicati, membranis in apice incrassatis, 8-sporei, in iodo non caerulescentes, 40–60 (–80) \times 9–12 (–14) μm . *Ascospores* ovoideae, 1-septatae, brunneae,

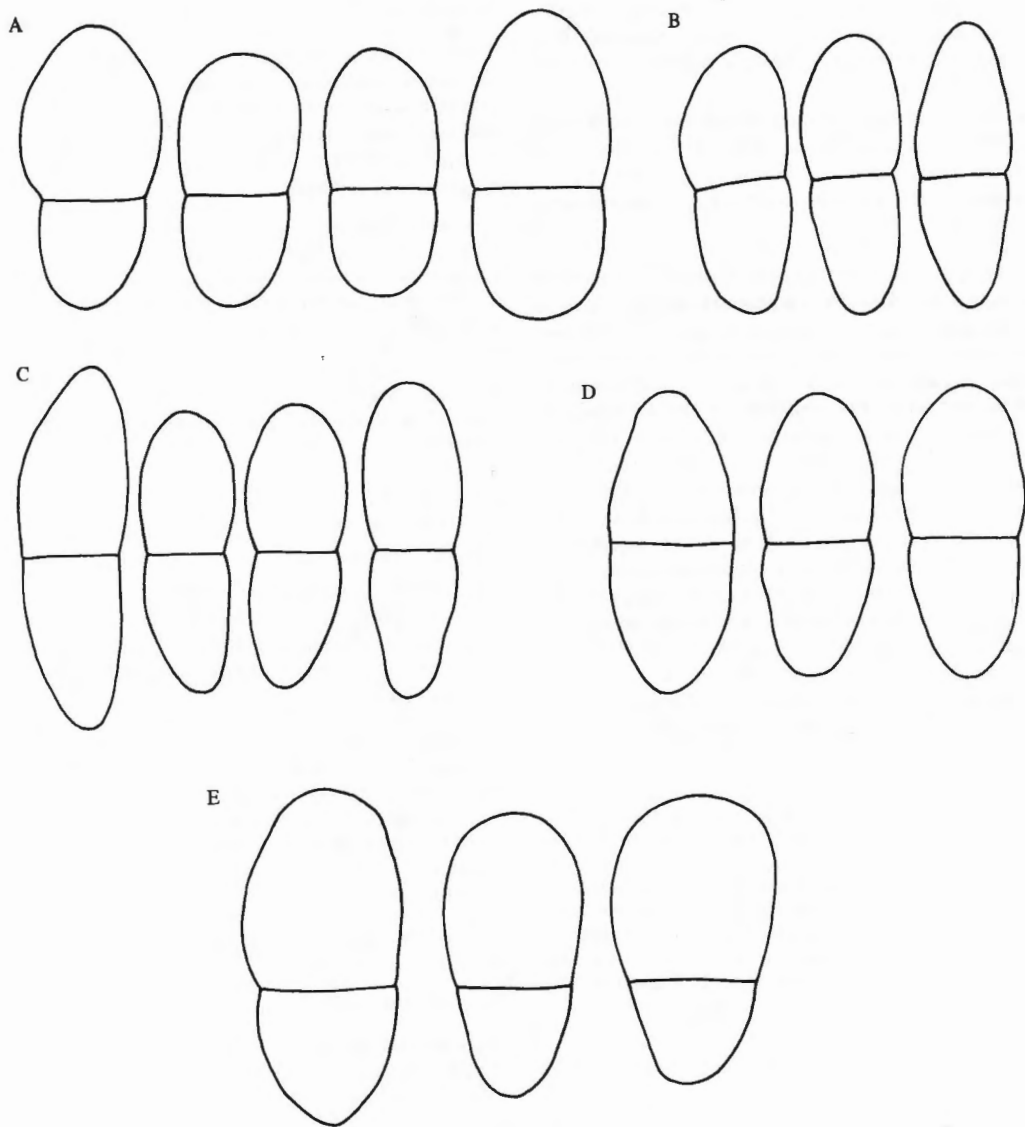


Fig. 2. Ascospore outlines of *Polycoccum* species with ascospores exceeding $25\ \mu\text{m}$ in length. (A) *P. cartilagosum* (M - lectotype); (B) *P. dzieduszyckii* (K - holotype of *Microthelia dispota*); (C) *P. crassum* (herb. Vězda - holotype); (D) *P. versisporum* (M - isotype); (E) *P. marmoratum* (Arnold, K).

verruculosae, $(12.5-13.5-16.5(-20) \times (6-6.5-8(-9))\ \mu\text{m}$.

Typus. Germania, Saarland, W St. Wendel, in thallo *Cladoniae*, in muscis, 12 Oct. 1977, V. John 711 (POLL - holotype; herb. Diederich - isotype).

Ascomata growing on the thallus of *Cladonia* species (squamules), at first immersed, \pm super-

ficial at maturity, scattered, subglobose, ostiolate, black, $100-250\ \mu\text{m}$ diam; wall brown, thickened near the ostiole, cells pseudoparenchymatous, $2-7\ \mu\text{m}$ diam. *Hamathecium* consisting of branched and anastomosing septate pseudoparaphyses (?paraphysoids), $1.5-2\ \mu\text{m}$ thick; centrum not turning blue in iodine. Asci arising in the lower part of the

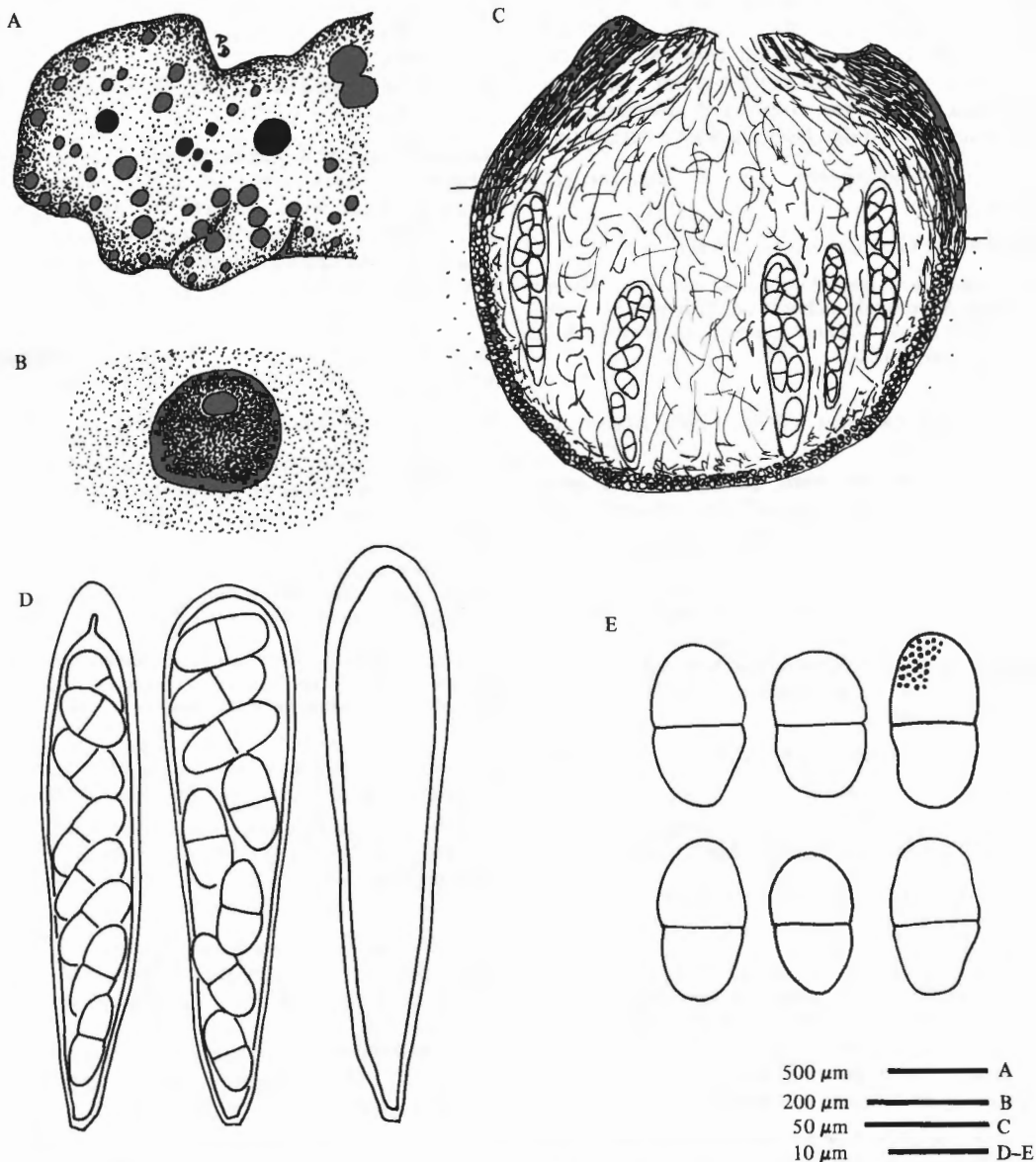


Fig. 3. *Polycoccum cladoniae* (POLL-holotype). (A) Infected *Cladonia squamule*; (B) surface view of ascoma; (C) vertical section of ascoma; (D) asci in different stages of development; (E) ascospores (detail of ornamentation in one).

ascomatal cavity, elongate-clavate, bitunicate in structure, thick-walled, the apex more strongly thickened, 8-spored, $40-60$ (-80) \times $9-12$ (-14) μm . *Ascospores* irregularly arranged in the asci, oval, 1-septate, often constricted at the septum, rounded at the apices, the cells \pm equal in size, brown, verruculose, $13.5-16.5 \times 6.5-8$ μm (length: $\bar{X} = 15.0$ μm , S.D. = 1.3 μm , $L_{\text{min}} = 12.5$ μm , $L_{\text{max}} =$

17.5 μm , $n = 50$; width: $\bar{X} = 7.5$ μm , S.D. = 0.6 μm , $W_{\text{max}} = 9$ μm , $n = 50$).

