

The lichenicolous Hyphomycetes

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Synopsis

This paper presents a revision of all known obligately or primarily lichenicolous Hyphomycetes (Fungi, Deuteromycotina); no comprehensive survey of these fungi has previously been attempted. Forty-four species belonging to 23 genera are accepted and keys to these are provided. Of these, one genus and 17 species are described as new, one new name is introduced, and four new combinations are made. In addition, a new ascomycete genus, *Ascohansfordiellopsis*, is described to accommodate the perfect states of two *Hansfordiellopsis* species. Sixty taxa are excluded for a variety of reasons and combinations transferring four of these to other genera are made. A list of Hyphomycetes fortuitously occurring on lichens is included, and indexes to both the lichen hosts and the fungi growing on them are provided.

Introduction

Lichenicolous fungi (i.e. fungi growing on lichens) are commonly encountered during the routine examination of lichen material both in the field and in the herbarium. They are frequently a source of some confusion either because they are mistaken for a part of their hosts or because they lead to deformations, discolourations, or other modifications of the infected thalli. In the absence of modern monographic surveys of these fungi it is both impossible for lichenologists to interpret easily what they encounter, and for mycologists to render them assistance.

In the course of my investigations of lichenicolous fungi, which started in c. 1971, it has become clear that the existing literature on most groups of lichenicolous fungi is totally inadequate, and not uncommonly quite unreliable with regard to the characters of the fungi involved, their systematic position, and the identifications of the host lichens. Particularly unsatisfactory are the studies on many of the Deuteromycotina (Fungi imperfecti) occurring on lichens and in this group the only way to be certain that a recently collected species, apparently restricted to lichens, had not previously been recognized, proved to be to revise all related fungi so far described. As the numbers of lichenicolous Deuteromycotina already present in the literature are considerable, to treat all in a single work would be a massive undertaking. The conidial fungi are generally divided into two major groups: the Hyphomycetes in which conidia are borne from hyphae or aggregations of hyphae, but not in delimited sporocarps, and the Coelomycetes where the conidia are borne in either flask-shaped (pycnidia) or disc-like (acervuli) sporocarps. As the Hyphomycetes are now a much better known group than the Coelomycetes (see, for example, the generic survey of Kendrick & Carmichael, 1973) these were selected for consideration first. When further progress in the taxonomy of the Coelomycetes as a whole has been made it will also be expedient to produce a revision of the lichenicolous fungi belonging to this group.

The main aim of the present contribution, therefore, has been to provide a survey of all known obligately or primarily lichenicolous Hyphomycetes based on the collections from which they were originally described. These data have, however, been supplemented by information from recent collections where these have been available, and the opportunity is taken to describe a number of such fungi for the first time.

The earliest name that has been interpreted as a lichenicolous hyphomycete appears to be *Lichen roseus* Schreb. (Schreber, 1771: 140), although some considerable doubt now surrounds the interpretation of that name (see p. 280). Since that time lichenicolous Hyphomycetes have been described sporadically by both lichenologists and mycologists, but few authors have made a special study of them. Indeed, the only author to pay particular attention to their description and illustration in the nineteenth century was the Scottish lichenologist W. L. Lindsay (e.g. Lindsay, 1869*b*). Lists of the then known lichenicolous fungi and their hosts have been presented by several authors (Lindsay, 1869*a*; Arnold, 1874; Zopf, 1896) but these were largely uncritical compilations.

The first author to attempt a thorough survey of the world's lichenicolous fungi, including keys and descriptions of the species, was l'Abbé L. Vouaux; regrettably he was shot by invading troops in 1914, the year the last part of his study was published (Vouaux, 1914). Vouaux accepted 49 species of lichenicolous Hyphomycetes ranged amongst 25 genera. Unfortunately Vouaux saw little type material and was forced to rely heavily on the often hopelessly inadequate descriptions of many of his predecessors. A considerable number of imperfect lichenicolous fungi were described as new to science by Vouaux, but as most of his herbarium is lost (Rondon, 1970), the application of many of his names remains uncertain; it is regrettable that he published only descriptions and no illustrations of these fungi. Karl von Keissler (1930) produced a major survey of the lichenicolous fungi in continental Europe for *Rabenhorst's Kryptogamen-Flora* in which 36 species of Hyphomycetes, placed in 23 genera, were accepted. Keissler, in common with Vouaux, studied very few original collections.

More recently Deighton (1960, 1965) and Batista & Cavalcanti (1964), in particular, carried out pioneering studies on the Hyphomycetes restricted to the lichens that occur on the leaves of trees in the tropics (foliicolous lichens); these fungi had been almost unrecognized before, although two such species were discussed in detail by Hughes (1952).

I have described and revised a number of lichenicolous Hyphomycetes in some previous publications (Hawksworth & Punithalingam, 1973; Hawksworth, 1975*a*, 1977*a*) and the present paper represents a continuation of these investigations.

Some mention must also be made of the work of Clauzade & Roux (1976) who attempted to compile keys to all lichenicolous fungi described throughout the world. Again this was largely an uncritical compilation, as the authors themselves stressed, necessarily drawing heavily on the inadequate work of earlier authors and omitting some taxa described since the compilations of Vouaux (1912–14) and Keissler (1930). These authors treated 53 species of lichenicolous Hyphomycetes distributed amongst 30 genera; as an indication of the paucity of our knowledge on this ecologically fascinating group of fungi even at such a late date, the fates of these taxa are summarized in Table 1.

Table 1 Disposition of the 53 species of lichenicolous Hyphomycetes treated by Clauzade & Roux (1976) in the present revision

	Number of species
Accepted here	10
Synonyms of species accepted here	4
Fungi fortuitously present on lichens	11
Fungi not on lichens	3
Lichenized fungi	3
Lichenicolous fungi other than Hyphomycetes	5
Not fungi (i.e. algae, bacteria, etc.)	5
Names of uncertain application	12
Total	53

Note: 14 species described prior to 1976, additional to those listed as accepted above, are also accepted in the present revision.

Although the available information on the world's lichenicolous Hyphomycetes is reviewed here, this contribution is *not* to be considered as a definitive monograph of all such fungi. Lichenicolous fungi are so rarely collected by mycologists and lichenologists that there can be little doubt that the bulk of such fungi which occur in nature still remain to be discovered and described. Some support for this thesis may perhaps be derived from the number of new taxa introduced in the present paper. This revision is consequently rather to be viewed as providing a basis for future studies by (a) presenting keys based on the examination of original material and not merely published descriptions, and (b) discussing the application of all names so far proposed for these fungi. I also hope that this publication will stimulate both mycologists and lichenologists to look for and study lichenicolous Hyphomycetes.

Lastly, it should be emphasized that, with few exceptions (e.g. Gams, 1971; Hawksworth, 1975*b*), little work has been carried out in recent years on the behaviour of lichenicolous fungi in culture, *or* the isolation of sterile mycelium into culture to facilitate determination, *or* surface sterilization and isolation from unhealthy thalli, *or* the keeping of sterile material in damp chambers so as to stimulate sporulation. Exploration of all these avenues will undoubtedly contribute substantially to our knowledge of lichenicolous fungi in the future. With the existence of pure cultures the possibility of inoculation experiments in order to determine the pathogenicity of the fungi would also exist.

Biological and taxonomic concepts

Biological concepts

The foremost aim of this revision was to consider the obligately lichenicolous Hyphomycetes now known. While in most cases there is little doubt that the restriction to lichenized fungi is

obligate, it is important to appreciate that (a) some may persist on the substrate after the death of the host (e.g. *Refractolilium achromaticum*, possibly *Monodictys lepraria*), (b) some may be primarily associated with the alga in the lichen and not the fungal partner (e.g. *Ampullifera pirozynskii*, *Leightonomyces phillipsii*) and (c) some fungi currently known only from lichenized fungi may not really be restricted to them, but simply not yet known from other substrates (e.g. *Acremonium antarcticum*, *A. rhabdosporum*, *Dendrodochium subeffusum*, *Endophragniella hughesii*, *Monodictys anaptychiae*). One or two fungi accepted here as lichenicolous might perhaps prove to be the same as some non-lichenicolous recognized species if they were grown in pure culture (e.g. *Trimmatostroma lichenicola*), but I am not convinced that the lichenicolous habit *per se* can account for the marked divergences found between lichenicolous and non-lichenicolous species of the same genus, particularly as many fungi occurring occasionally on lichens by chance have their characters unmodified.

Table 2 Summary of Hyphomycetes fortuitously occurring on lichenized fungi

<i>Acremonium strictum</i> W. Gams
<i>Aspergillus candidus</i> Link ex Link group
<i>A. glaucus</i> Link
<i>Cladosporium sphaerospermum</i> Penz.
<i>Corynespora</i> sp.
<i>Cryptocoryneum rilstonii</i> M. B. Ellis
<i>Cylindrocarpon janthothele</i> var. <i>majus</i> Wollenw.
<i>C. lichenicola</i> (C. Massal.) D. Hawksw.
<i>Epicoccum purpurascens</i> Ehrenb. ex Schlecht.
<i>Gliocephalis pulchella</i> (Penz. & Sacc.) D. Hawksw.
<i>Oidiodendron rhodogenum</i> Robak
<i>Penicillium claviforme</i> Bain.
<i>Raffaelea barbatum</i> (Ellis & Everh.) D. Hawksw.
<i>Stemphylium botryosum</i> Wallr.
<i>Taeniolella breviuscula</i> (Berk. & Curt.) S. Hughes
<i>T. scripta</i> (P. Karst.) S. Hughes
<i>Trichothecium roseum</i> (Pers. ex Fr.) Link ex Fr.
<i>Verticillium lecanii</i> (Zimm.) Viégas

Note: Most of the above taxa are discussed under Excluded species below; records of the remainder are supported by material in IMI.

It might be anticipated that a wide range of saprophytic Hyphomycetes would occur, occasionally at least, on lichen thalli. Although a number of such cases are known (compiled in Table 2), such fungi are much less commonly encountered in the field on lichens than on decaying or unhealthy phanerogams, pteridophytes and bryophytes. In Table 2 note particularly the absence of *Botrytis*, and the very few taxa in *Aspergillus*, *Cladosporium*, *Penicillium*, etc. listed. It is also of interest that many genera of plant pathogenic fungi have few or no species able to attack lichenized hosts, even though they may be able to grow on large numbers of vascular plants. Hale (1967: 119) emphasized this point and also related it to the long life spans of many lichens. The lichen products (phenolic compounds encrusting lichen hyphae) have been considered as possibly the cause of this phenomenon but remarkably little experimental work on the effects of lichen acids on other fungi has been carried out. The only pertinent paper of which I am aware is the study of Henningsson & Lundström (1970) in which ground lichen thalli, lichen extracts and usnic acid reduced or inhibited the growth of six fungi tested (*Allescheria terrestris*, *Chaetomium globosum*, *Lenzites betulina*, *L. sepiaria*, *Polyporus abietinus* and *Stereum sanguinolentum*).

With the possible exception of the species occurring on some foliicolous lichens (see below), most obligately or primarily lichenicolous fungi, accepted in the main body of the present work,

appear to have restricted host ranges, to judge from the material so far available; the restriction is sometimes to single genera or species. This restriction was not always apparent from the extant literature, as in the case of *Sclerococcum sphaerale* where 15 hosts from several genera are mentioned in print, although the fungus proves to be restricted to two (or possibly three) closely allied *Pertusaria* species (see Hawksworth, 1975a : 225). Some of the obligately lichenicolous Hyphomycetes are pathogens and can cause the death of the host (e.g. *Illosporium carneum*), but most cause relatively little damage (e.g. *Leightonimyces phillipsii*, *Milospium graphideorum*, *Sclerococcum sphaerale*). In infections by *Refractohilum* species, galls are characteristically formed. Such deformations are, however, rather rarely caused by Hyphomycetes, although not uncommonly by some ascomycetes growing on lichens (see, for example, Hawksworth, 1975b, 1978b). In cases where the apothecia are invaded (e.g. *Bispora christiansenii*, *Pseudocercospora lichenum*, *Trimmatostroma lichenicola*, *Xanthoriicola physciae*) severe infections inevitably interfere with ascosporeogenesis, and where extensive growths occur over thallus surfaces photosynthetic ability is also presumably reduced. Interestingly, no lichenicolous hyphomycete is known to produce the clearly delimited black-bordered necrotic patches recalling those formed by some Coelomycetes on *Parmelia* thalli (see Hawksworth & Punithalingam, 1973; Hawksworth, 1976, 1977b).

In the cases of invasions of foliicolous lichens, specificity and host relations proved almost impossible to work out. Many of the fungi concerned are so minute that they are generally encountered by accident, especially while producing 'Necol' mounts, or when the hosts are so heavily infected that determination is precluded, or on algae in early stages of lichenization which are still sterile and indeterminate. Even though the hosts could not be recognized in many instances, on individual leaves the fungi generally were restricted to particular thalli and not present irrespective of the host on the leaves; not uncommonly several determinable thalli free from the fungus would occur on a leaf and the fungus be restricted to an additional indeterminate type. Except in the case of *Hansfordiellopsis lichenicola* (and perhaps some other species of its genus), which appears to be adapted to foliicolous lichens with setae (the fungus often spreading up the setae), I suspect that many of such fungi may eventually prove to be restricted to either particular lichens or particular algae which can be lichen phycobionts (algal partners). Surprisingly, Santesson (1952 : 39) reported finding only 10 Fungi imperfecti on foliicolous lichens, of which nine belonged to the coelomycete genus *Pyrenotrichum* Mont. (syn. *Chlorocyphella* Speg.), but these did show a high degree of host specificity; 15 foliicolous lichenicolous Hyphomycetes are accepted below.

My investigations have been primarily concerned with the taxonomy of the fungi and I have made no attempt to determine the nutritional relationships between the bionts in the lichenized condition and the invading fungus. This is clearly a field in which ultrastructural work is required but none so far appears to have been carried out. As emphasized elsewhere (Santesson, 1967; Hawksworth, 1978a) a wide range of types of relationships exists between lichenicolous fungi and their hosts and it may well be that some of the lichenicolous Hyphomycetes, which are scarcely or not pathogenic, are more correctly interpreted as parasymbionts (i.e. symbiotic* with a pre-existing symbiosis) or, adopting Poelt's (1977) terminology, constituting a three-membered symbiosis.

Few of the lichenicolous Hyphomycetes have known perfect (teleomorphic) states. These are *Hansfordiellopsis elongata* and *H. lichenicola* with perfect states in the newly described genus *Ascohansfordiellopsis*, and *Illosporium carneum* with *Nectriella robergei* as its perfect state. *Niesslia cladoniicola* ascospores produce an imperfect *Monocillium* state in pure culture, but the conidial state has not itself been found on the host (Hawksworth, 1975b).

It might perhaps be expected that some lichen-forming fungi would have hyphomycete imperfect states but the evidence for this is meagre and in need of a critical examination. Hale (1957) claimed that ascospores ejected from *Buellia stillingiana* Steiner gave rise to *Sporidesmium folliculatum* (Corda) Mason & S. Hughes; while the identity of the fungus is not in doubt (deter-

* 'Symbiosis' is used here in its original sense of dissimilar organisms living together, and does not imply that the association is mutualistic.

mined by Dr S. J. Hughes; DAOM 43340, IMI 69050), it is difficult to accept that this was not a contaminant, because ascospores of other lichens have failed to give rise to comparable imperfect states. Furthermore, *S. folliculatum* is a widespread species in Europe as well as in North America, although the *Buellia* is restricted to North America, and attempts to repeat Hale's work have been unsuccessful (Ahmadjian, 1965). Perhaps more reliable are reports of the production of conidia by the isolated fungal components of *Phaeographina fulgurata* (Fée) Müll. Arg. and *Lecidea erratica* Körb. (Ahmadjian, 1963) but these do not appear to resemble any known fungi or lichenicolous taxa considered here, and must be regarded as exceptional in view of the large number of mycobionts (fungal components of lichens) now known in culture. Riedl's (1976a) report of an imperfect state recalling *Coniothecium toruloides* Corda in *Bacidia chlorococca* (Stenh.) Lett. appears dubious on the basis of his illustrations, and requires re-investigation; *Coniosporium aeroalgicola* Turian, described as partially lichenized and occurring on corticolous green algae (Turian, 1977), should also be considered further.

Mention must also be made of the erect, peltate, but partly synnematos, structures termed 'hypophores' recently recognized in a few foliicolous lichens belonging to the genera *Echinoplaca* and *Tricharia* (Vězda, 1973, 1975; Sérusiaux, 1977). These hypophores superficially recall the parasymbiont coelomycete genus *Pyrenotrichum* and are of unknown function, but, according to Vězda (1973), are definitely a part of the lichen and not an invading lichenicolous fungus. As true flask-shaped pycnidia are unknown in both *Echinoplaca* and *Tricharia* (Santesson, 1952) it is perhaps conceivable that these structures have a spermatial role, but thorough ontogenetic studies are required to establish their function.

Some lichenized Hyphomycetes and Coelomycetes have been described (e.g. Batista, 1961; Batista & Maia, 1965; Funk, 1973) which have no known ascospore-producing phase but these are currently very imperfectly known, regarded with some scepticism by many lichenologists, and largely ignored in recent accounts of lichen systematics (e.g. Henssen & Jahns, 1973; Poelt, 1974). Numerous lichens are, however, known to produce pycnidia (see Smith, 1921: 192-208) but little attention has been paid to these structures this century by either lichenologists or mycologists. As some lichenized taxa chiefly occur only as their pycnidial state (e.g. *Catillaria griffithii* (Sm.) Malme, *Opegrapha vermicellifera* (Kunze) Laund.), some coelomycete lichens lacking the ability to ever form ascospore-producing structures were perhaps to be anticipated; further, the ability of conidia from the pycnidia of several lichens to germinate and grow in pure culture (and in one case to form a pycnidium-like primordium) has recently been demonstrated (Vobis, 1977). That no lichens with hyphomycete imperfect states are currently recognized in nature (see p. 187) does not, however, mean that consistently lichenized Hyphomycetes might not be expected to occur, as lichenization is best viewed as a repeatedly evolving nutritional state (Hawksworth, 1978a). Nevertheless, it is possible that some of the conidial lichens so far described represent sterile thalli of other lichens infected with lichenicolous fungi. A critical revision of these associations is urgently required, but this a major undertaking falling outside the scope of this present work.

Taxonomic concepts

The criteria used for the classification of the Hyphomycetes at the generic level have undergone a traumatic re-thinking, mainly during the last 25 years, with paramount importance now being accorded to the precise mode of conidiogenesis (see, for example, Ellis, 1971; Kendrick, 1971; Subramanian, 1972; Kendrick & Carmichael, 1973). The typification of the genera of Hyphomycetes has also been rather thoroughly investigated compared with many other groups of fungi (Hughes, 1958; Kendrick & Carmichael, 1973). This enormous progress has taken place after most of the lichenicolous Hyphomycetes were last studied (in fact most had not been examined since their original description), and it was therefore not surprising to find that many taxa had been placed in genera which, according to modern concepts, are quite inappropriate.

As an example of the extent of revisionary work required, the case of the six species accepted by Keissler (1930) in *Coniothecium* might be mentioned. Hawksworth (1975a) found that these comprised two monotypic genera of Hyphomycetes (two of the previously accepted species

being conspecific in one of these), a lichenicolous coelomycete, a member of a genus of saprophytic Hyphomycetes, and even a lichenized ascomycete (in which the ascospores were mistaken for conidia).

In the taxonomic treatments adopted here, the generic concepts currently accepted by specialists in the Hyphomycetes have been followed, the obligately lichenicolous genera of which are distinguished both from each other, and from non-lichenicolous allies, by conidiogenesis, pigmentation (although this is not a valid generic criterion in all groups of Hyphomycetes) and the types of conidia. The size and degree of septation of the conidia is used at the specific level, usually combined with other features, to provide the species concept. As I have pointed out elsewhere, for me species should ideally be separated from one another by discontinuities in several unrelated characters (Hawksworth, 1974: 42); this approach has been followed here wherever possible. Occurrences on different hosts are not in my opinion sufficient to justify the recognition of separate species unless they are correlated with differences in the characters of the fungi themselves. In an earlier study on *Lichenoconium* (Hawksworth, 1977*b*), when the taxa were delimited without regard to the host, some proved to be restricted to particular hosts whilst others did not; this has also proved to be true amongst the lichenicolous Hyphomycetes.

In the present contribution, Hyphomycetes that prove to be saprophytes apparently only fortuitously present on lichens are merely compiled in Table 2; those previously mentioned in the literature are also treated under Excluded species (pp. 266–289). This approach was adopted because an adequate literature for the determination of most commonly encountered ubiquitous saprophytic fungi already exists (see Kerrich *et al.*, 1978, for references) and the number of such fungi that might be found by diligent searching is perhaps very large. The keys and detailed taxonomic treatments presented below deal only with the obligately or primarily lichenicolous Hyphomycetes. If a fungus is found on an unhealthy or decayed lichen the extensive literature on other Hyphomycetes must be consulted in addition to this compilation before deciding that the organism represents a new taxon.

Methods

In order to ascertain the Hyphomycetes that had been described from lichens, the host indexes available to the following standard compilations of fungal names were abstracted: Saccardo (1882–1931; host-index in manuscript at CMI), Petrak (1930–44, 1950) and the *Index of Fungi* (1940 on; inclusive of *A Supplement to Petrak's Lists 1920–1939*, 1969). These data were supplemented by works prepared specifically for lichenicolous fungi (Lindsay, 1869*a*; Arnold, 1874; Zopf, 1896; Vouaux, 1912–14; Keissler, 1930; Clauzade & Roux, 1976) and also some regional listings that also covered fungi occurring on lichens (e.g. Oudemans, 1919; Viégas, 1961). Further data were obtained from the study of a large number of individual papers both by mycologists and lichenologists. As it has been found that several lichenicolous fungi were not in fact recognized as such even by eminent mycologists describing them as new (e.g. *Chaetosphaeria insectivora* Hansf. described as on scale insects, *Periconia phillipsii* Berk. & Leight. described as on soil) it is inevitable that some names will nevertheless have been overlooked. The importance of studying mycological literature as a whole in the determination of lichenicolous fungi, and not only works specifically covering these, will thus be evident.

The specimens supporting the various published reports were then traced wherever possible and re-examined, supplemented by other collections available. As stressed in the Introduction no attempt to revise all material in the world's herbaria has been made in this study. Type or authentic material was obtained from the following herbaria: B, BM, CBS, E, FH, H, IMI, K, LINN, LPS, MA, NY, PAD, UPS, URM, S, VER, W and herb. Vouaux (with Prof. Y. Rondon at Marseille); herbarium abbreviations follow Holmgren & Keuken (1974). An exclamation mark (!) indicates that I have examined the specimen cited.

For routine examination lactophenol cotton-blue (20 g phenol : 20 g lactic acid : 40 g glycerine : 20 g water : a few drops of cotton-blue) was employed; it should be noted that using this reagent slides need to be heated to almost boiling to ensure maximum absorption of stain and reduce the possibilities of structures tending to shrink slightly in size. Slides made with this mountant

sealed with Glyceel are semi-permanent and those prepared from most specimens examined in this study are preserved in IML. For particularly dark structures, lactophenol without cotton-blue is more satisfactory. In order to work out details of conidiogenesis, particularly with almost or entirely hyaline species, a temporary erythrocin mountant (0.5 g erythrocin : 100 ml 10% ammonia) proved most satisfactory.

Where necessary, sections of 10–20 µm in thickness prepared with the aid of a freezing microtome were also examined.

The scanning electron micrographs in Figs 13, 19, 24 and 42 were taken with an ISI-60 SEM using air-dried specimens coated with gold.

Key to the genera

This artificial key is to the genera treated in the following section of this work, i.e. the obligately or primarily lichenicolous Hyphomycetes, and does not include Hyphomycetes fortuitously occurring on lichenized hosts (see Table 2). In the case of genera, including lichenicolous species, which are not described in detail in the following section (as they have been discussed by me elsewhere) fuller information is provided here than for the other taxa. It should be stressed that this key is designed only for the lichenicolous species of genera treated, and does not necessarily also allow for the total ranges of non-lichenicolous species belonging to them.

- | | | |
|--------|---|---|
| 1 | Conidia hyaline or pinkish at maturity | 2 |
| - | Conidia pale brown to dark brown at maturity | 7 |
| 2(1) | Conidiogenous cells phialidic | 3 |
| - | Conidiogenous cells annellidic or blastic | 6 |
| 3(2) | Conidia subglobose, ellipsoid or cylindrical, not curved, 0–1 septate | 4 |
| - | Conidia curved, with a heel-like basal cell, to 5-septate | Fusarium (p. 217) |
| 4(3) | Conidiophores mononematous, not forming compact sporodochia | 5 |
| - | Conidiophores forming compact appanate sporodochia | Dendrodochium (p. 211) |
| 5(4) | Conidiogenous cells very delicate and thin-walled throughout | Acremonium (p. 192) |
| - | Conidiogenous cells delicate above but the basal parts with thickened and refractive walls | Monocillium (p. 239) |
| 6(2) | Conidiogenous cells annellidic; conidiophores mononematous; conidia 0–3 septate, ellipsoid, with a highly refractive basal hilum | Refractohilum (p. 248) |
| - | Conidiogenous cells monoblastic or polyblastic; conidiophores indistinct, forming flesh coloured, orange or reddish compact convex sporodochia; conidia non-septate, globose or angular, without a refractive hilum | Illosporium (p. 231) |
| 7(1) | Conidiophores mononematous | 8 |
| - | Conidiophores forming distinct synnemata; to 250 µm tall; conidiogenous cells annellidic, ampulliform; conidia globose, non-septate, dark brown, coarsely verrucose, (8–)9–12(–14) µm | Leightonomyces phillipsii (p. 238) |
| 8(7) | Conidiogenous cells annellidic, blastic or tetric | 9 |
| - | Conidiogenous cells phialidic with broad collarettes; conidiophores immersed; conidia globose, non-septate, verrucose, 3.5–6 µm diam | Xanthoriicola physciae (p. 266) |
| 9(8) | Superficial mycelium with mucronate-hyphopodia or hyphopodium-like cells | 10 |
| - | Superficial mycelium lacking hyphopodia | 12 |
| 10(9) | Conidia formed in acropetal chains, 0–3 septate, cells ± concolorous | Ampullifera (p. 195) |
| - | Conidia formed singly, 3-many septate or muriform, the apical cell elongated and paler than the basal cells | 11 |
| 11(10) | Conidiogenous cells arising singly and vertically from repent hyphae | Hansfordiellopsis (p. 220) |
| - | Conidiogenous cells in chains and horizontally arranged | Dictyophyrnella (p. 213) |

12(9)	Conidia globose, ellipsoid, doliiform or obclavate	13
-	Conidia palmate, comprising to <i>c.</i> 50 radiating multiseptate slightly arcuate arms	Psammia (p. 244)
13(12)	Conidia all non-septate at maturity	14
-	Conidia 1-many septate at maturity or multicellular	16
14(13)	Conidia subglobose or doliiform	15
-	Conidia irregularly lobed, the outer walls becoming unevenly thickened, dark brown, smooth-walled, mainly 6-17(-20) × 5-10 μ m	Milospium graphideorum (p. 238)
15(14)	Conidiophores macronematous; erect; conidia doliiform, forming long chains	Ampullifera (p. 195)
-	Conidiophores semi-macronematous, sporodochial; conidia subglobose	Sclerococcum (p. 249)
16(13)	Conidia muriform or multicellular	17
-	Conidia with transverse septa only	20
17(16)	Conidiophores semi-macronematous, not percurrently proliferating	18
-	Conidiophores macronematous, percurrently proliferating and leaving distinct annellations on the conidiophores; conidia obclavate with a pale elongate apical cell and 1-3 basal appendages	Teratosperma (p. 260)
18(17)	Conidiophores superficial	19
-	Conidiophores \pm entirely immersed in the host; conidia very variable, multicellular, mainly elongate-ellipsoid	Trimmatostroma (p. 264)
19(18)	Conidiophores scattered or loosely aggregated; conidiogenous cells simple, much narrower than the conidia they give rise to; conidia smooth or verrucose	Monodictys (p. 241)
-	Conidiophores arranged in compact sporodochia; conidiogenous cells often complex, \pm same width as the conidia they give rise to; conidia smooth	Sclerococcum (p. 249)
20(16)	Conidia 2-many septate when mature	21
-	Conidia 1-septate when mature, sometimes separating with difficulty	25
21(20)	Conidiogenous cells percurrently proliferating	22
-	Conidiogenous cells not percurrently proliferating	23
22(21)	Conidia obclavate, the apical cell elongate and paler	Teratosperma (p. 260)
-	Conidia clavate, the basal cell paler	Endophragmiella (p. 215)
23(21)	Conidiogenous cells monoblastic; conidia with the apical cell paler	24
-	Conidiogenous cells polyblastic; conidia even in colour	Pseudocercospora (p. 246)
24(23)	Conidiogenous cells arranged in chains creeping over the surface of the host with the conidia borne from their dorsal side	Sessiliospora (p. 250)
-	Conidiogenous cells arising singly, vertical	Hansfordiellopsis (p. 220)
25(20)	Conidiophores semi-macronematous; conidiogenous cells monoblastic	26
-	Conidiophores macronematous; conidiogenous cells polyblastic	Cladosporium (p. 209)
26(25)	Conidia very pale brown, ellipsoid with rounded ends, readily separating	Bispora (p. 207)
-	Conidia brown to dark brown, doliiform with truncated thin-walled ends, separating with great difficulty	Taeniolella (p. 253)

Accepted species

The accepted genera and species have been arranged alphabetically for ease of reference. In the case of genera comprising more than a single obligately lichenicolous species, keys to the species are included after the account of the genus itself. Descriptions and full synonymies for taxa treated by me in previous publications are omitted, but references to the publications in which they are discussed are provided and the diagnostic characters included in the keys. For genera comprising lichenicolous and non-lichenicolous species, the generic diagnoses cover the genus as a whole.

I. *ACREMONIUM* Link ex Fr.

Syst. mycol. 1 : xlv (1821).

See Gams (1971 : 38) for synonyms of this generic name.

Colonies usually effuse; mycelium usually superficial, irregularly branched, hyaline or slightly pigmented, smooth or somewhat verruculose, sometimes forming pigments in the medium when grown in artificial culture. Stroma, setae and hyphopodia absent. Conidiophores micronematous, semi-macronematous or macronematous, arising singly or in loose sporodochia, sometimes arising from ropes of hyphae (plectonematogenous), hyaline or pigmented, simple or sparsely branched. Conidiogenous cells phialidic, discrete, terminal, narrowly subulate and tapering to the apex, hyaline or pigmented. Conidia solitary, either catenate or adhering in a slimy mass, subglobose to ellipsoid, rounded or truncated at one or both ends, more rarely subcylindrical, simple or 1-septate, hyaline or pigmented, smooth or slightly verruculose.

Type species: *Acremonium alternatum* Link ex Gray.

Number of species: About 105 are now recognized, of which 96 are described in detail by Gams (1971, 1975). Four species are so far known only from lichens or may be primarily lichenicolous, and a fifth may be fortuitously lichenicolous.

Perfect state: *Acremonium*-like imperfect states are known in about 17 genera of Sphaeriales (see Gams, 1971 : 19–21; Samuels, 1976).

Key to the lichenicolous species

- | | | |
|---|--|---|
| 1 | Conidia less than 10 μm long. | 2 |
| - | Conidia 12–18 \times 2–2.5 μm | <i>Acremonium rhabdosporum</i> (p. 194) |
| 2 | Conidiophores not or sparsely branched, smooth-walled | 3 |
| - | Conidiophores branched and forming lax sporodochial tufts, verruculose; conidia simple, 4–6 \times 2–3 μm | <i>Acremonium spegazzinii</i> (p. 195) |
| 3 | Conidia all simple | 4 |
| - | Conidia becoming 1-septate, 5–9.5 \times 1.5–2.5 μm | <i>Acremonium lichenicola</i> (p. 194) |
| 4 | Conidiogenous cells 20–40(–65) μm tall; conidia mainly 3.5–5.5 \times 1–2 μm , length: breadth ratio 2.5–4; fortuitously lichenicolous (?) | <i>Acremonium strictum</i> W. Gams (p. 269) |
| - | Conidiogenous cells 15–20 μm tall; conidia 4–5.5(–6) \times 1.5–2.5(–3) μm , length: breadth ratio 2–2.5 | <i>Acremonium antarcticum</i> (p. 192) |

1. *Acremonium antarcticum* (Speg.) D. Hawksw. **comb. nov.**

(Fig. 1A)

Sporotrichum antarcticum Speg., *An. Mus. nac. B. Aires* 20 : 416 (1910).

Type: Antarctic Islands, South Orkney Islands, on *Caloplaca* cf. *regalis* (Vain.) Zahlbr., January 1908, C. Spegazzini (LPS 21677—holotype!).

Colonies effuse, superficial, felted, white, arising on the host thallus; mycelium mainly superficial and only scarcely penetrating the cortex of the host, hyphae flexuose, thin-walled, hyaline, 1–2 μm wide. *Conidiophores* semi-macronematous, mononematous or loosely aggregated, unbranched or with one branch at the base, hyaline. *Conidiogenous cells* phialidic, discrete, terminal, narrowly subulate, hyaline, thin-walled, smooth-walled, 15–20 μm tall, c. 2 μm wide at the base but tapering to 1–1.5 μm at the apex. *Conidia* solitary, adhering in a slimy mass, ellipsoid, rounded at the apices, simple, hyaline, smooth-walled, 4–5.5(–6) \times 1.5–2.5(–3) μm (length: breadth ratio 2–2.5).

Host: The host was given as *Teloschistes* by Spegazzini (*loc. cit.*) but in fact represents a subfruticose pulvinate *Caloplaca* (of the type placed by Dodge (1973) in *Polycauliona* Hue), probably *C. regalis* (Vain.) Zahlbr., but the host is in a fragmentary condition.

Distribution: South Orkney Islands. Known only from the type collection.

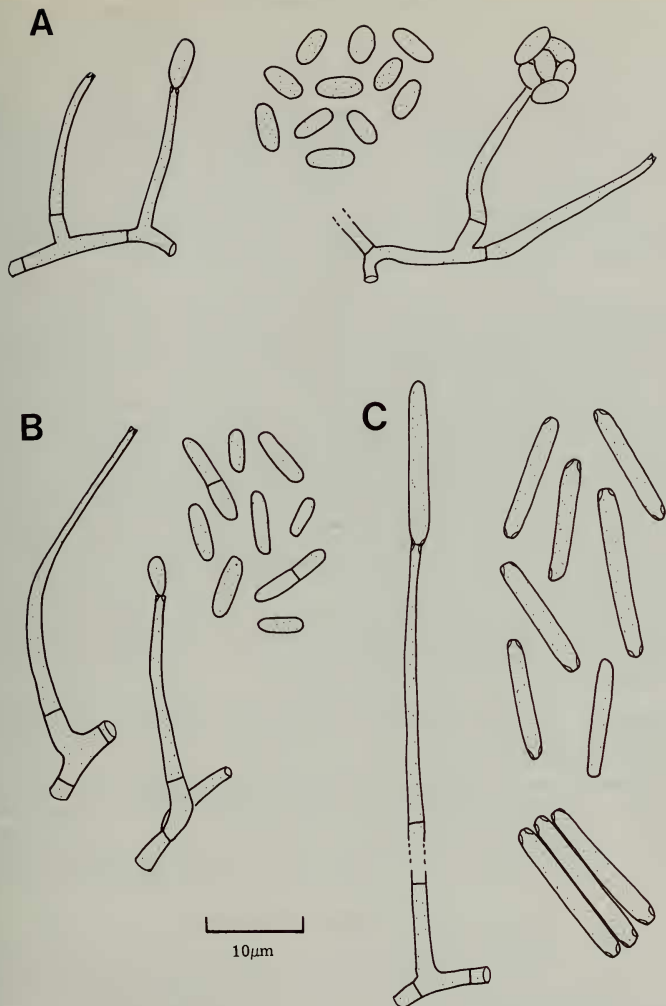


Fig. 1 A, *Acremonium antarcticum* (LPS 21677—holotype). B, *A. lichenicola* (IMI 225007). C, *A. rhabdosporum* (IMI 223813—isotype).

Observations: This species shows some affinity with both *A. charticola* (Lindau) W. Gams and *A. strictum* W. Gams but it differs from *A. charticola* in the shorter conidiogenous cells and less rounded conidia, and from *A. strictum* in the shorter conidiogenous cells and relatively broad conidia ($3.3\text{--}5.5(-7) \times 0.9\text{--}1.8 \mu\text{m}$; length : breadth ratio $2.5\text{--}4(-4.9)$ *vide* Gams, 1971).

The host in the type collection is also infected with a second fungus, most probably belonging in *Polycoccum*, with brown 1-septate echinulate fusoid ascospores about $16 \times 5 \mu\text{m}$; the specific identity of this fungus is uncertain at present. As the *Acremonium* is largely superficial it is probable that it is an opportunist colonizing thalli already adversely affected by the *Polycoccum*. *Acremonium antarcticum* should therefore be searched for on non-lichen hosts and substrates.

When further fresh material becomes available, this species should be studied in culture to ascertain whether the diagnostic short conidiogenous cells remain in the same size range or not; if they do not and the conidia also become more rounded the fungus should be subsumed with *A. charticola*.

2. *Acremonium lichenicola* W. Gams, *Cephalosporium-art. Schimmelpilze* : 134 (1971). (Fig. 1B)

Type: Germany, Plön District, Schuttbrehm, isol. ex *Betula* litter, May 1965, *W. Gams* (CBS 425.66—holotype; IMI 224426—isotype!).

Colonies only known in culture, reaching 6–10 mm diam in 10 days on malt agar at room temperature, slightly pulverulent or moist and slimy, at first pale pinkish or yellowish but later becoming ochraceous or greyish-brown; mycelium partly immersed in the agar and partly superficial, hyphae flexuose, abundantly branched, thin-walled, hyaline, mainly $1.5\text{--}2.5 \mu\text{m}$ wide. *Conidiophores* semi-macronematous, mononematous, unbranched, usually with a short basal cell which can be slightly chromophilic, hyaline. *Conidiogenous cells* phialidic, discrete, terminal, narrowly subulate, hyaline, thin-walled, smooth-walled, $30\text{--}65 \mu\text{m}$ tall, $2\text{--}3 \mu\text{m}$ wide at the base but tapering to $1\text{--}1.5 \mu\text{m}$ at the apex. *Conidia* solitary, adhering in a slimy mass, subcylindrical, rounded at the apices, 0–1 septate, hyaline, smooth-walled, $5\text{--}9.5 \times 1.5\text{--}2(-2.5) \mu\text{m}$ (length : breadth ratio $3\text{--}4.4$).

Hosts: Reported by Gams (1971 : 135) as isolated from an unnamed *Cladonia*, unnamed lichen apothecia, an unnamed lichen, lichens overgrowing a *Stereum* species, algal-covered bark, *Alnus* bark, *Betula* litter and *Phaeobulgaria inquinans* (Fr.) Nannf.

Distribution: Belgium, Germany and The Netherlands.

Observations: It is not clear whether this is primarily a lichenicolous species or a saprophyte fortuitously occurring on lichens. The ecology of this fungus and its effects on lichenized hosts require further investigation.

Additional specimens (see also Gams, 1971): **Germany:** Plön District, Schützbrehm, isol. ex *Phaeobulgaria inquinans* on *Quercus*, October 1965, *W. Gams* (CBS 776.69, IMI 225008!); *loc. cit.*, isol. ex algal-covered bark, October 1965, *W. Gams* (CBS 777.69, IMI 225007!).

3. *Acremonium rhabdosporum* W. Gams, *Cephalosporium-art. Schimmelpilze* : 136 (1971). (Fig. 1C)

Type: Austria, Innsbruck, near Aldranser Alm, isol. ex *Cladonia* sp., October 1965, *M. Gams* (CBS 438.66—holotype; IMI 223813—isotype!).

Colonies only known in culture, reaching 8 mm diam in 10 days on malt agar at room temperature, rather slimy, greyish, reverse slightly yellowish; mycelium partly immersed in the agar and partly superficial, hyphae flexuose, abundantly branched, thin-walled, hyaline, mainly $1.5\text{--}2.5 \mu\text{m}$ wide. *Conidiophores* semi-macronematous, mononematous, unbranched, usually with a distinct short basal cell, hyaline. *Conidiogenous cells* phialidic, discrete, terminal, narrowly subulate, hyaline, thin-walled, smooth-walled, $40\text{--}80 \mu\text{m}$ tall, $2.5\text{--}3 \mu\text{m}$ wide at the base but tapering to $1\text{--}1.5 \mu\text{m}$ at the apex. *Conidia* solitary, adhering in a slimy mass often arranged parallel to each

other, elongate-cylindrical, the apices with annular thickenings of the wall, simple, hyaline, smooth-walled, $12-18 \times 2-2.5 \mu\text{m}$ (length : breadth ratio 6.4-7.5).

Host: Isolated from a *Cladonia* species.

Distribution: Austria. Known only from the original isolation.

Observations: This species occupies a rather isolated position in *Acremonium* by virtue of the very long and narrow conidia with characteristic annular thickenings at their ends.

4. *Acremonium spagazzinii* D. Hawksw. nom. nov.

(Fig. 2)

Vectillum lichenicola Speg., *Boln Acad. nac. Cienc. Córdoba* 11 : 612 [p. 234 of reprint] (1889); as '*lichenicolum*'.

Type: Brazil, on decayed thallus of *Leptogium andinum* P. M. Jørg., 1880, *J. Puiggari* 127 (LPS 11.339—holotype!).

Non *Acremonium lichenicola* W. Gams ex anno 1971.

Colonies discrete, mainly superficial, tufted, white, arising on decayed parts of the host thallus; mycelium partly immersed, hyphae flexuose, thin-walled, smooth-walled to verruculose, hyaline, rather variable in thickness, mainly 2-4 μm wide. *Conidiophores* semi-macronematous, aggregated into lax sporodochial-like tufts 200-400 μm diam, branched but irregularly so and not clearly verticillate, hyaline, verruculose, mainly 3-5 μm wide. *Conidiogenous cells* phialidic, discrete, terminal, subulate, hyaline, thin-walled, inconspicuously to clearly verruculose, 20-60 μm tall, mainly 3-3.5 μm wide at the base but tapering to 1.5-2.5 μm at the apex. *Conidia* solitary, adhering in a slimy mass, elongate-ellipsoid, rounded at the apices, simple, hyaline, apparently smooth-walled but perhaps very minutely verruculose, $4-6 \times 2-3 \mu\text{m}$ (length : breadth ratio 2.5-4).

Host: Spegazzini originally gave the habitat as 'In margine apotheciorum *Physciae* et *Peltigerae*' but neither of these genera is present in the type material. The decayed thallus of a *Leptogium* species, which from its ascospores appears to be the recently recognized *L. andinum* P. M. Jørg., known from Bolivia and Colombia but not previously reported from Brazil (Jørgensen, 1975 : 439), predominates and is heavily infected by a member of the *Aspergillus glaucus* group. The *Acremonium* is restricted to the *Leptogium* but occurs scattered over the thallus and not only in the vicinity of the apothecia. Some fronds of *Heterodermia leucomelos* (L.) Poelt, perhaps the basis of Spegazzini's reference to *Physcia*, are also present but not infected by the *Acremonium*.

Distribution: Brazil. Known only from the type collection.

Observations: This fungus is probably most suitably accommodated in *Acremonium* sect. *Nectrioidea* W. Gams which already contains some verruculose species, for example *A. butyri* (van Beyma) W. Gams (conidial state of *Nectria viridescens* C. Booth) verruculose only at the base of the phialides, and both *A. trachycaulon* W. Gams and the *Acremonium* state of *Nectria freycinetiae* G. Samuels which are verruculose throughout but have larger conidia than *A. spagazzinii*.

In view of the decayed condition of the host, it is possible that *A. spagazzinii* is not an obligately lichenicolous fungus but rather an opportunist.

II. AMPULLIFERA Deight.

Mycol. Pap. 78 : 36 (1960).

Ampulliferella Bat. & Caval., *Port. Acta Biol. B*, 7 : 348 (1964).

Ampulliferopsis Bat. & Caval., *Port. Acta Biol. B*, 7 : 349 (1964).

Colonies effuse; mycelium superficial, adpressed, irregularly branched, brown, usually with abundant mucronate hyphopodia. Stroma and setae absent. *Conidiophores* macronematous, mononematous, erect, usually unbranched but sometimes becoming almost penicillate apically, brown to dark brown, smooth-walled, in some species with lobed foot cells. *Conidiogenous cells* monoblastic, integrated, terminal, sometimes percurrent, each apical cell in turn often acting as a

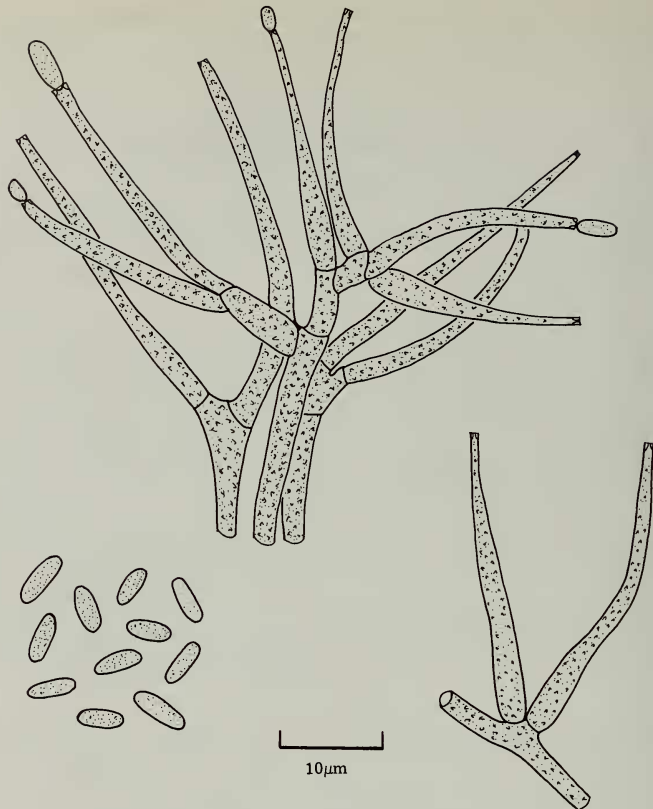


Fig. 2 *Acremonium spegazzinii* (LPS 11.339—holotype).

conidiogenous cell. Conidia catenate or sometimes solitary, dry, ellipsoid, obclavate, subcylindrical or lemoniform, brown to dark brown, non-septate or transversely septate.

