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THE AUSTRALASIAN PEZIZALES IN THE HERBARIUM OF THE ROYAL BOTANIC GARDENS KEW

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SUMMARY

Seventy-nine Australasian and eight extra-Australasian species of Pezizales are enumerated, described and illustrated from specimens preserved in the Herbarium of the Royal Botanic Gardens, Kew (England). They are distributed among thirty-two genera which in turn are arranged in eight families belonging to two suborders, the Sarcoscyphineae and the Pezizineae. Critical notes, nomenclatural and taxonomic synonyms, the habitat and area of distribution of almost all species described are given, together with comments on some related extra-Australasian taxa. *Peziza dochmia* is made the type species of the newly established sarcoscyphaceous genus *Aurophora*, whilst in the Humariaceae the new genera *Jafneadelphus*, *Nothojafnea*, *Geneosperma* (extra-Australasian), *Rhizoblepharia* and *Inermisia* are proposed, typified by *Rhizina ferruginea*, *Nothojafnea cryptotricha*, *Peziza geneospora*, *Rhizoblepharia jugispora* and *Peziza fusispora* respectively; the genera *Jafnea* and *Leucoscypha* are redefined. Lectotype species of some genera are designated, as a result of which it has been found necessary to propose the conservation of the generic names *Scutellinia* (against *Humaria* Fuckel) and *Geopyxis* [against *Tarzetta* (Cooke) Lamb.]. Fourteen new species are described in the genera *Underwoodia* (1), *Jafneadelphus* (3, one of which is an Argentinian species), *Nothojafnea* (1), *Rhizoblepharia* (1), *Scutellinia* (1), *Aleuria* (2), *Leucoscypha* (1), *Octospora* (1), *Peziza* (2) and *Plicaria* (1); a four-spored variety of a species of *Jafneadelphus* is also described. New combinations are made in *Plectania* (1), *Phillipsia* (2), *Aurophora* (1), *Sphaerosporella* (1), *Jafneadelphus* (2), *Geneosperma* (1), *Cheilymenia* (1), *Anthracobia* (1), *Leucoscypha* (5), *Lamprospora* (1), *Inermisia* (1), *Pulvinula* (4), *Peziza* (2) and *Plicaria* (3).

INTRODUCTION

In 1892 the rather meagre knowledge of the Australasian fungus flora was summarized in the "Handbook of Australian Fungi" by M. C. Cooke. Whereas subsequent revisions and more extensive studies on various groups of fungi have made their respective representatives in this area fairly well known, there are other groups including the operculate cup fungi, which are still very poorly understood. It is true that for the Pezizales there are several partial revisions by McLennan & Cookson (*1923, 1926*), Rodway (*1925*), McLennan & Halsey (*1936*) and Hansford (*1954*) in which some previous misdeterminations were corrected, rare or endemic species were more fully described and new discoveries were reported, but nevertheless a more systematic treatment seems to be desirable to give a better picture of the composition of the operculate cup fungus flora of this region.

At present it is not practicable to execute a floristic account of the Australasian Pezizales because of the lack of extensive collections upon which such a work can be soundly based. As a first step towards a more comprehensive treatment of this group in the future, an attempt has been made to re-examine the historical specimens mentioned by Cooke (*1892*) and his predecessors, and to bring their taxonomy and nomenclature up to date. Although almost all of these specimens, as well as those of the more recent authors and numerous other collections made in recent years by several local mycologists are preserved in the Herbarium of the Royal Botanic Gardens, Kew (England), the result of the study based on them can hardly be regarded as a fair representation of the Australasian Pezizales. Obviously more collections have to be made before the components of Australasian operculate cup fungus flora are adequately known and more laboratory and field observations are required to improve the specific delimitations of many species described below. There are numerous unidentified collections which are not described further, either because they are immature or too scanty and are inadequately provided with field notes; nevertheless, every effort has been made to secure the identity of all available specimens which have been put on record. Published accounts of many species which appeared before 1892, however, are not always cited or presented in complete chronological order, unless it is felt that a contribution to the knowledge of the species concerned is being made; a complete list of Australasian mycological literature published in this period can be found in McAlpine's (*1895*) book. To enable local collectors to identify collections of taxa not treated in the present work, passing reference has been made to many recent or important works on all groups of Pezizales.

As can be expected, the original colour and sometimes the shape of

apothecia of early collections – some of which were collected over one hundred years ago and few of which have been subjected to critical study during the past seventy years – cannot be judged from their present appearance. Consequently whenever available the descriptions have always been based on or supplemented with data obtained from more recent and usually more fully documented collections. Since the character of apothecia in fresh condition is indispensable in the classification of the Pezizales, I have made full use of field observations made on Australasian species which also occur in Great Britain. Data obtained from extra-Australasian collections, however, are very rarely incorporated in describing the species and if so they are always specifically indicated. The number of extra-Australasian species studied in order to obtain a good understanding of the scope of species or genera is rather extensive, but those listed here have been kept to a minimum. Descriptions of a few species have been exclusively based on specimens collected outside Australasia; these have been done to enable future collectors to confirm old records based on Australasian collections which are now no longer in existence [viz. *Leucoscypha rutilans* (Fr.) Dennis & Rifai], or because there is nomenclatural and taxonomic confusion [viz. *Pulvinula globifera* (Berk. & Curt. apud Berk.) Le Gal non sensu Le Gal] or for other specific reasons. Unless stated otherwise all specimens cited in the present study are preserved in Herb. Kew. [K].

Full information on habitats, methods of collecting, preserving and studying cup fungi and accounts on the general morphology and anatomy of the apothecia as well as the conventional terminology used in describing them may be found elsewhere (Starbäck, *1895*; Boudier, *1907*; Corner, *1929a*; Nannfeldt, *1932*; Velenovský, *1934*; Le Gal, *1947*; Korf, *1952*, *1958*; Graddon, *1957*; Snell & Dick, *1957*; Dennis, *1960*; Gamundi, *1960*; Ainsworth, *1961*; Denison, *1963*; Batra & Batra, *1963*; Dissing, *1964*). Although the terminology employed in the present work mostly conforms with that currently in use, the following brief definition and clarification may be valuable. The ascoscarps of the Pezizales are termed *apothecia*; as is understood here this term covers not only the typical discoid or cupulate fruit bodies but also those of the "pileate" species such as *Morchella* and *Helvella* and their allied genera. The term "pileus" has been used by some authors in describing fruit bodies of the latter group but the application of this term here is undesirable because it tends to obscure the close affinity between the Morchellaceae and the Helvellaceae and the rest of the Pezizales and also because there does not seem to be any fundamental difference between the discoid or cupulate and the pileate fruit bodies. The *disc* is the surface of the ascospore producing layer of the apothecia. The latter is called *hymenium* and is made up of a palisade-like layer of *asci* and *paraphyses*. The *receptacle* is the portion of the ascocarp immediately bearing the hymenium; depending upon the species the receptacle may be lenticular, scutellate, discoid,

cupulate, saddle shaped (helvelloid) or honeycomb-like (morchelloid) and are either sessile or stipitate. When sectioned it can be seen that in the majority of cup fungi the receptacle is composed of an outer layer, the *ectal excipulum*, and an inner and anatomically different tissue, the *medullary excipulum*. Each of these two layers can be either prosenchymatous and composed of distinct hyphal elements, or pseudoparenchymatous and made up of wide- but short-celled tissues which are not distinctly filamentous. The layer immediately beneath the hymenium is termed the *subhymenium*. The *flesh* may be present between the subhymenium and the excipulum; this term has often been used rather loosely in describing the complicated receptacle construction of the Pezizaceae. The receptacle of the Humariaceae is often covered with stiff, thick walled and septate *hairs* which arise superficially from the surface cells of the receptacle. In species of *Scutellinia* and its related genera the bases of their hairs are deeply buried in the ectal excipulum and following Denison (*1961*), to distinguish this kind of hairs from the ordinary superficial hairs, they are referred to as *rooting hairs*. Amongst the asci and paraphyses of the Sarcoscyphaceae there is another type of "hairs", which are distinctly wider than the typical paraphyses; these are termed "poils hymeniens" by Madame Le Gal (*1963*), a term literally translated into English here as *hymenial hairs*.

In matters relating to botanical nomenclature close adherence to the "International Code of Botanical Nomenclature" (*1961*) is observed, except for taxa above the generic levels. For the latter the traditional names of tribes, families and order are used without critically considering their nomenclatural status or acknowledging their respective authors. This is largely because the scheme of classification adopted in arranging the genera of Australasian cup fungi is not yet to my entire satisfaction and the intricacy of their nomenclature is such that it will be better to solve these problems when the delimitations of these taxa are more fully understood. The works of de Saint-Amans (April *1821*), Hooker (April or May *1821*), Mérat (June *1821*), Gray (November *1821*) and Persoon (*1822*)—which were published after 1 January 1821 but before the appearance of Fries' (*1822*) own account of cup fungi—have been taken into consideration, so that in many classical species accepted by Fries the familiar author citation "ex Fr." has been dropped and replaced by the earlier validating authors. However, a reference is always made to the place where Fries (*1821–1832*) "sanctioned" the use of the name concerned. No further consideration is given to the names published before 1 January 1821 unless they were revalidated by later authors.

The geographical term Australasia is used here in the traditional—but admittedly vaguely defined—sense to cover Australia, New Zealand, New Caledonia, the Solomon Islands, New Guinea and their adjacent islands.

Based on the mode of the ascus dehiscence Boudier (*1885*) divided the cup fungi into two major groups, the Operculatae and the Inoperculatae, the asci of which are operculate or suboperculate and inoperculate, hemi-operculate or very rarely suboperculate but never operculate respectively. This important division was not accepted by Boudier's contemporaries such as Quélet (*1886a*), Phillips (*1887*), Saccardo (*1889–1928*), Rehm (*1887–1896*), Cooke (*1892*), Schroeter (*1893*), Massee (*1895*), Lindau (*1897*), Clements (*1909*) and later was also rejected by Clements & Shear (*1931*) and Velenovský (*1934*). Most mycologists now agree that this subdivision is fully justified because there are many other characters associated with the type of ascus dehiscence (Dennis, *1960*), and the latter also reflects the probable phylogeny of this group of fungi (Le Gal, *1953*; Berthet, *1964a*). In recent years the validity of this ascus character as a primary criterion for dividing cup fungi has been doubted again and Le Gal (*1953*, *1959*) believed that the ascospore character should take precedence of all other characters. She pointed out that the ascospores of operculate cup fungi were always unicellular, often ornamented and larger than those of the inoperculate group which were smooth walled, always small, one to many celled and often with a very high length and breadth ratio. She unnecessarily proposed two new ordinal names, Homospermales and Heterospermales to replace the classical orders Pezizales and Helotiales respectively. It seems that the ascospore characters enumerated above are not always as decisive as those of the asci, though it must be pointed out that according to Kimbrough (*1966*) the asci of a few accepted genera of the Pezizales have no opercula. It may well be that the ascospore characters are of phenetic rather than phylogenetic significance.

In the Inoperculatae the orders Helotiales, Phacidiales and Ostropales have been recognized. Some authors have also included the lichenized cup fungi in this group but the affinity of many Discolichens with typical inoperculate Discomycetes is uncertain and may be quite remotebecause of their bitunicate asci (cf. Nannfeldt, *1932*; Luttrell, *1951*, *1955*; Korf, *1958*; Dennis, *1960*; Richardson & Morgan-Jones, *1962*; Groenhart, *1962*, *1966*).

The recent report by Burdsall (*1965*) on the puffing of ascospores and the presence of opercula in the asci of *Geopora cooperi* Harkness, a member of the hypogean and probably polyphyletic order Tuberales, supports the accepted views that together with the Pezizales the former order belongs to the Operculatae. In this connection it is of interest to note that already in 1949 the late J. H. Miller had used the operculate asci as a key character which led to the Tuberales, although he did it probably out of ignorance rather than foresight.

The position of the curious genus *Cyttaria* Berk. has not been satis-

factorily solved. Santesson (*1945*) and White (*1954*) stated that the asci were inoperculate and Chadefaud (*1960*) included it in the Helotiales. In contrast Nannfeldt (*1932*) indicated that it had a close affinity with the Pezizales; Korf (*1954*), followed by Batra & Batra (*1963*), even went a step further and placed the family Cyttariaceae in the Pezizales. My own observations have been inconclusive but because of the peculiar morphology and anatomy of its fruit bodies and the unique association with the fagaceous genus *Nothofagus*, the suggestion put forward by Luttrell (*1951*) to establish a separate order for it, the Cyttariales, is provisionally recommended. The Australasian species of *Cyttaria* have already been revised by Rawlings (*1956*).

The scope of the order Pezizales itself varies considerably from one author to another. Besides the operculate and inoperculate genera of cup fungi, the whole of the Discolichens were also absorbed in this order by Clements & Shear (*1931*). That the scheme of classification proposed by these authors was unnatural is evident from the fact it has been universally ignored. Gäumann (*1926*), Seaver (*1928*) and Bessey (*1950*) would accept the whole of the fleshy cup fungi in the Pezizales but the last two authors recognized the significance of the ascus character in the classification of these fungi. Early authors such as Rehm (*1887–1896*), Schroeter (*1893*) and others recognized the order Helvellales to accommodate the larger and distinctly stipitate species of Discomycetes without giving any consideration as to whether their asci are operculate (*Helvella*, *Morchella* and their related genera) or inoperculate (Geoglossaceae, Leotiaceae and Ostropaceae p.p.). Benedix (*1962*) accepted this order for the reception of those species with operculate asci only, but the majority of modern mycologists have merged the Helvellales with the Pezizales because the separation between these two orders is based on superficial and therefore unreliable characters. As has been pointed out earlier Korf (*1954*) and Batra & Batra (*1963*) treated the order Cyttariales as a family of the Pezizales but otherwise their conception of the latter order is similar to the one adopted in this work. It also corresponds to the order Homospermales of Le Gal (*1953*, *1959*) and to the Pezizales as formulated by Dennis (*1960*), Gamundi (*1960*, *1964*), Denison (*1963*), Moser (*1963*) and Gäumann (*1964*).

The number of families that should be recognized in the Pezizales also differs from one system of classification to the other. The families delimited by Boudier (*1885*, *1907*) were soon found to be unnatural because they were based mainly on the gross morphology of the apothecia. Seaver (*1928*), followed by Bessey (*1950*) and Martin (*1961*), accepted only two families, the Helvellaceae and the Pezizaceae. The two families were distinguished from each other by the presence or absence of well developed stipes and on the false distinction between pileus and apothecia! As a result of this system, many cupulate and sessile species of *Helvella* (which were referred to the genus *Paxina* O. Kuntze by Seaver, *1928*), as well

as the subsessile *Disciotis venosa* (Pers. ex Pers.) Boud. (which is related to the genus *Morchella*) would have to be classified in the Pezizaceae, which is obviously unwarranted. Based on the ascospore shape and other characters the family Pezizaceae was divided into eight tribes by Seaver (*1928*); Nannfeldt (*1932*) has already discussed the weakness of this scheme of classification, which is largely due to the fact that Seaver founded his scheme on sets of convenient but wholly unnatural genera. A more successful system of classification of the Pezizales was proposed by Nannfeldt (*1949*), who, following Le Gal (*1946*), attached great taxonomic significance to the operculate and the suboperculate asci. Nannfeldt recognized two families, the Pezizaceae and the Sarcoscyphaceae and in this respect the scheme is similar to the one outlined by Korf (*1954*), except that the latter author also included a third family, the Cyttariaceae. Batra & Batra (*1963*) slightly modified Korf's system of classification by accepting a fourth family, the Helvellaceae, which corresponds to the Helvellaceae of Seaver (*1928*) and Martin (*1961*) and to the Helvellales of Benedix (*1962*). Like Korf (*1954*), in working out the Costa Rican collections of the Pezizales, Denison (*1963*) also accepted three families but in the place of the Cyttariaceae, which does not occur in this tropical area, he recognized the Ascobolaceae. The latter was restricted to embrace the dark spored species only.

Recent cytological studies by Berthet (*1961*, *1963*, *1964a*) show that the system of classification proposed by Le Gal (*1947*) – in which families Morchellaceae, Helvellaceae, Aleuriaceae (= Pezizaceae), Humariaceae, Ascobolaceae and Sarcoscyphaceae are recognized – has much to recommend it. This system has been admirably put into practice by Dennis (*1960*) and Moser (*1963*) and it also follows the current trend among recent mycologists who prefer to have narrower family delimitations (Chadefaud, *1960*; Gäumann, *1964*; Gamundi, *1964*). For these reasons, in arranging the genera of the Australasian Pezizales, Le Gal's classification has in the main been adopted here. The suggestion made by Nannfeldt (*1949*), Korf (*1954*) and Berthet (*1964a*) to give equal rank to the Sarcoscyphaceae and the rest of the Pezizales has been incorporated into the scheme by recognizing two suborders, the Sarcoscyphineae [1]) and the Pezizineae.

At Herb. Kew. eight families of the Pezizales keyed out below are represented by Australasian specimens.

ANALYTICAL KEY TO THE AUSTRALASIAN FAMILIES OF THE PEZIZALES

A. Asci suboperculate, thick walled, long, cylindrical above, usually with much narrower, flexuous, trailing hypha-like base, of "aporhynque" type (Berthet, *1964a*); ascospores hyaline, always guttulate, plurinucleate, often asymmetrical,

[1]) **Sarcoscyphineae** Rifai, *subordo nov.* — Discomycetes, Pezizales, a Pezizineis Rehm emend. Rifai apotheciis plerumque epixylis gelatinosis coriaceis vel suberosis, ascis suboperculatis crasse tunicatis cylindraceis longioribus, ascosporis nonnunquam plurinucleatis et guttulatis differt. — Typus: Sarcoscyphaceae Le Gal → *Sarcoscypha* (Fr.) Boud.

smooth or covered by transverse or longitudinal striations or ridges unaffected by cotton-blue in lactic acid (except in *Galiella* Nannf. & Korf apud Korf, the ascospores of which are covered with callose-pectic warts); paraphyses delicate to slender, sometimes interspersed with distinctive hymenial hairs; medullary excipulum always prosenchymatous, sometimes embedded in a gelatinous matrix; apothecia though, corky, leathery, subgelatinous but never truly fleshy, lignicolous or rarely terricolous . Subordo SARCOSCYPHINEAE
Only one family . . . . . Family SARCOSCYPHACEAE

Aa. Asci operculate, or very rarely suboperculate, thin walled, cylindrical, subclavate, clavate or saccate, base not hypha-like, of "pleurorhynque" or "aporhynque" type; ascospores hyaline to dark coloured, with or without oil globules, plurinucleate, tetranucleate or mostly uninucleate, mostly symmetrical, smooth or covered by various kinds of ornaments of callose-pectic material; paraphyses slender to stout, rarely delicate; medullary excipulum pseudoparenchymatous or prosenchymatous but never embedded in a gelatinous matrix; apothecia fleshy to firm fleshy, brittle, mostly terricolous but sometimes also on dung or other vegetable remains, or lignicolous . . . . . Subordo PEZIZINEAE

B. Asci non-amyloid; ascospores hyaline to pale yellowish; ectal and medullary excipulum mostly well differentiated, many of which are of textura angularis or textura globulosa and textura intricata respectively.

C. Ascospores plurinucleate or tetranucleate; medullary excipulum always prosenchymatous; receptacle broadly effused or sponge-like, campanulate, saddle shaped or cupulate and distinctly stipitate, but if sessile they are always large and dull coloured and have uniguttulate ascospores; terricolous.

D. Ascospores plurinucleate, smooth walled, without oil globules but with numerous small external guttules around their polar regions . . . . . .Family MORCHELLACEAE

Dd. Ascospores always tetranucleate, smooth or rarely reticulate, containing 1–3 oil globules . . . . . Family HELVELLACEAE

Cc. Ascopores uninucleate; medullary excipulum prosenchymatous to pseudoparenchymatous; receptacle minute to large, lenticular, scutellate, discoid or cupulate, sessile or rarely substipitate, often with distinctive thick walled hairs; terricolous, fimicolous, lignicolous.