Polycoccum cladoniae is the first *Polycoccum* species to be discovered on *Cladonia* species. The infected thallus is discoloured or bleached by the presence of the parasite and becomes bullate. Apart from the different host, the new species is separated from

most other *Polycoccum* species by the shape and size of the spores and the ascomata, and the 8-spored asci. In the collection from Austria, rare ascospores up to $20-22 \times 8.5-9 \mu\text{m}$ were encountered; these are considered aberrant, and consequently excluded from the above description.

Hosts. *Cladonia* species (e.g. *C. digitata* (L.) Hoffm.).

Distribution. Germany and Austria.

Other specimen examined: Austria: Ostalpen, Grazer Bergland, Steiermark, Schöckl nördlich von St. Rade-gund, 1200 m, on *Cladonia digitata*, 23 May 1978, J. Hafellner 3903 (GZU).

POLYCOCCUM CRASSUM Vězda, *Česká Mykol.* 24: 227 (1970). (Fig. 2C)

Ascomata erumpent with the upper $\frac{2}{3}$ or more exposed at maturity, obpyriform, 300-400 (-500) μm diam. *Hamathecial* filaments 2-2.5 μm wide; hymenial gelatine I+reddish. *Asci* subcylindrical, (90-) 100-120 \times (10-) 12-15 (-16) μm , 4-spored. *Ascospores* \pm monostichously arranged, broadly fusiform, cells \pm equal in size, septum sometimes strongly thickened, brown, coarsely rugulose with labyrinthiform ornamentation, (25-) 30-32 (-36) \times 8-10 (-11) μm .

Illustrations. Hawksworth (1983b: 758), Vězda (1970: 226).

Hosts. *Peltigera* species (e.g. *P. lepidophora* (Nyl.) Bitter, *P. cf. neckeri* Hepp ex Müll. Arg.).

Distribution. British Isles, Czechoslovakia and Luxembourg.

A distinctive species separated from other long-spored species of the genus by the narrower and more fusiform ascospores which also have a most characteristic ornamentation (to 0.5 μm tall). 1-2 guttules are often present, so at low magnification spores may at first be considered 2-3 septate.

Specimens examined: British Isles: Inner Hebrides, Tiree, on *Peltigera cf. neckeri*, April 1983, B. J. Coppins (E). Czechoslovakia: Tatra Magna, Belanské Tatry, Jeleni hrbet prskalna vrata, 1600 m, on *Peltigera lepidophora*, July 1963, A. Vězda (herb. Vězda - holotype of *Polycoccum crassum*). Luxembourg: Steinfort, carrières, on *Peltigera* sp., 12 Sept. 1985, P. Diederich 6384 (herb. Diederich).

POLYCOCCUM DZIEDUSZYCKII (Boberski) D. Hawksw., in Hawksworth, James & Coppins, *Lichenologist* 12: 67 (1980). (Fig. 2B)

Microthelia dzieduszycyckii Boberski, *Spraw. Kom. fizyogr. Kraków* 22(2): 68 (1888).

Phaeospora parasitica forma *dzieduszycyckii* (Boberski) Keissler, Rabenh., *Krypt.-Fl.* 9, 1(2): 50 (1936).

Microthelia dispersa A. L. Sm., *J. Bot., Lond.* 49: 44 (1911).

Ascomata erumpent, $\frac{1}{2}$ or more exposed at maturity, subglobose, 50-100 μm diam. *Hamathecial* filaments 1.5-2 μm wide. *Asci* clavate, 55-70 \times 12-15 μm , 2-spored. *Ascospores* \pm monostichously arranged or overlapping, ellipsoid, cells \pm equal in size, brown, verruculose, 25-35 (-44) \times 8-10 (-14) μm .

Hosts. *Verrucaria baldensis* Massal. and probably other pyrenocarpous lichens on limestones.

Distribution. British Isles and Poland.

Although Boberski's collection has not been traced, his description leaves no doubt that his name was based on material conspecific with that from the British Isles. It is reported to have the largest ascospores in the genus, but ones of over 30 μm are scarce. No other species of the genus has consistently 2-spored asci.

Specimen examined. British Isles: Gloucestershire, S Apperton, Four Mile House, on *Verrucaria baldensis*, W. Joshua (K - holotype of *Microthelia dispersa*).

POLYCOCCUM EPICRASSUM (H. Olivier) R. Sant., *Svensk Bot. Tidskr.* 54: 504 (1960). (Fig. 1L)

Buellia epicrassa H. Olivier, *Bull. Int. Acad. géogr. Bot.* 14: 281 (reprint p. 29) (1905).

Didymosphaeria epicrassa (H. Olivier) Vouaux, *Bull. Soc. mycol. Fr.* 29: 108 (1913).

Ascomata arising in necrotic patches to 1.5 mm diam, 60-120 (-150) μm diam. *Hamathecial* filaments ca 2 μm wide. *Asci* elongate-clavate to subcylindrical, 55-80 \times 12-20 μm , 8-spored. *Ascospores* distichously arranged, ellipsoid, rounded at the apices, dark olivaceous brown, upper cell somewhat larger, verruculose, (15-) 19-22 (-26) \times (6-) 7-9 (-10) μm .

Illustration. Hawksworth (1986: 504).

Host. *Squamarina cartilaginea* (With.) P. James (thallus).

Distribution. We have seen material from the British Isles and Italy. It has been reported from Morocco (Keissler, 1933; Werner, 1954), Spain (Santesson, 1960), France (Vouaux, 1913), and incorrectly from Sweden (Keissler, 1923; Santesson, 1960).

Type material of H. Olivier has not been traced. The record of Bird *et al.* (1981) on *Placopsis gelida*

(L.) Lindsay from Canada is probably an error for *P. squamarioides* (q.v.).

This species was also mentioned from Norway on *Hymenelia lacustris* M. Choisy by Øvstedal (1986); we have seen two *Polycoccum*-like fungi on this host also from the British Isles (Breconshire, Nant y Gro, by Caban Coch reservoir, 8 Mar. 1987, A. Orange 4727, IMI 315597; Perthshire, Lochan an Cat, 23 July 1986, B. W. Fox, IMI 314120). Their identities require further study but neither seem to be conspecific with *P. epicrassum*.

Specimens examined: British Isles: Cornwall, Penhale Sands, on *Squamarina cartilaginea*, Aug. 1983, O. L. Gilbert (IMI 286819). Italy: Toscana, Siena prov., Chianti, ca 1 km NW of Castello di Brolio, on *S. cartilaginea*, 5 May 1985, B. J. Coppins 12000 (E, IMI 298196).

POLYCOCCUM GALLIGENUM Vězda, *Česká Mykol.* 29: 107 (1969). (Fig. 1G)

Ascomata arising in bullate galls, immersed, individual ascomata 150–200 µm wide and 150–300 µm tall. *Hamathecial* filaments 1.5–2.5 µm wide. *Asci* elongate-clavate to broadly cylindrical, 75–100 × 10–16 µm, 8-spored. *Ascospores* irregularly monostichously arranged, ellipsoid, brown, verruculose, 14–18 (–21) × 7–9 µm.

Illustrations. Hawksworth (1975: 198), Vězda (1969: 106).

Hosts. *Physica caesia* (Hoffm.) Fürnrohr, *P. dubia* (Hoffm.) Lettau and *P. wainioi* Räsänen.

Distribution. British Isles and Czechoslovakia.

Although the ascospore dimensions recall those of *P. cladoniae* (q.v.), the ascomata differ in that they are not flattened at the apex and lack the broad ostiolar opening characteristic of that species.

