

NOTES ON SOME FUNGICOLOUS HYPHOMYCETES
AND THEIR RELATIVES

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Cladobotryum Nees ex Steud. is redefined and two new species are added to this genus. The urediniculous genus *Colletoconis* gen. nov. is segregated from *Gloeosporium* Desm. & Mont. to accommodate *G. aecidiophilum* Speg. *Engyodontium* gen. nov. is erected for *Rhinotrichum parvisporum* Petch and a similar fungus. The monotypic genus *Helminthophora* Bon. is redescribed. *Sympodiophora* G. Arnold is combined with the earlier described genus *Pseudohansfordia* G. Arnold; eight new combinations are proposed. One new species is added to *Denticularia* Deighton and two to *Sporothrix* Hektoen & Perkins; in addition, two new combinations are proposed in the latter genus. A list of doubtful and excluded species formerly classified in the treated genera is given.

In 1975 a hyphomycete specimen growing on a carpophore of *Hyphodontia breviseta* (Karst.) J. Erikss. became available for study. It proved to represent a hitherto undescribed species. Although similar fungi had already been treated by various authors (Arnold, 1969, 1970; Gams & Hoozemans, 1970; Deighton & Pirozynski, 1972), the specimen at hand was difficult to classify due to unsatisfactory circumscriptions of suitable genera. For this reason a thorough taxonomic revision of these fungi was undertaken.

In the present paper the genus *Cladobotryum* Nees ex Steud. is redefined and delimited from *Helminthophora* Bon., and the generic name *Sympodiophora* G. Arnold is replaced by *Pseudohansfordia* G. Arnold. Otherwise the paper is supplementary to the previous treatments, describing some new species and giving notes, descriptions and illustrations where the existing literature was thought to be insufficient. In addition, related genera, two of which are new, are listed and some related species are described. The urediniculous genus *Colletoconis* gen. nov. is also included. All taxa are listed in alphabetical order.

Below every generic description a list of epithets ever combined with the genus name is given. In this list the epithets printed spaced are accepted in that genus and included in the revision, whereas those not printed spaced are excluded or doubtful and discussed in the check-list of subgeneric names.

All available live cultures were grown on oatmeal and mushroom agars at room temperature (20-22°C) in daylight. The mushroom agar was made of shredded and sterilized carpophores of species of *Lactarius*, *Russula*, and *Xerocomus* and of plain agar. By using this medium, the sporulation of many poor cultures was improved. Attempted growth on intact, superficially sterilized mushrooms was unsuccessful.

CLADOBOTRYUM Nees ex Steud.

Cladobotryum Nees in Syst. Pilze Schwämme 55. 1816; ex Steud., Nomencl. bot. 118. 1824.

Mucrosporium Preuss in Linnaea 24: 128. 1851.

Diplocladium Bon., Handb. allgem. Mykol. 98. 1851.

Didymocladium Sacc. in Syll. Fung. 4: 186. 1886.

PERFECT STATE.—*Hypomyces* (Fr.) Tul.

Colonies spreading, white, vinaceous or purple, occasionally becoming greyish due to chlamydospore formation; reverse ochraceous or crimson. Conidiophores hyaline to purplish, thin- to rather thick-walled, ascending to erect; branching pattern subverticillate to verticillate. Conidiogenous cells subulate, monoblastic or polyblastic, forming conidia more or less retrogressively or inconspicuously sympodially. Conidia hyaline, rather large, continuous or septate.

TYPE SPECIES.—*Cladobotryum varium* Nees ex Steud. (lectotype).

Epithets in *Cladobotryum*: *agaricinum*, *apiculatum*, *asterophorum*, *australe*, *binatum*, *capitatum*, *curvatum*, *dendroides*, *elegans*, *gelatinosum*, *heterocladum*, *leptosporum*, *macrosporium*, *multiseptatum*, *mycophilum*, *ovalisporum*, *ternatum*, *terrigenum*, *thuemenii*, *variospermum*, *varium*, *verticillatum*.

Epithets in *Mucrosporium*: *dendroides*, *fusarisporum*, *leptosporum*, *schlechtendalianum*, *sphaerocephalum*, *tenellum*, *uniseptatum*, *verticillatum*.

Epithets in *Diplocladium*: *clavariarum*, *cylindrosporum*, *elegans*, *gregarium*, *hydrangae*, *maius*, *melleum*, *minus*, *penicillioides*, *preussii*, *rennyi*, *tenuis*, *theobromae*.

Epithet in *Didymocladium*: *ternatum*.

The process of conidiogenesis in monoblastic species of *Cladobotryum*, as seen with the light microscope, has been described by Cole & Kendrick (1971). Electron microscopical findings were given by Cole & Samson (in prep.). The process was found to be essentially the same as in *Trichothecium roseum* (Pers.) Link ex S. F. Gray, which has been studied by numerous authors (e.g. Kendrick & Cole, 1969). It can be summarized as follows. The first conidium is an inflation of the tip of the conidiogenous cell. After delimitation the remaining apex below the conidium swells to produce the next conidium. The distal wall and part of the lateral wall of the conidiogenous cell are involved in this inflation, the fertile cell consequently becoming somewhat shorter after each conidial secession. Second and later inflations may either be lateral, in which case the scar of the previous conidium remains visible on its distal part (compare *T. roseum*; Cole & Kendrick, 1971), or axial, the terminal scars soon disappearing (compare *Basipetospora rubra* Cole & Kendrick, 1968).

In the conidial state of *Hypomyces dactylarioides* G. Arnold the conidia are also formed retrogressively, but here only small lateral wall-parts of the conidiogenous cells are involved in the inflation. The length of the conidiogenous cell is fixed; in the apical region it becomes covered with scattered conidia at right angles as in, for example, *Nodulisporium hinnuleum* (Preuss) G. Smith (Cole in Kendrick, 1971) and *Basifimbria peruviana* (Matsushima) de Hoog (de Hoog & Hermanides-Nijhof, 1977).

In *C. asterophorum* the conidiogenous cell shows some elongation while producing conidia sympodially at its apex. A short, irregular rhachis is thus formed. This protrusion may,

however, swell and become converted into a conidium, leaving the conidiogenous cell shortened to its original length. Only in *C. dendroides* (Bull. ex M erat) W. Gams & Hoozemans the conidiogenous locus is more or less progressive.

In summary, nearly all species of *Cladobotryum* show something retrogressive, but otherwise the process of conidiation is highly variable. Although markedly different types of conidiation are present in this group of fungi, these characters alone are not sufficient for the delimitation of the genera. They are used here only in combination with other criteria. *Cladobotryum* differs from *Trichothecium* Link ex Fr. mainly by having strongly branched conidiophores. Erect conidiophores are also present in *Helminthophora* Bon., but in this genus the conidia are formed singly, new conidiogenous loci being formed by considerable subapical elongation. Thus a sympodial rhachis is formed with few remote conidium-bearing denticles. *Pseudohansfordia* G. Arnold has conidiogenous cells similar to these, but forms conidia in basipetal chains from each denticle. The chains arise by monoblastic retrogressive conidiation, just as in *Cladobotryum apiculatum* (Tubaki) W. Gams & Hoozemans and *Trichothecium roseum*. The main difference with *Cladobotryum* then is the conidiogenous cell as a whole being polyblastic in *Pseudohansfordia* but monoblastic in *Cladobotryum*. However, sympodial branching of a *Cladobotryum* conidiogenous cell was once seen in a culture chamber of *C. verticillatum* (Link ex Gray) Hughes. The cell was observed when it had just produced a second conidial inflation. This conidium apparently adhered to the cover slip, with the result that the slowly elongating conidiogenous cell gradually bent. At first, the fertile region for the production of a third conidium became distinct. The region below then became markedly bent, and the conidiation ceased. The most distal part below the bend rapidly developed into a new fertile tip. Thus a diblastic conidiogenous cell was formed, resembling the 1-5-blastic cells of *Pseudohansfordia irregularis* G. Arnold. The conclusion is warranted, that the differences between the respective types of conidiation are not fixed, but on the contrary, sometimes show rather fundamental changes. This was also demonstrated in other types of conidiation by Madelin (*in Kendrick*, in prep.).

KEY TO THE SPECIES

- 1a. Conidiogenous cells, at least in part, polyblastic 2
- b. Conidiogenous cells monoblastic 4
- 2a. Conidia usually two-celled, straight *C. asterophorum*
- b. Conidia usually three- to four-celled, straight or curved 3
- 3a. Conidiophores with thick-walled stipes *C. dendroides*
- b. Conidiophore stalks not markedly differentiated *Hypomyces dactylarioides*
- 4a. Conidia predominantly one-celled, rarely two-celled 5
- b. Conidia predominantly two- to four-celled, although one-celled conidia sometimes are rather common 7
- 5a. Conidia, at least in part, clavate to subcylindrical, 4-8.5 µm wide 6
- b. Conidia broadly ellipsoidal, 9-12 µm wide *C. verticillatum*
- 6a. Conidia 20-28 µm long; chains of verrucose, pale reddish brown chlamydo­spores often present *C. apiculatum*
- b. Conidia 9-20 µm long; chlamydo­spores smooth-walled, subhyaline *Hypomyces petchii*
- 7a. Conidia broadly ellipsoidal, ratio l:b about 2:1 8
- b. Conidia clavate to subcylindrical, ratio l:b about 3:1 9

- 8a. Conidia 10–24 μm , usually 12–18 μm long; colonies with ochraceous reverse; odour absent *C. varium*
- b. Conidia 13–35 μm , usually 20–30 μm long; colonies with crimson reverse; odour suggesting camphor *C. mycophilum*
- 9a. Conidia usually curved *C. curvatum*
- b. Conidia straight 10
- 10a. Conidia fusiform to subcylindrical, slightly tapering towards the apex *C. multiseptatum*
- b. Conidia clavate to subcylindrical, with broadly rounded apex *Hypomyces trichothecioides*

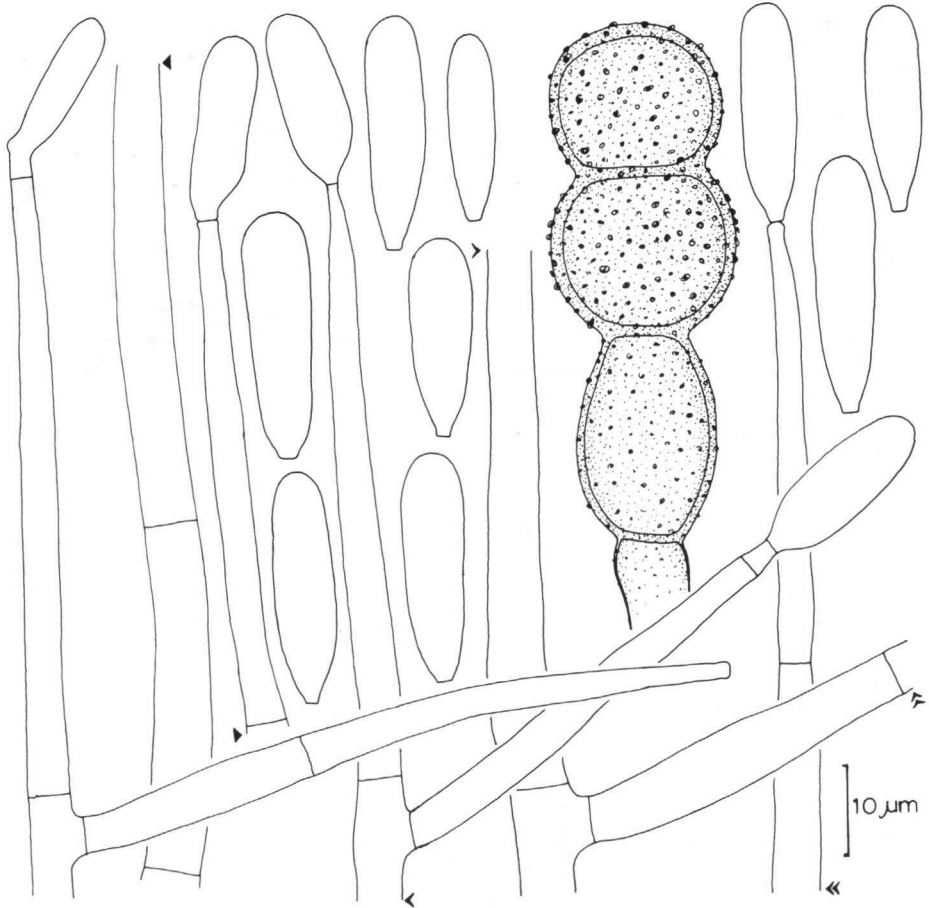


Fig. 1. *Cladobotryum apiculatum*, CBS 828.69 on mushroom agar.

CLADOBOTRYUM APICULATUM (Tubáki) W. Gams & Hoozemans—Fig. 1

Cylindrophora apiculata Tubaki in Nagaoa 5: 16. 1955. — *Cladobotryum apiculatum* (Tubaki) W. Gams & Hoozemans in Persoonia 6: 97. 1970.

CHLAMYDOSPORE STATE.—*Blastotrichum puccinioides* Preuss in Deutschl. Fl. (Pilze) (ed. J. Sturm) 25–26: 21. 1848. — *Mycogone puccinioides* (Preuss) Sacc. in Syll. Fung. 4: 184. 1886.

REFERENCES.—Tubaki (1955), Gams & Hoozemans (1970), Arnold (1971b).

Colonies filling the petri-dish within 3 days, appearing fluffy, lanose, with thin, suberect tufts about 1–2 cm high, purely white, later often becoming locally brownish due to abundant formation of chlamydospores; reverse pale ochraceous on oatmeal agar. *Conidiophores* fragile, hyaline, smooth- and thin-walled, ascending to suberect, occasionally over 5 mm long but more often profusely branched without a main stalk, lower branches 6–8 μm wide, the cells being 100–250 μm long, bearing 1–2 lateral branches just below each septum; ultimate branches arising singly or in pairs, at wide angles, 4.5–7 μm wide at the base, slightly tapering towards the apex, with 0–3 septa every 30–60 μm , each with a terminal fertile cell. *Conidiogenous cells* straight, cylindrical, 45–70 μm long, widest (3.5–5 μm) at the base, tapering towards the 1.5–2.5 μm wide apex, monoblastic, forming conidia by inflation of the tip; each subsequent conidium being initiated just below the previous one; the conidiogenous cell thus gradually becoming shorter with a wider apex. *Conidia* one-, rarely two-celled, hyaline, smooth- and thin-walled, cylindrical with a rounded apex, 20–28 \times 5–7.5 μm , with a prominent, butt-shaped hilum. Often multi-celled, rather thick-walled, verrucose, pale reddish-brown chlamydospores present.

The preceding description is of CBS 828.69 on mushroom agar at 20–22°C. The type strain of *C. apiculatum*, CBS 174.56, still sporulates rather well.

Cladobotryum apiculatum is the only *Cladobotryum* species with rough-walled chlamydospores. Though it is morphologically markedly different from *C. verticillatum*, both species are very similar in their cultural characteristics.

Cladobotryum asterophorum de Hoog, *spec. nov.*—Fig. 2

Eurasina spec., Matsushima, Ic. Microf. a Matsushima lect. 71. 1975.

Coloniae rapide expansae, laxe lanosae, ad 1–2 cm altae, candidae; reversum in agaro farina avenacea decocto dilute rubrum. *Conidiophora* fragilia, hyalina, levia, tenuitunicata, adscendentia vel fere erecta, saepe plus quam 5 mm longa, ad 8 μm lata, intervallis 30–60 μm septata, plus minusve verticillata. *Cellulae conidiogenae* rectae, subulatae, 17–35 μm longae, prope basin 3–4.5 μm latae, ad 1.0–1.5 μm sursum angustatae; conidia fere sympodialiter formata, intumescuntiam parvam relinquunt; conidia plerumque bicellularia, levia, tenuitunicata, ellipsoidea ad clavata, basi truncata, 14–23 \times 5.5–7.5 μm .

Typus: CBS 676.77, isolatus ex agarico quodam a T. Matsushima prope Hachioji urbem in Japonia, Maio 1966.

Colonies spreading, appearing fluffy lanose, with thin, suberect tufts about 1–2 cm high, purely white; reverse on oatmeal agar pale crimson. *Conidiophores* fragile, hyaline, smooth- and thin-walled, ascending to suberect, often over 5 mm long, up to 8 μm wide, septate every 30–60 μm ; branching pattern cymose, whorls on main stalks containing up to 4 conidiogenous cells, usually with 1–2 plagiotropic branches which repeatedly branch in the same way, often leading to drepanoid branching; all lateral branches about the same size, internodal cells 15–30 \times 3.5–4.5 μm ; lower conidiogenous cells first formed, branching later becoming more extended and profuse. *Conidiogenous cells* straight, subulate, 17–35 μm

long, widest (3–4.5 μm) just above the base, tapering towards the 1–1.5 μm wide apex; conidiation more or less sympodial, each conidium leaving a small protrusion after liberation, subsequent conidia initiated by an inflation next to the scar of the first formed conidium or by inflation of the whole protrusion; a minute, irregular rhachis is often present on older conidiogenous cells. *Conidia* usually two-celled, smooth- and thin-walled, ellipsoidal to clavate, 14–23 \times 5.5–7.5 μm , with acuminate bases.

TYPE CULTURE (living and dried).—CBS 676.77 = MFC 1743, isolated by T. Matsushima from an agaric, Hachioji City, Tokyo, Japan, May 1966.

The preceding description is based on CBS 676.77 on mushroom agar at 20–22°C.

The species is structurally very similar to *Cladobotryum verticillatum*, differing mainly by its dimensions, by conidium shape and by the process of conidiation. Branching is much more profuse than described and depicted by Matsushima (1975), each lateral branch bearing a large number of branches of higher order and the conidiophores may lack a distinct main stalk.

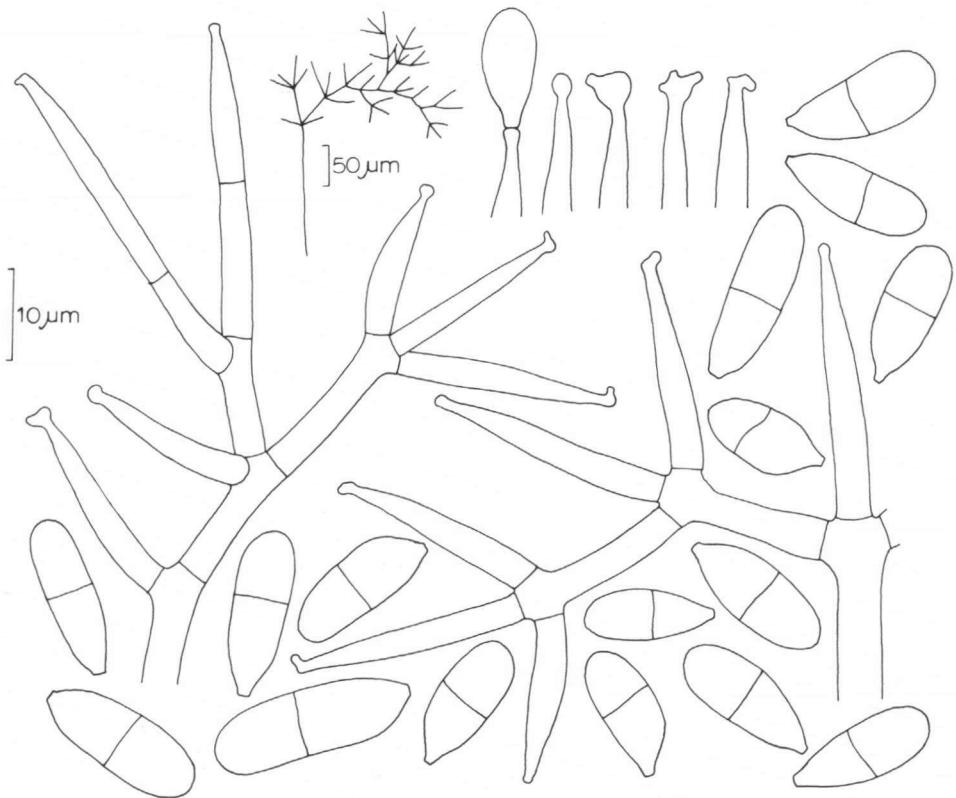


Fig. 2. *Cladobotryum asterophorum*, CBS 676.77 on mushroom agar.