E. Apothecia small to large, discoid, scutellate, cupulate or ear shaped, dull whitish or brownish or often brightly coloured from the presence of carotenoid pigments; ectal and medullary excipulum mostly well differentiated, the latter often prosenchymatous; asci cylindrical to subcylindrical, 4–8-spored; ascospores normally uniseriate, smooth or often ornamented with simple or complicated markings, mostly with oil globules . . .Family HUMARIACEAE

Ee. Apothecia very small, gregarious, densely crowded to confluent, orange or pinkish red, lenticular, seated on well developed subiculum on recently sterilized substrata; ectal and medullary excipulum pseudoparenchymatous; asci subcylindrical, thin walled, 8-spored; ascospores uniseriate, smooth walled, without oil globules or gaseous bubbles . . . . Family PYRONEMATACEAE

Eee. Apothecia minute, very small to small, scattered to gregarious, mostly dull coloured, habit ascoboloid, always fimicolous; ectal and medullary excipulum mostly pseudoparenchymatous, usually

poorly differentiated; asci one to many per apothecium, subcylindrical, broadly clavate to saccate, thin or thick walled, 8–multi-spored; ascospores uniseriate, biseriate or irregular, very small to rather large, smooth walled, without oil globules (in which case the asci are thick walled) or with conspicuous and highly refractive bubbles . . . . . Family THELEBOLACEAE

Bb. Asci mostly amyloid; ascospores hyaline to dark coloured; excipular tissue mostly of subglobose or polygonal isodiametric or slightly elongated cells (textura globulosa or textura angularis):

F. Ascospores hyaline or brown coloured, mostly thin walled, smooth or covered by callose-pectic markings of sporal origin Family PEZIZACEAE

Ff. Ascospores always dark coloured and thick walled, with purple or brown markings of extra sporal or vacuolar origin Family ASCOBOLACEAE

SUBORDER SARCOSCYPHINEAE

In transferring the humariaceous species *Peziza rutilans* Fr. to *Sarcoscypha* (Fr.) Boud. it was pointed out by von Höhnel (*1917*) that the genera *Sarcoscypha*, *Urnula* Fr., *Pithya* Fuckel, *Perrotia* Boud. (Helotiales) and also *Cookeina* O. Kuntze, *Caloscypha* Boud. (Humariaceae), *Melascypha* Boud., *Pseudoplectania* Fuckel and *Wynnella* Boud. (Helvellaceae) were related to each other and differed from the rest of the Pezizales in the possession of well developed prosenchymatous excipular tissue. The criterion used by von Höhnel in keeping these genera together is not so fundamental because it does not discriminate the operculate and suboperculate species and in some cases it is only partially correct. In the genus *Cookeina*, for example, the ectal excipulum is pseudoparenchymatous, whereas the medullary excipulum of the Helvellaceae and many Humariaceae is made up of distinct interwoven hyphae. Nevertheless the close affinity between the majority of genera mentioned by von Höhnel was later independently confirmed by Le Gal (*1946*) when she pointed out that these and some other related genera had suboperculate asci.

These asci can be distinguished from ordinary operculate asci by the presence of a characteristic thickened ring-like apical apparatus, with apical or sublateral hinged operculum. The asci are insensitive to Melzer's (iodine) reagent, thick walled, long cylindrical but distinctly taper below into long, narrow, trailing, flexuous, hypha-like bases, of "aporhynque" type (Berthet, *1964a*). The ascospores of this group of fungi are hyaline, generally large, smooth or ornamented with longitudinal or transverse ridges which do not react with cotton-blue in lactic acid, or rarely covered by callose-pectic warts which become blue in the latter stain. Unlike those of the other operculate genera, the ascospores of many species of the suboperculate group are asymmetrical and they always contain oil globules. According to Berthet (*1963*, *1964a*) when mature these ascospores become plurinucleate. The hymenia of some genera of the Sarcoscyphineae have

distinctive hymenial hairs, which are much coarser than the typical paraphyses. The latter usually are delicate, often profusely branched, sometimes freely anastomosing with one another to form an intricate fine network around the asci. The ectal excipulum of the Sarcoscyphineae varies from prosenchymatous to pseudoparenchymatous but their medullary excipulum is always made up of narrow and distinctly filamentous hyphae which are arranged into either a textura intricata or textura porrecta tissue. In some genera these hyphae may be embedded in a gelatinous matrix, a character yet unknown for the suborder Pezizineae. Consequently fresh apothecia of many suboperculate species have a gelatinous consistency and dry up into a horny specimen. In general the consistency of this group of fungi varies from tough leathery or corky to gelatinous, but is never fleshy. The apothecia are smooth or covered by simple or compound hairs and vary greatly in size, shape and colour. They may be subglobose or turbinate and very thick, or saucer shaped, cupulate, infundibuliform or even auriculate or fan shaped and relatively thin and are either sessile or provided with a well defined stipe, pseudorhiza or buried sclerotium. The colour of their discs is either grey or almost black, or of some shades of red or orange.

The sets of characters enumerated above clearly separate this group of fungi from the rest of the Pezizales, so that to give the former a rank corresponding to a subdivision of the latter group would be anomalous. In discussing the result of his extensive cytological studies Berthet (*1964a*) concluded that it would be logical and fully justified to give these two groups equal rank, as has been suggested by Nannfeldt (*1949*) and Korf (*1954*). Le Gal's (*1946*) proposal to treat the Sarcoscyphineae as an independent group (the Suboperculatae) intermediate between or corresponding to the Operculatae and Inoperculatae was criticized by Nannfeldt (*1949*) because it would minimize the close relationship between the Sarcoscyphineae and the rest of the Pezizales.

So far this new suborder contains only one family, the Sarcoscyphaceae. Le Gal (*1953*) demonstrated that *Midotiopsis bambusicola* P. Henn. had also suboperculate asci and for this reason she placed this genus in the Sarcoscyphaceae. This disposition was doubted by Dennis (*1954*, *1956*) who preferred to assign the genus *Midotiopsis* P. Henn. to the inoperculate family Helotiaceae. If Le Gal (*1953*) was correct in transferring this genus to the suboperculate group, then a second family of the Sarcoscyphineae will have to be created to accommodate it, which should be differentiated from the Sarcoscyphaceae chiefly by its exceptionally short asci and by the more complicated structure of its excipular tissue. Unfortunately the cytology of *Midotiopsis* is not yet known.

Le Gal (*1953*) suggested the possibility of *Rutstroemia* Karst. and *Helotium* Pers. ex St-Amans (= *Hymenoscyphus* S. F. Gray emend. Dennis) having arisen from the same ancestral stock and that from the former genus were derived the present day bright coloured Sarcoscyphaceae. This

suggestion has met with some criticism from Berthet (*1964a*) who believed that phylogenetically the dark coloured species should be considered less advanced than the bright ones. Using a completely different reasoning and approach Corner (*1930*) arrived at an almost similar conclusion. He stated that the rare, dark coloured and multiaxial genus *Wynnea* Berk. & Curt. apud Berk., which is a member of the Sarcoscyphineae, should be regarded as a primitive type of cup fungus. The possible sarcoscyphaceous origin of the Pezizineae and the inoperculate genera of Discomycetes seems to be supported by the existence of many forms which may be looked upon as possible links. There is a close and fundamental similarity in the apothecial constructions of the genus *Wynnea* or *Plectania* Fuckel emend. Sacc. and those of the operculate genus *Jafneadelphus* Rifai or the cupulate species of *Helvella* L. ex St-Amans emend. Nannf. It was suggested by Nannfeldt (*1937*) that amongst the species of *Helvella* s.l. the cupulate ones should be regarded as the less advanced forms. In this connection the structure of the yet imperfectly known species "*Peziza*" *drummondii* Berk. is of special interest, because although this species has a gelatinous medullary excipulum like species of *Galiella* Nannf. & Korf, its apothecia are terrestrial and have hairs and coloration like those of *Jafneadelphus*. Although having suboperculate asci, the genera *Phaedropezia* Le Gal, *Psilopezia* Berk. and "*Trichophaea*" *erinaceus* (Schw.) Le Gal sensu Le Gal (*1953*) – which according to Denison (*1961*) is an undescribed species of *Scutellinia* (Cooke) Lamb. emend. Le Gal – are included in the Pezizineae because their other characters are markedly different from the other members of the Sarcoscyphineae. Le Gal (*1953*) postulated that from these three taxa arose *Sowerbyella* Nannf., the Pezizaceae and the Ascobolaceae, and the bright coloured species of the Humariaceae respectively. The phylogonetic significance of the sclerotiniaceous suboperculate species *Rutstroemia nummiformis* (Pat.) Le Gal has been discussed by Le Gal (*1953*) who compared it further with that of *Midotiopsis bambusicola*. The latter species may fill the gap between the Sarcoscyphineae and the Helotiaceae subfam. Encoelioideae.

The known cytological characters of Discomycetes seem to correspond very closely with the notion that the Sarcoscyphineae may represent the possible source of the Pezizineae and the Helotiales and their related taxa. As has been indicated above mature ascospores of the Sarcoscyphineae are always plurinucleate. In the Pezizineae the number of nuclei in the ascospores is rather variable; it is always plurinucleate in the Morchellaceae, tetranucleate in the Helvellaceae and mostly uninucleate in the other families. According to Berthet (*1963, 1964a*) the ascospores of *Scutellinia hirta* (Schum. ex Fr.) Lamb. occasionally become binucleate. The ascospores of the majority of species of the Helotiales are uninucleate but in a few members of the Sclerotiniaceae they are bi- to plurinucleate. Berthet (*1961, 1964a*) also reported that the mycelia of the Sarcoscyphineae and Pezizineae were coenocytic; coenocytic mycelia have also been observed

in many species of the inoperculate families Sclerotiniaceae and Geoglossaceae, but the other families of the Helotiales usually have mycelia with uninucleate cells.

It must be noted that Berthet (*1964a*) held the view that in the evolution of Eumycetes the coenocytic condition should be regarded as less primitive than the uninucleate condition. Therefore, in agreement with that proposed previously by Korf (*1958*) the phylogenetic line of development he suggested was more or less the reverse of the one discussed above. Which of the two phylogenetic series can be considered to be nearer the truth is difficult to decide, especially because of the lack of fossil evidence. Nevertheless the studies conducted by Berthet (*1961*, *1963*, *1964a*) have greatly improved our understanding of the phylogenetic relationship between members of the Discomycetes as a whole.

FAMILY SARCOSCYPHACEAE

It has been generally accepted that based on the pigmentation of the apothecia the family Sarcoscyphaceae should be divided into two tribes, the Urnuleae and the Sarcoscypheae (Le Gal, *1947*; Nannfeldt, *1949*; Dennis, *1960*). The presence of hymenial hairs in many species of the former tribe will also lend additional weight to the separation of the two tribes. Berthet (*1964a*) stated that this subdivision was further supported by the cultural characters as well as by the cytology of its members; he found that the paraphyses of the Sarcoscypheae were always plurinucleate, whereas those of the tribe Urnuleae were invariably uninucleate.

Of those species which have been successfully grown in culture, only one species so far is known to produce a conidial state. Gremmen (*1949*), Hughes (*1951*) and Berthet (*1964*) obtained the hyphomycete *Verticicladium trifidum* Preuss from ascospore cultures of *Desmazierella acicola* Lib. The monotypic genus *Desmazierella* Lib. was thought to be inoperculate by Boedijn (*1933*) but in 1949 it was formally transferred to the Sarcoscyphaceae by Nannfeldt. Although this disposition was originally rejected by Le Gal (*1953*), the position of *Desmazierella* in the Sarcoscyphaceae tribe Urnuleae is confirmed by the anatomy and morphology of its apothecia as well as by its cytological characters (Le Gal, *1963*; Berthet, *1963*, *1964a*).

Le Gal (*1953*) suggested that the heterogeneity of the sclerotiniaceous genus *Rutstroemia* Karst. might be due to the fact that it represented a transitional form between the inoperculate and operculate cup fungi. A similar line of reasoning may be put forward to explain the existing disagreements and the difficulty in drawing the generic delimitations of the Sarcoscyphaceae. Le Gal (*1953*, *1958a*, *1959*) preferred rather wide generic concepts in dealing with this group of fungi but her generic limits were not without anomalies. The genus *Urnula*, for example, was defined to include not only *Urnula craterium* (Schw.) Fr. but also those species with gelatinous medullary excipulum which have been classified in a

separate genus by some authors (Boudier, *1885*, *1907*; Seaver, *1928*; Nannfeldt, *1949*; Korf, *1957*; Dennis, *1960*; Moser, *1963*). The North American *Urnula geaster* Peck was excluded – probably correctly – because of its peculiar paraphyses and the difference in pigmentation and shape of apothecia. The gelatinous species *Peziza rhytidia* Berk. was also excluded from *Urnula* and transferred to the genus *Sarcoscoma* Casp. apud Wint., but *Urnula platensis* Speg. which is so closely related and obviously congeneric with *Peziza rhytidia*, was retained in *Urnula*. Consequently neither *Urnula* nor *Sarcosoma* as understood by Le Gal (*1953*, *1958a*) can be regarded as well defined or homogeneous genera, because their distinguishing characters will obviously be extremely vague and clogged with numerous exceptions. For this reason it becomes expedient to adopt narrower generic concepts which will permit more accurate delimitation.

Although the family Sarcoscyphaceae chiefly flourishes in tropical areas, it is quite well represented in Australasian regions. It is expected that when special search is made in the future, more collections of tropical species such as *Cookeina tricholoma* (Mont.) O. Kuntze and species of *Sarcoscypha* and *Phillipsia* will be found in Northern Territory and North Queensland.

KEY TO THE AUSTRALASIAN GENERA OF SARCOSCYPHACEAE

Apothecia dark coloured; disc brown, brownish black or almost black

Tribe URNULEAE

1a. Apothecia multiaxial; receptacle ear or spoon shaped, clustered, several arising from a common main stalk. *Wynnea* Berk. & Curt. apud Berk.

b. Apothecia monaxial; receptacle cupulate 2

2a. Apothecia lignicolous; hairs coloured; ascospores smooth or longitudinally or traversely striate . . . . . *Plectania* Fuckel emend. Sacc.

b. Apothecia terricolous; hairs hyaline; ascospores warted *"Peziza" drummondii* Berk.

Apothecia bright coloured; disc of some shade of red from carotenoid pigments

Tribe SARCOSCYPHEAE

3a. Asci of the whole hymenium ripened simultaneously; ectal excipulum pseudoparenchymatous 4

b. Asci not ripened simultaneously; ectal excipulum prosenchymatous or sometimes pseudoparenchymatous 5

4a. Apothecia cupulate to funnel shaped, hairs conical or subcylindrical; medullary excipulum not gelatinized . . . . . *Cookeina* O. Kuntze

b. Apothecia urceolate to turbinate, hairs scaly triangular; part of medullary excipulum embedded in a gelatinous matrix *Boedijnopeziza* S. Ito & Imai

5a. Ascospores smooth walled, more or less symmetrical; ectal excipulum regularly made up, almost of textura porrecta or textura prismatica *Sarcoscypha* (Fr.) Boud.

b. Ascospores striate or smooth, usually asymmetrical, subcymbiform; ectal excipulum of interwoven hyphae 6

6a. Apothecia cupulate or discoid, medullary excipulum not gelatinized *Phillipsia* Berk.

b. Apothecia ear or fan shaped, medullary excipulum embedded in gelatinous matrix . . . . . *Aurophora* Rifai

TRIBE URNULEAE

Wynnea Berk. & Curt. *apud* Berk. *in* J. Linn. Soc. (Bot.) 9: 424. 1867; Thaxter *in* Bot. Gaz. 39: 235. 1905; Seaver, N. Am. Cup Fungi (Operc.) 180. 1928.

TYPE SPECIES: *Wynnea gigantea* Berk. & Curt. apud Berk.

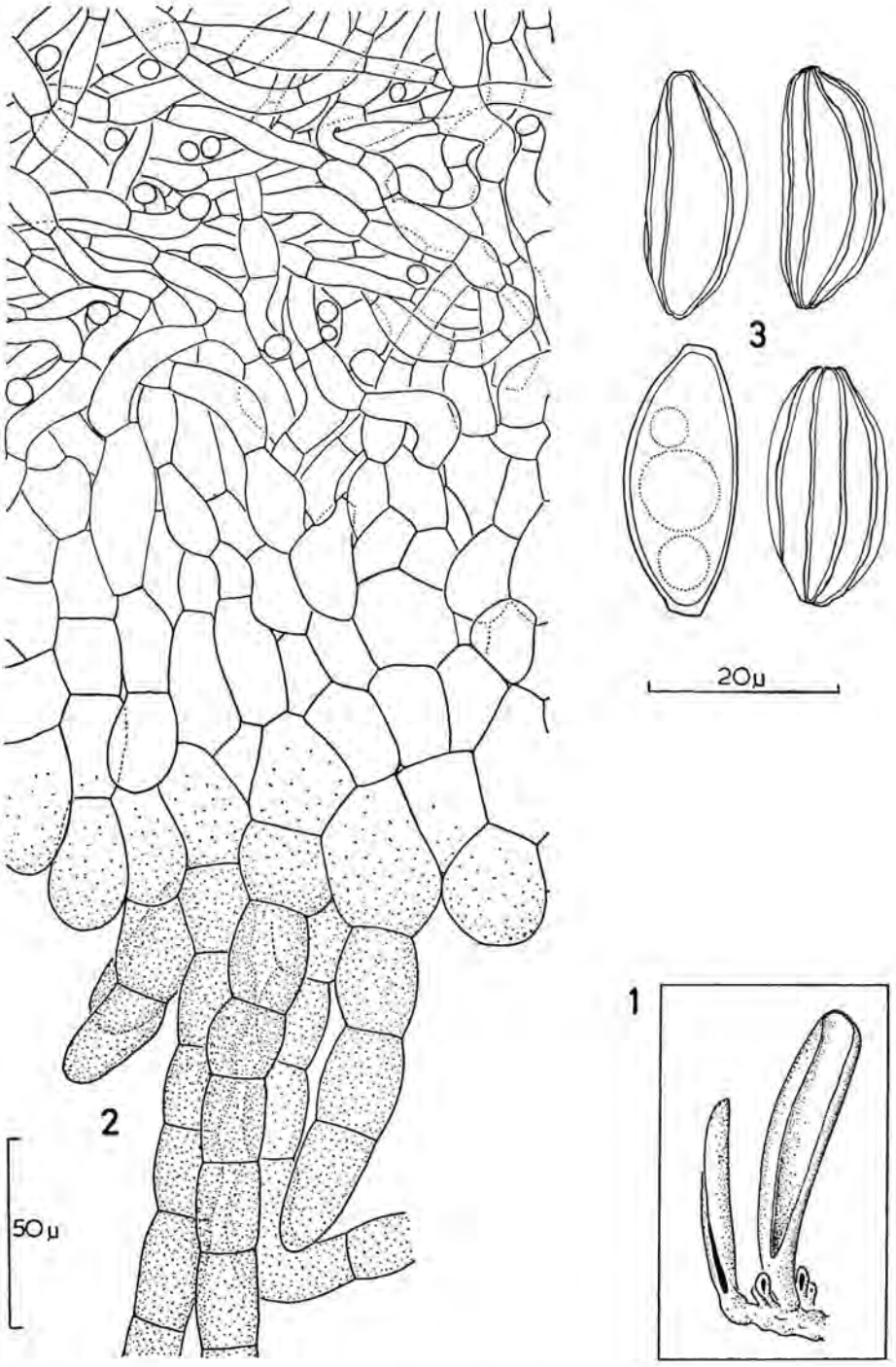
The revision published by Thaxter in 1905 appears to be still the most complete account of this curious and poorly known genus, which can be defined as follows: Sclerotium, so far only known in one species but very probably also occurs in the other species, globose in outline but irregularly lobed, large, brown, subgelatinous, buried in rich ground and producing a thick main axis which emerges above the ground. Apothecia scattered, large, multiaxial. Disc concave, dark reddish or purplish brown to brownish black. Receptacle arise singly or more often in large numbers in clusters from the common stalk or axis, thick, large, erect, elongate, ear or spoon shaped, with subcartilagenous to tough coriaceous consistency, dark reddish brown or blackish brown to brownish black, minutely scurfy but sometimes also appearing velvety from the presence of dark brown, long, wide hypha-like hairs, especially near the inrolled margin. Ectal excipulum of large polygonal to ovoid or pear shaped brown cells (textura globulosa to textura angularis). Medullary excipulum well differentiated, of loose textura intricata, hyphae subhyaline, septate and slender, gelatinous. Asci 8-spored, subcylindrical, distinctly attenuate below into a long trailing, flexuous hypha-like base, wall thick, not blued in Melzer's reagent. Ascospores uniseriate, hyaline, guttulate, subcymbiform, sometimes apiculate at each end, at maturity sparsely covered by longitudinal ridges which are unstained with cotton-blue in lactic acid. Paraphyses slender, apex slightly enlarged, septate, simple or irregularly branched.