Type species: *Ampullifera foliicola* Deight.

Perfect state: ? *Teratoschaeta* Bat. & Fonseca; see under *A. amoeboides*.

Number of species: Six species are accepted here, one of which is newly described. All occur as obligately lichenicolous fungi on foliicolous lichens with the possible exception of *A. pirozynskii*. The species of this genus often occur intermixed with other lichenicolous Hyphomycetes, particularly *Hansfordiellopsis* species, and also with each other.

Observations: This genus was originally described by Deighton (1960) for three fungi with hyphopodiata mycelia and non-septate conidia borne in acropetal chains. The concept of the

genus was subsequently expanded by Deighton (1965) to embrace a species with transversely septate conidia. Batista & Cavalcanti (1964) introduced two genera for species with septate conidia: *Ampulliferella* characterized by lobate 'hyphopodia' in addition to the mucronate type, and *Ampulliferopsis* which lacked the lobate 'hyphopodia'. These authors considered the conidial chains in their new genera to arise basipetally. Sutton (1969: 614-615) tabulated the reported differences between these genera and noted (*loc. cit.*: 613) that if the conidia were really basipetal Batista & Cavalcanti's genera might be distinct from *Ampullifera*. In the course of my observations and those of Deighton (*in litt.*), no evidence for basipetal conidiogenesis was found; as the lobate 'hyphopodia' appear to be foot-cells of conidiophores from which the conidiophores have been broken or not yet originated, and as I concur with Deighton (1965) in not accepting conidial septation as a generic criterion *per se*, these genera are united.

The species accepted within *Ampullifera* are mainly distinguished by the shape, size and septation of the conidia, which in most cases proved to be correlated with other characters, such as the nature of the hyphopodia, conidiophore length, and type of conidiophore foot-cells. It does not, however, appear to be possible to distinguish with certainty several of the species in the absence of conidiophores and conidia, and in other instances parts of so many microfungi occur in a single preparation, that a connection between a conidium and its supporting conidiophore can only be firmly established if they are seen attached; collections falling into these doubtful categories are compiled separately under *Ampullifera* spp. below (p. 207).

Key to the species

- | | | |
|---|---|--------------------------------------|
| 1 | Conidia septate at maturity | 2 |
| - | Conidia remaining non-septate at maturity | 4 |
| 2 | Hyphopodia subglobose, mainly under 5 μ m diam | 3 |
| - | Hyphopodia ampulliform, 5-7 \times 2-3 μ m; conidia mainly 2-septate, 14-25 \times 3-4 μ m | |
| | <i>A. pirozynskii</i> (p. 203) | |
| 3 | Conidia 1-3(-6) septate, the first formed septa near the ends of the cell (not median), (9-)12-15 \times 3-5-5-5 μ m; lobate foot-cells absent | <i>A. hippocrateacearum</i> (p. 201) |
| - | Conidia 1(?-3) septate, the first formed septum median, (11-)14-20 \times 5-6 μ m; lobate foot-cells present | <i>A. amoeboides</i> (p. 197) |
| 4 | Conidia ellipsoid or lemoniform; hyphopodia abundant | 5 |
| - | Conidia subcylindrical or barrel-shaped, 8-11 \times 3-4 μ m; hyphopodia rare | <i>A. leonensis</i> (p. 203) |
| 5 | Hyphopodia elongate-ampulliform, 7-14 \times 2.5-4 μ m; conidia lemoniform, abruptly truncated at the apices, (8-)10-14(-14.5) \times 4-6(-7) μ m | <i>A. ugandensis</i> (p. 205) |
| - | Hyphopodia subglobose, mainly 2.5-4 μ m diam; conidia ellipsoid, gradually truncated at the apices, (6-)7-13(-15) \times 4-6 μ m | <i>A. foliicola</i> (p. 199) |

1. *Ampullifera amoeboides* (Bat. & Caval.) D. Hawksw. **comb. nov.**

(Fig. 3)

Ampulliferella amoeboides Bat. & Caval., *Port. Acta Biol. B*, 7: 348 (1964).

Type: Brazil, Amazonas, Manaus, Reserva Ducke, on *Mazosia* sp., 28 February 1961, *A. C. Batista* (URM 27512—holotype non vidi).

Ampulliferopsis myriapoda Bat. & Caval., *Port. Acta Biol. B*, 7: 351 (1964).

Type: Brazil, Amazonas, Manaus, km 55 Rodonia AM-1, on *Mazosia* sp. on *Palmae* sp., 28 August 1961, *J. Maria* (URM 27525—holotype non vidi).

Icones: Batista & Cavalcanti, *Port. Acta Biol. B*, 7: 350 fig. 1, 352 fig. 2 (1964).

Colonies dispersed, superficial, olivaceous brown, arising on the surface of the host lichen; mycelium superficial, adpressed, irregularly branched, flexuose, hyphae relatively thin-walled, smooth-walled, pale brown to brown, slightly constricted at the septa, cells mainly 7-15 μ m long and 3-4.5 μ m wide; hyphopodia abundant, commonly unilateral, generally arising towards the distal end of the cell, often in pairs on opposite sides of the hyphae, subglobose to ampulliform below, base mainly 3-4 μ m diam, sometimes elongated to about 10 μ m, paler than the hyphae on

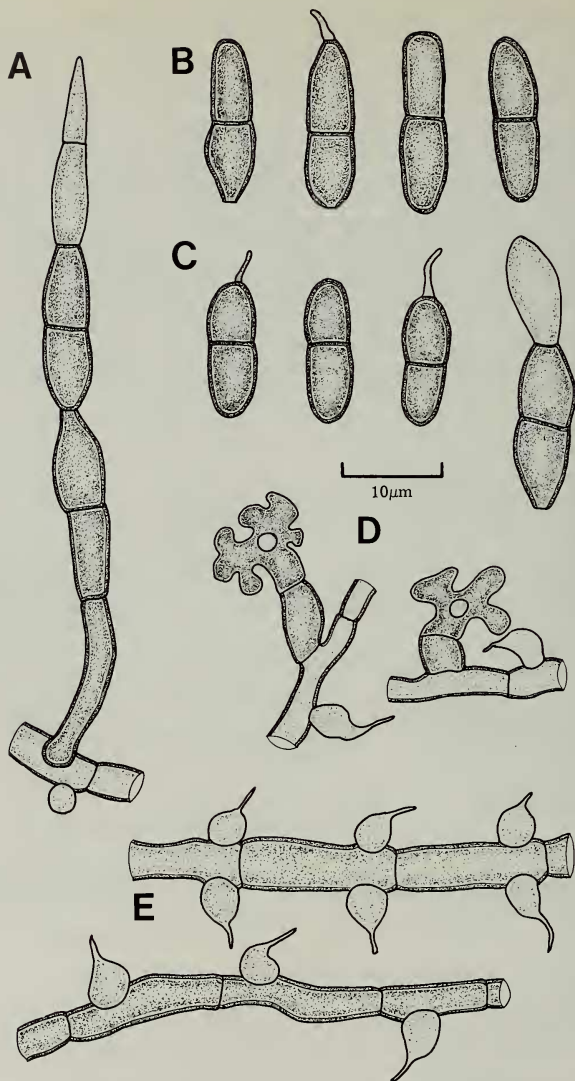


Fig. 3 *Ampullifera amoeboides*. A, Conidiophore with attached conidia. B-C, Conidia. D, Lobate foot cells. E, Mycelium with hyphopodia. A, B and E IMI 113850a; C IMI 113851; and D IMI 83230c.

which they arise, distinctly mucronate, the neck straight to flexuose, variable in length and about 0.5 μm wide; lobate cells often also produced, dark brown, 7–10 μm wide, often subtended by a short stalk-cell, sometimes very rare or absent. *Conidiophores* macronematous, mononematous, erect, mainly unbranched but rarely with subpenicillate heads, thick-walled, smooth-walled, dark brown, septate, slightly constricted at the septa, 10–20 μm tall and 5–6 μm wide, the foot rounded and originating directly from the mycelium or from characteristic lobed cells (see above) which may also occur without conidiophores. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell probably in turn acting as a conidiogenous cell. *Conidia* arising in single short and apparently acropetal chains, rarely adhering in chains after separation from the conidiophore, dry, 1-septate (? sometimes to 3-septate), the septum median, generally slightly constricted at the septum, dark brown, smooth-walled, elongate-ellipsoid, gradually truncated at the apices, (11–)14–20 \times 5–6 μm , scar often indistinct, 1–2 μm diam.

Perfect state: ? *Teratoschaeta rondoniensis* Bat. & Fonseca. This monotypic genus was described with a conidial state very similar to *A. amoeboides*; it has setose perithecia recalling those of *Ascohansfordiellops* but with 1-septate ascospores (Batista & Fonseca, 1967).

Hosts: On *Mazosia* species and some unidentified foliicolous sterile lichens.

Distribution: Brazil.

Observations: Although the original collections of this species were not available for study, collections authentic for the names were: URM 39393 (slides IMI 113851!) for *Ampulliferella amoeboides* and URM 36881 (slides IMI 113850a!) for *Ampulliferopsis myriapoda*. The latter species was described as having conidia which could be up to 3-septate, and longer conidiophores, rather triangular hyphopodia, and no lobate foot-cells; URM 36881, however, agreed in all respects with the description given above for *A. amoeboides*, but in view of these discrepancies it is possible that the holotype of *A. myriapoda* may eventually prove to be conspecific with *A. hippocrateacearum* rather than *A. amoeboides* as indicated here. These two species commonly grow together on the same host thallus and this is also true for the holotype of *Ampullifera brasiliensis* Deight. (see p. 201), the original description of which included some features from intermixed *A. amoeboides*.

The conidia in *Ampulliferella amoeboides* and *Ampulliferopsis myriapoda* were interpreted as originating basipetally by Batista & Cavalcanti (1964). Few conidial chains still intact were seen on the collections examined, but it seems more probable that they arise acropetally as in other species of *Ampullifera*. The isthmus-like cells connecting conidia in chains figured for *A. myriapoda* by Batista & Cavalcanti (*loc. cit.*: 353) almost certainly represent young conidia or germ-tube blow-outs, united into chains by artistic licence.

Ampullifera amoeboides is a distinctive taxon readily separable from other species of the genus by the very dark conidia with a single median septum, and also by the dark lobate foot-cells, which may not always be present.

Additional specimens: **Brazil**: Rondonia, Ariquenes, on indet. lichens on Oleaceae sp., February 1962, *Ö. Fomesca* (URM 39393, IMI 113851!); Rondonia, on indet. lichens on Moraceae sp., 8 February 1963, *L. Fernandes* (URM 39427 p.p., IMI 113853!); Rondonia, Est. da Penitenciaría P. Velho, on indet. lichens on Palmae sp., March 1962, *Ö. Fomesca* (URM 36881, IMI 113850a!); Pernambuco, Recife, Dois Irmãos, on indet. lichens on *Gustavia augusta*, 13 March 1960, *O. Soaves* (URM 18794a p.p., IMI 83230c!).

2. *Ampullifera foliicola* Deight., *Mycol. Pap.* 78: 36 (1960).

(Fig. 4)

Type: Ghana, Aburi, on *Tricharia* sp. on *Cola verticillata*, 5 April 1953, *T. W. Tinsley* (IMI 55448d—holotype!).

Icones: Deighton, *Mycol. Pap.* 78: 37 fig. 20 (1960).—Ellis, *Demat. Hyphom.*: 96 fig. 59 (1971).—Kendrick & Carmichael, in Ainsworth *et al.*, *The Fungi* 4A: 478 fig. 43G (1973).

Colonies dispersed, superficial, brown, arising on the surface of the host lichen; mycelium superficial, adpressed, irregularly branched (most commonly at about right angles), flexuose,

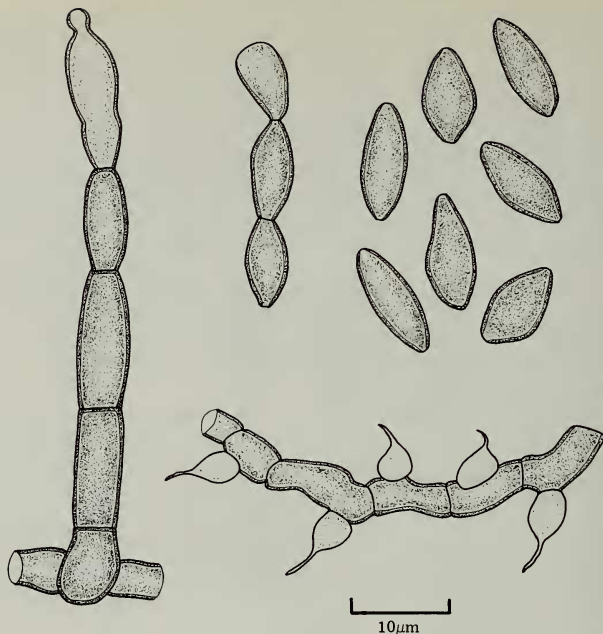


Fig. 4 *Ampullifera foliicola* (IMI 55448d—holotype).

hyphae relatively thin-walled, smooth-walled, pale brown to brown, septate, not or slightly constricted at the septa, cells very variable in length, mainly 7–12 μm long and 3–4.5 μm wide; hyphopodia abundant, alternate or opposite, generally arising towards the distal end of the cell, usually only one per cell but exceptionally more, subglobose below, base mainly 2.5–4 μm diam, paler than the hyphae on which they arise, distinctly mucronate, the neck straight to flexuose and to $7 \times 0.5 \mu\text{m}$. *Conidiophores* macronematous, mononematous, erect, mainly unbranched but exceptionally with subpenicillate heads, thick-walled, smooth-walled, dark brown, septate, becoming constricted above at the septa, 30–40 μm tall and mainly 5–6 μm wide, the foot-cell rounded and somewhat swollen (to 7 μm wide) but not lobed. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell in turn acting as a conidiogenous cell. *Conidia* arising in single acropetal chains, often adhering in chains after separation from the conidiophore, dry, non-septate, brown, slightly paler than the conidiophores, smooth-walled, ellipsoid, gradually truncated at the apices, (6–)7–13(–15) \times 4–6 μm , scar 1–2 μm diam.

Hosts: In the original collection the fungus occurs on the thallus of a sterile *Tricharia* species, while in the material from Brazil it grows over thalli also infected with *Pyrenotrichum spligerberi* Mont. (syn. *Chlorocyphella aeruginascens* (Karst.) Keissl.) which most probably belong to a species of either *Lopadium* or *Tapellaria* to judge from the host range of that fungus (see Santesson, 1952 : 40).

Distribution: Brazil and Ghana. Deighton's (1960: 39) reports of collections from the Dominican Republic, Singapore and Sierra Leone, together with those of Ellis (1971: 96) from Sabah and Sarawak, were based only on sterile mycelium and must be rejected, as pointed out by Deighton (1965: 31), because of possible confusion with *A. hippocrateacearum*.

Observations: This species is similar to *A. ugandensis* in its conidial dimensions, but the conidia of that species are lemoniform and the hyphopodia much larger. The sterile mycelium cannot be distinctly separated from that of *A. hippocrateacearum* and sometimes also *A. amoeboides* which are, however, readily distinguished from *A. foliicola* by the shape and septation of their conidia.

Additional specimen: **Brazil**: Rio de Janeiro, Jardim Botânico, on lichen thalli infected with *Pyrenotrichum spligerberi* on *Buxus sempervirens*, 1947, C. T. Rizzini 11b (UPS non vidi, IMI 85642!).

3. *Ampullifera hippocrateacearum* (Bat. & Caval.) D. Hawksw. *comb. nov.* (Fig. 5)

Ampulliferopsis hippocrateacearum Bat. & Caval., *Port. Acta Biol. B*, 7: 353 (1964).

Type: Brazil, Manaus, Rondonia, Am-1 km 55, on *Mazosia* sp. on Hippocrateaceae sp., 23 August 1961, J. Maria (URM 28638—holotype non vidi).

Ampullifera brasiliensis Deight., *Mycol. Pap.* 101: 28 (1965).

Type: Brazil, Pernambuco, Recife, Dois Irmãos, on indet. lichens on *Gustavia augusta*, 13 March 1960, O. Soaves (URM 18794a—holotype non vidi, IMI 83230b—slides!).

Icons: Batista & Cavalcanti, *Port. Acta Biol. B*, 7: 354 fig. 3 (1964).—Deighton, *Mycol. Pap.* 101: 30 fig. 12 (1965).

Colonies dispersed, superficial, olivaceous brown, arising on the surface of the host lichen; mycelium superficial, adpressed, irregularly branched (usually at wide angles), flexuose, hyphae relatively thin-walled, smooth-walled, pale brown to brown, not or slightly constricted at the septa, cells very variable in length, mainly 7–12 µm long and 2–3.5 µm wide; hyphopodia abundant, commonly unilateral but sometimes alternate, generally arising towards the distal end of the cell, usually one per cell, subglobose to ampulliform below, mainly 3–4 µm diam but to 7–8 µm occasionally, concolorous with or paler than the hyphae on which they arise, distinctly mucronate, the neck usually flexuose, to 5 × 0.5 µm. *Conidiophores* macronematous, mononematous, erect but commonly bent near the base, unbranched, thick-walled, smooth-walled, dark brown, septate, not or slightly constricted at the septa, mainly 50–100 µm tall and 3.5–5 µm wide, the foot cell often slightly swollen but apparently not lobate. *Conidiogenous* cells monoblastic, not differentiated from the conidiophores and each cell acting in turn as a conidiogenous cell. *Conidia* arising in single short acropetal chains, rarely adhering in chains of more than 2 cells after separation from the conidiophore, dry, mainly 1–2 septate but rarely to 6-septate, the first-formed septa not arising medianly but near the ends of the conidia, not or slightly constricted at the septa, pale brown, smooth-walled, ellipsoid to elongate-ellipsoid, gradually truncated at the apex and more abruptly so at the base, (9–)12–15 × 3.5–5.5 µm, basal scar 1–1.5 µm diam.

Hosts: On *Mazosia* species and unidentified foliicolous lichens.

Distribution: Brazil.

Observations: Deighton (*in litt.*) at first thought two *Ampullifera* species were involved in the collection designated as the holotype of *A. brasiliensis*, but prior to the publication of the name considered that the species was simply rather more variable than others of its genus and consequently accorded it a single name. Examination of collections which have become available subsequently leave no doubt that URM 18794a comprised two species, that described above predominating, with lesser amounts of *A. amoeboides* intermixed with it; this latter element has been designated as IMI 83230c. Deighton's (1965) drawing of lobate foot-cells and his description of 'abnormal conidia' refer to the *A. amoeboides* element.

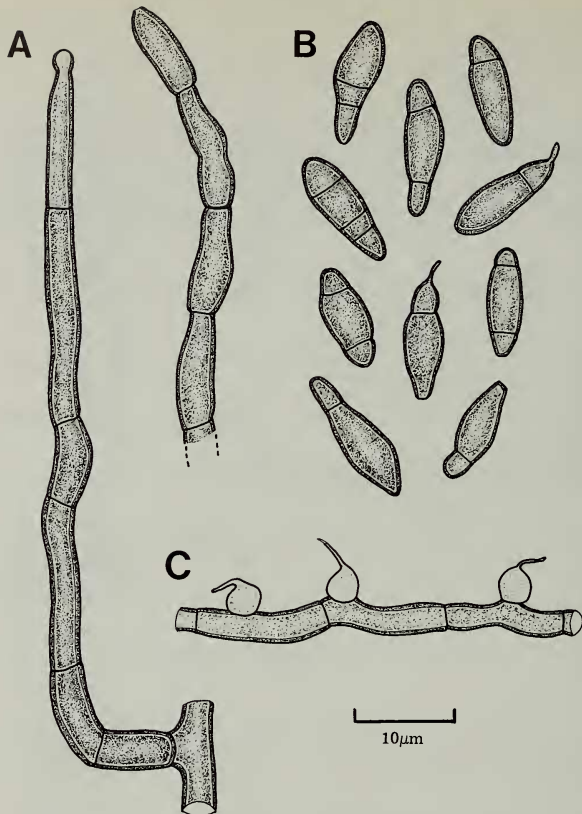


Fig. 5 *Ampullifera hippocrateacearum* (IMI 83230b). A, Conidiophores. B, Conidia. C, Hyphopodia.

Although the original collection of *Ampulliferopsis hippocrateacearum* was not available, a collection authentic for the name (URM 38140) was studied. No conidia attached to the conidiophores were seen, but the conidia themselves and the mycelial characters, taken together with the illustrations of Batista & Cavalcanti (1965 : 354) leave little doubt that this fungus is conspecific with *Ampullifera brasiliensis*; these two taxa are consequently united under the earlier epithet.

The conidia of this species were indicated to be basipetally formed by Batista & Cavalcanti (*loc. cit.*) but this is certainly not so for IMI 83230b, and no evidence to the contrary was obtained from the other collections seen.

Additional specimens: **Brazil:** Rondonia, on indet. lichens on Moraceae sp., 8 February 1963, L. Fernandes (URM 39427 p.p., IMI 113853c!); Rondonia, Est. do IATA km 33, Guajará Mirim, on indet. lichens on Apocynaceae sp., 8 February 1963, J. Oliveira (URM 38140, IMI 113849!).

4. *Ampullifera leonensis* Deight., *Mycol. Pap.* 78 : 41 (1960).

(Fig. 6)

Type: Sierra Leone, Pujehun (Panga-Kaponde), on lichens on *Homalium letestui*, 11 April 1939, F. C. Deighton M2010 p.p. (IMI 7664b—holotype!).

Icones: Deighton, *Mycol. Pap.* 78 : 42 fig. 22 (1960).

Colonies dispersed, superficial, pale brown to olivaceous or dark brown, arising on the surface of the host lichen and persisting when the host is in a severely damaged state; mycelium superficial, adpressed, irregularly branched and flexuose, hyphae rather thin-walled, smooth-walled, almost hyaline to pale brown, septate, not or slightly constricted at the septa, cells very variable in length, mainly 2.5–4 µm wide; hyphopodia extremely rare and absent on many hyphae, ampulliform, subhyaline to pale brown, mainly about 9 × 3.5 µm, excluding the mucronate neck which extends apically apparently entering the host tissue. *Conidiophores* macronematous, mononematous, erect, unbranched, sometimes arising in groups, thick-walled, smooth-walled, dark brown, septate, becoming constricted above at the septa, 70–120 µm tall and 3–5 µm wide, the foot-cell rounded and somewhat swollen (to 6 µm wide) but not becoming lobed. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell in turn acting as a conidiogenous cell. *Conidia* arising in single acropetal chains, often adhering in chains after separation from the conidiophore, dry, non-septate, pale brown, smooth-walled, subcylindrical or barrel-shaped, broadly truncate at both ends, 8–11 × 3–4 µm, scar 1.5–2 µm diam.

Host: In the original collection the fungus occurs on foliicolous lichen thalli which are so heavily infected by it that they cannot be named with any certainty. *Strigula elegans* (Fée) Müll. Arg. and *Tricharia vainioi* R. Sant. occur on the type collection in the uninfected condition.

Distribution: Sierra Leone. Known only from the type collection.

Observations: *Ampullifera leonensis* occupies a rather isolated position within the genus by virtue of its subcylindrical conidia and the scarcely hyphopodiate mycelium. The presence of occasional hyphopodia precludes its inclusion in *Xylohypha* (Fr.) Mason, a genus not known to include any lichenicolous fungi.

5. *Ampullifera pirozynskii* D. Hawksw. sp. nov.

(Fig. 7)

Fungus lichenicola vel algicola. Mycelium superficiale, ex hyphis repentibus, cellulis brunneis, plerumque 8–14 µm longis et 2.5–3.5 µm latis, cum cellulis hyphopodiis ampulliformibus et mucronatis usque 5.7 × 2.3 µm. Conidiophora macronemata, mononemata, recta, simplicia, septata, atrobrunnea, 30–40 × 3–4 µm, cum cellulis podiiformibus lobatis instructa. Cellulae conidiogenae monoblasticae, integrate, non bene distinctae. Conidia breviter catenulata, sicca, (1–)2-septata, levia, atrobrunnea, elongato-ellipsoidea, 14–25 × 3–4 µm.

Typus: Tanzania, Kigoma, Kakombe, in lichenibus foliicolis vel algis ad *Garcinia hullensis*, 7.ii.1964, K. A. Pirozynski M403d (IMI 106630d—holotypus!).

Colonies dispersed, superficial, spreading rather widely over the host thalli and leaf surface, olivaceous brown; mycelium superficial, adpressed, irregularly branched, usually at wide angles, flexuose, hyphae relatively thin-walled, smooth-walled, pale brown, slightly constricted at the septa, cells mainly 8–14 µm long and 2.5–3.5 µm wide; hyphopodia common but not on every cell, often alternate, generally arising towards the distal end of the cell, sometimes in pairs on opposite sides of the hyphae, ampulliform below, base mainly 5.7 × 2.3 µm, distinctly mucronate, the neck straight to flexuose and to about 6 × 0.5 µm. *Conidiophores* macronematous, mononematous, erect but often bent near the base, unbranched, thick-walled, smooth-walled, dark brown, septate, not or slightly constricted at the septa, 30–40 µm tall and 3–4 µm wide, the foot cell lobate and 6–8 µm wide. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell in turn acting as a conidiogenous cell, rarely laterally as well as apically. *Conidia* arising in single short acropetal chains, rarely adhering in chains after separation from the conidiophore, dry (1–)2-septate, usually slightly constricted at the septa, brown,

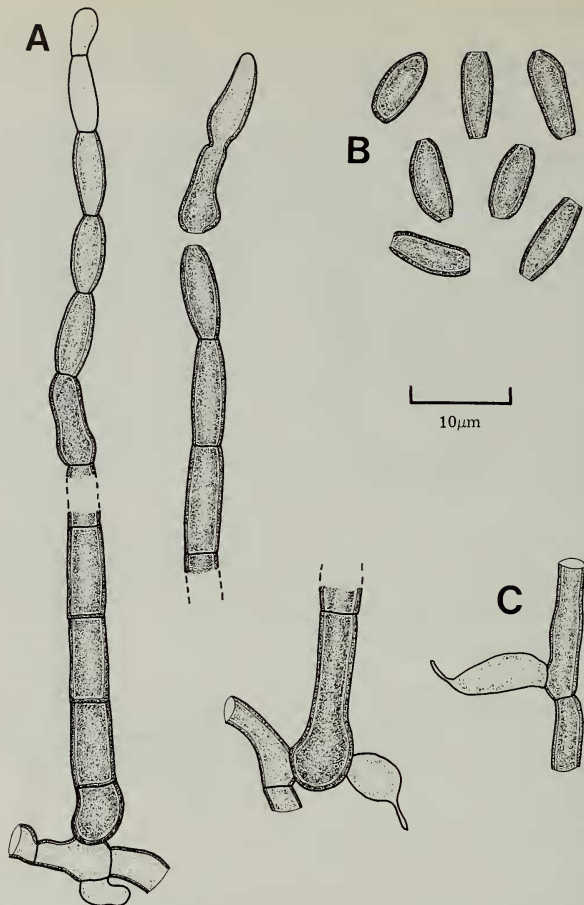


Fig. 6 *Ampullifera leonensis* (IMI 7664b—holotype). A, Conidiophores with attached conidia. B, Conidia. C, Hyphopodia.

the apical cell in 2-septate conidia often slightly paler in colour, elongate-ellipsoid to obclavate, gradually truncated at the apex but more abruptly truncated at the base, $14\text{--}25 \times 3\text{--}4 \mu\text{m}$, basal scar $1\text{--}2 \mu\text{m}$ diam.

Host: Some superficial algae, perhaps in a very early stage of lichenization, appear to be the primary substrate in the original collection, but the colonies are wide spreading and may well be at least partly truly lichenicolous.

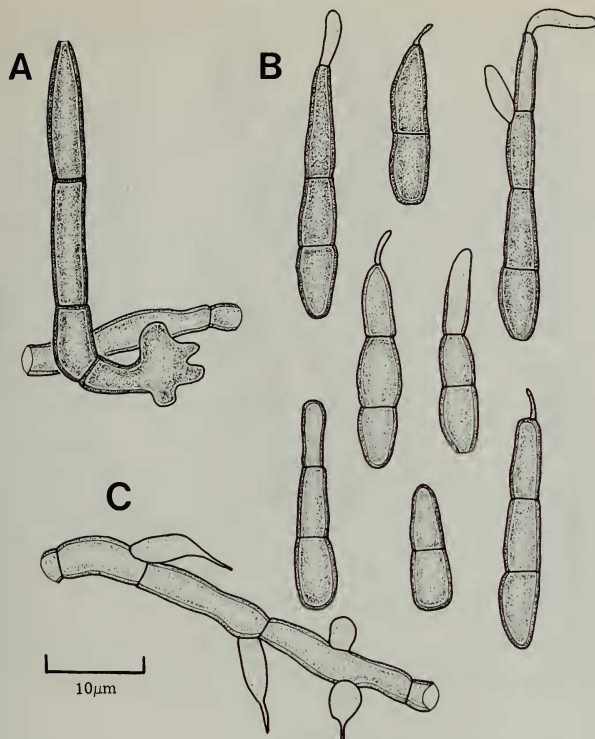


Fig. 7 *Ampullifera pirozynskii* (IMI 106630d—holotype). A, Conidiophore. B, Conidia. C, Mycelium with hyphopodia.

Distribution: Tanzania. Known only from the type collection.

Observations: This species is perhaps most closely allied to the Brazilian *Ampullifera amoeboides* from which it is distinguished by the preponderance of 2-septate conidia which also tend to be somewhat narrower.

6. *Ampullifera ugandensis* Deight., *Mycol. Pap.* 78 : 39 (1960).
(Fig. 8)

Type: Uganda, Masaka Road, associated with lichens and algae on *Mitragyna stipulosa*, December 1940, C. G. Hansford 2951 p.p. (IMI 25518d—holotype!).

Icones: Deighton, *Mycol. Pap.* 78 : 40 fig. 21 (1960).

Colonies dispersed, superficial, pale brown; mycelium superficial, adpressed, rather irregularly branched and flexuose, hyphae smooth-walled, pale brown to brown, septate, not markedly

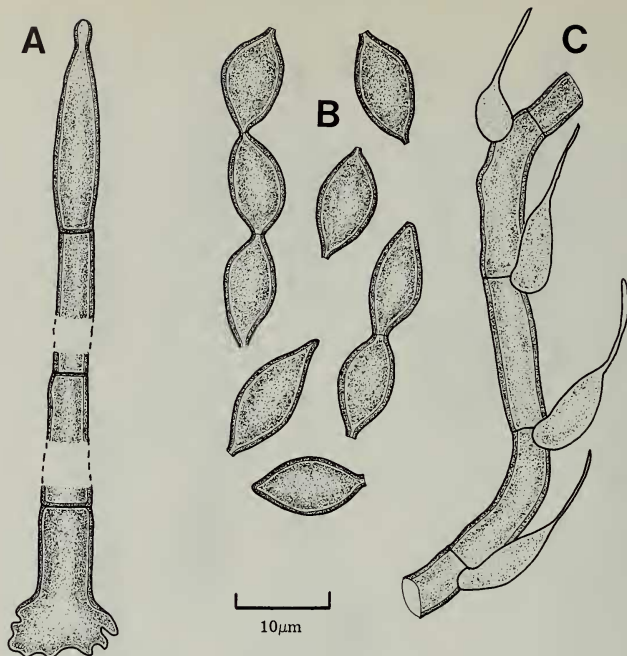


Fig. 8 *Ampullifera ugandensis* (IMI 25518d—holotype). A, Conidiophore. B, Conidia. C, Mycelium with hyphopodia.

constricted at the septa, cells very variable in length, mainly 3–6 μm wide; hyphopodia abundant, arising laterally near the distal septum on almost all cells, mainly singly and alternate but sometimes opposite, pale brown, paler than the hyphae from which they arise, elongate-ampulliform, mainly 7–14 \times 2.5–4 μm , excluding the mucronate neck which may be as much as 20 \times 1 μm . *Conidiophores* macroneumatous, mononeumatous, erect, unbranched, thick-walled, smooth-walled, dark brown, septate, becoming somewhat constricted above at the septa, 75–100 μm tall and 4–6 μm wide, the foot cell becoming swollen and lobate and to 10 μm wide. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell in turn acting as a conidiogenous cell, sometimes percurrently. *Conidia* arising in single acropetal chains, sometimes adhering in short chains after separation from the conidiophores, dry, non-septate, pale brown, smooth-walled, lemoniform, (8–)10–14(–14.5) \times 4–6(–7) μm , scar 1–2 μm diam.

Host: This species was originally described as 'associated with lichens and algae' but, somewhat surprisingly, as hypophyllous. IMI 25518d comprises only slides; the material from which these were made, now kept as IMI 25518a (sub *Meliola mitragynicola* var. *ugandensis* Deight.), supports a wide range of fungi and algae, but the *Ampullifera* was not re-located on these leaves. The identity of the host consequently remains uncertain.

Distribution: Uganda. Known only from the type collection.

Observations: *Ampullifera ugandensis* resembles *A. foliicola* in the size and shape of the conidia but is sharply separated from that species on the basis of the much larger and differently shaped hyphopodia.

Ampullifera spp.

Deighton (1960 : 38–39) mentioned that sterile hyphae figured by Arnaud (1954 : 273 fig. 3P) under the name *Uncigera cordae* Sacc. & Berl. might be *Ampullifera foliicola*; while this may be so in the case of the fungus Arnaud had, the hyphopodia-shaped structures in *Uncigera cordae* are phialides producing cylindrical conidia which recall *Gonytrichum* Nees ex Wallr. Deighton also compared the hyphopodia in *Ampullifera foliicola* to those described by Ciferri & Batista (1956) in *Parapodia intermedia* Cif. & Bat.; their material has been studied by Hughes (1976 : 795) who found the reported hyphopodia to be phialides and the species to belong to *Triposporiopsis* Yamamoto.

The specimens listed below, apart from the two from Tanzania in which the material is very much fragmented, lack conidiophores and conidia but produce mycelium very like that seen in this genus; some of these collections were listed by Deighton (1960 : 39) as discussed above (p. 201) but cannot now be referred with confidence to any particular species.

All are on sterile foliicolous lichens.

Specimens: **Dominican Republic:** Santo Domingo, Cordillera Central, Prov. La Vega, Rio Maimom, on *Omphalea pauciflora*, 18 December 1930, E. L. Ekman, Cif., *Mycofl. Dom. exs.* no. 269 p.p. (IMI 59260d!).—**Nigeria:** Benin, on *Caryota mitis*, 10 August 1961, A. G. Bailey 872 (IMI 99552b!).—**Sabah:** on *Achras sapota*, comm. 2 May 1961, T. H. Killiaeus PP 98/60 (IMI 86608b!).—**Sarawak:** Balingian, on *Hevea brasiliensis*, [no further data], FH 151 (IMI 96189a!); Batu Kawa, on *Nephelium lappaceum*, 23 March 1962, G. J. Turner FH 80 (IMI 93315b!).—**Sierra Leone:** Njala (Kori), on *Raphia hookeri*, 10 February 1954, F. C. Deighton M5638 p.p. (IMI 56449b!), on *Funtumia africana*, 22 January 1936, F. C. Deighton M954 p.p. (IMI 6059b!), on *Homalium letestui*, 5 March 1937, F. C. Deighton M1332 p.p. (IMI 25611b!); Mange (Bure), on *Parinari excelsa*, 7 February 1939, F. C. Deighton M1918 p.p. (IMI 8928e!), on *Blighia unijugata*, 17 February 1928, F. C. Deighton M1590 p.p. (IMI 25670b!); Tonkoli Forest Reserve, on *Newtonia aubrevillei*, 19 June 1954, D. Small M6107 p.p. (IMI 57450e!); Pujehun (Panga-Kaponde), on *Homalium letestui*, 11 April 1939, F. C. Deighton M2010 p.p. (IMI 7664c!); near Rokupr (Magbema), on *Pentadesma butyracea*, 2 February 1939, F. C. Deighton M1859 p.p. (IMI 9992e!).—**Singapore:** on *Ficus urophylla*, Baker, *Fungi mal.* no. 455 (BO 15867 non vidi, IMI 73820b!).—**Tanzania:** Kigoma, Kasekela, on *Monanthotaxis poggei*, 8 February 1964, K. A. Pirozynski M412g (IMI 106639g!); Kigoma, Mkenke, on *Baphia kirkii*, 28 March 1964, K. A. Pirozynski M891l (IMI 107199l!).

III. BISPORA Corda

Icon. Fung. 1 : 9 (1837).

Colonies dispersed, effuse or aggregated into small tufts, brown to black; mycelium immersed but sometimes partly superficial. Stroma, setae and hyphopodia absent. Conidiophores semi-macronematous, mononematous or caespitose, straight or flexuose, generally unbranched, brown, smooth-walled. Conidiogenous cells monoblastic, integrated, terminal, determinate, subcylindrical. Conidia arising in long acropetal chains, dry, acrogenous, brown to dark brown, doliiform or subcylindrical, usually 1-septate, the septum often broad and very darkly pigmented, usually scarcely or not constricted at the septum, smooth-walled.

Type species: *Bispora antennata* (Pers. ex Pers.) Mason.

Number of species: About 14 species are currently accepted (including the one described as new below), most of which are saprophytes occurring on the bark or wood of deciduous trees.

1. *Bispora christiansenii* D. Hawksw. sp. nov.

(Fig. 9)

Fungus lichenicola. Mycelium immersum, ex hyphis subhyalinis vel pallide brunneis, 2–3.5 µm latis, Conidiophora semi-macronemata, mononemata, recta, simplicia vel ad apicem vel basim sparse ramosa.

pallide brunnea, levia, $15-35 \times 2.5-4 \mu\text{m}$. Cellulae conidiogenaе monoblasticae, integrae, subcylindricaе. Conidia catenata, sicca, acrogena, ellipsoidea vel doliiformia, 1-septata, levia, pallidissime brunnea, $5-8(-9) \times 4-6(-7) \mu\text{m}$.

Typus: Dania, Sjælland, Vridsløselille, in *Candelariella vitellina* (Hoffm.) Müll. Arg. (apothecia) ad lignum, 20.vii.1944, M. Skytte Christiansen 11.704 (hb. Christiansen 552—holotypus!).

Exsiccatae: Räsänen, Lich. Fenn. no. 347 p.p. (BM!, IMI 228050!), hb. Christiansen; sub *Didymocyrtis consimilis* Vain.).

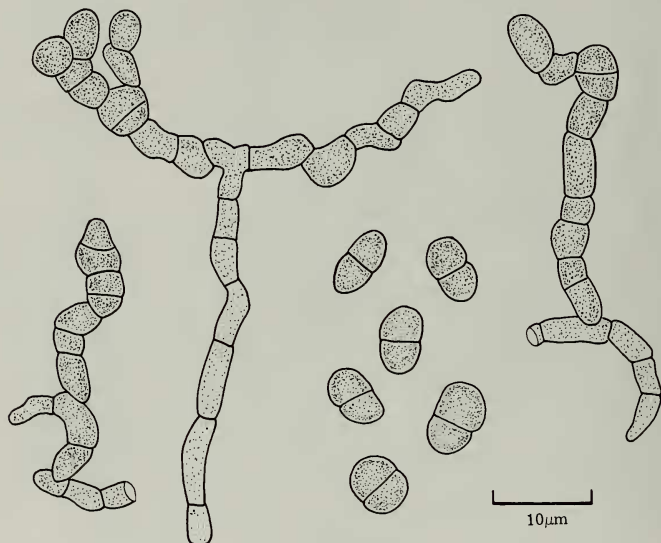


Fig. 9 *Bispora christiansenii* (hb. Christiansen 552—holotype).

Colonies discrete, arising in the tissues of the host, filling apothecia or associated with deformations, dark brown to black; mycelium immersed, originating deep in the thallus, often amongst phycobiont cells, composed of subhyaline or very pale brown flexuose hyphae, hyphae thin- and smooth-walled, septate, often markedly constricted at the septa, mainly $2.5-4 \mu\text{m}$ wide, becoming inflated near algal cells. *Conidiophores* semimaconematous, mononematous, straight to flexuose, unbranched or branched sparsely either near the base or close to the apex, pale brown, smooth-walled, thicker-walled than the mycelial hyphae, septate, scarcely to markedly constricted at the septa, sometimes appearing almost torulose, $15-35 \times 2.5-4 \mu\text{m}$. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical, pale brown, not clearly defined and the terminal cells in turn acting as conidiogenous cells. *Conidia* adhering in chains, dry, acrogenous, ellipsoid to doliiform, very pale brown, 1-septate, not or slightly constricted at the septum, the septum not broadened and thickened, smooth- and rather thin-walled, $5-8(-9) \times 4-6 \mu\text{m}$.

Hosts: *Caloplaca citrina* (Hoffm.) Th. Fr. (apothecia), *C. cerina* var. *cyanolepra* (DC.) Kickx (apothecia), *Candelariella vitellina* (Hoffm.) Müll. Arg. (apothecia), *Lecanora carpinea* (L.) Vainio

(apothecia), *L. chlarotera* Nyl. (apothecia), *L. dispersa* (Pers.) Sommerf. (apothecia), and *Phaeophyscia orbicularis* (Neck.) Moberg (thallus). Infected *Caloplaca*, *Candelariella* and *Lecanora* apothecia become brownish and are eventually destroyed by this fungus. On the *Phaeophyscia*, however, the fungus is associated with dark brown gall-like convex swellings 0.5–1 mm diam caused by an unknown agent*. On *Caloplaca cerina* it is associated with *Tichothecium lichenicola* (Sommerf. ex Fr.) R. Sant.

Distribution: British Isles, Denmark, Finland, Germany and Italy.

Observations: The generic disposition of this fungus presented several problems as it obviously has some similarity with *Trinmatostroma lichenicola*, but cannot be included in the accepted circumscription of that genus because of the separate 1-septate conidia as opposed to multicellular complex conidia. Although the type species of *Bispora* and many of the other taxa referred to it have broad thickened septa (see, for example, illustrations in Ellis, 1971 : 91) in the conidia, all do not show this feature, for example *B. catenula* (Lév.) Sacc. (Ellis, 1976 : 55). A further characteristic of *Bispora*, the regular acropetal septation of the conidia, is departed from in *B. pusilla* Sacc. which has been studied by Sutton (1969 : 614). If *B. catenula* and *B. pusilla* are to be retained in *Bispora*, *B. christiansenii* can also be placed here since it includes both these departures from the nucleus of the genus.

The hyphae of *Bispora christiansenii* were regularly found to stretch down to cells of the phycobiont, even those below the hypothecium in *Candelariella vitellina*, and to form large swollen hyphae that might well serve as absorptive organs around parts of or juxtaposed to algal cells. It is consequently possible that this fungus might be more accurately interpreted as algicolous rather than lichenicolous.

One specimen was received as a pure culture, isolated from *Lecanora dispersa* apothecia. The colonies reached only 7–10 mm diam after four weeks on a range of agar media (MA, MCZ, OA and PDA) at c. 20°C, were mounded and somewhat fluted, dark grey-brown, with a black margin and reverse. The characteristics of the species on the natural host were retained in culture.

This species is named in honour of Dr M. Skytte Christiansen (Copenhagen) in recognition of the important contribution he has made to the present monograph by making his collections and observations available to me.

Additional specimens: **British Isles**: Hertfordshire, Hatfield Polytechnic roof, isol. ex *Lecanora dispersa* (apothecia) on asbestos-cement panels, 21 February 1978, A. O. Lloyd (IMI 227584!); **North Essex**, Colchester, on *Caloplaca citrina* (apothecia) on city walls, 4 April 1978, J. F. Skinner (CLR 1013!).—**Denmark**: Aarby, 'Ashaes Forskov' wood, on *Lecanora chlarotera* (apothecia) on *Fraxinus*, 19 August 1968, M. Skytte Christiansen (hb. Christiansen!); Zealand, Jungshoved, on *Phaeophyscia orbicularis* (thallus) on *Populus virginiana*, 12 August 1966, M. Skytte Christiansen (IMI 225003!, hb. Christiansen).—**Finland**: Ostrobotnia borealis, Simo, Harvakari, on *Caloplaca cerina* var. *cyanolepra* (apothecia) on *Sorbus aucuparia*, 6 July 1933, V. Räsänen, Lich. Fenn. no. 347 p.p. (BM!, IMI 228050!, hb. Christiansen).—**Germany**: Hamburg, Gr. Buchned, on *Lecanora chlarotera* (apothecia), 8 May 1902, O. Jaap 142 p.p. (B!).—**Italy**: Südtirol, Mendelgebirge, Penegal SW of Bozen, lockerer Lärchenwald, 1650–1730 m, on *Lecanora carpinea* (apothecia), 20 October 1975, J. Hafellner (hb. Hafellner 1092!).

IV. CLADOSPORIUM Link ex Fr.

Syst. mycol. 1 : xlvi (1821).

See Hughes (1958 : 750) for synonyms of this generic name.

Colonies usually effuse, olivaceous, brown, grey or black; mycelium immersed and also often superficial. Stroma, setae and hyphopodia absent. Conidiophores macronematous or more rarely semi-macronematous, mononematous, straight or flexuose, unbranched below but in many species with branching occurring near the apex so as to form a conidiiferous head, olivaceous to brown,

*These symptoms, due to a discoloration of the host cortical hyphae, are seen in several other collections of this host (hb. Christiansen 602, 603, 604, 606, 607) and are not caused by the *Bispora*. The fungus responsible for these symptoms remains obscure.

smooth or verrucose. Conidiogenous cells polyblastic, \pm integrated, terminal or lateral, sometimes sympodial, cylindrical, often with conidial scars readily visible. Conidia arising in acropetal chains, dry, acropleurogenous, subglobose to subcylindrical, simple to 5 or more septate, scarcely constricted at the septa, often with well-marked scars, very pale brown to dark brown, smooth-walled or verrucose-echinulate.

Type species: Cladosporium herbarum Pers. ex Gray.

Number of species: Approximately 550 species have been described in this genus of which 43 are treated by Ellis (1971 : 308–319, 1976 : 325–344). Most are saprophytes or parasites of vascular plants occurring on leaves, wood and stems; *C. herbarum* is probably one of the most widespread fungi in the world and is exceptionally common. Only a single obligately lichenicolous species is accepted here.

Perfect state: Perfect states are unknown for most *Cladosporium* species but a few are known to have ones in *Amorphotheca* Parbery, *Mycosphaerella* Johansen, or *Venturia* Sacc.