Specimens examined: British Isles: Devon, Kingsbridge, Dodbroke Church, on *P. caesia*, 6 Aug. 1985, D. L. Hawksworth 5530 (IMI 296956); Sussex, Lindfield Church, on *P. caesia*, 3 Nov. 1973, B. J. Coppins (IMI 185174); Suffolk, Aldeburgh, on *P. caesia*, 23 July 1980, C. J. B. Hitch (herb. Hitch); Ayrshire, Loch Doon, on *P. caesia*, 5 Aug. 1975, B. J. Coppins 1034 (E, IMI 197665). Czechoslovakia: Moravia austro-occident., Moravsky Krumlov, in valle fluvii Rokytka prope pagum Budkovice, 300 m, on *P. dubia*, 7 Apr. 1964, A. Vězda (Vězda, *Lich. Sel. Exs.* no. 775) (BM, LG – paratypes of *Polycoccum galligenum*); *loc. cit.*, on *P. wainioi*, 28 July 1977, A. Vězda (LG); Moravia, distr. Blankso, near Krtiny church, 400 m, on *P. caesia*, 18 May 1986, A. Vězda (Santesson, *Fungi Lich. Exs.* no. 66) (IMI 314266).

POLYCOCCUM GELIDARIUM (Mudd) D. Hawksw., *Lichenologist* 15: 5 (1983). (Fig. 1M)

Sphaeria gelidaria Mudd, *Man. Br. Lich.*: 130 (1861).

Ascomata immersed, arising in small groups. *Hamathecial* filaments 1–1.5 µm wide. *Asci* not seen, 4-spored (*vide* Mudd, *loc. cit.*). *Ascospores* broadly ellipsoid, with rounded ends, cells ± equal, olive-vaccuous brown, ornamented with sparse coarse verrucae, 18 × 10.5 µm (one only seen).

Host. *Placopsis gelida*.

Distribution. British Isles; only known from the original collection.

The single specimen located is in poor condition and few intact ascomata remain. However, the nature of the hamathecium and the pseudo-parenchymatous nature of the ascomatal wall (cells ca 7 µm diam in surface view) leave no doubt that it belongs in *Polycoccum*. The spore seen is distinctive and the spores should be easily recognized if encountered.

Specimen examined: British Isles: Teesdale, on *Placopsis gelida* (ex herb. W. Mudd) (BM – holotype of *Sphaeria gelidaria*).

POLYCOCCUM INNATUM (Müll. Arg.) D. Hawksw., *Bull. Br. Mus. nat. Hist. (Bot.)* 14: 152 (1985). (Fig. 1H)

Microthelia innata Müll. Arg., *Bot. Jb.* 6: 417 (1885).

Ascomata immersed, strongly thickened in the upper part, wall poorly developed below, 75–120 (–150) µm wide and 100–150 µm tall. *Hamathecial* filaments 1.5–2 µm wide. *Asci* elongate clavate, 8-spored. *Ascospores* distichously arranged, broadly ellipsoid, rounded or slightly attenuated at the apices, the upper cell slightly larger, brown, verruculose to ± smooth-walled, with a gelatinous sheath often swelling in potassium hydroxide, (15–) 16–18 (–19) × (6.5–) 7–8 (–8.5) µm.

Illustration. Hawksworth (1985a: 152).

Distribution. Cuba; only known from the type collection.

Host. Biological status uncertain, associated with an unidentified crustose thallus on bark.

This species is distinguished by the unusual structure of the ascomata and further by the presence of a distinct gelatinous sheath on the ascospores (otherwise only reported in *P. kernerii* and in *P. opulentum*).

Specimen examined: Cuba: sine loc., C. Wright (Wright, *Verr. Cub.* no. 231) (G – holotype of *Microthelia innata*).

POLYCOCCUM JAMESII D. Hawksw., *Lichenologist* 17: 298 (1985). (Fig. 1E)

Ascomata arising in convex galls, to 60 per gall, immersed to erumpent, 75–150 μm diam. *Hamathelial* filaments 2–3 μm . *Asci* elongate-clavate, 45–55 \times 15–20 μm , 8-spored. *Ascospores* distichously arranged, ellipsoid, cells \pm equal in size, apices broadly rounded, olivaceous brown, smooth, 10–12 (–13) \times 6.5–7.5 (–8.5) μm .

Illustration. Hawksworth (1985b: 299–300).

Host. *Psoromidium versicolor* (J. D. Hooker & Taylor) D. Galloway.

Distribution. Australia (Tasmania). Only known from the original collection.

This species is distinguishable from all others accepted here on the basis of the smooth ascospores which have \pm equal cells with broadly rounded apices.

Specimen examined: Australia: Tasmania, Pine Valley, 890 m, on *Psoromidium versicolor*, 1983, G. Kantvilas 93/83 (IMI 288325 – holotype of *Polycoccum jamesii*; BM – isotype).

POLYCOCCUM KERNERI Steiner, *Sber. Akad. wiss. Wien, math.-nat. Kl.* 102: 162 (1893).

Ascomata erumpent, 200–300 μm diam. *Hamathelial* filaments 3–4 μm wide. *Asci* fusiform to cylindrical, 8-spored. *Ascospores* \pm monostichously arranged, ovoid, rounded at the apices, with a gelatinous sheath, 11–14 \times 8–9 μm .

Host. *Lecidea fuscoatra* (L.) Ach.

Distribution. Greece; only known from the original collection.

We have not seen any material of this species and the above notes are based on the original description. A mycelium also grew on the areolae, and Vouaux (1913: 109) stressed the spore 'halo' as a distinguishing feature. In view of the broad hamathelial filaments it may be that this species does not really belong to *Polycoccum*.

POLYCOCCUM MARMORATUM (Krempelh.) D. Hawksw., in Hawksworth, James & Coppins, *Lichenologist* 12: 107 (1980). (Fig. 2E)

Tichothecium marmoratum Krempelh., *Denkschr. K. bayer. bot. Ges. Regensb.* 4: 298 (1861).

Microthelia dispورا forma *octospora* W. Watson, *J. Bot., Lond.* 63: 123 (1925).

Ascomata immersed to erumpent and almost superficial when mature, (150–) 200–250 (–300) μm diam. *Hamathelial* filaments 2–2.5 μm wide; hymenial gelatine turning blue in iodine, at least in parts. *Asci* elongate-clavate, 50–90 μm tall, 8-spored. *Ascospores* broadly ellipsoid, the upper cell much larger and to $\frac{2}{3}$ the length of the spore, rounded at the apices, dark brown, coarsely verruculose, (20–) 25–30 (–36) \times 14–18 μm .

Illustrations. Keissler (1936: 42), Kopaczewskaja *et al.* (1977: 202), Nowak & Tobolewski (1975: 290), Ozenda & Clauzade (1970: 186), and Swinscow (1966: 234).

Host. On pyrenocarpous and crustose lichens on limestone.

Distribution. We have seen specimens from the British Isles, Italy and Spain. There are also reports from many other countries in Europe including Austria (Keissler, 1936: 42), Bulgaria (Popnikolov & Železova, 1964: 69), France (Ozenda & Clauzade, 1970: 186; Roux, 1982), Germany (Keissler, 1936: 42), Poland (Nowak & Tobolewski, 1975: 289), Romania (Moruzi *et al.*, 1967: 44), the USSR (Kopaczewskaja *et al.*, 1977: 202), and Yugoslavia (Kušan, 1953: 79).

This species has the broadest spores known in the genus. It is most similar to *P. cartilagosum* which differs in the lack of a blue colouration of the hymenial gelatine in iodine and narrower more equally celled ascospores.

Specimens examined: British Isles: Banffshire, Craig Bhuilg, with *Thelidium incavatum* Nyl. ex Mudd, ca 400 m, 7 July 1975, B. J. Coppins 4644 (E); Gloucestershire, Crickley Hill, 26 Mar. 1923, H. H. Knight (K – holotype of *Microthelia dispورا* forma *octospora*); Pembrokeshire, Broadhaven, on *Lecidea monticola* (Ach.) Schaerer, Aug. 1977, J. Fildes (IMI 239737). Italy: Kurstein bei Eichstätt, June 1862, F. Arnold (Arnold, *Lich. Exs.* no. 246) (K). Spain: Catalunya, Somaiija, on *Verrucaria calciseda* DC., 23 Oct. 1983, V. Navarro 103 (IMI 298707).

POLYCOCCUM MICROSTICTICUM (Leighton ex Mudd) Arnold, *Ber. bayer. Bot. Ges.* 1 (Anh.): 132 (1891). (Fig. 1F)

Acarospora cervina [var.] *microstictica* Leighton ex Mudd, *Man. Br. Lich.*: 159 (1861).