HABITAT: on rich ground in wood.

WYNNEA MACROTIS (Berk.) Berk. *vel prox.*

Peziza macrotis Berk. *in* Hook. J. Bot. & Kew Gdn Misc. 3: 203. 1851. — *Wynnea macrotis* (Berk.) Berk. *in* J. Linn. Soc. (Bot.) 9: 124. 1867. — *Midotis macrotis* (Berk.) Sacc., Syll. Fung. 8: 547. 1889.

Sclerotium, if present, unknown. Apothecia scattered, large, multiaxial. Disc concave, dark brownish black with purplish tint. Receptacle long ear or spoon shaped, several arising from a common short main axis, simple or proliferating, up to 70 mm long by 20 mm wide, margin somewhat incurved, especially when dried, apex rotund or rather pointed, thick, firm with subcartilagenous consistency, surface brownish black, velvety or minutely scurfy, often indistinctly hairy near the margin. Ectal excipulum up to about 200 μ thick, the outer layer of large, brown coloured, globose or ovoid or pear shaped cells measuring 15–30 μ diam. and up to 40 μ long (textura globulosa to textura angularis); these cells show a tendency to aggregate and form small conical projections which cause the scurfy appearance to the surface of receptacle; quite often from near the margin of the receptacle these cells bear long hairs with large barrel shaped cells measuring about 15 μ diam.; the inner layer of the ectal excipulum composed of light brown or yellowish, angular elongated or pear shaped cells somewhat smaller in diam. than the cells of the outer layer, and immediately inside this there is a layer of compactly intertwined



Figs. 1–3. *Wynnea macrotis*. 1. Habit sketch. 2. Section of ectal and lower part of medullary excipulum. 3. Ascospores. (From Dr. Guppy).

hyphae with cells 6–12 μ diam., mostly running parallel to the surface of the receptacle. Medullary excipulum of loose textura intricata hyphae 6–12 μ diam., probably gelatinous, sparingly septate and branched, subhyaline to yellowish, a little darker towards the hymenial layer. Subhymenium not very distinctive except that it is composed of more compacted textura intricata hyphae with smaller dimensions, 3–8 μ diam., interspaced by the long, thin, flexuous bases of the asci. Hymenium about 275 μ thick. Asci cylindrical, gently attenuate below into a long trailing, flexuous hypha-like base which is only about 3 μ wide and with lumen often almost obliterated, 8-spored, thick walled, up to 480 μ long by 12–15 μ diam. Ascospores uniseriate, subcymbiform, with an indistinct flat topped apiculus at each end, containing 1–3 large oil drops, hyaline, at maturity ornamented with longitudinal ridges running from end to end of the spore, 2–4 ridges appearing at any one side, 24.5–28.1 × 9.5–12 μ. Paraphyses 2.5–5 μ diam. below, enlarged at the clavate apex to about 4.5–5.4 μ, sparingly septate, often irregularly branched or simple (Fig. 1–3).

HABITAT AND DISTRIBUTION: on the ground in India and Solomon Is.

I do not feel very confident in identifying this rather immature collection with *Wynnea macrotis* (Berk.) Berk., so that this determination should be considered as tentative. Although its habit and general appearance is similar, the colour of the present collection is quite different from Berkeley's (*1851*) original description of *Peziza macrotis*. The type specimens of the latter ("on rotten wood", Darjeeling, India, June–July, Hooker f. 87) are badly preserved and in the sections prepared from them, the presence of hairs and the brown and large celled outer layer of the ectal excipulum cannot be clearly demonstrated. Berkeley remarked that this species was not uncommon in Darjeeling, and if this is so further collections would be welcome to give a better understanding of this poorly understood genus.

Macroscopically the Solomon Islands collection strongly resembles *Wynnea americana* Thaxt. (Thaxter, *1905*), their habit, pigmentation and hairs being similar. They can be easily distinguished from each other on account of the presence of more pronounced apiculi and larger size of ascospores of *Wynnea americana*. Furthermore, the ascospores of the latter contain numerous small oil globules.

SPECIMEN EXAMINED

SOLOMON Is. On the ground, 1885, Dr. Guppy.

PLECTANIA Fuckel emend. Sacc.

Plectania Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 323. 1870, emend. Sacc., Syll. Fung. 8: 163. 1889; non *Plectania* Fuckel emend. Seaver, N. Am. Cup Fungi (Operc.) 190. 1928 [misapplied, = *Sarcoscypha* (Fr.) Boud.] — *Peziza* [Dill.] St-Amans subgen. *Plectania* (Fuckel) Sacc. *in* Bot. Cbl. 18: 215. 1884. — *Sarcoscypha* (Fr.) Boud. [sect.] *Plectania* (Fuckel) Cooke, Handb. Austral. Fungi 259. 1892. — *Peziza* [Dill.] St-Amans subgen. *Geopyxis* Pers. sect. *Plectania* (Fuckel) Schroeter *in* Krypt.-Fl. Schles. 3 (2): 45. 1893.

Peziza [Dill.] St-Amans [ser. *Lachnea* Fr.] subgen. *Rhizopodella* Cooke, Mycograph.

1: 260. 1879. — *Rhizopodella* (Cooke) Boud. *in* Bull. Soc. mycol. Fr. 1: 103. 1885. — *Lachnea* (Fr.) Gill. subgen. *Rhizopodella* (Cooke) Phill., Br. Discom. 216. 1887. *Gloeocalyx* Massee in Bull. misc. Inf. Kew 1901: 155. 1901.

LECTOTYPE SPECIES (Saccardo, *1884*): *Calycina melastoma* (Sow.) ex S. F. Gray.

Apothecia medium to large size, gregarious, sessile or substipitate, with tough gelatinous consistency. Disc deeply concave, dark brownish black to almost black, smooth. Receptacle cup shaped, sometimes turbinate, contracted below into a broad base or pseudostipe from which radiates black anchoring mycelium; surface of receptacle a little paler than the disc, finely tomentose or velvety from intertwined dark coloured hairs. Ectal excipulum relatively thin, of small angular or polygonal to subglobose or pear shaped brown coloured thick walled cells (textura angularis to textura globulosa). Medullary excipulum thick, of loose textura intricata, hyphae hyaline or subhyaline, slender, sparingly septate or branched, embedded in a dirty whitish or yellowish gelatinous matrix; a thin layer of tightly intertwined brownish hyphae is often formed immediately beneath the subhymenium. Asci long, cylindrical, distinctly attenuate below into a flexuous, often hypha-like base, apex not blued in Melzer's reagent, thick walled, 8-spored. Ascospores uniseriate, ellipsoidal, in some species strongly asymmetrical, curved or even suballantoid, containing large oil globules, hyaline to pale yellowish, smooth or the more convex surface of the asymmetrical spores may be covered by horizontal ridges which occasionally anastomose with each other, the ridges unstained with cotton-blue in lactic acid. Paraphyses filiform, septate, in some species repeatedly branched and often anastomosing with each other, especially near the base. Hymenial hairs numerous, stout, subcylindrical, their upper halves non-septate, mostly as long as the paraphyses, their apices straight or curved and blunt.

HABITAT: on dead and fallen woody sticks or on buried or partially buried sticks.

Korf (*1953*, *1957*) has discussed the confusion of the application of the generic name *Plectania* which started in 1928 when Seaver, guided by the automatic first-species method, chose the fungus generally known as *Sarcoscypha coccinea* as the lectotype species of *Plectania* and reduced *Sarcoscypha* (Fr.) Boud. to its synonymy. This unfortunate practice was adopted by Kanouse (*1948a*), Nannfeldt (*1949*) and Le Gal (*1953*). The application of the rules for typification introduced and adopted by the VII International Botanical Congress in Stockholm in 1951 makes it necessary to use the name *Plectania* for fungi related to *Peziza melastoma*, as had been done previously. Seaver (*1928*) classified the latter species in *Bulgaria* Fr. but this is inadmissable because the name *Bulgaria* must be typified by the common inoperculate species *Bulgaria inquinans* Fr.

With the exception of *Plectania rhytidia* which she referred to *Sarcosoma*, Le Gal (*1958a*) would include all species of the present genus in *Urnula* Fr. In contrast Nannfeldt (*1949*), Nannfeldt & Korf (*in* Korf, *1957*), Dennis (*1960*) and Moser (*1963*) kept the two genera apart because in general species of *Urnula* have bigger apothecia which lack the thick distinct

gelatinous layer at maturity. According to Berthet (*1964a*) mature ascospores of *Urnula craterium* (Schw.) Fr. contained about 25 nuclei whereas those of *Plectania melastoma* and *Plectania platensis* had 6–10 and 8–10 nuclei respectively; it would be of interest to know the number of nuclei in the other species of both *Urnula* and *Plectania*.

PLECTANIA MELASTOMA (Sow. ex S. F. Gray) Fuckel

Peziza melastoma Sow., Col. Fig. Engl. Fungi *t. 149*. 1799. — *Calycina melastoma* (Sow.) *ex* S. F. Gray, Nat. Arr. Br. Pl. 1: 670. 1821. — *Peziza melastoma* (Sow. ex S. F. Gray) Fr., Syst. mycol. 2: 80. 1822. — *Plectania melastoma* (Sow. ex S. F. Gray) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 324. 1870 — *Lachnea melastoma* (Sow. ex S. F. Gray) Gill., Champ. Fr., Discom. 66. 1880. — *Rhizopodella melastoma* (Sow. ex S. F. Gray) Richon, Cat. rais. Champ. 191. 1889. — *Sarcoscypha melastoma* (Sow. ex S. F. Gray) Cooke, Handb. Austral. Fungi 259. 1892. — *Scutellinia melastoma* (Sow. ex S. F. Gray) O. Kuntze, Rev. Gen. Pl. 3 (3): 520. 1898. — *Urnula melastoma* (Sow. ex S. F. Gray) Boud., Hist. Class. Discom. Eur. 55. 1907. — *Bulgaria melastoma* (Sow. ex S. F. Gray) Seaver, N. Am. Cup Fungi (Operc.) 197. 1928.

Peziza rhizopus Alb. & Schw., Consp. Fung. 317. 1805. — *Peziza rhizopus* Alb. & Schw. *ex* Crouan, Fl. Finist. 51. 1867.

Peziza atro-fusca Grev., Scott. crypt. Fl. 3: *t. 315*. 1825.

Peziza crenulata Fuckel *in* Bot. Ztg **19**: 250. 1861 (teste Fuckel, *1870*).

? *Peziza rhizomorpha* Ell. & Everh. *in* J. Mycol. 4: 98. 1888. — *Plectania rhizomorpha* (Ell. & Everh.) Sacc., Syll. Fung. 8: 164. 1889. — *Scutellinia rhizomorpha* (Ell. & Everh.) O. Kuntze, Rev. Gen. Pl. 3 (3): 520. 1898.

Apothecia gregarious, sessile or stipitate, up to 20 mm diam. Disc deeply concave, brownish black to black. Receptacle cup shaped, almost turbinate, contracted below into an indistinct short stipe from which radiate dense tufts of blackish brown anchoring hyphae; their surface covered by dark brown, septate, undulate, thick walled, loosely intertwined, rather long hairs 4–7 μ diam., giving rise to the downy or velvety and dark brownish black appearance of the surface of the receptacle, except near the margin where the hairs are often encrusted with reddish granules causing a distinctive brick red coloration. Ectal excipulum about 70 μ thick, the outer layer of globose or polygonal, thick walled and dark brown coloured cells 5.5–9 μ diam.; the inner layer of angular elongated subglobose or pear shaped, light brown to subhyaline cells up to 20 μ long by 7–12.5 μ diam., with their long axes at right angles to the surface of the receptacle. These are connected by coarse hyphal elements or elongated pear shaped cells 4–7 μ diam. with the thick, pale yellowish and gelatinous layer of medullary excipulum, which is composed of loosely interwoven sparingly septate and branched, hyaline or subhyaline hyphae 2–4 μ diam. Towards the subhymenium they become more compacted and a little darker, often giving rise to a distinct light brown thin layer immediately beneath the subhymenium which in turn consists of subhyaline hyphae in a somewhat loose textura intricata. Hymenium about 400 μ thick. Asci cylindrical, attenuate below into a long flexuous and almost hypha-like base, thick walled, 8-spored, up to 450 μ long by 12–14 μ diam. Ascospores uniseriate, smooth-walled, hyaline or subhyaline, ellipsoid to subfusoid, 19–26.5 $\times$ 9–11 μ. Paraphyses filiform, slender, 1.8–2.3 μ diam., apex hardly enlarged but often irregularly lobed, septate, rarely branched. Hymenial hairs numerous, stout, 2.5–3 μ diam., straight, cylindrical, non-septate above (Fig. 6).

HABITAT AND DISTRIBUTION: on dead wood or branches in Europe (type locality England), North America and Australia.

The above description has been drawn from extra-Australasian specimens listed below, because the Queensland collection referred to as *Sarcoscypha melastoma* by Cooke (*1892*) has been found to be a collection of *Plectania campylospora*; although the ascospores of this latter specimen have not fully developed, the curved hymenial hairs and the thin ectal excipulum leave no doubt that it represents *Plectania campylospora*. What appears to be a true Australian collection of *Plectania melastoma* has been described by McLennan & Cookson (*1926*) from Victoria.

Seaver (*1928*) reduced *Peziza hirtipes* Cooke (*in* Hedwigia **14**: 81. *1875*) into synonymy with the present species. The type specimen of *Peziza hirtipes* (on fallen branches, Portland, Maine, Washington, U.S.A., s. dat., E. C. Bolles 74) consists of rather large, now brownish coloured fruit bodies (measuring up to 2 inches in diam. according to the original description) which have minutely rough walled subfusoid ascospores. Obviously *Peziza hirtipes* should be regarded as a synonym of *Galiella rufa* (Schw.) Korf. & Nannf. apud Korf and not of the present species.

SPECIMENS EXAMINED

EUROPE. Germany. Ad ramos foliaque pinea putrida, rarissime, vere, in sylva Hostrichiensi (Fuckel, Fungi rhenani no. 1214 sub *Peziza melastoma*).

AMERICA. U.S.A. On ground under conifers, Barque Pt., Garden Peninsula, Michigan, July 1961, D. A. Reid (immature).

PLECTANIA CAMPYLOSPORA (Berk.) Nannf. apud Korf

Peziza campylospora Berk. *in* Hook. f., Fl. Nov. Zeal. 2: 200. 1855. — *Macropodia campylospora* (Berk.) Sacc., Syll. Fung. 8: 159. 1889. — *Urnula campylospora* (Berk.) Cooke, Handb. Austral. Fungi 268. 1892. — *Sarcosoma campylospora* (Berk.) Rick *in* Annls mycol. 4: 310. 1906. — *Plectania campylospora* (Berk.) Nannf. *apud* Korf *in* Mycologia 49: 110. 1957.

Rhizina reticulata Berk. & Br. *in* J. Linn. Soc. (Bot.) 14: 102. 1873. — *Peziza reticulata* (Berk. & Br.) Petch *in* Ann. R. Bot. Gdns Peradeniya 4: 422. 1910; non *Peziza reticulata* Grev., Scott. crypt. Fl. 3: *t. 156*. 1825.

Peziza (*Geopyxis*) *cinereo-nigra* Berk. & Br. *in* Trans. Linn. Soc. Lond. II 1: 404. 1879. — *Geopyxis cinereo-nigra* (Berk. & Br.) Sacc., Syll. Fung. 8: 66. 1889.

Bulgaria sarasini P. Henn. *in* Warburg, Monsunia 1: 30. 1900 (teste Le Gal, *1953*). — *Sarcosoma sarasini* (P. Henn.) Boedijn *in* Bull. Jard. bot. Buitenz. III 12: 275. 1932 [misapplied, = *Plectania rhytidea* (Berk.) Nannf. apud Korf].

Gloeocalyx bakeri Massee *in* Bull. misc. Inf. Kew **1901**: 155. 1901.

? *Discina pallide-rosea* P. Henn. *in* Hedwigia 41: 31. 1902 (teste Rick, *1906*).

Apothecia gregarious to caespitose, subsessile or stipitate, up to 50 mm diam. Disc concave, smooth, dark brown, occasionally blackish. Receptacle cup or funnel shaped, dark brown or brownish black, sometimes olivaceous, velvety, contracted below into a rather distinct ridged stalk up to 20 mm long or more, margin entire, often inrolled. Hairs 4–8 μ diam., short to very long, flexuous or sinuouse, septate, sometimes branched, blackish brown, paler towards their apices, walls thick, often undulate; they are intertwined, somewhat compacted and form a massive layer about 100 μ

thick, often almost opaque and enmeshing soil particles. Ectal excipulum thin, 40–60 μ thick, the outer layer of two or three layers of angular subglobose, thick-walled, blackish brown cells 6–10 μ diam., the inner layer composed of angular elongated or polygonal to almost pear-shaped, light brown and thinner walled cells, 8–15 μ diam. by up to 30 μ long, orientated with their long axes at right angles to the surface of the receptacle; these cells arise from a thin layer of vertically running hyphae, which are often strongly constricted at their sparingly formed septa, 3.5–6 μ diam. Medullary excipulum thick, whitish to yellowish, gelatinous, composed of loose textura intricata; hyphae hyaline to subhyaline 2–4 μ diam., sparingly septate and branched, with their cells sometimes inflated. Towards the hymenium they form a more compact layer of about 100 μ thick with slightly darker hyphae which mostly run horizontally, and immediately beneath the subhymenium they become dark coloured and form a distinct dark brownish layer. Subhymenium rather indistinct, also of intricate hyphae but less compact in texture. Hymenium about 450 μ thick. Asci long, clavate cylindrical, gently attenuate below into a narrow hypha-like flexuous base often with an almost obliterated lumen, thick walled, 8-spored, up to 490 μ long by 14.5–18.2 μ wide. Ascospores uniseriate, hyaline, containing 1–3 large oil globules with numerous smaller ones, subfusiform ellipsoidal, curved rather strongly, suballantoid, smooth-walled, 22.7–31.8(–35) × 9.1–13.6 μ. Paraphyses filiform, 1.8–2.7 μ diam., septate, with their cells sometimes inflated, occasionally anastomosing with each other, generally branched especially near the lobed, undulate or somewhat curved apex. Hymenial hairs numerous, stout, non-septate except near their base, 3–4 μ diam., apex not enlarged but typically curved or rarely almost hooked (Fig. 4–5).

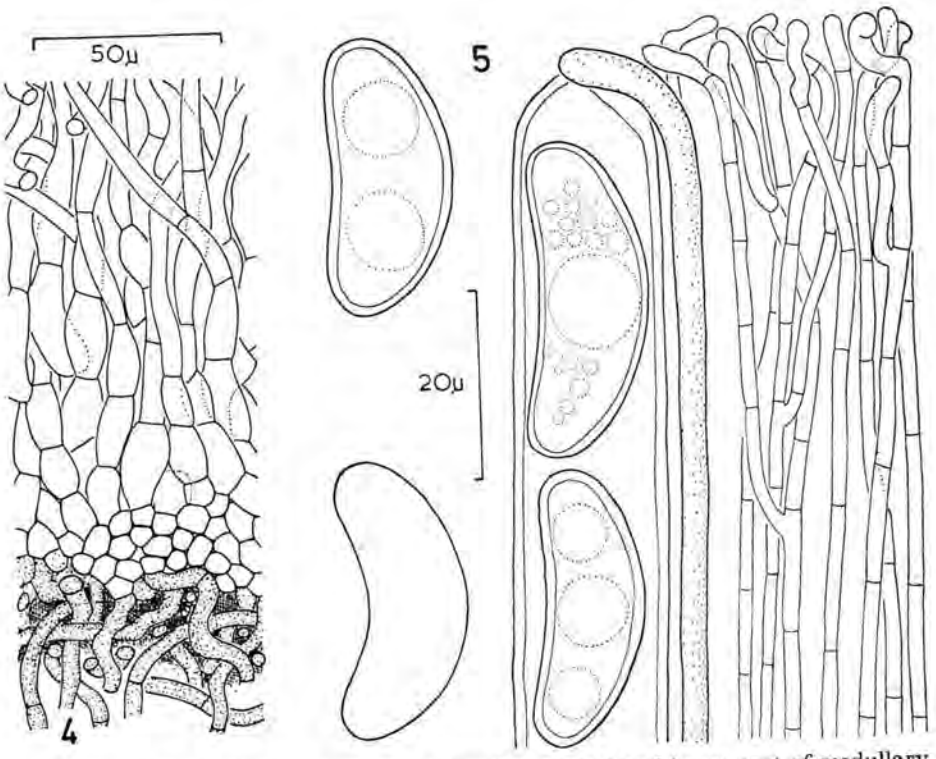
HABITAT AND DISTRIBUTION: on decaying wood or logs in Australasia (type locality New Zealand), Ceylon and probably also in Malesia.