Observations: Two *Cladosporium* species, in addition to *C. arthoniae* treated below, have been described from lichens: *C. lichenicola* Linds. which is probably based only on torulose mycelium (see p. 269) and *C. lichenum* Keissl. which is most satisfactorily placed in *Pseudocercospora* (see p. 246). One fortuitously lichenicolous species, *C. sphaerospermum* Penz., has also been noted (see p. 287).

Key to the lichenicolous species

- 1 Conidia subglobose, non-septate, coarsely warted, mainly 3–4.5 μm diam; fortuitously lichenicolous *Cladosporium sphaerospermum* Penz.
 – Conidia ellipsoid, usually 1-septate, verruculose, 6–10 \times 4–5 μm . *Cladosporium arthoniae* (p. 210)

1. *Cladosporium arthoniae* M. S. Christ. & D. Hawksw. sp. nov.

(Fig. 10)

Fungus lichenicola. Mycelium immersum, ex hyphis pallide brunneis vel subhyalinis, 2–3 μm latis. Conidiophora macronemata, recta, simplicia sed ad apicem ramosa, brunnea, verruculosa, 30–50 \times 3–4 μm . Cellulae conidiogenae polyblasticae, integrae, cylindricae. Conidia catenata, sicca, acropleurogena, ellipsoidea, usque 1-septata, brunnea vel pallide brunnea, verrucosa, 6–10 \times 4–5 μm .

Typus: Suecica, Skåne, Genarp, Håckeberga, in *Arthonia impolita* (Hoffm.) Borr. (apothecia) ad *Quercum*, 24.iv.1946, M. Skytte Christiansen 12.967a (hb. Christiansen 570—holotypus!).

Colonies dispersed over infected apothecia of the host, brown; mycelium immersed, rather scant, composed of pale brown or subhyaline hyphae, hyphae thin-walled, smooth-walled to slightly verrucose, septate, 2–3 μm wide. *Conidiophores* macronematous, mononematous or loosely aggregated, erect, unbranched below but repeatedly branching towards the apex, brown, verrucose, moderately thick-walled, septate, somewhat constricted at the septa, 30–50 \times 3–4 μm . *Conidiogenous cells* polyblastic, integrated, cylindrical, pale brown to brown, not well-defined with the terminal cells in turn acting as conidiogenous cells, lacking distinct scars. *Conidia* adhering in acropetal chains, dry, acropleurogenous, ellipsoid, rounded at the apices, not distinctly scarred, brown, 0–1 septate, slightly constricted at the septum, verrucose, moderately thick-walled, 6–10 \times 4–5 μm .

Host: Arthonia impolita (Hoffm.) Borr., apothecia. The infected apothecia appear to be destroyed by the invasion of this fungus.

Distribution: Sweden. Known only from the type collection.

Observations: The habit of the conidiophores, polyblastic conidiogenous cells and catenate verrucose conidia clearly indicate that this fungus should be referred to *Cladosporium*. The only major character indicating that this might not be appropriate is the absence of clearly visible scars on the conidiogenous cells and conidia. However, in view of the degree of agreement in other features too much emphasis should not be placed on this difference.



Fig. 10 *Cladosporium arthoniae* (hb. Christiansen 570—holotype).

In the original collection *Taeniolella delicata* is intermixed with the *Cladosporium*. *Taeniolella verrucosa* occurred on a different portion of the same specimen.

V. DENDRODOCHIUM Bonord.

Handb. Allgem. Mykol. : 135 (1851).

Colonies orbicular or effuse; mycelium mainly superficial, irregularly branched, hyaline or pale shades. Stroma, setae and hyphopodia absent. Conidiophores macronematous, forming sporodochia, compacted, \pm hyaline, branched, method of branching variable but often subverticillate. Conidiogenous cells phialidic, discrete, terminal, subcylindrical to subulate, \pm hyaline. Conidia solitary, slimy in mass, hyaline singly but sometimes with pale colours in mass, simple, ellipsoid to clavate, rounded at the apex, rounded or distinctly truncate at the base.

Type species: Dendrodochium aurantiacum Bonord.

Number of species: About 60 species are described, but many may not be congeneric with *Dendrodochium aurantiacum* and a revision of the group is required. Most species are saprophytes or weak plant parasites and only one is known to be lichenicolous.

1. *Dendrodochium subeffusum* Ellis & Galw., *J. mycol.* 6: 33 (1890). (Fig. 11)

Type: U.S.A., New York, Farmington, on *Physcia millegrana* and *Candelaria concolor* on trunk of a pear tree, August 1889, E. Brown, Ellis & Everh., *N. Am. Fungi*, ser. 2, no. 2394 (K—2 isotypes!).
Dendrodochium effusum Vouaux, *Bull. trimest. Soc. mycol. Fr.* 30: 315 (1914); lapsus, nom. inval. (Art. 34).

Exsiccatae: Ellis & Everhart, *N. Am. Fungi*, ser. 2, no. 2394 (K!).

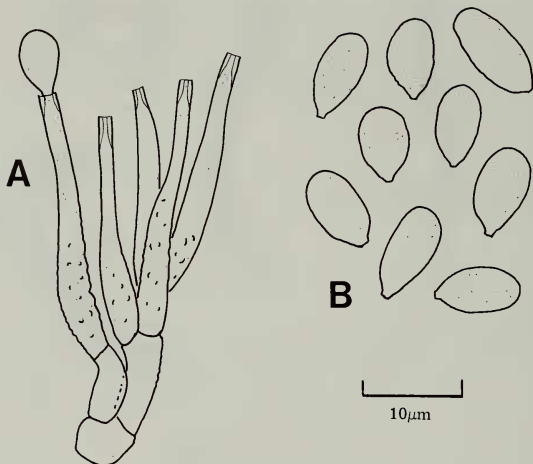


Fig. 11 *Dendrodochium subeffusum* (K—istotype). A, Conidiogenous cells. B, Conidia.

Colonies spreading, \pm superficial, white to very pale orange, arising in dying areas of the host thalli; mycelium partly superficial and partly penetrating the upper layers of the host, hyphae flexuose, thin-walled, hyaline, mainly 2.5–4 μ m wide. *Conidiophores* macronematous, forming translucent, appanate, irregular, gelatinized sporodochia mainly 300–500 μ m across and pale orange, compacted, individually hyaline, branched, irregularly subverticillate with only 2–3 phialides at each node. *Conidiogenous cells* terminating at about the same level, phialidic, discrete, terminal, subcylindrical to subulate, hyaline, thin-walled, generally distinctly roughened below, 20–30(–35) μ m tall, mainly 3–4.5 μ m wide at the base but tapering to 2–3 μ m wide at the tip. *Conidia* abundantly produced, solitary, slimy in mass, broadly ellipsoid, rounded at the apex but with a peg-like narrowly truncated base, simple, hyaline singly but pale orange in mass, \pm smooth-walled but occasionally rather uneven in outline, (6–)7–9(–9.5) \times 4.5–6 μ m.

Host: *Physcia millegrana* Degel., thallus; also spreading on to adjacent thalli of *Candelaria concolor* (Dicks.) Stein in the type collection.

Distribution: U.S.A. Known only from the type collection.

Observations: The genus *Dendrodochium* has been used in the past for a wide range of sporodochial fungi. Tulloch (1972: 5–6), however, considered that it could be regarded as separated from *Myrothecium* Tode ex Fr. by the pale and not dark conidial mass. An entirely satisfactory circumscription of *Dendrodochium* requires a monographic study, but at the moment it can be asserted that *D. subeffusum* is congeneric with the type species of the genus, *D. aurantiacum* Bonord.

Dendrodochium subeffusum appears to be primarily a pathogen of *Physcia millegrana*, but some doubt must remain in the absence of further collections. Its hosts do not appear to have previously been determined; it was originally described as 'on thallus of some foliaceous lichen'.

VI. DICTYOPHRYNELLA Bat. & Cavalcanti

Port. Acta Biol. B, 7: 356 (1964); as '*Dictyophrynella*'.

Colonies effuse; mycelium superficial, adpressed, sparsely regularly branching at right angles, brown, the cells giving rise to subglobose mucronate hyphopodia. Stroma and setae absent. Conidiophores micronematous, mononematous, prostrate, simple, dark brown, smooth-walled. Conidiogenous cells probably monotretic, integrated, intercalary, often catenate, determinate, subcylindrical or doliiform, dark brown, with one (or rarely two) oval lateral scars. Conidia solitary, dry, acrogenous, obclavate, submuriform with 3–4(–5) transverse septa and 0–2 oblique septa, basal cells brown to dark brown, apical cell markedly elongated, beak-like and subhyaline.

Type species: *Dictyophrynella bignoniacearum* Bat. & Cavalcanti.

Number of species: Monotypic.

1. *Dictyophrynella bignoniacearum* Bat. & Cavalcanti, *Port. Acta Biol. B*, 7: 356 (1964).

(Figs 12–13)

Type: Brazil, Amazonas, Manáus, Rondonia AML-km 55 Manáus, on indet. lichen on leaves of *Bignoniaceae* sp., 23 August 1961, *J. Maria* (URM 28007 [20.144]—holotype!).

Icons: Batista & Cavalcanti, *Port. Acta Biol. B*, 7: 357 fig. 4 (1964).

Colonies dispersed, superficial, dark brown, arising on the surface of the host lichen; mycelium superficial, adpressed, regularly branching approximately at right angles, hyphae at first pale brown, flexuose and rather thin-walled but later becoming brown to dark brown, thick-walled, smooth-walled, cells mainly 3.5–5(–6) μm wide and 5–10 μm long, slightly constricted at the septa; hyphopodia arising rather irregularly, frequent, lateral, most often near the distal cell septum, one per cell, subglobose, brown, slightly thinner walled than the hyphae, mainly 3.5–5 μm diam, with flexuose mucronate necks 2–6 μm long and about 0.5 μm wide. *Conidiogenous* cells probably monotretic (rarely polytretic), integrated, intercalary, often forming chains, remaining prostrate, determinate, subcylindrical to doliiform, identical in size to the vegetative hyphae from which they are distinguishable only by attached conidia or 1(–2) distinct lateral scars, the scars oval, subhyaline, 1–2 μm diam. *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 3–4(–5) transverse and 0(–2) oblique septa, portion excluding the apical cell 14–20 μm long and 5–7 μm wide, dark brown, the basal cell not or only slightly truncated, the scar usually ill-defined, subterminal cell paler than the basal cells or concolorous with the apical cell, apical cell markedly elongated, pale brown to subhyaline, mainly 14–16 μm long but variable, tapering to 1–2 μm wide near the apex, overall length 25–45 μm .

Host: On an undeterminable sterile foliicolous lichen. The fungus is restricted to the lichen thallus and does not spread on to adjacent areas of the leaf.

Distribution: Brazil. Known only from the type collection.

Observations: The conidia of this species are remarkably similar to those of some *Hansfordiellopsis* species, so that for some time (before I was able to examine the type in URM) I wondered whether it might be based on mycelium of an *Ampullifera* mixed with *Hansfordiellopsis* conidia.

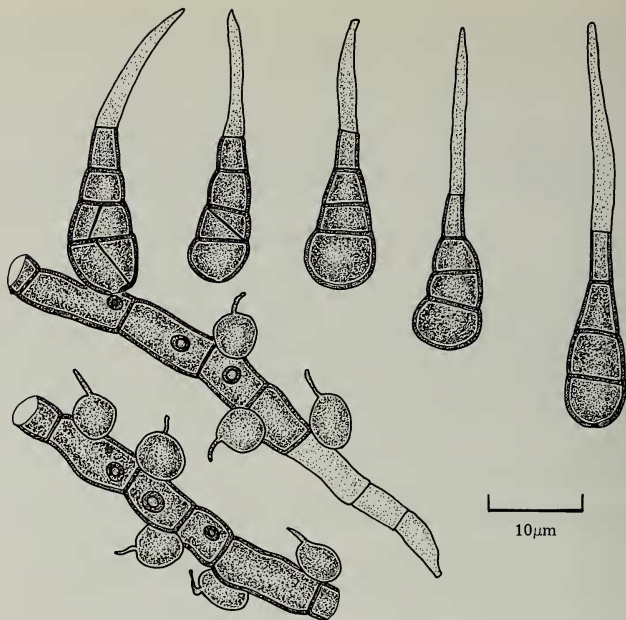


Fig. 12 *Dictyophrynella bignoniacearum* (URM 28007—holotype).

A study of the original material by both light and scanning electron microscopy left no doubt as to the accuracy of Batista & Cavalcanti's (1964) description and illustration. *Dictyophrynella* appears superficially like a *Hansfordiellopsis* in which the role of the vertical conidiogenous cells has been taken over by the cells subtending them. If this were so the merits of retaining *Dictyophrynella* as a distinct genus might be doubted, but in addition to the arrangement of the conidiiferous structures two other differences must be considered: the regular presence of functional (i.e. mucronate) hyphopodia, and, more importantly, the difference in the conidial scars (Fig. 13B-C) left on the conidiogenous cells. These latter lack the flattened rim characteristic of *Hansfordiellopsis* conidiogenous cells (compare with Fig. 19C). It is possible that its conidiogenesis is monoblastic, not monotretic, but transmission electron microscopy will be necessary to establish this fact.

The habit of *Dictyophrynella bignoniacearum* shows a remarkable resemblance to *Sessiliospora bicolor*, but the latter is kept in a distinct genus in view of its complete lack of hyphopodia or hyphopodium-like cells, the differently shaped conidia which are always only transversely septate, and, most importantly, the scars on the conidiogenous cells and conidia which have the flattened rim like region seen in *Hansfordiellopsis* but not *Dictyophrynella*. A small amount of the *Sessiliospora* was mounted for scanning electron microscopy but unfortunately proved to comprise only sterile mycelium; in view of the scant material no more was used and so a detailed account of its method of conidiogenesis must await further collections of the fungus.

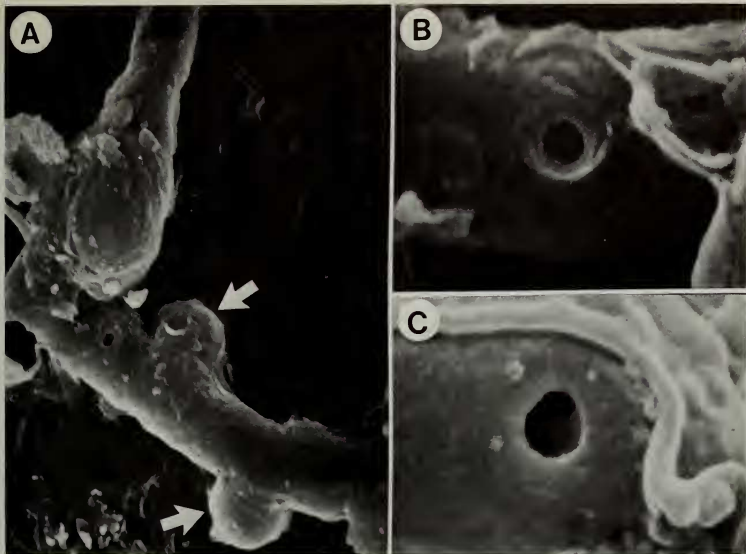


Fig. 13 *Dictyophrynella bignoniacearum* (URM 28007—holotype). A, Mycelium with hyphopodia (arrows) and conidium ($\times 3500$). B-C, Scars left by the secession of conidia ($\times 12000$). A-C Scanning electron micrographs.

VII. ENDOPHRAGMIELLA B. Sutton

Mycol. Pap. 132 : 58 (1973).

Colonies effuse, dark brown or black; mycelium immersed or sometimes partly superficial, irregularly branched, brown. Stroma sometimes developed but absent in most species. Setae and hyphopodia absent. Conidiophores macronematous, mononematous, erect, unbranched in most species but branched several times, particularly towards the base, in others, septate, pale to dark brown, smooth-walled, thick-walled but the wall somewhat unequal in thickness due to the method of proliferation, lacking a specialized foot cell. Conidiogenous cells monoblastic, integrated, terminal, usually percurrently proliferating (often many times) with the proliferation occurring from the distal septum of the penultimate cell of the conidiophore (or its successive proliferations). Conidia usually solitary, dry, acrogenous, rather variable in shape but mostly ellipsoid to clavate, pale to dark brown, the cells often unequally pigmented, 1-5 septate, smooth-walled or rarely slightly verrucose, each septum generally with a central pore, the base truncate and with a small portion of the conidiogenous cell adhering as a short frill in most species.

Type species: *Endophragiella pallescens* B. Sutton.

Number of species: Four species were accepted by Ellis (1976 : 143-145) but several have been recognized since and many taxa formerly placed in the genus *Endophragmia* Duvernoy & Maire are currently being transferred to it by Hughes (unpublished), so that the actual number of species in the genus is about 30. Most species are saprophytes but some appear specific to particular hosts.

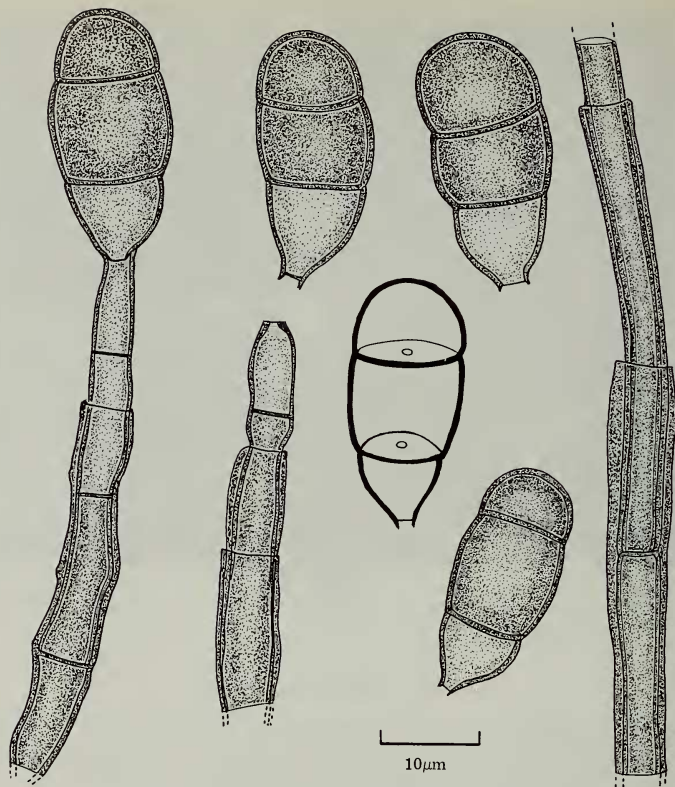


Fig. 14 *Endophraggiella hughesii* (IMI 217271—holotype).

Observations: Hughes (unpublished) is changing the concept of *Endophraggiella* considerably, and regards its key characters as the peculiar method of percurrent proliferation of the conidiogenous cells and the rhexolytic secession of the conidia.

1. *Endophraggiella hughesii* D. Hawksw. sp. nov.
(Fig. 14)

Fungus lichenicola. Mycelium immersum, ex hyphis pallide brunneis, plerumque 3–4 μm latis. Conidiophora macronemata, mononemata, recta, non ramosa, atrobrunnea, plerumque 80–150 \times 5–8 μm . Cellulae conidiogenae monoblasticae, integrae, subcylindricae, proliferatae. Conidia solitaria, sicca, acrogena, late-clavata, 2-septata, levia, cellulis atrobrunneis sed cellula basi subhyalina vel pallide brunnea, 25–30(–40) \times 11–13 μm .

Typus: Magna Britannica, Scotia, Kintyre, c. 7 km SW e Crinan, insula N e Carsaig Island, in *Lobaria pulmonaria* (L.) Hoffm. (thallus emortuus) ad saxa, 14.viii.1977, N. Brandt (IMI 217271—holotypus!; DAOM—isotypus!).

Colonies dispersed, effuse, arising on the surface of the host lichen; mycelium immersed, irregularly branched, rather sparse, composed of irregularly branched hyphae, hyphae relatively thin-walled, pale brown, smooth-walled, septate, not or slightly constricted at the septa, mainly 3–4 μm wide. *Conidiophores* macronematous, mononematous, erect, unbranched, thick-walled, smooth-walled, rather uneven in diameter due to the method of proliferation of the conidiogenous cells, dark brown, mainly 80–150 \times 5–8 μm . *Conidiogenous cells* monoblastic, integrated, subcylindrical, often rather uneven in thickness due to the method of proliferation, percurrently proliferating many times with the proliferations arising from the distal septum of the penultimate cell of the conidiophore (or its successive proliferation), sometimes proliferating atypically, the method of proliferation giving the impression of multilayered walls to both the conidiophores and conidiogenous cells. *Conidia* solitary, dry, acrogenous, broadly clavate, 2-septate, slightly but clearly constricted at the septa, each septum with a central pore visible in optical sections or not fully pigmented spores, smooth-walled, the upper two cells dark brown to almost black at maturity, the basal cell remaining subhyaline or pale brown, base truncate with a scar usually 2–3 μm wide and a frill of tissue produced during rhexolytic secession from the conidiogenous cells, 25–30(–40) \times 11–13 μm .

Host: *Lobaria pulmonaria* (L.) Hoffm., decaying thallus. The fungus is abundant on dead thalli of the host in the type collection, but it is also infected by several other lichenicolous fungi (including *Cornutispora lichenicola* D. Hawksw. & B. Sutton) and it is by no means clear that *Endophragmiella hughesii* was the cause of death. It is possible that this is not an obligately lichenicolous species, but might be a more catholic saprophyte still to be found on other substrates.

Distribution: British Isles. Known only from the type collection.

Observations: This species is named after Stanley J. Hughes who has laid the foundations of modern hyphomycete systematics over the last 25 years. The present fungus was examined by Dr Hughes (*in litt.*) who confirmed it as undescribed. *Endophragmiella hughesii* is distinguished from other species in the genus by the shape, size and pigmentation of the conidia.

The method of percurrent proliferation leading to the appearance of multilayered walls in the upper parts of conidiophores and lower parts of the conidiogenous cells is particularly characteristic of this genus, and is a useful aid for the separation of this species from all other known lichenicolous Hyphomycetes.

The type collection was sent to me in a moist condition by Mr B. J. Coppins in the hope that it might be possible to isolate the *Endophragmiella* into pure culture. Two attempts to do this were made, but only common fast-growing saprophytes (particularly species of *Penicillium*) were obtained.

VIII. FUSARIUM Link ex Fr.

Syst. mycol. 1: xli (1821).

See Kendrick and Carmichael (1973: 368) and Subramanian (1972: 657) for synonyms of this generic name.

Colonies usually effuse; mycelium usually superficial but sometimes partly immersed, irregularly branched, hyaline but sometimes forming yellowish, greyish, pinkish, reddish or purplish pigments in the medium when grown in artificial culture. Stroma, setae and hyphopodia absent. Conidiophores macronematous, usually forming sporodochia but sometimes scattered amongst the mycelium, \pm hyaline, simple or richly branched, often verticillately so. Conidiogenous cells phialidic, discrete, terminal, usually subulate, \pm hyaline. Conidia solitary, slimy in mass, hyaline, of two types: microconidia which are usually simple, subglobose to ellipsoid, rounded at the apices, not known in all species; macroconidia which are usually 3-many transversely septate,

fusiform to falcate or arcuate, characteristically with apices rounded and the base with a heel-like foot-cell.

Type species: Fusarium roseum Link ex Fr.

Number of species: About 50 species are currently accepted, of which 44 were treated in the monograph of Booth (1971). Only one obligately lichenicolous species is known.

Perfect state: Perfect states, where known, are all in the Hypocreaceae de Not. (Pyrenomyces—Sphaeriales) and include ones in the genera *Calonectria* de Not., *Gibberella* Sacc., *Micronectriella* Höhn. and *Nectria* Fr.

Observations: Only a single species is accepted as obligately lichenicolous here, but attention is drawn to the treatments of *Fusarium sampaii* and *Selenosporium* below (see also p. 237) which may also be based on species of this genus.

1. *Fusarium peltigerae* Westend., *Herb. crypt. Belg.*, fasc. 9, no. 414 (1849). (Fig. 15)

Type: Belgium, Courtrai, on old lobes of *Peltigera rufescens*, October, G. D. Westendorp, *Herb. crypt. Belg.*, fasc. 9, no. 414 (K—isotype!).

Fusarium ciliatum var. *majus* Wollenw., *Fusarium autogr. delin.*, no. 872 (1930); nom. nov. for *Fusarium peltigerae* Westend.

Exsiccatae: Westendorp, *Herb. crypt. Belg.*, fasc. 9, no. 414 (K!).

Colonies compact, erumpent, convex, gelatinous, pale pinkish orange, mainly 150–200 µm diam, arising in small discoloured brownish patches on the surface of aged lobes; mycelium ramifying within the cortical and algal layers of the host, hyphae flexuose, thin-walled, hyaline, 1–1.5 µm wide. *Conidiophores* macronematous, forming sporodochia, densely crowded and difficult to distinguish separately, hyaline, very irregular in shape, mainly 5–10 × 2–3 µm. *Conidiogenous cells* arranged ± parallel to one another, phialidic, discrete, terminal, collarete indistinct, subcylindrical or slightly curved, hyaline, thin-walled, very variable in length, mainly 10–18(–25) µm tall, 2–3 µm wide. *Microconidia* attached to conidiogenous cells not seen, ellipsoid, slightly attenuated basally, hyaline, smooth-walled, 3.5–5.5 × 2–3 µm. *Macroconidia* abundantly produced, solitary, arcuate, tapered at the apex but with a characteristic heel-like base, simple when first formed but with up to 5 septa when mature, hyaline, smooth-walled, (60–)70–120 × 2–3.5 µm.

Host: Peltigera rufescens (Weiss) Humb., thallus.

Distribution: Belgium. Known only from the type collection.

Observations: This species was treated as a synonym of *Fusarium aquaeductum* Lagerh., the conidial state of *Nectria purtonii* (Grev.) Berk., by Booth (1971) in his monograph of *Fusarium* Link ex Fr. In that species, however, the conidia are generally only 1-septate and 15–45 × 3–3.5 µm. Booth based his opinion as to the identity of this fungus on the treatment of it as an infraspecific taxon within *F. ciliatum* Link by Wollenweber (C. Booth, personal communication) and did not examine Westendorp's material. There can be no doubt that this is a distinct species of *Fusarium* because none of the taxa with long conidia accepted by Booth (1971) have such narrow spores. Modern *Fusarium* taxonomy is largely based on the study of species in pure culture and the reliable placing of *F. peltigerae* within the currently accepted sectional divisions of the genus is therefore difficult. It may perhaps be most appropriately placed in either sect. *Arthrosporiella* Wollenw. & Reink. or sect. *Sporotrichiella* Wollenw., depending on the manner in which the microconidia are produced; this could not be determined in the Westendorp collection studied.

As no *Fusarium* corresponding to *F. peltigerae* has been detected during the very extensive studies on the genus carried out over the last 65 years, it seems probable that this may be an obligately lichenicolous species. The fungus does, however, occur on aged lobes of the thallus, so it is possible that it is a saprophytic rather than a pathogenic species. A firm opinion as to its status in this regard must await fresh collections.

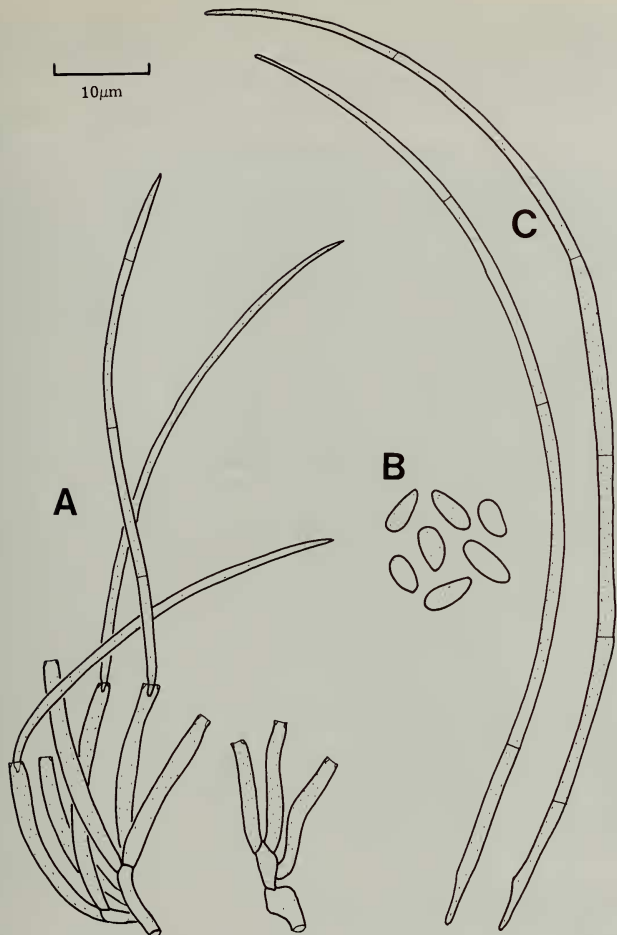


Fig. 15 *Fusarium peltigerae* (K—istotype). A, Conidiogenous cells with attached conidia. B, ? Microconidia. C, Macroconidia.

The epithet '*peltigerae*' is generally cited as being published in 1851, but that work (Westendorp, 1852: 407) did not appear until 1852; the latter date is clearly printed on the paper cover of the journal, although the issue was for 1851. The exsiccatum label, which is reproduced word-for-word in Westendorp (*loc. cit.*), was, however, published in 1849 (Sayre, 1969: 56) and so the epithet must be considered to date from then as a description was provided.

Wollenweber (1930) gave the maximum length of the conidia as 80 μm but in the K isotype many exceed this figure; the isotype he examined was evidently sporing less abundantly. Westendorp (*loc. cit.*) stated that the conidia included '... 10 à 15 sporules globuleuses et hyalines'; it is probable that these were merely guttules or oil drops, as it is most unlikely that he would have seen the fewer very thin septae present in them.

IX. HANSFORDIELLOPSIS Deight.

Mycol. Pap. 78 : 33 (1960).

Colonies effuse; mycelium superficial, adpressed, regularly branching, brown, in most species near the distal cell septa a pair of lateral hyphopodium-like hemispherical cells are produced; these rarely produce mucronate haustoria. Stroma, setae and true hyphopodia (?) absent. Conidiophores macronematous, mononematous, erect, unbranched, brown, smooth-walled. Conidiogenous cells monotretic, integrated, terminal, determinate, subcylindrical to almost ampulliform. Conidia solitary, dry, acrogenous, obclavate, usually submuriform with 3–5 transverse septa and 0–2 oblique septa, basal cells brown to dark brown, apical cell markedly elongated, beak-like and subhyaline.

Type species: *Hansfordiellopsis lichenicola* (Bat. & Maia) Deight. (syn. *H. aburiensis* Deight.).

Perfect state: *Ascohansfordiellopsis* D. Hawksw., known in *H. elongata* and *H. lichenicola* only.

Number of species: Five species are accepted here, four of which are newly described. All are obligately lichenicolous fungi occurring on foliicolous lichens in the tropics, although a few may spread from lichen colonies on to immediately adjacent areas of leaf.

Observations: This genus was originally considered by Deighton (1960 : 35) to have some affinity with *Clasterosporium* Schw. and *Sporidesmium* Link ex Fr. in the method of conidiogenesis which was described as blastic. Ellis (1971 : 126), following Deighton, referred to the conidiogenesis as monoblastic. Subsequent observations by Deighton (*in litt.*) and myself leave little doubt that the conidia are monoretically produced (see Fig. 19C). The genus consequently seems to occupy a rather isolated position amongst the Hyphomycetes, a not uncommon situation amongst the obligately lichenicolous fungi.

Hansfordiellopsis species generally produce pairs of lateral cells which are almost hemispherical in shape. Deighton (1960 : 35) did not consider them to be attachment organs and their function is unclear. In some instances they were found to produce mucronate haustorium-like extensions during the present study (Figs 18Aa, 20 and 22B), but these occur so irregularly that it is difficult to accept that this is their primary role.

The overall size of the conidia and their septation proved to be rather variable characters for species delimitation in the genus, and in the treatment adopted here emphasis has been placed on the conidiogenous cells and the mycelium; in several instances these were found to be correlated with other differences, particularly in the conidia.

Hansfordiellopsis species do not, as far as is known, actually kill their hosts, but when abundant they must surely inhibit photosynthesis by reducing the surface area exposed to sunlight. In this respect it is of interest to note that ascocarps are often not, or only sparingly, produced in foliicolous lichens attacked by fungi of this genus.

Key to the species

- | | | |
|---|--|--------------------------------|
| 1 | Conidiogenous cells less than 30 μm tall | 2 |
| – | Conidiogenous cells (30)–35–40(–45) μm tall | <i>H. elongata</i> (p. 221) |
| 2 | Conidia mainly exceeding 5 μm in width; hyphopodium-like cells abundant | 3 |
| – | Conidia 3.5–5 μm wide; hyphae 3–4 μm wide; hyphopodium-like cells generally absent | <i>H. tenuissima</i> (p. 229) |
| 3 | Conidiogenous cells mainly less than 10 μm tall | 4 |
| – | Conidiogenous cells 10–20(–25) μm tall | <i>H. lichenicola</i> (p. 224) |

- 4 Conidia 5–6 μm wide, the first two subterminal cells \pm concolorous with the basal cell, basal cell generally somewhat attenuated **H. minuta** (p. 227)
 — Conidia 6–7.5 μm wide, the first two subterminal cells distinctly paler than the basal cell, basal cell not markedly attenuated **H. variegata** (p. 231)

1. *Hansfordiellopsis elongata* D. Hawksw. sp. nov.

(Fig. 16)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis brunneis plerumque 5–10 μm longis et 7–8 μm latis, cum cellulis similibus hyphopodiis subhemisphaericis plerumque 5 μm diam. Cellulae conidiogae monotreticae, integrae, subcylindricae, ex cellulis hypharum singulariter orientes, brunneae, (30–)35–40(–45) \times 4–5.5 μm . Conidia solitaria, sicca, acrogena, obclavata, levia, submuriformia, 4–transverse septata, 0–2 oblique septata, 24–30 \times 5.5–7.5 μm , cellulis brunneis sed cellula apicali in rostro subhyalino.

Typus: Kenya, South Western Mau Forest Reserve, 35°18'30'' E et 0°36'30'' S, in lichenibus foliicolis (*Porina trichothelioides* R. Sant.) ad *Culcasiam* sp., 14.viii.1949, R. A. Maas Geesteranus 5794b (IMI 85643 —holotypus!; UPS—istotypus).

Colonies dispersed, superficial, olivaceous brown to dark brown, arising on the surface of the host lichen; mycelium superficial, adpressed, regularly branching at wide angles, hyphae fairly thick-walled, smooth-walled, brown, septate, slightly constricted at the septa, cells mainly 5–10 μm long and 7–8 μm wide; hyphopodia-like cells arising in pairs on opposite sides of the mycelium, near the distal cell septa, subhemispherical, mostly 5 μm diam. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical, tapering only very slightly from the base, brown, smooth-walled, terminated by a single truncate scar, (30–)35–40(–45) \times 4–5.5 μm . *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 4 transverse septa and 0–2 oblique septa, portion excluding the terminal cell 12–16 \times 5.5–7.5 μm , brown, basal cell truncated with a scar usually 2 μm wide, apical cell markedly elongated, subhyaline, mainly 10–20 μm long but variable in length, tapering to 1–2 μm wide near the apex, overall length of the conidia 24–30 μm .

Perfect state: *Ascophansfordiellopsis deightonii* D. Hawksw.*

Hosts: On thalli of *Porina trichothelioides* R. Sant in the type collection but also seen on a sterile foliicolous lichen thallus which was indeterminate.

Distribution: Kenya and Sierra Leone.

Observations: *Hansfordiellopsis elongata* is a distinctive species in the genus clearly distinguished by its wide and rather short-celled hyphae, very abundant hyphopodia-like cells, and more particularly by the elongated conidiogenous cells which the specific epithet recalls. In the type collection, the fungus is strictly confined to thalli of *Porina trichothelioides* and does not spread on to adjacent areas of lichen-free leaf. In the Sierra Leone collection, in which it occurs on sterile foliicolous lichen thalli, it is of interest that it does not occur on *Tricharia* colonies on the same leaf. These very preliminary observations perhaps suggest that *H. elongata* has a different host

**Ascophansfordiellopsis* D. Hawksw. gen. nov.

Genus lichenicola, ad Sphaeriales vel Pseudosphaeriales incertae sedis pertinens. Perithecia ex mycelio cum cellulis similibus hyphopodiis orientia, subglobosa, ostiolata, atrobrunnea, sparse setosa. Paraphyses non distinctae. Asci tenuissimo-tunicati, clavati, octospori. Ascosporae distichae, ellipsoideae, brunneae, laeves, 3-septatae. Status imperfectus ad genus *Hansfordiellopsis* Deight. pertinens.—Species holotypica est *Ascophansfordiellopsis deightonii* D. Hawksw.

***Ascophansfordiellopsis deightonii* D. Hawksw. sp. nov.**

(Fig. 17A–C)

Perithecia dispersa, superficialia, globosa vel subglobosa, atrobrunnea, ostiolata, 70–100 μm diam, setosa cum setis arcuatis atrobrunneis et laevibus 20–50 \times 6–8 μm ; peridium e 3–4 stratis cellularum brunnearum pseudo-parenchymaticarum, 15–20 μm crassum. Paraphyses non distinctae. Asci tenuissimo-tunicati, clavati, octospori, 40–45 \times 8–10 μm . Ascosporae distichae, ellipsoideae, brunneae, laeves, 3-septatae, 11.5–14 \times 5–6.5 μm . Status imperfectus est *Hansfordiellopsis elongata* D. Hawksw.—Holotypus: Kenya, South Western Mau Forest, 35°18'30'' E et 0°36'30'' S, in lichenibus foliicolis (*Porina trichothelioides* R. Sant.) ad *Culcasiam* sp., 14.viii.1949, R. A. Maas Geesteranus 5794b (IMI 85643!).

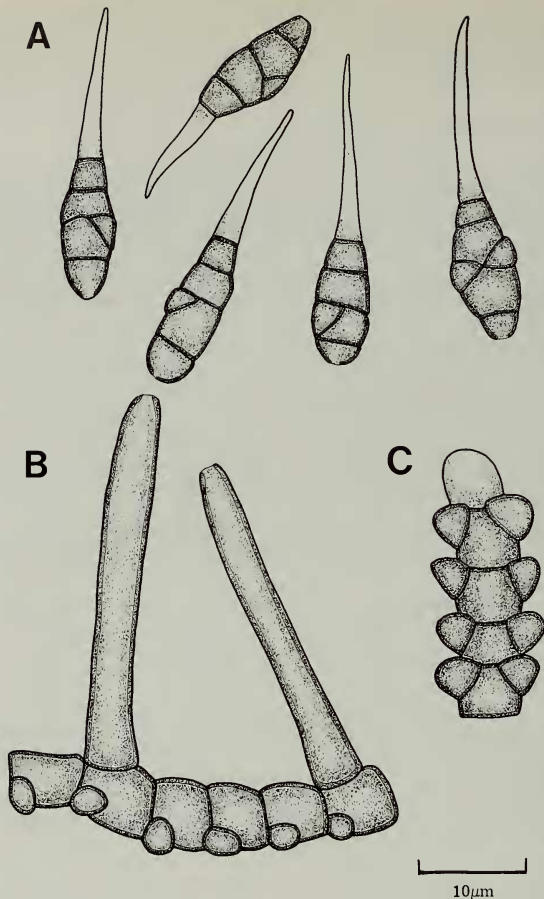


Fig. 16 *Hansfordiellopsis elongata* (IMI 85643—holotype). A, Conidia. B, Mycelium and attached conidiogenous cells. C, Mycelium in surface view showing arrangement of the hyphopodia-like cells.

range to *H. lichenicola*, but any categoric statement would be premature in the absence of further material.

Perithecia are abundantly developed from mycelia of *Hansfordiellopsis elongata* in the type collection and some perithecia were also noted on IMI 52353c, although in that material they were effete. The perfect state is clearly congeneric with *Chaetosphaeria insectivora* Hansf. (see p. 224), the perfect state of *H. lichenicola*, from which it differs in the slightly larger ascospores

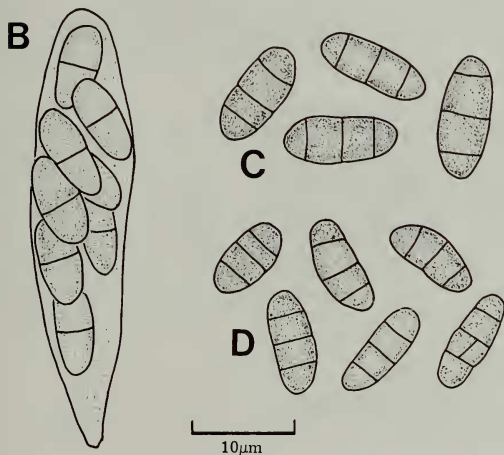
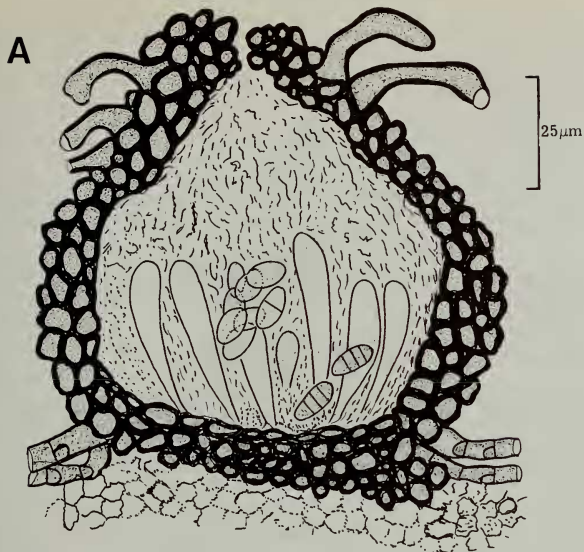


Fig. 17 A-C *Ascohansfordiellopsis deightonii* (IMI 85643—holotype). A, Vertical section of perithecium. B, Immature ascus. C, Ascospores. D, *A. insectivora* (IMI 4249—holotype) ascospores.

(11.5–14 × 5–6.5 µm) as well as the very different conidial states. The limits of *Chaetosphaeria* Tul. have been the subject of considerable controversy in recent years but Gams and Holubová-Jechová (1976: 8) restrict it to taxa with hyaline ascospores and phialidic imperfect states. The rather scant material precludes a thorough anatomical investigation of the perfect state without destroying it, but nevertheless there can be little doubt that the perfect states of *H. elongata* and *H. lichenicola* represent a hitherto unrecognized genus for which the generic name *Ascohansfordiellopsis* is introduced here. While the position of this genus remains uncertain at the present time, it is of interest to note that it has at least some superficial similarity to *Phaeopragmiella* Hansf., also an imperfectly understood genus, which is parasitic on *Meliola* species (Hansford, 1946a: 94–101) but differs in the much larger ascospores and the absence of any known imperfect state, and further to *Teratoschaeta* Bat. & Fonseca, possibly the perfect state of *Ampullifera* (see p. 199).

Additional specimen: Sierra Leone: Njala (Kori), on indet. lichens on *Blighia sapida*, 16 March 1953, F. C. Deighton M5184 (IMI 52353c!).

2. *Hansfordiellopsis lichenicola* (Bat. & Maia) Deight., *Mycol. Pap.* 101: 31 (1965).
(Figs 18–19)

Hansfordiella lichenicola Bat. & Maia, *Publçoës Inst. Micol. Recife* 283: 27 (25 September 1960).

Type: Brazil, Pernambuco, Recife, Dois Irmãos, on *Setomyces giganteae* Bat. & Bez. on *Gustavia augusta*, 13 March 1960, O. Soares da Silva (URM 18781—holotype!).

Hansfordiellopsis aburiensis Deight., *Mycol. Pap.* 78: 34 (28 September 1960).

Type: Ghana, Aburi, on lichens on *Cola verticillata*, 5 April 1953, T. W. Tinsley (IMI 55448c—holotype!).

Hansfordiellopsis deightonii Bat. & Herr., in Batista and Cavalcanti, *Port. Acta Biol. B*, 7: 358 (1964).

Type: Brazil, Pará, Bragança, on *Setomyces orchidae* Bat. & Peres on Leguminosae leaves, 4 October 1961, C. T. Vasconcelos (URM 28063—holotype non vidi).

Icons: Batista, Bezerra & Maia, *Publçoës Inst. Micol. Recife* 283: 28 fig. 10 (1960).—Batista & Cavalcanti, *Port. Acta Biol. B*, 7: 357 fig. 5 (1964).—Deighton, *Mycol. Pap.* 78: 35 fig. 19 (1960).—Ellis, *Demat. Hyphom.*: 128 fig. 83 (1971).—Kendrick & Carmichael, in Ainsworth *et al.*, *The Fungi* 4A: 472 Pl. 37A (1973).

Colonies dispersed, superficial, olivaceous brown to dark brown or almost black, arising on the surface of the host lichens but also spreading on to adjacent parts of the leaf surface, commonly also extending up the sterile setae of setose hosts; mycelium superficial, adpressed, regularly branching at wide angles, hyphae fairly thick-walled, smooth-walled, pale brown to dark brown, septate, slightly constricted at the septa, cells mainly 6–12 µm long, 4–6(–7) µm wide; hyphopodia-like cells arising, usually in pairs on opposite sides of the mycelium, near the distal cell septa, subhemispherical, brown, mainly 3–5 µm diam, exceptionally becoming mucronate with a subhyaline haustorium-like hypha 2–4 µm long. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical but tapering from the base, arising singly on the mycelium, exceptionally with a septum in the lower third, brown, smooth-walled, 10–20(–25) µm tall, 4–6 µm wide at the base and 2–3 µm wide at the apex which is terminated by a single truncate scar. *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 3–5 transverse septa and (0–)1–3 oblique septa, portion excluding the terminal cell 12–18 µm long and 5–7(–8.5) µm wide, brown, basal cell truncated with a scar mainly 2–3 µm wide, subterminal cell slightly paler brown, apical cell markedly elongated, paler brown to subhyaline, mainly 10–30 µm long but very variable, tapering to 1–2 µm wide near the apex, overall length of the conidia 18–50 µm.