***Cladobotryum curvatum* de Hoog & W. Gams, spec. nov.—Fig. 3**

Coloniae in substrato naturali effusae, lanosae, cremeae. Conidiophora fragilia, levia, tenuitunicata, adscendentia vel fere erecta, ad $12\ \mu\text{m}$ lata, intervallis $60\text{--}120\ \mu\text{m}$ septata, repetiter verticillata; cellulae conidiogenae singulae ad ternae (quaternae) verticillatae, rectae, subulatae, $20\text{--}35\ \mu\text{m}$ longae, prope basin $3.5\text{--}5\ \mu\text{m}$ latae, ad $1.5\ \mu\text{m}$ sursum angustatae, unum locum conidiogenum ferentes. Conidia $2\text{--}4$ ($\text{--}5$)-cellularia, levia, tenuitunicata, hyalina, clavata, sub medio conspicue curvata, $20\text{--}30 \times 5.5\text{--}7.5\ \mu\text{m}$.

Typus: in foliis ramulisque putridis in Horto Bogoriensi, Java in Indonesia, *van Beusechem*, 21 Maio 1950, in Herb. U 180 683 B.

Colonies on the natural substrate effuse, cottony, cream coloured. Conidiophores fragile, smooth- and thin-walled, ascending to suberect, up to $12\ \mu\text{m}$ wide, septated every $60\text{--}120\ \mu\text{m}$; branching pattern verticillate; whorls on main stalks containing several smaller, plagiotropic branches; the ultimate branches are fertile cells, occurring in whorls of $1\text{--}3$ ($\text{--}4$). *Conidiogenous cells* straight, subulate, $20\text{--}35\ \mu\text{m}$ long, widest $3.5\text{--}5\ \mu\text{m}$ just above the base, tapering towards the *c.* $1.5\ \mu\text{m}$ wide apex, monoblastic. *Conidia* $2\text{--}4$ ($\text{--}5$)-celled, smooth- and thin-walled, hyaline, clavate, conspicuously curved just below the middle, $20\text{--}30 \times 5.5\text{--}7.5\ \mu\text{m}$.

TYPE SPECIMEN.—Herb. U 180 683 B on rotten leaves and twigs, Hortus Bogoriensis, Java, Indonesia, *van Beusechem*, 21 May 1950.

In the dried specimen the process of conidiation could not be studied. No shortened co-

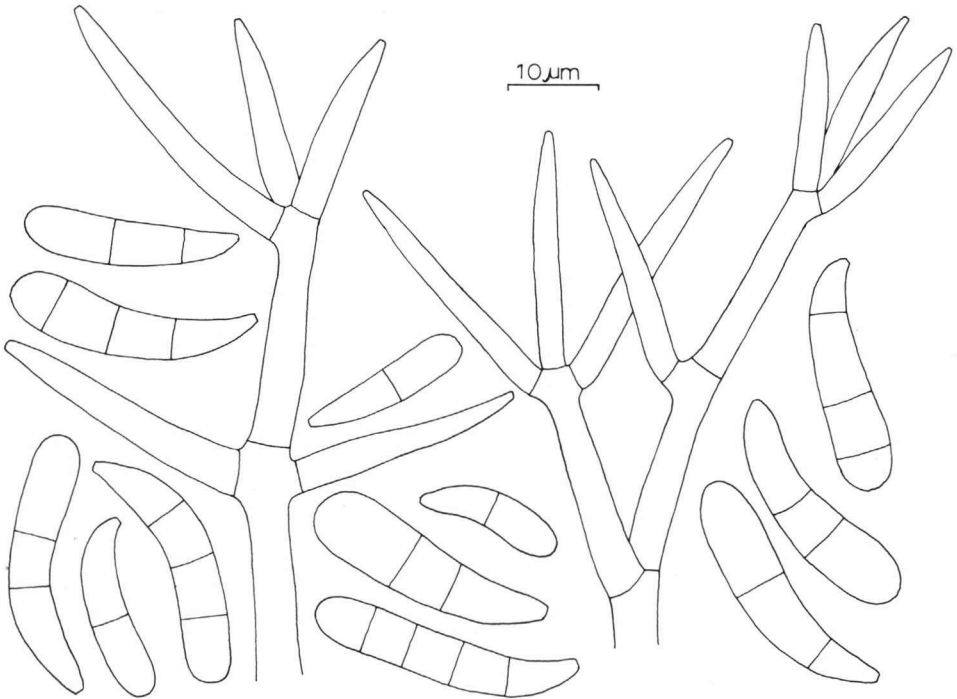


Fig. 3. *Cladobotryum curvatum*, U 180 683B on the natural substrate.

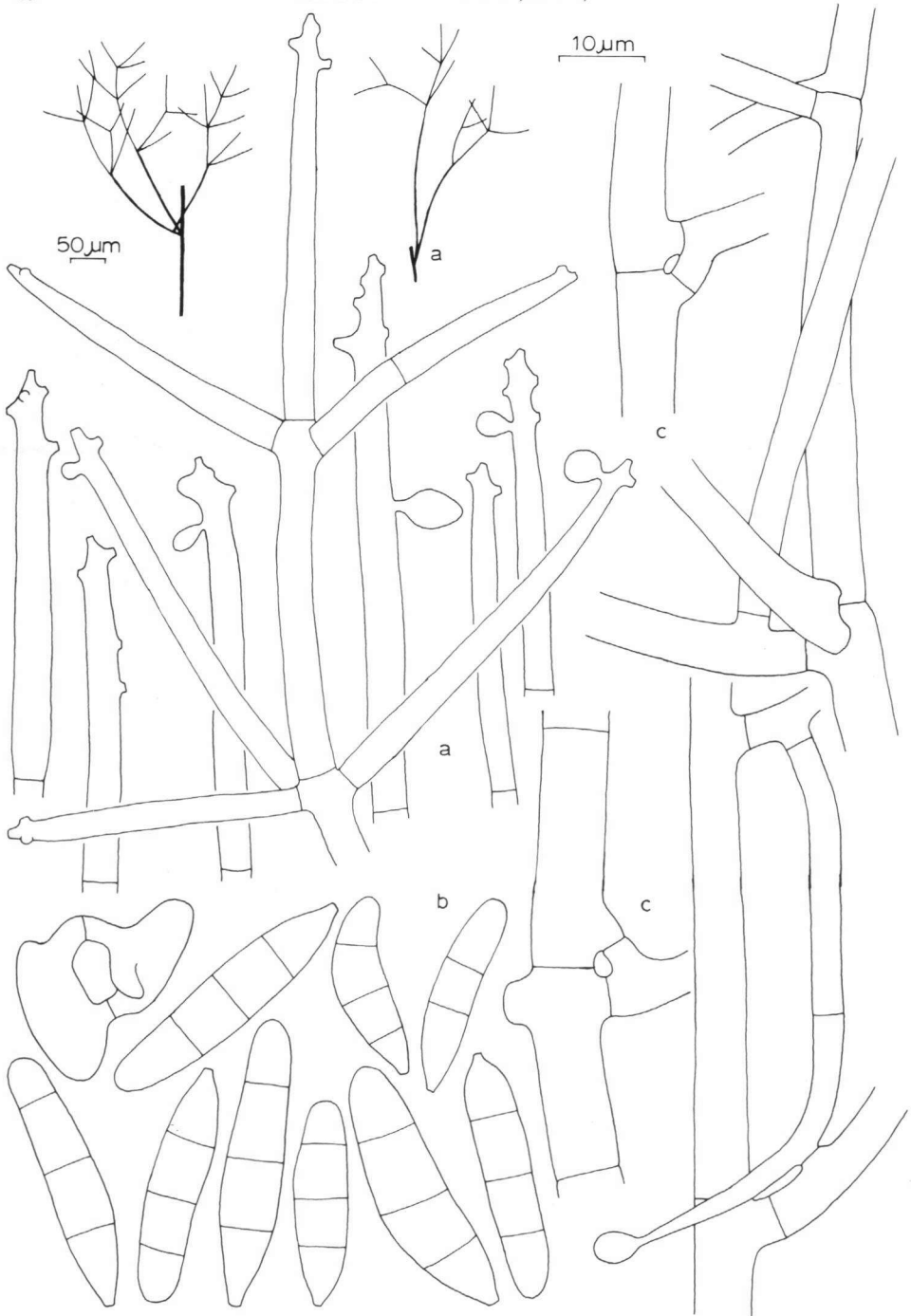


Fig. 4. *Cladobotryum*-state of *Hypomyces dactylarioides*, CBS 141.78 on mushroom agar. — a. Branching pattern and fertile structures. — b. Conidia. — c. Anastomoses and occasional insertion of lateral branches.

nidiogenous cells or conidia with two scars were observed; consequently the species might also belong to *Sibirina* G. Arnold, which forms conidia singly or in basipetal succession on phialides (Gams, 1973). It should be stated, however, that the difference between species with multiple but more or less stable loci, such as *Cladobotryum mycophilum* or *C. multisporum*, species with phialides, such as *Sibirina orthospora* W. Gams, and species with solitary conidia, such as *S. fungicola* G. Arnold, is rather small. It is doubtful whether the genus *Sibirina* can be maintained solely on the basis of differences in conidiogenesis (compare also the classification of *Pseudohansfordia* species which have loci producing one or several conidia). For this reason *Cladobotryum* seems to be the most appropriate genus for the species.

CLADOBOTRYUM-state of HYPOMYCES DACTYLARIOIDES G. Arnold—Fig. 4

REFERENCE.—Arnold (1971c).

Colonies spreading, consisting of felty to depressed lanose aerial mycelium, above which appear some cobweb-like hyphae about 0.5 cm high, pale pink to pink; reverse on oatmeal agar crimson. *Conidiophores* fragile, hyaline to pale purple, smooth- and rather thin-walled, ascending to suberect, often over 1 mm long, up to 10 μ m wide, septated every (30–)50–120 μ m; branching profuse, more or less verticillate, whorls on main stalks containing up to 4 smaller, plagiotropic branches; ultimate branches bearing fertile cells plagiotropically at wide angles, verticillately in whorls of 1–3; branches usually just below, occasionally also just above the septa of the supporting branches, infrequently the branch being inserted at both sides of the septum. *Conidiogenous cells* straight, subulate to cylindrical, 30–55 μ m long, widest (3–4.5 μ m) just above the base, tapering slightly towards the 2.2–3.5 μ m wide apex, forming conidia retrogressively by inflation of terminal or lateral wall-parts, each conidium leaving a butt-shaped protrusion after liberation, leading to the formation of a straight rhachis with scattered, blunt conidium-bearing denticles. *Conidia* usually four-celled, straight or unilaterally flattened, infrequently curved, smooth- and thin-walled, cylindrical to obclavate, 21–32 \times 5.5–8.5 μ m, with rounded apices and acuminate bases.

TYPE CULTURE (living and dried).—CBS 141.78 = AUPD 5824, sent by G. R. W. Arnold, isolated by S. D. Brooke, Orere Point, New Zealand, 22 June 1958, and dried specimen of the same on carpophore of unknown Polyporaceae (JE).

The preceding description is based on CBS 141.78 on mushroom agar at 20–22°C.

CLADOBOTRYUM DENDROIDES (Bull. ex Mérat) W. Gams & Hoozemans—Fig. 5

Mucor dendroides Bull., Hist. Champ. Fr. 105. 1791. — *Botrytis dendroides* Bull. ex Mérat, Nouv. Fl. Envir. Paris, Ed. 2, 1: 14. 1821 (basionym). — *Dactylium dendroides* (Bull. ex Mérat) Fr., Syst. mycol. 3: 414. 1832. — *Cladobotryum dendroides* (Bull. ex Mérat) W. Gams & Hoozemans in Persoonia 6: 103. 1970.

Botrytis macrospora Link in Mag. Ges. naturf. Fr., Berl. 3: 15. 1809; ex Pers., Mycol. eur. 1: 33. 1822. — *Cladobotryum macrosporum* (Link ex Pers.) Schmalz, Flora, Jena 6: 569. 1823. — *Dactylium macrosporum* (Link ex Pers.) Fr., Syst. mycol. 3: 414. 1832.

Cladobotryum ternatum Corda, Icon. fung. 1: 21. 1837.

Cladobotryum ternatum Corda var. *binatum* Preuss in Linnaea 24: 124. 1851. — *Cladobotryum binatum* (Preuss) Sacc. in Syll. Fung. 4: 160. 1886.

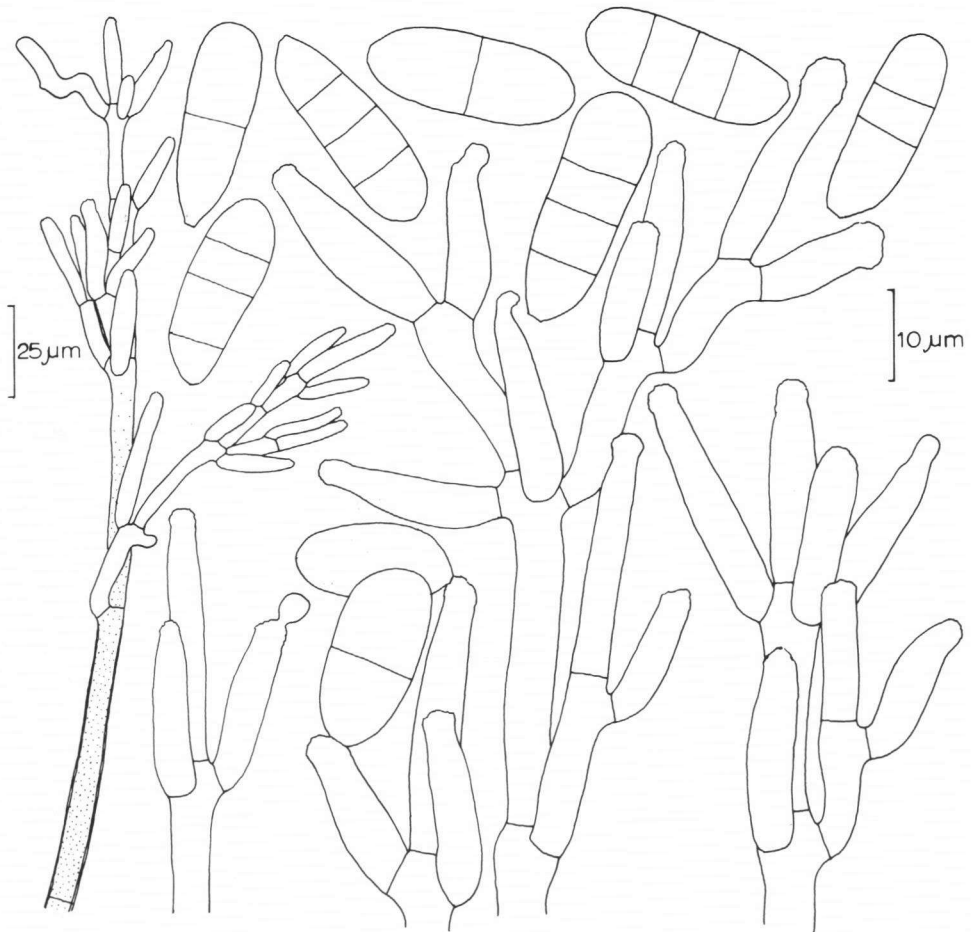


Fig. 5. *Cladobotryum dendroides*, CBS 233.34 on mushroom agar.

Mucrosporium schlechtendalianum Preuss in *Linnaea* 24: 128. 1851. — *Dactylium schlechtendalianum* (Preuss) Sacc. in *Syll. Fung.* 4: 191. 1886 (incidentally mentioned).

Mucrosporium verticillatum Preuss in *Linnaea* 24: 129. 1851. — *Dactylium verticillatum* (Preuss) Sacc. in *Syll. Fung.* 4: 191. 1886 (incidentally mentioned).

Cladobotryum terrigenum Karst. in *Meddn Soc. Fauna Fl. fenn.* 16: 35. 1888.

PERFECT STATE.—*Hypomyces rosellus* (Alb. & Schw. ex Fr.) Tul.

Possible synonyms in check-list under *agaricina*, *agaricinum*, *boletorum*, *candidum*, *tenellum*, *tenera*.

REFERENCES.—Morquer (1931), Zycha (1935), Barron (1968), Gams & Hoozemans (1970).

Colonies filling the petri-dish within 10 days, about 2 mm high, regular, with dense, greyish- or pinkish-white, lanose aerial mycelium at the centre, otherwise greyish-pink towards the

margin, with minute whitish specks of conidiophores; reverse crimson. *Conidiophores* stiff but fragile, pink, with smooth-walled or locally encrusted, slightly thickened walls, erect, usually 10–14 μm wide, made up of 100–180 μm long cells which are considerably shorter in the apical portion; stalks profusely branched in the upper part, at each septum 1–3 strongly plagiotropic branches being borne which often bear branches of a second or third order; ultimate branches bearing 1–3(–4) fertile cells plagiotropically; fertile cells and branches often in the same whorl. *Conidiogenous cells* straight, smooth- and thin-walled, cylindrical, 15–30 μm long, usually uniformly 4–6 μm wide or tapering slightly towards the apex; apical part rounded or slightly inflated above a vague constriction, finally becoming irregularly cylindrical, forming conidia sympodially; remaining scars flat, inconspicuous. *Conidia* one-, two-, but usually four-celled, smooth- and thin-walled, short cylindrical to broadly clavate, 22–27 \times 7.5–9 μm , with a slightly prominent, about 1.5 μm wide, basal scar.

The preceding description is based on CBS 233.34 on oatmeal agar at 20–22°C.

The conidia are formed in an inconspicuously sympodial order. Gams & Hoozemans (1970) referred to the conidiogenous cells as phialides, supposing the presence of a meristematic portion bulging out of an apical opening of the fertile cell, as is also known in *Chloridium virescens* (Pers. ex Pers.) W. Gams & Hol-Jech. and *Gonytrichum* C. G. & F. Nees ex Leman (Gams & Holubová-Jechová, 1976). However, no discontinuity between the wall of the basal part of the conidiogenous cell and the protrusion was observed. The wall of the basal part is conspicuously thicker than that of the conidium-bearing part and hence the latter has the appearance of a secondary wall. Similar structures have been described by de Hoog (1977) in sympodial *Leptodontium* species.

Cladobotryum multiseptatum de Hoog, *spec. nov.*—Fig. 6

Coloniae post 10 dies 9 cm diametro, lanosae, ad 8 mm altae, candidae; reversum in agaro farina avenacea decocto cito roseum ad purpureum. Conidiophora fragilia, hyalina, levia, tenuitunicata, ascendentia vel fere erecta, irregulariter copiose ramosa; rami inferiores 5–7 μm lati, 70–100 μm longi. Cellulae conidiogenae rectae, cylindricae, 30–70 μm longae, prope basin 3.2–4.0 μm latae, ad 1.5–2.5 μm sursum angustatae, unum locum conidiogenum ferentes, successione conidiorum gradatim longitudine minuta. Conidia 2–4-cellularia, hyalina, levia, tenuitunicata, fusiformia, latissima paulo sub medio, sursum modice angustata, 18–28 \times 6.5–8.5 μm , hilo basilari conspicuo praedita. In coloniis vutustis catenae breves cellularum crassitunicatarum, subhyalinarum, globosarum adsunt.

Typus: CBS 472.71, isolatus ex Agarico brunnescente Peck prope Prebbleton in Nova Zealantia ab A. W. Smith, 1970.