Didymosphaeria microstictica (Leighton ex Mudd) Winter, Rabenh., *Krypt.-Fl.* 1(2): 430 (1885).

Ascomata immersed, (50–) 100–150 μm diam. *Hamathelial* filaments 1.5–2.5 μm wide. *Asci* broadly cylindrical, 65–90 \times 10–12 μm , 4–8-spored. *Ascospores* irregularly monostichously to distichously

arranged, ellipsoid, cells \pm equal in size or the upper slightly larger, rounded at the apices, dark brown, generally coarsely verruculose, $14-18 \times 7-8.5 \mu\text{m}$.

Hosts. *Acarospora fuscata* (Nyl.) Arnold, *A. (Xanthothallia) sp.*, *Buellia stellulata* and (?) *Rhizocarpon sp.*

Distribution. We have seen material from the British Isles, Ireland, and U.S.A. Also reported from Germany, Sweden (Keissler, 1923) and Italy (Keissler, 1930).

Four- and 8-spored asci can be found in the same ascoma; asci with four maturing and four absorbing spores were also noted in IMI 254095. At first we were uncertain whether the specimens not on *Acarospora* should be included but no clear morphological basis for this could be found; however, in the specimen on *Buellia stellulata* the ascospores were particularly coarsely ornamented. *P. microsticticum* is separated from other species with similarly shaped spores by their size, the nature of the ornamentation, and the dimensions of the ascomata.

Specimens examined: British Isles: Ayrshire, near Kennedy's Pass, on *Buellia stellulata*, 1 Aug. 1975, B. J. Coppins (E); Merioneth, Barmouth, Borthwen, on *Acarospora sp.*, 1872, W. A. Leighton (K); Shropshire, N of Craven Arms, Roundton Hill, 350 m, on *A. fuscata*, 26 Oct. 1980, B. L. W. Fox 1124 (IMI 254095). Ireland: Co. Kerry, Kenmare, Dunkerron, on (?) *Rhizocarpon sp.*, T. Taylor (K). U.S.A.: Cayota Canyon, 400 m, on *A. (Xanthothallia) sp.*, 14 Apr. 1966, W. A. Weber & R. Santesson 17833 (Santesson, *Fungi Lich. Exs.* no. 67) (IMI 314267).

POLYCOCCUM OPULENTUM (Th. Fr. & Alm.)
Arnold, *Flora, Jena* 57: 144 (1874).

Endococcus opulentus Th. Fr. & Alm., *Bot. Notiser* 1867: 109 (1867).

Didymosphaeria opulenta (Th. Fr. & Alm.) Sacc. & D. Sacc., in Sacc., *Syll. Fung.* 17: 682 (1905).

Ascomata half-immersed, $100-150 \mu\text{m}$ diam. *Hamathelial* filaments $3 \mu\text{m}$ wide; hymenial gelatine turning blue in iodine. *Asci* broadly clavate, $75-90 \times 25-35 \mu\text{m}$, 8-spored. *Ascospores* ellipsoid, the upper cell larger, rounded at the apices, dark brown, with a gelatinous sheath, $25-28 \times 11-14 \mu\text{m}$.

Hosts. *Polyblastia intercedens* (Nyl.) Lönnr. and *Lecidea plana* (Lahm) Nyl.

Distribution. Sweden and Spain (Santesson, 1960).

We have not studied material of this species which has been examined critically by Santesson (1960) who stressed the gelatinous sheath on the spores. It can also be readily distinguished from most other large-spored species with 8-spored asci by the size of the ascomata, but is rather close to *P. cartilaginsum*, differing in the reaction with iodine and the ascospore sheath.

POLYCOCCUM PELTIGERAE (Fueckel) Vězda, *Česká Mykol.* 23: 109 (1969). (Fig. 1D)

Didymosphaeria peltigerae Fueckel, *Jahrb. Nassauischen Vereins Naturk.* 23-24: 140 (1870).

Ascomata immersed, becoming erumpent only in the vicinity of the ostiole, more rarely in the upper $\frac{1}{2}$, arising in groups in somewhat swollen areas of the thallus, mainly $125-175 \mu\text{m}$ wide and $125-240 \mu\text{m}$ tall. *Hamathelial* filaments $1.5-2.5 \mu\text{m}$ wide. *Asci* elongate-clavate, $55-75 \times 8-12 \mu\text{m}$, 4-8-spored. *Ascospores* irregularly monostichously arranged, ellipsoid to fusiform, cells \pm equal in size, generally somewhat attenuated at the ends, pale brown to olivaceous, smooth, $(12-)$ $13.5-16 (-18) \times 4-6 (-7) \mu\text{m}$.

Illustrations. Hawksworth (1978: 190; 1985a: 61), Müller & von Arx (1962: 291), Scheinpflug (1958: 353).

Hosts. On diverse *Peltigera* species.

Distribution. Belgium, British Isles, Germany, Luxembourg, and Sweden. Also recorded from France and Switzerland (Keissler, 1930). This species was also reported from *Parmelia reticulata* Taylor in India by Raikar & Patwardhan (1979), but according to their illustration that specimen appears most likely to be a species of *Clypeococcum*.

P. peltigerae is distinguished from other species of the genus with relatively large ascomata in that these are often entirely immersed in the host thallus, and more importantly by the narrow and equal-celled ascospores tending to have attenuated apices. Considerable variation in the shape of the ascospores can occur even within a single ascoma. Fusiform and ellipsoid ascospores tend to occur in separate asci but this is clearly not taxonomically important; these types are both shown in Fig. 1D. The ascospores in 4-spored asci are usually larger than those in 8-spored asci.

Specimens examined: Belgium: S Han-sur-Lesse, on *P. praetextata* (Flörke ex Sommerf.) Zopf, 23 Mar. 1985, P. Diederich 5920 (herb. Diederich). British Isles: Derbyshire, Lathkill Dale, on *P. praetextata*, 19 May 1980, D. L. Hawksworth 5011 (IMI 254100); Lancashire, Formby, Freshfield dunes, on *P. canina* (L.) Willd. *s.l.*,

14 May 1951, G. Salisbury (IMI 189658); Yorkshire, Hebden Bridge, Nutcleugh Mill, on *P. didactyla* (With.) Laundon, 23 Nov. 1973, P. M. Earland-Bennett (E, IMI 212820). Germany: S Manderscheid, vallée de la Kleine Kyll, on *P. praetextata*, 19 June 1984, P. Diederich 5534 (herb. Diederich). Luxembourg: Esch-sur-Alzette, Lallingerberg, on *P. rufescens* (Weis) Humb., 10 July 1986, M. Asperges (herb. Diederich 7836); Kayl, Léiffrächen, on *P. rufescens*, 17 March 1987, G. Marson (herb. Diederich 7856); Dudelange, Haardt, on *P. rufescens*, 22 Aug. 1981, P. Diederich 3323 (herb. Diederich). Sweden: Uppland, Estuna par., Norr Malma, Bybacken, on *P. praetextata*, 30 Sept. 1956, R. Santesson 13603 (Santesson, *Fungi Lich. Exs.* no. 68) (IMI 314268).

POLYCOCCUM RUGULOSARIUM (Lindsay) D. Hawksw., in Pegler, Spooner & Smith, *Kew Bull.* 35: 513 (1980). (Fig. 1C)

Microthelia rugulosaria Lindsay, *Trans. R. Soc. Edinb.* 25: 540 (1869).

Didymosphaeria rugulosaria (Lindsay) Sacc. & Trotter, in Sacc., *Syll. Fung.* 22: 177 (1913).

D. placodiorum Vainio, *Résult. Voyage Belgica 1897-1899, Rapp. Sci. Bot. (Lichens)*: 39 (1903).

Endococcus wandelensis Hariot, in Hue, *Expéd. Antarct. franç., Bot., Lichens*: 8 (1908).

Didymosphaeria wandelensis (Hariot) Sacc., *Syll. Fung.* 24: 933 (1926).

Rhabdospora antarctica Speg., *An. Mus. nac. B. Aires* 20: 390 (1910).

?*D. kuttlingeriae* Dodge, *B. A. N. Z. Res. Exped. 1929-1931, Reports*, ser. B, 7: 263 (1948).

?*D. macquariensis* Dodge, *B. A. N. Z. Res. Exped. 1929-1931, Reports*, ser. B, 7: 263 (1948).

Ascomata immersed in the apothecia or the thallus of the host, sometimes to $\frac{1}{4}$ erumpent with age, (50-) 75-100 (-180) μm diam. *Hamathecial* filaments 3-4 μm thick. *Asci* elongate-clavate, 60-80 \times 17-20 μm , 8-spored. *Ascospores* irregularly distichously arranged, ellipsoid, cells equal in size or the upper slightly larger, brown to dark brown, weakly verruculose, (10-) 12-15 (-16) \times (4-) 4.5-6 (-6.5) μm .