Perfect state: *Ascohansfordiellopsis insectivora* (Hansf.) D. Hawksw. **comb. nov.** (basonym: *Chaetosphaeria insectivora* Hansf., *Proc. Linn. Soc. Lond.* 157: 185, 1946; type: Uganda, Entebbe Road, on *Gyalectidium rotuliforme* on *Aristolochia dorsivenia*, March 1944, C. G. Hansford 3381, IMI 4249—holotype!).

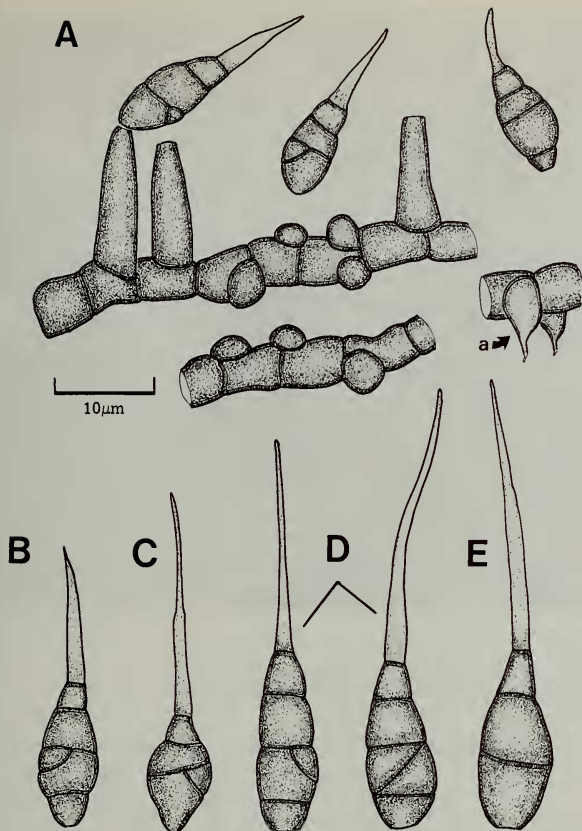


Fig. 18 *Hansfordiellopsis lichenicola*. A, Conidiogenous cells, conidia and mycelium with hyphopodia-like cells. B-E, Conidia. A IMI 55448c, a' URM 18781 (holotype), B IMI 106122e, C IMI 99552a, D IMI 89824a and E IMI 81812.

Hosts: On foliicolous lichens, particularly *Gyalectidium aspidotum* (Vain.) R. Sant., *G. rotuliforme* Müll. Arg., *Setomyces giganteae* Bat. & Bez., *S. orchidae* Bat. & Peres, and *Tricharia* species. Ascocarp formation in the hosts is apparently often inhibited by the presence of this fungus rendering host determination difficult.

Distribution: Apparently pantropical as are its hosts. Collections have been seen by me from Brazil, the Congo, Jamaica, Malaya, Nigeria, Puerto Rico, Sarawak, Sierra Leone, Tanzania, Trinidad and Uganda.

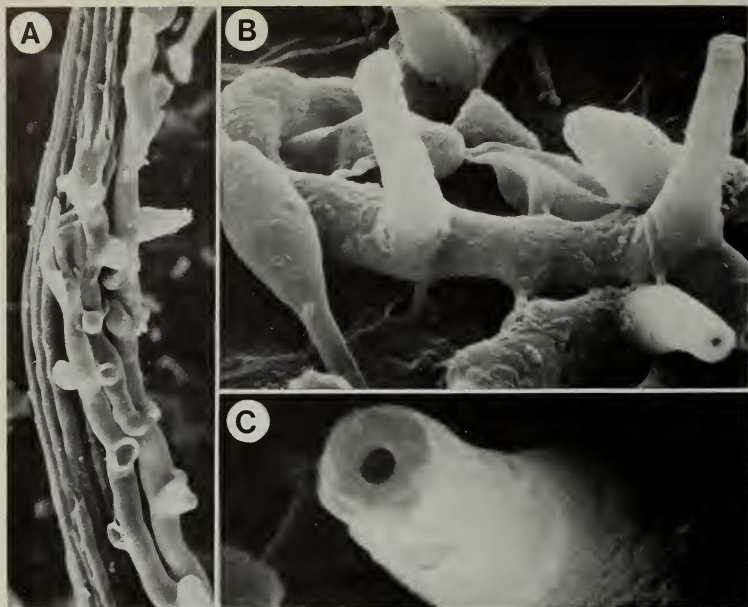


Fig. 19 *Hansfordiellopsis lichenicola*. A, Seta of *Tricharia* sp. with hyphae of the lichenicolous fungus growing up it (IMI 52353b, $\times 1300$). B, Conidiogenous cells, mycelium and conidia (IMI 106122a, $\times 3600$). C, Apex of conidiogenous cell showing scar left by conidium secession (IMI 106122a, $\times 12\ 000$). A-C Scanning electron micrographs.

Observations: *Hansfordiellopsis lichenicola* is evidently not an uncommon species although it has rarely been mentioned in the literature. The mycelial characters are generally constant, apart from the rare production of haustoria by the hyphopodia-like cells which was seen in a single collection (URM 18781), and these, together with the length of the conidiogenous cells, serve to distinguish it from the other species of its genus. The septation of the conidia and also their overall length are very variable (Fig. 18), but because of the range of conidium types which occurs within single colonies, this appears to be of minor importance and is perhaps due merely to environmental factors.

A particularly interesting trait seen in this fungus is its ability to entwine itself around the setae present on its hosts (e.g. Fig. 19A); in some collections it is even largely confined to the setae, with little mycelium on the thallus itself. Although it is able to spread on to adjacent areas of leaf from lichen colonies and also from them over epiphyllous liverworts, in no case has it been found on an area of leaf unattached to a lichen.

The imperfect and perfect states of this fungus were apparently first described by Hansford (1946b: 185) but he did not appreciate that it was lichenicolous and reported it '... in insect parasiticum' and '... always associated with what appears to be the same insect, probably a scale or aleyrodid'; the structures he was interpreting as insect in origin were in fact the convex thalli of *Gyalectidium rotuliforme* which even has apothecia in Hansford's holotype. The perfect

state is evidently rare and rather few mature perithecia are present on *Hansford 3381*; a few also occur in *Hansford 3495*, collected in the type locality. The perithecia are 80–110 µm diam, with 2–6 arcuate setae 40–70 × 7–8 µm, asci 40–50 × 10–12 µm, and ascospores 3-septate when mature, pale brown, 9–11 × 4–5 µm (not 11–13 µm long as stated by Hansford, *loc. cit.*).

Although the type of *Hansfordiellopsis deightonii* was not obtained from URM, study of a specimen authentic for the name supplied (IMI 113850b!) and the original illustrations leave little doubt that it represents *H. lichenicola* as interpreted here.

Additional specimens: Brazil: Rondonia Province, on *indet.* lichens on *Palmae*, March 1962, *O. Fonseca* (IMI 113850b!, URM).—*Congo:* Semliki Valley, on *indet.* lichen on *Phoenix reclinata*, *Hendrickx 2737* (IMI 5721!).—*Jamaica:* Portland, Ecclesdown, on *indet.* lichen on *Lobelia grandifolia*, 29 March 1961, *R. I. Leather CB 442* (IMI 87776!).—*Malaya:* Selangor, Serdang, Federal Experimental Station, on *indet.* lichen on *Lansium domesticum* var. *dukii*, 11 November 1949, *A. Johnston 478 p.p.* (IMI 41011b!); *loc. cit.*, on *Tricharia* sp. on *Lansium domesticum*, 2 January 1955, *A. Johnston 1244* (IMI 56061b!).—*Nigeria:* Benin, on *Tricharia* setae on *Caryota mitis*, 10 August 1961, *A. G. Bailey 872* (IMI 99552a!).—*Puerto Rico:* Rio Piedras, Agricultural Experimental Station, on *indet.* lichen on *Garcinia mangostana*, 4 April 1962, *F. A. Wellman 3622* (IMI 94767!).—*Sarawak:* Balingian, on *Gyalectidium aspidotum* on *Coffea robusta*, 27 August 1962, *G. J. Turner FH 154* (IMI 96192c!); Kucking, on *indet.* lichen on *Cinnamomum zeylanicum*, 28 July 1965, *G. J. Turner FH 270* (IMI 115461c!).—*Sierra Leone:* Njala (Kori), on *Tricharia* sp. on *Blighia sapida*, 16 March 1953, *F. C. Deighton 5184* (IMI 52353b!); *loc. cit.*, on *Tricharia* setae on *Parinari excelsa*, 15 July 1953, *F. C. Deighton M5364 p.p.* (IMI 53373b!); Gegbwema (Tunkia), on *indet.* lichen on *Voacanga thouarsii*, 4 April 1939, *F. C. Deighton M1970 p.p.* (IMI 23413b!).—*Tanzania:* Kigoma, Mkenke, on *indet.* lichen on *Baphia kirkii*, 28 March 1964, *K. A. Pirozynski M891k* (IMI 107199k!); Kigoma, Kasekela, on *Tricharia* sp. on *Monanthotaxis poggei*, 8 February 1964, *K. A. Pirozynski M412f* (IMI 106639f!); Kigoma, Kakombe, on *indet.* lichen on *M. poggei*, 28 December 1963, *K. A. Pirozynski M112b* (IMI 105932b!); Kigoma, Mkenke, on *Tricharia* setae on *Tiliacora funifera*, 9 January 1964, *K. A. Pirozynski M241e* (IMI 106122e!).—*Trinidad:* Aripo savanna, on *Tricharia* sp. on *indet.* leaf, 27 September 1960, *C. L. A. Leakey 25* (IMI 86315a!).—*Uganda:* Entebbe Road, on *Gyalectidium aspidotum* on *Artabotrys nitidus*, November 1943, *C. G. Hansford 3245* (IMI 89824a!); *loc. cit.*, on *G. sp.* on *Aristolochia dorsiventa*, May 1944, *C. G. Hansford 3495* (IMI 4731!); Kampala, on *G. aspidotum* on *Coffea excelsa*, *C. G. Hansford 849* (IMI 81812!); *loc. cit.*, on *G. aspidotum* on *C. liberica*, September 1930, *C. G. Hansford 1354* (IMI 96606!).

3. *Hansfordiellopsis minuta* D. Hawksw. sp. nov.

(Fig. 20)

Fungus lichenicola. Mycelium superficialis, ex hyphis repentibus, cellulis brunneis plerumque 7–10 µm longis et 5–7 µm latis, cum cellulis similibus hyphopodiis subhemisphaericis plerumque 3–4 µm diam. Cellulae conidiogenae monotreticae, integratae, subcylindricae, ex cellulis hypharum singulariter orientes, brunneae, 7–9(–10) × 4–5 µm. Conidia solitaria, sicca, acrogena, obclavata, levia, submuriformia, 2–4 transverse septata, 0–1 oblique septata, 20–40 × 5–6 µm, cellulis brunneis sed cellula apicali in rostro subhyalino, cellula basi plerumque angustata.

Typus: Sierra Leone, Njala (Kori), in lichenibus foliicolis, ad *Parinari excelsa*, 15.viii.1953, *F. C. Deighton M5364 p.p.* (IMI 53373c—holotypus!).

Colonies dispersed, superficial, olivaceous brown to brown, arising on the surface of the host lichen; mycelium superficial, adpressed, regularly branching at wide angles, hyphae fairly thick-walled, smooth-walled, brown, septate, not or slightly constricted at the septa, cells mainly 7–10 µm long and 5–7 µm wide; hyphopodia-like cells arising in pairs on opposite sides of the mycelium, near the distal cell septa, subhemispherical, mostly 3–4 µm diam but sometimes with mucronate haustorium-like hyphae 3–5 µm long originating from them. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical, tapering from the base, somewhat to almost ampulliform, brown, smooth-walled, terminated by a single truncate scar, 7–9(–10) × 4–5 µm. *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 2–4 transverse septa and 0–1 oblique septa, portion excluding the terminal cell 12–18 × 5–6 µm, brown, basal cell often rather markedly narrowed and truncated with a scar 1–1.5 µm wide, subterminal cell pale brown, apical cell markedly elongated, subhyaline, 10–20 µm long but very variable in length, tapering to 1.5–2 µm wide near the apex, overall length of the conidia 20–40 µm.

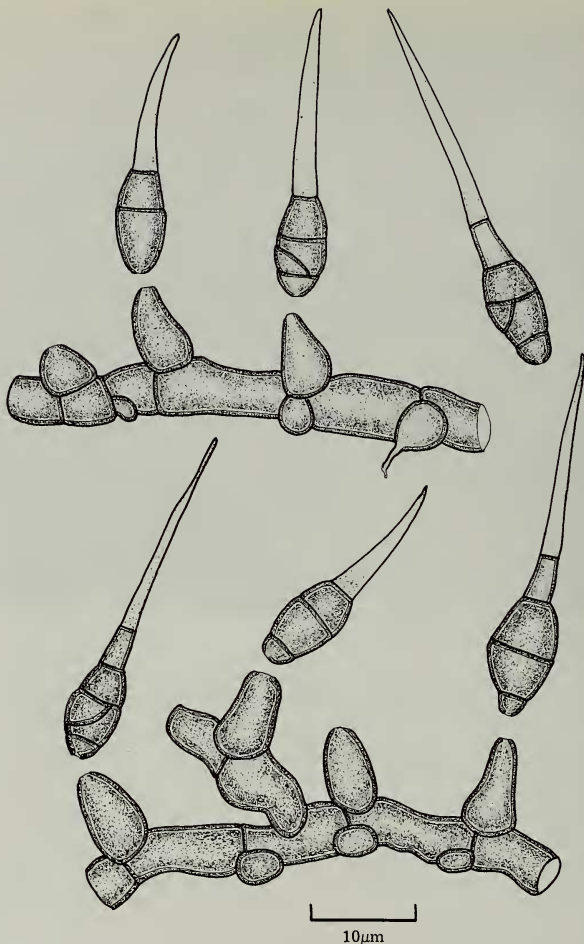


Fig. 20 *Hansfordiellopsis minuta* (IMI 53373c—holotype).

Hosts: On indeterminate foliicolous lichen thalli.

Distribution: Ghana and Sierra Leone.

Observations: In the holotype collection, *Hansfordiellopsis minuta* occurs on the same leaf as *H. lichenicola* but is present on different lichen thalli and maintains its distinctness. *H. minuta*

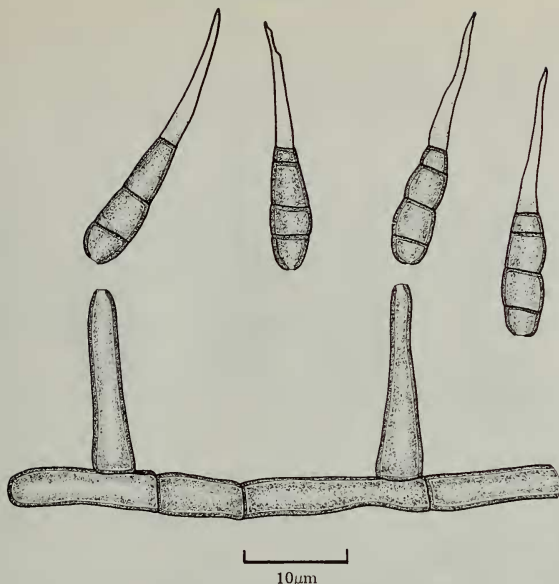


Fig. 21 *Hansfordiellops tenuissima* (IMI 99086b—holotype).

recalls *H. variegata* in having very short conidiogenous cells, but differs from that species in the coloration of the conidia and shape of the basal cell of the conidia.

Additional specimen: Ghana: Aburia, on indet. lichens on *Cola verticillata*, 5 April 1953, T. W. Tinsley (IMI 53448e!).

4. *Hansfordiellops tenuissima* D. Hawksw. sp. nov.

(Fig. 21)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis brunneis plerumque 10–22 μ m longis et 3–4 μ m latis, plerumque sine cellulis similibus hyphopodiis. Cellulae conidiogenae monotreticae, integratae, subcylindricae, ex cellulis hypharum singulariter orientes, brunneae, 18–20 \times 3.5–5 μ m. Conidia solitaria, sicca, acrogena, obclavata, levia, 3–4 septata, 20–25(–28) \times 3.5–5 μ m, cellulis brunneis sed cellula apicali in rostro subhyalino.

Typus: Ghana, Aburi, in lichenibus foliicolis ad *Ananas sativus*, 1.x.1953, F. C. Deighton CB 1001 (IMI 99086b—holotypus!).

Colonies dispersed, superficial, olivaceous brown, arising on the surface of the host lichen but sometimes spreading on to adjacent parts of the leaf; mycelium superficial, adpressed, sparsely branching at wide angles, hyphae fairly thick-walled, smooth-walled, brown, septate, not or slightly constricted at the septa, cells mainly 10–22 μ m long and 3–4 μ m wide; hyphopodia-like cells generally absent but rare swellings which could be these or young branches 3.5–4 μ m diam were seen on a few hyphae. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical, tapering slightly from the base, smooth-walled, terminated by a single truncate

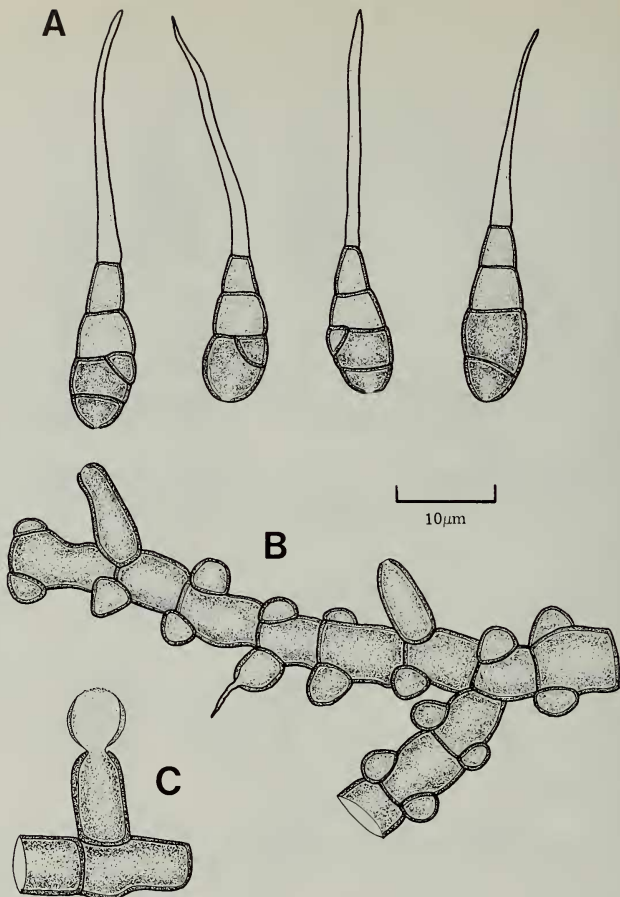


Fig. 22 *Hansfordiellopsis variegata* (IMI 4778c—holotype). A, Conidia. B, Conidiogenous cells and mycelium with hyphopodia-like cells. C, Conidium in a very early stage of formation.

scar, 18–20 × 3.5–5 µm. Conidia solitary, dry, acrogenous, obclavate, smooth-walled, 3–4(–5) septate, portion excluding the terminal cell 12–15 × 3.5–5 µm, brown, basal cell truncated with a scar 1–1.5 µm wide, apical cell markedly elongated, subhyaline, mainly 10–12 µm long but variable in length, tapering to 1–2 µm wide near the apex, overall length of the conidia 20–25(–28) µm.

Host: On indeterminate foliicolous lichen thalli.

Distribution: Ghana. Known only from the type collection.

Observations: This distinctive species is readily separable from the other species of *Hansfordiellopsis* accepted here by the narrower conidia, which are also only transversely septate, the narrow mycelial hyphae, and furthermore by the absence of abundant hyphopodia-like cells. (A few rare cells which possibly were hyphopodiiform were seen, see above.)

5. *Hansfordiellopsis variegata* D. Hawksw. sp. nov.

(Fig. 22)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis brunneis plerumque 7–9 μm longis et 4–6 μm latis, cum cellulis similibus hyphopodiis subhemisphaericis plerumque 3–4 μm diam. Cellulae conidiogenae monotreticae, integratae, subcylindricae vel ampulliformae, ex cellulis hypharum singulariter orientes, brunneae, 8–12 \times 4–5 μm . Conidia solitaria, sicca, acrogena, obclavata, levia, submuriformia, 3–4 transverse septata, 0–1 oblique septata, 35–40 \times 6–7.5 μm , cellulis brunneis sed cellula apicali in rostro hyalino.

Typus: Uganda, Entebbe Road, in lichenibus foliicolis (*Gyalectidium aspidotum* (Vain.) R. Sant.) ad *Ficus urceolaris*, xi. 1943, C. G. Hansford 3260 (IMI 4778c—holotypus!).

Colonies dispersed, superficial, pale olivaceous brown, arising on the surface of the host lichen but sometimes spreading somewhat on to adjacent areas of the leaf; mycelium superficial, adpressed, regularly branching at wide angles, hyphae fairly thick-walled, smooth-walled, brown, septate, slightly constricted at the septa, cells mainly 7–9 μm long and 4–6 μm wide; hyphopodia-like cells arising in pairs on opposite sides of the mycelium, near the distal cell septa, subhemispherical, mostly 3–5 μm diam, sometimes becoming mucronate with a subhyaline to hyaline haustorium-like projection to 6 μm long. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical to almost ampulliform, brown, smooth-walled, terminated by a single truncate scar, 8–12 \times 4–5 μm . *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 3–4 transverse and 0–1 oblique septa, portion excluding the terminal cell 14–18 \times 6–7.5 μm , the lower two cells in 4-septate and the lower cell in 3-septate spores dark brown, the median two cells pale brown, basal cell truncated with a scar about 1.5–2 μm wide, apical cell markedly elongated, subhyaline, mainly 15–20 μm long, tapering to 1–2 μm wide near the apex, overall length of the conidia 35–40 μm .

Host: On thalli of *Gyalectidium aspidotum* (Vain.) R. Sant.

Distribution: Uganda. Known only from the type collection.

Observations: This collection was cited by Hansford (1946b: 185) as an imperfect state collection of *Chaetosphaeria insectivora*, and Deighton (1960: 35) listed it under *Hansfordiellopsis aburiensis* without a critical study of this specimen (Deighton, *in litt.*). *H. variegata* is, however, quite distinct from *H. lichenicola*, the two cells below the apical one having a distinctly paler shade than the one (or two) cells below them. On more careful examination it is also seen to differ in the much shorter conidiogenous cells. *H. minuta* resembles *H. variegata* in having short conidiogenous cells, but differs in the cells in the body of the spore being concolorous and the basal cell of the conidia somewhat attenuated.

X. ILLOSPORIUM Mart. ex Ficus & Schubert

Fl. Dresd. 2: 259 (1823); Fr., *Syst. mycol.* 3(1): 258 (1829).

Illosporium Mart., *Fl. crypt. Erlang.*: 325 (1817); nom. inval. (Art. 13).

Colonies usually discrete, sometimes becoming confluent and effuse; mycelium immersed, very irregular, hyaline. Stroma, setae and hyphopodia absent. Conidiophores mononematous, forming compact convex subgelatinous sporodochia which are often brightly coloured, very irregularly branched and difficult to distinguish from the vegetative hyphae. Conidiogenous cells monoblastic or polyblastic, integrated, terminal or intercalary, subcylindrical to subglobose or

irregular, hyaline. Conidia catenate, adhering in compact irregular masses, hyaline singly but usually pale pink or rose in mass, simple, subglobose but often angular due to compression by adjacent cells, smooth or indistinctly verruculose, lacking any distinct scar.

Type species: Illosporium carneum Fr. (syn. *I. roseum* Mart. ex Ficinus & Schubert).

Perfect state: Nectriella Nitschke, known in one species (*I. carneum*).

Number of species: This generic name has been employed for considerable numbers of non-lichenicolous taxa, most of which are probably not congeneric with *Illosporium carneum*. A thorough revision is needed. Although Keissler (1930: 629–635) accepted four lichenicolous species and one variety in Europe, only two are here, and one of these is in need of further investigation.

Observations: This generic name has not been investigated by mycologists in recent years. Kendrick & Carmichael (1973: 378), for example, considered it as probably a *nomen dubium*. Subramanian (1972: 615), however, provided a short diagnosis and included one non-lichenicolous species 'with hesitation'. The type species of the genus has generally been cited as '*Illosporium roseum* Mart. ex Fries' but such a name does not appear to exist. Fries (1829: 258–260) accepted four species in the genus: *I. roseum* (Schreb.) Fr., *I. carneum* Fr., *I. coccineum* Fr. and the non-lichenicolous *I. persicinum* Fr. If *I. roseum* (Schreb.) Fr. were considered the type species then the generic name would be of uncertain application in view of the uncertainties surrounding that epithet (see p. 280). Martius (1817: 325), however, introduced the generic name *Illosporium* for a single species which he called *I. roseum* 'mihi' but made no reference to Schreber's epithet. Fries (*loc. cit.*) did not specifically designate a type species for the generic name but he firmly attributed it to Martius; in view of this he can be considered as using the name in Martius' sense and so the species concept of '*I. roseum* Mart.', not '*I. roseum* (Schreb.) Fr.', must be regarded as the type of the generic name even though the correct name for that species is in fact *I. carneum* (see below).

Attention is also drawn here to a fungus macroscopically very similar to *Illosporium* but which has compacted helicoid conidia and is known now from two collections (Canada: Ontario, Peel County, W. of Palgrave, on *Physcia stellaris* (L.) Nyl., 6 November 1955, R. F. Cain, IMI 73146!, TRTC 31698; Italy: Bresica, Idro, shore of lake 'Lago d'Idro', on *Candelaria concolor* (Dicks.) Stein on *Populus*, 4 September 1977, M. Skytte Christiansen, IMI 226836!). This fungus is currently being studied further but appears to be closely allied to the genus *Hobsonia* Berk.

Key to the lichenicolous species

- 1 Sporodochia irregular above, pale pink; conidia mainly (4)–6–7 μm diam, indistinctly verruculose, separating **I. carneum** (p. 232)
- Sporodochia strongly convex and regularly delimited above, orange to bright pink or rose; conidia 6–10 μm diam, smooth, separating only with extreme difficulty **I. corallinum** (p. 236)

1. *Illosporium carneum* Fr., *Syst. mycol.* 3(1) : 259 (1829).

(Figs 23–24)

Type: France, Lyon, on *Peltigera rufescens*, Montagne (UPS-Fries—lectotype!).

Illosporium roseum Mart., *Fl. crypt. Erlang.* : 325 (1817); nom. inval. (Art. 13).

Orig. coll.: Germany, Erlangen, 'in thallo lichenum nonnullorum terrestrium, praesertim in *Capitularium* et *Peltidearum*, in ericetis'. Type: see below for neotypification.

Illosporium roseum Mart. ex Ficinus & Schubert, *Fl. Dresd.* 2 : 259 (1823); nom. illegit. (Arts. 13, 64).

Non *Illosporium roseum* (Schreb.) Fr., *Syst. mycol.* 3(1) : 258 (1829).

Exsiccatae: Arnold, *Lich. Monac.* no. 456 (K!).—Cooke, *Fungi Br. Exs.*, ed. 2, no. 535 (K!).—Jaap, *Fungi sel. Exs.* no. 450 (K!).—Karsten, *Fungi Fenn.* no. 66 (K!).—Libert, *Pl. crypt. Ard.* no. 383 (K!).—Lundell and Nannfeldt, *Fungi Exs. Suec.* no. 682 (K!).—Sydow, *Mycoth. march.* no. 4029 (K!).*

* Sydow, *Mycoth. Germ.* no. 547, distributed under this name, is *I. corallinum* (q.v.).

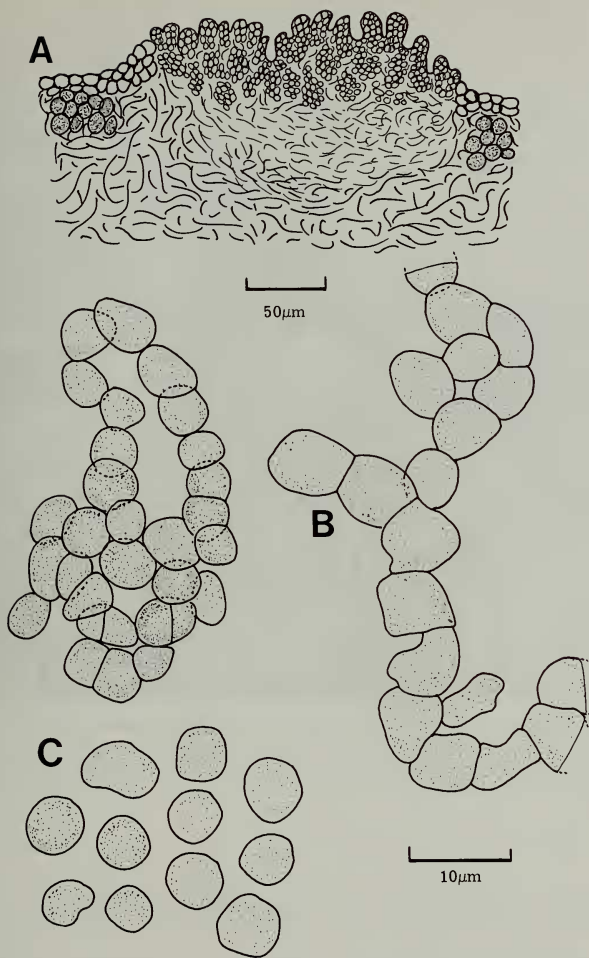


Fig. 23 *Illosporium carneum* (Jaap, *Fungi sel. Exs.* 450, K). A, Vertical section of sporodochium on a *Peltigera* thallus. B, Conidiogenous cells and chains of conidia. C, Conidia.

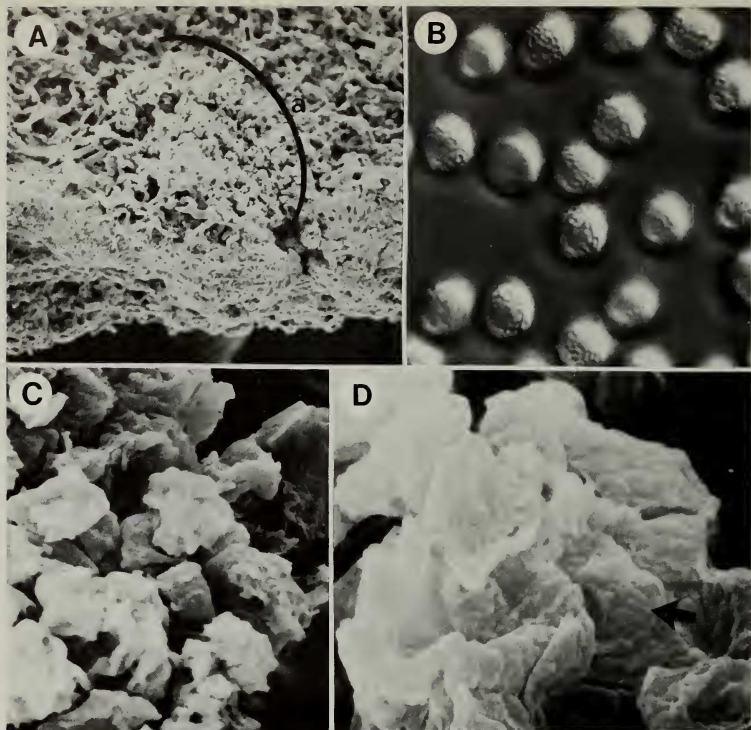


Fig. 24 *Illosporium carneum* (Jaap, *Fungi sel. Exs.* 450, K). A, Section through sporodochium on a *Peltigera* thallus (a, limit of sporodochium) ($\times 250$). B, Conidia showing verrucae ($\times 1000$). C, Conidia ($\times 3000$). D, Conidia showing verrucae ($\times 12\ 000$). A, C and D Scanning electron micrographs, B Differential interference contrast.

Icones: Corda, *Icon. Fung.* 3 : Pl. 1 fig. 1 (1839).—Killian & Werner, *Bull. trimest. Soc. mycol. Fr.* 41 : Pl. 8 fig. 1–4 (1925).—Keissler, *Rabenh. Krypt.-Fl.* 8 : 630 fig. 131–132 (1930).

Colonies delimited, erumpent through the upper cortex of the host thallus, pale pink; mycelium immersed in the cortex and medulla of the host, hyphae flexuose, irregularly branched, hyaline, torulose, often markedly constricted at the septa, thin-walled, mainly 2.5–4 μm wide. *Conidiophores* micronematous, forming sporodochia, densely compacted, very irregular and difficult to distinguish, sporodochia very variable, mainly 200–300 μm wide, applanate to almost coremiiform. *Conidiogenous cells* probably monoblastic, sometimes evidently polyblastic, integrated, terminal or intercalary, irregular in shape, mainly ellipsoid to elongate-ellipsoid, hyaline. *Conidia* catenate, often adhering in compact masses 50–100 μm tall, hyaline singly but pale pink in mass, simple, subglobose but often rather angular due to compression by adjacent conidia, thin-walled, indis-

tinctly verruculose (verrucae clearly seen by differential interference contrast microscopy; Fig. 24B), rather variable in size but mainly (4-)6-7 μm diam.

Perfect state: Nectriella robergei (Mont. & Desm.) Weese. The connection with the perfect state is based on circumstantial evidence and has not been proved by single ascospore cultures; this evidence is very strong (see Killian & Werner, 1924) as perithecia of this *Nectriella* are almost always found to be associated with this *Illosporium*.

Hosts: Apparently restricted to the thalli of *Peltigera* species. It is particularly common on *P. rufescens* (Weiss) Humb., but is also known from *P. canina* (L.) Willd., *P. horizontalis* (Huds.) Baumg., *P. malacea* (Ach.) Funck, *P. polydactyla* (Neck.) Hoffm. and *P. spuria* (Ach.) DC.

Distribution: Widespread and often common in Europe. There are reliable reports from at least the British Isles, Belgium, Finland, France, Germany, Italy, Spain and Sweden. I have also seen specimens from both Canada (Ontario) and the U.S.A. (New York). In the course of this revision it must be stressed that no exhaustive literature or herbarium searches were carried out; a study of the *Peltigera* folders in major herbaria would be expected to reveal numerous additional records.

Observations: This fungus has always been somewhat dubious to mycologists, although a survey of the lichenological literature suggests it is well known. This situation has arisen because, while the gross features are readily seen with a hand lens, the mode of conidiogenesis is difficult to work out. In many specimens the conidia adhere so tightly in almost pseudoparenchymatous masses that one might speculate whether the cells were really conidia at all; I consider that they are conidia and that this phase represents a developmental one, as in some collections a powder of dispersed conidia occurs around the main conidial mass. Cultural studies will perhaps be the only way to ascertain with certainty the development and conidiogenesis in it and are urgently required. The ornamentation on the conidia of *Illosporium carneum* has not previously been noted, but was confirmed by scanning electron microscopy (Fig. 24D).

Peltigera thalli infected by *Illosporium carneum* may become discoloured, usually pale brown, but it is perhaps not a serious pathogen as in some cases infected plants almost retain their normal colouration.

There is only a single specimen in Fries' herbarium under the name *Illosporium carneum*; this was probably a syntype and is consequently designated here as the lectotype for this name. Fries (1829 : 259) cited '*I. roseum*. Mart. l.c.?' as a synonym of *I. carneum* and evidently appreciated that Martius' name was nothing to do with *I. roseum* (Schreb.) Fr. (see p. 280). Martius (1817 : 325) clearly considered *Peltigera* (syn. *Peltidea*) species as host for his fungus and, as no other similar fungus is known from *Peltigera* thalli, there can be little doubt that his name is correctly placed. Although Martius' name was validated after 1821 (Art. 13) in 1823, six years before the combination *I. roseum* (Schreb.) Fr. was made, Fries' later homonym is accepted and Martius' name treated as illegitimate because of Art. 13(f) which protects the nomenclatural status of names used by Fries in the *Systema mycologicum*. This is fortunate as the name *I. roseum*, widely used for the taxon called *I. corallinum* in this paper, consequently does not have to be taken up for the well-known *I. carneum*.

No original material of *Illosporium roseum* Mart. could be traced in AWH (W. van den Bergh, *in litt.*), BR (A. Bienfait, *in litt.*) or M (H. Hertel, *in litt.*). I consequently designate the lectotype of *I. carneum* as neotype for Martius' name in order to fix its application, and so that of the generic name.

Additional specimens: **British Isles:** England, Berkshire, Hitchcopse Pit, on *Peltigera rufescens*, February 1973, H. J. M. Bowen (IMI 2239361); Lincolnshire, Risby Warren, on *P. rufescens*, 16 October 1971, M. R. D. Seaward (IMI 161341!).—**Canada:** Ontario, Mamatoulin Island, near Mamatouaw Mines, on *P. polydactyla*, 18 May 1974, D. H. S. Richardson (IMI 185310!).—**Sweden:** Halefällan, on *P. rufescens*, 6 June 1815, J. Forsander (UPS!).—**U.S.A.:** New York, on *P. cf. rufescens*, C. H. Peck (K!).

2. *Illosporium corallinum* Roberge, in Desmazières, *Pl. crypt. Fr.*, Ed. 1, fasc. 32 no. 1551 (1847). (Fig. 25)

Type: France, on *Physcia tenella*, J. B. H. J. Desmazières, *Pl. crypt. Fr.*, Ed. 1, fasc. 32 no. 1551 (K—2 isotypes!).

Illosporium roseum var. *corallinum* (Roberge) Ferr., *Fl. ital. Crypt.* 1 : 43 (1910).

Lepra carnea Ehrh., *Pl. crypt. Linn.* no. 308 (1795); nom. inval. (Arts. 13, 32).

Type: Germany, Hannover, Herrenhausen, on *Physcia adscendens*, J. F. Ehrhart, *Pl. crypt. Linn.* no. 308 (LINN-Sm. 1720.21—isotype!).

Sclerotium granulatum b. *persicolor* Schumacher, *Enum. Pl. Scell.* 2 : 186 (1803); nom. inval. (Art. 13).

Type: Denmark, Zealand, Copenhagen, on *Physcia* sp., H. C. F. Schumacher, MS 'Flora Hafniensis fungi delineati' 1 : 89 fig. 1 (C—lectotype!).

Illosporium aurantiacum Lasch, in Rabenhorst, *Fungi Eur.*, cent. I no. 74 (1859).

Type: Germany, near Driesen, on *Physcia adscendens* on *Pyrus malus*, G. W. Lasch, Rabenh. *Fungi Eur.*, cent. I no. 74 (K—3 isotypes!).

Hymenobolus parasiticus Zukal, *Öst. bot. Z.* 43 : 73 (1893) *pro parte* (see p. 277).

Fusarium sampaioi Gonz. Frag., *Bolm Soc. broteriana* II, 2 : 50 (1924) *pro parte* (see p. 274); nom. illegit. (Art. 70).

Illosporium roseum auct. mult., non Mart. ex Ficinus & Schubert (1823), *nec* (Schreb.) Fr. (1829) (see p. 280).

*Exsiccatae**: Desmazières, *Pl. crypt. Fr.*, Ed. 1, fasc. 32 no. 1551 (K!).—Ehrhart, *Pl. crypt. Linn.* no. 308 (LINN-Sm. 1720.21!; sub *Lepra carnea*).—Fuekel, *Fungi Rhen.* no. 240 (K!; sub *I. coccineum*).—Libert, *Pl. crypt. Ard.* no. 281 (K!; sub *I. coccineum*).—Rabenhorst, *Fungi Eur.*, cent. I no. 74 (K!; sub *I. aurantiacum*).—Sydow, *Mycoth. Germ.* no. 547 (IMI 16620!, K!; sub *I. carneum*).

Colonies delimited, erumpent through the upper cortex of the host or sometimes almost superficial, orange-red to bright pink or rose, convex and translucent; mycelium immersed in the cortex and medulla of the host or scarcely apparent, hyphae flexuose, irregularly branched, hyaline, torulose, generally constricted at the septa, thin-walled, mainly 5–7 µm wide. *Conidio-phores* (?) micronematous, forming sporodochia, densely compacted into a translucent clearly delimited and sometimes almost corticate mass which is often constricted basally, convex to subglobose, and 100–300 µm diam, the masses arising singly or aggregated into small, sometimes confluent, groups. *Conidiogenous cells* (?) probably monoblastic to polyblastic, integrated, terminal or intercalary, very irregular in shape, mainly broadly ellipsoid, hyaline. *Conidia* (?) catenate, adhering in compact irregular masses, simple, subglobose to irregular, often angular due to compression by adjacent conidia, thin- and smooth-walled, very variable but mainly 6–10 µm.

Perfect state: It has been suggested that *Illosporium coccineum* Fr., a name which is not a lichenicolous fungus (see p. 278), is the imperfect state of *Nectriella coccinea*† Fuekel (e.g. Keissler, 1930 : 286). The name *I. coccineum* has, however, been generally misapplied and used for the species called *I. corallinum* here. Whether *N. coccinea* is really the perfect state of *I. corallinum* is dubious and in need of further investigation. Keissler (1930: 633) suggested the common bark saprophyte *Nectria coccinea* (Pers. ex Fr.) Fr. but that is most improbable.

Hosts: I have seen material from *Lecanora conizaeoides* Nyl. ex Cromb., *Parmelia glabratula* (Lamy) Nyl., *P. omphalodes* (L.) Ach., *P. saxatilis* (L.) Ach., *P. sulcata* T. Tayl., *Physcia adscendens* (Th. Fr.) Oliv., *P. semipinnata* (Gmelin) Moberg and *P. tenella* (Scop.) DC. Further hosts listed by Keissler (1930 : 632) for '*Illosporium roseum*' were: *Anaptychia ciliaris* (L.) Körb., *Hypogymnia physodes* (L.) Nyl., *Parmelia flaventior* Stirt., *P. olivacea* (L.) Ach., *P. pulla* Ach., *P. tiliacea* (Hoffm.) Ach., *P. subrudecta* Nyl., *Physcia stellaris* (L.) Nyl., *Physconia pulverulenta* (Schreb.) Poelt and *Xanthoria parietina* (L.) Th. Fr.; his mention of *Solorina saccata* (L.) Ach. was based on the type of *Illosporium globulatum* Nyl. which was nothing to do with *I. corallinum* (see p. 279).

* Arnold, *Lich. mon.* no. 1896 (K!), distributed as *Illosporium corallinum* on *Parmelia saxatilis* (L.) Ach., is only material of *P. sulcata* T. Tayl. in which the soredia (and parts of the thallus) have become reddened due to the breakdown of salazinic acid.

†i.e. *Nectriella tincta* (Fuekel) R. Sant.

Distribution: Probably widely distributed in Europe; I have seen material from the British Isles, Belgium, France, Germany and Portugal but have made no exhaustive search for material in other herbaria. There are also mentions of its occurrence in America (e.g. Vouaux, 1914 : 316).

Observations: I have found the circumscription and interpretation of this taxon extremely difficult to resolve satisfactorily, and the use of a single specific name and its retention in *Illosporium* are both matters for some conjecture. In the case of *I. carneum*, there is no doubt that the spherical cells formed are conidia as they are found scattered around infection spots on the surface of the host. This is not, however, so for *I. corallinum*, where the structures termed sporodochia above are discrete compact masses of cells often with some sort of limiting layer of cells

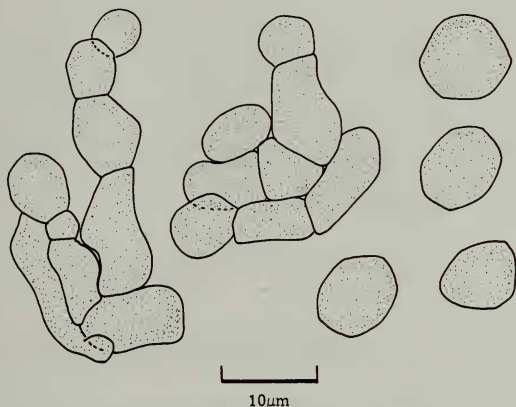


Fig. 25 *Illosporium corallinum* (K—isotype).

present; I was not able to convince myself that the rounded cells formed were really conidia in this case, and not simply rounded pseudoparenchymatous cells (perhaps even young *Nectriella* perithecia?). The reports of *Fusarium*-like conidia in association with structures recalling *I. corallinum* (see under *F. sampaioi* and *Selenosporium lichenicola*) make me speculate as to whether these may eventually be formed; cultural studies might be expected to shed further light on this question. A further problem is whether the various colour shades, particularly orange as opposed to bright pink, represent stages or variants of a single taxon or more than one; a broad concept was adopted partly because of a lack of evidence for host specificity in the different colour types. These problems clearly merit more detailed investigations than has been possible during the present survey.

Illosporium corallinum is a pathogen of both *Parmelia* and *Physcia* species, infected thalli generally becoming decolourised, whitened and subsequently completely disintegrating.

With respect to the nomenclature presented above, it should be noted that the epithets *corallinum* and *aurantiacum* were both validly published on their exsiccati labels, as these had descriptions provided on them; these were issued prior to accounts appearing in journals (i.e. Desmazières, 1848; Schlechtendal, 1859).

Sclerotium granulatum b. *persicolor* was described 'In caudice *Pruni Cerasi*, & in ramis *Vaccinii uliginosi*' by Schumacher (1803 : 186). No herbarium material of this taxon is extant but Schumacher did refer to an illustration in Oeder (1799) under the name *Lichen roseus* Schreb. and in

C there is a painting by Schumacher of his *persicolor* in a manuscript volume annotated 'Sclerotium *persicolor* m. *Lichen roseus* Fl. Dan. Tab. 1243 f.1. In caudice *Pruni Cerasi* nec non in ramis *Vaccinii uliginosi* semel inveni Hyeme viget'. Dr M. Skytte Christiansen sent me coloured transparencies of the painting in C which undoubtedly represents *Illosporium corallinum* as interpreted here and this painting is designated here as the lectotype for Schumacher's name. The drawing in Oeder (1799: Pl. 1243 fig. 1) was indicated to be based on a collection of Schumacher's, but is different from that in Schumacher's manuscript because the pink masses appear as if they might be arising not from the foliose lichens figured (probably *Physcia* and *Xanthoria* species) but rather from bark between their thalli; this illustration might consequently be of some other organism (see p. 281). A few authors have incorrectly given Schumacher's epithet as '*versicolor*' (e.g. Vouaux, 1914: 215), but as Schumacher used the spelling '*persicolor*' in his manuscript as well as in his publication, and compared the colour with the flowers of peach, '*persicolor*' is not to be regarded as a typographical error for '*versicolor*'.