Colonies filling the petri-dish within 10 days, appearing regularly lanose, about 8 mm high, purely white; reverse on oatmeal agar soon becoming pinkish purple, particularly towards the margin. *Conidiophores* fragile, hyaline, smooth- and thin-walled, ascending to suberect, profusely branched without a main stalk; lower branches 5–7 μm wide; the cells being 70–100 μm long, bearing 1–2 lateral branches just below each septum; ultimate branches arising singly or in pairs, at wide or acute angles, 3.2–4 μm wide at the base, slightly tapering towards the apex, each with 0–1 septum at 25–40 μm from the base; the terminal cell being fertile. *Conidiogenous cells* straight, cylindrical, 30–70 μm long, widest (3.2–4 μm) at the base, tapering towards the 1.5–2.5 μm wide apex, monoblastic, forming conidia by inflation of the tip, each subsequent conidium being initiated just below the previous one; as a result the conidiogeneous cell gradually becoming shorter with a wider apex. *Conidia* 2–4-celled, hyaline, smooth- and thin-walled, fusiform, widest part somewhat below the middle, slightly tapering towards the apex, 18–28 \times 6.5–8.5 μm , with a prominent, butt-shaped hilum. Often

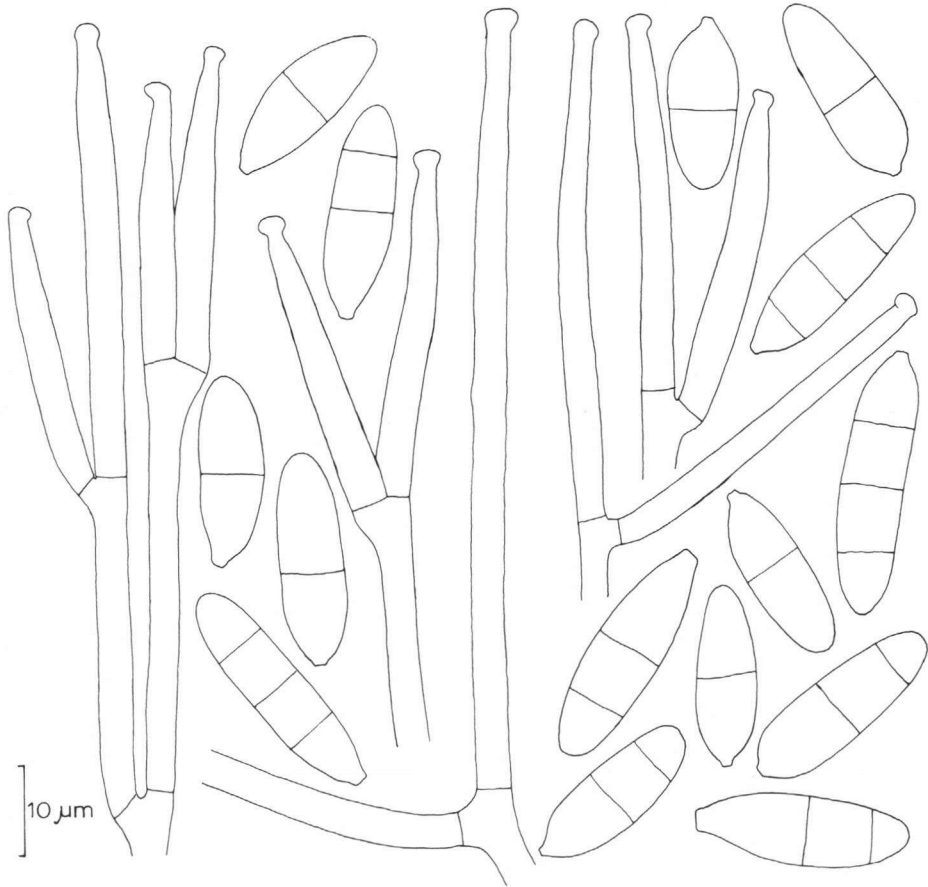


Fig. 6. *Cladobotryum multiseptatum*, CBS 472.71 on mushroom agar.

short chains of somewhat thick-walled, subhyaline, globose (about 8–12 μm in diam) chlamydospore-like cells present in older cultures.

TYPE CULTURE (living and dried).—CBS 472.71 = LINC 2861, isolated by A. W. Smith as the causal agent of 'mildew' or 'cobweb disease' from *Agaricus brunnescens* Peck, Prebbleton, New Zealand, sent by I. C. Harvey.

On direct observation in the petri-dish, only few conidial chains were seen. In most cases an asterisk-shaped cluster of conidia was located on the tip of the fertile cell. In contrast to most other species of *Cladobotryum*, the inflating tip of the conidiogenous cell involves only a small part of the lateral wall. Occasionally a subapical part of the wall inflated to form a conidium, the process being more or less sympodial. The species differs from *C. asterophorum* by larger, often four-celled conidia and longer, almost cylindrical conidiogenous cells.

CLADOBOTRYUM MYCOPHILUM (Oudem.) W. Gams & Hoozemans

Dactylium mycophilum Oudem. in Archs néerl. Sci. 2: 42. 1867. — *Cladobotryum mycophilum* (Oudem.) W. Gams & Hoozemans in Persoonia 6: 102. 1970.

PERFECT STATE.—*Hypomyces odoratus* G. Arnold

Possible synonyms in check-list under *elegans*, *majus*, *ternatum*.

REFERENCES.—Fassatiová (1958), Arnold (1964), Barron (1968), Gams & Hoozemans (1970), Matsushima (1975).

In *Cladobotryum* strains with broadly ellipsoidal, two-celled conidia, morphologically two approximate groups can be distinguished by relatively large or small conidia, fitting *C. mycophilum* and *C. varium* respectively. In many strains the conidia vary greatly in shape and size, hence the differences between the species are only gradational. In each of the species very similar perfect states were demonstrated (Plowright, 1882; Nicot & Parguey, 1963; Arnold, 1964; Gams & Hoozemans, 1970). Comparison of the descriptions of these states, given by authors who actually proved a connection (Table I: taxa separated on the basis of the conidial states), indicates that the differences in spore size are insufficient for the discrimination of the species. Remaining key-features are the crimson colony reverse and camphor smell of *C. mycophilum*, *C. varium* being odourless and having an ochraceous colony reverse.

TABLE I
COMPARISON OF CONIDIUM AND ASCOSPORE DIMENSIONS OF TWO CLADOBOTRYUM SPECIES AND THEIR HYPOMYCES PERFECT STATES (THE LATTER IN BRACKETS)

REFERENCE	<i>C. varium</i> (<i>H. aurantius</i>)	<i>C. mycophilum</i> (<i>H. odoratus</i>)
Plowright (1882)*	16–18 × 8–10 (15–24 × 4–6)	
Tubaki (1955)	12.5–22.8 × 7.4–11.4	
Nicot & Parguey (1963)	12.2–18.5 × 7.5–10.5** (14–16 × 3)	
Arnold (1964)		20.6–40.0 × 10.0–12.7 (25.8–34.4 × 6.0–7.7)
Gams & Hoozemans (1970)	10.5–16.0 × 5.0–7.0 (23.0–26.0 × 3.7–4.0)	15.0–32.0 × 7.5–12.0 (18.0–24.0 × 4.5–6.0)
Matsushima (1975)	10.0–24.0 × 6.0–9.5	14.0–34.0 × 6.5–10.0

* Measurements confirmed in authentic material (K).

** Measurements from CBS 621.77 = PC 1664, not mentioned in the publication.

CLADOBOTRYUM VARIUM Nees ex Steud.

Cladobotryum varium Nees, Syst. Pilze Schwämme 56. 1816; ex Steud., Nomencl. bot. 118. 1824. — *Botrytis variosperma* Link in Mag. Ges. naturf. Fr. Berl. 7: 36. 1816 (name change); ex Pers., Mycol. eur. 1: 35. 1822. — *Botrytis varia* (Nees ex Steud.) Duby, Bot. gall 2: 919. 1830. — *Dactylium varium* (Nees ex Steud.) Fr., Syst. mycol. 3: 414. 1832. — *Cladobotryum variospermum* (Link ex Pers.) Hughes in Can. J. Bot. 36: 750. 1958.

Dactylium melleum Berk. & Br. in Ann. Mag. nat. Hist., Ser. IV, 11: 345. 1873. — *Diplocladium melleum* (Berk. & Br.) Sacc. in Syll. Fung. 4: 177. 1886.

Dactylium rennyi Berk. & Br. in Ann. Mag. nat. Hist., Ser. IV, 11: 346. 1873. — *Diplocladium rennyi* (Berk. & Br.) Sacc. in Syll. Fung. 4: 177. 1886.

Diplocladium penicillioides Sacc. in Syll. Fung. 4: 177. 1886.

PERFECT STATE.—*Hypomyces aurantius* (Pers. ex Gray) Tul.

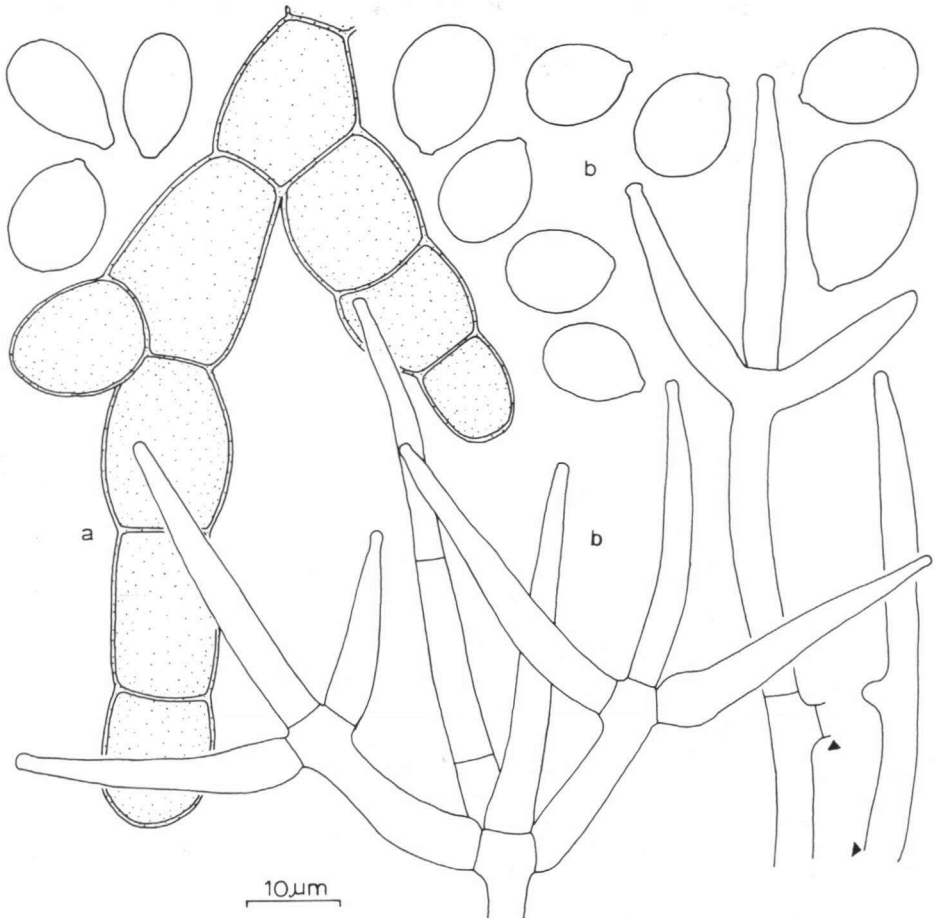


Fig. 7. *Cladobotryum verticillatum* on mushroom agar. — a. CBS 424.67. — b. CBS 535.77.

Possible synonyms in check-list under *cylindrosporium*, *minus*, *roseum*, *ternatum*.

REFERENCES.—Tubaki (1955), Fassatiová (1958), Barron (1968), Nicot (1962), Nicot & Parguey (1963), Gams & Hoozemans (1970), Matsushima (1975).

The type specimens of *Dactylium melleum* (K) and *Diplocladium penicillioides* [Plowright's (1882) material of the conidial state of *Hypomyces aurantius* (K)] could be re-identified as *Cladobotryum varium*. A specimen of *Dactylium rennyi* collected by J. Renny figures in the herbarium M. C. Cooke (K) and is probably authentic for the name. The synonymy with *C. varium*, as published by Massee (1893), could be confirmed.

Matsushima (1975) described and depicted the species exhaustively and also mentioned a *Cladobotryum* spec., which differed from *C. varium* by having disc-shaped connections between many conidia. In his strain MFC 1816 (=CBS 675.77) these discs are not always present, but sometimes very prominent, the conidial extremities in SEM studies appearing to be alate with minute longitudinal furrows. The character is insufficient to warrant the description of a separate taxon.

CLADOBOTRYUM VERTICILLATUM (Link ex Gray) Hughes—Fig. 7

Acremonium verticillatum Link in Mag. Ges. naturf. Fr. Berl. 3: 15. 1809; ex S. F. Gray, Nat. Arrang Br. Pl. 1: 550. 1821. — *Mycogone verticillata* (Link ex S. F. Gray) Spreng., Linn. Syst. Veg. 4: 555. 1827. — *Cladobotryum verticillatum* (Link ex S. F. Gray) Hughes in Can. J. Bot. 36: 750. 1958.

Verticillium lactarii Peck in Rep. N.Y. St. Mus. nat. Hist. 35: 140. 1882.

Possible synonym in check-list under *agaricinum*.

REFERENCES.—Fassatiová (1958), Gams & Hoozemans (1970), Arnold (1971b).

Colonies spreading, appearing fluffy lanose, with thin, suberect tufts about 1–2 cm high, purely white; reverse on oatmeal agar pale ochraceous. *Conidiophores* fragile, hyaline, smooth- and thin-walled, ascending to suberect, often over 5 mm long, up to 12 μ m wide, sparsely septate; the cells being up to 800 μ m long; branching pattern verticillate; whorls on main stalks containing up to 4 smaller, plagiotropic branches; ultimate branches bearing fertile cells ortho- or plagiotropically, verticillately in whorls of 1–3(–4); terminal conidigenous cells first formed, branching later becoming more profuse. *Conidigenous cells* straight if terminal, usually slightly curved upwards if lateral, subulate, 20–35 μ m long, widest (5–6.6 μ m) just above the base, tapering towards the 1.5–1.8 μ m wide apex, monoblastic, forming conidia by inflation of the tip, each subsequent conidium being initiated just below the previous one; the conidigenous cell thus becoming shorter with a wider apex. *Conidia* one-celled, smooth- and thin-walled, hyaline, broadly ellipsoidal, 12–20 \times 7–11 μ m, with protruding basal scars. Often multi-celled, smooth-walled, hyaline to subhyaline chlamydospores, present, which occasionally form irregular clusters resembling small sclerotia.

The preceding description is based on CBS 535.77 on mushroom agar at 20–22°C.

Septum formation is often retarded. Terminal whorls of branches may be formed without any septa, but these do appear later, with several being formed concurrently in one part of the system. There does not seem to be a fixed order in which the septa arise. Branching may also be irregular, ultimate branches being before or after the lower branches.

Collettoconis de Hoog & van der Aa, gen. nov.

Conidiomata applanata vel pulvinata, melanconicea, setis carentia, hyalina, e prosenchymate basilari, parenchymate medio et hymenio denso phialidum cylindricarum constant. Conidia continua, levia, seu tenuitunicata, hyalina, subcylindrica, seu fere crassitunicata, dilute brunnea et late ellipsoidea.

Species typica: *Gloeosporium aecidiophilum* Speg.

Conidiomata flat or pulvinate, melanconiceous, without setae, hyaline, consisting of basal prosenchyma, intermediate parenchyma, and a hymenium of parallel, cylindrical conidiogenous cells which form conidia in basipetal succession. Conidia one-celled, smooth-walled, of two types: thin-walled, hyaline, subcylindrical, and rather thick-walled, pale brown, broadly ellipsoidal.

TYPE SPECIES.—*Gloeosporium aecidiophilum* Speg.

The conidial dimorphism is the key-feature in *Collettoconis*. Both types of conidia are produced from identical conidiogenous cells in the same fruitbody. In this respect the genus differs from *Gloeosporidiella* Petrak e.g., in which spermatia are produced from filiform fertile cells, the main type of conidiogenous cells being more or less conical, and from *Cryptosporiopsis* Bubák & Kabát, in which spermatia are formed on smaller conidiogenous cells, in addition to secondary conidia formed by budding of the primary conidia. *Cryptosporiopsis* also differs by often having stromatic, multilocular fruitbodies and by fusiform primary conidia.

The type species of *Collettoconis* occurs in association with a rust fungus, but pure cultures of the species without any host fungus are able to sporulate abundantly over many years.

***Collettoconis aecidiophila* (Speg.) de Hoog, van der Aa & U. P. Singh, comb. nov.**—Fig. 8, 9

Gloeosporium aecidiophilum Speg. in An. Soc. Cienc. Argent. 22: 203. 1886 (basionym).

Conidiomata on the natural substrate in or adjoining aecidio- or uredosori of rustfungus, flat or pulvinate, often irregular in outline, about 100–300 μm in diam, melanconiceous, hyaline; basally, particularly between host tissue cells, consisting of prosenchyma composed of thin-walled, strongly interwoven, 4–6 μm wide hyphae, gradationally passing into 5–15 cells (10–40 μm) thick intermediate parenchyma composed of thin-walled, hyaline, isodiametrical cells 3–12 μm in diam, mixed with rustspores in various stages of disintegration; uppermost cell-layer 10–40 μm thick, composed of hyaline, thin-walled, short-cylindrical cells 10–25 \times 2–5 μm , in parallel arrangement, bearing the conidiogenous cells.

Colonies attaining a diameter of 3–6 mm in 14 days; ultimate diameter 20 mm but occasionally 45 mm; colonies initially smooth, more or less volcano-shaped, with a central slime droplet due to abundant sporulation, outer part almost flat, with sharp margin, pale buff, later often being covered with flat, silky white aerial mycelium; colonies later becoming irregularly, radially furrowed at the centre, with white, uniform or slightly zonate aerial mycelium; the outer parts remaining pale buff, with minute concentric furrows; reverse pale ochraceous near the margin, ochraceous to cinnamon at the centre. Colonies developing from swollen conidia which become septate and give rise to a cluster of inflated cells, smooth- or rough-walled, often rather thick-walled, hyaline, with some scattered conidiogenous cells. *Hyphae* arising from most of the swollen intercalary cells as plagiotropic branches, more or less radially oriented, smooth- and rather thin-walled, hyaline, straight or

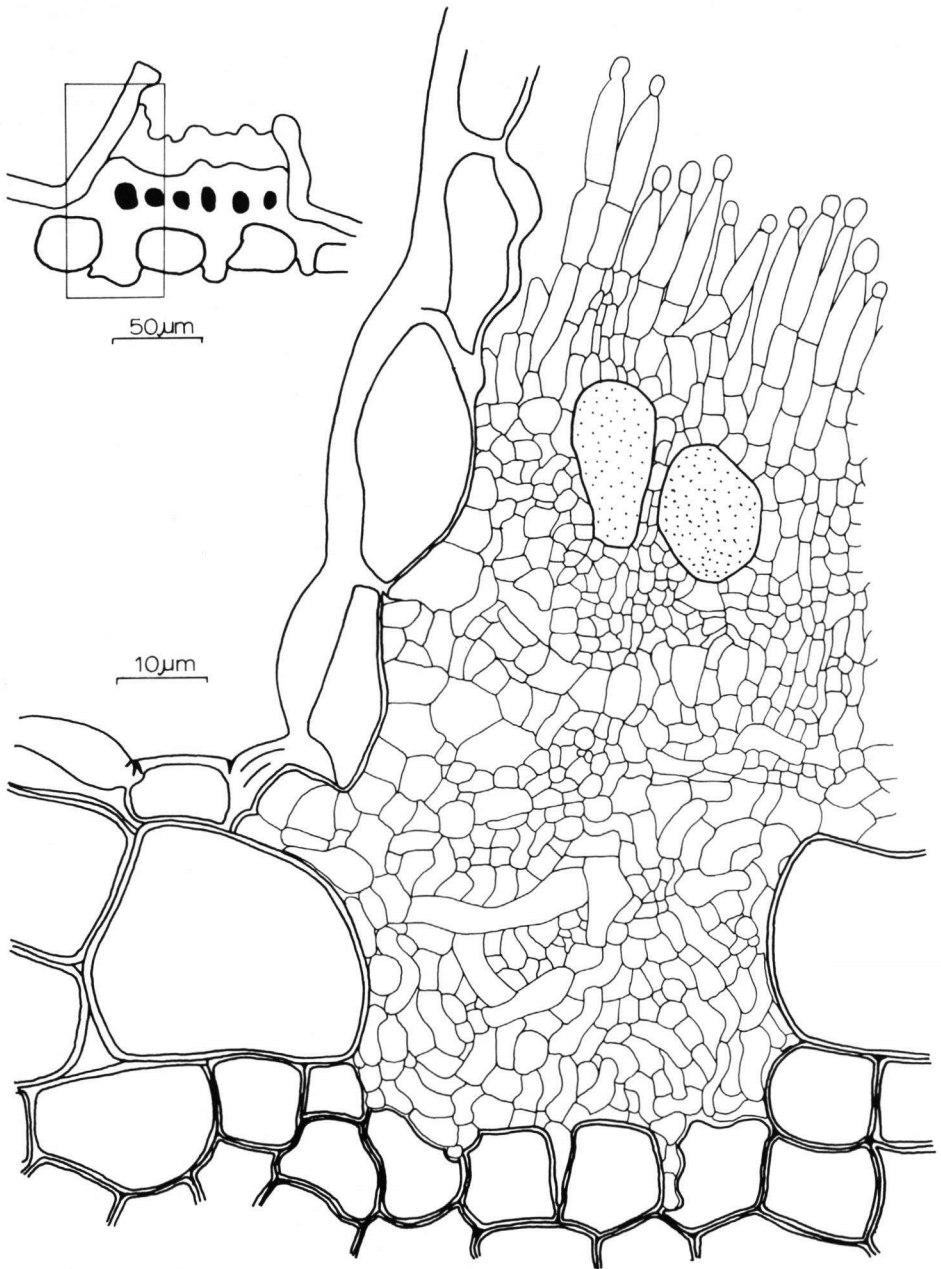


Fig. 8. *Collettoconis aecidiophila*, herb. CBS 759 on the natural substrate.