Massee (*1896*) considered *Plectania campylospora* as a synonym of *Plectania rhytidia* and his description of the latter species was apparently based on the present species. This is probably due to the fact that the type of *Plectania rhytidia* was rather young when it was collected and its ascospores were still smooth and slightly curved so that superficially they resemble those of *Plectania campylospora*.

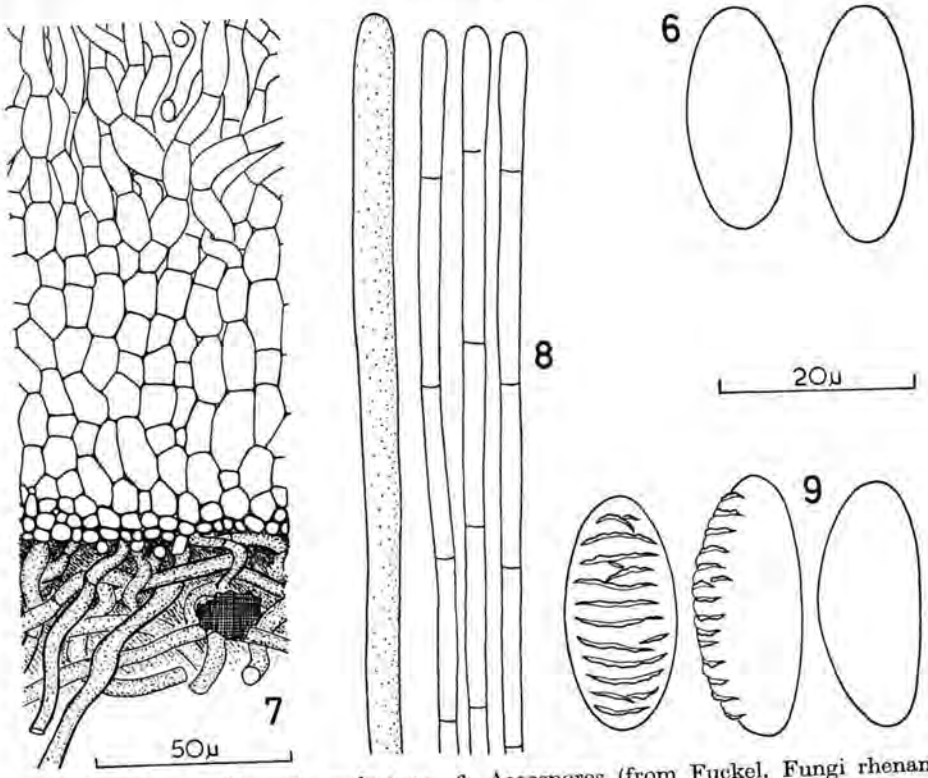
As has been suggested by Le Gal (*1953*), *Bulgaria sarasini* is identical with *Plectania campylospora* because Henning's original description and illustration agree very well with the present species. Boedijn (*1932*), who apparently accepted the synonymy proposed by Massee (*1896*), transferred *Bulgaria sarasini* to the genus *Sarcosoma* but he assigned to it collections of *Plectania rhytidia*.

Prof. J. A. Nannfeldt (Uppsala) already indicated on the labels of the type specimens of *Rhizina reticulata* and *Peziza cinereo-nigra* that these two species are indistinguishable from *Plectania campylospora*. Korf (*1957*) believed that *Gloeocalyx bakeri* was synonymous with the present species and a study on the type specimen of the former confirms this view.

There are some variations in the thickness of paraphyses as well as in the size of ascospores but these variations do not seem to have any significance for taxonomic purposes.



Figs. 4, 5. *Plectania campylospora*. 4. Section of ectal and lower part of medullary excipulum. 5. Part of ascus, paraphyses, hymenial hair and ascospores. (From G. Beaton 85).



Figs. 6–9. — *Plectania melastoma*. 6. Ascospores (from Fuckel, Fungi rhenani no. 1214). — *Plectania rhytidia*. 7. Section of ectal and lower part of medullary excipulum. 8. Paraphyses and hymenial hair. 9. Ascospores. (From W. Barke). — Figs. 6, 8, 9 to same scale.

SPECIMENS EXAMINED

AUSTRALIA. Queensland. On dead branches, Brisbane, s. dat., coll. unknown, no. 768 [recorded as *Sarcoscypha melastoma* by Cooke, *1892*]; on wood, Brisbane, s. dat., F. M. Bailey 70 [type specimen of *Peziza cinereo-nigra* Berk. & Br.]; on wood, 1880, Baron Müller. — Victoria. On fallen logs, Turton's track near Beech Forest, 30 March 1963, G. Beaton 85. — New South Wales. On wood, Lesaniose, 5 August 1916, J. B. Cleland, ex WARI 2734; on wood, Kendall, June 1917, D. S. J. Johnston, ex WARI 3113; on woods, Kurrajong Heights, 19 August 1912, J. B. Cleland, ex WARI 3114; on wood, Kangaroo Valley, June 1919, J. B. Cleland, ex WARI 3115; on wood, Mt. Wilson, 5 June 1915, J. B. Cleland, ex WARI 3141; on decaying logs, Tumbulgum, April 1898, comm. R. T. Baker; on decaying logs, Tumbulgum, s. dat., R. T. Baker 9 [type specimen of *Gloeocalyx bakeri* Massee]; on dead wood, Richmond River, s. dat., no. 305. — Western Australia. On wood, Perth, 1914, W. N. Cheesman.

NEW ZEALAND. On decayed wood, s. dat., Colenso 5053 [type specimen of *Peziza campylospora* Berk.]; on dead wood, Mamaku, near Rotorua, 1914, W. N. Cheesman.

CEYLON. On wood, Hakgalla, December 1867, 1868, no. 321 [syntype specimens of *Peziza reticulata* Berk. & Br.].

PLECTANIA RHYTIDIA (Berk.) Nannf. & Korf apud Korf

Peziza rhytidia Berk. *in* Hook. f., Fl. Nov. Zeal. 2: 200. 1855. — *Urnula rhytidia* (Berk.) Cooke, Handb. Austral. Fungi 269. 1892. — *Sarcosoma rhytidia* (Berk.) Le Gal, Discom. Madag. 224. 1953. — *Plectania rhytidia* (Berk.) Nannf. & Korf *apud* Korf *in* Mycologia 49: 110. 1957.

[Misapplied name: *Sarcosoma sarasini* (P. Henn.) Boedijn *in* Bull. Jard. bot. Buitenz. III 12: 275. 1932 = *Plectania rhytidia*].

Apothecia gregarious, sessile or substipitate, usually less than 30 mm diam. Disc deeply concave, smooth, brownish black. Receptacle cup shaped, contracted below into a rather indistinct stipe, from which abundant dark brown or blackish anchoring hyphae radiate; external surface of receptacle blackish brown, covered by intricate, somewhat compacted, thick, smooth or rough walled, blackish brown, septate undulate or flexuous hairs 4–6.5 μ diam. Ectal excipulum about 90 μ thick, outer layer of about 2 or 3 cells thick, with cells angular and almost isodiametric, dark reddish brown, thick walled, 5–9 μ diam., followed by a thin layer of lighter coloured, angular elongated cells 8–12 μ diam. by up to 18 μ long; the inner half of the ectal excipulum composed of light brown to subhyaline polygonal elongated or pear shaped cells about 10 μ diam., arising from undulating hyphal elements which are often constricted at their septa and measure 4–7.5 μ in diam. Medullary excipulum thick, dirty white to yellowish, gelatinous, of loosely interwoven, sparingly septate and branched textura intricata hyphae 2–4 μ diam.; towards the hymenium these hyphae become more compacted and less gelatinous, and gradually appear darker and ultimately form a distinct thin brownish layer immediately beneath the subhymenium. Subhymenium of loose textura intricata subhyaline hyphae 2.7–5 μ diam. Hymenium about 425 μ thick. Asci clavate cylindrical, long, gently attenuate below into a narrow flexuous base, thick walled, 8-spored, up to 550 μ long by 14.5–20 μ wide. Ascospores obliquely uniseriate, hyaline, asymmetrical, subcymbiform, subfusoid-ellipsoidal, 21.8–26(–28.1) × 10–13.1 μ, with 10–13(–14) horizontal, delicate, occasionally anastomosing ridges, which

cover only the more convex surface whilst the other side remains smooth. Paraphyses slender, long cylindrical, septate, about 1.8 μ diam., occasionally anastomosing and branched below, apex simple or rarely forked, mostly straight, embedded in amorphous brownish substance. Hymenial hairs numerous, stout, generally non-septate except near their base, cylindrical, apex rounded, sometimes lobed, 2.8–3.6 μ diam. (Fig. 7–9).

HABITAT AND DISTRIBUTION: on decaying wood or sticks in New Zealand, Malesia, Madagascar.

This species has been recorded from the Malesian region by Boedijn (*1932*) as *Sarcosoma sarasini* and Le Gal (*1953*) fully redescribed it from Madagascar as *Sarcosoma rhytidia*. On account of its coloration and its ascospore characters it is maintained here under *Plectania*.

SPECIMENS STUDIED

NEW ZEALAND. On decayed wood, s. dat., collector unknown [Colenso?], no. 2554 [This collection was illustrated by Berkeley when he published the name *Peziza rhytidia*]; ? on wood, Bay of Is., s. dat., J. D. Hooker [lectotype specimen —indicated by Le Gal, *1953*—of *Peziza rhytidia* Berk.]; in clumps on litter at foot of Pohutukara tree, Botanic Gardens, Wellington, 27 September 1960, W. Barke.

Plectania platensis (Speg.) Rifai, *comb. nov.*

Urnula platensis Speg. *in* An. Mus. nac. Hist. nat. B. Aires II 3: 310. 1899.

Urnula torrendi Boud. *apud* Boud. & Torrend *in* Bull Soc. mycol. Fr. 27: 129. 1911 (teste Malençon, *1939*).

Apothecia scattered or more often gregarious, sessile to substipitate, 9–35 mm diam. Disc deeply concave, brownish black to almost black, smooth. Receptacle cup shaped, margin irregularly crenulate, contracted below into an indistinct stem-like base and anchored to the substratum by blackish and byssoid mycelium; the surface of the receptacle marked, especially in dried condition, by prominent vertical ridges, brownish black and slightly paler than the disc, finely tomentose or velvety from hairs. Hairs numerous, smooth or rough and thick walled, dark brown, rarely almost opaque, only sparingly septate and branched, undulate or flexuous, 4–8 μ diam. Ectal excipulum approximately 125 μ thick, of subglobose, pear shaped or subangular elongated cells (textura angularis to textura globulosa) 10–30 μ diam. by up to 40 μ long, with their long axes at right angles to the surface of receptacle; the outer layer of ectal excipulum about 2 or 3 cells thick, dark coloured, with thicker walled cells and smaller in size than those of the inner layer, which in turn is much paler. Medullary excipulum yellowish, made up of a thick layer of loose and indistinctly interlacing hyphae 2–4.5 μ diam., only sparingly septate and branched and embedded in gelatinous substance; towards the hymenium these hyphae become more tightly intertwined with each other, less gelatinous but their walls are more heavily pigmented and give rise to a distinct dark brownish layer immediately beneath the subhymenium. Subhymenium about 80 μ thick, of textura intricata, hyphae light coloured and measuring 1.8–3.5 μ diam. Hymenium about 400 μ thick. Asci long, the upper part cylindrical, gently attenuate below into a long straight or flexuous hypha-like base, wall thick, 8-spored, 370–450 × 13–16.5 μ. Ascospores 19.1–23.1 × 8.5–11.8 μ, when young containing numerous oil

globules, hyaline, ellipsoid, or subfusiform ellipsoid in outline but strongly asymmetric and almost bean shaped, ornamented with 9–11 horizontal and rarely anastomosing striations which cover only the more convex surface of the spores. Paraphyses thread-like, 1.2–2 μ diam., septate, occasionally anastomosing with each other, filled with granular contents, near the apex typically branched, apex not distinctly enlarged or sometimes even narrowed. Hymenial hairs numerous, somewhat stout, typically non septate except near their base, 2.7–3.2 μ diam. cylindrical, apex hardly enlarged and sometimes attenuate slightly into a blunt end. These paraphyses, at least their upper parts, are apparently embedded in amorphous brownish substance (Fig. 10–14).

HABITAT AND DISTRIBUTION: on sticks or charcoal or decayed parts of *Eucalyptus* in Argentinia (type locality), Marocco, Portugal, South France, South Africa and Australia.

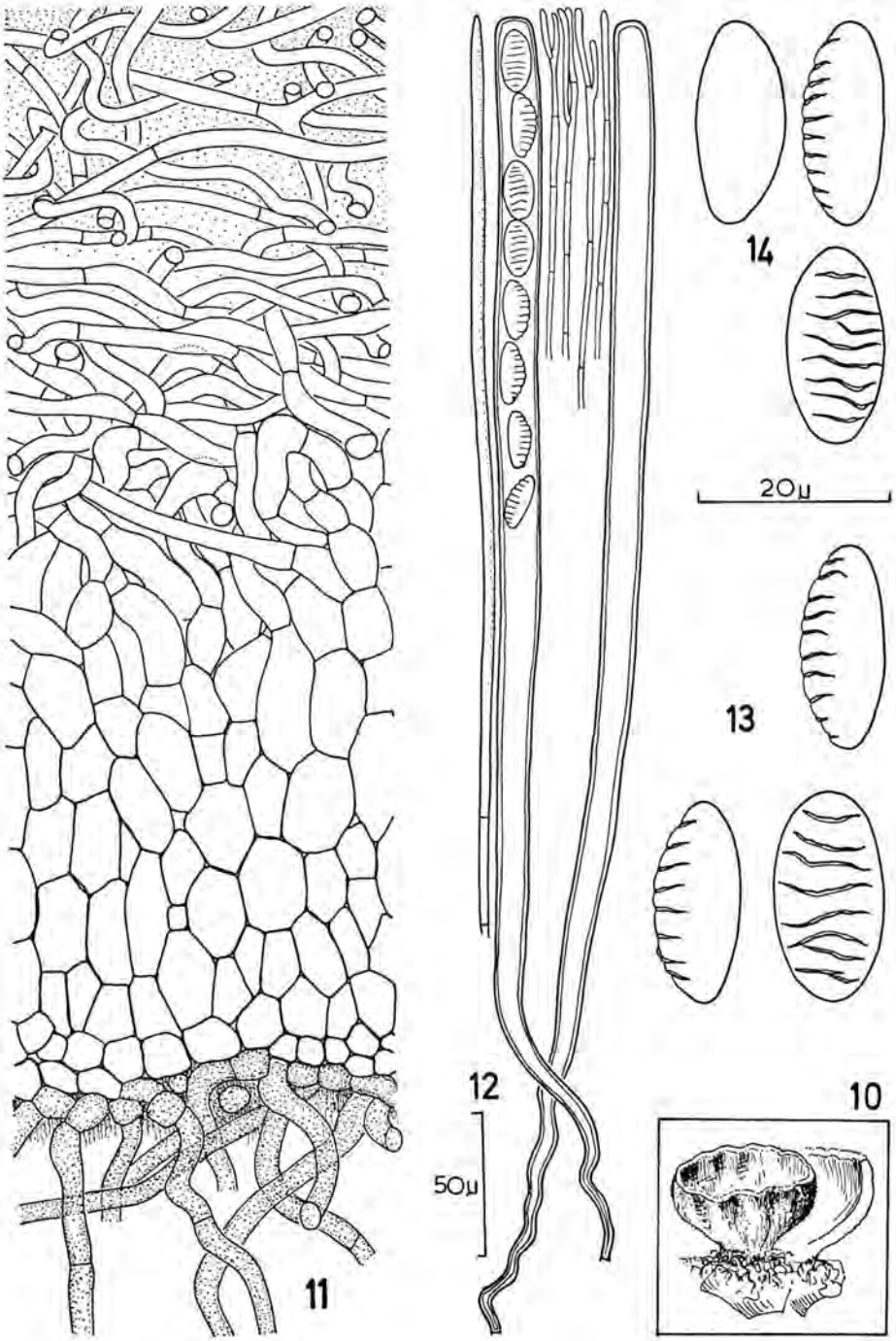
Plectania platensis was first described by Spegazzini from La Plata in Argentina in 1899 and some years later Boudier & Torrend (*1911*), who apparently were unaware of Spegazzini's paper, redescribed this species as new, basing their description on a collection from Portugal. Malençon (*1939*) reported its occurrence in Marocco and suggested that it should be looked for in places where *Eucalyptus* are grown, because so far this species seemed to be always associated with decaying parts of *Eucalyptus*. With this idea in mind Berthet searched for this species in *Eucalyptus* plantations in France and in 1963 he reported finding it there. Furthermore Berthet (*1963a*) pointed out that this species has not been recorded from Australia, the home country of *Eucalyptus*.

The identity of the first two Australian collections received at Herb. Kew. was rather puzzling because their apothecia seemed to grow directly on the ground and the label stated that they have a terrestrial habitat, growing amongst mosses. A closer examination has shown, however, that the apothecia were growing on charcoal, which was covered by thin layer of soil. Dr. C. R. Metcalfe of Jodrell Laboratory, Kew, kindly identified the bit of charcoal as that of a species of *Eucalyptus*. Another collection growing on a small stick of *Eucalyptus* has also been found in Australia and Dr. K. Tubaki has collected a similar species on a similar substrate in Tasmania. Besides these collections in Herb. Kew. there is also a specimen from South Africa which has been identified by Le Gal as *Urnula platensis*.

Plectania platensis can be separated from *Plectania rhytidia* by its smaller ascospores which bear fewer striations, and by its rather profusely branched paraphyses. Furthermore, as has been stated above, *Plectania platensis* is always associated with *Eucalyptus*.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On *Eucalyptus* burnt chips and sticks covered by soil amongst mosses, 2 miles from Janieson on Eildon Road, 4 October 1962, G. Beaton 31; on *Eucalyptus* charcoal covered by soil, Gellibrand River flat, 3 miles from Gellibrand, 18 October 1962, G. Beaton 38. — Queensland. On *Eucalyptus* stick,s



Figs. 10–14. *Plectania platensis*. 10. Habit sketch. 11. Section of ectal and medullary excipulum. 12. Ascus, paraphyses and hymenial hair. 13. Ascospores. (From G. Beaton 38). 14. Ascospores (From Landon 1398).

Springbrook, South Queensland, 26 November 1953, Landon 1398. — Tasmania. On *Eucalyptus* stick buried in the ground amongst mosses, Mt. Field National Park, 27 November 1963, Keisuke Tubaki IFO 10652.

South Africa. On *Eucalyptus*, Leonis River, Natal, 17 May 1948, P. H. B. Talbot.