Additional specimens: **British Isles**: England, Devon, Slapton, Duck Marsh, on *Parmelia glabratula* on *Salix*, 28 July 1977, D. L. Hawksworth 4480 (IMI 215200!), eastern margin of Slapton Ley, on *Physcia tenella* on *Sambucus*, 1 November 1973, D. L. Hawksworth 3569 (IMI 180128!); Surrey, Farnham, on *Lecanora conizaeoides*, February 1973, H. J. M. Bowen (IMI 224648!); Cumberland, Lazonby Fell, on *Parmelia omphalodes* and *P. sulcata*, 21 November 1975, R. W. M. Corner (IMI 199418!, 199419!, 199420!); Scotland, Argyll, Loch Drumbay, mainland opposite Tobermory, on *Parmelia saxatilis*, 12 August 1975, S. M. Francis (IMI 196190!).—**France**: Caen, on *Physcia tenella* on *Quercus*, Roberge (UPS-Fries!; authentic specimen).—**Germany**: Gipsel des Prudelberges bei Stonsdorf (Urschberg), on *Parmelia saxatilis*, 5 October 1848, Flotow (UPS-Fries!).

XI. LEIGHTONIOMYCES D. Hawksw. & B. Sutton

in Hawksworth, *Bot. J. Linn. Soc.* 75: 199 (1977).

See Hawksworth (1977a: 199–200) for description and further discussion of this genus.

Type species: *Leightoniomyces phillipsii* (Berk. & Leight.) D. Hawksw. & B. Sutton.

Number of species: Monotypic.

1. *Leightoniomyces phillipsii* (Berk. & Leight.) D. Hawksw. & B. Sutton, in Hawksworth, *Bot. J. Linn. Soc.* 75: 200 (1977).

See Hawksworth (1977a: 200–203) for synonymy, photomicrographs (including scanning electron micrographs) and description.

Hosts: Thalli of *Steinia geophana* (Nyl.) Stein and *Thrombium epigaeum* (Pers.) Wallr.; perhaps primarily associated with the *Leptosira* phycobiont these species have in common.

Distribution: Azores and the British Isles.

XII. MILOSPIUM D. Hawksw.

Trans. Br. mycol. Soc. 65: 227 (1975).

See Hawksworth (1975a) for further information on this genus.

Type species: *Milospium graphideorum* (Nyl.) D. Hawksw.

Number of species: Monotypic.

1. *Milospium graphideorum* (Nyl.) D. Hawksw., *Trans. Br. mycol. Soc.* 65: 228 (1975). (Fig. 26)

See Hawksworth (1975a: 228–231) for description, extensive synonymy, and further information on this species.

Hosts: On *Opegrapha* species, most commonly *O. lyncea* (Sm.) Borr. ex Hook. and less frequently on *O. atra* Pers.

Distribution: European, probably rather southern, reflecting the range of the major host. Reliably recorded at least from the British Isles, Czechoslovakia, France and Ireland.

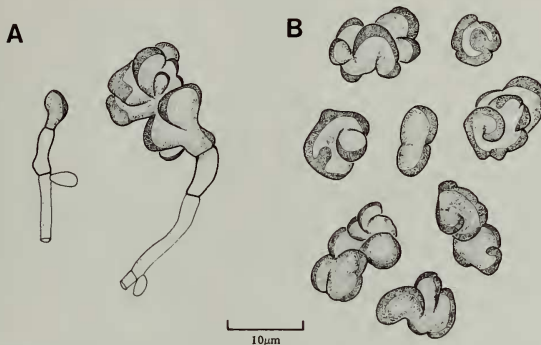


Fig. 26 *Milospiium graphideorum* (IMI 186254). Reproduced from Hawksworth (1975a : 230).

XIII. MONOCILLIUM Saksena

Indian Phytopath. 8 : 9 (1955).

Colonies effuse; mycelium usually superficial, irregularly and frequently branched, hyaline or shades of pink. Stroma, setae and hyphopodia absent. Conidiophores semi-macronematous to macronematous, mononematous, \pm hyaline, erect and unbranched or sparsely branched at the base, not or sparsely septate. Conidiogenous cells phialidic, discrete, terminal, subcylindrical, the lower portion characteristically with a thickened highly refractive wall, becoming thinner-walled above, sometimes not delimited from the conidiophores by a septum (orthophialides), hyaline, smooth-walled. Conidia solitary, catenate or adhering in a mass, slimy, hyaline, simple or 1-septate, ellipsoid to obpyriform or almost subglobose, not distinctly truncated basally in most species. Chlamydospores produced in a few species, generally in chains, subglobose, and brown.

Type species: *Monocillium indicum* Saksena.

Number of species: About 15. Twelve species were described and figured by Gams (1971 : 151–166) and are mainly saprophytes known from various decaying plant materials, wood and soil. Only one species may be lichenicolous.

Perfect state: Several of the species are known to have perfect states, all of them in *Niesslia* Auersw.

1. *Monocillium* state of *Niesslia cladoniicola* D. Hawksw. & W. Gams, in Hawksworth, *Kew Bull.* 30 : 194 (1975).

(Fig. 27)

Type: British Isles, Wales, Glamorgan, Merthyr Mawr, on aged podetia of *Cladonia rangiformis* in sand dunes, 15 September 1973, M. C. Clark (IMI 179266—holotype!; CBS 960.73—cultures).

Icones: Hawksworth, *Kew Bull.* 30 : 195 fig. 8 (1975).

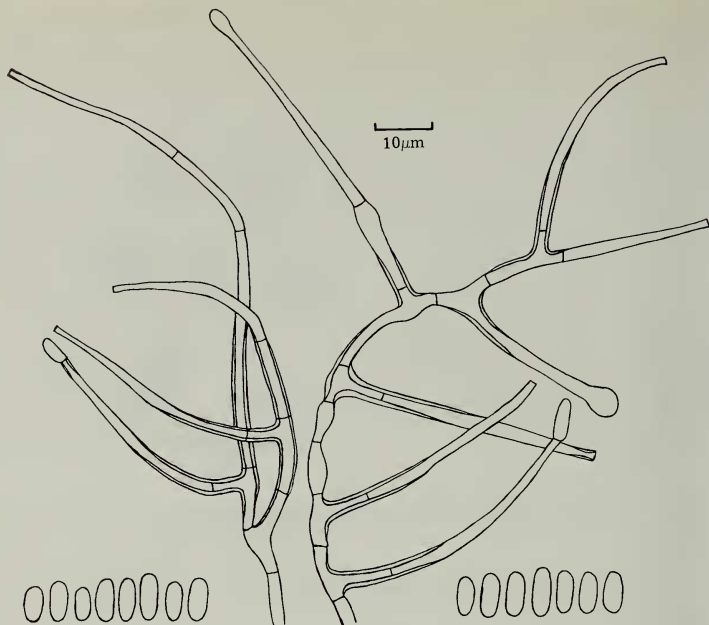


Fig. 27 *Monocillium* state of *Niesslia cladonicola* (CBS 960.73).
Reproduced from Hawksworth (1975b : 195).

Colonies only known in pure culture, growing rather slowly, pale rose, marginate; mycelium mainly superficial, hyphae flexuose, relatively thick-walled, hyaline, 1.5–2.5 μm wide. *Conidiophores* macronematous, mononematous, hyaline, erect, unbranched. *Conidiogenous cells* phialidic, orthotropic, discrete, terminal, subcylindrical, the lower part somewhat swollen and with a thickened refractive wall, becoming narrowed above, 25–37 μm long, 1.7–2.2 μm wide at the base and 0.7–1.2 μm wide at the apex. *Conidia* ellipsoid to subcylindrical, adhering in slimy heads, hyaline, simple, rounded at the apices, smooth- and thin-walled, 4.6 \times 2–2.4 μm . *Chlamydospores* absent.

Host: *Cladonia rangiformis* Hoffm., aged podetia.

Distribution: British Isles. Known only from the type collection.

Observations: The *Monocillium* imperfect state was obtained from the culture of single ascospores, and has not yet been found growing on lichens in the field. This state is included here, because since the perfect state is lichenicolous, the imperfect state is also presumably able to grow on lichens and consequently may be encountered in the future. The imperfect state has not been accorded a separate binomial as this appears superfluous when it is unknown to occur in nature. *Niesslia cladonicola* forms black superficial setose perithecia 100–150 μm diam and produces 1-septate hyaline ascospores 4.5–8 \times 1.5–2 μm .

XIV. MONODICTYS S. Hughes

Can. J. Bot. **36** : 785 (1958).

Colonies effuse, very variable in colour, most commonly greenish-brown to dark brown; mycelium mainly superficial, sometimes scant. Stroma, setae and hyphopodia absent. Conidiophores micro- or semi-macronematous, mononematous, not or irregularly branched, usually flexuose, hyaline to pale brown, smooth-walled, the cells sometimes somewhat inflated. Conidigenous cells monoblastic, integrated, terminal, determinate, subcylindrical to swollen and broadly ellipsoid or subglobose. Conidia solitary, dry, acrogenous, pale brown to dark brown or almost black, very variable in shape, always muriform when mature, smooth- or verrucose-walled, usually abundantly produced.

Type species: Monodictys putredinis (Wallr.) S. Hughes.

Number of species: About 15 species are currently accepted (Ellis, 1971 : 68–70, 1976 : 41–44). Most are lignicolous saprophytes or occur on decaying herbaceous stems. One species is only known on lichens (*Monodictys anapythiae*), and a second is either primarily or regularly facultatively lichenicolous (*M. lepraria*). The genus appears heterogeneous as currently circumscribed, but *M. lepraria* is definitely congeneric with *M. putredinis* which has smooth-walled many-celled massive conidia. *M. anapythiae*, however, belongs to another element in the genus, which includes species with verrucose, relatively few-celled and much smaller conidia; this latter element also includes *M. asperospora* (Cooke & Masee) M. B. Ellis, *M. castaneae* (Wallr.) S. Hughes and *M. fluctuata* (Tandon & Bilgrami) M. B. Ellis and might merit separation as a distinct genus.

Key to the lichenicolous species

- 1 Conidia 2–5(–6)-celled, distinctly verrucose when mature, 8–12 × 5–10 μm
Monodictys anapythiae (p. 241)
 – Conidia 50– or more celled when mature, smooth-walled, 25–50 μm diam to 100 × 50 μm
Monodictys lepraria (p. 241)

1. Monodictys anapythiae (Lindau) D. Hawksw., *Trans. Br. mycol. Soc.* **65** : 220 (1975).
 (Fig. 28)

See Hawksworth (1975a : 220–221) for description and synonymy.

Host: Anapythia ciliaris (L.) Körb., thalli. There are dubious reports of this fungus from several other hosts (see Hawksworth, *loc. cit.*).

Distribution: Known with certainty only from the type locality in Germany. The reports from France and the USSR (Bouly de Lesdain, 1910 : 280; Vouaux, 1914 : 313) are treated as dubious.

2. Monodictys lepraria (Berk.) M. B. Ellis, *More Demat. Hyphom.* : 44 (1976).
 (Fig. 29)

Sporidesmium lepraria Berk., *Kew J. Bot.* **5** : 43 (1853), nom. nov.

Lepraria nigra Turn. & Borr., in Smith, *Engl. Bot.*, tab. 2409 (1812); nom. inval. (Art. 13).

Lepraria nigra Turn. & Borr. ex Turn. & Borr., *Spec. Lich. Br.* : 21 (1839).

Type: England, ? Sussex, on gate posts, *W. Borrer* (K-Borr.—holotype!).

Non *Monodictys nigra* Matushima, *Icon. microfungi Matushima* : 98 (1975).

Sporidesmium cellulolum Sacc., *Syll. Fung.* **4** : 501 (1886); nom. illegit. (Art. 64).

Type: Italy, Padova, on *Pyrus communis*, *P. A. Saccardo* (PAD—lectotype non vidi; see Hughes, 1958 : 786).

Monodictys cellulosa S. Hughes, *Can. J. Bot.* **36** : 786 (1958), nom. nov.

Non *Sporidesmium cellulolum* (Corda) Rabenh., *Deutschl. Krypt.-Fl.* **1** : 31 (1844).

Sporidesmium lepraria var. *nigerrima* Berk., *Kew J. Bot.* **5** : 43 (1853).

Type: Canada, ? North West Territories, on wood, *loc. cit.* Pl. 3 fig. 9 (lectotype!).

Exsiccatae: Cooke, *Fungi Br.*, Ed. 2 no. 631 (IMI 10428!).—Vize, *Micro-fungi Br.* no. 24 (IMI 57023!).

Icones: Berkeley, *Kew J. Bot.* 5: Pl. 3 fig. 9 (1853).—Ellis, *More Demat. Hyphom.*: 43 fig. 27A (1976).—Saccardo, *Fungi Ital.* no. 907 (1881).

Colonies dispersed, superficial, dark brown to black, arising on the surface of the host lichen or on decorticate wood; mycelium scant, superficial, irregularly branched, hyphae relatively thin walled, smooth-walled, pale brown to brown, often markedly constricted at the septa, mainly 3–7 μm long and 2.5–4 μm wide. *Conidiophores* micronematous to semi-micronematous, mononematous, not or irregularly branched, flexuose, pale brown to brown or sometimes dark brown, smooth-walled, septate, often swollen between the septa, very variable in length, mainly 10–30 μm long. *Conidiogenous cells* monoblastic, integrated, terminal, determinate, subcylindrical to subglobose, brown to dark brown, mainly 4–7 μm wide and 4–6 μm tall. *Conidia* arising singly at the apices of the conidiogenous cells, dry, acrogenous, muriform, composed of 50 or more cells when fully developed, the individual cells mainly 5–10 μm diam, dark brown to black, even to uneven in outline, smooth-walled, thick-walled, very variable in size and shape, mainly subglobose and 25–50 μm diam or ellipsoid to elongate-ellipsoid and then to about 100 \times 50 μm .

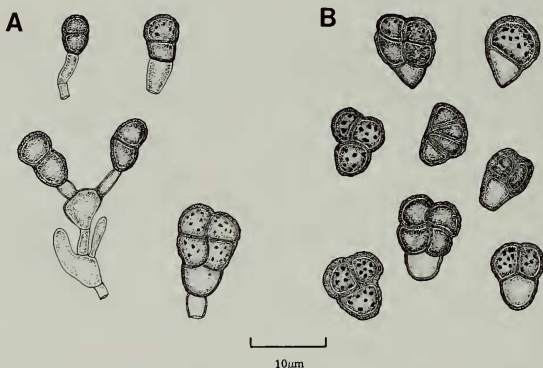


Fig. 28 *Monodictys anaptychiae* (HBG—isotype). A, Conidiogenous cells with attached conidia. B, Conidia. Reproduced from Hawksworth (1975a: 220).

Hosts: Most commonly collected from decorticate wood in xeric situations and on which it can thrive. This fungus is often found associated with lichen thalli (e.g. dead *Parmelia* cf. *subaurifera* Nyl. in the holotype, *Lecanora expallens* Ach. in Vize's exsiccatum) but appears to be a pathogen of *Lecanora conizaeoides* Nyl. ex Cromb.; in the latter species the fungus appears as black flecks over the thallus surface and apothecia and can even penetrate the hymenium to some extent. In IMI 224315 (with *L. conizaeoides*), the fungus also grows on the thallus of *Bacidia chlorococca* (Stiz.) Lett. and *Buellia pulverea* Coppins & P. James. Whether this species is primarily a lichenicolous fungus able to exist saprophytically on wood after the death of the host lichen, or whether it is a lignicolous saprophyte able to spread over lichens, remains uncertain.

Distribution: Canada and Europe. I have seen specimens only from the British Isles but the species is probably widespread.

Observations: I was in some doubt as to whether this fungus should be regarded as primarily lichenicolous or a saprophyte occasionally occurring on lichens. It is treated here and not under 'Excluded species' with some hesitation, principally because the species appears to have a predilection for *Lecanora conizaeoides* which it can kill.

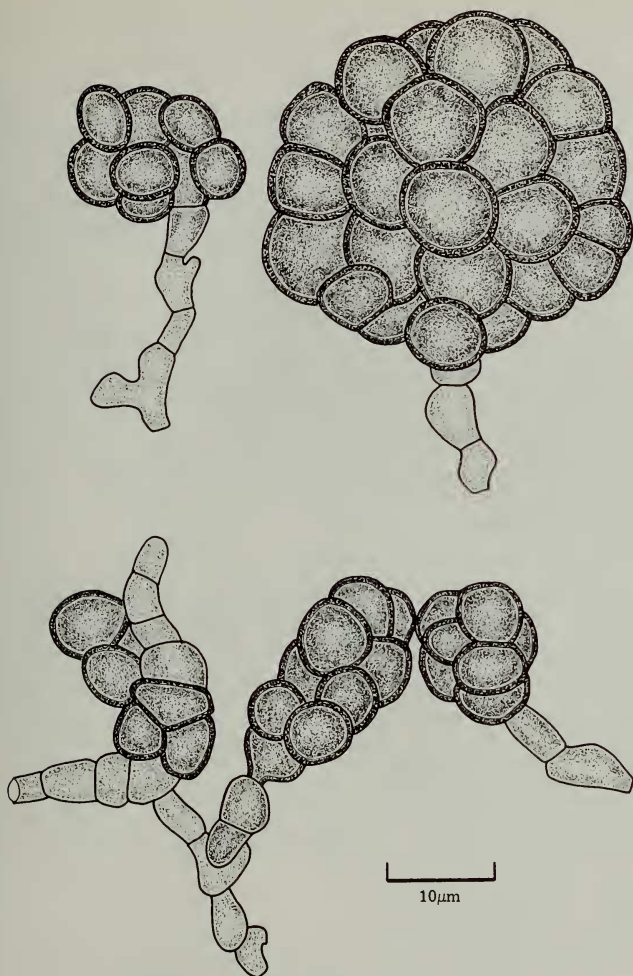


Fig. 29 *Monodictys lepraria* (IMI 224315).

The lichenicolous collections agree in all respects with material directly from lignum and their taxonomic separation cannot be justified. At first the conidia are almost globose and this shape predominates in IMI 224315; such conidia recall those of *Monodictys putredinis* (Wallr.) S. Hughes, which differs in that the conidia are only 20–30 × 15–25 µm. This type of conidium is illustrated in Fig. 29; for illustrations of elongate larger conidia see Ellis (1976 : 43).

As the full synonymy of this species does not appear to have been previously compiled it is presented here. *Spiloma microscopicum* Turn. & Borr. was considered to be '... a mere variety of the same species' by Berkeley (1853 : 43) but examination of the type material of that name (K-Borr.—holotype!) showed it to be a mixture of fungi best rejected under Art. 70 as based on discordant elements.

Additional lichenicolous specimens: **British Isles:** England, Warwickshire, Earlswood, Windmill Naps, on *Lecanora conizaeoides* on *Quercus*, 1 January 1973, M. C. Clark MCI287 (IMI 171798!); Scotland, Fife, Devilla Forest, on *Lecanora conizaeoides*, etc. on dead *Calluna* stems, 9 May 1976, B. J. Coppins 1770 (E, IMI 224315!).

XV. PSAMMINA Rouss. & Sacc.

Bull. Soc. r. Bot. Belg. 29 : 295 (1901).

Colonies discrete; mycelium mainly immersed, irregularly branched, subhyaline or pale brown. Stroma if present pseudoparenchymatous and poorly developed but sometimes appearing acervular. Setae and hyphopodia absent. Conidiophores semi-macronematous, mononematous, subhyaline, unbranched. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, subhyaline to pale brown. Conidia solitary, dry, acrogenous, almost hyaline to pale brown singly but distinctly brown in mass, multiseptate, palmate with numerous arms, arms transversely septate, slightly curved or straight, smooth to slightly and irregularly roughened.

Type species: *Psammia bommeriae* Rouss. & Sacc.

Number of species: Two, previously monotypic.

Observations: The type species of the genus is a saprophyte of *Ammophila* and *Juncus* culms and stems developing subepidermally. *Psammia* has generally been referred to the Melanconiales in the Coelomycetes (e.g. Sutton, 1973 : 556) because it can appear almost acervular even though the acervulum itself could be viewed as almost rudimentary. The discovery of a lichenicolous species developing mainly superficially and not enclosed by an epidermis at first prompts a reassessment of its position. That the lichenicolous species described below is congeneric with *P. bommeriae* cannot be doubted as the highly characteristic conidia and method of conidiogenesis are the same, and the species differ mainly in the sizes of parts of the complex conidia. As there is no evidence for an acervulum in *P. stipitata* it seems most appropriate to treat the genus as belonging to the Hyphomycetes and interpret the poorly delimited acervulum of *P. bommeriae* as only a rudimentary stroma appearing acervular in some cases due to modifications caused by the subepidermal habit. It would be of interest in this connection to study *P. bommeriae* in culture to see what form the stroma then assumed, but so far no isolates of it appear to have been obtained.

1. *Psammia stipitata* D. Hawksw. sp. nov.

(Fig. 30)

Fungus lichenicola. Mycelium plerumque immersum, ex hyphis cellulis subhyalinis, usque 3–4 µm latis. Conidiophora semi-macronemata, subhyalina, recta, non ramosa, usque 20–50 × 4–5 µm. Cellulae conidiogenae monoblasticae, integratae, cylindricae. Conidia solitaria, sicca, acrogena, multiseptata, palmata, ex circa 50 brachiis rectis vel leviter arcuatis, septatis, subhyalinis ad pallide brunneis, 25–50 × 3–3.5(–4) µm, levia vel irregulariter sparse rugosa, ubique 120–160 µm diam.

Typus: Magna Britannica, Anglia, Dorset, Chettle, in thallis *Schismatommae decolorantis* (Turn. & Borr. ex Sm.) Clauz. & Vězda ad *Quercum*, ii.1973, H. J. M. Bowen (IMI 225006—holotypus!).

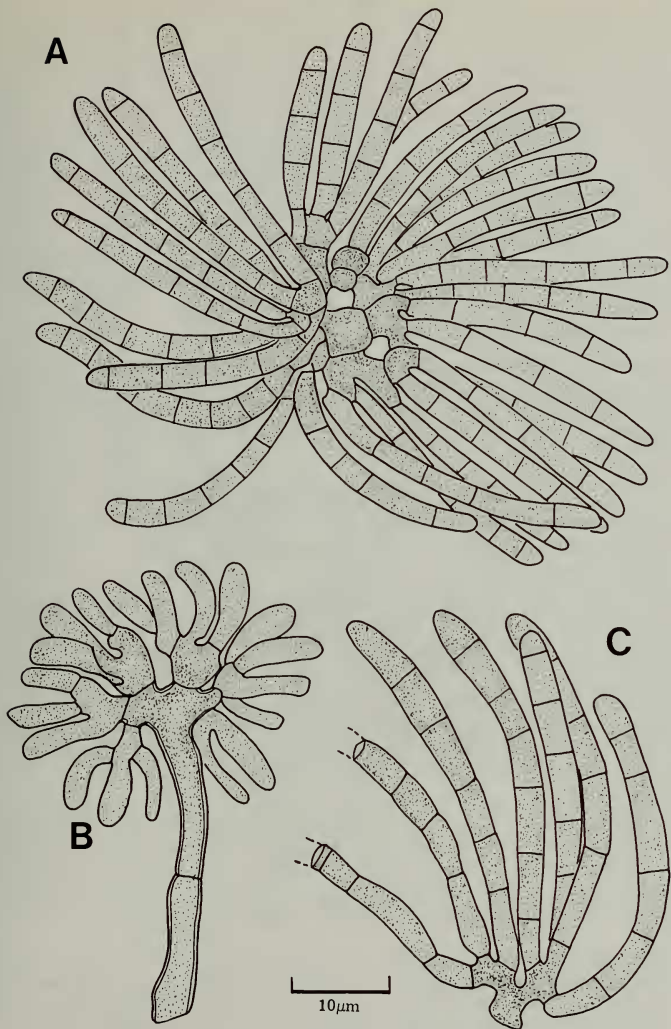


Fig. 30 *Psammia stipitata* (IMI 225006—holotype). A, Conidium. B, Conidiogenous cell with the arms of a conidium starting to develop. C, Detail of portion of a conidium.

Colonies discrete but sometimes becoming confluent and then appearing almost effuse, brown; mycelium mainly immersed, rather localised, composed of subhyaline to pale brown torulose hyphae mainly 3–4 μm wide, abundantly branched. *Conidiophores* semi-macronematous, tending to arise in small groups, erect, \pm straight or slightly flexuose, unbranched, smooth-walled, septate, very variable in length but mainly 20–50 μm tall (inclusive of the conidiogenous cell) and 4–5 μm wide. *Conidiogenous cells* monoblastic, integrated, terminal, cylindrical, not or poorly delimited from the conidiophores. *Conidia* arising singly, dry, acrogenous, multiseptate, palmate, consisting of about 50 arms, each arm with 3–7 transverse septa and 25–50 \times 3–3.5(–4) μm , subhyaline to pale brown, smooth-walled or irregularly sparsely rugose, the arms straight or slightly arcuate, generally somewhat uneven in diameter and tending to be swollen between some septa, overall 120–160 μm diam, clearly brown in mass.

Host: *Schismatomma decolorans* (Turn. & Borr. ex Sm.) Clauz. & Vězda, thallus. The fungus appears as small brownish granules on the surface of the thallus which is discoloured and killed in its presence. Adjacent thalli of *Enterographa crassa* (DC.) Fée in the type collection are not colonized by *Psammina stipitata*.

Distribution: British Isles. Known only from the type collection.

Observations: *Psammina stipitata* differs from *P. bommeriae* not only in the absence of an acervular stroma as mentioned above, but also in other features, in particular the more pronounced stalk-like conidiogenous cells and conidiophores, the very numerous arms of the conidia, and the longer and generally thicker arms (these latter mainly 1.5–3 μm wide in *P. bommeriae*).

XVI. PSEUDOCERCOSPORA Speg.

An. Mus. nac. Hist. nat. B. Aires 20: 438 (1910).

See Deighton (1976: 8–10) for synonyms of the generic name, a fuller description, and discussion of its relationships.

Colonies generally discrete, subhyaline to brown or dark brown; mycelium usually immersed. Stroma present or absent; setae and hyphopodia absent. Conidiophores macronematous, mononematous and arranged in caespitose tufts or in some species synnematosus, unbranched, straight to flexuose, erect, subhyaline to dark brown, smooth-walled. Conidiogenous cells sympodially polyblastic and with unthickened conidial scars (monoblastic when very young), integrated, terminal, subcylindrical to geniculate. Conidia solitary, dry, acrogenous or acropleurogenous, subhyaline to brown, elongate and narrowly ellipsoid to filiform or subcylindrical, often with a distinctly truncated base, with 3–numerous transverse septa, exceptionally also with occasional longitudinal septa, smooth to slightly verruculose.

Type species: *Pseudocercospora vitis* (Lév.) Speg.

Number of species: 226 species were accepted by Deighton (1976) almost all of which are specific to the leaves of particular subtropical or tropical plants, often causing leaf-spots. Only the following lichenicolous species is known.

1. *Pseudocercospora lichenum* (Keissl.) D. Hawksw. comb. nov.

(Fig. 31)

Cladosporium lichenum Keissl., *Zentbl. Bakt. ParasitKde* 11, 37: 389 (1913).

Type: Austria, Steiermark, valle See-Aü am Leopoldsteiner See bei Eisenerz, alt. 700 m, on *Haematoma cismonicum* apothecia, July 1912, K. von Keissler (W 1912/117—holotype!).

Icones: Keissler, *Zentbl. Bakt. ParasitKde* 11, 37: 390 fig. 2 (1913).—Keissler, *Rabenh. Krypt.-Fl.* 8: 12 fig. 7, 610 fig. 127–128 (1930).

Colonies effuse, dark brown to black, eventually covering the entire disc of the host apothecia; mycelium ramifying through the epithecium and into the thecium of the host apothecia, hyphae

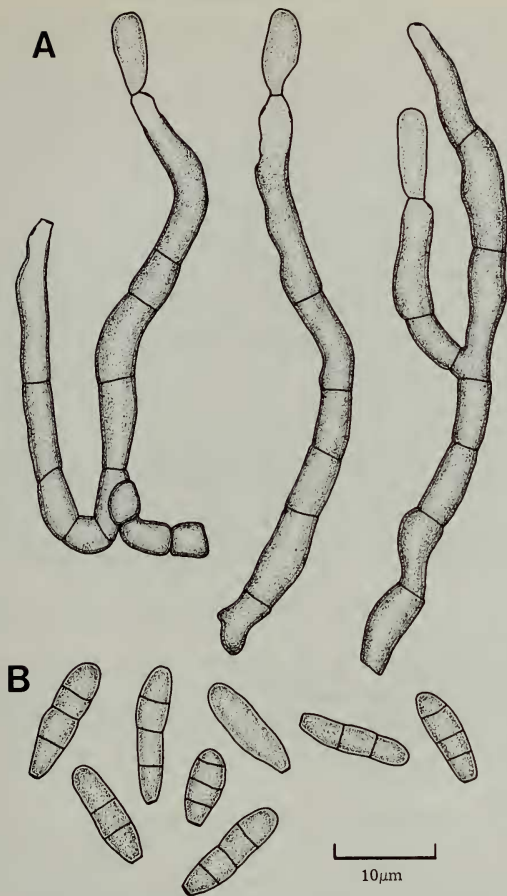


Fig. 31 *Pseudocercospora lichenum* (W 1912/117—holotype). **A**, Conidiophores, some with young conidia attached to the conidiogenous cells. **B**, Conidia.

flexuose, pale brown, relatively thin-walled, sometimes sparse, 1.5–3 μm wide. *Stroma* arising on the surface of the apothecial disc, very variable in extent, to 40 μm wide and 20 μm tall but structure often obscure due to mixture with the epithelial tissue and its granular pigments, composed of brown torulose hyphae with cells mainly 3–7 μm long. *Conidiophores* macronematous, mononematous, aggregated into fascicles of 2–3 or originating singly, divergent, usually unbranched, regularly septate, rather short-celled, not to slightly constricted at the septa, smooth-

and thick-walled, brown to dark brown below but tending to become somewhat paler above, mainly 40–60 μm tall and 3–4 μm wide, straight to slightly geniculate. *Conidiogenous cells* integrated, terminal, generally monoblastic but becoming polyblastic on older conidiophores and then sympodial, paler than the conidiophores and thinner-walled, mainly 2.5–3.5 μm wide, variable in length, conidial scars unthickened and very inconspicuous to almost indistinguishable. *Conidia* arising singly, not catenate, dry, subcylindrical to obclavate, truncated at the base but rounded at the apex, simple at first but becoming 3-septate when mature, often constricted at the central septum, smooth-walled to slightly roughened, pale olivaceous brown to brown, 9–14 \times 3–4 μm .

Host: *Haematomma cismonicum* Beltr., apothecia.

Distribution: Austria. Known only from the holotype collection.

Observations: The genus *Cladosporium* Link ex Fr. includes dematiaceous Hyphomycetes in which the conidia are borne in chains, not singly, and in which the conidial scars are generally thickened and so distinct (see Ellis, 1971). It is consequently clear that Keissler's fungus cannot be retained in *Cladosporium*. The most appropriate genus for this fungus appears to be *Pseudocercospora* Speg., which has been studied in some detail by Deighton (1976), and, as no previously accepted species in that genus appears to be conspecific with Keissler's fungus, *C. lichenum* is transferred to *Pseudocercospora* here. The conidiophores are less markedly fasciculate than is usual in most species of *Pseudocercospora*, the conidia are relatively small, and the conidial scars particularly difficult to discern.

Two other collections were tentatively referred to this species by Keissler (France: Deux Sevres, on *Cladonia squamules*, 1879, Richard, W 1932/1833! ex M; Tanzania: Öst-Usambara, Amani, alt. 800 m, on *Phyllospora parvifolia* var. *granulosa* (Tuck.) Müll. Arg. apothecia, July 1909, J. Brünthaler, W 1932/2998!) but in neither of these could the fungus present be reliably referred to a genus because of the poor nature of the material. Keissler's original slides prepared from the holotype of *Cladosporium lichenum* are preserved as W 1912/118(!).

XVII. REFRACTOHILUM D. Hawksw.

Bot. J. Linn. Soc. 75: 204 (1977).

See Hawksworth (1977a: 204) for description and further information on this genus.

Type species: *Refractohilum galligenum* D. Hawksw.

Number of species: Three, all of which are lichenicolous although one may persist on wood or bark after the decay of the host.

Key to the species

- | | | |
|---|---|---|
| 1 | Conidia non-septate | 2 |
| - | Conidia 3-septate when mature, (11-)13-15(-17) \times 3.5-4.5(-6) μm | <i>Refractohilum achromaticum</i> (p. 248) |
| 2 | Conidia (8-)9-11(-14) \times 3-3.5(-4) μm | <i>Refractohilum galligenum</i> (p. 249) |
| - | Conidia (15-)18-20(-25) \times 6-7.5(-9) μm | <i>Refractohilum peltigerae</i> (p. 248) |

1. *Refractohilum achromaticum* (B. Sutton) D. Hawksw., *Bot. J. Linn. Soc.* 75: 205 (1977).

See Hawksworth (1977a) for description, illustration and synonymy.

Host: Probably primarily a parasite of *Parmelia* cf. *sulcata* T. Tayl. but able to persist on wood or bark for some time after the death of the host.

Distribution: Canada. Known from numerous collections made in Manitoba and Saskatchewan.

2. *Refractohilum galligenum* D. Hawksw., *Bot. J. Linn. Soc.* 75: 207 (1977).

See Hawksworth (1977a) for description and illustration.

Host: Nephroma laevigatum Ach., thalli. Infected lobes have bullate gall-like deformations discoloured ochre-yellow to brownish from the surface of which the conidiophores project giving a frosted appearance.

Distribution: British Isles. Known only from the type collection from Devon.

3. *Refractohilum peltigerae* (Keissl.) D. Hawksw., *Bot. J. Linn. Soc.* 75 : 208 (1977).

See Hawksworth (1977a) for description, illustration and synonymy.

Hosts: Peltigera species, thalli. Particularly frequent on *P. rufescens* (Weiss) Humb. and *P. spuria* (Ach.) DC. on which it produces bullate gall-like deformations which are reddish-brown in colour and from the surface of which the conidiophores project giving a frosted appearance.

Distribution: Europe. Reliably reported from Austria, Bulgaria, Czechoslovakia, Finland and Sweden.

XVIII. SCLEROCOCCUM Fr. ex Fr.

Syst. orb. Veg. 1 : 173 (1825).

See Hawksworth (1975a) for further information on this genus.

Type species: Sclerococcum sphaerale (Ach. ex Ficinus & Schubert) Fr.

Number of species: Only one species was accepted by Hawksworth (1975a) but an additional species has since been discovered which is described below. Both are obligately lichenicolous.

Key to the species

- | | | |
|---|---|--|
| 1 | Conidia 1(-2) celled, (3.5-)4-7(-8) μm diam | <i>Sclerococcum simplex</i> (p. 249) |
| - | Conidia 2-6(-9) celled, (8-)10-15(-17) μm diam | <i>Sclerococcum sphaerale</i> (p. 250) |

1. *Sclerococcum simplex* D Hawksw. sp. nov.

(Fig. 32)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis hyalinis ad pallide brunneis, usque 2-3 μm latis. Conidiophora semi-macronemata, in sporodochiis, simplicia ad sparse ramosa, hyalina ad pallide brunnea, 3-5 μm lata. Cellulae conidiogenae monoblasticae vel rarissimo polyblasticae, integrae, subglobosae ad ellipsoideae, usque pallide brunneae, non bene distinctae. Conidia catenata, sicca, acropleurogena, subglobosa, 0(-1) septata, levia, atrobrunnea, (3.5-)4-7(-8) μm diam.

Typus: Magna Britannica, Scotia, Westernness, Knoydart, in valle inter Creag Bheithe et Stob na Muicraidh, in thallo *Pertusariae* cf. *ophthalmizae* (Nyl.) Nyl. in *Betula*, 22.v.1976, *B. J. Coppins & F. Rose* 2217 (E—holotypus!).

Colonies forming discrete patches mainly on the apothecial verrucae of the host but also occurring on the thallus, mycelium originating deep in the host tissues, dark brown to black; mycelium entirely immersed, composed of hyaline to pale brown flexuose hyphae mainly orientated vertically, hyphae thin- and smooth-walled, septate, generally somewhat constricted at the septa, irregularly branched, mainly 2-3 μm wide. *Conidiophores* semi-macronematous, meristematic, aggregated into dense tufted convex sporodochia (50-)100-300 μm diam, not or sparsely branched, hyaline or more usually pale brown, formed of swollen cells mainly 3-5 μm wide. *Conidiogenous cells* monoblastic or more rarely polyblastic, integrated, terminal, subglobose to ellipsoid, mainly pale brown, not very distinct. *Conidia* produced in short basipetal chains, separating rather easily, dry, acrogenous, subglobose, brown to dark brown, mainly non-septate but rarely 1-septate, smooth- and thick-walled, non-septate conidia (3.5-)4-7(-8) μm .

Host: Pertusaria cf. *ophthalmiza* (Nyl.) Nyl., apothecial verrucae and more rarely thallus. Apparently scarcely damaging the host and perhaps a parasymbiont.

Distribution: British Isles. Known only from the type collection.

Observations: The superficial appearance of this species is remarkably similar to that of *Sclerococcum sphaerale*, which is known to inhabit saxicolous but not corticolous *Pertusaria* species, but on microscopic examination proves to be readily distinguishable by the 0(-1) celled conidia and less complex conidiogenous apparatus. At first I wondered if *S. simplex* should be placed in the same genus as *S. sphaerale* but as they agree in most characters apart from the arrangement of the conidiogenous cells and the conidia not usually being multicellular in *S. simplex*, and further as they occur on allied hosts, it seems most prudent to enlarge the concept of *Sclerococcum* to include this species.

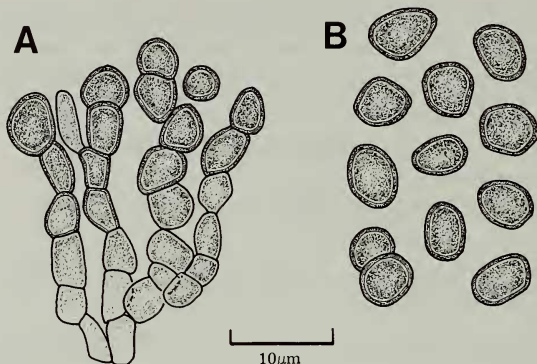


Fig. 32 *Sclerococcum simplex* (E—holotype). A, Conidiophores and conidia. B, Conidia.

2. *Sclerococcum sphaerale* (Ach. ex Ficus & Schubert) Fr., *Syst. orb. veg.* 1: 173 (1825). (Fig. 33)

See Hawksworth (1975a: 223–227) for description, extensive synonymy and further observations on this species.

Hosts: On saxicolous *Pertusaria* species, most commonly encountered on *P. corallina* (L.) Arnold thalli. There are erroneous and unsubstantiated reports from a wide range of other hosts (see Hawksworth, *loc. cit.*); to these can be added one reputedly on *Caloplaca saxicola* (Hoffm.) Nordin (Wheldon, 1923).

Distribution: Europe. Reliably recorded at least from Austria, the British Isles, Czechoslovakia, France, Germany, Iceland, Ireland, Italy, Portugal, Sweden and Switzerland.

Specimens (additional to those listed by Hawksworth, 1975a; all on *Pertusaria corallina* unless otherwise indicated): **Austria:** Steiermark, Schladminger Tauren, Lassachtal oberhalb der Breitlahnhütte in der Kleinsölk, alt. 1300–1500 m, 9 July 1973, *J. Poelt* (hb. Poelt!); Steiermark, Stubalpe, Ostrücken des Speikkogel, alt. 1750–1800 m, on indet. white K- thallus, 24 June 1973, *J. Poelt* 72333 (hb. Poelt!).—**British Isles:** England, Devon, Dartmoor, Rippon Tor, 30 August 1976, *D. L. Hawksworth* 4341 (IMI 206383!); Scotland, W. Ross, Little Gruinard Bay, June 1977, *F. S. Dobson* (IMI 214675!); Wales, Caernarvonshire, Gwydyr Forest, 15 October 1977, *D. L. Hawksworth* 4548 (IMI 217411!).—**France:** Pyrénées atlantiques, Vallée des Aldudes, Banca, vallon de la Hayra, alt. 400–500 m, 20 April 1972, *J. Vivant* (BM!).—**Italy:** Presanella-Gruppe, Trentino, W ober Madonna di Campiglio, alt. 1950–2100 m, 25 October 1976, *J. Hafellner* (hb. Hafellner 1821!).

XIX. SESSILIOSPORA D. Hawksw. gen. nov.

Genus lichenicola ad Hyphomycetes Dematiaceae s.l. pertinens. Stromata, setae et hyphopodia absentia. Conidiophora micronemata, mononemata, prostrata, simplicia vel ramosa, brunnea, levia.

Cellulae conidiogenaе monotreticae, integratae, intercalares, determinatae, brevi-cylindricaе, atrobrunneae, cum una cicatrice laterali, ovali et subhyalina instructae. Conidia solitaria, sicca, acrogena, elongata et obclavata, transverse septata, levia, cellulis brunneis sed cellula apicali in rostro subhyalino.

Colonies effuse; mycelium superficial, adpressed, branched. Stroma, setae and hyphopodia absent. Conidiophores micronematous, mononematous, prostrate, simple or branched, brown, smooth-walled. Conidiogenous cells monotretic, integrated, intercalary, determinate, short-cylindrical, dark brown, with a lateral oval subhyaline scar. Conidia solitary, dry, acrogenous, elongate-obclavate, transversely septate, smooth-walled, the lower cells brown but the apical cell elongated, beak-like and subhyaline.

Type species: *Sessiliospora bicolor* D. Hawksw. (holotypus).

Number of species: Monotypic.

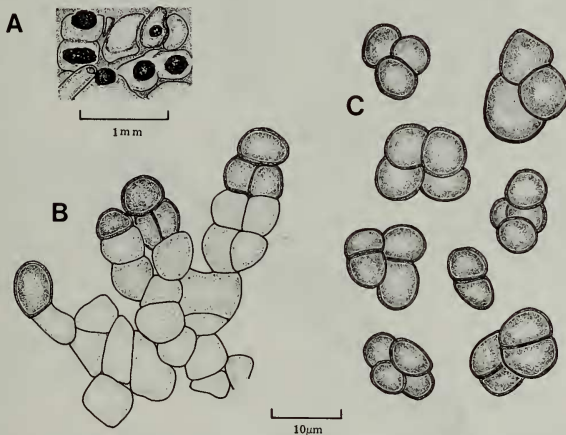


Fig. 33 *Sclerococcum sphaerale* (IMI 186244). A, Sporodochia on *Pertusaria corallina*. B, Conidiophores. C, Conidia. Reproduced from Hawksworth (1975a : 224).

1. *Sessiliospora bicolor* D. Hawksw. sp. nov. (Fig. 34)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis pallide brunneis vel subhyalinis, 2.5–3.5 μm latis, cellulis hyphopodiis absentibus. Cellulae conidiogenaе monotreticae, integratae, intercalares, determinatae, brevi-cylindricaе, atrobrunneae, plerumque 8–10 μm longae et 4.5–6 μm latae, cum una cicatrice laterali, ovali, subhyalina et 1–1.5 μm diam instructae. Conidia solitaria, sicca, acrogena, elongato-obclavata, 3–4 transverse septata, levia, 30–35(–45) × 4–5.5 μm, cellulis atrobrunneis sed cellula apicali in rostro subhyalino, cellula basi truncata.

Typus: Malaya, Selangor, Serdang, Federal Experimental Station, in lichenibus foliicolis (*Lasioloma arachnoideum* (Kremp.) R. Sant. et indet.) ad *Lancium domesticum* var. *dukii*, 11.xi.1949, A. Johnston 478 p.p. (IMI 41011c—holotypus!).

Colonies dispersed, superficial, brown to dark brown, arising on the surface of the host lichen; mycelium superficial, adpressed, irregularly branched, hyphae relatively thin-walled, smooth-walled, flexuose, pale brown to almost hyaline, septate, only slightly constricted at the septa, 2.5–3.5 μm wide; hyphopodia absent. *Conidiogenous cells* monotretic, integrated, intercalary and

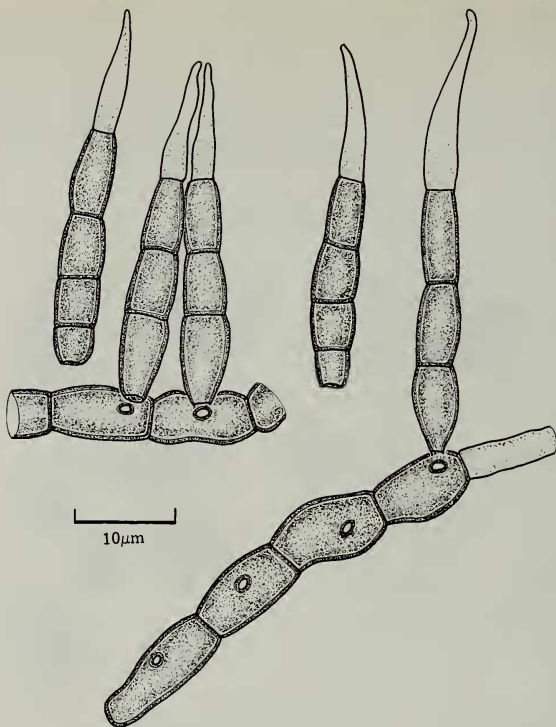


Fig. 34 *Sessiliospora bicolor* (IMI 41011c—holotype).

often forming long prostrate chains of 10 or more cells, determinate, short-cylindrical or barrel-shaped, dark brown, smooth-walled, mainly 8–10 μm long and 4.5–6 μm wide, with a distinct lateral scar on the dorsal face which is oval, subhyaline, and 1–1.5 μm diam. *Conidia* solitary, dry, pleurogenous, acrogenous, elongate-obclavate, 3–4 septate, smooth- and thick-walled, portion excluding the terminal cell dark brown and 18–25 μm long, basal cell abruptly truncated and apparently with a papillate depressed scar, apical cell elongated, subhyaline, tapering to 2–3 μm wide near the apex and thinner-walled, overall dimensions of the conidia 30–35(–45) \times 4–5.5 μm .

Host: *Lasioloma arachnoideum* (Kremp.) R. Sant. (thallus) and a sterile indeterminate thallus are colonized and apparently damaged by this fungus. Several other foliicolous lichens are present on the leaf with the type of this species (e.g. *Gyalectidium aspidotum*, *Strigula nemathora* Mont., *Tricharia* sp.) but these are not attacked by it.