flexuose, regularly 1.2–2.5 μm wide, remotely septate, soon forming a tough and compact mycelium. *Conidiogenous cells* more or less vertical, densely packed around the less compact centre which is irregular in outline, arising laterally or terminally, ortho- or plagiotropically from undifferentiated hyphae, smooth- and thin-walled, hyaline, often basally swollen with a cylindrical neck, straight or flexuose, widest (2.5–4 μm) near the base, slightly tapering towards the 1.5–2.5 μm wide, truncate apex, forming conidia in basipetal order, rarely

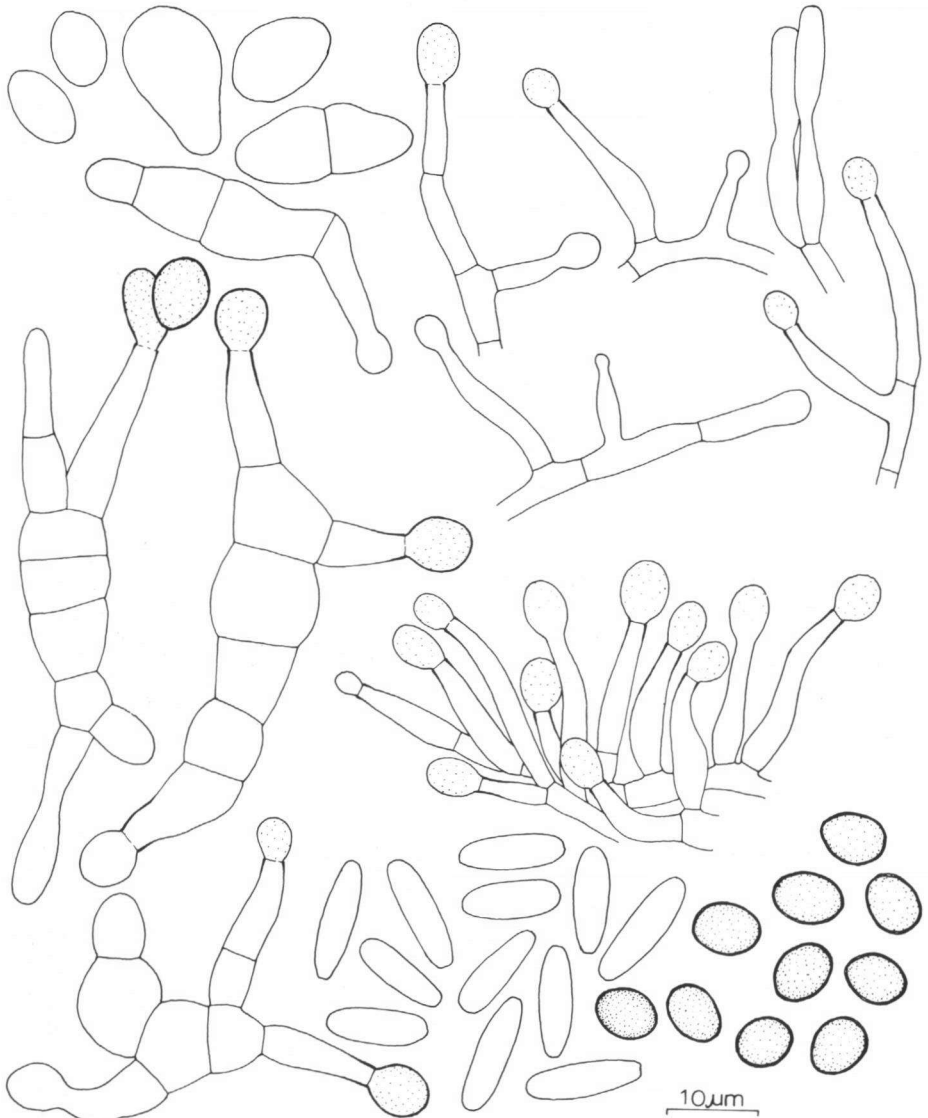


Fig. 9. *Colletotrichum aecidiophila*, CBS 155.78 on oatmeal agar.

some minute annellations being discernible. *Conidia* one-celled, smooth-walled, of two types: thin-walled, hyaline, cylindrical, slightly tapering towards each obtuse end, $11-14 \times 3-4.2 \mu\text{m}$, and thin-walled and subhyaline but finally becoming rather thick-walled and pale brown, broadly ellipsoidal or subglobose, $7-9 \times 4.5-6 \mu\text{m}$, with hardly discernible basal scars.

MATERIAL EXAMINED.— CBS 273.67 = ATCC 18400, isolated by J. L. Cunningham from *Puccinia* spec. on *Hyptis capitata*, Dominica, West Indies, Dec. 1966; CBS 155.78 = herb. CBS 759, isolated by H. A. van der Aa from uredosori of *Puccinia* spec. on leaves of *Arachis hypogaea*, U. P. Singh & M. Lal, Varanasi, U.P., India, Oct. 1977.

The preceding description is based on CBS 155.78 (=Herb. CBS 759) on the natural substrate and on malt agar at $20-22^\circ\text{C}$.

The identity of the examined specimens with the type of *Gloeosporium aecidiophilum* was confirmed by J. A. von Arx (pers. commun.). Several other melanconiaceous fungi parasitizing rusts have been described. *Tuberculina persicina* (Dit.) Sacc. has a purplish hymenium of cylindrical conidiogenous cells with an abruptly tapering apex and producing globose, verruculose conidia. According to von Arx (1970) *Gloeosporium aecidiicola* Ranaj. is probably the same species. *Colletotrichum aeciicola* Tehon, *C. aecidiicola* Negru, and *C. uredinophilum* Hulea all have conidiomata with large, dark brown, pluriseptate setae.

DENTICULARIA Deighton

Denticularia Deighton in Trans. Br. mycol. Soc. 59: 421. 1972.

Colonies on the natural substrate forming small pustules, greyish-white to pale ochraceous. Conidiophores subhyaline, thin-walled, suberect, fasciculate; branching pattern irregular. Conidiogenous cells cylindrical, sympodial, with scattered, conical denticles. Conidia arising in short chains, subhyaline, more or less fusiform, continuous or septate.

TYPE SPECIES.—*Cladosporium modestum* H. Syd.

KEY TO THE SPECIES

- | | |
|------------------------------------|------------------------|
| 1a. Conidia lemon-shaped | <i>D. limoniformis</i> |
| b. Conidia fusiform | 2 |
| 2a. Conidia one-celled | <i>D. modesta</i> |
| b. Conidia often septate | 3 |
| 3a. Conidia 0-1-septate | <i>D. fici</i> |
| b. Conidia 1-6-septate | <i>D. tertia</i> |

DENTICULARIA FICI Deighton

Denticularia fici Deighton in Trans. Br. mycol. Soc. 59: 423. 1972.

Denticularia limoniformis de Hoog, spec. nov.—Fig. 10

Mycelium in substrato naturali pustulatas, ad $300-500 \mu\text{m}$ altas, $200 \mu\text{m}$ diametro, dilute ochraceas formans. Hyphae in medio pustularum $3-4 \mu\text{m}$ latae, subhyalinae ad dilute brunneae, leves, fere tenuitunicatae, sursum divaricatae et conidiophora irregulariter ramosa formantes. Cellulae conidio-

genae cylindricae, flexuosae, $20-40 \times 2-3 \mu\text{m}$, in apice nonnullos denticulos conidiiferos conicos ad $1.5 \mu\text{m}$ longos sympodialiter proferentes; denticuli cicatrice applanata modice pigmentata $0.8 \mu\text{m}$ diametro terminati. Conidia levia vel irregulariter verrucosa, fere tenuitunicata, dilute brunnea, utrinque angustata et saepe acuminata, $9-12 \times 3.8-4.5 \mu\text{m}$, brevibus catenis connexa.

Typus: in *Hyphodontia breviseta* in trunco Piceae abietis, in parochia Västerlanda, prov. Bohuslän in Suecia, J. Eriksson & T. Hallingbäck, in Herb. CBS 292.

Mycelium on the natural substrate consisting of conical pustules $300-500 \mu\text{m}$ high, about $200 \mu\text{m}$ in diam., pale ochraceous. *Hyphae* in the core of the pustules $3-4 \mu\text{m}$ wide, subhyaline to pale brownish, smooth- and rather thin-walled, apically splaying out and forming irregularly branched conidiophores. *Conidiogenous cells* cylindrical $20-40 \times 2-3 \mu\text{m}$, flexuose, sympodial, in the apical region with few scattered, conical denticles up to $1.5 \mu\text{m}$ long; denticles nearly upright, angle subtended by the abaxial side almost being 180° , adaxial angle acute; with a slightly pigmented, flat scar about $0.8 \mu\text{m}$ wide. *Conidia* smooth-walled or irregularly verruculose, rather thin-walled, pale brown, tapering towards the base and the apex, often distinctly acuminate at both extremities, $9-12 \times 3.8-4.5 \mu\text{m}$, single or catenulate, frequently a basal as well as an apical scar being discerned.

TYPE SPECIMEN.—Herb. CBS. 292, associated with *Hyphodontia breviseta* (Karst.) J. Erikss. on fallen trunk of *Picea abies*, Västerlanda parish, Torrgårdsvatten, Bohuslän, Sweden, J. Eriksson & T. Hallingbäck, 20 Aug. 1975.

The species occurs rather frequently on old fruitbodies of *Hyphodontia breviseta* in Sweden (J. Eriksson, pers. commun.). Attempts to grow the fungus in pure culture remained unsuccessful. Conidia were detached quite easily. Considering the prominent extremities of most conidia it may be assumed that they arise in short chains, though these were never actually seen.

Denticularia limoniformis is similar to *Pseudohansfordia meliolae*, but differs by forming pustules, by short conidiiferous rhachides and by more narrow conidia. By its probably

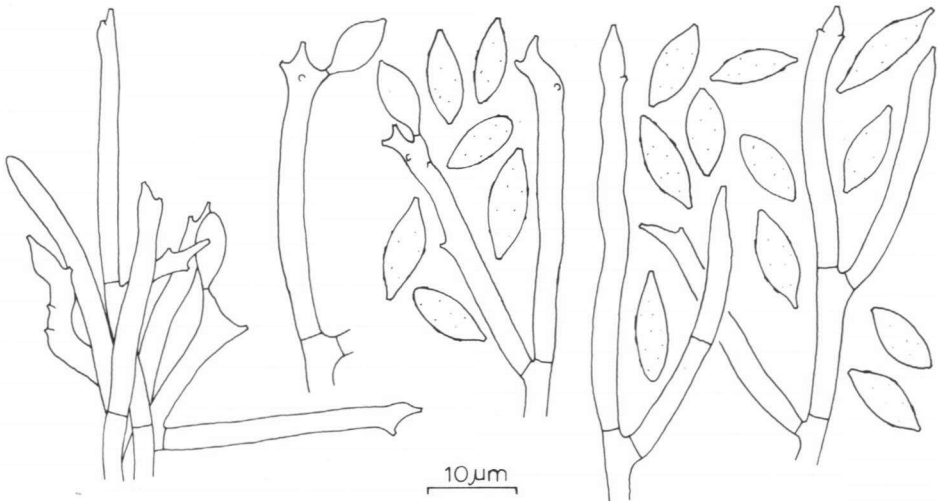


Fig. 10. *Denticularia limoniformis*, herb. CBS 292 on the natural substrate.

hyperparasitic nature, it is more close to *Pseudohansfordia* than to the remaining plant pathogenic *Denticularia* species. The genus *Denticularia* is close to *Ramularia* Unger, merely differing by the presence of conical denticles in the former.

DENTICULARIA MODESTA (H. Syd.) Deighton

Cladosporium modestum H. Syd. in *Annls mycol.* 37: 252. 1939. — *Denticularia modesta* (H. Syd.) Deighton in *Trans. Br. mycol. Soc.* 59: 422. 1972.

DENTICULARIA TERTIA (Chupp & Greene) Deighton

Cercospora tertia Chupp & Greene in *Am. Midl. Nat.* 34: 269. 1945. — *Denticularia tertia* (Chupp & Greene) Deighton in *Trans. Br. mycol. Soc.* 61: 115. 1973.

Engyodontium de Hoog, gen. nov.

Coloniae arachnoideae, albae. Conidiophora hyalina, tenuitunicata, repentia vel adscendentia, plus minusve verticillata. Cellulae conidiogenae subulatae ad cylindricae, polyblasticae, nonnullos denticulos obtusos vel capillariformes vel rhachidem elongatam formantes. Blastoconidia hyalina, parva, continua.

Species typica: *Rhinotrichum parvisporum* Petch

Colonies cobweb-like, white. Conidiophores hyaline, thin-walled, creeping to suberect; branching pattern subverticillate to verticillate. Conidiogenous cells subulate to cylindrical, polyblastic, forming holoblastic conidia on butt- to hair-shaped denticles on elongated rhachides. Conidia hyaline, small, one-celled.

TYPE SPECIES.—*Rhinotrichum parvisporum* Petch

Engyodontium albus (Limber) de Hoog, comb. nov.

Tritirachium album Limber in *Mycologia* 32: 27. 1940 (basionym). — *Beauveria alba* (Limber) Saccas in *Revue Mycol.* 13: 64. 1948.

REFERENCES.—Limber (1940), de Hoog (1972), Matsushima (1975).

By excluding the species from *Beauveria* Vuill., this genus becomes more homogeneous, being restricted to species with dense clusters of short branches and fertile cells on undifferentiated hyphae, disintegrating only when the strains are grown on artificial media. *Tritirachium* Limber differs by pigmented colonies and regularly geniculate conidiiferous rhachides with flat conidial scars.

Engyodontium parvisporum (Petch) de Hoog, comb. nov.—Fig. 11

Rhinotrichum parvisporum Petch in *Trans. Br. mycol. Soc.* 16: 244. 1931 (basionym).

Mycelium forming a cobweb-like felt on remains of mites on the abaxial sides of leaves, white to cream-coloured. *Hyphae* creeping, smooth- and thin-walled, hyaline, 1–1.8 μm wide, irregularly branched, in part fertile, intermingled with suberect, hyaline conidiophores

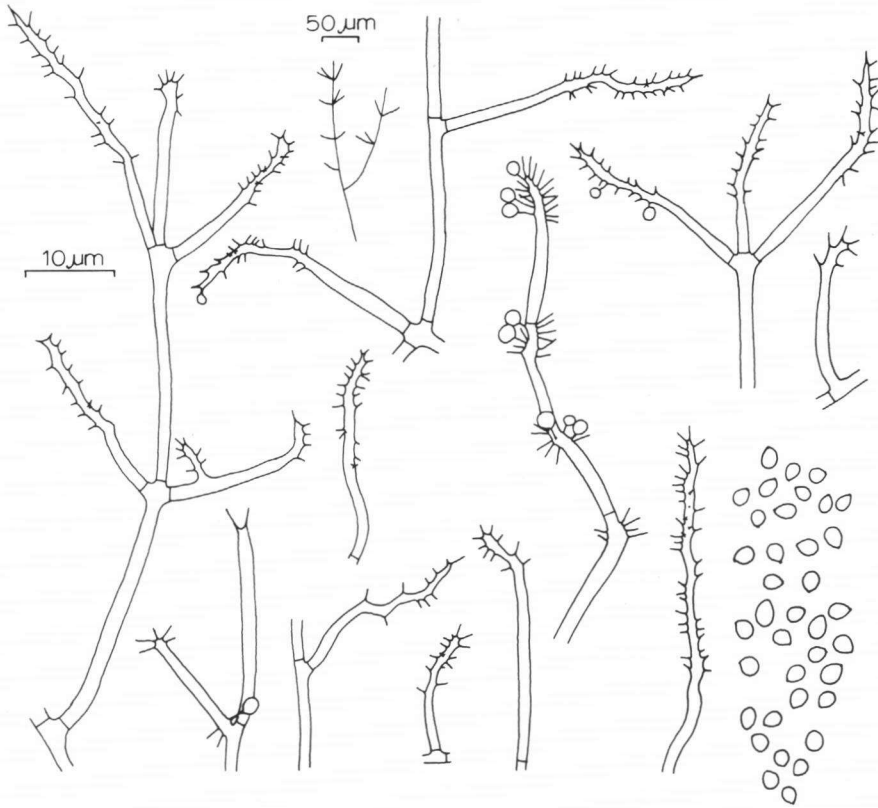


Fig. 11. *Engyodontium parvisporum*, Petch R-400 on the natural substrate.

with slightly thickened walls; conidiophores often over 200 μm high, regularly 1.5–2 μm wide, septate every 25–50 μm , with whorls of (1)–2–3(–5) plagiotropic conidiogenous cells just below the septa, the apical whorl being the largest, sometimes with one or two lateral branches of similar structure as the main stalk. *Conidiogenous cells* scattered or in whorls, straight, cylindrical, when arising from differentiated conidiophores often very slightly tapering towards the tip, the broadest part just above the base; basal part 10–20 \times 1.2–1.8 μm , rhachis straight or flexuose, 0.8 μm wide, densely covered with hair-shaped conidiiferous denticles 1–2 μm long; conidiogenous cells on undifferentiated hyphae entirely covered with denticles, sometimes intercalary. *Conidia* hyaline, smooth- and thin-walled, subglobose to guttuliform, occasionally obovoidal, with acuminate base, 1.2–3 \times 1.2–1.5 μm .

MATERIAL EXAMINED.—Petch R-400, on *Aspidiotus* and *Lecanium* on *Hevea brasiliensis*, Dewalakande, Sri Lanka, Jan. 1928 (type of *R. parvisporum*, K); Petch R-494, on cocoon, Nuwara Eliya, Sri Lanka, July 1928 (K); Petch R-599, Sri Lanka, Sept. 1928 (associated with *Gibellula* spec., K); Petch (without number), on *Aleyrodes* on mango (associated with type of *Gonatorrhodiella coccorum* Petch, K); Petch R-301, on fly, Nuwara Eliya, Sri Lanka (K).

The preceding description is of dried specimen Petch R-400 (K) on the natural substrate.

The species is close to *Engyodontium album* in its thin, white colonies, the slightly differentiated, verticillate conidiophores and the guttuliform conidia. The general structure of *E. parvisporum* is, however, somewhat more irregular, the length of the basal parts of the conidiogenous cells being variable with equally wide, occasionally intercalary rhachides. The main feature for distinction of both species is the rhachis, which is cylindrical, slightly flexuose with extremely thin denticles in *E. parvisporum*, but geniculate with butt-shaped denticles on the edges in *E. album*.

HELMINTHOPHORA Bon.

Helminthophora Bon., Handb. allgem. Mykol. 93. 1851. — *Dactylium* Nees sect. *Helminthophora* (Bon.) Sacc. in Syll. Fung. 4: 190. 1886.

Eurasina G. Arnold in Z. Pilzk. 35: 305. 1969.

Colonies spreading, white or nearly white. Conidiophores hyaline, thin-walled, erect; branching pattern verticillate. Conidiogenous cells subulate, monoblastic, often proliferating laterally to form a straight or slightly flexuose rhachis with a few scattered conidium-bearing denticles. Conidia hyaline, large, usually septate.