Illustration. Hawksworth (in Pegler *et al.*, 1980: 513).

Hosts. *Caloplaca cirrochrooides* (Vainio) Zahlbr., *C. regalis* (Vainio) Zahlbr. and *C. sublobulata* (Nyl.) Zahlbr.

Distribution. Antarctica (incl. South Orkney Islands and Bouvetøya) and Australia (Tasmania).

A distinctive species recognizable by the rather short and narrow \pm equal-celled ascospores; the hamathecial filaments are also rather broad. This fungus is confined to apothecia of a very restricted

group of hosts within the genus *Caloplaca*; it does not appear to damage the infected apothecia. The original material of *Endococcus wandelensis* Hariot was not traced by Hawksworth (*loc. cit.*), but has since been located in PC by Mrs F. J. White and examined (see below). This was said to occur in the apothecia of *Lecanora wandelensis* Hue which proved to be based on a thallus of a species of *Usnea* subgen. *Neuropogon* intimately intermixed with a *Caloplaca* of the *C. regalis* group. The specimen is fragmentary and while no *Polycoccum* ascomata were located in the few remaining apothecia, a few brown 1-septate ascospores were found on squashed thallus fragments of the *Caloplaca*; the measurements given by Hariot (*loc. cit.*) of 12-14 \times 4-6 μm agree with those of *P. rugulosarium*. The identity of *Rhabdospora antarctica* is discussed in Hawksworth (1981, pp. 84-85).

Specimens examined: Antarctica: Antarctic Peninsula, Détroit de Gerlache, Ile Auguste, on *C. regalis*, 1898, E. G. Racovitza 1-211 (TUR-VAINIO 32503 - lectotype of *Didymosphaeria placodiorum*); Cap van Beneden, Terre de Danco, on *C. regalis*, 1898, E. G. Racovitza 219 (TUR-VAINIO 32504); Palmerarchipel, Isla Doumer, unweit der Station Yolcho, 30 m, on *C. regalis*, Feb. 1963, G. Follmann (Follmann, *Lich. Exs. Sel. Mus. Bot. Berol.* Ed. no. 49, sub *Polycauliona regalis*) (KOELN); *ibid.*, 60 m, on *C. regalis*, 1963, G. Follmann 13931b (KOELN, herb. Diederich); Bouvetøya, Nyroysa SSE, above Sørstranda, 50 m, on *C. cirrochrooides*, 13 Jan. 1979, T. Engelskjøn 336 (O); King George Island, Penguinera östl. Station, on *C. regalis*, 21 Nov. 1984, L. Kappen A751 (IMI 317261); South Orkney Islands, on *C. cf. regalis*, Jan. 1908, C. Spegazzini (LPS 21677 p.p.; LPS 11231 - holotype of *Rhabdospora antarctica*); South Orkney Islands, Isla Laurie, Bahia Escocia, on *C. regalis*, 28 Feb. 1953, A. C. Hunziger 10231b (KOELN); Wandel Island, on *C. sp.*, 1903-1909, herb. Hue 279 (PC - holotype of *Endococcus wandelensis*). Australia: Tasmania, South Port, on *C. rugulosa*, C. Stuart (BM - holotype of *Microthelia rugulosaria*).

POLYCOCCUM SPORASTATIAE (Anzi) Arnold, *Flora, Jena* 57: 144 (1874).

Tichothecium sporastatae Anzi, *Atti Soc. Ital. Sci. nat. Milan* 9: 257 (p. 17 of reprint) (1866).

Didymosphaeria sporastatae (Anzi) Winter, *Rabenh., Krypt.-Fl.*, 1 (2): 431 (1885).

Ascomata immersed in convex gall-like swellings on areoles of the host, ca 150-200 μm wide and ca 200-250 μm tall, associated with a superficial network of hyphae. *Hamathecial* filaments ca 2 μm wide. *Asci* elongate-clavate, 55-80 \times 17-20 μm , 4- or rarely 8-spored. *Ascospores* distichously arranged, broadly ellipsoid, upper cell often slightly broader and rounded, the lower often somewhat attenuated, olivaceous brown at maturity, 16-23 (-25) \times 6-9.5 (-12) μm .

Illustration. Arnold (1874: table 2, fig. 9).

Hosts. *Sporastatia polyspora* (Nyl.) Grumm. and *S. testudinea* (Ach.) Massal.

Distribution. Austria and Switzerland. It has also been mentioned from France (Rondon, 1970).

We have not seen material of this species and the above notes are adapted from the original description and that of Keissler (1930, p. 474). This species appears to be distinguishable from all others with relatively large ascospores on the basis of the length of the ascospores and the generally 4-spored asci.

POLYCOCCUM SQUAMARIOIDES (Mudd) Arnold, *Flora, Jena* 57: 174 (1874). (Fig. 1N)

Sphaeria squamarioides Mudd, *Man. Br. Lich.*: 130 (1861).

Didymosphaeria squamarioides (Mudd) Sacc. & D. Sacc., *Syll. Fung.* 17: 681 (1905).

?*Sorothelia confuens* Körber, *Parerga Lich.*: 472 (1865).

?*Microthelia perrugosaria* Lindsay, *Trans. R. Soc. Edinb.* 24: 437 (1866).

?*Didymosphaeria perrugosaria* (Lindsay) Sacc. & Trotter, *Syll. Fung.* 22: 176 (1913).

Ascomata immersed, not causing deformations of the host, 75–100 µm diam. *Hamathecial* filaments 1.5–2.5 µm wide. *Asci* elongate-clavate, ca 60 × 15 µm, 8-spored. *Ascospores* distichously arranged, ellipsoid, cells ± equal in size, scarcely constricted at the septum, tending to taper towards the rounded ends, olivaceous to almost black, ± smooth-walled, (18–)19–26 × (5.5–) 6–7 (–8) µm.

Illustrations. Keissler (1930: 404–405) and Zopf (1897: 113–114).

Hosts. *Placopsis gelida* and *P. perrugosaria* (Nyl.) Nyl. (apothecia).

Distribution. British Isles, France, Sweden, and New Zealand. It has also been reported by Rondon (1970) from the Canary Islands on *Pertusaria multipuncta* (Turner) Nyl.

This species is close to *P. epicrassum* in the overall ascospore dimensions but differs in that the ascospore cells are ± equal in size and tend to be slightly narrower as well as in occurring on different hosts. *P. gelidarum*, which also grows on *Placopsis* species, has broader and more rounded ascospores produced in 4-spored asci and with distinct verrucose ornamentation.

Specimens examined: British Isles: 'Common in Scotland', on *Placopsis gelida*, J. Harriman (E – ?isotype of

Sphaeria squamarioides); Inverness, Invermoidart, on *P. gelida*, Feb. 1908, S. M. MacVicar (E); Outer Hebrides, Isle of Lewis, Loch Erisort, on *P. gelida*, Aug. 1959, S. A. Manning (E). Greenland: Narassaq District, Kvane-fjeld, 525 m, on *P. gelida*, 29 June 1978, V. Alstrup 2438279 (C). Sweden: Jämtland, Are parish, waterfalls of Handöl, 580 m, on *P. gelida*, 4 Aug. 1948, R. Santesson 48.189 (Santesson, *Fungi Lich. Exs.* no. 69) (IMI 314269).

POLYCOCCUM TRYPETHELIOIDES (Th. Fr.) R. Sant., *Svensk Bot. Tidskr.* 54: 505 (1960). (Fig. 1O)

Diatrype trypethelioides Th. Fr., *Acta Reg. Soc. Sci. Ups.*, ser. 3, 2 (1): 317 (1858).

Polycoccum condensatum Sauter, in Körber, *Parerga Lich.*: 470 (1865); nom. inval. (Art. 34).

Microthelia stereocaulicola Lindsay, *Trans. R. Soc. Edinb.* 25: 537 (1869).

Didymosphaeria stereocaulicola (Lindsay) Sacc., *Syll. Fung.* 17: 681 (1905).

Lophothelium acervatum Stirton, *Scott. Naturalist (Perth)* 9: 37 (1887).

Discothecium acervatum (Stirton) A. L. Sm., *Monogr. Br. Lich.*, ed. 2, 2: 387 (1926).

Polycoccum sauteri Körber, *Parerga Lich.*: 470 (1865).

Discothecium sauteri (Körber) Vouaux, *Bull. Soc. mycol. France* 29: 55 (1913).

?*Polycoccum sauteri* var. *margarodes* Norman, *Scripta Soc. R. Sci. Norw.* 5: 377 (1868) (not seen).

?*Didymosphaeria sauteri* var. *margarodes* (Norman) Sacc. & Trav., *Syll. Fung.* 19: 600 (1910).