Distribution: Malaya. Known only from the type collection.

Observations: This genus is perhaps, at least superficially, most similar to *Dictyophrynella* Bat. & Cavalcanti; its distinction from that genus has been discussed above (p. 214) so is not

repeated here. In addition *Sessiliospora bicolor* has some slight similarity to *Piricauda paraguayensis* (Speg.) R. T. Moore (see Ellis, 1971 : 369–370), a foliicolous tropical South American fungus, but that has much more irregularly arranged conidiogenous cells and almost subglobose to pyriform muriform basal parts to the conidia.

Hansfordiellopsis lichenicola is also present on the type collection of *Sessiliospora bicolor*.

XX. TAENIOLELLA S. Hughes

Can. J. Bot. 36 : 816 (1958).

Colonies dispersed, effuse or aggregated into tufts, brown to black; mycelium generally immersed but sometimes becoming superficial. Stroma, setae and hyphopodia absent. Conidiophores semi-macronematous, usually aggregated into small groups, erect, straight or flexuose, not or sparsely branched (particularly near the base), brown, smooth-walled or somewhat verrucose. Conidiogenous cells monoblastic, integrated, terminal, determinate, subcylindrical or doliiform. Conidia usually arising in long acropetal chains, dry, acrogenous, brown to dark brown, 1–24 or more septate depending on the species, subcylindrical to doliiform, usually constricted at the septa, often not separating easily with the outer walls becoming deformed, thick-walled, smooth-walled or verrucose.

Type species: *Taeniolella exilis* (P. Karst.) S. Hughes.

Number of species: 21 species, including those described below, have been recognized, of which four are so far known only from lichens. *Taeniolella* species are essentially saprophytes occurring on bark and wood or other decaying plant materials and at least two may be fortuitously found on lichen thalli: *T. breviscula* (Berk. & Curt.) Hughes (see p. 288) and *T. scripta* (P. Karst.) S. Hughes (**British Isles:** Warwickshire, Oversley Wood, on *Lecanora corizaecoides* Nyl. ex Cromb. on *Corylus*, spreading from adjacent bark, 11 May 1973, M. C. Clark MC1329, IMI 173234!). Twelve species of the genus are described and illustrated in Ellis (1971 : 91–94, 1976 : 55–62).

Key to the lichenicolous species

- | | | |
|---|---|--|
| 1 | Conidia mainly 1–3 septate | 2 |
| – | Conidia 2–17 septate, 12–70 × 5–7 µm; fortuitously lichenicolous | |
| | | <i>Taeniolella scripta</i> (P. Karst.) S. Hughes |
| 2 | Conidia smooth-walled at maturity | 3 |
| – | Conidia coarsely verrucose at maturity due to the splitting and disintegration of the outer wall, 10–13 × 8–10 µm | |
| | | <i>Taeniolella verrucosa</i> (p. 258) |
| 3 | 1-septate conidia exceeding 15 µm in length | 4 |
| – | 1-septate conidia less than 15 µm in length | 5 |
| 4 | Conidia mostly 2–3 septate, 17–45 × 10–13 µm; fortuitously lichenicolous | |
| | | <i>Taeniolella breviscula</i> (Berk. & Curt.) S. Hughes |
| – | Conidia mostly 1-septate, 18–25 × 7–9 µm | |
| | | <i>Taeniolella phaeophysciae</i> (p. 255) |
| 5 | 1-septate conidia 7–11 × 3.5–5(–6) µm | |
| – | 1-septate conidia 10–12.5 × 6–9 µm | |
| | | <i>Taeniolella delicata</i> (p. 253) |
| | | <i>Taeniolella punctata</i> (p. 257) |

1. *Taeniolella delicata* M. S. Christ. & D. Hawksw. sp. nov.

(Fig. 35)

Fungus lichenicola. Mycelium immersum ad superficiale, ex hyphis pallide brunneis, 2–3.5 µm latis. Conidiophora semi-macronemata, plerumque caespitosa, recta, non vel ad basim sparse ramosa, brunnea, 15–30(–50) × 3.5–6 µm. Cellulae conidiogenae monoblasticae, integrae, subcylindricae. Conidia plerumque catenata, sicca, acrogena, doliiformia, 1(–2) septata, levia, brunnea, 7–11 × 3.5–5(–6) µm.

Typus: Magna Britannica, Anglia, Buckinghamshire, Waddesdon Manor, in *Lecanora* cf. *chlarotera* Nyl. (apothecia) ad *Fraxinum*, 20.iv.1977, D. L. Hawksworth 4457 (IMI 214396—holotypus).

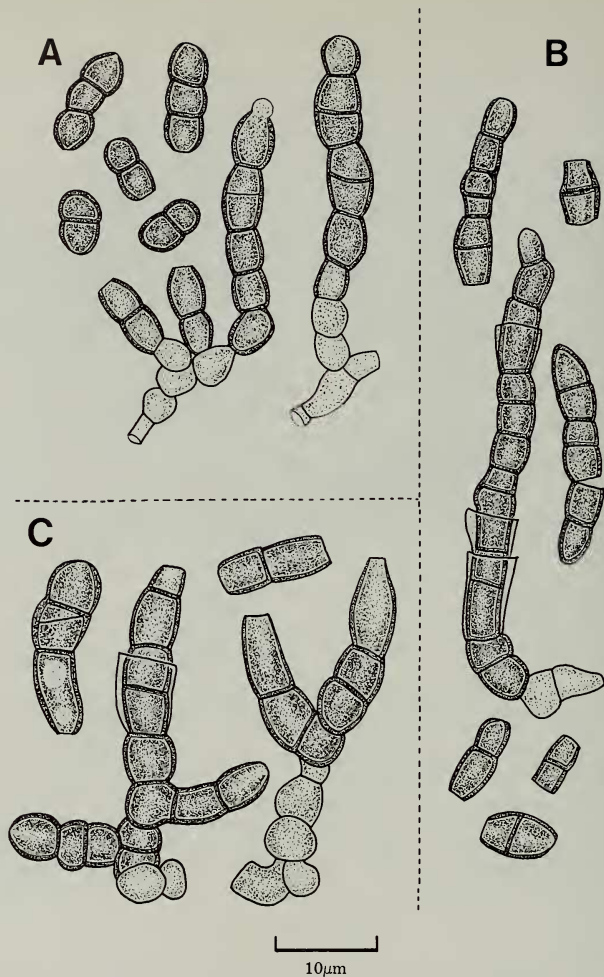


Fig. 35 *Taeniolella delicata*. A, IMI 2205005. B, IMI 214396 (holotype).
C, on *Buellia*, hb. Christiansen.

Colonies scattered over the infected tissues of the host, or compacted and filling apothecia, dark brown to almost black; mycelium partly immersed and originating deep in the thallus but sometimes largely superficial, rather sparsely developed, composed of very pale brown flexuose hyphae, hyphae thin- and smooth-walled, septate, often constricted at the septa, mainly 2–3.5 µm wide. *Conidiophores* semi-macronematous, tending to arise in caespitose tufts, straight, not branched or with 1–3 branches at the base, brown, smooth-walled, thicker-walled than the mycelial hyphae, septate, becoming somewhat constricted at the septa, 15–30(–50) × 3.5–6 µm. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical, brown, not well-marked and with the terminal cells acting in turn as conidiogenous cells. *Conidia* mostly adhering in chains, separating only with difficulty, dry, acrogenous, doliiform, brown, 1(–2) septate, slightly or not constricted at the septa, smooth- and thick-walled, 7–11 × 3.5–5(–6) µm.

Hosts: *Arthonia impolita* (Hoffm.) Borr. (apothecia and thallus), *Buellia punctata* (Hoffm.) Massal. (thallus), *Candelariella vitellina* (Hoffm.) Müll. Arg. (apothecia), *Lecanora* cf. *chlarotera* Nyl. (apothecia), *L. campestris* (Schae.) Hue (apothecia), *L. pallida* (Schreb.) Rabenh. (apothecia), *Physconia pulverulenta* (Schreb.) Poelt (thallus) and *Rhizocarpon obscuratum* (Ach.) Massal. (thallus). Evidently pathogenic to both apothecia and thalli of infected hosts which it can destroy. Infected apothecia soon become discoloured brown to dark brown or almost black, ascus production is inhibited, and the whole of the hymenium eventually becomes occupied by a mass of conidiophores. On *Physconia pulverulenta* infections first appear as dispersed black spots which later become confluent extending over large parts of the thallus.

Distribution: Austria, British Isles, Denmark, France and Sweden.

Observations: For some time I was uncertain as to whether all the collections treated under this name here should be regarded as conspecific because of variations in the shape and size of the conidia. However, as varying degrees of overlap occurred between the collections, and the amount of variation is less than that already known in some other species of the genus, separation into several species does not appear to be justifiable on the basis of the material currently available.

Taeniellella delicata appears to be quite distinct from other species referred to the genus, but nevertheless shows some similarity to *T. faginea* (Fuckel) S. Hughes which differs in the 3–5 septate larger (15–37 × 6–9 µm) conidia.

Additional specimens: **Austria**: Nördliche Kalkalpen, Steiermark, Gesäuse, ca. 2 km E von Gstatterboden, alt. 600–660 m, on *Lecanora pallida*, 2 October 1977, J. Hafellner (hb. Hafellner 2499 p.p.).—**British Isles**: S. Devon, Slapton, Southgrounds Farm, on *Lecanora campestris* on wall, 28 August 1977, D. L. Hawksworth 4478b (IMI 215199b!).—**Denmark**: Zealand, Jungshoved, on *Buellia punctata* on *Populus*, 12 August 1966, M. Skytte Christiansen (hb. Christiansen!); Zealand, Vallo, on *Physconia pulverulenta* on *Tilia*, 31 May 1942, M. Skytte Christiansen 8084 (IMI 226838!); Zealand, Kildebronde, on *Physconia pulverulenta* on *Fraxinus*, 22 September 1940, M. Skytte Christiansen 5797 (IMI 226837!); Zealand, Bognæs, on *Physconia pulverulenta* on *Populus*, 20 September 1942, M. Skytte Christiansen 9619 (hb. Christiansen 592!); East Jutland, Helgenæs, on *Candelariella vitellina* on boulder at shore of Begtrup Vig, 10 October 1976, M. Skytte Christiansen 76.814 (hb. Christiansen 419!).—**France**: Eure, Les Andelys, along road to Val-St-Martin, on *Rhizocarpon obscuratum* on pebble, 7 May 1977, M. Skytte Christiansen 77.085 (IMI 225005!), hb. Christiansen).—**Sweden**: Skåne, Genarp, Hackeberga, on *Arthonia impolita* on old *Quercus* at the lake, 24 April 1946, M. Skytte Christiansen 12.967 p.p. (hb. Christiansen 569 p.p., 571!).

2. *Taeniellella phaeophysciae* D. Hawksw. sp. nov.

(Fig. 36)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis pallide brunneis, 2.5–4 µm latis. Conidiophora semi-macronemata, caespitosa, recta, non ramosa, atrobrunnea, 40–80(–150) × 7–9 µm. Cellulae conidiogenae monoblasticae, integrae, subcylindricae. Conidia catenata, sicca, acrogena, doliiformia, plerumque 1-septata, levia, atrobrunnea, guttulate, 18–25 × 7–9 µm.

Typus: Magna Britannica, Anglia, Devon, Slapton, Slapton Ley, prope mare, in *Phaeophyscia orbicularis* (Neck) Moberg ad *Sambucus*, 11.v.1975, D. L. Hawksworth 3999 (IMI 194016—holotypus!).

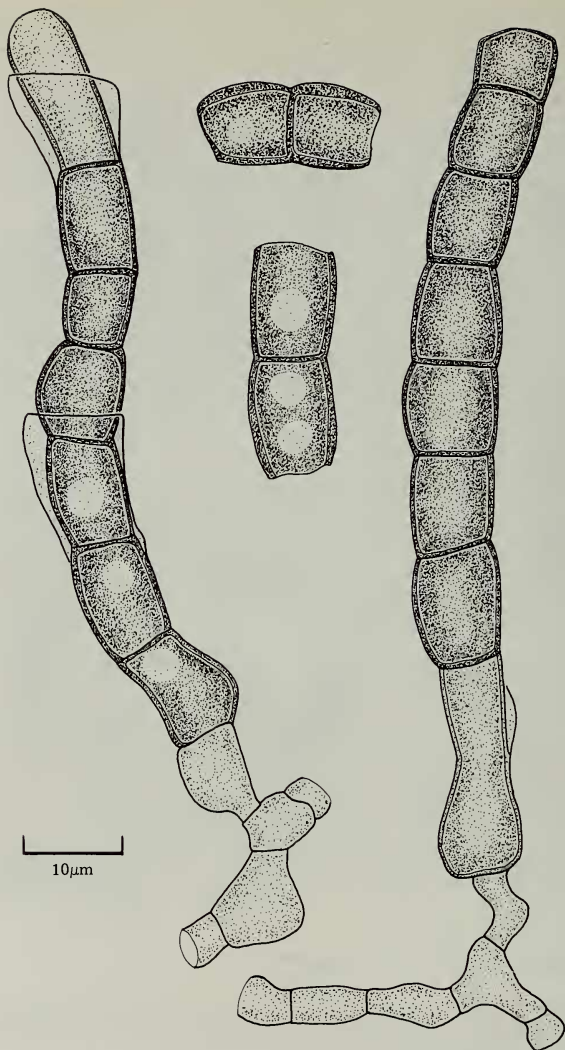


Fig. 36 *Taeniolella phaeophysciae* (IMI 194016—holotype).

Colonies usually discrete in strictly localized areas of the host thallus, more rarely somewhat scattered, dark brown to black and then often somewhat shiny; mycelium mainly immersed in the upper cortex of the host, composed of pale brown flexuose hyphae, hyphae thin-walled, smooth-walled, septate, not or slightly constricted at the septa, 2.5–4 µm wide. *Conidiophores* semi-macronematous, arising singly or in caespitose tufts, straight, unbranched, dark brown, septate, smooth- and thick-walled, constricted at the septa, very variable in height, 40–80(–150) × 7–9 µm. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical to doliiform, dark brown, not well marked with the terminal cells acting in turn as conidiogenous cells. *Conidia* adhering in chains, separating with difficulty, dry, acrogenous, doliiform, dark brown, mostly 1-septate, only slightly constricted at the septum, frequently 1–2 guttulate, smooth- and thick-walled, 18–25 × 7–9 µm.

Hosts: Phaeophyscia orbicularis (Neck.) Moberg (thallus) and *Physconia pulverulenta* (Schreb.) Poelt (thallus). The caespitose dark brown to black tufts of conidiophores are easily seen with a hand lens. Infected lobes tend to become somewhat bleached suggesting that this species may be a pathogen.

Distribution: British Isles and Ireland.

Observations: This is a distinctive and rather constant species which is similar to *Taeniolella exilis* (P. Karst.) S. Hughes, a rather rare species of *Betula* bark and wood. *T. exilis* differs from *T. phaeophysciae* in the larger and broader conidia which are mostly 1–3 septate and 22–75 × 12–15 µm.

Additional specimens: **British Isles:** Huntingdonshire, Glatton, on *Phaeophyscia orbicularis*, 18 March 1977, P. M. Earland-Bennett (IMI 224497!); Wiltshire, Burderop Park, on *Phaeophyscia orbicularis* on *Fraxinus*, December 1972, H. J. M. Bowen (IMI 224496!).—**Ireland:** South Tipperary, Marfield House, on *Physconia pulverulenta* on *Fraxinus*, 1 July 1974, M. R. D. Seaward (E!).

3. *Taeniolella punctata* M. S. Christ. & D. Hawksw. sp. nov.

(Fig. 37)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis pallide brunneis, usque 4–6 µm latis. Conidiophora semi-macronemata, caespitosa, recta, usque ad basim 1–3 ramosa, brunnea, 20–40(–60) × 5–8 µm. Cellulae conidiogenae monoblasticae, integratae, subcylindricae. Conidia catenata, sicca, acrogena, doliiformia, 1–2 septata, levia, brunnea, uniseptata est 10–12.5 × 6–9 µm.

Typus: Dania, Lolland, Ryde, in sylvae Kristianssæde Skov, in *Græpe scripta* (L.) Ach. (thallus) ad *Carpinus*, 24.vii.1977, M. Skytte Christiansen 77.140 (IMI 225002—holotypus!; hb. Christiansen—isotypus).

Colonies scattered over the host thallus, punctate, brown; mycelium immersed, rather scant, extending into the host tissues intermixed with the periderm of the phorophyte, composed of subhyaline to pale brown flexuose torulose hyphae, hyphae thin-walled, smooth-walled, septate, generally markedly swollen between the septa, mainly 4–6 µm wide. *Conidiophores* semi-macronematous, arising in small caespitose tufts, erect, usually 1–3 branched at the base, dark brown, smooth-walled, thick-walled, septate, constricted at the septa, 20–40(–60) × 5–8 µm. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical, brown to dark brown, not well-defined with the terminal cells in turn acting as conidiogenous cells. *Conidia* adhering in chains, separating only with difficulty, dry, acrogenous, doliiform, dark brown, 1–2 septate, not usually constricted at the septa, smooth- and thick-walled, 1-septate conidia 10–12.5 × 6–9 µm.

Host: Graphis scripta (L.) Ach., thallus. The fungus is limited to the lichen colonies in the type collection and does not occur on adjacent bark. The *Graphis* is abundantly colonized by the *Taeniolella* and in a degenerate condition, which, in view of the even distribution of the fungal infection punctae, is probably caused by this fungus.

Distribution: Denmark. Known only from the type collection.

Observations: *Taeniolella punctata* is most similar to *T. pulvillus* (Berk. & Br.) M. B. Ellis, a species of *Quercus* bark, but differs from that fungus in that *T. pulvillus* forms large compact

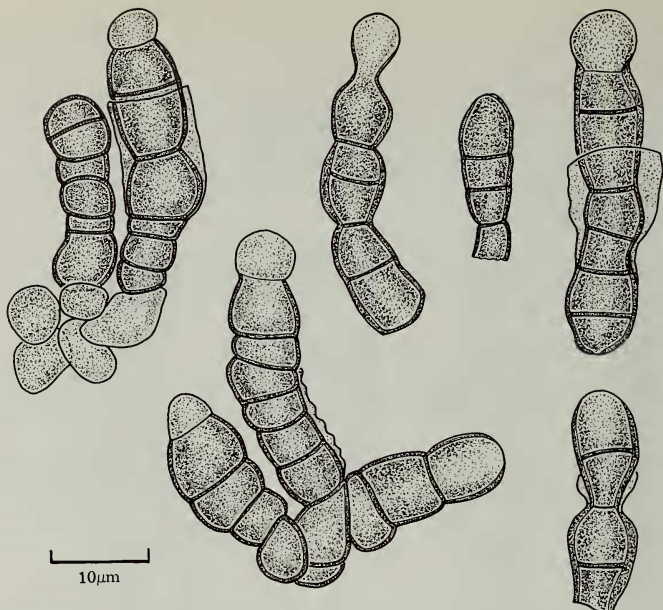


Fig. 37 *Taeniolella punctata* (IMI 225002—holotype).

tufts of very elongated conidiophores arranged more or less parallel to one another and conidia which are 2–11 septate and $25\text{--}90 \times 7\text{--}9 \mu\text{m}$. *T. punctata* appears to be primarily a lichenicolous species as it is strictly limited in the original collection to parts of the bark with *Graphis* thalli, even though microtome sections showed that it penetrated into the periderm layers, amongst which remnants of the lichen thallus were also to be found. It shows some similarity to *T. delicata* but that species has consistently narrower more delicate conidia and lighter pigmented conidiophores.

4. *Taeniolella verrucosa* M. S. Christ. & D. Hawksw. sp. nov.

(Fig. 38)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis brunneis, usque $4\text{--}7 \mu\text{m}$ latis. Conidiophora semi-macronemata, caespitosa, recta vel prostrata, usque ad basim 1–2 ramosa, atrobrunnea, usque $30\text{--}50 \times 6\text{--}7 \mu\text{m}$. Cellulae conidiogenaе monoblasticae, integratae, subcylindricaе. Conidia catenata, sicca, acrogena, doliiformia, 0–1 septata, grosse verrucosa, atrobrunnea, uniseptata est $10\text{--}13 \times 8\text{--}10 \mu\text{m}$.

Typus: Suecia, Skåne, Genarp, Håckeberga, in *Arthonia impolita* (Hoffm.) Borr. (thallus) ad *Quercum*, 24.iv.1946, M. Skytte Christiansen 12.967 p.p. (hb. Christiansen 569—holotypus!).

Colonies scattered or loosely aggregated on the surface of the host thallus, dark brown to almost black; mycelium immersed, sparse, composed of brown mainly torulose hyphae, hyphae thin-walled, smooth-walled, septate, swollen between and markedly constricted at the septa, mainly $4\text{--}7 \mu\text{m}$ wide. Conidiophores semi-macronematous, arising in small caespitose tufts, erect or

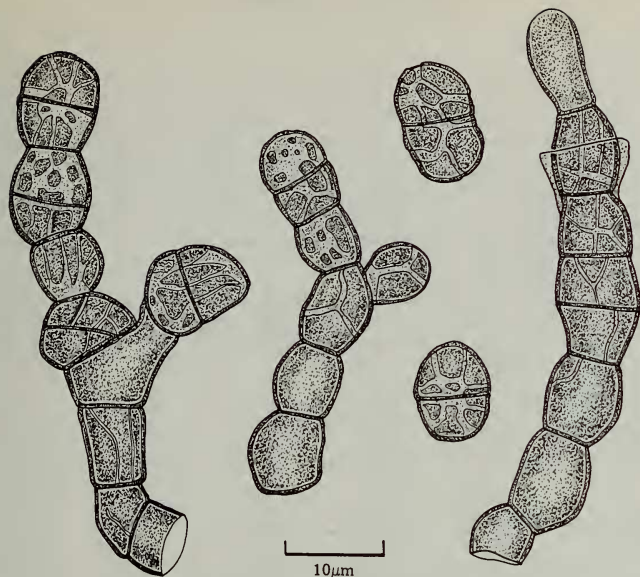


Fig. 38 *Taeniolella verrucosa* (hb. Christiansen 569—holotype).

almost prostrate, often 1-2 branched at the base, dark brown, smooth-walled at first but sometimes with the outer wall splitting to produce a coarsely verrucose ornamentation, thick-walled, septate, constricted at the septa, mainly $30-50 \times 6-7 \mu\text{m}$. *Conidiogenous cells* monoblastic integrated, terminal, subcylindrical, dark brown, not well-defined with the terminal cells in turn acting as conidiogenous cells. *Conidia* adhering in chains, separating only with great difficulty, dry, acrogenous, doliiform, dark brown, 0-1 septate, only slightly constricted at the septum, generally with a coarsely verrucose ornamentation produced by the splitting and breaking up of the outer wall of the conidia, thick-walled, 1-septate conidia $10-13 \times 8-10 \mu\text{m}$.

Host: *Thoria impolita* (Hoffm.) Borr., thallus. The infected areas of the thallus are dark brown to black due to the conidiophores and conidia of the fungus, but show little sign of actual damage.

Distribution: Sweden. Known only from the type collection.

Observations: *Taeniolella verrucosa* is a distinctive species differing from all others referred to the genus in that the conidia become coarsely verrucose due to a splitting and disintegration of the outer wall of the conidia. Of the species treated here, in the shape and size of the conidia it most closely resembles *T. punctata* but can easily be separated by the sculpturing of the conidia. *T. delicata* is also present in the type collection of *T. verrucosa* and the species occur mixed with one another in a few places on the thallus; they do, however, always retain their individuality and are easily separable from each other.

XXI. TERATOSPERMA Syd.

Annls mycol. 7: 127 (1909).

Colonies orbicular or effuse; mycelium superficial and/or immersed, irregularly branching, brown to dark brown. Stroma, setae and hyphopodia absent. Conidiophores macronematous, mononematous, erect, usually unbranched, brown to dark brown, smooth-walled, with a thickened irregularly lobate basal foot-cell in the lichenicolous species. Conidiogenous cells monoblastic, integrated, terminal, percurrently proliferating, with well-marked annellations. Conidia solitary, dry, acrogenous, pale to dark brown, transversely septate, obclavate, the basal cell generally with 1-4 paler appendages and the apical cell or other cells occasionally with appendages also, apical cell or cells paler in colour than the basal cells, acicular hyaline microconidia sometimes also produced from the appendages or apical cell in the lichenicolous species.

Type species: Teratosperma singulare Syd.

Number of species: Five species were accepted by Ellis (1957, 1971) and a further species is described here. Only two species are lichenicolous, three being saprophytes and occurring on decaying wood and leaves, and one occurring on colonies of blue-green algae on leaves (*T. appendiculatum* (S. Hughes) M. B. Ellis).

Key to the lichenicolous species

- 1 Conidia mainly 3-septate, with 1-2(-3) appendages on the basal cell, overall (17-)20-30(-35) × (4.5-)5-6.5(-7) μm T. *anacardii* (p. 260)
- Conidia mainly 2-septate, lacking appendages on the basal cell, overall 18-25 × 5-6 μm T. *lichenicola* (p. 262)

1. *Teratosperma anacardii* Hansf., *Proc. Linn. Soc. Lond.* 155: 54 (1943). (Fig. 39)

Type: Uganda, Kampala, alt. 4000 ft, on *Strigula elegans* (Fée) Müll. Arg. on *Anacardium occidentale*, May 1936, G. Chandler [Hansford no. 1831.] (K—holotype!; IMI 10442—istotype!).

Podocopsis anacardii (Hansf.) S. Hughes, *Mycol. Pap.* 48: 65 (1952).

Icones: Ellis, *Mycol. Pap.* 69: 7 fig. 5 (1957).—Ellis, *Demat. Hyphom.*: 134 fig. 88E (1971).—Hansford, *Proc. Linn. Soc. Lond.* 155: 51 fig. 11 (1943).—Hughes, *Mycol. Pap.* 48: 65 fig. 25 (1952).

Colonies dispersed, superficial, olivaceous brown to dark brown, arising on the surface of the host lichen but also sometimes spreading on to adjacent parts of the leaf surface; mycelium superficial, adpressed, irregularly branched, flexuose, hyphae relatively thin-walled, pale brown, smooth-walled, septate, not or slightly constricted at the septa, mainly 2-3 μm wide. *Conidiophores* macronematous, mononematous, erect, usually unbranched (see Hughes, 1952), thick-walled, smooth-walled, dark brown, septate, (25-)50-70(-100) μm tall and 3-5 μm wide, with a clearly demarcated foot cell which is irregularly lobate and mainly 7-10 μm diam. *Conidiogenous cells* monoblastic, integrated, terminal, percurrently proliferating to leave to 15 well-marked annellations, otherwise resembling the conidiophores. *Conidia* solitary, dry, acrogenous, obclavate, (2-)3(-4) septate, the basal two cells brown to dark brown, the upper cells subhyaline or pale brown, basal cell truncated with a scar 1.5-3 μm wide, basal cell bearing 1-2(-3) subhyaline appendages 2-10(-18) × 2-3 μm, a similar appendage also sometimes occurring from the sub-apical cell, overall dimensions (excluding appendages) (17-)20-30(-35) × (4.5-)5-6.5(-7) μm, appendages occasionally acting as conidiogenous cells and forming acicular hyaline microconidia 10-20 × 0.5 μm.

Hosts: On foliicolous lichens, particularly *Strigula elegans* (Fée) Müll. Arg.; it may be restricted to this single species (see below).

Distribution: Ghana, New Guinea, Nigeria, Sierra Leone and Tanzania.

Observations: *Teratosperma anacardii* was not recognized as being lichenicolous by Hansford (1943) who reported it only as 'in foliis'. Hughes (1952: 65) was the first author to realize that this

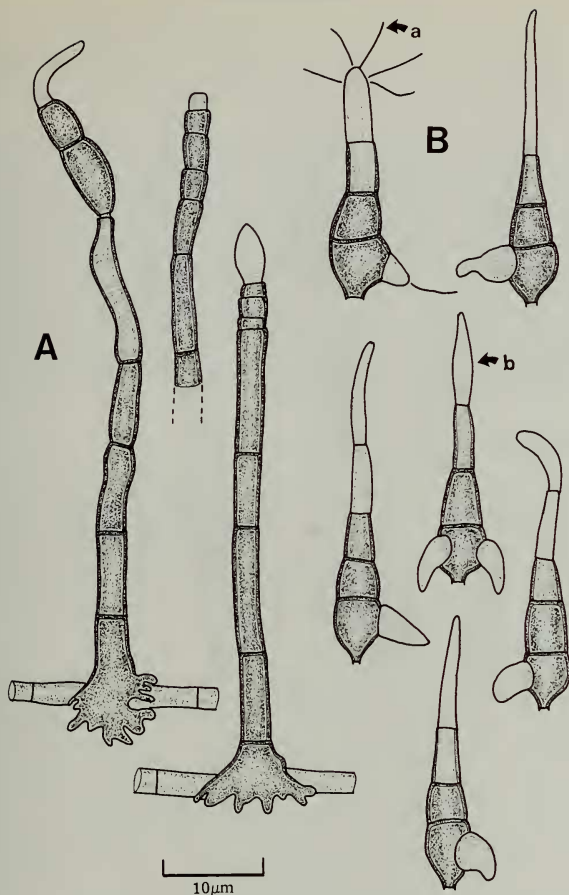


Fig. 39 *Teratosperma anacardii* (IMI 89537b except as indicated). A, Conidiophores. B, Conidia (a, secondary conidia; b, conidium from IMI 10442—isotype).

was a lichenicolous species and he further demonstrated that the acicular appendages on the apical and lateral cells figured by Hansford were in reality a kind of microconidia. Similar microconidia occur in *T. lichenicola* (p. 262) but are unknown in most species of the genus.

This fungus appears to be primarily a pathogen of *Strigula elegans* although determination of the host is often uncertain as ascocarps are not formed. The fungus can even attack colonies of *Cephaleuros* which are in the process of lichenization (e.g. IMI 56743d!) and it is most often

found on either completely sterile thalli recalling *S. elegans* in their superficial appearance, or ones which only produce pycnidia of the lichen. The infected lichen thalli become discoloured brownish and are evidently eventually killed. Interestingly, *T. anacardii* does not seem to be able to spread onto adjacent colonies of *Gyalectidium aspidotum* even when it is very abundant on *S. elegans* on the same leaf (e.g. IMI 51718!); this supports the hypothesis that this fungus may be host specific.

Additional specimens (all on *Strigula elegans* or indeterminate thalli most probably of this species): **Ghana**: Aburi, on *Hura crepitans*, 24 May 1949, S. J. Hughes 797 (IMI 44046a!); *loc. cit.*, on *Chrysobalanus orbicularis*, 24 May 1949, S. J. Hughes 802 (IMI 43710a,b!), 3 May 1949, S. J. Hughes 173 (IMI 43713a!); Togoland, Jasikan, on *Cola lateritia*, 27 May 1949, S. J. Hughes 1026 (IMI 44501f!); Suhum, on *Discoglypema caloneura*, 28 April 1949, S. J. Hughes 101 (IMI 44151b!).—**New Guinea**: Popondetta, Belfields, on *Persea gratissima*, 24 August 1961, D. E. Shaw 3298 (IMI 89537b!).—**Nigeria**: Ondo Province, Ado Ekiti, on *Theobroma cacao*, 2 May 1950, C. A. Thorold 10 p.p. (UPS non vidi, IMI 85640!).—**Sierra Leone**: Gbesebu (Kumaje), on *Alchornea hirtella*, 27 April 1954, F. C. Deighton M5908d (IMI 56743d!); Pujehun (Panga-Kaponde), on *Homalium letestui*, 11 April 1939, F. C. Deighton M2010 p.p. (IMI 7664f!); Njala (Kori), on *Homalium letestui*, 5 March 1937, F. C. Deighton M1332 p.p. (IMI 25611i!); *loc. cit.*, on *Parinari excelsa*, 15 July 1953, F. C. Deighton M5364a (IMI 53373a!); *loc. cit.*, on *Kopsia fruticosa*, 4 February 1953, F. C. Deighton M5105 (IMI 51718!); *loc. cit.*, on *Camellia sinensis*, 26 July 1953, F. C. Deighton M5388 p.p. (IMI 53385a!).—**Tanzania**: Kigoma, Kakombe, on *Deinbollia fulvo-tomentella*, 7 January 1964, K. A. Pirozynski M326iib (IMI 106117b!).

2. *Teratosperma lichenicola* D. Hawksw. sp. nov.

(Fig. 40)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis pallide brunneis, 2–3 μm latis. Conidiophora macronemata, mononemata, recta, non ramosa, atrobrunnea, plerumque 60–80 \times 3.5–5 μm , cum cellulis podiiformibus lobatis instructa. Cellulae conidiogenae monoblasticae, integratae, subcylindricae, annellidicae. Conidia solitaria, sicca, acrogena, obclavata, 2(–3) septata, levia, cellulis atrobrunneis sed cellula apicali subhyalina, appendices desunt sed cellulis apicalibus rarissimo microconidia filiformia et hyalina 5–10 \times 0.5 μm productis, 18–25 \times 5–6 μm .

Typus: Sierra Leone, Njala (Kori), in lichenibus foliicolis (*Strigula elegans*) ad *Homalium letestui*, 5.iii.1937, F. C. Deighton M1332 p.p. (IMI 25611h—holotypus!).

Icones: Hughes, *Mycol. Pap.* 48 : 67 fig. 26 (1952).

Colonies dispersed, superficial, olivaceous brown, arising on the surface of the host lichen but sometimes spreading on to adjacent areas of the leaf; mycelium superficial, adpressed, irregularly branched, flexuose, hyphae relatively thin-walled, pale brown, smooth-walled, septate, not or slightly constricted at the septa, 2–3 μm wide. *Conidiophores* macronematous, mononematous, erect, usually unbranched (see Hughes, 1952), thick-walled, smooth-walled, dark brown, septate, mainly 60–80 \times 3.5 μm , with a clearly demarcated foot cell which is irregularly lobate and mainly 7–10 μm diam. *Conidiogenous cells* monoblastic, integrated, terminal, percurrently proliferating to leave to 10 well-marked annellations, otherwise resembling the conidiophores. *Conidia* solitary, dry, acrogenous, obclavate, 2(–3) septate, the basal two cells brown to dark brown, the apical cell subhyaline or pale brown, basal cell truncated with a scar 1.5–2 μm wide, appendages absent in most specimens (a single apical appendage was figured by Hughes, 1952 : 67, from IMI 44156), overall dimensions 18–25 \times 5–6 μm , the apical cell occasionally acting as a conidiogenous cell producing acicular hyaline microconidia 5–10 \times 0.5 μm .

Hosts: On foliicolous lichens, particularly *Strigula elegans* (Fée) Müll. Arg.; it may be restricted to this single species (see discussion regarding the hosts of *Teratosperma anacardii* above).

Distribution: Ghana, Malaya and Sierra Leone.

Observations: This species was figured by Hughes (1952 : 67) who treated it as '*Podoconis* sp.'; he was hesitant to describe it as new in the absence of further collections particularly because the spores of *Teratosperma anacardii* may sometimes lack appendages and be only 2-septate. The discovery of further material which is clearly conspecific, and the constancy of the spore

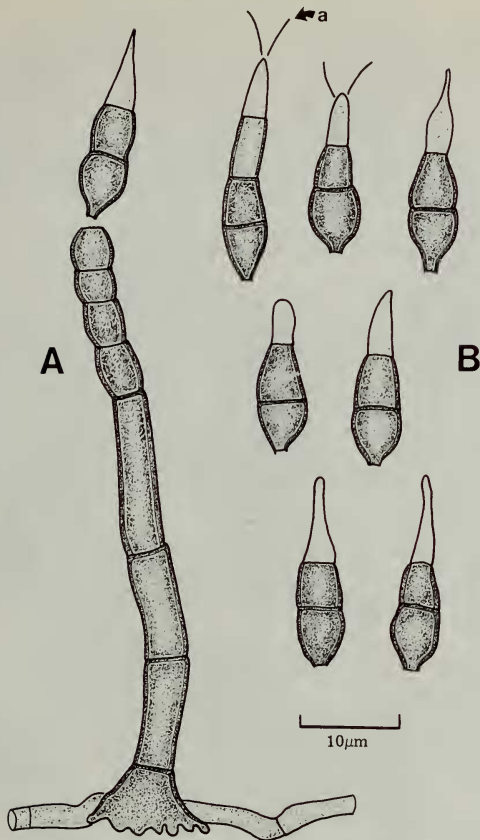


Fig. 40 *Teratosperma lichenicola* (IMI 25611h—holotype). A, Conidiophore. B, Conidia (a, secondary conidia).

characters in the taxon, now leave little doubt that it does represent a species distinct from *T. anacardii*.

This species is unlike the taxa hitherto placed in *Teratosperma* in that it lacks appendages on the basal cell. The only alternative genus for it would be *Sporidesmium* Link ex Fr., which is essentially separated from *Teratosperma* on the basis of this character, but currently comprises a heterogeneous assemblage of species. In view of the very close affinity of *T. lichenicola* and *T. anacardii* it is inconceivable to place them in different genera, even though the inclusion of *T. lichenicola* in *Teratosperma* broadens the concept of that genus considerably. Not only are the conidia similar, apart from the appendages, but they have the ability to form characteristic

microconidia rarely seen in other species of *Sporidesmium* or *Teratosperma*, and characteristic stout conidiophores with lobate foot cells.

T. lichenicola is, like *T. anacardii*, probably a pathogen of *Strigula elegans*. It is readily distinguished from that species on the basis of the septation, size and lack of appendages on the conidia.

Additional specimens: Ghana: Bunsu, on indet. lichen on *Griffonia simplicifolia* (syn. *Bandeiraea simplicifolia*), 7 June 1949, S. J. Hughes 1116 (IMI 44156!); Tafo, on indet. lichen on *Carapa procera*, 18 June 1949, S. J. Hughes 1369 (IMI 44218c!).—*Malaya:* Serdang, Federal Experimental Station, on indet. lichen on *Lansium domesticum*, 2 January 1953, A. Johnston 1244 p.p. (IMI 56061c!).

XXII. TRIMMATOSTROMA Corda

Icon. fung. 1: 9 (1837).

Colonies usually appearing as pulvinate sporodochia but sometimes more effuse, dark brown; mycelium superficial and/or immersed, often sparse. Stroma characteristically present in the non-lichenicolous species, pseudoparenchymatous, brown; setae and hyphopodia absent. Conidiophores macronematous or semi-macronematous, meristematic, elongating by septation behind the apical cell and its subsequent growth, erect or prostrate, flexuose, not or occasionally branched, generally becoming compacted together, pale brown or brown, smooth-walled or verrucose. Conidiogenous cells monoblastic, integrated, terminal, subcylindrical, each apical cell in turn acting as a conidiogenous cell. Conidia solitary or in basipetal irregular chains, dry, schizogenous, brown or dark brown, multicellular and extremely variable in shape and degree of septation, almost always muriform.

Type species: Trimmatostroma salicis Corda.

Number of species: 17 species have been described of which five are figured by Ellis (1971: 41–42, 1976: 27–30). All are saprophytes, mainly occurring on bark, and no lichenicolous species have been hitherto described. The genus is in need of a monographic revision as its current limits appear extremely broad.

1. *Trimmatostroma lichenicola* M. S. Christ. & D. Hawksw. sp. nov.

(Fig. 41)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis pallide brunneis, 3–7 μm latis. Conidiophora macronemata, mononemata ad laxe aggregata, flexuosa, non vel sparse ramosa, brunnea, plerumque 70–120 \times 4–6 μm . Cellulae conidiogenae monoblasticae, integratae, subcylindricae, non bene distinctae. Conidia solitaria vel irregulariter catenata, sicca, schizogena, subcylindrica vel irregulariter ellipsoidea, multi-septata, muriformia, levia, atrobrunnea, plerumque 18–25 \times 6–12 μm sed valde variabilia.

Typus: Groenlandia, Insula Disko, Nordfjord, W. e Kugssinnersuaq, alt. 150 m, in apotheciis *Candelariellae vitellinae* ad ossea, 13.viii.1975, V. Alstrup 91 (hb. Christiansen 553—holotypus!).

Colonies mainly immersed and dispersed through the hymenium of the host lichen, brown to dark brown, extending from the hypothecium and sporulating at the surface of the apothecium; mycelium immersed, mainly in the hypothecium, rather sparse, irregular and sometimes almost pseudoparenchymatous in places, very pale brown, flexuose, hyphae relatively thin-walled, smooth-walled, septate, generally constricted at the septa, cells rather short, mainly 3–7 \times 3–7 μm . *Conidiophores* macronematous, mononematous or compacted, meristematic, erect, unbranched or sparsely branched and sometimes anastomosing, rather thick-walled, smooth-walled, brown, septate, many-celled, 70–120 μm tall, cells mainly 4–6 μm diam. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical or doliiform, brown, not well marked and each terminal cell able to act in turn as a conidiogenous cell. *Conidia* solitary or adhering in irregular chains, dry, schizogenous, subcylindrical to irregularly ellipsoid, very variable in shape 2- to multi-septate to muriform, the individual cells markedly swollen, smooth- and thick-walled, dark brown, mainly 18–25 \times 6–12 μm .

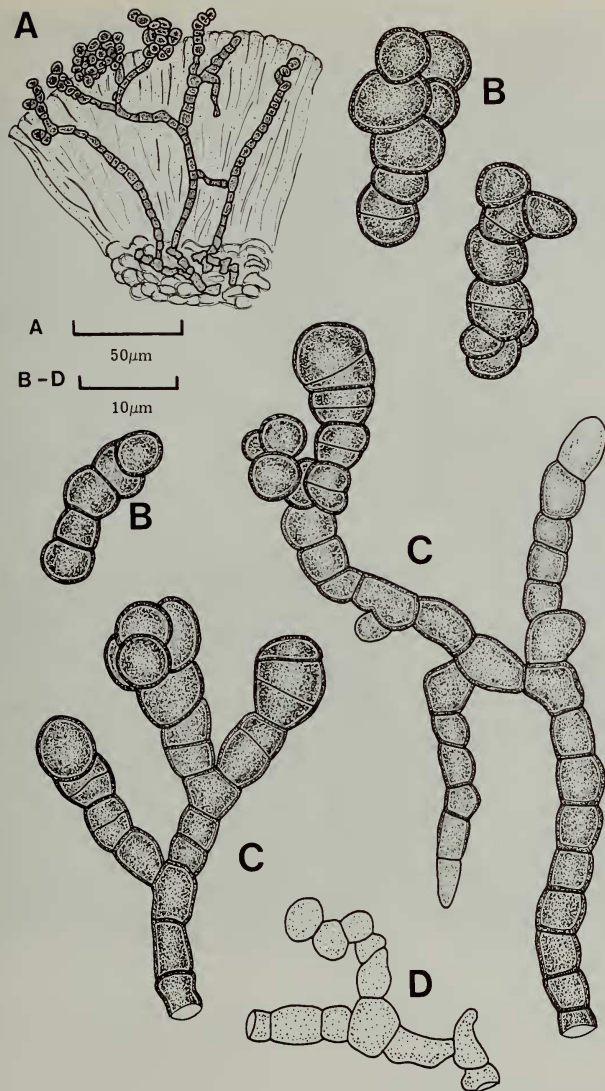


Fig. 41 *Trimmatostroma lichenicola* (hb. Christiansen 553—holotype). A, Vertical section of infected hymenium of *Candelariella vitellina*. B, Conidia. C, Conidiophores with attached maturing conidia. D, Mycelium from the hypothecium of the host.

Host: On *Candelariella vitellina* (Hoffm.) Müll. Arg., apothecia becoming blackened in the presence of the fungus. Mature normally developed asci and ascospores occur in close proximity to the invading fungus in some instances, but where the conidiophores are most abundant ascus production appears to be reduced.

Distribution: Greenland. Known only from the original collection.

Observations: This fungus is being placed in *Trimmatostroma* with some hesitation as the sporodochial habit characteristic of the genus is scarcely evident in *T. lichenicola*. Conidiogenesis, however, strongly resembles that in *T. betulinum* (Corda) S. Hughes, the conidia of which also show some similarity to those of *T. lichenicola*, although they are somewhat smaller and occasionally verrucose. In placing the fungus here, the sporodochial habit is presumed to have been lost in the process of adaptation to the lichenicolous hymenial habit, but the cellular to almost sometimes pseudoparenchymatous appearance of the hypothecial mycelium could be conceived as the remnants of a primitive stroma.

XXIII. XANTHORIICOLA D. Hawksw.

in Hawksworth & Punithalingam, *Trans. Br. mycol. Soc.* 61 : 66 (1973).

See Hawksworth & Punithalingam (1973 : 66–68) for further information on this genus.

Type species: *Xanthoriicola physciae* (Kalchbr.) D. Hawksw.

Number of species: Monotypic.

Xanthoriicola physciae (Kalchbr.) D. Hawksw., in Hawksworth & Punithalingam, *Trans. Br. mycol. Soc.* 61 : 67 (1973).

(Fig. 42)

See Hawksworth & Punithalingam (1973 : 67–68) for description, synonymy and further information on this species.

Hosts: *Xanthoria parietina* (L.) Th. Fr., apothecia.

Distribution: Probably widespread in Europe. Reliably recorded from the British Isles, France, Hungary, Spain and Sweden.

Observations: As my previous account of this fungus (Hawksworth & Punithalingam, 1973) was illustrated only by line drawings, the opportunity is taken here to show its features by photomicrographs and scanning electron micrographs (Fig. 42). Note particularly the ornamentation on the conidia which is much less coarse than that in *Leightonimyces* (Hawksworth, 1977a : 203 Pl. 2), the verrucae being more similar to several *Lichenocodium* species (Hawksworth, 1977b : Pls 24A, 27C–D, 28H–I, 29G).

Excluded species

Taxa referred to the Hyphomycetes by their original or later authors which have been considered as lichenicolous, but which are not accepted in the preceding section, are compiled here alphabetically; obligate synonyms are listed only under their basionyms and not individually.

Aegerita carnea Pat., *Expl. scient. Tunisie, Cat. Pl. cell.* : 135 (1897).

Type: Tunisia, Tunis, on indet. crustose lichens on walls, December 1892, *N. Patouillard* (FH-Pat. 5762—holotype!).