TYPE SPECIES.—*Dactylium sphaerocephalum* Berk. (= *Helminthophora tenera* Bon.).

The process of conidiogenesis was studied by means of culture chambers slightly modified after Cole & al. (1969). Each conidiogenous cell first blows out at the apex to form a conidium holoblastically. It takes several days for the conidium to fully mature. The conidia may remain attached to the supporting cell for a long period, even after formation of a basal septum. Often, however, the terminal conidium is pushed aside by a lateral growing point which again blows out holoblastically at its apex. The new outgrowth usually leads to a short, straight or slightly flexuose rhachis with up to 4 large denticles at acute or nearly right angles. Each of the denticles forms one conidium only. The conidiogenous cell was rarely seen to proliferate on or through the scar of a previously seceded conidium (Fig. 12e). More often the conidiogenous cell proliferates before producing any conidium, so that a constriction of the cell remained visible (Fig. 12d), as was also shown by Gams & Hoozemans (1970).

Helminthophora tenera Bon., the first species described in the genus, was listed as a possible synonym of *Cladobotryum dendroides* by Gams & Hoozemans (1970). However, the unbranched conidiophore stalks with regular whorls of subulate conidiogenous cells in Bonorden's (1851) figure 137 doubtlessly point to their *Cladobotryum leptosporum* (Sacc.) W. Gams & Hoozemans, for which the older synonym *Dactylium sphaerocephalum* Berk. has now been found. Moreover, *H. tenera* was described as occurring on rotten wood, the same substratum as that of the type specimens of *C. leptosporum* (PAD) and *D. sphaerocephalum* (K), whereas *C. dendroides* is usually found on mushrooms.

In the above sense the genus *Helminthophora* is close to *Pseudohansfordia* G. Arnold, but differs because of its verticillate branching pattern and the inconspicuously sympodial conidium formation. *Calcarisporium* Preuss is also similar, but differs in having clusters of small conidium-bearing denticles at the apices of the fertile cells. *Sibirina* G. Arnold also

has a verticillate branching pattern and subulate conidiogenous cells, but the latter are monoblastic, forming conidia singly or in basipetal succession (Gams, 1973).

***Helminthophora sphaerocephala* (Berk.) de Hoog, *comb. nov.*—Fig. 12**

Dactylium sphaerocephalum Berk. in *Ann. Mag. nat. Hist.* 6: 347. 1841 (basionym). — *Mucrosporium sphaerocephalum* (Berk.) Sacc. in *Syll. Fung.* 4: 190. 1886.

Helminthophora tenera Bon., *Handb. allgem. Mykol.* 93. 1851. — *Dactylium tenerum* (Bon.) Sacc. in *Syll. Fung.* 4: 190. 1886.

Dactylium dendroides (Bull. ex Mérat) Fr. var. *leptosporum* Sacc. in *Michelia* 2: 576. 1882. — *Dactylium leptosporum* (Sacc.) Lentz in *Mycopath. Mycol. appl.* 32: 14. 1967. — *Cladobotryum leptosporum* (Sacc.) W. Gams & Hoozemans in *Persoonia* 6: 106. 1970.

Eurasina bondarzewiae G. Arnold in *Z. Pilzk.* 35: 305. 1969.

Possible synonyms in check-list under *agaricinum*, *fusarisporum*.

REFERENCES.—Lentz (1967), Arnold (1969, 1971a), Gams & Hoozemans (1970).

Colonies attaining a diameter of 25–40 mm in 14 days, appearing lanose, about 3 mm high, with some thin, suberect tufts about 1 cm high and some flat, dense mycelium at the centre,

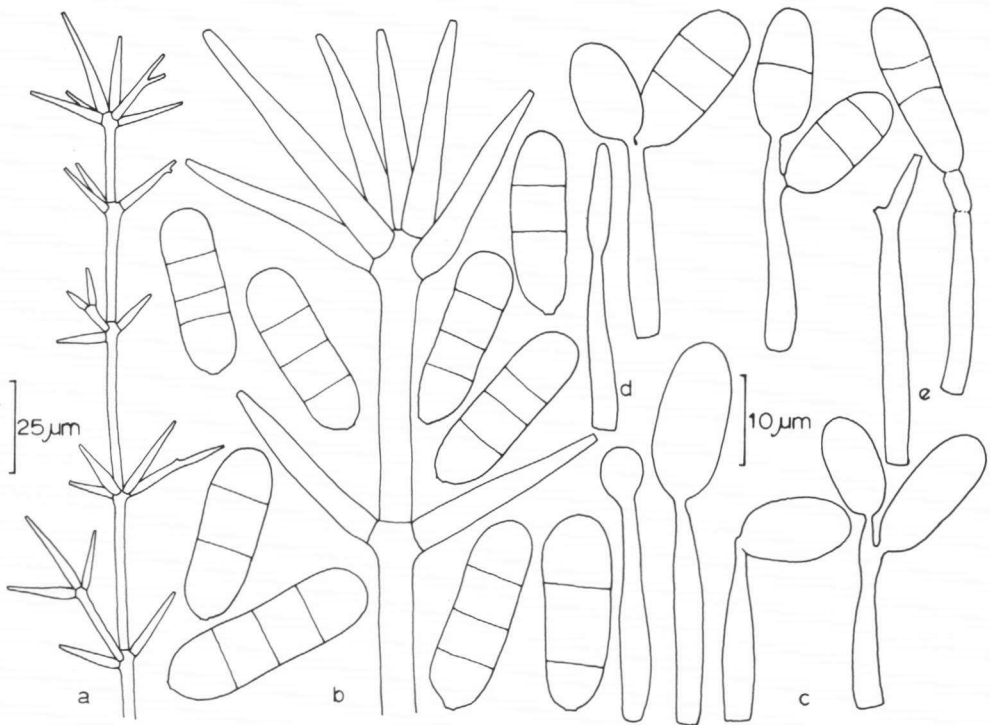


Fig. 12. *Helminthophora sphaerocephala*, CBS 974.73 on mushroom agar. — a. Branching pattern. — b-e. Fertile structures.

purely white; reverse on oatmeal agar pale ochraceous; often forming some hyaline exudate. *Conidiophores* arising orthotropically from fragile, hyaline, smooth- and thin-walled, 5–7 μm wide, aerial hyphae, suberect to erect, main stalk with slightly thickened walls, 200–700 μm long, 4–7 μm wide at the base, 2.5–3.5 μm wide near the apex, septate every 30–50 μm ; branching pattern verticillate, whorls on main stalks containing (2–)4–7 conidiogenous cells, sometimes also with a short lateral branch. *Conidiogenous cells* straight, subulate, 20–35 μm long, widest (3.2–4 μm) just above the base, tapering towards the 1–1.5 μm wide apex, initially monoblastic, forming conidia singly by inflation of the tip, at a later stage proliferating sympodially, leading to a short, flexuose rhachis with 1–4 scattered, butt-shaped denticles on the edges. *Conidia* 3–4-celled, smooth- and thin-walled, short-cylindrical with broadly rounded extremities, 17–25 \times 5.5–7.5 μm , often with a slightly prominent scar at the base.

The preceding description is based on CBS 974.73 on mushroom agar at 20–22°C.

PSEUDOHANSFORDIA G. Arnold

Pseudohansfordia G. Arnold in Z. Pilzk. 35: 307. 1969 (non *Pseudohansfordia* Reddy & Bilgrami in Nova Hedwigia 26: 152. 1975).

Sympodiophora G. Arnold in Nova Hedwigia 19: 301. 1970.

Colonies spreading, purely white or pale greyish, on the natural substrate forming a dense felt. *Conidiophores* hyaline to subhyaline, ascending to suberect; branching pattern subverticillate or irregular. *Conidiogenous cells* subulate to cylindrical, polyblastic, with usually remote loci on a flexuose rhachis, each locus forming holoblastic conidia singly or retrogressively. *Conidia* hyaline, continuous or septate.

TYPE SPECIES.—*Pseudohansfordia irregularis* G. Arnold

In the type species, *P. irregularis*, the mode of conidiogenesis is essentially the same as in most species of *Cladobotryum*. The first conidium blows out terminally; it then becomes delimited by a septum, below which a narrow zone swells to give rise to the second conidium. On the young inflation the scar of the previous conidium often remains visible, mature conidia showing two scars on the basal region. After completion of a short series of conidia, the conidiophore tip proliferates subapically with a new fertile growing point, thus leading to a flexuose rhachis with blunt conidium-bearing denticles on the edges.

In the type species of *Sympodiophora*, *S. stercicola* G. Arnold, the same phenomena occur. In this case, however, the inflating zones are narrow, the inflations being almost restricted to the scars of the previous conidia. When directly observed in a petri-dish the conidia are sessile and form small asterisk-shaped clusters on the fertile denticles. *Sympodiophora didyma* Deighton & Pirozynski is similar to *S. stercicola*, but the conidia form singly on each locus. Hence a number of sympodial species, forming one conidium on each denticle and described by Deighton & Pirozynski (1972) in *Sympodiophora*, are here included in *Pseudohansfordia*.

Pseudohansfordia in the above sense differs only slightly from *Pseudofusarium* Matsushima. The latter genus now comprises only two species, but *Blastotrichum araneorum* Petch, *Nodulisporium didymosporium* Nicot and several taxa of the section *Arthrosporiella* sensu Booth of *Fusarium* are closely related. Many of these are frequently found in asso-

ciation with other fungi, possibly being weak hyperparasites. They mainly differ from *Pseudohansfordia* by having more densely clustered conidium-bearing denticles, the rhachis, if present, being non or hardly flexuose. The conidiogenous cells of *Pseudohansfordia* species are either indeterminate, or become intercalary, in which case they bear only one or two denticles at the most. *Sympodiophora venezuelensis* Deighton & Pirozynski is intermediate between the two groups.

Pseudohansfordia is also reminiscent of some *Pseudocercospora*-like fungi [e.g. *Elletevera parasitica* (Ellis & Everh.) Deighton], which, however, all differ by having flat, slightly pigmented, conidial scars.

The description of *Pseudohansfordia* Reddy & Bilgrami is poor. The type specimen (CMI) of the only species, *P. hughii* Reddy & Bilgrami, the causative agent of leaf spots on *Psidium guajava* L., comprises a small piece of a dried culture, which is nearly smooth, hyaline, with dark olivaceous pustules of about $120 \times 90 \mu\text{m}$. The sympodial conidia are hyaline, one-celled, broadly clavate and are borne in small numbers on the tips of cylindrical conidiogenous cells. The fungus is close to sporodochial genera, such as *Hadrotrichum* Fuckel, *Pseudoepicoccum* M. B. Ellis and *Asperisporium* Maublanc, but the poor condition of the herbarium material, possibly due to severe heating during drying, does not allow further identification.

KEY TO THE SPECIES

- 1a. Conidia all continuous. *P. melirolae*
- b. Conidia septate, a small number of continuous conidia sometimes being present 2
- 2a. Conidia predominantly 4-celled, with acute apex 3
- b. Conidia (1-)2(-3)-celled, with rounded apex 4
- 3a. Conidiophores single, with scattered, pimple-shaped denticles; conidia usually over $5.5 \mu\text{m}$ wide
- P. tenuis*
- b. Conidiophores fasciculate, with conic denticles partly in loose groups; conidia usually less than $5.5 \mu\text{m}$ wide *P. venezuelensis*
- 4a. Conidiogenous cells soon becoming transversely septate, intercalary cells being about $5 \mu\text{m}$ long; secondary conidia may be present *P. varanasiensis*
- b. Conidiogenous cells, when intercalary, over $10 \mu\text{m}$ long; secondary conidia absent 5
- 5a. Conidia with rounded base 6
- b. Conidia with acuminate base 7
- 6a. Conidiogenous cells, excluding rhachides, about $20-45 \mu\text{m}$ long; denticles meristematic
- P. irregularis*
- b. Conidiogenous cells, excluding rhachides, about $100-150 \mu\text{m}$ long; denticles each forming a single conidium *P. mycophila*
- 7a. Conidia about $8-11 \times 3.4-4.5 \mu\text{m}$ *P. pulchella*
- b. Conidia about $15-25 \times 5-7 \mu\text{m}$ 8
- 8a. Denticles meristematic *P. stereicola*
- b. Denticles each forming a single conidium *P. didyma*

Pseudohansfordia didyma (Deighton & Pirozynski) de Hoog, *comb. nov.*

Sympodiophora didyma Deighton & Pirozynski in Mycol. Pap. 128: 63. 1972 (basionym).

The species is very similar to *Sympodiophora stereicola*; it is merely distinguished by the production of only one conidium per denticle.

PSEUDOHANSFORDIA IRREGULARIS G. Arnold—Fig. 13

Pseudohansfordia irregularis G. Arnold in Z. Pilzk. 35: 308. 1969.

REFERENCES.—Arnold (1969, 1971a).

Colonies attaining a diameter of about 20 mm in 10 days, appearing powdery to finely lanose with a smooth margin, about 1 mm high, purely white; reverse on oatmeal agar pale olivaceous. *Conidiophores* hyaline, smooth- and thin-walled, suberect, crowded, about 100–200 μm high, 4–5.5 μm wide, septate about every 30–50 μm , usually without a distinct main stalk, branched more or less verticillately in the apical part; each whorl containing 1–3 plagiotropic branches or conidiogenous cells. *Conidiogenous cells* rather straight if terminal, often slightly curved upwards if lateral, cylindrical, basal part 15–40 \times 3.5–4.5 μm ; co-

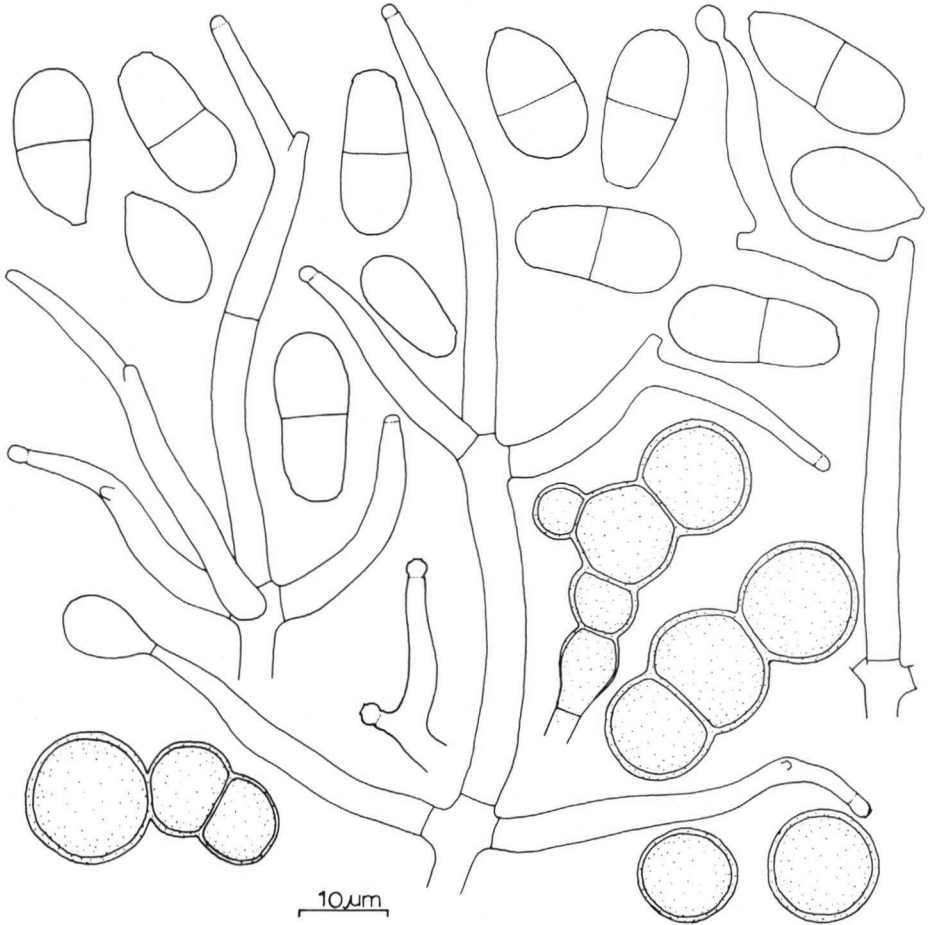


Fig. 13. *Pseudohansfordia irregularis*, CBS 459.71 on mushroom agar.

nidiiferous rhachis sympodial, flexuose with blunt denticles (about $2.5 \times 1.5 \mu\text{m}$) on the edges; denticles forming conidia by inflation of the tip; each subsequent conidium being initiated just below the previous one. *Conidia* 1–2(–4)-celled, smooth- and thin-walled, broadly ellipsoidal to broadly clavate, $13\text{--}20 \times 6\text{--}9 \mu\text{m}$, with broadly rounded bases, either with one central, slightly prominent scar or with two flat scars on both sides of the basal extremity.

The above description is based on the type strain CBS 459.71 on mushroom agar at $20\text{--}22^\circ\text{C}$. The same strain was used by Arnold (1969). In the latter publication, the conidigenous cells were depicted as being rather short and firm; the ratio length/width of these cells was described as being 2.5–8. In the present study this ratio was found to be about 7.5–17.5. In his second article on the species, Arnold (1971a) repeated his first description, but the illustration showed much more elongate fertile cells, having a length/width ratio of about 7–11. Two available specimens were then mentioned, but no indication was made as to which of these was depicted.

Pseudohansfordia meliolae* (Stev.) de Hoog, *comb. nov.

Acremonium meliolae Stev. in Bot. Gaz. 65: 234. 1918 (basionym). — *Sepedonium meliolae* (Stev.) Cif. in Sydowia 9: 335. 1955. — *Symptodiophora meliolae* (Stev.) Deighton & Pirozynski in Mycol. Pap. 128: 73. 1972.

REFERENCES.—Hansford (1946), Deighton & Pirozynski (1972).

Its lemon-shaped conidia remind one of the hyperparasite *Denticularia limoniformis*, but the conidial apparatus of the latter species is much more dense and stocky, and the probably catenulate conidia often have a pigmented scar at each end.

***Pseudohansfordia mycophila* (Tubaki) de Hoog, *comb. nov.*—Fig. 14**

Dactylaria mycophila Tubaki in Nagaoa 5: 17. 1955 (basionym). — *Symptodiophora mycophila* (Tubaki) Deighton & Pirozynski in Mycol. Pap. 128: 72. 1972.

REFERENCES.—Tubaki (1955), Deighton & Pirozynski (1972), Matsushima (1975).

The type strain CBS 175.56 still sporulates rather well on mushroom agar. The conidia are formed in strict sympodial order, the rhachis often being straight or nearly straight. Each conidial peg only forms one conidium. The chlamydo-spores, often becoming rounded, may be liberated as large globose cells, and are very similar to those of *Pseudohansfordia irregularis*.

Pseudohansfordia pulchella* (Deighton & Pirozynski) de Hoog, *comb. nov.

Symptodiophora pulchella Deighton & Pirozynski in Mycol. Pap. 128: 64. 1972 (basionym).

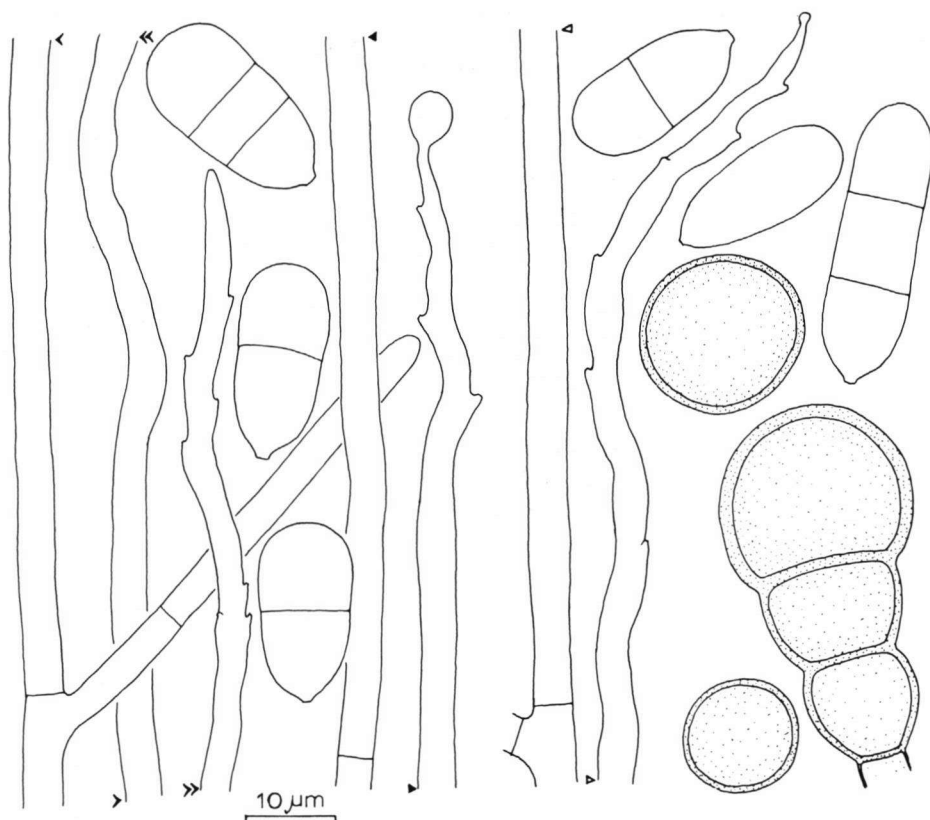


Fig. 14. *Pseudohansfordia mycophila*, CBS 175.56 on mushroom agar.