Ascomata immersed in massive subglobose galls on the thallus of the host, 150–250 µm diam. *Hamathecial* filaments 1.5–2.5 µm wide. *Asci* elongate-clavate, (74–) 80–100 × (14–) 16–19 µm, 8-spored. *Ascospores* irregularly monostichously arranged, the upper cell much larger in size, the lower only about $\frac{1}{3}$ the length of the spore, broadly ellipsoid to soleiform, brown to dark brown, smooth, 14–22 × 8–10 µm.

Illustrations. Arnold (1874: table 2, fig. 10, *P. sauteri* var. *margarodes*), Galløe (1972: pls 56–57), and Hawksworth (1978: 192).

Hosts. Diverse *Stereocaulon* species.

Distribution. British Isles, Sweden, Greenland (Alstrup, 1981), Finland (Keissler, 1930) and Germany.

This, the type species of *Polycoccum*, is readily recognized by the rounded shape and unequal cells of the ascospores; it is unlikely to be confused with any other species of the genus, no other member of which is known on *Stereocaulon*. The type material

of *Diatrype tryptelioides* Th. Fr. in UPS and of *P. sauteri* in L was studied by Santesson (1960) and so was not restudied by us. *P. sauteri* var. *margarodes* Norman is probably not correctly placed here but we have not seen the original material; the ascospores were figured as occasionally becoming 1-septate by Arnold (1874: table 2, fig. 10) and the host was said to be *Lecidea fumosa*.

Specimens examined: British Isles: Aberdeenshire, Braemar, Glen Derrie, July 1854, A. Croall (E - holotype of *Microthelia stereocaulicola*); Banffshire, River Avon, NW of Inchroy, on *Stereocaulon* sp., 10 July 1975, B. J. Coppins & P. Harrold 902 (E, IMI 997662); Morayshire, Culbin Forest, 10 m, on *S. condensatum* Hoffm., 27 Aug. 1983, B. J. Coppins 9957 (Vězda, *Lich. Sel. Exs.* no. 1974) (BM); Perthshire, Ben Lawers, Craig-na-Guur, 18 July 1866, J. Stirton (K - holotype of *Lophothelium acervatum*). Sweden: Torne Lappmark, Torneträsk area, Vassitjåkko, 1000 m, on *S. alpinum* Laurer, 16 July 1948, R. Santesson (Santesson, *Fungi Lich. Exs.* no. 34) (IMI 292406).

POLYCOCCUM UMBILICARIAE (Lindsay) D. Hawksw.
Bull. Br. Mus. nat. Hist. (Bot.) 14: 171
(1985). (Fig. 1I)

Microthelia umbilicariae Lindsay, *Trans. R. Soc. Edinb.* 25: 538 (1869).

Ascomata immersed in gall-like swellings, becoming erumpent in the upper $\frac{1}{4}$, exposed wall thickened, 100-150 μm diam. *Asci* elongate-clavate, 8-spored. *Ascospores* irregularly distichously arranged, ellipsoid, cells \pm equal in size, broadly rounded at the ends, occasionally non-septate, dark brown, smooth, 13.5-15 \times (6-) 6.5-7.5 μm .

Host. *Lasallia pustulata* (L.) MÉRAT.

Distribution. Norway.

A distinctive species easily distinguished in vertical sections by the thickened cellular erumpent part of the ascomata and the shape and size of the ascospores. This species is not to be confused with *Clypeococcum grossum* (Körber) D. Hawksw. which forms conspicuous galls on various *Umbilicaria* species; in that genus the ascomata have hyphal walls, are finally united by a common black clypeus, and the brown verruculose (not smooth) ascospores measure (14-) 16-20 (-21) \times 7-9(-10) μm ; this species has been cited from Scandinavia and Canada (Hawksworth, 1982) but material has also been seen from Greenland (Narssaq district, Kvanefjeld, on *U. cylindrica* (L.) Delise ex Duby, 24 July 1978, V. Alstrup 243936b, C) and New Zealand (Otago, Rock and Pillar Range, on *U. vellea* (L.) Ach., 18 Sept. 1981, F. J. Walker, IMI 314793). It is of interest to note that while *P.*

umbilicariae occurs on *Lasallia*, *C. grossum* appears to be restricted to species of *Umbilicaria* sensu stricto. If hamathecial filaments are lacking, see also *Endococcus gyrophorarum* below.

Specimen examined: Norway: 'Commercial pustulose moss', on *Lasallia pustulata* (E - holotype of *Microthelia umbilicariae*).

POLYCOCCUM VERMICULARIUM (Lindsay) D.
Hawksw., *Bull. Br. Mus. nat. Hist. (Bot.)* 14:
172 (1985). (Fig. 1J)

Lecidea vermicularia Lindsay, *Trans. R. Soc. Edinb.* 22: 143 (1859).

Ascomata remaining immersed except at the ostiole, (60-) 75-95 (-100) μm . *Hamathecial* filaments poorly developed, septate 1.5-2.5 μm thick. *Asci* elongate-clavate, 8-spored. *Ascospores* \pm distichously arranged, ellipsoid, cells \pm equal in size, brown, weakly verruculose, 14-18 \times 7-9 μm .

Host. *Thamnolia vermicularis* (Swartz) Ach. ex Schaerer.

Distribution. Falkland Islands.

This species has the smallest ascomata of the *Polycoccum* species treated here. The nature of the hamathecial tissue is difficult to determine and the species has therefore been referred to *Endococcus* previously (Hawksworth, 1979); vertical sections however, revealed occasional knobby septate pseudoparaphyses that could perhaps later develop into the extended filaments generally encountered in *Polycoccum*. The type material is rather scant precluding the more critical study needed to conclusively determine its position; that must await fresh collections.

Specimen examined: Falkland Isles: on *Thamnolia vermicularis*, 1842, J. D. Hooker (E - holotype of *Lecidea vermicularia*).

POLYCOCCUM VERSISPORUM (Bagl. & Car.) D.
Hawksw., *Bull. Br. Mus. nat. Hist. (Bot.)* 14:
173 (1985). (Fig. 2D)

Microthelia versispora Bagl. & Car., *Atti Soc. Critogam. Ital.* 2: 337 (1881).

Ascomata partially immersed. *Hamathecial* tissues not turning blue in iodine. *Asci* elongate-clavate, 4-spored. *Ascospores* ellipsoid, cells \pm equal in size or the lower slightly smaller, dark brown to almost black, rather coarsely verruculose, 28-32 \times 11-12 μm .

Host. On an undeterminable whitish saxicolous lichen.

Distribution. Italy.

This species recalls *P. marmoratum* from which it is separated by the 4-spored asci and the narrower ascospores with \pm equal cells. No intact asci were seen in the isotype examined, but Keissler (1936: p. 57) saw 4 (-6)-spored asci and a drawing on the packet in M depicts 4-spored asci. A detailed description must await the discovery of further specimens.

Specimen examined: Italy: Monte Plaide supra Riva Vallisessiter, F. Baglietto (M - isotype of *Microthelia versispora*).

EXCLUDED SPECIES

This section reviews the identity of 29 epithets that have either been placed in or considered as possibly representing *Polycoccum* species, together with other lichenicolous taxa that have been placed in *Didymosphaeria*. Such names proved to have been poorly catalogued and while we have endeavoured to make it as comprehensive as possible, this list is not to be treated as exhaustive.

Didymosphaeria atryneae (Arnold) Magnus, in Dalla Torre & Sarnth., *Fl. Tirol* 3: 648 (1905).

Endococcus atryneae Arnold, *Flora, Jena* 65: 410 (1882).

Treated by Keissler (1930, p. 375) as a synonym of the species now known as *Stigmidium schaeferi* (Massal.) Trevisan.

Didymosphaeria caudata (Kernst.) Magnus, in Dalla Torre & Sarnth., *Fl. Tirol* 3: 473 (1905).

Cercidiospora caudata Kernst., *Ver. zool.-bot. Ges. Wien* 44: 212 (1894).

This species, reported on *Caloplaca* Th. Fr. species, recalls *D. epipolytropa* (q.v.) but differs in that the hyaline ascospores have the septum in the lower third. The ends of the spores are not rounded and recent material examined (Turkey, 12 km north-west of Korapunar, Konya Basin, alt. 1200 m, 8 Aug. 1972, M. J. Parsons, IMI 240532a) also gave an aeruginose reaction of the upper part of the ascumata in potassium hydroxide. The two species are clearly congeneric and appropriately retained in *Cercidiospora* for the present (see under *D. epipolytropa* below).

Didymosphaeria dannenbergii (B. Stein ex Eitner) Sacc. & D. Sacc., *Syll. Fung.* 17: 683 (1905).

Tichothecium dannenbergii B. Stein ex Eitner, *Jahrb. Schles. Ges. Vaterl. Kult.* 1895: 26 (1896).

Polycoccum dannenbergii (B. Stein ex Eitner) Vězda, *Česká mykol.* 23: 109 (1969).