The original collection is extremely fragmented and now largely powdered, but a few of the subtremelloid flesh-coloured structures described by Patouillard were eventually discovered. These proved to merely represent epiphytic colonies of an alga; the $36 \times 20 \mu\text{m}$ structures described as conidia remained unstained in both cotton blue and iodine and appear to be cysts of either that alga or another intermixed with it.

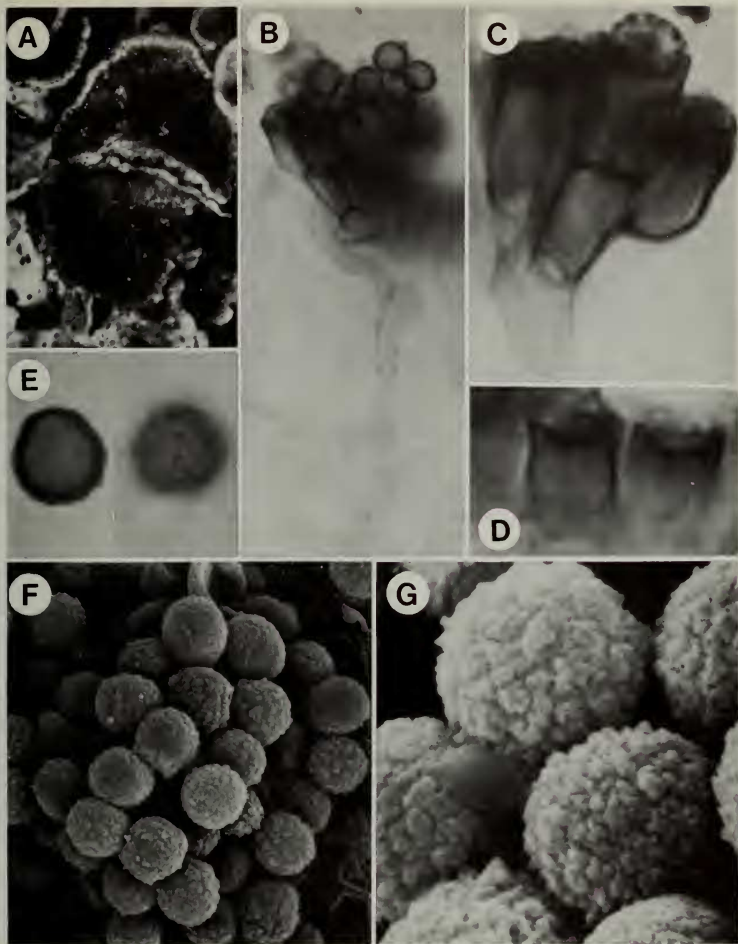


Fig. 42 *Xanthoriicola physciae*. A, Infected discoloured apothecia of *Xanthoria parietina* ($\times 16$). B, Conidiophores immersed in the thecium of the host ($\times 1400$). C-D, Conidiogenous cells ($\times 3500$). E, Conidium in optical section and surface view ($\times 3500$). F, Group of conidia ($\times 3000$). G, Conidia showing verrucose ornamentation ($\times 11\ 000$). A, F-G IMI 171822; B-E IMI 164974. F-G Scanning electron micrographs.

Aegerita mellea Berk. & Br., *J. Linn. Soc., Bot.* **14**: 101 (1873).

Type: Sri Lanka, Peradeniya, on cf. *Heterodermia* sp., December 1868, [collector not indicated] 1019 (K—holotype!).

This taxon was first described as forming 'small yellow tremelloid specks scarcely visible without a lens' on the lichen thallus but without further details. Petch (1927: 177) studied the material and considered it a fungus producing 'pseudoconidia' which were ovate or globose and $10-16 \times 7-12 \mu\text{m}$. Many structures identical to the 'specks' described by the original authors still occur on the type collection; these 'specks' swell and become translucent-amber on wetting, are entirely superficial, floating off the lichen thallus in a drop of water, and their occurrence on the lichen must consequently be regarded as accidental. The cells of the 'specks' are very irregular in outline and densely compacted together but do not appear to be fungal. On mounting in Melzer's iodine some massive parietal structures recalling chloroplasts became apparent in some cells, and therefore this taxon is consequently referred to the algae.

Aegerita physciae Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30**: 314 (1914).

This name was based on two collections of *Physcia adscendens*: one from Laitre-sous-Amance (Meurthe-et-Moselle) made by Vouaux, and one from Bergues sent to Vouaux by Bouly de Lesdain. Unfortunately this taxon is not represented amongst the remnants of Vouaux's herbarium (Rondon, 1970) and Bouly de Lesdain's collections were destroyed in 1940. The fungus was described as macroscopically recalling *Illosporium roseum* (i.e. the species treated as *I. corallinum* above), but producing non-septate hyaline conidiophores $25-35 \mu\text{m}$ long and $4-7 \mu\text{m}$ wide at the base, and conidia forming by budding, separating by a septum and then becoming detached. The conidia themselves were described as hyaline, simple, thin- and smooth-walled, with granular contents, exactly spherical and $10-15 \mu\text{m}$ diam. I have not so far seen a lichenicolous fungus agreeing with Vouaux's description but if the same species is collected again it should be possible to recognize it from the description and then establish its true position. *Aegerita* Pers. ex Fr. is unlikely to be appropriate for this fungus (see Kendrick & Carmichael, 1973).

Atractium flammeum Berk. & Rav., in Berkeley, *Ann. Mag. nat. Hist.* **II**, **13**: 461 (1854).

Type: U.S.A., South Carolina, on bark, peeping up beneath *Parmelia crinita* Ach., H. W. Ravenel 976 (K—lectotype!).

Although this taxon was not described as lichenicolous but from bark on which lichens were present (see Keissler, 1930: 624), Clauzade & Roux (1976: 93) nevertheless give its habitat as 'sur thalles corticoles de *Parmelia*, *Xanthoria* et *Physcia*'. In the original diagnosis two collections were mentioned, one from the bark of living willows in Penzance, England, where it was collected by J. Ralfs, and the other 'peeping up beneath lichens' in South Carolina collected by H. W. Ravenel. The Ralfs' British specimen (K!) is associated with *Parmelia glabrata* (Lamy) Nyl. but few synnemata are now present and it is consequently not ideal for selection as the lectotype for this name. There are also five Ravenel specimens under this name in K from South Carolina; that selected as lectotype here comprises thalli of *Parmelia crinita* Ach., between the lobes of which synnemata of the fungus project abundantly, and includes a sketch by Berkeley with '*Sphaeria muscivora* ? Berk.' scored out, and the name '*Atractium flammeum*' inserted in Berkeley's hand.

This pale orange synnematomous fungus has 4-6 septate subcylindrical conidia $70-75 \mu\text{m}$ long and is identical with *Microcera coccophila* Desm., the conidial state of *Sphaerostilbe flammea* Tul. (Hypocreales), which is parasitic on scale insects (Petch, 1921, 1938) and is not a lichenicolous fungus.

Campotrichum bicolor Ehrenb. ex Pers., *Mycol. Eur.* **1**: 20 (1822).

Campotrichum bicolor Ehrenb., *Jahrb. Gewächsk* **1**: 55 (1819); nom. inval. (Art. 13).

Type: Germany, Saxony, Vogtland district, on *Usnea plicata*, C. G. Ehrenberg (L 90.0.H.910.262-776—lectotype non vidi).

Myxotrichum bicolor (Ehrenb. ex Pers.) Fr., *Syst. mycol.* **3**(2): 351 (1832).

Although Keissler (1930: 623) listed this species amongst the Dematiaceae, it is in reality an ascomycete belonging in the Gymnoascaceae. The taxon has been investigated in detail by Hughes

(1968) who found it to be conspecific with *Myxotrichum poluninii* Apinis which had been described subsequently from a species of *Cetraria* collected in Canada (Apinis, 1964); *M. bicolor* is consequently the correct name for *M. poluninii*. Keissler (1930) also listed *Ceratonema bicolor* Pers. as a tentative synonym of this taxon, but this is certainly a *lapsus* as that species is not lichenicolous.

Cephalosporium acremonium Corda, *Icon. fung.* 3: 11 (1839).

This name has been extensively and incorrectly applied to the fungus now correctly called *Acremonium strictum* W. Gams (Gams, 1971: 42) as well as to other species of that genus. *A. strictum* is an ubiquitous saprophyte and its occurrence on lichens is perhaps to be expected. Vouaux (1914: 325) reported the presence of *Cephalosporium acremonium* on an aged *Pertusaria* thallus collected by Bouly de Lesdain in the Parc de Versailles, France, but whether this was really *A. strictum* cannot be established in the absence of Bouly de Lesdain's collection.

Ceratonema fucinum Wallr., *Fl. crypt. Germ.* 2: 171 (1833).

Type: Germany, 'Hercyn. et Thuringo passim, inter tomentum spongiosum' *Pannaria rubiginosa* (Thunb. ex Ach.) Del.

Capillaria fucina (Wallr.) Sacc., *Syll. Fung.* 14: 1184 (1899).

The original description of this taxon was 'rhabdis vage patentimque ramosis teretibus dein ligamentosis alternatim compressis, in strata mollia laxe congestis fusco-purpurascensibus'. No reply could be obtained from STR so it is not known whether the original material on which this name was based is present amongst Wallroth's herbarium today; no collections under this name were found in PRM (M. Svrček, *in litt.*) which has a few of his specimens (Hughes, 1958). It is possible that this name was based on rhizinae arising from the spongy hypothallus of *Pannaria rubiginosa*; such rhizinae occasionally arise in tufts from the upper as well as the lower surface in this species and superficially recall tufts of dematiaceous conidiophores. Final confirmation of this hypothesis must await examination of Wallroth's material if any is still extant.

Cladosporium lichenicola Linds., *Q. Jl. microsc. Soc.* II, 11: 42 (1871); as 'lichenicolum'.

Type: Scotland, S. Aberdeenshire, Falls of the Garrawalt, on thallus of *Peltigera aphthosa* (L.) Willd., August 1856, *W. L. Lindsay*.

The original collection on which this name was based was sent by Lindsay to M. C. Cooke at Kew but could not be located either in E (B. J. Coppins, *in litt.*) or K. Lindsay (*loc. cit.*) records that 'The only structure visible under power 380 of Nacet's microscope consists of brown articulated tubuli — the constituent cells of which are oblong, and either empty or contain atomic granules in roelike masses — with difficulty visible'. In view of these observations there can be little doubt that this name refers only to sterile mycelium. Lindsay (*loc. cit.*) was hesitant in introducing the name as he stated that the fungus '... if it is entitled to specific distinction, may be fitly denominated *C. lichenicolum*'. This name could perhaps be treated as not validly published under Art. 34, but it was accepted by Arnold (1874: 155).

Coniosporium lecanorae Jaap, *in Lindau, Verh. bot. Ver. Prov. Brandenb.* 47: 71 (1906).

Type: Germany, Prov. Brandenburg, Triglitz i. d. Prignitz, on *Lecanora chlorotera* apothecia on *Sorbus aucuparia*, 31 December 1901, *O. Jaap* (B—holotype!).

Although this fungus was thought to be a hyphomycete by Jaap and has been assumed to be such by all subsequent workers on lichenicolous fungi, it proved to have irregularly opening pycnidia about 60 µm diam, lined with phialides 5-7 × 3-3.5 µm which formed brown globose conidia with verruculose walls mainly 3-4.5 µm diam. Jaap appears only to have observed discharged conidia on the surface of the apothecia and assumed that hyphae arising from germinating conidia were conidiophores. This fungus is conspecific with *Licheniconium parasiticum* D. Hawksw., a species already known on *Lecanora chlorotera* (Hawksworth, 1977b). As Jaap's epithet predates *Licheniconium parasiticum* by 71 years it must be taken up for that species; the

new combination *Lichenocoonium lecanorae* (Jaap) D. Hawksw. **comb. nov.** is consequently made here.

This interpretation of Jaap's name is supported by other collections in B which he referred to this taxon, although they also included various other fungi as well. Reports of this species by other workers may, however, refer to a variety of fungi and should not automatically be assumed to belong to *Lichenocoonium lecanorae*.

Coniosporium lecanorae var. *arthoniae* Vouaux, in Bouly de Lesdain, *Rech. Lich. Dunkerque* : 278 (1910); nom. nud. (Art. 32).

This variety was introduced without any description but several collections, all from France, were listed as belonging to it: on *Arthonia radiata* (Pers.) Ach. (syn. *A. gregaria* (Weig.) Krb.) and *Opegrapha vulgata* (Ach.) Ach. (syn. *O. cinerea* Chev.) from Merckeghem, and on *A. tumidula* (Ach.) Ach. (syn. *A. astroidea* (Ach.) Ach.) from both Bollezele and Rexpode. No material of this taxon exists amongst the remnants of Vouaux's herbarium (Rondon, 1970) and as Bouly de Lesdain's material was destroyed in 1940 it is not possible to firmly ascertain the position of this name.

Vouaux (1914 : 308) reconsidered this taxon and subsumed it under his, probably erroneous, concept of *Coniosporium lecanorae* categorically stating it did not merit varietal status. In placing the name as a synonym of *C. lecanorae*, Keissler (1930 : 606) was almost certainly copying Vouaux. I would, however, be most surprised if the var. *arthoniae* proved to be a *Lichenocoonium* (as *Coniosporium lecanorae* is) for no *Lichenocoonium* species are recorded on *Arthonia* or *Opegrapha* (Hawksworth, 1977b).

Coniosporium mildbraedii Lindau, *Wiss. Ergebn. dt. ZentAfr. Exped.* 2 : 110 (1911).

Type: Congo, Ruanda, Nyavarango west of Akanjaru-Einfluss, on thallus and apothecia of *Lecanora poliothallina* Lindau on 'Kandelabereuphorbien', August 1907, G. W. J. Midbread 789 (B—holotype destroyed).

All the material collected by the German expeditions of 1907-8, 1910-11, 1913 and 1928 into central Africa was destroyed in World War II (Vegter, 1976 : 538). This was confirmed by B. Hein (*in litt.*) who also checked the general lichen herbarium as well as the fungal collections in B; no material was deposited in HBG either (I. Friederichsen, *in litt.*). This fungus was described as comprising fuscous-black to black hyphae 4-4.5 µm wide spreading over the areolae of the host thallus and more rarely occurring on the apothecial discs. The conidia arose singly or in chains of 2-3 at the apices of the hyphae and were ellipsoid, slightly pointed to rounded at the apex, at first slightly truncate at the base but becoming rounded, brown, smooth-walled, non-septate, and 7.5-9.5 × 7-7.5 µm. No illustration was provided by Lindau (*loc. cit.*) and in the absence of further information as to the method of conidium formation, this fungus cannot be confidently assigned to any particular genus.

Coniosporium pertusariae Jaap, *Verh. bot. Ver. Prov. Brandenb.* 64 : 59 (1923); nom. nud. (Art. 32).

Type: Germany, 'Parasitisch auf *Pertusaria communis* DC. [i.e. *P. pertusa* (L.) Tuck.] an einer alten Eiche', 5 April 1906, O. Jaap.

This name was introduced without any description and no material of it could be found amongst Jaap's fungal and lichen collections in HBG (P. Wiemann, *in litt.*) or B (B. Hein, *in litt.*). It must consequently be treated as of uncertain application.

Coniosporium pulvereum Vouaux, *Bull. trimest. Soc. mycol. Fr.* 30 : 309 (1914).

Type: France, Ghyvelde Dunes, on stone, 'sur thalle strile crustace', M. Bouly de Lesdain.

Unfortunately no material of this taxon is present amongst the remnants of Vouaux's herbarium (Rondon, 1970) and Bouly de Lesdain's herbarium was destroyed in 1940. The identity of this fungus and its host consequently remain uncertain. The conidia were described as simple, brownish, more or less spherical, and 8-13 µm diam, and said to be produced without conidiophores in dusty heaps 50-100 µm diam.

Dactylium dendroides subsp. *lichenicola* P. Karst., *Meddn Soc. Fauna Flora fenn.* **14**: 107 (1887).

Type: Finland, nr Mustiala, 'in thallo putrescente *Parmelium*', September 1872, P. A. Karsten.

Dactylium lichenicola (P. Karst.) Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30**: 307 (1914).

The genus *Dactylium* Nees ex Fr. is typified by *D. candidum* Nees ex Pers., the epithet of which has been combined into *Candelabrella* Rifai & R. C. Cooke by Rifai (1968) despite uncertainties surrounding this name (Barron, 1968: 145). *D. dendroides* (Bull. ex Mérat) Fr., the conidial state of *Hypomyces rosellus* (Alb. & Schwein. ex Fr.) Tul. (Hypocreales) which is not uncommon on decaying Agaricales, has been transferred to *Cladobotryum* Nees ex Steud. by Gams and Hoozemans (1970: 103). *C. dendroides* was evidently known to Karsten as he noted it on agarics in the same paper in which subsp. *lichenicola* was described. The taxon was stated to differ from subsp. *dendroides* in having narrower conidia not apiculate at the base but the absence of an apiculate base to the conidia suggests his fungus may not have been a *Cladobotryum* species. Unfortunately, no material of Karsten's taxon could be located amongst his collections in H (T. Niemela, *in litt.*), BPI (P. D. Millner, *in litt.*) or UPS (R. Moberg, *in litt.*) so the identity of his fungus remains obscure. It should also be remembered that Karsten was not a lichenologist and has been known to confuse species of *Parmelia* and *Physcia* when describing lichenicolous fungi (Hawksworth, 1975a: 234). If this occurred in this instance, it is perhaps possible that his species was very similar to *Monacosporium carestianum* Ferr. (see p. 282) described as having 1-3 septate conidia $21-26 \times 7-8 \mu\text{m}$; Karsten's 3-septate conidia were reported as $24-36 \times 7-8 \mu\text{m}$.

Diplosporium caudatum Speg., *An. Mus. nac. B. Aires* **6**: 334 (1899).

Type: Argentina, Parque de La Plata, on *Lobaria quercizans* Michx. (syn. *Ricasolia casarettiana* (de Not.) Nyl.) on *Melia azedarach*, April 1890, C. Spegazzini.

This fungus was described as forming superficial widely spreading pale rose colonies of 2-3 μm wide hyphae on the thallus of the host. The conidia appear to have been especially distinctive and were described as fusoid, 1-septate and $14-16 \times 3 \mu\text{m}$ but with cauda at both ends; one $5-6 \times 1 \mu\text{m}$ at the base, and one $14-16 \times 1 \mu\text{m}$ at the apex. The conidia were said to be colourless and smooth-walled and in the original description Spegazzini suggested that the fungus might represent the imperfect state of *Nectria subimperspicuae* Speg. Unfortunately no material of this taxon could be located in LPS (I. J. Gamundi, *in litt.*) but from the description it clearly has nothing to do with *Diplosporium* Link, a synonym of *Oedemium* Link (Hughes, 1958), which is a member of the Dematiaceae forming chains of conidia only slightly apiculate at the apices and which is the imperfect state of *Thaxteria fusca* (Fuckel) C. Booth. Several genera of moniliaceous Hyphomycetes with bicaudate one-septate spores are known (e.g. *Leptodiscella* Papendorf, *Menisporiopsis* S. Hughes) and there are others with simple central cells which are bicaudate (e.g. *Neottiosporella* Höhnelt ex Graniti) although none of these has such unequal-lengthed appendages or is known to be the imperfect state of any nectriaceous fungus. The identity of *Diplosporium caudatum* must consequently remain uncertain until either the type material is refound or further collections probably conspecific with it are made in order that the arrangements of the conidiophores and method of conidiogenesis can be established.

Epicoccum neglectum Desm., *Annls Sci. nat., Bot.* **II**, **17**: 95 (1842).

This species was reported by Vouaux (1914: 320) from dead thalli of *Peltigera canina* collected at Plainfaing, Vosges, by Harmand; this record has been copied by Keissler (1930: 639) and Clauzade & Roux (1976: 98). The genus *Epicoccum* Link ex Schlecht. was studied in detail by Schol-Schwarz (1959) and *E. neglectum* found to be synonymous with the ubiquitous saprophyte now correctly called *E. purpurascens* Ehrenb. ex Schlecht. The occurrence of this fungus on *Peltigera* is consequently regarded as fortuitous.

Epicoccum parmeliarum Oliv., *Bull. internat. géogr. Bot.* **17**: 232 (1907).

Type: France, Orne, 'sur le thalle des *Parmelia caperata* (L.) et *sulcata* (Tayl.)'.

Phoma parmeliarum (Oliv.) Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30**: 196 (1914).

Even though this fungus was pycnidial and produced hyaline simple spores, it was originally placed in *Epicoccum* Link ex Schlecht. which is a genus of dematiaceous Hyphomycetes (see, for

example, Ellis, 1971 : 72). In the absence of type material it is impossible to be certain as to the identity of this taxon. The conidia were indicated to be $6-9 \times 5-7 \mu\text{m}$, too wide for *Phoma cytophora* (Vouaux) D. Hawksw. which is found on the same hosts (see Hawksworth & Punithalingam, 1973 : 60-63), and to be stalked; Vouaux's (*loc. cit.*) suggestion that it might be the pycnidial state of *Abrothallus parmeliarum* (Sommerf.) Arnold is unlikely to be correct.

Epicoccum usneae Anzi, *Atti Soc. ital. Sci. nat.* **11**(4) : 181 [p. 25 of offprint] (1868).

Type: Italy, Cerdécco, 'in silvis Bormiensesibus opacioribus', in apothecia of *Usnea filipendula* Stirt. agr., *M. Anzi* [*Lich. rar. Langob. exs. no. 523*] (K—isotypes!).

Coniothyrium usneae (Anzi) Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30** : 295 (1914).

Lichenoconium usneae (Anzi) D. Hawksw., *Persoonia* **9** : 185 (1977).

This is not a hyphomycete and is correctly placed in the genus *Lichenoconium* Petr. & Syd. (Sphaeropsidales) which has been revised elsewhere (Hawksworth, 1977b). Schol-Schwarz (1959 : 171) placed this name as a synonym of the species now called *Epicoccum purpurascens* Ehrenb. ex Schlecht. but presumably did not study Anzi's material.

Fusarium barbatum Ellis & Everh., *J. mycol.* **4** : 45 (1888).

Type: U.S.A., New Jersey, Newfield, associated with insect debris on *Usnea* sp., 8 January 1888 [? *J. B. Ellis*] (NY—holotype!).

The type collection is now in an extremely fragmented form and only with great difficulty were the greyish to orange applanate conidial areas described by Ellis & Everhart discovered. These were close to the base of the *Usnea*, associated with insect debris, and also occurred on the debris alone as well as directly on the lichen cortex. The conidiophores are hyaline, $20-30 \times 2-3 \mu\text{m}$, tapered above and sometimes with a few surface crystals, bearing conidia acropetally and sympodially; the conidia themselves were hyaline, non-septate, cuneiform to pyriform and $4.5-6(-7) \times (2.5-3)-3.5 \mu\text{m}$ (Fig. 43). The fungus clearly belongs to the genus *Raffaelea* v. Arx & Henneb. which currently comprises 10 species, eight of which are associated with bark beetles. An examination of the descriptions of these, most of which are only known in pure culture, showed that all diverged from that of *Fusarium barbatum*; this fortuitously lichenicolous fungus is consequently transferred into *Raffaelea* here as *Raffaelea barbatum* (Ellis & Everh.) D. Hawksw. **comb. nov.** This species is most similar to *R. albimanens* Scott & Du Toit, which differs in remaining quite hyaline and in the ability to form much longer conidiophores; it would be of interest to grow *R. albimanens* on natural substrates to see if these features were then modified.

The lichen involved was determined as '*Usnea barbata*' by Ellis & Everhart, a name which has been used in different senses. The *Usnea* is somewhat attenuated at the base and not blackened, but is so fragmentary that it is difficult to envisage its true habit. The material is much decayed with most of the outer cortex torn away revealing the medulla which has become pinkish-red, presumably due to the breakdown of norstictic or salazinic acid (cf. p. 279). I suspect that the species involved may well have been *U. strigosa* (Ach.) Eaton which is common in eastern North America.

Booth (1971 : 189) listed *Fusarium barbatum* only as 'dubia fide Wollenw.' but it was accepted under that name by Clauzade & Roux (1976 : 96).

Fusarium lichenicola C. Massal., in Maire & Saccardo, *Annls mycol.* **1** : 223 (1903); as '*lichenicolum*'.

(Fig. 44)

Type: Italy, Verona, Tregnago, on *Candelaria concolor* (Dicks.) Stein, November 1902, *C. Massalonge* (PAD—holotype!).

Bactridium lichenicola (C. Massal.) Wollenw., *Fusarium autogr. delin.*, no. 456 (1916).

Icones: Wollenweber, *Fusarium autogr. delin.*, no. 456 (1916).—Keissler, *Rabenh. Krypt.-Fl.* **8** : 637 fig. 134 (1930).

This fungus forms a loose web of mycelium over the thallus surface but most of the lichen present retains its yellow colour and the fungus appears to be a saprophyte rather than a parasite. The conidia are ellipsoid, hyaline, 0-3 septate, have a short truncate base, and measure

(17–)19–26(–32) \times 5–7.5 μ m; these are borne on unbranched, or more rarely 1–3 branched, conidiophores which are very variable in length but mainly 50–70 \times 2.5–3 μ m; the conidiogenous cells are phialidic. This species proved to be conspecific with the taxon generally called *Cylindrocarpon tonkinense* Bugnicourt (e.g. Booth, 1966) but as Massalongo's epithet predates Bugnicourt's by 36 years, the new combination *Cylindrocarpon lichenicola* (C. Massal.) D. Hawksw. **comb. nov.** is made for this species here. *C. lichenicola* is essentially a saprophytic species and has been isolated from diverse habitats; there are isolates in IMI from Colombia, India, Indo-China, Nigeria, Pakistan, Peru and the British Isles.

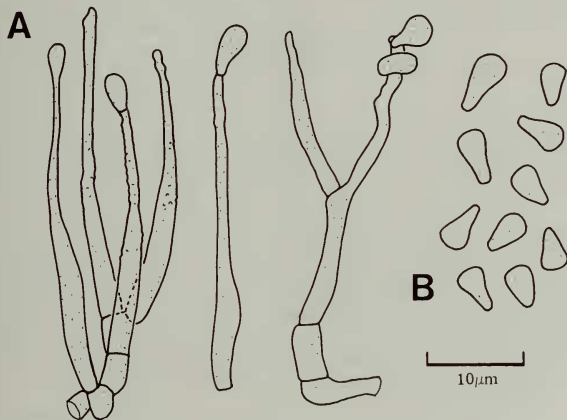


Fig. 43 *Raffaelea barbatum* (NY—holotype). A, Conidiophores and conidiogenous cells. B, Conidia.

Massalongo's original collection agrees in almost all details with the description of *Cylindrocarpon tonkinense* provided by Booth (1966 : 42–43) which was largely based on cultures. The only differences noted were that the chlamydospores tended to be slightly smaller (7–8 μ m vs 7–11 μ m diam) and the conidiophores somewhat longer, features scarcely meriting taxonomic separation in this group of fungi.

Topotype material, collected by Massalongo in '1905–1907', was distributed by Kabát & Bubák in their *Fungi imperf. exs.* no. 546; the example of this number in K(!), however, supported only sterile white mycelia, and no conidia identical with those of the holotype could be found on it.

Fusarium pallens Nees ex Link, in Willdenow, *Linn. Sp. Plant.*, Ed. 4, 6(2) : 104 (1825).

Atractium pallens Nees, *Nova Acta Acad. Caesar. Leop. Carol.* 9 : 237 (1818); nom. inval. (Art. 13).

This taxon was reported by Vouaux (1914 : 320) from the thallus of *Lecanora dispersa* (Pers.) Sommerf. (syn. *L. hagenii* auct.) growing on *Alnus* at Malo-Terminus in France on the basis of a collection made by Bouly de Lesdain. Booth (1971 : 207) indicated that this name was a synonym of *Cylindrocarpon janthothele* var. *majus* Wollenw., the imperfect state of *Nectria mammoidea* Phil. & Plowr.; a detailed description and illustrations of this *Cylindrocarpon*, which is widespread on hardwood trees and other plant debris, are provided by Booth (1966 : 29–30). If Vouaux's determination was correct, the occurrence of this fungus on the *Lecanora* can only be regarded as fortuitous.

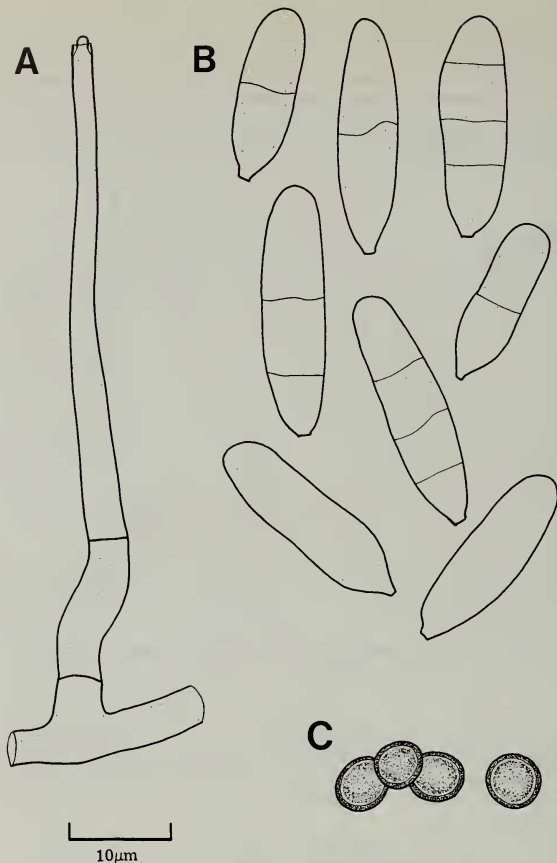


Fig. 44 *Cylindrocarpon lichenicola* (PAD—holotype). A, Conidiophore. B, Conidia. C, Chlamydospores.

***Fusarium sampaioi* Gonz. Frag., *Bolm Soc. broteriana* II, 2: 50 (1924).**

Type: Portugal, near Taboço, on thalli of *Physcia semipinnata* (Gmelin) Moberg (syn. *P. leptalea* (Ach.)DC.), December 1922, *J. Macedo Pinto* (MA 5878—syntype!).

This taxon was described as having 0–3 septate conidia, $14\text{--}24 \times 2\text{--}3.2 \mu\text{m}$, which were curved and borne in fascicles. It was reported from two localities in the original description and from several hosts at each: on *Lasallia pustulata* (L.) Mérat, *Parmelia saxatilis* (L.) Ach. and *P. soledians* Nyl. near Gaia, Alto da Bandeira; and on *P. exasperata* (DC.) de Not., *Physcia semipinnata*, *P.*

tenella (Scop.) DC., *Phaeophyscia orbicularis* (Neck.) Moberg and *Physconia grisea* (Lam.) Poelt near Taboço. Only the single syntype cited above was available from MA which supported numerous globose sporodochia recalling those described by González Fragoso (*loc. cit.*) and associated with dead lobes of the host. These sporodochia, however, were of an *Illosporium* (see p. 236) and no conidia similar to those originally reported were present. I wrote to Barcelona (BC) in case they had further syntypes but received no reply. As the description of *Sporoschisma mirabile* var. *lichenicola* in the same publication (González Fragoso, 1924) was found to be reliable as regards dimensions and shapes (see below) it seems unlikely that Fragoso did not see conidia such as he described. The most probable explanation of Fragoso's description is that he saw superficially similar sporodochia on a wide range of hosts and presumed all would produce conidia like those he reported, and which he found on at least one of the hosts, further presuming that the *Illosporium* sporodochia were simply immature. I therefore consider that this name should be rejected as almost certainly based on discordant elements (Art. 70).

In his monograph of *Fusarium*, Booth (1971 : 213) only listed this taxon as 'not known in culture' and did not discuss it further.

Fusisporium kuehnii Fuckel, *Jb. nassau. Ver. Naturk.* 23/24 : 371 (1870); as 'kühnii'.

Type: Germany, *sine loc.*, on thalli of *Physcia adscendens* (Th. Fr.) Oliv. and *Xanthoria parietina* (L.) Th. Fr., *K. W. G. L. Fuckel*, *Fungi rhen.* no. 1920 (K—3 isoelectotypes!).

Fusarium kuehnii (Fuckel) Sacc., *Syll. Fung.* 4 : 714 (1886).

Fusarium devastans Kühn, *Krankh. Culturgew.* : 32 (1858); nom. inval. (Art. 32).

Kühn (1858 : 32) described the damage this fungus caused to lichens but provided no description himself and for this reason a new name was introduced for the taxon by Fuckel. No material of Kühn's appears to be extant and, as in introducing the name *Fusisporium kuehnii* Fuckel also cited his own *exsiccata*, that is designated as the lectotype for this epithet here. The isoelectotypes examined comprise either *Physcia adscendens* or *Xanthoria parietina*, or both these species, overgrown by white funiculose hyphae which are sterile. The superficial appearance of the material suggests that the species may be *Athelia arachnoidea* (Berk.) Jül., as was also proposed by Keissler (1930 : 524), but in the absence of sclerotia and basidia some doubt must remain.

Gliocladium pulchellum Penz. & Sacc., *Malpighia* 15 : 242 (1901).

(Fig. 45)

Type: Java, Tjibodas, 'in thallis *Lichenum* et surculis foliisque vivis *Muscorum*', 11 February 1897, O. Penzig (PAD—holotype!).

Icones: Penzig & Saccardo, *Icones fung. Javan.* : Pl. 57 fig. 4 (1904).

Conidiophores scattered on decaying lichen fragments, hyaline to whitish, arising singly; stalks of the conidiophores 1-1.5 mm tall and mainly 30-50 μ m wide, straight to flexuose, hyaline, cylindrical below with walls 2-4 μ m thick, non-septate, unbranched, smooth-walled, becoming slightly constricted to 20-25 μ m wide subapically and then expanding into an hemispherical to subglobose columella-like head mainly 30-40 μ m diam, this head bearing numerous prophialides which leave raised rounded scars on the surface of the head when broken off, head subhyaline to pale orange; prophialides densely packed over the columella-like area, hyaline, thin-walled, slightly rugose-walled, mainly 25-40 \times 3-4 μ m. *Conidiogenous cells* phialidic, arising at the apex of the prophialides, 2-4 (?-5) on each prophialide, subcylindrical, hyaline, slightly rugose-walled, mainly 30-50 \times 2-3 μ m, densely packed together, very variable in length. *Conidia* arising singly at the apices of the conidiogenous cells, at first adhering in chains but later forming a subglobose slimy mass enveloping the whole head of the conidiophore, hyaline singly but the whole head assuming a glistening deep reddish coloration, ellipsoid, not septate, thin-walled, slightly rugose-walled, 3-5(-7) \times 2.5-3.5 μ m.

The type collection comprises fragments of dead lichen thalli and mosses and it was only with difficulty that the fungus described from it was found. The identity of the lichen could not be ascertained; it is a foliose species with a densely tomentose-rhizinate lower cortex suggestive of a member of the Stictaceae but no cyphellae or pseudocyphellae were noted on the fragments,

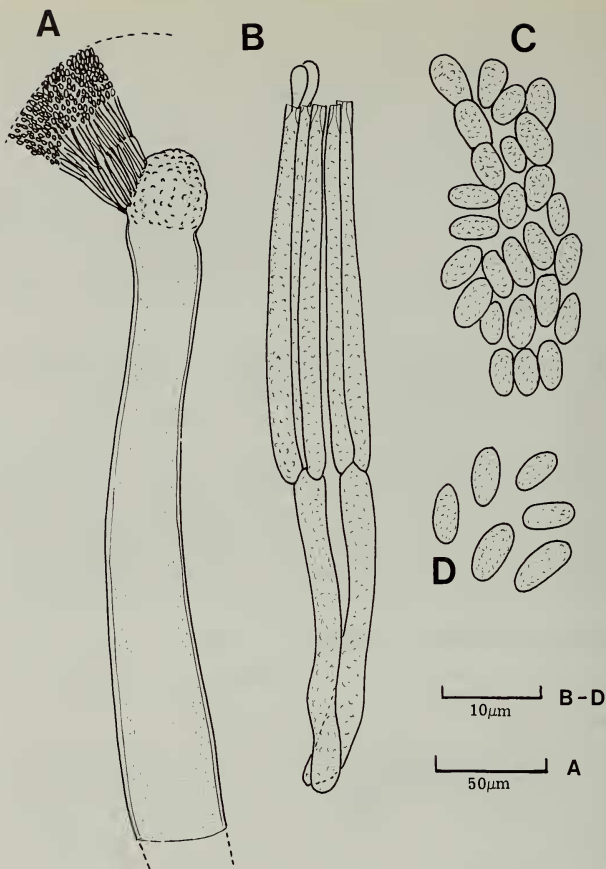


Fig. 45 *Glioccephalis pulchella* (PAD—holotype), A, Conidiophore apex. B, Arrangement of conidiogenous cells. C-D, Conidia.

which are discoloured brownish. As the fungus, superficially reminiscent of the Mucorales, occurred on only a single fragment, on its upper and lower surfaces, and was originally reported associated with adjacent mosses, I consider that it is a saprophyte which is not obligately lichenicolous and which arose secondarily on decaying thalli of the lichen; it is consequently treated here and not in the main part of this work.

It will be evident from the illustrations presented here that this fungus is not a species of *Gliocladium* Corda, as it has a columella-like head to the conidiophore stalk which recalls that of

Aspergillus Mich. ex Fr.; it does, however, differ from the last genus in that the phialides are not ampulliform and short, but the conidia are ellipsoid and non-globose, and form a massive slimy head which is not dry. The only suitable genus I have been able to locate for this fungus is the monotypic *Gliocephalis* Matr., once thought to belong in the Mucorales but now known to be a hyphomycete (Embree, 1963). From the illustrations of *G. hyalina* Matr. published by Matruchot (1899 : Pl. 14), Arnaud (1952 : 197) and Barron (1968 : 176) it seems clear that this species can be placed with it. The new combination ***Gliocephalis pulchella*** (Penz. & Sacc.) D. Hawksw. **comb. nov.** is consequently made here. *G. hyalina* differs from *G. pulchella* in being hyaline throughout and having completely smooth-walled prophialides, phialides and conidia; the dimensions of the various structures are remarkably alike in the two species except that the length on the conidiophore stalk is much longer in *G. pulchella* (to only 500 µm tall in *G. hyalina* according to Matruchot, *loc. cit.*). *G. hyalina* is most probably a saprophyte and is known from soil and decaying plant material.

Hymenella veronensis C. Massal., *Atti Mem. Accad. Agr., Soc. Lett. Art., Verona IV, 3* : 149 (1902).

Type: Italy, Verona, on bark of *Platanus*, January 1902, C. Massalongo (VER—holotype!).

This name was accepted by Keissler (1930 : 641) as a facultatively lichenicolous fungus, apparently on the basis of a reference to its occurrence on the apothecia of *Lecanora dispersa* (Pers.) Sommerf. (syn. *L. unbrina* auct.) growing on linoleum in France and collected by Bouly de Lesdain. Massalongo's taxon proves to be a later synonym of the sporodochial hyphomycete *Bloxamia leucophthalma* (Lév.) Höhn. (syn. *B. truncata* Berk. & Br.) previously known from bark of *Malus* and *Ulmus*; this fungus was illustrated by Pirozynski & Morgan-Jones (1968 : 185–187) and is not lichenicolous. As Keissler cited the page number of Massalongo's work incorrectly and, to illustrate the genus, provided a figure of a *Chalara* species, it is doubtful if Keissler saw the original publication let alone Massalongo's collection. Keissler did not provide any details of Bouly de Lesdain's fungus, the published description probably being drawn from Saccardo's *Sylloge* treatment of Massalongo's name, and so the identity of his specimen remains uncertain.

Hymenobolus parasiticus Zukal, *Öst. bot. Z.* **43** : 73 (1893).

Hymenobolina parasitica (Zukal) Zukal, *Öst. bot. Z.* **43** : 133 (1893).

Licea parasitica (Zukal) G. Martin, *Mycologia* **34** : 702 (1942).

For typification and further synonyms see Martin & Alexopoulos (1969 : 46–47).

While following Lister (1925 : 184) and accepting Zukal's taxon as a myxomycete, Keissler (1930 : 631) also listed the name 'pro parte' as a synonym of *Illosporium roseum*. This arises because Zukal considered the hyphomycete present in his material to be the plasmodial phase of the myxomycete. Santesson (1948) argued that Zukal's name should consequently be rejected as based on discordant elements but his view was not accepted by Martin & Alexopoulos (1969 : 47) who considered that the myxomycete element should be selected as a 'satisfactory type' in the sense of Art. 70. Since Zukal's name has not been taken up in the Hyphomycetes, and as the species is well known as a myxomycete, I concur with their view.

Hyphelia rosea Pers. ex Fr., *Syst. mycol.* **3**(1) : 211 (1829).

Trichoderma roseum Pers., *Römer's Neue Mag. Bot.* **1** : 92 (1794); nom. inval. (Art. 13).

Hyphoderma roseum (Pers. ex Fr.) Fr., *Summ. veg. Scand.* **2** : 447 (1849).

Trichothecium roseum (Pers. ex Fr.) Link, *Magazin Ges. naturf. Fr. Berl.* **3** : 18 (1809); nom. inval. (Art. 13).

Trichothecium roseum (Pers. ex Fr.) Link ex Fr., *Syst. mycol.* **3**(2) : 426 (1832).

For typification and further synonyms see Hughes (1958).

The name '*Hyphelia rosea* Fr.' was listed by Keissler (1930 : 524) as sterile mycelium of the fungus now known as *Athelia arachnoidea* (Berk.) Jül. However, Fries based his name on Persoon's taxon and this has been typified by material in L (Hughes, 1958) and is the ubiquitous saprophyte well known as *Trichothecium roseum* today. This species is not uncommonly encountered on

decaying lichens but it is by no means primarily a lichenicolous species. It was also treated by Keissler (*loc. cit.*) under the name *T. roseum*, but must be omitted from any account of the obligately lichenicolous fungi.

Fries (1825: 149) introduced the generic name *Hyphelia* Fr. for Persoon's fungus instead of employing Link's generic name *Trichothecium* as he considered Link to have misapplied Persoon's name. As Link clearly based his name on Persoon's species it can nevertheless be typified by Persoon's material and not that of Link.

***Hyphelia viridula* Wallr., *Fl. crypt. Germ.* 2: 244 (1833).**

Type: Germany, circa Heringang Thuring, 'ad Lichenum gonidia asyntheta in *Salicum cortice rarius*'.

The original description of this taxon was 'sporodochis primum maculari pallide-viride depresso, ambitum hyphoideum pallidiorem emittente dein coacto umbonato, sporidia alba compacta obvallante'. No reply could be obtained from STR so it is not known whether the original material on which this name was based is present there today amongst Wallroth's herbarium; no fungi under this name exist in PRM (M. Svrček, *in litt.*) which has a few Wallroth collections according to Hughes (1958). Keissler (1930: 622) noted 'Die Deutung dieser Art ist ganz unmöglich'; it must so remain until Wallroth's material can be examined.

***Hyphoderma effusum* Fuckel, *Jb. nassau. Ver. Naturk.* 23/24: 363 (1870); nom. inval. (Art. 32).**

Type: Germany, Reichartshausen, on *Xanthoria parietina* (L.) Th. Fr., *K. W. G. L. Fuckel*, Fungi rhen. no. 241 (sub *Illosporium roseum*) (K—2 isotypes!).

The host of this fungus was originally given as '*Parmelia stellaris*' but only *Xanthoria parietina* was present on the isotypes studied and the thalli of this had been killed by an invading white mycelium. Although no sclerotia were found, the habit and symptoms recall those caused by *Athelia arachnoidea* (Berk.) Jül. on this host; Keissler's (1930: 524) suggestion that it might be an immature state of that species is consequently accepted.

***Hyphoderma sparsum* Fuckel, *Jb. nassau. Ver. Naturk.* 23/24: 363 (1870).**

Type: Germany, Hessen-Nassau, 'ad Lichenes varios in corticibus, non frequens. Autumnò', *K. W. G. L. Fuckel*, Fungi rhen. no. 239 (sub *Illosporium aurantiacum*) (K—2 isotypes!).

One of the isotypes studied mainly comprised *Physcia adscendens* (Th. Fr.) Oliv. attacked by a sparse sterile white mycelium, while the second had both this species and *P. aipolia* (Ehrh. ex Humb.) Hampe attacked by abundant *Illosporium corallinum*. Keissler (1930: 524) placed Fuckel's name as a synonym of the species now called *Athelia arachnoidea* (Berk.) Jül. but also listed the exsiccatum under *Illosporium*. As Fuckel compared his taxon with *Hyphoderma effusum* (q.v.) however, it is evident that he intended the name to apply to the element other than the *Illosporium*. The name *H. sparsum* is consequently treated here as of uncertain application as it is not clear that the sterile mycelium belongs to *Athelia*.

***Illosporium coccineum* Fr., *Syst. mycol.* 3(1): 259 (1829).**

Type: France, Mougeot '666' (UPS-Fries—lectotype!).

Illosporium roseum β . *coccineum* (Fr.) Ferr., *Fl. ital. Crypt.* 1: 43 (1910).

Icones: Corda, *Icon. Fung.* 3: Pl. 1 fig. 3 (1839).

Exsiccatae: Mougeot and Nestler, *Stirp. crypt. Voges.*, fasc. 10 no. 996 (1833).—Roumeuguère, *Fungi sel. Gall.* no. 321 (1879).

The original habitat of this taxon was given by Fries (*loc. cit.*) as 'In Lichenibus leprosis crustaceis, v.c. in *Leparia argena* et *aglaea* [sic] Ach. in Gallia occidentali. Prevost.' There are three specimens under this name in Fries's herbarium: (1) 'Scania' [Skåne] collected by Fries but undated, (2) 'Moug. n. 666' with no further information and (3) a specimen collected by Flotow in Germany in 1848 occurring on *Parmelia saxatilis* (L.) Ach. and labelled with a query ('?'). The first two specimens agree in all respects but the third does not and belongs elsewhere (see p. 238); in view of its date this latter collection is not important for the purposes of typifica-

tion of Fries's name. As Fries did not mention any occurrences in Scandinavia, it seems possible that the first was collected after 1829. The second collection mentioned is intriguing; Mougeot and Nestler's exsiccatum no. 666 is '*Sphaeria trichina* Pers.', has nothing to do with the present taxon, but was distributed in 1820; material agreeing with the Uppsala specimen was, however, sent out by them as no. 996 in 1833 or 1834 (Sayre, 1969 : 77) but labelled 'invenit primo in Gallia occidentali amicus *Le Prevost*, nos postea in Lotharingia'. It is tempting to speculate that Mougeot sent a *Le Prevost* specimen to Fries prior to 1820 when preparing the seventh fascicle of the exsiccata intending to distribute this as no. 666, but subsequently found he had insufficient material and held back sending it out until they had collected further specimens themselves. This second specimen is designated as lectotype for Fries's name here as it is presumably from France and may well have been seen before 1829; if the above speculations were correct, however, it would be the holotype for this name.