Pseudohansfordia stercicola* (G. Arnold) de Hoog, *comb. nov.

Sympodiophora stercicola G. Arnold in *Nova Hedwigia* 19: 302. 1970 (basionym).

REFERENCES.—Arnold (1970), Deighton & Pirozynski (1972).

Pseudohansfordia tenuis* (H. Syd.) de Hoog, *comb. nov.

Eriomycopsis tenuis H. Syd. in *Annls mycol.* 25: 137. 1927 (basionym). — *Ramularia tenuis* (H. Syd.) Toro apud Seaver & Chardon in *Sci. Survey P.R. and Virgin Isl.* 8: 222. 1932 (non *Ramularia tenuis* J. J. Davis in *Trans. Wis. Acad. Sci. Arts Lett.* 21: 261. 1924). — *Sympodiophora tenuis* (H. Syd.) Deighton & Pirozynski in *Mycol. Pap.* 128: 70. 1972.

REFERENCES.—Sydow (1927), Deighton & Pirozynski (1972).

Pseudohansfordia varanasiensis* (Deighton & Pirozynski) de Hoog, *comb. nov.

Sympodiophora varanasiensis Deighton & Pirozynski in *Mycol. Pap.* 128: 68. 1972 (basionym).

The one-celled conidia, described by Deighton & Pirozynski (1972) as possibly immature, are actually secondary conidia formed at the apices of the septate conidia, which consequently often have a scar at each end. No tertiary conidia were observed.

Pseudohansfordia venezuelensis* (Deighton & Pirozynski) de Hoog, *comb. nov.

Symptodiophora venezuelensis Deighton & Pirozynski in Mycol. Pap. 128: 66. 1972 (basionym).

S P O R O T H R I X Hektoen & Perkins

Sporothrix Hektoen & Perkins in J. exp. Med. 5: 77. 1900; Nicot & Mariat in Mycopath. Mycol. appl 49: 61. 1973.

The genus was recently revised by de Hoog (1974). Some insect pathogenic species with scattered denticles on more or less flexuose rhachides, e.g. *S. ghanensis* de Hoog & Evans, remind one of *Pseudohansfordia* but are usually smaller and have continuous conidia. They may also bear similarity to *Denticularia* species which, however, have firmer, subhyaline conidiophores and conidia arising in short chains. The generic limits are arbitrary.

***Sporothrix guttuliformis* de Hoog, *spec. nov.*—Fig. 15**

Coloniae in agaro farina avenae dicto temperatura ambiente 10 diebus ad 10 mm diametro, planae, primum leves, hyalinae, cito farinosae in medio, albae; margo regularis, vage delimitata, hyalina. Reversum albidum, in medio cremeum. Exsudatum abest, neque olet. Hyphae submersae hyalinae, leves, tenuitunicatae, juvenes omnes radiantes, dichotomae, raro septatae, constanter 2.5–3 μm latae, deinde ramos laterales 0.8–1.5 μm latos densos proferunt; rami latiores subinde densius septati et raro disrupti. Hyphae aerae tenues, cellulas conidiogenas abundantes proferunt. Cellulae conidiogenae terminales, laterales vel intercalares, cylindricae, latitudinae hyphis basilaribus similes, longitudine variables; terminales et laterales conidia in apice aggregata proferunt e cicatricibus modice prominentibus haud pigmentatis. Conidia hyalina, tenuitunicata, levia, guttuliformia, hilo et cicatricibus inconspicuis praedita, singula, plerumque 2.8–3.5 \times 2–3 μm , saepe 1–3 conidia secundaria e primariis majoribus, 3.5–6 \times 2.5–3.4 μm , oriuntur.

Typus: CBS 437.76, isolatus ex solo in Malaysia ab T. Furukawa.

Colonies on oatmeal agar attaining a diameter of 10 mm in 10 days, appearing flat, initially smooth, hyaline, soon becoming farinose at the centre, white; margin straight, rather vague, hyaline. Reverse whitish, cream at the centre. Exudate and odour absent. Submerged *hyphae* hyaline, smooth- and thin-walled, running in a radial direction when young, dichotomously branched, sparingly septate, regularly 2.5–3 μm wide, soon bearing 0.8–1.5 μm wide lateral branches and forming a compact mycelium. The wider branches finally become septate at irregular distances and very rarely fragment into separate cells. Aerial hyphae thin, with abundant conidiation. *Conidiogenous cells* intercalary or free, cylindrical, of the same width as the supporting hypha and of variable length; lateral and terminal cells usually produce a small group of conidia at the apex; scars slightly prominent, unpigmented. *Conidia* hyaline, smooth- and thin-walled, guttuliform, with an inconspicuous hilum, mostly 2.8–3.5 \times 2–3 μm , single or with 1–3 on ramo-conidia measuring 3.5–6 \times 2.5–3.4 μm ; apical scars of the latter hardly discernible.

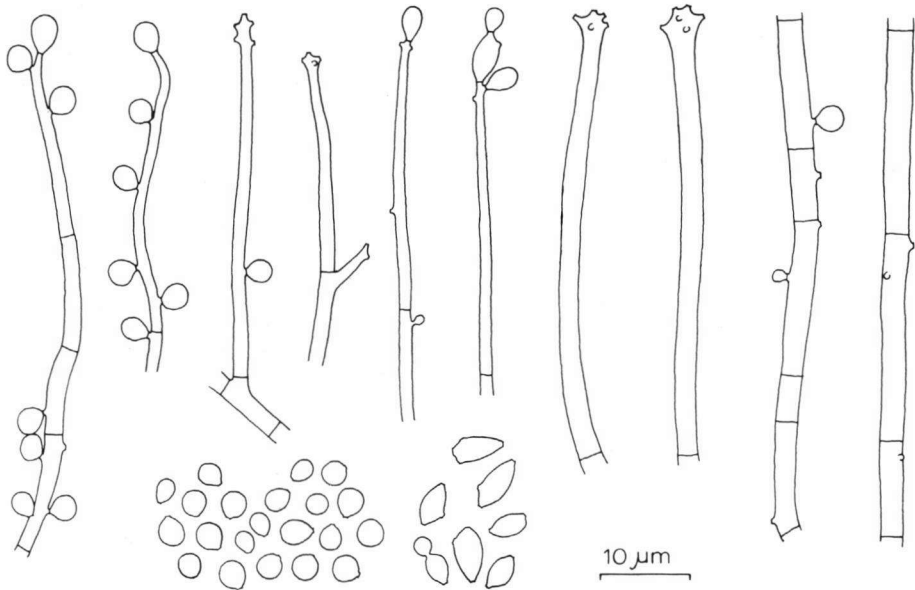


Fig. 15. *Sporothrix guttuliformis*, CBS 437.76 on oatmeal agar.

TYPE CULTURE (living and dried).—CBS 437.76, amylase producing strain, isolated from soil, Malaysia, sent by T. Furukawa, Japan.

On V-8 juice agar the colonies attain a diameter of 30 mm in 10 days. On this medium optimal sporulation is obtained, the incidence of conidia on free hyphal tips being rather high. On other media the great majority of the conidia are formed laterally on intercalary cells. Colonies on malt agar are nearly or completely colourless, and crowded with minute, less than 1 mm high, hyphal strands at the centre. On the latter medium the submerged mycelium is slightly elevated and shows regular radial furrows.

Sporothrix guttuliformis is similar to *S. schenckii* but differs by less prominent denticles and by the lateral and terminal conidia being identical in shape and size, whereas in *S. schenckii* they are lacrymoid to fusiform and (sub-)globose respectively. In addition, the submerged mycelium is relatively wide, often dichotomously branched. In this respect the species is similar to *S. ramosissima* Arn. ex de Hoog, but the latter has distinct conidiophores. Conidial states of *Ophiostoma stenoceras* (Robak) Melin & Nannf., fitting the concept of *Sporothrix schenckii* (pro parte) and of *S. pallida* (Tubaki) Matsushima, may be distinguished by their spreading, lanose colonies. In its cultural characteristics *S. guttuliformis* resembles *S. fungorum* de Hoog & de Vries, from which it differs by a much lower incidence of secondary conidia.

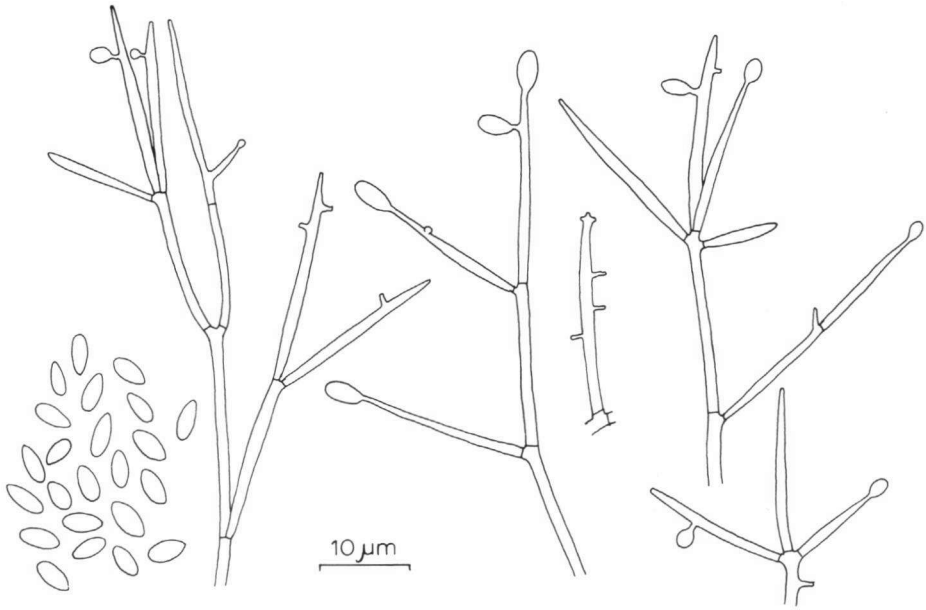


Fig. 16. *Sporothrix rectidentata*, CBS 641.74 young culture on oatmeal agar.

***Sporothrix rectidentata* (Matsushima) de Hoog, *comb. nov.*— Fig. 16**

Tritirachium rectidentatum Matsushima, Ic. Microf. a Matsushima lect. 160. 1975 (basonym).

Acrodontium album Kushwaha & Agrawal in Mykosen 20: 97. 1976.

Matsushima's (1975) classification of this species in *Tritirachium* Limber was based on its verticillate branching. However, all accepted *Tritirachium* species have pigmented colonies, more distinct conidiophores and regularly flexuose rhachides on which the scars are discerned with difficulty (de Hoog, 1972). *Acrodontium* de Hoog has pigmented conidiogenous cells with denticulate rhachides, the scars being little pigmented. *Sporothrix rectidentatum* forms conidia singly, rarely in small sympodial clusters on the apices of the conidiogenous cells. When at least one terminal conidium is formed, new conidia may be initiated much lower down. Consequently the major part of the process of conidiogenesis is more or less retrogressive. The lateral conidia are strictly comparable to the so-called chlamydospores of many *Sporothrix* species, and classification in this genus is thought to be more apt.

***Sporothrix sclerotialis* de Hoog, *spec. nov.*—Fig. 17**

Coloniae in agar farina avenacea decocto post 5 dies 32 mm diametro, planae, leves, in medio mycelio aërio crispatae, hyalinae, ochrascentes, deinde sclerotiis copiosis brunneo-griseae. Cellulae conidiogenae sparsae, nonnumquam inconspicue verticillatae, recte vel modice flexuosae, saepe sursum modice angustatae, plerumque 12–25 μm longae et diametro 1.5–2.5 μm hypha basilari similes; rhachis conidiifera

sympodialis brevis, denticulata; denticuli truncati, 0.2–1.5 μm longi. Conidia hyalina, levia, tenuitunicata, obclavata ad fusiformia, basi acuminata, 4.0–6.4 \times 1.8–3.0 μm .

Typus: CBS 312.77, isolatus e radicibus Lolii perennis in prato prope Wageningen in Neerlandia, ab O. Gerritsma, 9 Mart. 1977.

Colonies attaining a diameter of 32 mm in 5 days, appearing flat, smooth or nearly smooth

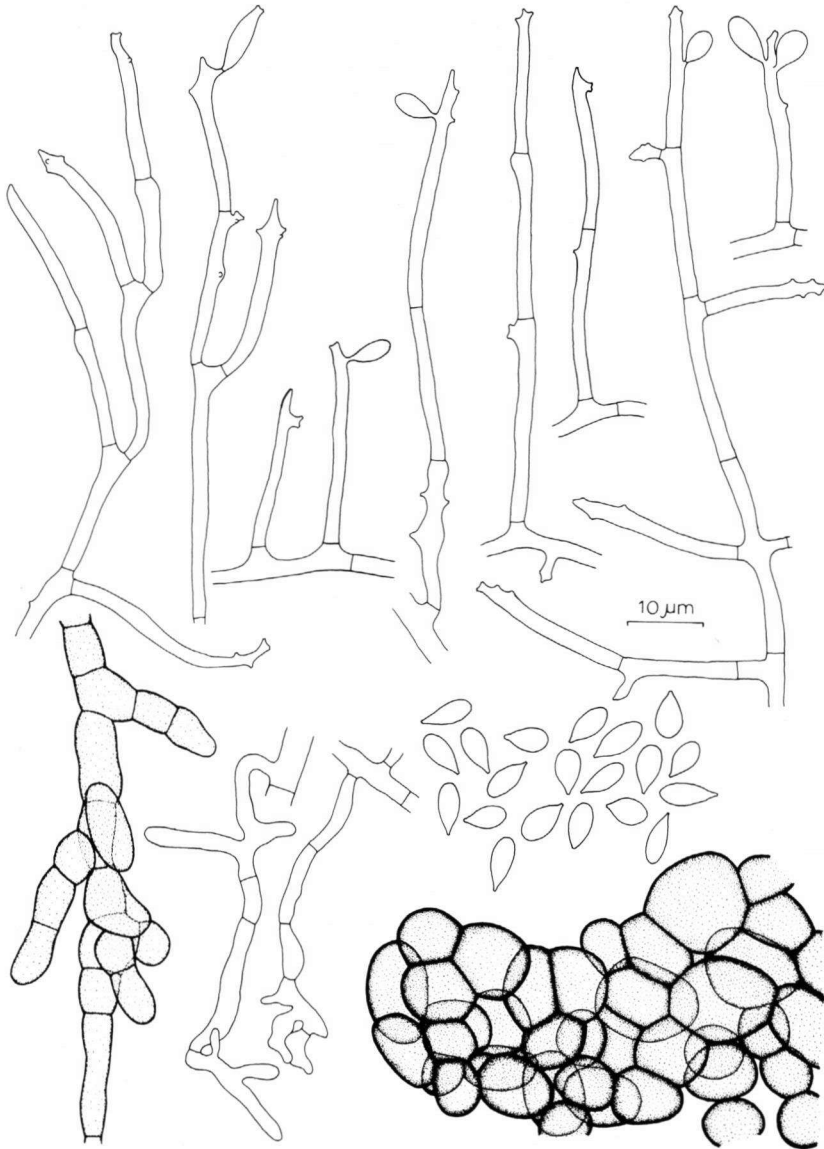


Fig. 17. *Sporothrix sclerotialis*, CBS 312.77 on oatmeal agar.

at the margin, with thin, crisped aerial mycelium near the centre, hyaline, centrally becoming whitish to pale ochraceous, finally dark brownish-grey due to abundant formation of sclerotium-like bodies; occasionally alternate dark and lighter sectors formed; margin sharp and regular. Submerged *mycelium* loose, consisting of hyaline, smooth- and thin-walled, remotely septate, regularly 2–3.5 μm wide hyphae, which later form hyphal fascicles; hyphae soon branched with thinner, flexuose branches; the mycelium becoming tough; irregular swellings on the branches formed, leading to compact clews of partly swollen hyphal cells; in addition, clusters of regularly inflated hyphal cells grow out to form tough, pseudoparenchymatous stromata composed of dull brown, thick-walled, broadly ellipsoidal cells measuring about 7–15 \times 6–13 μm . *Conidiogenous cells* scattered, occasionally in inconspicuous whorls of 1–2(–3), arising orthotropically or somewhat plagiotropically from undifferentiated hyphae, often also in a terminal position or integrated into short lateral branches, straight or slightly flexuose, cylindrical but often slightly tapering towards the tip, mostly about 12–25 μm long and as wide as the supporting hypha (1.5–2.5 μm); apical part forming conidia by sympodial growth, consisting of a loose cluster of conidium-bearing denticles which may form a short rhachis; denticles blunt, nearly flat or pimple- to volcano-shaped, 0.2–1.5 μm long. The conidiogenous cell often proliferates at or somewhat below the apex and gives rise to another cluster of denticles or a conidiogenous cell, which may in turn become intercalary. *Conidia* hyaline, smooth- and thin-walled, obclavate to fusiform with acuminate bases, 4–6 \times 1.8–3 μm .

TYPE CULTURE.—CBS 312.77, isolated by O. Gerritsma from roots of *Lolium perenne* meadow, Wageningen, under No. 770309–054, sent by J. W. Veenbaas-Rijks; second strain, CBS 163.77, from the same source.

The species differs from all known *Sporothrix* species by having dark, multi-celled sclerotial bodies. The sympodial state is similar to *S. ghanensis* de Hoog & Evans, but has less flexuose fertile cells and a different branching pattern; *S. schenckii* and the conidial state of *Ophiostoma epichloes* (Guerrero) de Hoog are mostly much smaller. *Denticularia* species have conidiophores in small bundles and conidia arising in short acropetal chains.

Sporothrix vizei (Berk. & Br.) de Hoog, *comb. nov.*—Fig. 18

Verticillium vizei Berk. & Br. apud Vize, Micro-fungi brit. 247. 1880 (basionym).

Colonies forming minute whitish patches; *hyphae* hyaline, smooth-walled or finely warted, 2.5–3.5 μm wide, septate every 10–20 μm , loose, forming an ascending, profusely ortho- or somewhat plagiotropically branched conidial apparatus in which no main stalks can be discerned. *Conidiogenous cells* in whorls of 1–3 on conidiophores, cylindrical, often slightly tapering towards the apex, 10–20 \times 1.8–2.5 μm , apical part forming conidia by sympodial growth, consisting of a slightly inflated, up to 4 μm wide cluster of conidium-bearing denticles; denticles flat, blunt, less than 0.5 μm long, often hardly prominent at all. The conidiogenous cells may proliferate at or somewhat below the apex, leading to a short, nodose conidiiferous rhachis. *Conidia* hyaline, smooth-walled or finely warted, obconical, with rounded apex, one-celled or with aseptum below the middle, 6–9 \times 2.5–3.5 μm , basal scar 0.5 μm wide.

The preceding description is based on exsiccate specimens (Vize, Micro-fungi brit. 247, MANCH, PAD) on sori of ferns.

The nearest neighbour of this species is *Sporothrix ramosissima* Arn. ex de Hoog, which also shows rough-walled hyphae, marked orthotropical branching and blunt conidium-bearing denticles. These characters are all rather unusual in the genus *Sporothrix*. The present species deviates from all other species of the genus by the conidia often being two-celled.