TRIBE SARCOSCYPHEAE

Cookeina O. Kuntze

Peziza [Dill.] St-Amans [ser. *Aleuria* Fr.] subgen. *Trichoscypha* Cooke, Mycograph. 1: 252. 1879. — *Hymenoscyphus* S. F. Gray subgen. *Trichoscypha* (Cooke) Phill., Man. Br. Discom. 126. 1887. — *Trichoscypha* (Cooke) Sacc., Syll. Fung. 8: 160. 1889; non *Trichoscypha* Hook. f. *apud* Benth. & Hook. f., Gen. Pl. 1: 423. 1862 (= Anacardiaceae); nec *Trichoscypha* Boud. *in* Bull. Soc. mycol. Fr. 1: 117. 1885 (= *Trichoscyphella* Nannf., = *Lachnellula* Karst. emend. Dennis).

Cookeina O. Kuntze, Rev. Gen. Pl. 2: 849. 1891.

Pilocratera P. Henn. *in* Bot. Jb. 14: 363. 1892.

Type species: *Peziza tricholoma* Mont.

Apothecia medium sized to rather large, stipitate or rarely subsessile. Disc deeply concave, of various shades of pink or orange red. Receptacle deeply cup-shaped or funnel shaped, much paler than the disc, pubescent or distinctly hairy, seated, sometimes somewhat obliquely, on a distinct, terete or rarely flattened stipe. Hairs either cover the whole receptacle surface and sometimes also the stipe or are confined to the marginal area of the cup, mostly superficial but in one species originating from medullary excipulum; these hairs are compound and composed of bundles of hyphae or an aggregation of elongated cells. Ectal excipulum of a few layers of elongated or subglobose cells arranged with their long axes at wide angles to the receptacle surface (textura angularis), often with several cells aggregated superficially on surface of receptacle and giving rise to the minutely scurfy appearance of the apothecia. Medullary excipulum of horizontally running parallel hyphae (textura porrecta) which diverge near the margin of the cup. Asci of the whole hymenium ripening simultaneously, long, cylindrical, abruptly contracted below into the short and narrow stalk-like base, thick-walled, apex not blued in Melzer's reagent, 8-spored. Ascospores obliquely uniseriate, ellipsoidal to fusoid, sometimes somewhat asymmetrical, often distinctly apiculate, with two or rarely more large oil globules and several smaller ones, subhyaline to pale pink in mass, at maturity remaining smooth or appearing striate from the presence of fine and occasionally anastomosing ridges which do not stain in cotton-blue in lactic acid. Paraphyses thread-like, septate and much branched and anastomosed to form a delicate network, hyaline, with fine granular contents; in one species stout, septate, club shaped branches of the paraphyses may project beyond the general level of the hymenium.

Habitat: on dead branches and wood.

Members of this genus are well characterized and each species can be readily separated from the others. The hairs of *Cookeina tricholoma* arise from medullary excipulum, whereas in the other species they are superficial in origin. In *Cookeina colensoi* and *Cookeina venezuelae* (Berk. & Curt.) Le Gal the hairs are composed of elongated cells which are rather

thick walled; since these compound hairs are short and mostly less than 500 μ long to the unaided eyes the apothecia of these two species will appear almost smooth or downy. In contrast the hairs of *Cookeina tricholoma* and *Cookeina sulcipes* are composed of bundles of strictly parallel running hyphae. Unlike those of the other species, the spores of *Cookeina colensoi* have perfectly smooth walls. The presence of distinctive enlarged branches of paraphyses which project above the general level of the hymenium makes *Cookeina sulcipes* readily recognizable even if the material is sterile. This characteristic structure, which probably is analogous to the hymenial hairs of the tribe Urnuleae, also indicates the remote relationship between this species and *Desmazierella acicola* Lib. of the Urnuleae. Because of its subsessile apothecia, poorly developed hairs and wider bands of its spore ornamentation, Le Gal (*1953*) stated that *Cookeina venezuelae* was closer to *Phillipsia* than the other species of *Cookeina* were. The impression gained from a study of species of *Cookeina* is that this genus is polyphyletic so that in the future it might be advisable to separate its species into smaller infrageneric entities or even to exclude the aberrant ones.

The genus *Geodina* Denison (Denison, *1965*) is related to *Cookeina* but differs in its terrestrial habitat, ascus shape and stage of development, brownish hairs as well as the ascospore ornamentation.

Cookeina tricholoma (Mont.) O. Kuntze

Peziza (*Lachnea*) *tricholoma* Mont. *in* Ann. Sci. nat. (Bot.) II 2: 77. 1834. — *Lachnea tricholoma* (Mont.) Pat. *in* Bull. Soc. mycol. Fr. 4: 98. 1888. — *Trichoscypha tricholoma* (Mont.) Sacc., Syll. Fung. 8: 160. 1889. — *Cookeina tricholoma* (Mont.) O. Kuntze, Rev. Gen. Pl. 2: 849. 1891. — *Pilocratera tricholoma* (Mont.) P. Henn. *in* Bot. Jb. 17: 9. 1893.

Peziza hystrix Berk. *in* Ann. Mag. nat. Hist. II 9: 201. 1852.

Pilocratera tricholoma (Mont.) P. Henn. var. *celebica* P. Henn. *in* Warburg, Monsunia 1: 33. 1900.

Peziza medusina Speg. *in* An. Mus. nac. B. Aires III 1: 78. 1902 (teste Gamundi, *1959*). — *Pilocratera medusina* (Speg.) Sacc. & D. Sacc. *in* Sacc., Syll. Fung. 18: 32. 1906.

Apothecia stipitate to rarely subsessile, scattered or gregarious. Disc deeply concave, smooth, pinkish orange or other shades of orange. Receptacle 5–20 mm in diam., deep cup shaped or sometimes almost funnel-shaped, obliquely seated on a well defined stipe, much paler than the disc, sometimes ridged or otherwise smooth or finely roughened, conspicuously hairy, especially near the margin of the cup where the hairs form a distinct fringe. Stipe hairy, especially towards the upper half, terete or rarely flattened, mostly tapering towards the base, up to 45 mm long by 1–3 mm diam., concolorous with the receptacle or somewhat whitish. Ectal excipulum thin, of subglobose or angular elongated cells (textura angularis) up to 15 μ diam., laid down with their long axes at right angles to the surface of the receptacle; on the surface of the receptacle there are groups of aggregated or catenulate cells which are globose or pear shaped, dirty yellow, thick walled, mostly warted, about

10–20 μ diam., which give rise to the roughness or pruinosity of the surface of the receptacle. Medullary excipulum of horizontally running, septate, subhyaline, occasionally branched hyphae 2.5–7 μ diam. (textura porrecta). At intervals from these hyphae arise bundles of hyphae which break through the excipular layer at right angles to the surface of the receptacle and continue as compound hairs; these are subulate, whitish or brownish yellow, up to 6 mm long by 250 μ diam., the individual hyphae sparingly septate, 4–6 μ diam., decreasing in length with the distance from the centre of the hair, often slightly inflated at the rounded tip to about 9 μ diam. Subhymenium of loose intricate hyphae up to 6 μ diam. Hymenium about 310 μ thick. Asci cylindrical, 290–340 × × 15–20 μ, 8-spored, thick walled (up to 2 μ thick), hardly attenuate below but abruptly contracted at the base into a narrow short flexuous stalk. Ascospores ellipsoid to subfusoid, apiculate at both ends, containing two large oil drops and several smaller ones, 25.4–31 × 11.8–14 μ, subhyaline, at maturity appearing longitudinally striate from the presence of delicate and sometimes anastomosing low ridges. Paraphyses thread-like, delicate, much branched and freely anastomosing with each other, 1.5–2.5 μ diam., sometimes with irregular peg-like and one-sided swellings at their middle, their apex more profusely branched, ending in rounded clavate tips up to 3 μ diam., containing fine granules (Fig. 15–17).

HABITAT AND DISTRIBUTION: on dead branches and wood, pantropical; also in Madagascar, Argentina and Australia.

According to Boedijn (*1933*) spore deposits of this and the following species appear pale pink. Boedijn also demonstrated that the type specimen of *Pilocratera tricholoma* var. *celebica* P. Henn. was indistinguishable from the present species.

The specific epithet 'tricholoma' is not quite apt for the present species, because usually the hairs cover almost the whole exterior of the apothecia. Based on an assumption that in *Cookeina tricholoma* the hairs were confined only to the margin of the cup, Berkeley (*1852*) redescribed the present species under another name, *Peziza hystrix*, which has been generally regarded as a synonym of *Cookeina tricholoma*.

SPECIMENS EXAMINED

AUSTRALIA. Queensland. On rotten tree, Daintree River, s. dat., collector unknown.

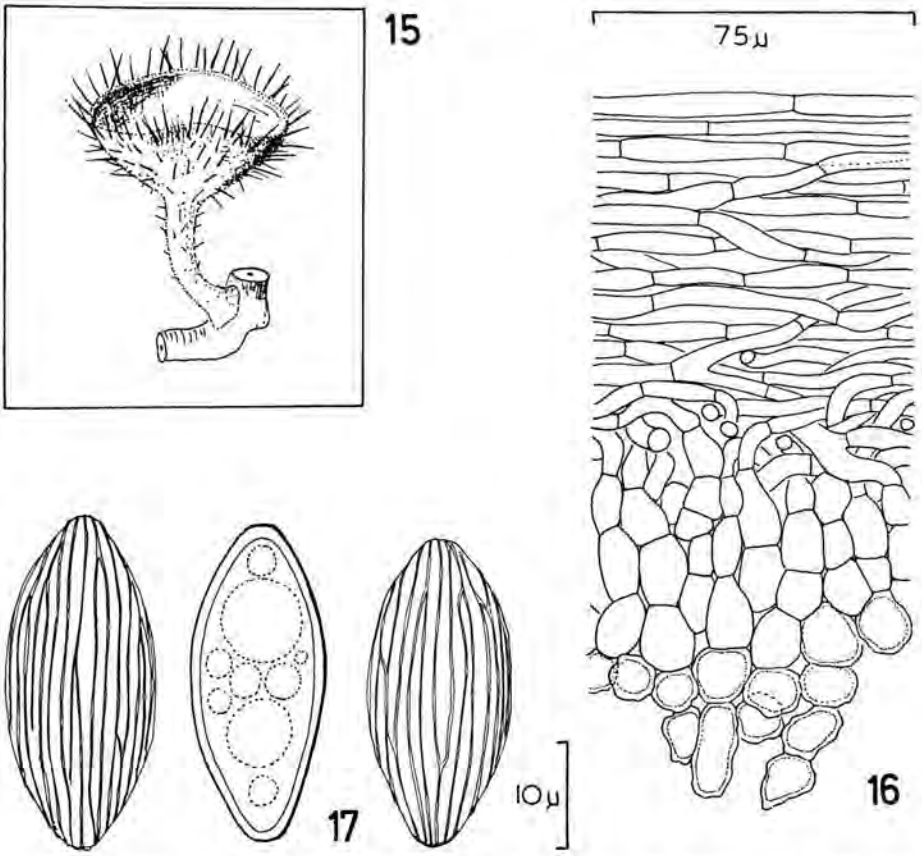
LOYALTY IS. On wood, Lifu, April 1912, Sarasin 211.

SOLOMON IS. On fallen branch, Gallego, Guadalcanal, 3 July 1965, RS(BSIP) 538; ibid., 6 July 1965, RS(BSIP) 538A; ibid., 3 July 1965, RS(BSIP) 539; on sticks in the forest, Warahito camp, San Cristobal, 27 July 1965, RS(BSIP) 832; on sticks, Kolombangara, 8 September 1965, RS(BSIP) 1345 (all comm. E. J. H. Corner).

SANTO DOMINGO. On wood, s. dat., Salle 35 [type specimen of *Peziza hystrix* Berk.].

COOKEINA SULCIPES (Berk.) O. Kuntze

Peziza sulcipes Berk. *in* Lond. J. Bot. 1: 141. 1842. — *Trichoscypha sulcipes* (Berk.) Sacc., Syll. Fung. 8: 161. 1889. — *Cookeina sulcipes* (Berk.) O. Kuntze, Rev. Gen. Pl. 2: 849. 1891. — *Pilocratera sulcipes* (Berk.) Sacc. & Trav. *in* Sacc., Syll. Fung. 20: 413. 1911.



Figs. 15–17. *Cookeina tricholoma*. 15. Habit sketch. 16. Section of ectal and medullary excipulum. 17. Ascospores. [16 from RS (BSIP) 538, the rest from Sarasin 211].

Peziza hindsii Berk. *in* Lond. J. Bot. 1: 456. 1842. — *Lachnea hindsii* (Berk.) Pat. *in* Bull. Soc. mycol. Fr. 4: 98. 1888. — *Trichoscypha hindsii* (Berk.) Sacc., Syll. Fung. 8: 161. 1889. — *Cookeina hindsii* (Berk.) O. Kuntze, Rev. Gen. Pl. 2: 849. 1891. — *Pilocratera hindsii* (Berk.) P. Henn. *in* Hedwigia 32: 225. 1893.

Peziza (*Aleuria*) *javanica* Nees *ex* Lév. *in* Ann. Sci. nat. (Bot.) III 3: 39. 1845. — *Trichoscypha javanica* (Nees ex Lév.) Sacc., Syll. Fung. 8: 162. 1889. — *Cookeina javanica* (Nees ex Lév.) O. Kuntze, Rev. Gen. Pl. 2: 849. 1891. — *Aleuria javanica* (Nees ex Lév.) Overeem & Overeem-de Haas *in* Bull. Jard. bot. Buitenz. III 4: 12. 1922.

Peziza (*Lachnea*) *amoena* Lév. *in* Ann. Sci. nat. (Bot.) III 3: 39. 1845. — *Trichoscypha amoena* (Lév.) Sacc., Syll. Fung. 8: 161. 1889. — *Cookeina amoena* (Lév.) O. Kuntze, Rev. Gen. Pl. 2: 849. 1891.

Peziza afzelii Fr. *in* Nova Acta R. Soc. Sci. upsal. III 1: 121. 1851. — *Trichoscypha afzelii* (Fr.) Sacc., Syll. Fung. 8: 161. 1889. — *Cookeina afzelii* (Fr.) O. Kuntze, Rev. Gen. Pl. 2: 849. 1891. — *Pilocratera afzelii* (Fr.) Sacc. & Trav. *in* Sacc., Syll. Fung. 20: 412. 1911.

Pilocratera engleriana P. Henn. *in* Bot. Jb. 14: 363. 1892. — *Trichoscypha engleriana* (P. Henn.) Sacc., Syll. Fung. 11: 398. 1895.

Geopyxis elata Massee *in* Bull. misc. Inf. Kew 1898: 123. 1898.

Cookeina sumatrana Boedijn *in* Recl Trav. bot. néerl. **26**: 407. 1929.

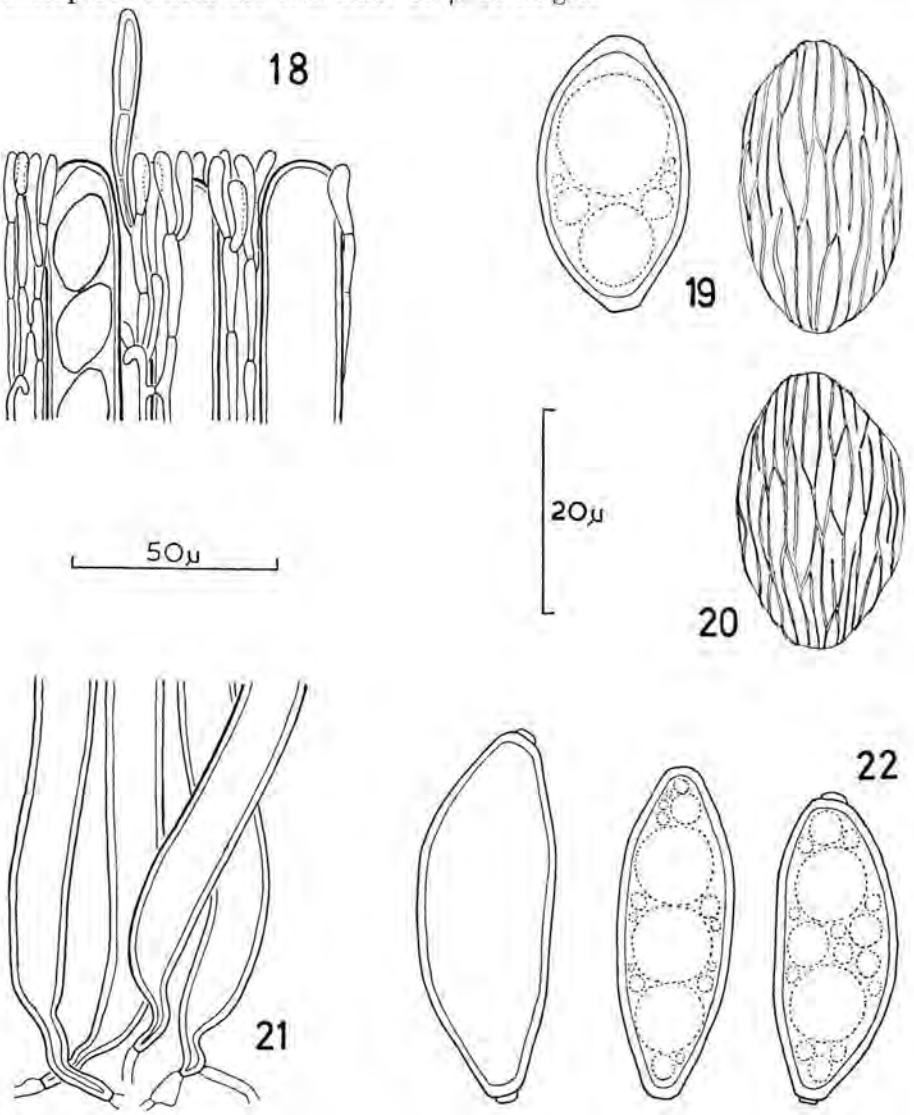
Geopyxis striatospora Maubl. & Roger *in* Bull. Soc. mycol. Fr. **52**: 83. 1936 (teste Le Gal, *1953*).

Apothecia scattered to gregarious, stipitate or rarely subsessile. Disc deeply concave, appears smooth to the unaided eye, of various shades of orange or pink. Receptacle cup shaped or rarely funnel shaped, 5–30 mm diam., much paler than the disc, sometimes whitish, minutely scurfy except around the margin where there are usually up to 5 distinct circular ridges from which compound hairs arise. Stipe terete or compressed, sometimes grooved, concolorous or even paler than the receptacle, slightly attenuate below and often forming a disc-like holdfast at the bottom, up to 55 mm long by 1.5–4 mm thick. Ectal excipulum of thin walled subglobose or angular elongated cells 6–17(–20) μ diam., lying at right angles to the surface of the receptacle (textura angularis) with their cells rounder and their walls thicker with the distance from the hymenium; at the surface of the receptacle several thick walled and sometimes warted, globose or pyriform cells up to 30 μ diam. are often irregularly aggregated and this may cause the scurfy or pruinose appearance of the receptacle. From the ectal excipulum, usually confined to the area near the margin of the cup arise numerous, whitish, narrowly conical or subulate compound hairs up to 1 mm long by 250 μ wide, composed of strictly parallel, septate, subhyaline to yellowish hyphae 4–10 μ diam. Medullary excipulum of horizontally running parallel and septate hyphae 2.5–7 μ diam. (textura porrecta), which as they pass into the subhymenium become irregular, thread-like and loosely intertwined with each other (textura intricata). Hymenium about 300 μ thick. Asci cylindrical, 270–320 × 16–20 μ, with about 2 μ thick wall, 8-spored, hardly narrowed towards the almost rounded base, then abruptly contracted into the supporting short and narrow stalk. Ascospores uniseriate, ellipsoid, somewhat asymmetrical, sometimes with distinctly apiculate ends, subhyaline under the microscope, mostly with two large and numerous much smaller oil drops, at maturity appearing striate from the presence of fine, rarely anastomosing, longitudinal ridges, 25.5–30 × 13.5–15.5 μ. Paraphyses delicate, thread-like, branched and anastomosing to form a fine complicated network, septate, with granular contents, 1.5–2 μ diam., their apices more profusely branched and terminated by clavate cells up to 4.5 μ diam. and forming a dense and firm layer around the ascus tips. Frequently some of these terminal clavate branches may become distinctly enlarged, thicker walled, septate, stout, up to 7.5 μ diam., subhyaline, projecting as hymenial hairs up to about 47 μ beyond the general level of the hymenium (Fig. 18–20).