The 'host' in all cases proved to be *Phlyctis argena* (Spreng.) Flot. but the identity of the vivid pink granules described by Fries and later author's was at first puzzling as they appeared to be essentially structureless crystalline masses dissolving in potassium hydroxide. A survey of the literature on this host soon left me in no doubt that these were the same structures described as pink soralia which were considered to constitute f. *erythrosora* (Erichs.) Almb. (syn. *Phlyctis erythrosora* Erichs.), a taxon not accepted as meriting separate recognition by modern lichenologists (Laundon, 1970 : 307). In fact these structures seem to be almost devoid of algae and essentially represent excrescences of norstictic acid which is normally colourless but can assume a pink colouration on decomposition in basic situations, particularly by the seepage of alkaline moisture (see Lamb, 1964 : 11); it is noteworthy that the pink granules occur on parts of thalli which would have been in bark crevices and thus subject to such seepage. *Illosporium coccineum* Fr. is consequently to be regarded as a synonym of this morph of *Phlyctis argena*.

In addition to the exsiccatae cited above, two further exsiccatae were sent out under this name (Libert, *Pl. crypt. Ard.* no. 281; Fuckel, *Fungi rhen.* no. 240); these have been mentioned on p. 236.

Keissler (1930 : 633) noted that this taxon had been reported from a range of hosts; all apart from those not cited as 'on' *Phlyctis* species (a genus surprisingly not included in Keissler's list!) are misidentifications.

***Illosporium flavellum* Berk. & Br., *Trans. Linn. Soc. Lond.* II Bot., 2 : 68 (1883).**

Type: Australia, Queensland, Brisbane, *F. M. Bailey 273* (K—holotype!).

Icones: Berkeley & Broome, *Trans. Linn. Soc. Lond.* II Bot., 2 : Pl. figs 12–14 (1883).

The lichen in the type collection was not determined by the authors of this taxon but proves to be *Heterodermia speciosa* (Wulf.) Trevis. (syn. *Anaptychia speciosa* var. *tremulans* (Müll. Arg.) Kurok.). The pale orange structures described and illustrated by Berkeley & Broome (*loc. cit.*) are not, however, confined to the soralia and lobe surfaces of the lichen but also occur directly on both leaves of mosses and other debris amongst the lichen lobes. A microscopic examination of the orange bodies showed them to comprise spherical cells mainly 7–10 µm diam which were sometimes linked in irregular chains or had the individual cells becoming more elongate and filament-like. The cells appear to contain a parietal cupuliform chloroplast and this name is consequently to be referred to the Chlorophyceae and not to the Fungi. The *Heterodermia* is not damaged by the presence of this superficial alga and no lobe discoloration had taken place.

***Illosporium globulatum* Nyl., in Nylander & Saelan, *Herb. mus. fenn.* : 112 (1859).**

Type: Finland, Ob. Övertorneå (Ylitornio), Alkkula, 1850, [*A.*] *E. Nylander* (H—holotype!).

This name was treated as probably identical with *Illosporium roseum* (see p. 236) by Keissler (1930 : 631) who gave the 'host' as *Solorina saccata* (L.) Ach. The type collection has eroded orbicular patches on the thallus, erumpent from the algal layer, which comprise globose structures mainly 60–80 µm diam made up of cells mainly 7–8 µm diam, which were originally taken to be conidia. At first the structures are pale pink but later some become bluish-green due to the

inclusion of algal cells. A comparison of the material with *Peltigera spuria* (Ach.) DC. (as the sorediate morph *P. erumpens* (Tayl.) Vain.) leaves no doubt that Nylander's name was simply based on the soredia of this species and that it has nothing to do with *Solorina*. This confusion is perhaps not too surprising if it is remembered that the sorediate morph of *P. spuria* was first described in 1847 and Nylander was probably unfamiliar with it by 1850 when the diagnosis of this taxon may well have been written.

Illosporium puniceum Lib., *Pl. crypt. Arduenn.*, fasc. 3, no. 282 (1834).

Type: Belgium, Arduennes, 'in *Muscis*, Hieme', *M. A. Libert*, *Pl. crypt. Arduenn.*, fasc. 3, no. 282 (K—3 isotypes!).

Myxosporium puniceum (Lib.) Corda, *Icon. fung.* 3 : 2 (1839).

Phylloedia punicea (Lib.) Sacc., *Syll. Fung.* 4 : 66 (1886).

Myrothecium puniceum (Lib.) Oud., *Enum. syst. Fung.* 1 : 184 (1919); ? nom. inval. (Art. 34).

One of the isotypes in K has *Cladonia portentosa* (Duf.) Zahlbr. which supports superficial deep red sessile or shortly stipitate translucent bodies 1–1.5 mm wide; similar structures occur on bryophytes in that isotype and on the bryophytes in the other two isotypes studied, which contain no lichens. Microscopic examination revealed that the bodies contained sporangia with rounded thick-walled microcysts characteristic of the Bacteria, order Myxobacteriales; the material could not be referred to any particular family or genus within this order on the basis of this state but it is of interest that the epithet appears to be the oldest ever proposed for a member of the Myxobacteriales (see Buchanan & Gibbons, 1974).

Tulloch (1972 : 40) regarded Oudemans's use of *Myrothecium* for this taxon as merely a misprint for *Myxosporium*; this interpretation is almost certainly correct.

Isaria virescens Elenk. & Danil., *Notul. syst. Inst. cryptog. Horti bot. petropol.* 1 : 5 (1922).

Type: U.S.S.R., 'e thallo *Peltigerae aphthosae* (L.) Hoffm. hic fungus ab A. B. Danilov sub vitro in cultura purissima receptus'.

This taxon probably represents the first lichenicolous hyphomycete to be grown in pure culture. No herbarium material or dried cultures could be located amongst either the fungal or lichen herbaria in LE (N. Golubkova, *in litt.*) but from the extensive description provided it seems most probable that this fungus was *Penicillium claviforme* Bain., a not uncommon saprophytic species common in forest soils and frequent on dung. For a detailed description of *P. claviforme* see Samson *et al.* (1976 : 13–14). This is consequently not a strictly lichenicolous fungus and is excluded from further consideration here, its isolation from *Peltigera aphthosa* being treated as accidental.

Lichen roseus Schreb., *Spicil. Fl. Lips.* : 140 (1771).

Type: Germany, Leipzig, 'cortici tiliarum annosarum adnascitur, in horto Apeliano frequens'.

Lepra rosea (Schreb.) Willd., *Fl. Berol. Prodr.* : 371 (1787).

Byssus roseus (Schreb.) Retz., *Fl. Scand. Prodr.*, Ed. 2 : 308 (1795).

Tuberularia rosea (Schreb.) Pers., *Obs. mycol.* 1 : 78 (1796).

Lepraria rosea (Schreb.) Ach., *Lich. Suec. Prodr.* : 9 (1798); nom. inval. (Art. 34).

Palmella rosea (Schreb.) Lyngb., *Tent. Hydroph. Dan.* : 207 (1819).

Coccochloris rosea (Schreb.) Spreng., *Linn. syst. Veg.*, Ed. 16, 4(1) : 373 (1827).

Illosporium roseum (Schreb.) Fr., *Syst. mycol.* 3(1) : 258 (1829).

Protococcus roseus (Schreb.) Corda, *in Sturm, Disch. Fl., Alg.* 6 : 37 (1833).

Microcystis rosea (Schreb.) Kütz., *Linnaea* 8 : 373 (1833).

Haematococcus roseus (Schreb.) Meneghini, *Consp. Alg. Egan.* : 5 (1837).

Non *Illosporium roseum* Mart. ex Ficinus & Schub., *Fl. Dresd.* 2 : 259 (1823); nom. illegit. (Arts. 13, 64).

No authentic material of this taxon could be located in M (H. Hertel, *in litt.*). Drouet & Daily (1956 : 153), however, designated Schreber's original description as the 'temporary Type'. This was as follows (Schreber, *loc. cit.* : 140):

'1150. LICHEN (*roseus*) pulverulentus conglomeratus roseus.'

'Glebulae parvae, rotundae aut irregulares, pulcherrimae, figura et colore floris cobalti, (qualis quarzo inspersus in fodinis subinde occurrit) pulverulentae: moleculis ejusdem formae ac pulveris saepe e lichenibus efflorescentis.'

On the basis of this description it cannot be certainly stated that Schreber was dealing with a lichenicolous organism as the last phrase could mean simply arising from amongst lichen thalli. Persoon (1796 : 79) was in no doubt that the taxon could *sometimes* be lichenicolous and gave *Anaptychia ciliaris*, *Physcia stellaris*, *P. tenella* and *Xanthoria parietina* as hosts. Acharius (1798 : 9) at first considered it a true lichen but later (Acharius, 1803 : 3) followed Persoon and treated it as a fungus. Quite independently Schreber's name came to be used by algologists as will be evident from the synonymy above. If the species was lichenicolous as Persoon, and later Fries, thought, it is surprising that Schreber, who was a lichenologist of some note, did not clearly indicate that this was the case or name the host lichen. Schreber's original description does not agree with any lichenicolous fungus known to me; the cobalt crystal colour and shape reported is particularly difficult to explain. It does not seem possible to be certain what type of organism Schreber was dealing with.

While the identity of Schreber's taxon remains obscure, there can be little doubt that Persoon (1796 : 78-79) and many later authors have applied this name to the lichenicolous fungus now treated as *Illosporium corallinum*; this same usage was adopted by Fries (1829 : 258-259) but no material is present amongst his collections in UPS today. This usage of the name cannot, however, be reconciled with either Schreber's description or the use of the epithet by algologists. Further, Schumacher (in Oeder, 1799 : Pl. 1243 fig. 1) and Nees (1837 : Pl. 11(2) figs. 1-3) both provided coloured illustrations under the name *Lichen roseus* in which vivid pinkish masses arose on wood but not on foliose lichens close by in their illustrations; there are several possibilities as to the identities of the structures figured. The taxon might have been a member of the Dacrymycetales (e.g. *Dacrymyces stillatus* Nees ex Fr.), young *Ascocoryne sarcoides* (Jacq. ex Gray) Groves & Wilson, *Hormomyces aurantiacus* Bonord. (see Tubaki, 1976), the *Tubercularia* state of a *Nectria*, a member of the Myxobacteriales, plasmodia of some myxomycete (e.g. *Arcyria* spp., *Lycogala epidendrum* (L.) Fr.), etc.

In view of these uncertainties there is no alternative but to treat Schreber's name as of uncertain application. As it cannot be firmly established to which group of organisms this name belongs, its starting point date and hence its place of valid publication is also uncertain. Such difficulties in the application of multiple starting point dates have already been commented upon elsewhere (Hawksworth, 1978a : 232-234).

Lindauiopsis caloplacae Zahlbr., *Ber. dt. bot. Ges.* 24 : 145 (1906).

Type: Crete, Pa Bhöhe Bebona bei Kavusi, in apothecia of *Caloplaca aurantia* (Pers.) Hellb. on limestone, 21 May 1904, R. Sturany (W 1906/755—lectotype!).

Icons: Keissler, *Rabenh. Krypt.-Fl.* 8 : 598 fig. 120, 599 fig. 121 (1930).—Zahlbruckner, *Ber. dt. bot. Ges.* 24 : Pl. 10 fig. 1-10 (1906).

Zahlbruckner introduced the new generic name *Lindauiopsis* Zahlbr. for this taxon which he interpreted as a hyphomycete growing in the hymenium of *Caloplaca aurantia*. Riedl (1976b) investigated this case in some detail and concluded that the structures figured by Zahlbruckner merely represented degenerated hymenial tissues in which the paraphyses tips had become rather swollen and consequently were mistaken for conidia. My examination of the lectotype specimen confirms Riedl's interpretation of this name.

Macrosporium commune Rabenh. ex Sacc., *Fungi ital. delin.* : tab. 1207 (1882).

This species was mentioned by Vouaux (1913 : 78) as occurring on thalli of *Ochrolechia parella* (L.) Massal. infected by *Merismatium lecanorae* (Oliv.) Vouaux in France; it was accepted in Keissler (1930) as a lichenicolous species. The identity of *M. commune* has been thoroughly investigated by Wiltshire (1938) who found it to be a synonym of *Stemphylium botryosum* Wallr.,

the conidial state of *Pleospora herbarum* (Fr.) Rabenh., a widespread parasite and saprophyte of vascular plants forming leaf-spots and occurring on decaying herbaceous stems, etc. This is consequently excluded as not an obligately or primarily lichenicolous fungus but one fortuitously occurring on lichens.

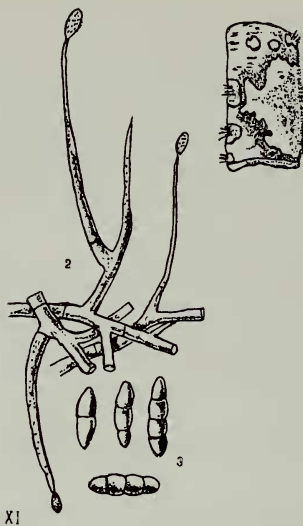


Fig. 46 *Monacosporium carestianum*. Reproduced from Ferraris (1904).

***Monacosporium carestianum* Ferraris, *Malpighia* 18 : 500 (1904).**

(Fig. 46)

Type: Italy, Riva Valdobbia, on thallus of a *Physcia*, September 1901, *A. Carestia* 2121.

Icones: Ferraris, *Malpighia* 18 : Pl. 9 fig. 11 (1904).—Keissler, *Rabenh. Krypt.-Fl.* 8 : 601 fig. 122 (1930).

No material of this taxon could be located in PAD (L. Curti, *in litt.*), RO (Q. Bartoli Rambelli, *in litt.*), VER (F. Bianchini, *in litt.*), or TOR (G. Forneris, *in litt.*). This fungus was described as producing long conidiophores to about 100 μm tall and 5 μm wide at the base, which were hyaline singly but pale rose in mass. The conidia were 1–3 septate, slightly constricted at the septa, broadly fusiform, rose in mass, and $21\text{--}26 \times 7\text{--}8 \mu\text{m}$. The striking resemblance between the description of this fungus and that of *Dactylium dendroides* subsp. *lichenicola* has already been mentioned under the latter above. *Monacosporium* Oud. mainly comprises nematophagous fungi and it seems most unlikely that this species should be placed there. An assessment of the position of this fungus must await either the location of the type material or the re-discovery of a species agreeing closely with the original description so that the method of conidiogenesis can be established.

***Oidiodendron rhodogenum* Robak, *Nyt Mag. Naturvid.* 71 : 251 (1932).**

Smith (1946 : 232) reported this species as new to the British Isles on the basis of a culture 'Ag 109' which was isolated by the late J. H. V. Charles from a lichen on a wooden post, in

December 1926'. No indication of the name of the lichen was provided but, as the culture came from the Ardeer collection of the Nobel Explosive Company, it almost certainly originated in Scotland. *Oidiodendron rhodogenum* was originally isolated from the sludge of wood pulp containers in Norway. To judge from material of this fungus now in IMI, it is predominantly a species of decaying wood but can occur in a variety of other habitats (air spora, cellophane, soil, straw and the stomach of an aborted bovine foetus). A subculture of 'Ag 109' is maintained at CMI as IMI 91983(!) and appears conspecific with the non-lichenicolous isolates. It seems most probable that this was only fortuitously obtained from a lichen as a result of conidia which had spread on to the thallus from the wooden post on which it was growing.

Sclerococcum lecanorae Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30** : 325 (1914).

Diplodia lecanorae (Vouaux) Keissl., *Ark. Bot.* **18**(16) : 10 (1923).

This taxon was originally described from the apothecia and thalli of *Lecanora saligna* (Schrad.) Rabenh. collected by Bouly de Lesdain at Ghyvelde and Versailles, and also from apothecia of *L. piniperda* Körb. collected by Marc at Meyrueis in Lozère; as Bouly de Lesdain's herbarium was destroyed in 1940 and no material is present amongst Vouaux's remaining material (Rondon, 1970) some doubt must surround the application of this name. Vouaux (*loc. cit.*) compared the taxon to *Microdiplodia lecanorae* Vouaux but stated that it had no 'perithecia'; the brown 1-septate ellipsoid conidia described are strongly reminiscent of that species. Keissler (1923) referred some specimens on unnamed *Lecanora* and *Lecidea* species in UPS to this which definitely had pycnidia; later (Keissler, 1930 : 575) he indicated that this species differed from *Microdiplodia lecanorae* in the much darker brown conidia, which are also reported to be slightly longer than is usual for that species. The available evidence consequently suggests that Vouaux really had a coelomycete very similar to the common *M. lecanorae*.

Sclerotium granulatum Schumacher, *Enum. Pl. Scell.* **2** : 186 (1803).

Type: Denmark, Zealand, *H. C. F. Schumacher*, MS 'Flora Hafniensis fungi delineati' (C—lectotype!).

No herbarium material of this taxon is now available but through the courtesy of Dr H. Knudsen I was able to examine colour transparencies of Schumacher's drawings of this in C. The organism looks superficially *Illosporium*-like and forms irregular pinkish masses on the thallus of a foliose lichen, most probably a *Parmelia* species. The pinkish granules are not, however, confined to the lichen thallus but figured as abundant on adjacent bryophytes; for this reason I am not convinced that this was a fungus and suggest that a member of the Myxobacteriales was involved. The original habitat was cited as '. . . in Lichenibus variis, stellato, saxatilique arborea praesertim . . .' so it would appear probable that some other specimens included under this name belonged in *Illosporium*. If the name was proved to be of a fungus it would not be validly published (Art. 13).

Sclerotium lichenicola Svendsen, *Bot. Notiser* **52** : 227 (1899).

Type: Sweden, 'ad Upsaliam, Holmiam, Dalarö et Örebro'.

This sclerotium-forming fungus was investigated in culture in considerable detail but failed to produce any perfect stage. As clamp-connections were produced (Svendsen, 1899 : Pl. 2 figs 2-3) there can be no doubt that this was a basidiomycete and, from the host lists and descriptions provided, this taxon was certainly the sclerotial state of *Athelia arachnoidea* (Berk.) Jül.

Selenosporium lichenicola Speg., *An. Mus. nac. B. Aires* **20** : 459 (1910).

Type: Argentina, La Plata, on *Candelaria fibrosa* (Fr.) Müll. Arg. (thallus), September 1906, *C. Spegazzini* (LPS 32.788—holotype!).

Fusarium lichenicola (Speg.) Sacc. & Trott., *Syll. Fung.* **22** : 1486 (1913); nom. illegit. (Art. 64), non *Fusarium lichenicola* C. Massal. ex anno 1903.

The type material supports some orange-red translucent sporodochia-like structures recalling *Illosporium corallinum* in their superficial appearance, but no conidia could be found. There is a pencil drawing on the packet in Spegazzini's hand which shows 3-5 septate slightly curved

Fusarium-like conidia borne on simple conidiophores; the conidia are given as $75\text{--}110 \times 8\text{--}9 \mu\text{m}$ on the packet but in the published description the width appeared as $6\text{--}9 \mu\text{m}$. There can be no doubt that this fungus was a *Fusarium* species but it cannot be placed in any of the species accepted by Booth (1971) without further information on the arrangement of the conidiogenous cells. The host lichen is little affected by the presence of this fungus and is in a reasonably healthy condition. It is thus possible that Spegazzini's fungus represents an obligately lichenicolous species but it would be premature to accept it (which would mean introducing a new name) in the absence of further material.

Following Wollenweber, Booth (1971: 201) placed this name tentatively as a synonym of *Bactridium lichenicola* (C. Massal.) Wollenw. but it is clearly nothing to do with that taxon (see p. 272).

Spilonium species.

The identities of all taxa which have been referred to *Spilonium* Nyl. are discussed by Hawksworth (1975a) and are therefore not repeated here.

Sporoschisma mirabile var. *lichenicola* Gonz. Frag., *Boln Soc. broteriana* II, 2: 49 (1924).

Type: Portugal, 'cerca de Coimbra', on thalli of *Collema cristatum* var. *marginale* (Huds.) Degel. (syn. *C. multifidum* (Scop.) Rabenh.) on mossy ground, January 1922, G. Sampaio (MA 5918—holotype!).

The thallus of the *Collema* supports colonies of an epiphytic alga, different from the lichen phycobiont. The measurements of the alga leave no doubt that this is what González Frago (loc. cit.) described. My conclusions are thus in accordance with those of Hughes (1949: 20) who further reported that Miss C. E. Dickinson had indicated that the alga belonged to the Scytonemataceae (Cyanophyceae).

Sporotrichum lettauianum Bachm., *Hedwigia* 66: 336 (1926).

Type: Germany, Thüringen, Unterpörlitz, in thalli of *Cornicularia* cf. *aculeata* (Schreb.) Ach., G. Lettau (W 1940/503—holotype!).

Icons: Bachmann, *Hedwigia* 66: 331 fig. 1, 332 fig. 2, 334 figs. 3–8 (1926).—Keissler, *Rabenh. Krypt.-Fl.* 8: 595 figs. 117–119 (1930).—Keissler, *Rabenh. Krypt.-Fl.* 9, 5(4): 186 fig. 29A (1959).

This taxon was described as probably the causal agent of the formation of abnormal witches' broom-like (Hexenbesen) tufts of branches in *Cornicularia*. These were studied in some detail by Bachmann (1926) but the material on which the investigation was based is now reduced to a few minute scarcely determinable fragments in which no structures recalling the conidia, $8\text{--}5\text{--}10 \times 4\text{--}6 \mu\text{m}$ reported, could be found. Some brown torulose hyphae similar to those originally described were found within the thallus but it is possible that these belonged to a species of *Lichenoconium* (probably *L. usneae* (Anzi) D. Hawksw.) also found on this specimen by Bachmann. There is a second specimen which was tentatively referred to this species by Keissler (Sweden: Hälsingland, Enåger, Bäckmolaasen, October 1935, S. Ahlner, W 1936/1629!) on *Cornicularia muricata* (Ach.) Ach.; in this, which was sufficiently large to permit examination in section, some torulose hyphae were again discovered and, with extensive searching, a few rare structures that might correspond to the structures considered as conidia by Bachmann; these are drawn in Fig. 47.

The identity of the type species of *Sporotrichum* Link ex Fr., *S. aureum* Link ex Gray, has been investigated by von Arx (1971) who found it to have clamp connections and thus to be the imperfect state of a basidiomycete; it is also hyaline and has conidia with broadly truncate bases. The structures illustrated by Bachmann cannot be referred to that genus. They perhaps show some superficial similarity to *Beniowskia sphaeroidea* (Kalchbr. & Cooke) Mason, a graminicolous species, but that is completely hyaline, has globose conidia, and distinct denticulate scars. A more definite opinion as to the identity of Bachmann's structures will have to await the discovery of further such deformed *Cornicularia* thalli; it is regrettable that the original slides used by Bachmann were not kept in W with the drawings.

Keissler (1959: 185) interpreted *Cornicularia tenuissima* f. *pustulata* (Schaer.) Zahlbr. as material infected by *Sporotrichum lettauianum*; this view was reiterated by Grumann (1960: 125–126) but there is no evidence either saw Schaerer's material.

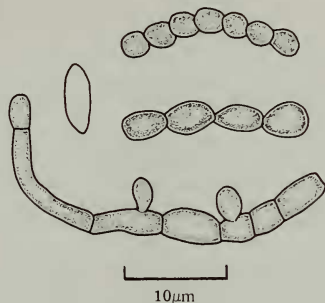


Fig. 47 ? *Sporotrichum lettauianum* (W 1936/1629).

Sporotrichum lichenicola Berk. & Br., *J. Linn. Soc., Bot.* **14**: 102 (1873).

Type: Sri Lanka, Peradeniya, 'our white mould', December 1867, [collector not indicated] (K—holotype!).

The type collection comprises a species of *Phaeographina* with pruinose margins to the lirellae on which there is a considerable amount of insect frass and eggs. Some superficial white mycelium is present and some ellipsoid hyaline conidia $3\text{--}5 \times 1.5\text{--}2 \mu\text{m}$ were found but no conidiophores discerned. A sketch by Berkeley on the type sheet indicates that he found these to be branched in a manner reminiscent of *Verticillium* sect. *Prostrata* W. Gams, with the conidia borne singly and not in chains. I suspect this fungus to be very close to or conspecific with *V. lecanii* (Zimm.) Viégas, a primarily entomogenous fungus which is known to be very common in the Peradeniya Botanic Garden today (Gams, 1975). Its occurrence on the lichen thallus appears to be due merely to the insect debris present, and so this taxon is not accepted as a true lichenicolous species. The epithet *lichenicola* predates *lecanii* by 25 years but as some measure of doubt as to the identity of *Sporotrichum lichenicola* remains it should not be taken up for that well-known species.

Keissler (1930: 524) listed *Sporotrichum lichenicola* as a synonym of the species now called *Athelia arachnoidea* (Berk.) Jül. but this cannot be supported. There is no evidence that Keissler ever saw the original collection of the *Sporotrichum* in K.

Stigmatella aurantiaca Berk. & Curt., in Berkeley, *Intr. Crypt. Bot.*: 313 (1857).

Type: U.S.A., South Carolina, *H. W. Ravenel 1328* (K—lectotype!).

Chondromyces aurantiacus (Berk. & Curt.) Thaxt., *Bot. Gaz.* **17**: 401 (1892).

For further synonyms and citations of illustrations see Keissler (1930: 33) and McCurdy (1974).

The name *Stigmatella aurantiaca* was introduced in Berkeley (1857) as a new genus and species with only an illustration and citation in the figure legend of the name and a collection by Ravenel on '*Sphaeria hibisci*'; in my view this publication can be accepted as valid under Art. 44 although this was not, or was overlooked, by Anon. (1976: 587) and McCurdy (1974). Only the pyrenomycete, which is effete, was found on this collection in K. In providing a description of the organism for the first time, Berkeley (1875: 97), however, cited an additional collection, 'Ravenel No. 1328. On Lichens'; two specimens of this number are present in K (that ex-herb. Berkeley being

designated as lectotype above) which, as Ravenel noted on the label of one packet, are on 'truncis putridis' and not lichenicolous but rather associated with various fragmented dematiaceous Hyphomycetes and effete Pyrenomycetes. Thaxter (1892) investigated this taxon thoroughly and established its position as a mycobacterium, the commonest of the group, occurring 'on decaying wood and fungi'; two strictly lichenicolous species were described by Thaxter in the same paper, *Chondromyces lichenicola* Thaxt. (correctly *Melittangium lichenicola* (Thaxt.) McCurdy) and *C. serpens* Thaxt. (correctly *Archangium gephyra* Jahn), but these are not discussed further here as they are not Hyphomycetes.

In treating *Stigmatella aurantiaca* as a hyphomycete Vouaux (1914: 314) and Clauzade & Roux (1976: 94) evidently overlooked the work of Thaxter (1892) and saw no material of this taxon.

This genus and species are currently accepted in the gliding bacteria (Myxobacteriales, Cystobacteriaceae McCurdy) and McCurdy (1974) provides a comprehensive description of the organism including its behaviour in pure culture. He also designated *Thaxter 4477* (FH *non vidi*) as a neotype for the name but this appears to be superfluous in view of the material suitable for lectotypification preserved in K.

Torula alpina Fourç., in Roumeguère, *Fungi sel. Exs.* no. 4188 (1887).

Type: Spain, Pyrenées, rochers du Col de Venasque, on *Alectoria ochroleuca* (Hoffm.) Massal., automne 1886, *C. Fourcade*, Roum. *Fungi sel. Exs.* no. 4188 (K—isotype!).

No fungus in a determinable condition was located on the isotype in K and Dr J. L. Crane (*in litt.*) also failed to find any fungus on further isotypes in ILL and NY. To judge from the original description only torulose dark brown hyphae were being described, and therefore this name is rejected as based merely on sterile mycelium. Rather few fungi seem able to occur on this host but it is perhaps of interest that one which does occur on it in the Pyrenées, *Tichothecium alectoriae* D. Hawksw. (Hawksworth, 1971), has dark brown hyphae.

Keissler (1910: 22 fig. 1) illustrated some sterile brown torulose hyphae found on thalli of *Pertusaria lactea* (L.) Arnold from Thüringen which he tentatively referred to *Torula alpina*.

Torula cyanescens Kalchbr., *Mat. természettud. Közlem.* 3: 296 (1865).

Type: Hungary, Szepes Hebrich adjoining Szepes Olaszi forest, on '*Usnea barbata* var. *dasygoga*,' *K. Kalchbrenner*.

Oospora cyanescens (Kalchbr.) Sacc. & Vogl., in Saccardo, *Syll. Fung.* 4: 25 (1886).

Icones: Kalchbrenner, *Mat. természettud. Közlem.* 3: Pl. 2 fig. 10 (1865).

Keissler (1930: 557), in listing this name as a synonym of the species now known as *Lichenoconium usneae* (Anzi) D. Hawksw., attributed the epithet to Hazslínský and gave the date of publication as 1855. In the course of my studies on *Lichenoconium* I had been unable to obtain a copy of Kalchbrenner's original description of this taxon but through the courtesy of Dr J. L. Crane I have now been able to examine this work. There is no doubt that Kalchbrenner is the author of the epithet as while 'm.' appears on p. 296, 'Kalchbr.' is given in the legend to the plate on p. 319; the cover of the journal has the date 1845 in Roman numerals but the title page and its reverse side both have 1865 (in Roman on the cover and Arabic numerals on its reverse); the date 1855 does not appear on the publication.

The original description of this fungus was very brief:

'Ferre microscopica! Sporidiis 3-10 subhyalinis, sphaeroideis, in fila erecta, brevia, moniliformia plerumque simplicia compaginatia, hyphas non vidi.'

The published illustration shows three erect chains of subglobose cells, one of which has a single lateral branch towards its apex. Unfortunately no material of this taxon has been traced in either B (B. Hein, *in litt.*) or BP (J. Gönczöl, *in litt.*) and on the basis of the original description and illustrations it is not possible to assign this name with confidence to any known genus of Hyphomycetes; however, there is no doubt it is not *Lichenoconium usneae* and it must be excluded from that genus (Hawksworth, 1977b: 193).

There is also a report of *Oospora cyanescens* from Denmark (Lind, 1913 : 495) but as this was growing directly on wood it seems most unlikely that this was conspecific with Kalchbrenner's material.

Torula lichenicola Linds., *Trans. R. Soc. Edinb.* **25** : 515 (1869).

Type: Scotland, Perthshire, Loch Tay, on thallus and apothecia of *Lecanora chlorotera* Nyl. on *Fraxinus* by roadside, June 1856, *W. L. Lindsay* (E—lectotype!).

Sirothecium lichenicola (Linds.) Keissl., *Öst. bot. Z.* **60** : 61 (1910).

Vouauxiella lichenicola (Linds.) Petr. & Syd., *Reptium Spec. nov. Regni veg., Beih.* **42**(3) : 484 (1927).

This is the holotype species of the generic name *Vouauxiella* Petr. & Syd., an obligately lichenicolous genus of Coelomycetes in which three species are currently accepted (Hawksworth, 1976, 1978b). Lindsay (1869 : 515–518, 530–533, Pl. 23 figs 1–18) described this species in considerable detail and, unlike most of the subsequent workers on lichenicolous imperfect fungi, also provided fine coloured illustrations (macro- and microscopic). He cited 30 collections, most of which are now in E, but no lectotype appears to have been previously selected; the specimen chosen here is one of those figured in Lindsay's plate, has more pycnidia than many of the others studied and correspond's exactly to the concept of this species adopted by later workers (e.g. Vouaux, 1914; Keissler, 1930; Hawksworth, 1976). It should be noted that some of the specimens cited by Lindsay prove not to belong to *V. lichenicola* but to other lichenicolous Coelomycetes.

Torula lichenicola f. *cerinae* B. de Lesd., *Bull. Soc. bot. Fr.* **55** : 424 (1908).

Type: France, Cantal, bois de Nuits, on apothecia of *Caloplaca cerina* (Ehrh. ex Hedw.) Th. Fr., 1902, l'Abbé Charbonnel.

Sirothecium lichenicola f. *cerinae* (B. de Lesd.) Keissl., *Zentbl. Bakt. ParasitKde* **11**, **27** : 210 (1910).

Unfortunately the material on which this name was based was destroyed with Bouly de Lesdain's herbarium in 1940. Keissler (1930 : 567) placed this name as a synonym of the coelomycete *Vouauxiella lichenicola* (Linds.) Petr. & Syd. but to my knowledge that species does not occur in the apothecia of *Caloplaca* species. Bouly de Lesdain (*loc. cit.*) considered that his form was distinguished from f. *lichenicola* by '... des périthèces plus réguliers et des chapelets de spores beaucoup moins longs (2 à 3 spores seulement)'. The occurrence of only 2–3-celled chains of conidia would be most unexpected in *V. lichenicola*; it seems probable that what Bouly de Lesdain was describing were 1-septate conidia attached to the conidiogenous cells in *Microdiplodia lecanorae* Vouaux (syn. *M. ferrugineae* Vouaux), a fungus not uncommon in apothecia of *Caloplaca* species.

Torula lichenopsis Höhn., *Denkschr. Akad. Wiss. Wien* **83** : 36 (1907).

Type: Brazil, São Paulã, on indet. sterile crustose lichen on bark, July 1901, *G. Schiffner* (FH-Höhnel 1275—holotype!).

The original collection was examined by Dr J. L. Crane (*in litt.*) in 1973 and found to be conspecific with *Cladosporium sphaerospermum* Penz., an ubiquitous saprophytic species; I agree with this determination. The host of the *Cladosporium* is sterile and indeterminate, but it is of interest that the fungus is restricted to a single lichenized taxon in this collection and does not spread on to the thalli of a *Lecanora* intermixed with it.

Torula lichenum Keissl., *Zentbl. Bakt. ParasitKde* **11**, **37** : 388 (1913).

Type: Austria, Steiermark, 'in der Userzone des Leopoldsteiner See bei Eisenerz', alt. c. 600 m, in aged perithecia of *Staurothele rufifraga* (Massal.) Arnold, June 1910, *K. von Keissler* (W 1912/17—holotype!).

Icones Keissler, *Zentbl. Bakt. ParasitKde* **11**, **37** : 389 fig. 1 (1913).—Keissler, *Rabenh. Krypt.-Fl.* **8** : 607 fig. 126 (1930).

Only sterile brown torulose hyphae were illustrated by Keissler (*loc. cit.*) and this was all that could be located in the type collection; this name is consequently to be rejected from the Hyphomycetes as representing only sterile mycelium. Keissler (1930 : 608) tentatively referred collec-

tions on *Lecanora subfusca* Ach. and *Pertusaria lactea* (L.) Arnold from Germany, and on *Lecanora dispersa* (Pers.) Sommerf. from Switzerland, to this species. Material on which these reports were based has not been seen but there are two further collections under this name in W (Yugoslavia: Dalmatia, West-Cursola, 'Honi' bei Velaluka (Vallé grande), alt. 200–250 m, on *L. dispersa*, 21 March 1910, J. Baumgartner, W 1918/29!); **Finland**: Karelia ladogensis, Kurkijoki, on *Pertusaria protuberans* (Sommerf.) Th. Fr. on *Alnus incana*, 1 June 1933, C. F. E. Erichsen 287, W 1935/340!); these, like the holotype, merely support sterile brown torulose hyphae. *Torula lichenum* was also mentioned by Magnusson (1946: 144) on *L. polytropa* (Hoffm.) Rabenh. (apothecia), *P. protuberans* (apothecia) and *Xanthoria elegans* (Link) Th. Fr. (apothecia), all from Lycksele Lappmark, Sweden; the *Xanthoria* apothecia were said to be 'blackish brown from dense conidia' but no further details were supplied.

Torula opaca Cooke ex Sacc., *Syll. Fung.* 10: 574 (1892).

Type: U.S.A., New Jersey, Newfield, 'on bark of various dead and living shrubs', November 1881, J. B. Ellis, N. Am. Fungi, cent. 8, no. 759 (K—isotype!).

Torula opaca Cooke, in Ellis, N. Am. Fungi, cent. 8, no. 759 (1882); nom. inval. (Art. 32).

This fungus occurs in scattered colonies on thalli of three lichens in the isotype in K (*Buellia erubescens* Arnold, *Lecanora pallida* (Schreb.) Rabenh. and *Pertusaria multipuncta* (Turn.) Nyl.) but does not appear to damage them at all. As reported by Hughes (1958: 817), the fungus is conspecific with *Taeniolella breviscula* (Berk. & Curt.) S. Hughes, a species illustrated by Ellis (1976: 60 fig. 42A) and characteristic of live *Acer* bark in North America. This is not primarily a lichenicolous fungus, but is only fortuitously present on lichen thalli in Ellis' material and is consequently excluded from further consideration.

Torula ramalinae Nyl., in Roumeguère, *Fungi sel. Exs.* no. 4188 (1887); nom. inval. (Art. 34).

The name '*Torula ramalinae* Nyl. pr.p.' appears on the above exsiccatum label as a synonym of *T. alpina* Fourç. (q.v.). It has not been possible to locate any mention of this name in the publications of Nylander examined so far, and no specimens under this name could be located in Nylander's herbarium in H (T. Ahti, *in litt.*). This epithet is consequently of uncertain application.

Torula verrucosa Vouaux, in Bouly de Lesdain, *Bull. Soc. bot. Fr.* 54: 697 (1907).

Type: France, Parc de Versailles, Trianon, in *Lecanora chlorotera* apothecia on *Juniperus*, 24 October 1907, M. Bouly de Lesdain (hb. Vouaux—holotype!).

Sirothecium verrucosum (Vouaux) Keissl., *Öst. bot. Z.* 60: 61 (1910).

Vouauxiella verrucosa (Vouaux) Petr. & Syd., *Rep. Spec. nov. Regni veg., Beih.* 42: 483 (1927).

This is a coelomycete correctly placed in *Vouauxiella* which, as it has been discussed and illustrated by Hawksworth (1976: 58), is not treated further here.

Torulella asperellae Gyeln., *Lilloa* 4: 64 (1939).

Type: Norway, Hedemarken, Rörås, Skaar Hammerdal, on *Placynthium aspratile*, July 1924, E. P. Vrang (S—? holotype!).

Icones: Gyelnik, *Lilloa* 4: 65 fig. 1 (1939).

This species, the holotype of the generic name *Torulella* Gyeln. (Gyelnik, 1939: 64), was described as occurring in the apothecia of *Placynthium aspratile* (Ach.) Henss. (syn. *P. asperellum* (Ach.) Trev.). The holotype was said to be in BP but no reply has been received to requests for the loan of this taxon. The collection located in S, however, is labelled '*Torulella asperellae* Gyelnik n. sp. et n. gen. 1938.iv. Gyelnik' in Gyelnik's own hand and is evidently that sent by Vrang to Gyelnik. Gyelnik is known to have returned original collections of some lichen names he described to the collectors without retaining a portion in BP (although the type was stated to be in BP; see, for example, Brodo & Hawksworth, 1977: 68, 103, 136) and it is probable that

this occurred in this instance; this view is supported by Gyelnik (1940 : 64) citing Vrang's collection of the host as 'Herb. Vrang' with no mention of BP. As it is not certain that no material is in BP, the specimen in S can at the moment only be regarded as probably the holotype; at the very least it is an isotype.

Gyelnik (1939) described the conidia as 1-septate, ellipsoid, 'fusca', about $8 \times 4 \mu\text{m}$, and considered them to be produced at the surface of the apothecia from conidiophores originating in the hypothecium. Rather few apothecia were present on the specimen examined and a proportion of these were studied; in no case could structures recalling Gyelnik's description be found and the apothecial tissues were normally developed. However, scattered amongst the *Placynthium* are some pale fawn convex bodies 1–1.5 mm wide. It could not be firmly established if these were gall-like structures belonging to the *Placynthium* or areolae or young fruits of some other lichen. These growths were found to support torulose brown mycelium, mainly $3\text{--}5 \mu\text{m}$ wide, at their surface from which some hyphae penetrated down into the lichenized tissues; some rounded cells, mainly in chains, were discovered and a few of these were 1-septate but only appeared to be chlamydospores. As the latter measured $7\text{--}9 \times 4\text{--}5 \mu\text{m}$ there can be little doubt that these were the structures on which Gyelnik based his name; *Torulella asperellae* is consequently rejected as based on sterile torulose mycelium.

Torulella solorinella Gyeln., *Lilloa* 4 : 66 (1939).

Type: Austria, near Krems, alt. 200–350 m, on apothecia of *Solorinella astericus* on bare ground, *J. Baumgartner*, Krypt. Exs. Vindob. no. 43 (BM—2 arithmotypes!).

Icones: Gyelnik, *Lilloa* 4 : 66 fig. 2 (1939).

This taxon was described on the basis of a copy of the exsiccatum cited above in BP. Although this was requested from BP it was not received, but two copies of this number in BM were available for study; neither appeared to have the $3\text{--}4 \mu\text{m}$ wide brown mycelium Gyelnik (*loc. cit.*) described ramifying through the lichen, and no structures recalling the about $8 \times 4\text{--}5 \mu\text{m}$ 1-septate, ellipsoid, 'fusca' conidia he reported, were discovered. The application of this name consequently remains uncertain but in view of Gyelnik's description and the study of *Torulella asperellae* (above) it might be expected to be based merely on sterile torulose hyphae. A further possibility might be that what was really being observed was the apical parts of the paraphyses which form a dark brown epithelial layer (see illustrations in Poelt & Vězda, 1969).

Tubercularia lichenicola Sacc., *Fungi ital.* no. 962 (1881).

Type: Italy, sylvia Montello, September 1876, *P. A. Saccardo* (PAD—holotype!).

Icones: Saccardo, *Fungi ital.* no. 962 (1881).

This species was described 'in thallo lichenum' but examination of the holotype revealed that the whitish 'thallus' on which Saccardo's fungus was growing was merely bird lime. The conidia are borne on creamy white stalked synnemata which are very sparse in the type collection; some larger synnematos heads occur and appear almost sessile, and Saccardo (1882 : 561) described these, apparently overlooking the more typical stalked type. The heads of the synnemata are pale yellowish in colour and the hyaline ellipsoid conidia, which adhere in a translucent gelatinous mass, measure $2\text{--}5\text{--}4\text{--}(6) \times 2\text{--}3 \mu\text{m}$. This fungus is clearly a member of the genus *Stilbella* Lindau and appears to be indistinguishable from *S. erythrocephala* (Ditm. ex Fr.) Lindau, a common coprophilous fungus.

The place of publication of this name has generally been cited as Saccardo (1882 : 561) but in Saccardo's series of icones cited above this taxon was not only provided with an illustration, but also details of conidial measurements and citation of the holotype collection; this meets the requirements for valid publication (Art. 32) and so the name is considered to date from 1881.

Glossary

As many of the lichenologists wishing to use this work may be unfamiliar with some of the terms employed by mycologists in descriptions of Hyphomycetes, those most likely to be a cause of

difficulty are briefly defined here. For fuller information on mycological terms see Ainsworth (1971), Ellis (1971) and Kendrick (1971).

acrogenous : conidia forming entirely immediately outside the apex of the conidiogenous cell (e.g. not enclosed in a collarette or bounded by the wall of the conidiogenous cell).

acropleurogenous : conidia forming at the ends and at the sides of the conidiogenous cells.

annellations : ring-like scars on conidiogenous cells which are annellides.

annellides : conidiogenous cells in which each conidium originates from the end of a proliferation extending above the scar left by the separation of the previous conidium.

basipetal : developing towards the base so that the apical cell or conidium is the oldest.

catenate : forming chains.

collarette : a cup-shaped extension of the apex of phialides.

conidiogenous cells : cells actually producing the conidia.

conidiophores : cells immediately supporting the conidiogenous cells; conidiophores may or may not resemble conidiogenous cells or mycelium.

determinate : of conidiophores and conidiogenous cells whose growth ceases with the production of conidia from the apex.

discrete : conidiogenous cells which have a distinctive shape so that they are easily distinguished from the conidiophores bearing them.

dry : of conidia not adhering in a slimy mass which are powdery.

hypophodia : short specialized lateral branches arising from mycelium which lies on the host; sometimes with delicate, presumably absorptive or adhesive, processes arising from them when they are referred to as *mucronate*.

integrated : conidiogenous cells incorporated into the main axis or branches of the conidiophores.

macronematous : conidiophores which are morphologically very distinct from the vegetative mycelium.

micronematous : conidiophores which are not or scarcely morphologically distinct from vegetative mycelium.

monoblastic : a conidiogenous cell producing conidia by forming an apical blow-out which involves both the inner and outer walls of the conidiogenous cells.

mononematous : conidiophores arising singly or in loose tufts.

montretic : a conidiogenous cell producing conidia by forming a blow-out which involves only the inner wall of the conidiogenous cell, this wall often extending through a distinctive scar or pore in the outer wall of the conidiogenous cell.

penicillate : conidiogenous cells arranged in a brush-like manner comparable to that seen in the genus *Penicillium* Link ex Gray.

percurrent : conidiogenous cells which grow straight on through the open end left by the separation of the previous conidium.

phialide : conidiogenous cells in which neither the inner nor the outer wall of the conidiogenous cell gives rise to the conidium but in which the conidia are formed by extrusion through a pore or narrow canal (usually apically and with a collarette).

polyblastic : a conidiogenous cell producing conidia like a monoblastic cell but in which conidia are produced at several points on the conidiogenous cell and not only at the apex.

semi-macronematous : conidiophores which are morphologically very similar to the vegetative hyphae but differ in that they are ascending and not prostrate.

setae : bristle-like erect modified vegetative hyphae.

slimy : of conidia adhering in a globular mass due to production of some gelatinous substance; slimy conidial masses generally appear as drops of liquid at the apices of the conidiogenous cells in unsquashed preparations.

sporodochia : a dense tufted mass of short conidiophores supporting a common mass of conidia.

stroma : a dense mass of vegetative tissue, sometimes involving material of the host, and from which conidiophores may arise.

synnema (pl. *synnemata*) : a compacted and often fused erect group of elongate conidiophores bearing conidia in a mass at the apex or, more rarely, also laterally.

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