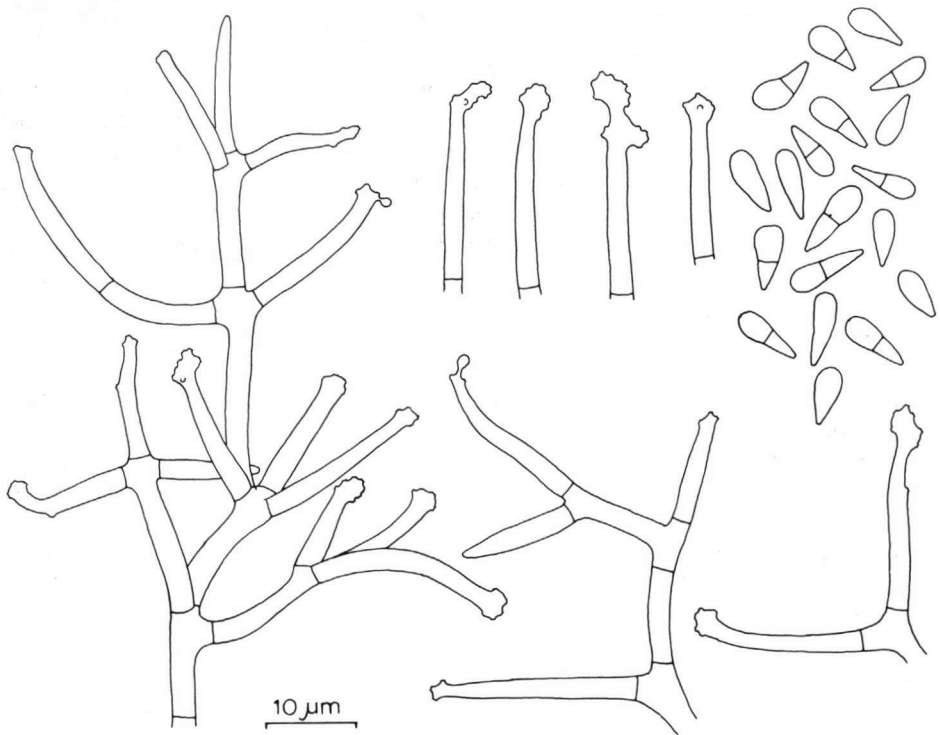


Fig. 18. *Sporothrix vizei*, Vize, Micro-fungi brit. 247 (MANCH) on the natural substrate.

Doubtful genus

CYLINDROPHORA Bon., Handb. allgem. Mykol. 92. 1851. — Original species: *Cylindrophora verticillata* Bon., *C. alba* Bon., *C. tenera* Bon.

The first listed species is a name change for *Verticillium cylindrosporum* Corda, of which the type specimen is lost. Possibly *Verticillium fungicola* (Preuss) Hassebr. was concerned. Bonorden's (1851) collections are all lost. Judging from his figures, *C. alba* may be close to *Cladobotryum apiculatum*, and *C. tenera* to *Acremonium strictum* W. Gams.

Epithets: *alba*, *albedinis*, *apiculata*, *araneorum*, *candida*, *epitrichia*, *fagi*, *hoffmannii*, *lindaviana*, *tenera*, *verticillata*, *virgata*.

Check-list of specific and subspecific names

aecidiophila. — See *Collettoconis aecidiophila*.

agaricina. — *Botrytis agaricina* Link in Mag. Ges. naturf. Fr. Berl. 3: 15. 1809; ex

Pers., Mycol. eur. 1: 34. 1822. — *Cladobotryum agaricinum* (Link ex Pers.) Steud., Nomencl. Bot. 118. 1824. — *Verticillium agaricinum* (Link ex Pers.) Corda, Ic. Fung. 2: 15. 1838.

According to Gams & Hoozemans (1970) the original material is lost. Referring to Ditmar's (*in Sturm, 1817*) table 51, which was probably drawn from authentic material, they listed the species as a synonym of *Cladobotryum verticillatum* (Link ex Gray) Hughes. Fries (1832), who also examined an original specimen, mentioned it under *Dactylium dendroides* (Bull. ex Mérat) Fr. (syn.: *Cladobotryum dendroides*), which, however, is now known as a species with multi-celled conidia. Gams & Hoozemans (1970) also mentioned the binomial *Cladobotryum agaricinum* (Link) Nees, although Nees (1816) did not effectively publish the combination in *Cladobotryum*.

agaricinum. — *Sporotrichum agaricinum* Link in Jb. Gewächskde 1: 170. 1818; ex Link, Linn. Spec. plant., Ed. 4, 6: 7. 1824. — *Monosporium agaricinum* (Link ex Link) Bon., Handb. allgem. Mykol. 95. 1851.

The type material at Berlin (B) does not allow proper identification (Gams & Hoozemans, 1970). The latter authors treated the species as a synonym of *Cladobotryum verticillatum*, on the basis of Bonorden's (1851) figure 112. It remains uncertain, however, whether Bonorden's (1851) and Link's (1824) specimens are identical, since the former author depicted a species with obclavate conidia which were said to be only initially globose, whereas the latter mentioned merely globose conidia. Bonorden's material is not known to be preserved.

agaricinum. — *Trichothecium agaricinum* Bon., Handb. allgem. Mykol. 99. 1851. — *Dactylium agaricinum* (Bon.) Sacc. in Syll. Fung. 4: 189. 1886.

According to Gams & Hoozemans (1970) the type material is probably lost. The species was thought to be close to *Cladobotryum dendroides* by Saccardo (1886) and Gams & Hoozemans (1970), but the narrow, subulate, conidiogenous cells of Bonorden's (1851) figure 114 are more suggestive of synonymy with *Helminthophora sphaerocephala*.

alba. — *Cylindrophora alba* Bon., Handb. allgem. Mykol. 92. 1851.

No type material is known to be preserved. Bonorden's (1851) figure 131 shows a *Cladobotryum*-like species with cylindrical conidia, possibly identical to *C. apiculatum*. According to Saccardo (1886) it occurred inside a *Tuber* species.

albedinis. — *Cylindrophora albedinis* Killian & Maire in Bull. Dir. Agric. Colon. Serv. Bot. 73: 97. 1930 (nomen provisorium); *Fusarium albedinis* Killian & Maire ex Malençon in C.r. hebd. Séanc. Acad. Sci., Paris 198: 1261. 1934. — *Fusarium oxysporum* Schl. var. *albedinis* (Killian & Maire ex Malençon) Malençon in Rev. Mycol., Suppl. colon. 15: 45. 1950. — *Fusarium oxysporum* Schl. forma specialis *albedinis* (Killian & Maire ex Malençon) Gordon in Can. J. Bot. 43: 1310. 1965.

This *Fusarium* species is the causative agent of a serious disease of *Phloenix dactylifera* L. Killian & Maire (1930) described it tentatively from cultures showing chlamydospores and microconidia. Malençon (1934) was the first to recognize its affinity to macroconidial *Fusarium* species and validated the name by giving a short description. The original publi-

cation of *Cylindrophora albedinis* was incorrectly referred to in Petrak's List and by numerous subsequent authors.

album. — See *Engyodontium album* and *Sporothrix rectidentatum*.

aleuritidis. — *Cladobotryum aleuritidis* Sawada in Spec. Publ. Coll. Agric. nat. Taiwan Univ. 8: 184. 1959 (without Latin diagnosis).

No material was available for study. Referring to the original publication, Deighton (1972) listed the name as a synonym of *Hansfordia pulvinata* (Berk. & Curt.) Hughes.

apiculatum. — See *Cladobotryum apiculatum*.

aranearum. — *Cylindrophora aranearum* Petch in Trans. Br. mycol. Soc. 27: 85. 1944.

The species was described as the conidial state of *Torrubiella albolanata* Petch. In the type specimen (K) it forms a white, compact felt covering spiders. The hyphae are hyaline, thin-walled, becoming verrucose in areas with fertile cells, the latter occurring scattered or in small clusters, being flask-shaped to subulate and $7-13 \times 2.4-3.0 \mu\text{m}$. Each conidiogenous cell mono- or polyblastically gives rise to bacilliform to sickle-shaped conidia, $8-12 \times 0.8-1.0 \mu\text{m}$ (Fig. 19b).

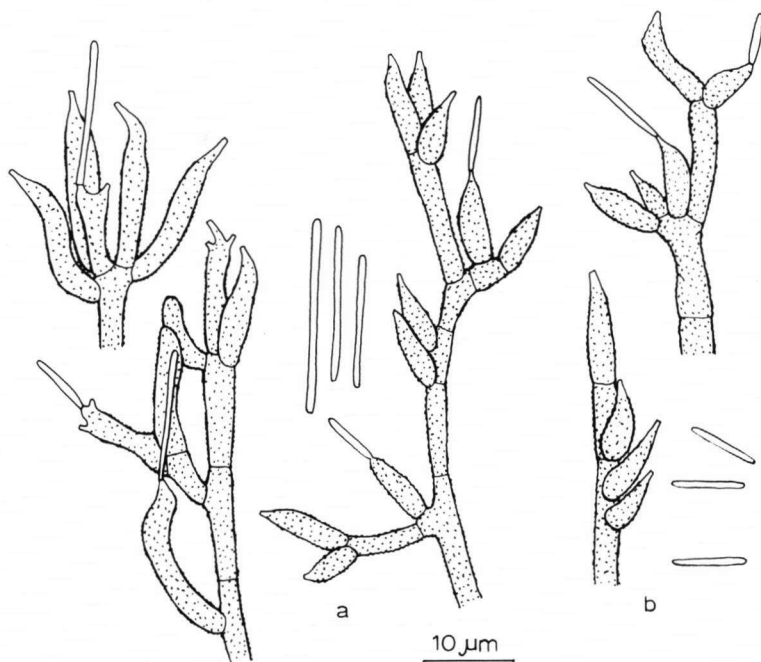


Fig. 19. *Granulomanus aranearum* on the natural substrate. a. leg. H. C. Evans. — b. type specimen at K.

Similar conidial structures also occur in several species of *Gibellula* (Samson & Evans, 1977); occasionally they are found sporulating independently. The fungi superficially resemble *Aciculariella foliicola* Arn., which was invalidly published without a Latin diagnosis; no authentic material is known to be preserved. *Pseudomicrodochium aciculare* Sutton is also similar, but distinctly monophialidic. Consequently no generic name is available for these fungi, and hence the following is proposed.—

Granulomanus de Hoog & Samson, *gen. nov.*

Coloniae compactae, albae. Conidiophora indistincta, hyalina, tenuitunicata, saepe verrucosa, repentia vel adscendentia. Phialides lageniformes ad cylindricae, rostris conidiiferis singulis vel compluribus, collaro inconspicuo praedita. Conidia continua, hyalina, parva, plus minusve bacilliformia.

Species typica: *Cylindrophora araneorum* Petch.

Colonies compact, white. Conidiophores undifferentiated, hyaline, thin-walled, frequently rough-walled, creeping to suberect. Phialides flask-shaped to cylindrical, apically provided with one to several conidiiferous protrusions with indistinct collarettes. Conidia one-celled, hyaline, small, more or less bacilliform.

TYPE SPECIES.—*Granulomanus araneorum* (Petch) de Hoog & Samson, *comb. nov.* (basionym: *Cylindrophora araneorum* Petch in *Trans. Br. mycol. Soc.* 27: 85. 1944).—Fig. 19.

asterophorum. — See *Cladobotryum asterophorum*.

australe. — *Cladobotryum australe* Viégas in *Bragantia* 6: 365. 1946.

No material was available for study. Referring to the original publication, Deighton (1972) listed the name as a synonym of *Hansfordia pulvinata*.

binatum. — See *Cladobotryum dendroides*.

boletorum. — *Sporotrichum boletorum* Ehrenb., *Sylvae mycol. berol.* 22. 1818; ex Steud., *Nomencl. bot.* 401. 1824. — *Dactylium boletorum* (Ehrenb. ex Steud.) Sacc. in *Syll. Fung.* 4: 190. 1886.

The type material is lost. Judging from the description, it is probably *Cladobotryum dendroides*, as was already pointed out by Fries (1832) and Gams & Hoozemans (1970).

bondarzewiae. — See *Helminthophora sphaerocephala*.

candida. — *Cylindrophora fagi* Oudem. var. *candida* Bres. in *Annls mycol.* 13: 106. 1915.

The type specimen (S) consists of compact, whitish mycelial dots 1–3 mm in diam. on branchlets and needles of *Pinus sylvestris*; it can be described as follows. Hyphae hyaline, thin-walled, fragile, usually 4–5 μm wide, regularly septate, profusely branched. Conidiogenous cells arising from undifferentiated hyphae, flask-shaped to fusiform, 6–8 \times 2.8–3.8 μm , apically beaked, with a minute, inconspicuous phialidic collarette which is about 1 μm wide. Conidia adhering together in packets, hyaline, thin-walled, cylindrical with slightly acuminate base, 4-celled with ultimate cells smaller than central cells, 13–16 \times 1.8–2.0 μm (Fig. 20).

The variety resembles the monotypic genus *Uncigera* Sacc., which has erect to suberect conidiophores with sterile tips. *Cylindrodendrum* Bon., of which *C. album* Bon. was first

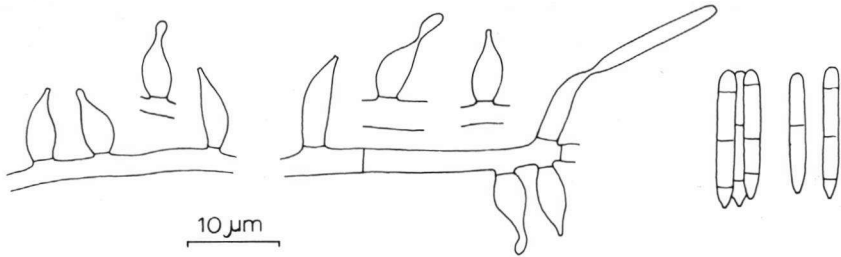


Fig. 20. *Pseudomicrodochium candidum*, herb. S on the natural substrate.

mentioned and treated by Kendrick & Carmichael (*in* Ainsworth & *al.*, 1973) as lectotype of the genus, was described as having *Uncigera*-like conidiophores with sterile, hooked apices. The genus is probably an earlier synonym of *Uncigera*, but since Bonorden's (1851) material is lost, this cannot be ascertained. Some living CBS-strains of *Uncigera*-like fungi, after a few transfers rapidly lost their differentiated conidiophores and became similar to *Cylindrocarpon* Wollenw. A genus with scattered, flask-shaped conidiogenous cells on the natural substrate is *Pseudomicrodochium* Sutton, of which all the species described to date differ from *Cylindrophora fagi* var. *candida* by having only two-celled conidia and more pronounced collarettes. Some species of *Harposporium* with cylindrical conidia, e.g. *H. sicyodes* Drechsl., are also close. All these taxa need more thorough study in order to fully clear the generic limits. Pending such a study, *Harposporium* Lohde is here taken as being restricted to nematophagous species, *Uncigera* to species, on the natural substrate having differentiated conidiophores, and *Pseudomicrodochium* to species with only scattered conidiogenous cells. Bresadola's taxon should then be referred to as *Pseudomicrodochium candidum* (Bres.) de Hoog, *comb. nov.* (basonym: *Cylindrophora fagi* Oudem. var. *candida* Bres. *in* *Annls mycol.* 13: 106. 1915).

c a n d i d u m. — *Trichothecium candidum* Bon. (as 'Link'), *Handb. allgem. Mykol.* 99. 1851 (non *Trichothecium candidum* Wallr., *Fl. cryptog. Germ.* 2: 285. 1833).

Bonorden (1851) listed the name as '*Trichothecium candidum* Link', although Link (1824) did not include this binomial in his account of the genus. Gams & Hoozemans (1970) supposed the name to be based on *Sporotrichum candidum* Link, the type of which (B) is unidentifiable. In the diagnosis of the latter species the conidia were described as being globose, whereas Bonorden (1851) depicted a species with clearly cylindrical conidia. Bonorden's material is now lost. Referring to his figure 167, Gams & Hoozemans (1970) listed *T. candidum* Bon. as a possible synonym of *Cladobotryum dendroides*. The type material of *T. candidum* Wallr. is probably lost. A secondary collection on leaves and branchlets of *Hedera* spec. (PAD), described by P. A. Saccardo *in* *Syll. Fung.* 4: 179 and *F. ital.* fig. 955, contains an abundantly sporulating, pale yellowish-white *Ramularia*-like species mixed with small patches of a *Trichothecium* species. The latter has conidia about $19\text{--}27 \times 10\text{--}12 \mu\text{m}$ and is consequently identical to the later described *T. luteum* Petch, which was fully redescribed by Rifai & Cooke (1966).

c a p i t a t u m. — *Cladobotryum capitatum* Raybaud in C.r. Soc. Biol. **84**: 798. 1921.

No original material is preserved at PC or MARS. The fungus was described as having pale pigmented, erect conidiophores with whorls of flask-shaped conidiogenous cells over their entire length, each cell producing an apical cluster of small, globose, hyaline conidia on denticles. This combination of characters is only found in the genus *Costantinella* Matr. No mention was made, however, of any curved conidiogenous cells; the species is therefore regarded as doubtful.

c l a v a r i a r u m. — *Diplocladium penicillioides* Sacc. var. *clavariarum* Pat., Cat. rais. Pl. cell. Tunesia 130. 1897.

No authentic material is preserved at PC. The reddish colonies and the fusiform, constricted, two-celled, rather large conidia mentioned in the diagnosis, may point to *Cylindrocarpon* or a similar genus.

c o r d a e. — *Verticillium cylindrosporum* Corda, Ic. fung. 1: 20. 1837. — *Cylindrophora verticillata* Bon., Handb. allgem. Mykol. 92. 1851 (name change). — *Acrocylindrium cordae* Sacc. in Syll. Fung. 4: 161. 1886 (name change).

Probably no authentic material has been preserved. Corda's (1837) figure 275 shows a *Verticillium* species close to *V. fungicola* (Preuss) Hassebr. When changing the name, Bonorden (1851) mentioned '*Verticillium cylindrophorum* Corda' as a synonym of his *Cylindrophora verticillata*, referring to Corda's *V. cylindrosporum*.

c u r v a t u m. — See *Cladobotryum curvatum*.

c y l i n d r o p h o r u m, *c y l i n d r o s p o r u m*. — See this list under *cordae*, under *roseum*.

c y l i n d r o s p o r u m. — *Diplocladium cylindrosporum* Ellis & Everh. in Bull. Torrey bot. Club **27**: 58. 1900.

No type material was available at NY. The fungus grew on dead leaves and was described as forming hyaline bundles of conidiophores, branched in the apical region, with one-septate conidia 40–50 × 4–5 μm. Boedijn & Reitsma (1950) treated it as a synonym of *Cylindrocladium scoparium* Morgan.

d e n d r o i d e s. — See *Cladobotryum dendroides*.

d i d y m a. — See *Pseudohansfordia didyma*.

e l e g a n s. — *Cladobotryum elegans* Arn. in Bull. trimest. Soc. mycol. Fr. **68**: 191. 1952 (without Latin diagnosis).

No original material is known to be preserved. The species was listed by de Hoog (1974) as synonymous with *Calcarisporium arbuscula* Preuss.

e l e g a n s. — *Diplocladium elegans* Bain. & Sartory in Annl. mycol. **11**: 359. 1913.

No material is preserved at PC. The clear drawing in the original publication is suggestive of identity with *Sibirina fungicola* G. Arnold. Gams & Hoozemans (1970) listed it under *Cladobotryum mycophilum*, which, however, has shorter and stouter conidiogenous cells.

epitrichia. — *Cylindrophora epitrichia* Ramsb. apud Gibbs, Contr. Phytogeogr. Arfak Mount 190. 1917.

No type material is preserved at BM, CMI or K; no literature was available for study.

fagi. — *Cylindrophora fagi* Oudem. in Ned. Kruidk. Archf, Ser. 3, 4: 900. 1903.

The type material (L) only consists of a drawing. The fungus was described as being sporodochial, with dark basal hyphae and hyaline, cylindrical conidia, in part arising from the tips of thread-like hyphae; it is of doubtful identity.

fici. — See *Denticularia fici*.

fusarisporum. — *Mucrosporium fusarisporum* Peyronel, Germi atmosfer. Funghi con Micelio 26. 1912.