HABITAT AND DISTRIBUTION: on dead wood, pantropical.

The only Australian specimen which I could study consists of a single apothecium which is rather young and badly preserved. Originally it was mixed in the same packet as *Cookeina tricholoma*. The identity of this young specimen, however, can be established beyond any doubt because of the presence of the distinctive hymenial hairs. Similarly, although the preparation made from the type specimen of *Pilocratera engleriana* did not yield any spores, the presence of these structure leaves no doubt that this species is identical with *Cookeina sulcipes*, as has been suggested by Boedijn (*1933*) and Le Gal (*1953*).

Relying on Massee's (*1898*) description, Le Gal (*1953*) doubted the correctness of Seaver's (*1928*) and Boedijn's (*1933*) suggestion that *Geopyxis elata* was identical with *Cookeina sulcipes*; she remarked that on account of its ascospore size Massee's species might be synonymous with *Cookeina colensoi*. An examination of its type specimen shows that *Geopyxis elata* cannot be separated from *Cookeina sulcipes*. It is not clear why Massee gave the spore measurement as 32–35 × 14–15 μ, which in fact falls within the range *Cookeina colensoi*; his specimen yielded striated ascospores which are less than 29 μ in length.



Figs. 18–22. — *Cookeina sulcipes*. 18. Part of asci, paraphyses and the characteristic enlarged branch of the paraphysis (From H. M. S. "Challenger"). 19. Ascospores (From Brauerlen 23). 20. Ascospores (From type of *Geopyxis elata*). — *Cookeina colensoi*. 21. Bases of asci. 22. Ascospores. (From type).

SPECIMENS EXAMINED

AUSTRALIA. Queensland. On rotten tree, Daintree River, s. dat., collector unknown.

SOLOMON IS. On fallen branch, Gallego, Guadalcanal, 3 July 1965, RS(BSIP) 536; ibid., 9 July 1965, RS(BSIP) 536A; ibid., 3 July 1965, RS(BSIP) 537; on sticks, Kolombangara, 8 September 1965, RS(BSIP) 1346 (all comm. E. J. H. Corner).

ADMIRALTY IS. On dead wood, March 1875, H.M.S. "Challenger".

ARU IS. (Indonesia). On dead wood, September 1874, H.M.S. "Challenger".

NEW IRELAND (R.B.N.). On dead wood, s. dat., R. B. Hinds [type specimen of *Peziza hindsii* Berk.].

NEW GUINEA. On the ground (?), Kamusi River, 1895, W. Fitzgerald (comm. F. von Müller) [type specimen of *Geopyxis elata* Massee]; on dead wood, Strickland River, 1885, Brauerlen 23.

AFRICA. Kamerun. On dead twig, Barumbi-station, 4 September 1890, Preuss [type specimen of *Pilocratera engleriana* P. Henn.].

AMERICA. Surinam. On dead wood, s. dat., Hostman [type specimen of *Peziza sulcipes* Berk.].

COOKEINA COLENSOI (Berk.) Seaver sensu Le Gal

Peziza colensoi Berk. *in* Hook. f., Fl. Nov. Zealand. 2: 200. 1855. — *Sarcoscypha colensoi* (Berk.) Sacc., Syll. Fung. 8: 64. 1889. — *Cookeina colensoi* (Berk.) Seaver *in* Mycologia 5: 191. 1913 [misapplied, = *Cookeina venezuelae* (Berk. & Curt.) Le Gal], sensu Le Gal, Discom. Madag. 241. 1953.

Peziza aluticolor Berk. *in* J. Linn. Soc. (Bot.) 13: 176. 1872. — *Geopyxis aluticolor* (Berk.) Sacc., Syll. Fung. 8: 157. 1889. — *Ciboria aluticolor* (Berk.) Rick *in* Annls mycol. 4: 408. 1904.

Ciboria argentinensis Speg. *in* An. Mus. nac. Hist. nat. B. Aires III 19: 444. 1909 (teste Gamundi, *1957*.).

Apothecia scattered, mostly stipitate, rarely subsessile. Disc smooth, deeply concave, yellowish to bright orange. Receptacle deeply cup shaped or funnel shaped, much paler than the disc, somewhat whitish, under a hand lens appearing sparsely and minutely pubescent, while around the margin of the cup usually almost downy and whitish, 3–30 mm diam. Stipes up to 11 mm long by 1–2.5 mm wide, subcylindrical, slightly attenuate towards the base, then widened again at the bottom and forming an indistinct disc-like holdfast; they are mostly concolorous with the receptacle, usually with longitudinal ridges and furrows which may extend to the receptacle. In dried specimens the whole apothecia fade to yellowish brown shades. Ectal excipulum of pseudoparenchymatous layer of globose or subangular elongated rather thin walled cells 8–13 μ diam. arranged with their long axis at a wide angle to the surface of the receptacle; towards the outside these cells become thicker walled and darker (pale dirty yellowish) coloured, more isodiametric or globose in outline and also smaller, 6–12 μ diam. From this layer, especially from the region around the margin of the cup arise conical compound hairs, which are more or less trigonal in outline, up to 150 μ long by 80 μ wide at the base and composed of elongated thick walled cells about 10 μ diam. Medullary excipulum of horizontally running, sparingly branched, septate, colourless hyphae 2–5 μ diam. (textura porrecta). Hymenium about 350 μ thick. Asci long cylindrical, hardly or only gradually decreasing in diam. towards the base, then passing abruptly into a narrow flexuous stalk-like supporting base, 280–420 × 14–18 μ, 8-spored, thick walled. Ascospores obliquely

uniseriate, unequal sided to almost curved, subfusoid or ellipsoid in dorsal view, sometimes with short apiculus about 2 μ diam. at both ends, hyaline, smooth walled, mostly containing 2 or rarely more large oil guttules with numerous smaller ones, 27.5–35.5 × 9.2–12 μ. Paraphyses thread-like, much branched and freely anastomosing with each other to form an irregular delicate network, 1–1.8 μ diam., septate, sometimes constricted at the septa; the apical portions of the paraphyses form a rather compact layer because they are more profusely branched and each branch terminates in a clavate apex about 3.5 μ diam. (Fig. 21–22).

HABITAT AND DISTRIBUTION: on wood in Australia, New Zealand (type locality), Madagascar and Argentina.

Seaver (*1913*, *1928*) applied the name *Cookeina colensoi* to some West Indian specimens which were not conspecific with the New Zealand and Australian specimens. The West Indian species has striate and shorter ascospores and for this the name *Cookeina venezuelae* (Berk. & Curt.) Le Gal is available. The name *Cookeina colensoi* is used here in its original sense of Berkeley (*1855*) adopted by Le Gal (*1953*) and Gamundi (*1957*).

The distribution of this species is rather interesting. Specimens have been studied from Africa, Le Gal (*1953*) had it from Madagascar and Gamundi (*1957*) described the Argentinian collection, but surprisingly it has not been reported from the neighbouring Malesian region. *Cookeina colensoi* is the commonest of the three species of this genus known from Australia.

SPECIMENS EXAMINED

AUSTRALIA. Queensland. On dead wood, Brisbane, s. dat., Bailey 790. — New South Wales. On wood, Clarence River, s. dat., collector unknown [type specimen of *Peziza aluticolor* Berk.]; on wood, Dorrige, 24 January 1918, J. B. Cleland, ex WARI 3131.

NEW ZEALAND. On dead stick, near the River Manawutu, s. dat., Colenso [type specimen of *Peziza colensoi* Berk.]; on dead log, near Ashurse Ferry, s. dat., T. Kirk 286.

LOYALTY IS. On wood, Lifu, s. dat., Sarasin 259.

BOEDIJNOPEZIZA S. Ito & Imai

Boedijnopeziza S. Ito & Imai *in* Trans. Sapporo nat. Hist. Soc. **15**: 58. 1937.

TYPE SPECIES: *Peziza insititia* Berk. & Curt.

Apothecia small to medium sized, distinctly stipitate. Disc deeply concave, white to pale cream or sometimes tinged pinkish. Receptacle urceolate to turbinate, paler than the disc, distinctly and coarsely hairy, especially towards the margin of the cup. Hairs arise from the margin and from the surface of the receptacle, flat, scalene triangular, composed of bundles of parallel hyphae. Ectal excipulum thin, of a few layers of globose, subglobose or polygonal cells (textura globulosa). The outer part of the medullary excipulum is made up of interwoven hyphae embedded in a gelatinous matrix, whereas the inner part is composed of mostly horizontally running hyphae. Asci of the whole hymenium ripening simultaneously, long, cylindrical, rather abruptly contracted below into a narrow hypha-like base, 8-spored, wall thick, not blued in Melzer's reagent.

Ascospores uniseriate, long, subfusoidal, asymmetrical or distinctly curved, hyaline, with numerous oil globules, smooth walled. Paraphyses thread-like, delicate, septate, much branched and anastomosed with each other to form a delicate network around the asci, their apices usually more profusely branched.

HABITAT: on dead wood.

Le Gal (*1953*) maintained that *Peziza insititia* Berk. & Curt. should be retained in the genus *Cookeina* but as Boedijn (*1933*) already pointed out, this species differs markedly from the other species of that genus. The size, shape and pigmentation of the apothecia of *Peziza insititia* are different from those of typical *Cookeina*, as are the shape and the development of some of its hairs. According to Boedijn (*1933*) in the young state "the aperture of the apothecium in this species is closed by a nearly continuous subconical sheath, which by expansion of the cup ruptures radially and gives rise to a ring of hairs." This kind of sheath is unknown for species of *Cookeina*. The ectal excipulum of *Cookeina*, at least the inner part of it, is usually composed of angular elongated cells, whereas that of *Peziza insititia* is invariably made up of a textura globulosa, with its cells slightly larger than those of species of *Cookeina* (compare Fig. 16 and Fig. 24). Furthermore the presence of a distinct gelatinous layer immediately inside the ectal excipulum and the long and multiguttulate ascospores indicate that *Peziza insititia* is not congeneric with *Cookeina tricholoma*. Boedijn (*1951*) has subsequently excluded the former species from *Cookeina* and has transferred it to the genus *Microstoma* Bernstein, but this disposition is likewise unsatisfactory on account of the marked differences in the apothecial habit and coloration, the hair character, the structure of the paraphyses and above all in the presence or absence of a buried pseudorhiza. The latter character determines the type of habitat and it has been found that habitats – and to some extent also the geographical distributions – of members of the Sarcoscyphaceae are very useful in delimiting the genera of this group of fungi. The morphological and the anatomical characters of *Peziza insititia* seem to be outstanding enough to make it acceptable as the type species of the monotypic genus *Boedijnopeziza* S. Ito & Imai (*1937*).

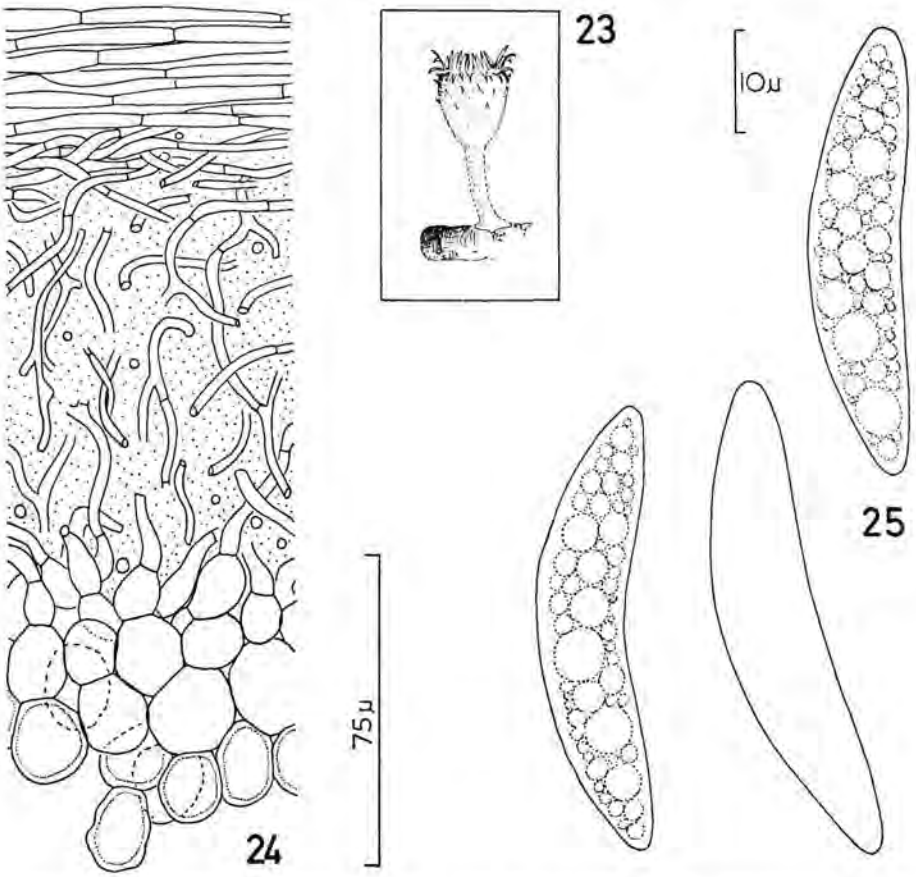
BOEDIJNOPEZIZA INSITITIA (Berk. & Curt.) S. Ito & Imai

Peziza insititia Berk. & Curt. *in* Proc. Am. Acad. Arts Sci. **4**: 127. 1860. — *Trichoscypha insititia* (Berk. & Curt.) Sacc., Syll. Fung. **8**: 161. 1889. — *Cookeina insititia* (Berk. & Curt.) O. Kuntze, Rev. Gen. Pl. **2**: 849. 1891. — *Pilocratera insititia* (Berk. & Curt.) Sacc. & Trav. *in* Sacc., Syll. Fung. **20**: 412. 1911. — *Boedijnopeziza insititia* (Berk. & Curt.) S. Ito & Imai *in* Trans. Sapporo nat. Hist. Soc. **15**: 58. 1937. — *Microstoma insititia* (Berk. & Curt.) Boedijn *in* Sydowia **5**: 212. 1951.

Trichoscypha magnispora Lloyd, Mycol. Writ. **6**: 1050. 1921 (teste Boedijn, *1933*).

Apothecia scattered to gregarious, stipitate. Disc deeply concave, white to pale cream, sometimes pale pinkish near the margin; the label of the Solomon Is. specimen draws attention to the presence of a fuscous hue

near the margin of the disc as well as on the marginal area of the receptacle surface which probably is due to an external or alien factor. Receptacle up to 12 mm diam., urceolate to turbinate, seated on a well defined stipe, paler than the disc, pallid white or sometimes tinged pinkish drab towards the margin; margin set with white, erect, scalene triangular and flattened hairs up to 2 mm long by about 0.5 mm at the base and gradually taper towards the pointed apex; in the juvenile state these hairs "partly form a nearly continuous subconical sheath, which closes the apothecium and afterwards splits up into separate hairs" (Boedijn, *1933*). Stipe terete, whitish, 3–15 mm long by 1.5–2 mm diam., smooth. Ectal excipulum thin, 30–50 μ thick, composed of two or three or sometimes more layers of globose, subglobose or rarely polygonal cells 9–20 μ diam. (textura globulosa); on the surface of the ectal excipulum there are numerous globose, thicker walled and sometimes warted cells up to 28 μ diam. which are aggregated with each other to form irregular small conical projections at an irregular interval. At even a wider interval from the surface of the ectal excipulum, especially in the upper half of the receptacle, arise flattened hairs similar in structure to those occupying the margin of the receptacle but mostly shorter; these hairs are made up of bundles of



Figs. 23–25. *Boedijnopeziza insititia*. 23. Habit sketch. 24. Section of ectal, gelatinized layer and medullary excipulum. 25. Ascospores. [From RS(BSIP) 1444].

parallel, septate, unbranched, subhyaline hyphae 4–9 μ diam. but at the bases of these compound hairs the cells may be wider but shorter, up to 14 μ diam. The medullary excipulum consists of two layers: immediately inside the ectal excipulum there is a layer of loosely interwoven, delicate, septate and branched hyphae 0.9–3.6 μ diam. (textura intricata) which is embedded in a distinctive gelatinous matrix; this gelatinous layer is up to 90 μ thick; the inner layer of the medullary excipulum is composed of horizontally running parallel hyphae 1.8–6.3 μ diam. which are septate, typically unbranched and diverge near the margin of the cup. Subhymenium of loosely interwoven septate and branched hyphae 2–2.7 μ diam. Hymenium about 390 μ thick. Asci cylindrical, long base obconical and then abruptly contracted into a narrow hypha-like base, thick walled, 8-spored, 400–450 × 12–15 μ. Ascospores usually obliquely uniseriate, subfusoidal to fusoidal, asymmetrical or distinctly curved, 38.5–47(–52) × × 8.1 to 10 μ, smooth walled, hyaline, containing numerous oil globules. Paraphyses delicate, thread-like, branched and irregularly anastomosed, septate, 1–1.8 μ diam., below occasionally with irregular swellings; their apices more profusely branched, often bearing small furcations. (Fig. 23–25).

HABITAT AND DISTRIBUTION: on dead branch or wood in Bonin Is. (type locality), the Phillippines, Ceylon, Java, Sumatra, Talaud Is. and the Solomon Is.

SPECIMENS EXAMINED

SOLOMON IS. On dead wood on a limestone hill, Sesendok, Ysabel I., 21 September 1965, RS(BSIP) 1444 (comm. E. J. H. Corner).

BONIN IS. On dead wood, 1853–1856, C. Wright 148 [type specimen of *Peziza insititia* Berk. & Curt.].

SARCOSCYPHA (Fr.) Boud.

Peziza [Dill.] St-Amans "div." *Discina* Fr. "ser." *Lachnea* Fr. "trib." *Sarcoscypha* Fr., Syst. mycol. 2: 78. 1822. — *Lachnea* (Fr.) Gill. subgen. *Sarcoscypha* (Fr.) Sacc. *in* Bot. Cbl. 18: 216. 1884 [misapplied, = *Pseudoplectania* Fuckel, p.p.]. — *Sarcoscypha* (Fr.) Boud. *in* Bull. Soc. mycol. Fr. 1: 103. 1885.

Peziza [Dill.] St-Amans ser. *Lachnea* Fr. [subser.] *Scypharia* Quél. *in* Mém. Soc. Emul. Montbéliard II 5: 398. 1873. — *Scypharia* (Quél.) Quél. *in* C.r. Ass. fr. Av. Sci. 14 (2): 451. 1886 [misapplied]; non *Scypharia* Miers *in* Ann. Mag. nat. Hist. III 6: 9. 1860. — *Peziza* [Dill.] St-Amans subgen. *Scypharia* (Quél.) Quél., Enchir. Fung. 281. 1886.

[Misapplied name: *Plectania* Fuckel emend. Seaver, N. Am. Cup Fungi (Operc.) 190. 1928; Kanouse *in* Mycologia 40: 483. 1948; Nannfeldt *in* Svensk bot. Tidskr. 43: 476. 1949; Le Gal, Discom. Madag. 289. 1953 [= *Sarcoscypha* (Fr.) Boud.].

TYPE SPECIES: *Peziza coccinea* (Jacq. ex S. F. Gray) Pers.

Apothecia scattered to gregarious, small to large, sessile or distinctyl stipitate. Disc concave, brightly coloured, scarlet to orange, rarely white. Receptacle saucer shaped to cup shaped, contracted below into either a broad base or a distinct stipe, margin even or crenulate, outer surface whitish, smooth, velvety or finely tomentose. Ectal excipulum thin, either of prosenchymatous hyphal elements which run parallel with surface of receptacle or of pseudoparenchymatous tissue with angular or polygonal and slightly thick walled cells (textura prismatica to textura angularis). Medullary excipulum well developed, of textura intricata, hyphae slender, septate, and infrequently branched. Asci long cylindrical, often distinctly

attenuate below into hypha-like base, 8-spored, thick-walled, pores not blued in Melzer's reagent. Ascospores uniseriate, hyaline, with a few oil globules, ellipsoidal or oblong ellipsoidal to almost subcylindrical, smooth walled, mostly symmetrical. Paraphyses filiform to slender, branched, especially towards the base, septate, hardly enlarged at the straight apices.