The type material of this species was examined by Hawksworth (1985a, p. 124) who found it to be a synonym of *Peridiothelia fuligineta* (Norman) D. Hawksw., a saprophyte of *Tilia* bark, and not a lichenicolous fungus.

Didymosphaeria epicallopisma (Weddell) Sacc. & D. Sacc., *Syll. Fung.* 17: 682 (1905).

Verrucaria epicallopisma Weddell, *Mém. Soc. natn. Sci. nat. Cherbourg* 17: 372 (1873).

The type material and other collections of this taxon, which occurs on placodioid *Caloplaca* species, were examined by Hawksworth (1986, pp. 512-517) who found it to represent a new genus *Weddellomyces* D. Hawksw., into which it was combined. It is distinguished by 'ascumata' in which the upper parts are composed of 'cephalothecoid' plates, and ascospores which are (1-) 3-septate and verruculose.

Didymosphaeria epipolytropa (Mudd) Winter, *Hedwigia* 26: 26 (1886).

Thelidium epipolytropum Mudd, *Man. Br. Lich.:* 298 (1861).

Cercidiospora epipolytropa (Mudd) Arnold, *Flora, Jena* 57: 154 (1874).

The only extant original material (British Isles, sine loc., on *Lecanora polytropa* (Hoffm.) Rabenh., W. Mudd, K - lectotype selected here) of this distinctive lichenicolous fungus has been examined. It is reported on *Lecanora intricata* (Ach.) Ach. and *L. polytropa*, and related species and is distinguished by colourless 1-septate ascospores, delicate branched and anastomosing hamathelial filaments, and a largely hyaline ascumatal wall turning aeruginose in potassium hydroxide around the ostiole. The species is discussed in more detail and illustrated by Vězda (1970: pp. 221-223). It has generally been treated in *Cercidiospora* Körber but differs from the type species of that genus, *C. ulothii* (q.v.) in the rounded and not pointed ends of the ascospores. This species merits closer study but could prove to be more appropriately treated as a member of a separate genus, for which the name *Prolisea* Clem. is available*.

* A revision of *Cercidiospora* by Haffelner (*Herzogia* 7: 353-365, 1987) appeared while this paper was in press and should be consulted for a modern treatment of this group.

Didymosphaeria fumosaria (Leighton) Sacc. & D. Sacc., *Syll. Fung.* 17: 681 (1905).

Verrucaria fumosaria Leighton, *Trans. Linn. Soc. Lond., Bot., ser. 2*, 1: 239 (1876).

Polycoccum fumosarium (Leighton) Arnold, *Flora, Jena* 64: 326 (1881).

This species, described on *Lecidea fuscoatra* (L.) Ach. from Wales, was treated by Keissler (1930, p. 390) as a synonym of the species now known as *Endococcus rugulosus* Nyl. The ascomata were described as lacking 'paraphyses' and, in the absence of type material, we have no reason to dissent from Keissler's view.

Didymosphaeria fusigera (Th. Fr. & Almq.) Sacc. & D. Sacc., *Syll. Fung.* 17: 683 (1905).

Endococcus fusigera Th. Fr. & Almq., *Bot. Notiser* 1867: 109 (1867).

This taxon, described from thalli of *Rhizocarpon geminatum* Körber in Sweden, was treated by Keissler (1930, p. 394) as a synonym of the species now known as *Endococcus stigma* (Körber) Stizenb. This interpretation seems reasonable on the basis of the original description in which the ascospores were said to have somewhat fusiform cells and the hamathecial tissues are gelatinized.

Didymosphaeria gyrophorarum (Arnold) Sacc. & D. Sacc. (as '*gyrophorae*'), *Syll. Fung.* 17: 682 (1905).

Arthopyrenia gyrophorarum Arnold, *Verh. zool.-bot. Ges. Wien* 46: 140 (1896).

Stigidium gyrophorarum (Arnold) D. Hawksw., *Kew Bull.* 30: 201 (1975).

The ontogeny of this species, which occurs on *Umbilicaria* Hoffm. thalli, was examined by Janex-Favre (1965) and found to be similar to that of the Mycosphaerellaceae Lindau. It has been regarded as a *Pharcidia* Körber or a *Stigidium* Trevisan species by most authors on the basis of the hyaline ascospores. However, studies on isotype material (Arnold, *Lich. Exs.* no. 1669, K) revealed that the ascospores became brown at maturity, as already noted by Zopf (1897, p. 120); according to the current generic concepts the name consequently requires transfer to *Endococcus* and the new combination ***Endococcus gyrophorarum*** (Arnold) J. David & D. Hawksw. comb. nov. is herewith proposed.

Didymosphaeria infestans Speg., *An. Soc. Cient. Arg.* 12: 176 (1881).

This species, described from the thalli and apothecia of a lichen named *Teloschistes flavicans* (Sw.) Norman from Argentina, was stated to produce

ascomata 180–250 μm diam, asci 80–85 \times 6–6.5 μm , and \pm uniseriate 1-septate ascospores in which the lower cell was smaller, hyaline then olivaceous, and 12–14 \times 5–6 μm . This species is excluded from *Polycoccum* as the centrum was stated to be 'aparaphysati'. Type material must be examined in order to determine an appropriate generic disposition.

Didymosphaeria maculans Vouaux, in Pitard & Harmand, *Bull. Soc. mycol. Fr., Mém.* 22: 71 (1911).

This species was described as growing on thalli of *Ramalina subgeniculata* Nyl. in the Canary Islands (Tenerife). No material is present in the remnants of Vouaux's herbarium (Rondon, 1970), but the original diagnosis is strongly reminiscent of a species of *Lichenostigma* Hafellner (Hafellner, 1982) growing with a possible *Phaeosporobolus* D. Hawksw. & Hafellner anamorph (Hawksworth & Hafellner, 1986). However, the dimensions of the cells in the conidia ('vel gregarius 3–4 emitantur') and the ascospores (12.5–16 \times 5.5–6.5 μm) suggest it may be a third member of *Lichenostigma*. The species was stated to produce irregular and anastomosing 'paraphyses' but, if these were indeed present and not remains of discharged asci this alone would not preclude a placement in that genus as the closely related *Lichenothelia* D. Hawksw. includes species with and without pseudoparaphyses (paraphysoids) as described by Henssen (in litt.).

Microthelia marmorata var. *tubercularis* Norman, *Bot. Notiser* 1872: 37 (1872).

The original material of this taxon could not be traced (Hawksworth, 1985a, p. 170) but as it was stated to produce 4- to 8-spored asci it is probable that it is a synonym of one of the accepted species of the *Polycoccum marmoratum* group.

Didymosphaeria microstictica var. *alboatrae* Vouaux, *Bull. Soc. mycol. Fr.* 29: 112 (1913).

This variety was described from the thalli of *Diplotomma alboatrum* (Hoffm.) Flotow collected in France; no specimen is present in the remnants of Vouaux's herbarium (Rondon, 1970). The ascomata were described as spherical or a little flattened, 140–200 μm , and contained asci 64–80 \times 14–17 μm with distichously arranged ascospores 13.5–17 \times 5.5–8 μm ; the hymenial gelatine was said to turn very pale violet and then yellow in iodine. The dimensions of the ascomata and ascospores are remarkably close to those of *Arthonia punctella* Nyl. which occurs on the same host species and has

an I+ blue thecium (Hawksworth, 1980a). This taxon is most appropriately regarded as a possible synonym of *A. punctella* on the assumption that the arthonioid nature of the ascومات was overlooked.

Microthelia minor Kernst., *Verh. zool.-bot. Ges. Wien* 46: 307 (1896).

Type material was studied by Hawksworth (1985a: p. 158) who reported that this could be a species of *Polycoccum*. The ascومات were 100–200 µm diam and the ascospores 1-septate, verruculose, dark brown and (12–) 13–16 (–18) × 7–10 (–11) µm; the centrum turned blue in iodine. The material was sparse and the nature of the hamathecial tissues could not be resolved. The host could conceivably be *Lecidella stigmatia* (Ach.) Hertel & Leuckert. See also *Didymosphaeria sporastatae* f. *incongruae* below.

Didymosphaeria neottizans (Leighton) A. L. Sm., *Trans. Br. mycol. Soc.* 3: 177 (1910).

Verrucaria neottizans Leighton, *Trans. Linn. Soc. London*, ser. 2, 1: 239 (1876).

The holotype of this name was examined by Hawksworth (1980b, p. 371) and found to be a synonym of the species now called *Pyrenidium actinellum* Nyl.

Didymosphaeria parietinaria (Lindsay) Sacc. & D. Sacc., *Syll. Fung.* 17: 681 (1905).

Microthelia parietinaria Lindsay, *Trans. R. Soc. Edinb.* 25: 341 (1869).