No authentic material is known to be preserved. The species was described as being purely white, with ascending to erect, verticillately branched conidiophores and fusarioid conidia arising from small heads. This description reminds one of *Helminthophora sphaerocephala*.

gelatinosum. — *Cladobotryum* (?) *gelatinosum* Fuckel in Jahrb. Nassau. Ver. Naturk. 23–24: 360. 1870.

The binomial was first published as a nomen provisorium, but later included without the question-mark by Fuckel (1871). Four authentic collections (F. rh. 227 at K, L, NY, and S) were examined. All contained putrid *Populus* wood on which old *Cytospora*-like fruitbodies were found. In most samples remains of minute, pale pinkish-brown acervuli, more or less fitting the diagnosis, were also present. The conidia of the latter fungus were one-celled, hyaline or nearly hyaline, finely warted, ellipsoidal, $17\text{--}24 \times 8\text{--}12.5 \mu\text{m}$, with inconspicuous basal scars, and were reported to be sympodially produced (Fuckel, 1870). A *Cryptocline*-like species was possibly concerned, but the conidiogenous cells were too poorly preserved to allow proper identification. The species was reported to be associated with the discomycete *Niptera* (?) *microcarpa* Fuckel [= *Mollisia microcarpa* (Fuckel) Sacc.]. Two authentic collections (F. rh. 2381 at L and S) contained sterile apothecia of a similar structure to the above-described *Cladobotryum gelatinosum*.

gregarium. — *Diplocladium gregarium* Bres. in Anns mycol. 1: 127. 1903.

The type specimen (S) consists of some small pieces of *Pinus sylvestris* bark with numerous discrete, penicillate conidiophores, which can be described as follows. Conidiophores mononematous, erect, up to $800 \mu\text{m}$ high, stipe uniform throughout, hyaline, with walls up to $2 \mu\text{m}$ thick, densely covered with globose or confluent warts $1\text{--}3 \mu\text{m}$ in diam, stipes $10\text{--}12$ septate, constricted at the cross-walls which are slightly thinner than the outer walls; cells $40\text{--}70 \times 28\text{--}38 \mu\text{m}$; stipes branched at the apex with $2\text{--}3$ primary metulae; each

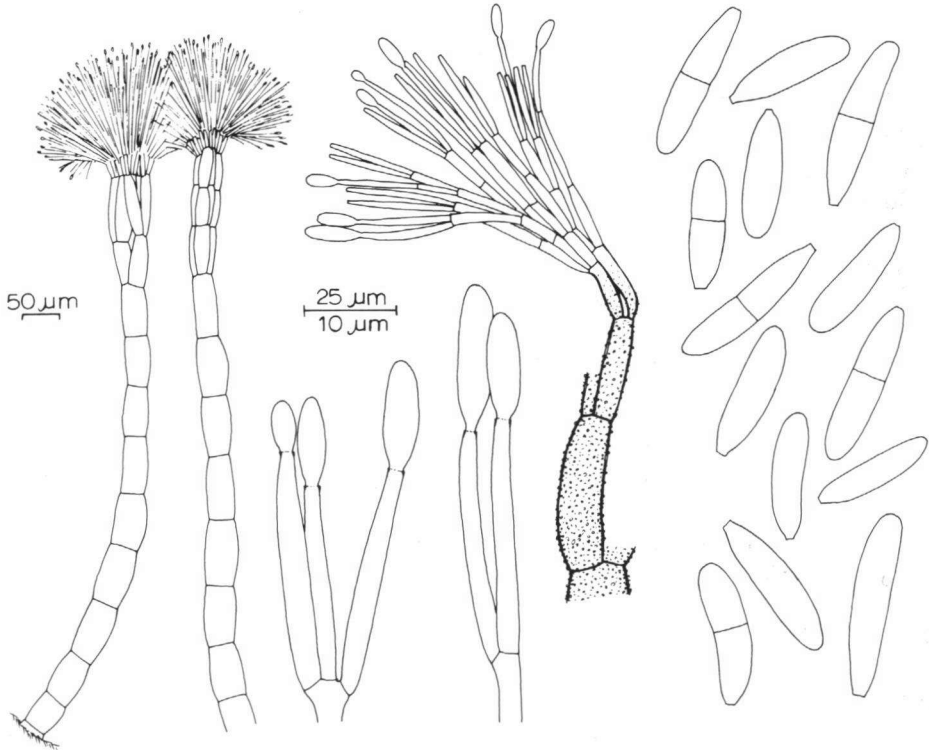


Fig. 21. *Cyliandrocladium gregarium*, herb. S on the natural substrate.

metulus bearing 2–3 secondary metulae; branching becoming more profuse in the apical region of the fertile head; 5–6 series of metulae in all; metulae of first to fourth order coherent, slightly rough-walled, firm; metulae of higher order splaying out, smooth- and thin-walled; ultimate metulae each bearing 1–4 conidiogenous cells. Divergent part of conidial apparatus about $120\ \mu\text{m}$ wide and $70\ \mu\text{m}$ high, covered by a hyaline mass of conidia. Conidiogenous cells cylindrical, $20\text{--}25\ \mu\text{m}$ long, $2.2\text{--}3.0\ \mu\text{m}$ wide just above the base, slightly tapering towards the tip, with an apical phialidic channel, $1.8\ \mu\text{m}$ wide. Conidia hyaline, smooth- and thin-walled, one- or two-celled, straight or slightly curved, cylindrical to cucumber-shaped, $12\text{--}23 \times 4\text{--}5\ \mu\text{m}$, with a truncate, slightly prominent, basal scar (Fig. 21).

Mononematous, hyaline, rough-walled stipes bearing a head of phialides are known in *Gloiosphaera* Höhn. However, the only species accepted in this genus, *G. globuligera* Höhn. (Wang, 1971), has a unique structure, the stipe being unbranched with numerous metulae and phialides in the apical region. The branching pattern of *Diplocladium gregarium*, on the contrary, is similar to that of *Leptographium* Lagerberg & Melin and *Phialocephala* Kendrick, but colourless, rough-walled stipes are not known in either of these genera. *Cyliandrocladium* Morgan has hyaline conidiophore stalks bearing penicillately arranged phialides in their uppermost parts. Branching is usually much looser than in the present species, the

conidiophores terminating in a sterile tip; in most species the conidia are strictly cylindrical. Some species with comparatively short conidia, e.g. *C. parvum* Anderson, have a branching pattern similar to *Phialocephala* and may lack sterile tips (Matsushima, 1971). *Cylindrocladium peruvianum* Batista & al. often has rough-walled conidiophore stalks. Consequently the species at hand should be referred to as *Cylindrocladium gregarium* (Bres.) de Hoog, *comb. nov.* (basonym: *Diplocladium gregarium* Bres. in *Annls mycol.* 1: 127. 1903).

guttuliformis. — See *Sporothrix guttuliformis*.

heterocladum. — *Verticillium heterocladum* Penz. in *Michelia* 2: 462. 1882; F. ital. t. 1193. 1882 (non *Verticillium heterocladum* Penz. sensu Fawcett, *Fungi paras. Aleyrodes citri* 23. 1908. — *Verticillium cinnamomeum* Petch in *Trans. Br. mycol. Soc.* 16: 233. 1931 (non *Verticillium heterocladum* Penz. sensu Fron in *Bull. trimest. Soc. mycol. Fr.* 27: 486. 1911). — *Cladobotryum heterocladum* (Penz.) Petch in *Trans. Br. mycol. Soc.* 16: 233. 1931.

No type material is known to be preserved. The species was described and depicted as having hyaline, ascending conidiophores with whorls of conidiogenous cells, the latter bearing apical heads of conidia on denticles. Possibly a meagre *Calcarisporium* species was concerned, as was suspected by Gams (1971); see also this list under *ovalisporum*. The fungus described by Fawcett (1908) as *V. heterocladum* had profusely branched conidiophores and lacked conidium-bearing denticles; consequently it should be retained in *Verticillium*. Fron's (1911) specimen was probably *V. lecanii* (Zimm.) Viégas.

hoffmannii. — *Cylindrophora hoffmannii* Daszewska in *Bull. Soc. Bot. Genève, Ser. 2,* 4: 286. 1912.

The type strain CBS 110.13 only contained *Fusarium oxysporum* Schl. and was discarded from the CBS collection in 1965 as a supposed contamination. The original description and figure of *C. hoffmannii*, however, are those of a poorly developed microconidial state of a *Fusarium* species close to *F. oxysporum*. In the CBS records the typical purplish agar pigment of this species was mentioned immediately after receipt of the strain in 1913.

hydrangae. — *Diplocladium hydrangae* Togashi & Onuma in *Bull. Morioka imp. Coll For. Agric.* 17: 51. 1934.

No type specimen was available for study. The original drawing showed pale brown, branched conidiophores very similar to those of *Hansfordia pulvinata*, but the conidia were described as being cylindrical and two-celled. There is no *Hansfordia*-like species known with such conidia. Possibly a mixture of fungi was described.

irregularis. — See *Pseudohansfordia irregularis*.

lactarii. — See *Cladobotryum verticillatum*.

leptosporum. — See *Helminthophora sphaerocephala*.

leptosporum. — *Mucrosporium leptosporum* Peyronel, *Germi atmosfer. Funghi con Micelio* 26. 1913.

No original material was available for study; the description points to a *Cylindrocarpon*-like species.

limoniformis. — See *Denticularia limoniformis*.

lindaviana. — *Cylindrophora lindaviana* Jaap in Verh. Bot. Ver. Prov. Brandenb. 58: 37. 1916.

No type material is preserved at B, BP, E, F, HBG, L, or PC; the species is doubtful.

macrospora. — See *Cladobotryum dendroides*.

major, majus. — *Diplocladium majus* Bon., Handb. allgem. Mykol. 98. 1851 (as '*major*').

The type material is probably lost. The greater part of Bonorden's (1851) figure 168 clearly points to *Cladobotryum mycophilum*, but in addition to *Cladobotryum* conidiophores loose, dark, four-celled conidia were depicted and described as being blackish. Since the conidia of *C. mycophilum* are hyaline and more one- to two-celled (rarely up to four-celled; Matsushima, 1975), *D. majus* was probably based on a mixture of fungi. It should consequently be rejected as a nomen confusum. Saccardo's (1886) description under this name was based on another specimen (PAD), which was indistinguishable from *C. mycophilum*.

meliolae. — See *Pseudohansfordia meliolae*.

melleum. — See *Cladobotryum varium*.

minor, minus. — *Diplocladium minus* Bon., Handb. allgem. Mykol. 98. 1851 (as '*minor*').

No type material is known to be preserved. Bonorden's (1851) figure 119 points to synonymy with *Cladobotryum varium* or *C. mycophilum*. Though no conidial dimensions were given, the epithet '*minus*' makes the first supposition the most likely (compare this list under *majus*). Saccardo's (1886) specimen (PAD; F. ital. fig. 711) could be reidentified as *C. varium*.

modesta. — See *Denticularia modesta*.

multiseptatum. — See *Cladobotryum multiseptatum*.

mycophila, mycophilum. — See *Pseudohansfordia mycophila*, *Cladobotryum mycophilum*.

ovalisporum. — *Cladobotryum ovalisporum* Petch in Trans. Br. mycol. Soc. 16: 233. 1932.

The type specimen *Petch R-69* and a secondary collection *Petch R-558* on insect remains are preserved at K; they can be described as follows. Mycelium effuse, flat, loose, overgrow-

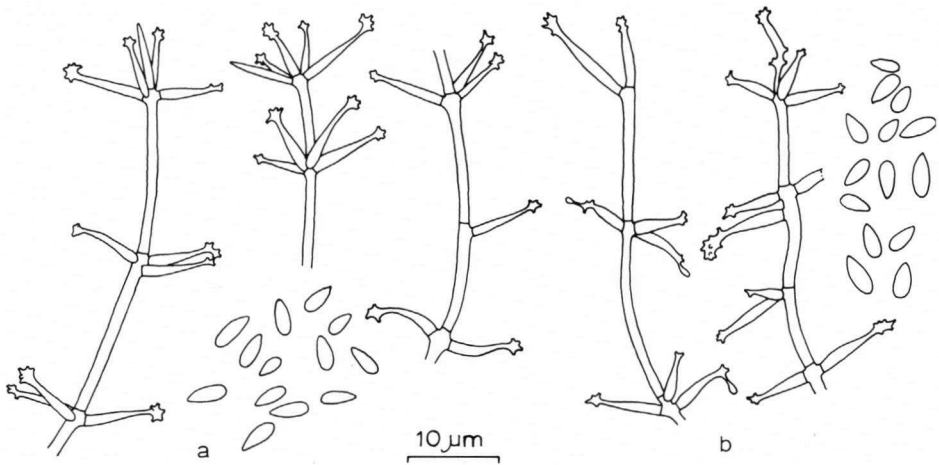


Fig. 22. *Calcarisporium ovalisporum*, herb. K on the natural substrate. — a. Petch R-69. — b. Petch R-558.

ing remains of small insects at the abaxial surface of leaves, purely white. Conidiophores ascending to erect, hyaline, fragile, thin-walled, usually 200–300 μm long, of equal width throughout (1.6–2.2 μm), septate every 10–20 μm , in the upper part bearing 3–6 whorls of 1–5 conidiogenous cells; the latter being subulate, 5–12 μm long; the widest part 1.4–1.8 just above the base, tapering towards the tip to about 0.8 μm ; apically provided with an unswollen or slightly swollen cluster of pimple- to spine-shaped denticles up to 1.2 μm long, less than 0.3 μm wide. Conidia one-celled, hyaline, smooth- and thin-walled, ovoidal, navicular or fusiform, 3–5 \times 1.2–1.8 μm , with an acuminate base and rounded apex (Fig. 22).

In both collections the fungus was associated with other hyphomycetes; consequently its entomogenous nature is questionable. The species was described as new by Petch (1932), since he was unsure about the identity of the probably similar species, *Verticillium heterocladum*. Petch's material represents a typical *Calcarisporium* species; hence the name *Calcarisporium ovalisporum* (Petch) de Hoog, *comb. nov.* (basonym: *Cladobotryum ovalisporum* Petch in Trans. Br. mycol. Soc. 16: 233. 1932) is proposed for its accommodation. It differs from the closely related *C. arbuscula* by being considerably smaller and by having less markedly differentiated conidiophores. *Sporothrix setiphila* (Deighton & Pirozynski) de Hoog has about the same conidial dimensions, but has scattered, linear, conidiogenous cells.

parvisporum. — See *Engyodontium parvisporum*.

penicillioides. — See *Cladobotryum varium*.

preussii. — See this list under *uniseptatum*.

pulchella. — See *Pseudohansfordia pulchella*.

rectidentata. — See *Sporothrix rectidentata*.

r e n n y i. — See *Cladobotryum varium*.

r o s e u m. — *Alytospodium roseum* Ehrenb., Sylv. mycol. berol. 11. 1818; ex Steud., Nomencl. bot. 55. 1824 [non *Sporotrichum roseum* (Rebent.) Pers., Mycol. eur. 1: 81. 1822; non *Sporotrichum roseum* Link in Mag. Ges. naturf. Fr. Berl. 3: 35. 1816; non *Sporotrichum merdarium* Link var. *roseum* Link, Linn. Spec. plant., Ed. 4, 6: 13. 1824; non *Chrysosporium merdarium* (Link) Carmichael var. *roseum* W. Gams & Domsch in Nova Hedwigia 18: 6. 1968]. — *Sporotrichum cylindrosporium* Link, Linn. Spec. plant., Ed. 4, 6: 14. 1824 (name change). — *Acrocyndrium roseum* (Ehrenb.) Bon., Handb. allgem. Mykol. 98. 1851.

No original material has been preserved. Saccardo (1886) listed the species on page 161 as being related to *Cladosporium varium*, but on page 719 both *A. roseum* and *S. cylindrosporium* were treated as synonymous with *Fusarium longum* (Wallr.) Sacc. Fries (1832) and Gams & Hoozemans (1970) listed it as a possible synonym of *C. varium*.

The identity of the various taxa described as *Sporotrichum roseum* is doubtful, since for not one of these has authentic material been preserved. The taxonomic position of *Chrysosporium merdarium* var. *roseum* will be discussed elsewhere.

s c h l e c h t e n d a l i a n u m. — See *Cladobotryum dendroides*.

s c l e r o t i a l i s. — See *Sporothrix sclerotialis*.

s p h a e r o c e p h a l u m. — See *Helminthophora sphaerocephala*.

s t e r e i c o l a. — See *Pseudohansfordia stericola*.

t e n e l l u m. — *Dactylium tenellum* Fr., Syst. mycol. 3: 413. 1832. — *Mucrosporium tenellum* (Fr.) Sacc. in Syll. Fung. 4: 191. 1886.

No authentic material is preserved at UPS. Judging from the original description, possibly *Cladobotryum dendroides* was concerned.

t e n e r a. — *Cylindrophora tenera* Bon., Handb. allgem. Mykol. 92. 1851.

The type material is probably lost. Judging from the original description and figure, an *Acremonium* species close to *A. strictum* W. Gams might have been concerned.

t e n e r a. — See *Helminthophora sphaerocephala*.

t e n u e. — *Diplocladium tenue* Rostr. in Dansk bot. Ark. 2: 43. 1916.

No authentic material is preserved at C. Judging from the original article, which shows a verticillately branched fungus with two-celled, fusiform conidia measuring 8–11 × 2.5 μm, possibly a *Verticillium* species close to *V. falcatum* (Petch) W. Gams was concerned.

t e n u i s. — See *Pseudohansfordia tenuis*.

t e r n a t u m. — See *Cladobotryum dendroides*.

ternatum. — *Cladotrichum ternatum* Bon., Handb. allgem. Mykol. 78. 1851. — *Didymocladium ternatum* (Bon.) Sacc. in Syll. Fung. 4: 187. 1886.

The type material is probably lost. Referring to the original diagnosis and illustration, Gams & Hoozemans (1970) suspected synonymy with *Cladobotryum varium*. Isolates described by Tubaki (1955) and Nicot & Parguey (1963) as *D. ternatum* were also reidentified as *C. varium*.

terrigenum. — See *Cladobotryum dendroides*.

tertia. — See *Denticularia tertia*.

theobromae. — *Fusarium theobromae* Lutz in Bull. Soc. bot. Fr. 53: 50. 1907 ('1906') (non *Fusarium theobromae* Appel & Strunk in Zentbl. Bakt. ParasitKde, Abt. 2, 11: 635. 1903). — *Diplocladium theobromae* (Lutz) Sacc. & Trott. in Syll. Fung. 22: 1309. 1913.

The species was listed by Booth (1971) as a synonym of *F. decemcellulare* Brick. It outdates the latter by a year, but was invalidly published as a later homonym of *F. theobromae* Appel & Strunk, which is *F. solani* (Mart.) Sacc. according to Booth (1971).

thuemenii. — *Cladobotryum thuemenii* Sacc. in Michelia 1: 272. 1878; F. ital. fig. 709. 1881.

The type specimen (PAD) was reidentified by Gams & Hoozemans (1970) as *Athelia*.

uniseptatum. — *Mucrosporium uniseptatum* Preuss in Linnaea 25: 728. 1852. — *Diplocladium preussii* Sacc. in Syll. Fung. 4: 177. 1886 (name change).

The scanty type material (B) contained a fungus with mainly two-celled conidia, probably identical to *Cladobotryum varium*.

varanasiensis. — See *Pseudohansfordia varanasiensis*.

variospermum, *varium*. — See *Cladobotryum varium*.

venezuelensis. — See *Pseudohansfordia venezuelensis*.

verticillatum. — See *Cladobotryum dendroides*, *C. verticillatum* and see this list under *cordae*.

virgata. — *Cylindrophora virgata* Bon. in 'Bot. Zeit. 62: 202, t. VIII, Fig. 5'.

The type specimen is probably lost. No description could be found with the above reference from Saccardo (1886); possibly it contains a misprint. Saccardo (1886) described a *Cladobotryum*-like fungus occurring on *Gloeosporium fructigenum* Berk. (= stat. con. *Glomerella cingulata* (Stonem.) Spauld. & v. Schrenck; v. Arx, 1970).

vizei. — See *Sporothrix vizei*.

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