HABITAT: on dead sticks or wood close to or half buried in the ground.

The majority of modern authors (Ramsbottom & Balfour–Browne, *1951*; Rosinski, *1953*; Korf, *1953*; Dennis, *1960*; Alexopoulos, *1962*; Denison, *1963*; Moser, *1963*) have correctly applied the generic name *Sarcoscypha* for a group of fungi related to *Sarcoscypha coccinea*, a species which according to Korf (*1953*) should be accepted as the type species of the name *Sarcoscypha* (Fr.) Boud. On the other hand Seaver (*1928*), Kanouse (*1928a*), Nannfeldt (*1949*), Le Gal (*1953*) and more recently Berthet (*1964a*) preferred to use the name *Plectania* for it.

Saccardo (*1884*, *1889*) listed *Scypharia* (Quél.) Quél. as a synonym of *Sarcoscypha*. The nomenclatural status of the former name is uncertain, but because it can be typified by *Sarcoscypha coccinea*, it is also treated here as a synonym of *Sarcoscypha*. Furthermore, Quélet's genus is a later homonym of *Scypharia* Miers. Originally Quélet (*1873*) introduced this name for an infrageneric grouping within the genus *Peziza*, and *Sarcoscypha coccinea* was included there. In 1886 Quélet used *Scypharia* as a generic name when he briefly described the newly transferred species *Scypharia rutilans* (Fr.) Quél. In giving *Scypharia* a generic status, however, Quélet did not refer to his earlier paper and he also failed to describe it. The description of the *Scypharia rutilans* cannot be accepted as a valid descriptio generico-specifica because it is not a description of a new species. For these reasons the generic name *Scypharia* (Quél.) Quél. apparently has not been validly published. Shortly afterwards Quélet (*1886a*) delimited and lowered the status of *Scypharia* to the subgeneric level within the genus *Peziza* and he admitted to it numerous species including *Sarcoscypha coccinea* and *Peziza rutilans*. It must be pointed out, however, that *Peziza* (*Scypharia*) *rutilans* sensu Quélet (*1873*, *1886*) has "spore sphérique ($0^{mm},013$), puis élégamment grênelée" so that it is not conspecific with *Leucoscypha rutilans* (Fr.) Dennis & Rifai (*vide infra*) as this species is generally understood today. *Scypharia rutilans* is the only combination proposed by Quélet (*1873*, *1886*, *1886a*) in the genus *Scypharia*, and all combinations supposedly published by Quélet in "Enchiridion Fungorum" as indicated in the lists of synonyms of various species by Rehm (*1884–1896*) are in fact spurious.

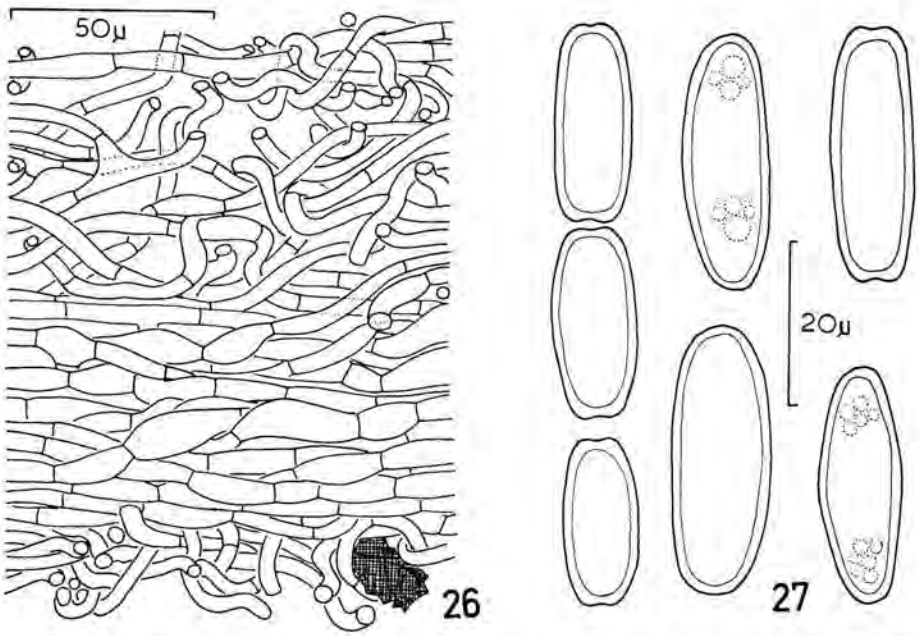
Following Saccardo (*1889*), in the "Handbook of Australian Fungi" Cooke (*1892*) used the name *Sarcoscypha* in a very wide sense to include not only *Sarcoscypha coccinea* but also *Plectania melastoma*, *Cookeina colensoi*, *Aleuria rhenana* and *Geopyxis majalis*. The last two species have operculate asci and belong to a different family; superficially they do sometimes resemble *Sarcoscypha coccinea*.

Kanouse (*1948a*) already discussed the difference between *Sarcoscypha* and the other brightly coloured genera of the Sarcoscyphaceae such as *Microstroma* Bernstein and *Anthopeziza* Wettst. *Sarcoscypha* can be separated from *Cookeina* and *Boedijnopeziza* by its normal ascus development and the ascus base character, as well as by its apothecial construction. *Phillipsia* is closely related to *Sarcoscypha* but the former has a slightly different ectal excipulum and usually striate and asymmetrical ascospores. As has been suggested by Denison (*1963*) further studies in this group of fungi may find it necessary to redefine the generic circumscription of *Sarcoscypha*.

Sarcoscypha coccinea (Jacq. ex S. F. Gray) Lamb.

Peziza coccinea Jacq., Fl. austr. 2: *t. 163.* 1774. — *Macroscyphus coccineus* (Jacq.) *ex* S. F. Gray, Nat. Arrang. Br. Pl. 1: 672. 1821. — *Peziza coccinea* (Jacq. ex. S. F. Gray) Pers., Mycol. eur. 1: 258. 1822; Fr., Syst. mycol. 2: 79. 1822. — *Plectania coccinea* (Jacq. ex S. F. Gray) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 324. 1870. — *Lachnea coccinea* (Jacq. ex S. F. Gray) Gill., Champ. Fr., Discom. 66. 1880. — *Sarcoscypha coccinea* (Jacq. ex S. F. Gray) Lamb., Fl. mycol. Belg., Suppl. 1: 302. 1887. — *Geopyxis coccinea* (Jacq. ex S. F. Gray) Massee, Brit. Fung.-Fl. 4: 377. 1895.
Peziza dudleyi Peck *in* Rep. N.Y. State Mus. 47: 23. 1894 (teste Kanouse, *1948a*).

The two Australasian collections of this species available at Herb. Kew. have subsessile apothecia up to about 25 mm in diam.; usually the apothecia are gregarious, distinctly stipitate or sometimes subsessile and may be up to 40 mm in diam. Disc concave, sometimes rather deeply, bright scarlet. Receptacle cup-shaped to almost infundibuliform, margin somewhat inrolled, attenuate below into either a broad base or a stout stipe; outer surface white, covered by floccose, hyaline, flexuous hair-like hyphae. Ectal excipulum well-defined, about 30–40 μ thick, of compacted hyphae which mostly run parallel with the surface of the receptacle, subhyaline to pale yellowish coloured, 5–10 μ diam., cells 14–40 μ long, wall rather thick, often assuming a pseudoparenchymatous tissue. To the outside these tissues give rise to numerous thinner walled, hyaline, more delicate and intertwined hyphae which cause the receptacle surface to appear tomentose or floccose. Immediately inside the ectal excipular layer there is an indistinct transitional layer of thinner walled and wider, barrel-shaped celled hyphae up to 14 μ diam., from which arise very loosely interwoven, sparingly septate and branched, slender, hyaline hyphae 2.5–5 μ diam. which constitute the well-differentiated and thick medullary excipulum; towards the hymenium these hyphae appear more tightly interwoven and more regularly arranged with more and more hyphae running horizontally. Subhymenium of loosely intertwined fine hyphae. Hymenium about 350 μ thick. Asci long cylindrical, narrower below, wall rather thick, 8-spored, up to 400 μ long by 12–15 μ wide. Ascospores uniseriate, hyaline, smooth walled, containing numerous small oil globules which sometimes aggregate near the ends of the spore, narrowly ellipsoidal or oblong ellipsoidal to subcylindrical, obtuse or truncate at both ends, sometimes even appearing indented in optical section, 20–35(–46) × 10–12.5 μ. Paraphyses thread-like, septate, branched, especially towards the base, about 1.7 μ diam., hardly enlarged towards their apices (Fig. 26–27).



Figs. 26, 27. *Sarcoscypha coccinea*. 26. Section of ectal and part of medullary excipulum. 27. Ascospores. (From the specimen collected on 27 April 1828).

HABITAT AND DISTRIBUTION: on buried or partially buried dead branches in Europe, North America, Madagascar, Pakistan and Australia.

Cooke's (*1892*) record and description of this species was without doubt based on an extra-Australasian collection, because the specimen which he cited (on decaying branches, Tasmania, s. dat., W. Archer, determined by Berkeley as *Peziza coccinea* Jacq.) has been found to be an inoperculate species. Wakefield (*in* Sarasin & Roux, *1920*) described a new variety of *Sarcoscypha coccinea* from Loyalty Islands but this variety has been found to be based on a species of *Phillipsia*. The Tasmanian collection described by Rodway (*1925*) as *Geopyxis coccinea* may represent true *Sarcoscypha coccinea* but I have not been able to study it. The above description has been drawn up largely from a presumed Australian specimen in the Australasian folder of *Sarcoscypha coccinea* in Herb. Kew. and from a Victorian specimen.

According to Le Gal (*1953*) *Sarcoscypha coccinea* has three forms: forma *coccinea* (as forma *typica*) with elongate ascospores 21–52 × 8.5–15 μ and a red coloured hymenium; forma *albida* Klinge with similar ascospores but its hymenium is white; forma *jurana* (Boud.) Le Gal which has a red hymenium but its ascospores are mostly obtuse and measure 21–43 × × 9–15 μ. Rosinski (*1953*) stated that besides the size and shape of the ascospores there was further evidence which would justify the recognition of the first and the last forms as varieties. He found that the ascospore germination of the two taxa was different. In variety *coccinea*, whose

ascospores are mostly ellipsoidal and slightly tapered towards the rounded ends, germination happens by the emergence of only one or at the most two ordinary germ tubes which will grow into branched hyphae. In variety *jurana*, however, one to four short germ tubes are formed, which soon produce small ellipsoidal buds or conidium-like cells. On morphological grounds, the collections described above belong to this variety *jurana*.

SPECIMENS EXAMINED

AUSTRALASIA. On dead branch, near the waterfall, exact locality not stated, 27 April 1828, collector unknown. — Victoria. On log near stream in deep gully, Mt. Drummer jungle, 20 May 1964, G. Crichton (comm. G. Beaton 195; on the label it was stated that the apothecia were pure white when fresh; now they appear pale pink).

PHILLIPSIA Berk.

Phillipsia Berk. *in* J. Linn. Soc. (Bot.) 18: 388. 1881.

TYPE SPECIES: *Peziza domingensis* Berk.

Apothecia small, large to very large, subsessile or stipitate, scattered or gregarious. Disc smooth, flat, shallowly or deeply concave, sometimes umbilicate or even subinfundibuliform, brightly coloured, yellowish or some shade of red. Receptacle cupulate or discoid, centrally or more commonly eccentrically stipitate, much paler than the disc, whitish, minutely downy from the presence of poorly developed hair-like hyphae, margin sometimes undulate, entire or crenate. Ectal excipulum thin, prosenchymatous, hyphae delicate, either compactly interwoven or running parallel with the surface of receptacle. Medullary excipulum well developed, thin to very thick, of loose textura intricata, hyphae slender, hyaline, sparingly septate and branched. Asci long clavate cylindrical, or sometimes rather short, thick-walled, typically 8-spored, apex not blued in Melzer's reagent. Ascospores uniseriate, hyaline, broadly ellipsoidal but mostly unequal sided to subcymbiform, containing one to two large oil drops with several smaller ones, at maturity appearing striate from the presence of delicate, longitudinally arranged bands which do not stain in cotton-blue in lactic acid, sometimes subapiculate. Paraphyses filiform, septate, simple or branched and often anastomosing with each other.

HABITAT: on dead branches or wood.

The genus *Phillipsia* is one of the larger genera of the Sarcoscyphaceae; Le Gal (*1953*) enumerated 13 accepted species but further search for species of this topical genus in poorly explored areas may substantially enlarge this number.

There are two or three recognizable series within the genus *Phillipsia*. The first one is characterized by large apothecia with well developed (up to 8.5 mm thick or more) medullary excipulum; *Phillipsia domingensis* (Berk.) Berk. and *Phillipsia subpurpurea* Berk. & Br. belong here. The second series, for which *Phillipsia minor* (Wakef.) Rifai may be cited as an example, can be recognized by its small apothecia with thin (usually less than 1 mm thick) medullary excipulum; another character which distinguishes this series from the first one is the consistency, because in

general the smaller apothecia tend to have a firmer consistency, especially when dried. Within this series there is a group of species which has shorter asci, which do not have a flexuous, narrow and hypha-like base. This may constitute the third series and *Phillipsia umbilicata* (Penz. & Sacc.) Boedijn can be allocated here. This species is probably remotely related to *Phillipsia tetraspora* (Seaver) Le Gal, which according to Denison (*1963*) may deserve a separate genus together with some of its closely related species. Future monographic studies should decide whether or not the series outlined above will deserve formal taxonomic recognition.

Le Gal (*1953*) provided a key to the species of *Phillipsia* which she had studied.

PHILLIPSIA SUBPURPUREA Berk. & Br.

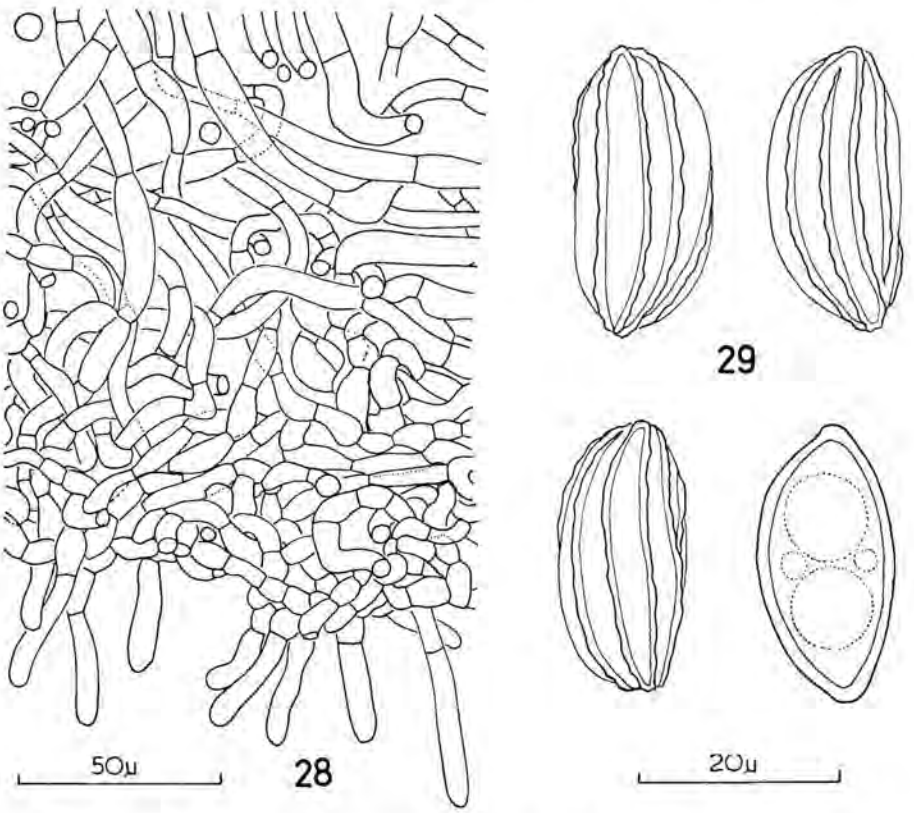
Phillipsia subpurpurea Berk. & Br. *in* Trans. Linn. Soc. Lond. II 2: 69. 1883.

Apothecia scattered, rather large, up to 60 mm diam. according to Massee (*1896*) and Le Gal (*1953*). Disc concave to almost infundibuliform, reddish purple, becoming reddish brown when dried. Receptacle thick, shallowly infundibuliform, contracted below into a short thick central or almost central stalk-like base, consistency firm fleshy, margin even or sometimes undulate, outer surface minutely tomentose, whitish, reddish brown around the margin. Hairs arising from surface of ectal excipulum, numerous, hyaline, 0–2 septate, thin walled, up to 70 μ long by 9 μ wide. Ectal excipulum only about 60 μ thick, pale yellowish, of septate hyphae 2–7.5 μ diam. in a compact textura intricata. Medullary excipulum well developed and up to 8.5 mm thick, of rather loose interwoven hyphae (2–)3.5–9 μ diam., rather sparingly septate and branched, hyaline; the larger hyphae are often strongly constricted at their septa; towards the hymenium these hyphae become smaller in diam. The subhymenium itself is composed of tightly interwoven slender hyphae of only up to 2.7 μ diam. Hymenium 370 μ thick at the centre of the disc. Asci cylindrical, 370–450 × 14.5–17 μ, gently attenuate below into the long flexuous and narrow (only about 3.5 μ wide) hypha-like base, 8-spored, thick walled. Ascospores 25–29.5 × 11.8–13.6 μ, uniseriate, hyaline, mostly with two large oil drops and several smaller ones, at first smooth walled but at maturity ornamented with bands about 1.2 μ wide which run longitudinally from end to end of the spore, 4–6(–7) raised bands appear at any one side; the spores are ellipsoidal or broadly spindle shaped in outline, but from side view they appear subcymbiform because they are strongly unequal sided or almost curved. Paraphyses filiform, 1.8–2.2 μ diam., septate, sometimes branched or anastomosed with each other, gradually increasing in width towards the subcylindrical, lobed or clavate and 2.7–3.6 μ wide apices (Fig. 28–30).

HABITAT AND DISTRIBUTION: on dead wood in Australia (type locality), Madagascar and Japan.

This species only critically differs from *Phillipsia domingensis*. The apothecia of the latter species are slightly smaller and according to Le Gal (*1953*) its ascospores have bands which are fewer (3–6) and finer (0.75 μ wide), and are also slightly smaller in size. Seaver (*1928*) and Boedijn (*1933*) have united the two species.

I have followed Le Gal (*1953*) in accepting Cooke's (or Massee's?) interpretation of this species based on a specimen collected by Lumbolz in Australia one year after the name *Phillipsia subpurpurea* was published. The label of this specimen bears the following annotation: "*Peziza expansa*, Berk. Queensland, Australia. C. Lumbolz, Dec. 1884" [scripsit Cooke] and the specific epithet "expansa", which was probably a manuscript name, was crossed out and "subpurpurea" substituted by Massee. It is not known whether Berkeley had seen this specimen or not. The type or original specimen of *Phillipsia subpurpurea* (on wood close to the ground, Brisbane, F. M. Bailey 167) is not preserved at Herb. Kew.



Figs. 28, 29. *Phillipsia subpurpurea*. 28. Section of ectal and part of medullary excipulum. 29. Ascospores. (From C. Lumbolz).

SPECIMEN STUDIED

AUSTRALIA. Queensland. On dead wood, December 1884, C. Lumbolz.

Phillipsia minor (Wakef.) Rifai, *stat.* & *comb. nov.*

Sarcoscypha coccinea (Jacq. ex Pers.) Lamb. var. *minor* Wakef. *in* Sarasin & Roux, Nov. Caled., Bot. 1 (2): 108. 1920.