Endococcus parietinarius (Lindsay) Clauz. & Roux, *Champ. Lich. Non-Lich.*: 28 (1976).

The holotype material was examined by Hawksworth (1985a, p. 159) who confirmed that this species was correctly placed in *Endococcus* Nyl. A description and illustration are included in Hawksworth (1982, pp. 382–383).

Didymosphaeria pallax (Nyl.) Sacc. & D. Sacc., *Syll. Fung.* 17: 682 (1905).

Endococcus pallax Nyl., *Flora, Jena* 56: 204 (1873).

This species, described on *Peltula obscurans* (Nyl.) Gyelnik from the Pyrenees, was not reported to produce 'paraphyses' and so is probably correctly referred to *Endococcus*.

Didymosphaeria physciicola (Nyl.) Sacc. & D. Sacc., *Syll. Fung.* 17: 682 (1905).

Mycoporum physciicola Nyl., *Flora, Jena* 56: 299 (1873).

This species was described as decolorizing thalli of *Xanthoria parietina* (L.) Th. Fr. in France and has

generally been regarded as a synonym of the species now called *Endococcus parietinarius* (Lindsay) Clauz. & Roux (e.g. Keissler, 1930: p. 392); we see no reason to dissent from that view.

Didymosphaeria pseudocarpa (Nyl.) Sacc. & D. Sacc., *Syll. Fung.* 17: 682 (1905).

Endococcus pseudocarpus Nyl., *Flora, Jena* 56: 204 (1873).

This species was described from squamules of '*Heppia guelpinii* var. *nigrolimbata* (Nyl.) Nyl.', probably a species close to *Peltula euploca* (Ach.) Poelt ex Ozenda & Clauz., collected in the Pyrenees and stated to produce 1-septate 'leviter nigrescentes' ascospores 9–18 × 5–7 µm and no 'paraphyses' were mentioned. The species is probably correctly referred to *Endococcus*. It was regarded as a form of the species now known as *Endococcus stigma* (Körber) Stizenb. by Keissler (1930, p. 396).

Didymosphaeria pulposi Zopf, *Nova Acta Leop. Carol. Acad.* 70: 186 (1898).

This species, first described on thalli and apothecial margins of the species now called *Collema tenax* (Swartz) Ach. from Germany, is excluded from *Polycoccum* on the basis of the hyaline ascospores. It produces 4- to 6-spored asci and ascospores 14–18 × 4.9–5.36 µm and is currently interpreted as a synonym of *Didymella sphinctrinoides* (Zwackh) Berl. & Vogl.

Didymosphaeria sphinctrinoides (Zwackh) Winter, *Hedwigia* 25: 26 (1886).

Endococcus sphinctrinoides Zwackh, *Flora, Jena* 47: 88 (1864).

Didymella sphinctrinoides (Zwackh) Berl. & Vogl., *Syll. Fung.* 9: 671 (1891).

This is currently accepted as a species of *Didymella* Sacc. ex Sacc. occurring on Collemataceae. A description and illustrations are provided by Vězda (1963).

Didymosphaeria sphinctrinoides var. *aspiciliicola* Zopf, *Nova Acta Leop. Carol. Acad.* 70: 178 (1898).

This variety was described from material of *Aspicilia laevata* Arnold f. *albicans* Arnold from Italy and stated to produce hyaline 1-septate ascospores 18.4–21.4 × 6.6–7.6 µm. It was included as a synonym of *D. sphinctrinoides* (q.v.) by Keissler (1930, p. 460) but merits re-examination.

Didymosphaeria sphinctrinoides var. *immersae* (Arnold) Winter, Rabenh., *Krypt.-Fl.* 1(2): 432 (1885).

Endococcus sphinctrinoides var. *immersae* Arnold, *Flora, Jena* 57: 174 (1874).

Described as parasitic on thalli of *Lecidella immersa* Th. Fr., and stated to have hyaline ascospores $18 \times 6 \mu\text{m}$ which were rarely 2-septate. This therefore appears unlikely to represent a species of *Polycoccum*; it was placed as a synonym of *Didymella sphinctrinoides* (Zwackh) Berl. & Vogl. by Keissler (1930, p. 459).

Didymosphaeria sphinctrinoides var. *physciicola* Zopf, *Nova Acta Leop.-Carol. Acad.* 70: 175 (1898).

This variety, described from the apothecia of the species now known as *Xanthoria elegans* (Link) Th. Fr., was distinguished by the numerous ascomata and 4 (-6)-spored asci. Keissler (1930: p. 459) included the variety within *Didymella sphinctrinoides* (q.v.).

Didymosphaeria sphinctrinoides var. *verrucariae* Zopf, *Nova Acta Leop.-Carol. Acad.* 70: 176 (1898).

This variety was described from an aquatic *Verrucaria* Schrader species, *V. pachyderma* Arnold, and distinguished only by the host. Keissler (1930, p. 459) includes it within *Didymella sphinctrinoides* (q.v.).

Didymosphaeria sporastatae forma *incongruae* (Arnold) Sacc. & D. Sacc., *Syll. Fung.* 17: 681 (1905).

Polycoccum sporastatae f. *incongruae* Arnold, in Zopf, *Hedwigia* 35: 337 (1896).

This species was represented by material on *Lecidella incongrua* Nyl. from the Italian Tirol but no dimensions were provided; we have seen no material of this taxon. It is of interest to draw attention here to *Microthelia minor* (q.v.) which may be on a related host.

Didymosphaeria stictaria (Lindsay) Sacc. & Trotter, *Syll. Fung.* 22: 17 (1913).

Microthelia stictaria Lindsay, *Trans. R. Soc. Edinb.* 25: 541 (1869).

This species, described on a *Pseudocyphellaria* Vainio species from Campbell's Island, was reported to have 1-septate brown verruculose ascospores produced in 8-spored asci in a centrum turning 'deep violet' in iodine; no dimensions were given. The type material could not be located

(Hawksworth, 1985a, p. 166) and no information as to the presence or absence of hamathecial tissues was given. This could represent a further species of *Polycoccum* but must be excluded until the holotype or other material is discovered.

Didymosphaeria ulothii (Körber) Winter, *Hedwigia* 26: 26 (1886).

Cercidiospora ulothii Körber, *Parerga Lich.*: 466 (1866).

This is the type species of the genus *Cercidiospora* Körber, distinguished by colourless 1-septate ascospores with pointed ends. It is fully described by Müller & von Arx (1962, pp. 392-393)*.

Didymosphaeria verrucariiformis (Fuckel) Winter (as '*verrucariaeformis*'), Rabenh., *Krypt.-Fl.* 1(2): 429 (1885).

Epicymatica verrucariiformis Fuckel (as '*verrucariaeformis*'), *Jb. nassau. Ver. Naturk.* 23-24: 118 (1870).

This species was described from *Crataegus oxyacantha* and stated to have colourless ascospores $16 \times 5 \mu\text{m}$; no mention of it occurring on a lichenized thallus was made by Fuckel (*loc. cit.*). Saccardo (1882, p. 574) gave the substratum as 'supra epidermidem (thallo lichenoso invasam?)' but the reason for this is obscure; the ascospores were stated to be hyaline and only Morthier's collection was cited. The original material was examined by Winter (*loc. cit.*) who found that the ascospores became pale brown when mature and measured $14-17 \times 6 \mu\text{m}$; he did not indicate any lichenized thallus was present and suggested a relationship with *Microthelia* Körber. These spore dimensions and the host led Hawksworth (1985a: p. 99) to tentatively place this as a synonym of *Mycromicrothelia melanospora* (Hepp) D. Hawksw.

Didymosphaeria verrucosaria (Lindsay) Magnus, in Dalla Torre & Sarnthein, *Fl. Tirol.* 3: 473 (1905).

Microthelia verrucosaria Lindsay, *Q. J. Microsc. Sci.* 9: 349 (1869).

This taxon was reported from thalli of the species now known as *Pachyospora verrucosa* (Ach.) Massal. but no type material has been located (Hawksworth, 1985a: p. 172). As it was stated to have hyaline 1-septate ascospores it is most unlikely to belong to *Polycoccum*.

We are indebted to Dr V. John and Dr J. Hafellner for the material described here as *P. cladoniae*; Mr J. C. David for information on *Endococcus gyrophorarum* and assistance in screening

* See also footnote on p. 307.

material; Mrs C. Thatcher for microtome sections; Mr V. Alstrup, Dr B. J. Coppins, Miss J. Fildes, Professor Dr G. Follmann, Professor B. W. Fox, Dr C. J. B. Hitch and Mr G. Marson for providing interesting specimens; and the curators of BM, C, E, G, GZU, IMI, K, KOELN, LG, M, O, PC, POLL and TUR for permission to examine material in their care.

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(Received for publication 27 May 1987)