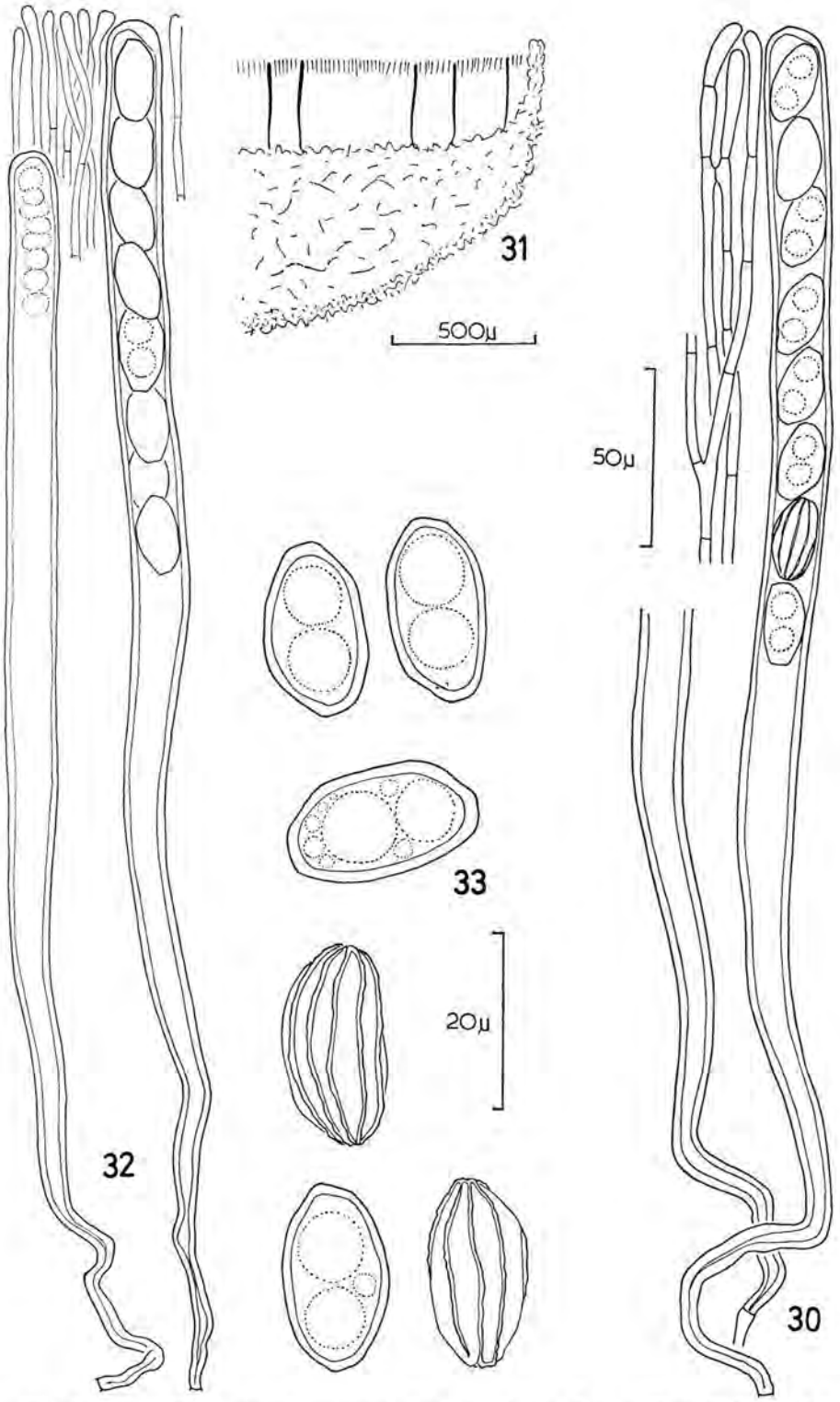


Fig. 30–33. — *Phillipsia subpurpurea*. 30. Asci and paraphyses. (From C. Lumbolz). — *Phillipsia minor*. 31. Diagramatic median section of margin of apothecium. 32. Asci and paraphyses. 33. Ascospores. (From type). — Figs. 30, 32 to same scale.

Apothecia scattered, about 10 mm in diam. Disc concave, depressed in the middle, red coloured according to the label, now appearing buff coloured or dirty brownish yellow. Receptacle cup shaped, contracted below and attached to the substratum by a broad stem-like base, margin entire, outer surface whitish, finely tomentose, wrinkled when dried. Consistency firm fleshy to firm elastic, firmer than that of *Phillipsia subpurpurea*. Hairs on the surface of receptacle numerous, hyaline, rarely septate, up to 50 μ long by 4.5 μ wide, blunt tipped, thin and smooth walled, flexuous or undulate. Ectal excipulum thin, 30–40 μ thick, of interwoven, septate, subhyaline to yellowish hyphae 2–4 μ diam., which mostly run parallel with the surface of the receptacle. Medullary excipulum well-developed, about 800 μ thick, of hyaline, irregularly interwoven (textura intricata), septate and branched hyphae 1.8–6.3 μ diam. Subhymenium distinct, of more tightly intertwined but much narrower (about 2.7 μ diam.) hyphae, interspaced with the bases of asci. Hymenium about 350 μ thick. Asci subcylindrical, gently attenuate below into a long flexuous base, thick-walled, 8-spored, 340–410 μ long by 13.5–15.5 μ diam. at the widest part but only about 2.7–4 μ at the base. Ascospores uniseriate, broad ellipsoidal and unequal sided, or subcymbiform, 20–23.6 $\times$ 9.5–13 μ, hyaline, usually containing two large oil globules and some smaller ones, at first smooth-walled, at maturity becoming striate from the development of longitudinal fine ridges, 3 to 5 of which can be seen at any one side running from end to end of the spore. Paraphyses filiform, septate, occasionally branched and anastomosed below, 1.5–2 μ diam., enlarged to about 3.5 μ at the subcylindrical or clavate blunt apices (Fig. 31–33).

HABITAT AND DISTRIBUTION: on wood in Loyalty Is.

The type specimen of *Sarcoscypha coccinea* var. *minor* consists of one immature apothecium. Its asymmetrical striate ascospores, which contain two large conspicuous oil globules points out its affinity which members of *Phillipsia* rather than those of *Sarcoscypha*.

This species seems to be related to the Malesian *Phillipsia umbilicata* (Penz. & Sacc.) Boedijn. According to Boedijn (*1940a*) the latter species had smooth walled and slightly smaller ascospores; furthermore its asci were only up to 210 μ long and often only slightly attenuated at their base.

SPECIMEN EXAMINED

LOYALTY IS. On dead wood, Kepenee, Lifu, April 1912, Sarasin 210 [type of *Sarcoscypha coccinea* (Jacq. ex Pers.) Lamb. var. *minor* Wakef.].

Phillipsia hartmannii (Phill. apud Cooke) Rifai, *comb. nov.*

Peziza (*Humaria*) *hartmannii* Phill. *apud* Cooke *in* Grevillea **16**: 5. 1887 [ut "*Hartmanni*"]. — *Humaria hartmannii* (Phill. apud Cooke) Sacc., Syll. Fung. **8**: 125. 1889.

? *Phillipsia carnicolor* Le Gal, Discom. Madag. 281. 1953.

Apothecia gregarious, substipitate, up to about 6 mm diam. Disc concave, then expanded, in the original description said to be "pallide coccinea". Receptacle thin, with a rather firm fleshy consistency, cup shaped, supported by a very short and broad stem-like base, almost smooth or minutely downy or tomentose under a hand lens, whitish. Ectal

excipulum up to 40 μ thick (textura intricata), often with a few loose hair-like hyphal apices which project outside the surface of the receptacle. Medullary excipulum of more or less horizontally running hyphae 2.7–8 μ diam. with occasional transverse branching (textura porrecta but sometimes also assuming a textura intricata). Hymenium about 225 μ thick. Asci cylindrical, narrower towards their base, wall thick, 8-spored, 10–14 μ wide. Ascospores uniseriate, asymmetrically ellipsoidal, almost bean shaped or subcymbiform, hyaline, with two large oil globules and several smaller ones, smooth, 17.2–22.7 × 8.5–10.9 μ. Paraphyses slender, sparingly septate, sometimes branched near the base, rarely anastomosing, 1.8–2.5 μ diam., apex straight, up to 3.2 μ diam. (Fig. 34).

HABITAT AND DISTRIBUTION: on dead sticks in Australia but probably pantropical.

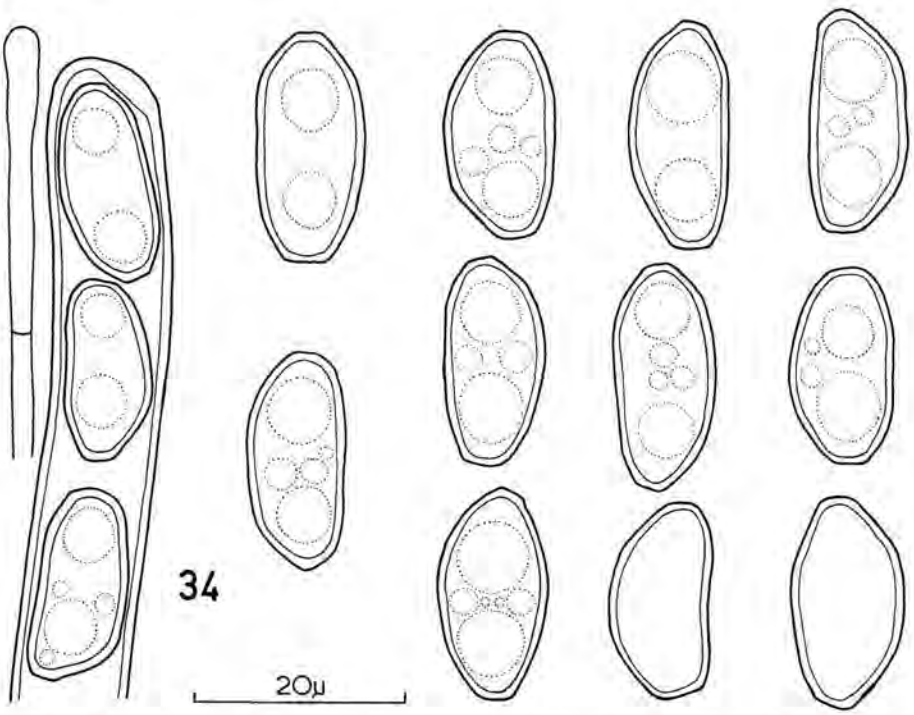


Fig. 34. *Phillipsia hartmannii*. Part of ascus, paraphyses and ascospores (From type).

The type specimen of *Peziza hartmannii* redescribed above is not fully mature but it is very likely that the species described by Le Gal (*1953*) as *Phillipsia carnicolor* Le Gal represents a more fully developed condition of the present species. According to Le Gal, some ascospores of *Phillipsia carnicolor* have very fine striations at complete maturity, which can be demonstrated under an oil immersion lens.

Phillipsia umbilicata mentioned in the discussion of the preceding species is also very similar but seems to differ in its darker coloration (coral red according to Boedijn, *1940a*) and much shorter asci.

SPECIMEN EXAMINED

AUSTRALIA. Queensland. On decayed stick, Condamine River, 1887, C. Hartmann [type specimen of *Peziza hartmannii* Phill. apud Cooke].

Aurophora Rifai, *gen. nov.*

TYPE SPECIES: *Peziza dochmia* Berk. & Curt. apud Berk.

Apothecia gregaria, magna, stipitata vel subsessilia, inaequalia, flabelliformia, auriformia vel rara discoidea. Caro (excipulum medullare) e textura intricata, hyphis septatis, gracilibus, gelatinosis composita. Asci subcylindracei, inferne longe angustati, octospori. Ascospori uniseriati, hyalini, guttulati, leniter curvati, striati. Paraphyses lineares, septatae, ramosae.

Hab. ad lignum putridum.

Apothecia scattered to gregarious, large but relatively thin, firm elastic to subcartilaginous. Disc bright coloured, concave or flattened, smooth. Receptacle fan shaped or auriculate, sometimes shallow cup shaped in which case it is excentrically stipitate, much paler than the disc, often minutely downy, margin entire. Ectal excipulum thin, of textura intricata, hyphae delicate, septate and branched, hyaline. Medullary excipulum well developed, of loose interwoven hyphae, the latter sparingly septate and branched, hyaline, embedded in a gelatinous matrix. Asci cylindrical, long, gently attenuate into the long, narrow, flexuous hypha-like base, wall thick, apex suboperculate, not blued in Melzer's reagent, 8-spored. Ascospores uniseriate, hyaline, subcymbiform, containing one or two large oil globules, ornamented with longitudinal ridges which run from end to end of the spore and unstained with cotton-blue in lactic acid. Paraphyses filiform, septate, occasionally branched or anastomosed at the base, apex subclavate or lobed.

HABITAT: on dead wood or branches.

The gross morphology [2]) of the apothecia and the presence of a gelatinous matrix in the medullary layer distinguish this genus from *Phillipsia*.

Aurophora dochmia (Berk. & Curt. apud Berk.) Rifai, *comb. nov.*

Peziza dochmia Berk. & Curt. *apud* Berk. *in* J. Linn. Soc. (Bot.) **10**: 364. 1868. — *Otidea dochmia* (Berk. & Curt. apud Berk.) Sacc., Syll. Fung. **8**: 95. 1889. — *Phillipsia dochmia* (Berk. & Curt. apud Berk.) Seaver, N. Am. Cup Fungi (Operc.) 184. 1928.

Apothecia scattered, orbicular, triangular, or fan shaped in outline, up to about 35 mm across. Disc shallowly concave or flattened, smooth, deep yellowish brown to reddish brown in dried specimen, becoming yellow or yellowish brown when moistened; colour of fresh specimen unknown. Receptacle fan shaped, spathulate or auriculate, usually attached to the substratum by the rather short, lateral or strongly excentric stem, outer

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[2]) The species of this genus usually have fan-shaped apothecia, hence the name *Aurophora* (from *αὔρα* = wind, and *φορός* = bearing); according to an oriental fairy tale the fan was invented by a poor village youth in his attempt to win the hand of a fair Princess whose riddle was to carry wind on a piece of paper.

surface whitish, smooth or nearly so. Ectal excipulum about 50 μ thick or more, of compacted textura intricata, hyphae hyaline and delicate, 2–5 μ diam., sometimes producing short, hyaline and delicate hair-like projections on the surface of receptacle. Medullary excipulum well developed, about 1000 μ thick and sometimes reaching a thickness of 2.5 mm according to Le Gal (*1953*), of loosely intertwined, hyaline, sparingly septate and branched hyphae 1.8–5.4 μ diam. which sometimes have a relatively thick wall and narrow lumen, embedded in a gelatinous matrix. Subhymenium also of textura intricata but with hyphae much narrower, mostly less than 3 μ diam., and more tightly interwoven. Hymenium about 370 μ thick. Asci cylindrical, long, gradually attenuate below into a narrow flexuous base, thick walled, 360–420 × 13–15 μ, often only about 3.5 μ diam. at the base, 8-spored. Ascospores 22.7–27.3 × 11.8–13.6 μ, uniseriate, hyaline, subcymbiform, often indistinctly apiculate at both ends, containing 1 or 2 large oil globules with several smaller ones, at first smooth walled but ultimately ornamented with longitudinal ridges which run from end to end of the spore, 4–6 (mostly only 5) ridges can be observed at any one side. Paraphyses filiform, 1.5–2.5 μ diam., slightly enlarged to about 3.5 μ diam. at the subclavate or lobed apex, septate, occasionally branched or anastomosed (Fig. 35–38).

HABITAT AND DISTRIBUTION: on dead wood or branches in Cuba (type locality), Madagascar and Australia.

In 1886 Berkeley described three closely related species of *Peziza* from Cuba, namely *Peziza dochmia* Berk. & Curt., *Peziza inaequalis* Berk. & Curt. and *Peziza hirneoloides* Berk. & Curt. The Australian collection described above was included by Berkeley in the last species. Cooke (*1892*) also recorded the last named species from Australia based on collections from Victoria and Queensland which unfortunately cannot be located in Herb. Kew., so that their identity cannot be verified.

The distinction between these three species is very critical and for this reason I have refrained from proposing the transfer of *Peziza inaequalis* and *Peziza hirneoloides* to this new genus until more is known about the characters of every species in fresh condition. As has been pointed out by Massee (*1896*), the colour of fresh apothecia of *Aurophora dochmia* and *Peziza hirneoloides* was not known with certainty. According to Le Gal (*1953*) the hymenium of the latter species was red and not yellowish or yellowish brown as in *Aurophora dochmia*. This may be so and Cooke (*1879*, *1892*) did illustrate the colour of these two species differently but nevertheless this needs confirmation.

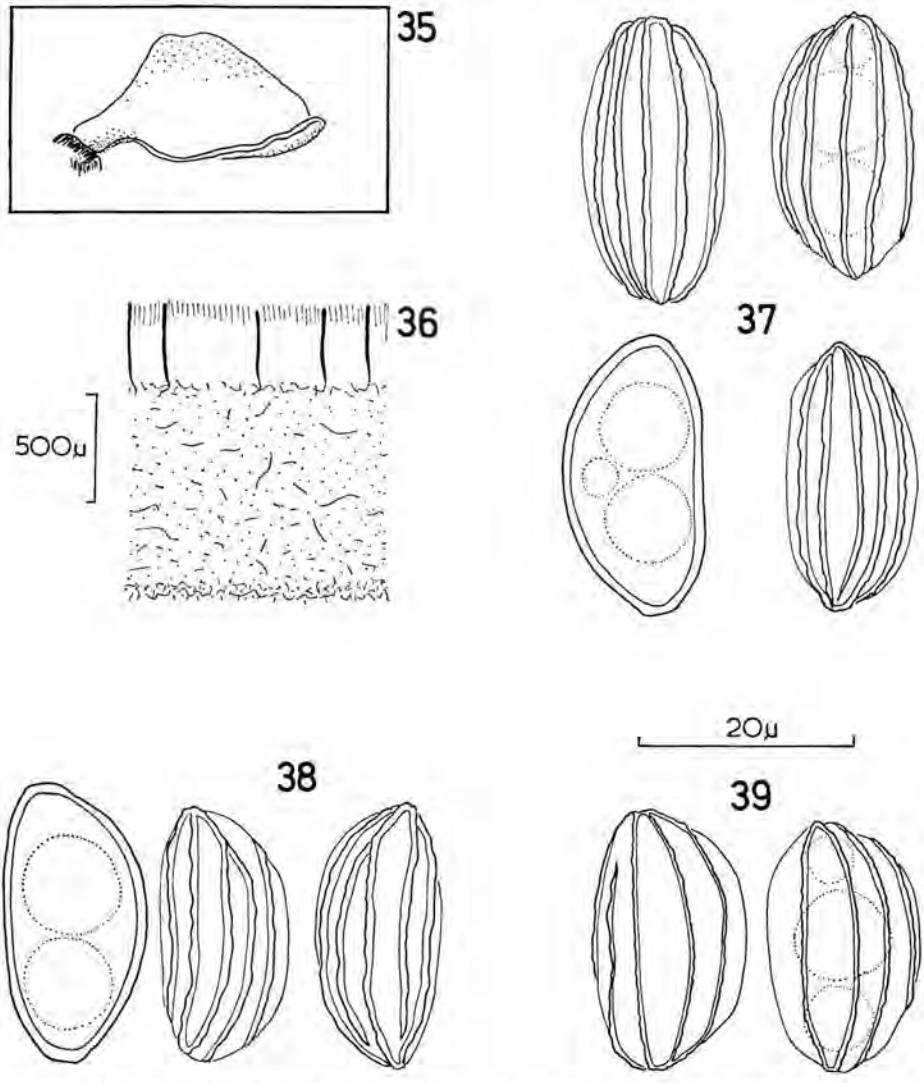
Seaver (*1928*) reduced *Peziza hirneoloides* to the synonymy of the present species but as Le Gal (*1953*) has already suggested this seems to be unjustified, because the former species has ascospores with finer and more widely spaced ridges. An examination of the type specimen of *Peziza hirneoloides* (on dead wood, Cuba, s. dat., C. Wright 236) shows further that this species has shorter but slightly broader ascospores (21.5–26.3 × 12.7–14.5 μ, Fig. 39), so that its length and breadth ratio is slightly smaller than that of *Aurophora dochmia*. Le Gal (*1953*) gave the spore measurement of the latter species as 24–35 × 11–16 μ against

23.5–31.5 × 12.5–16 μ for *Peziza hirneoloides*. For these reasons the Australian specimen which has been referred to the last named species is identified here with *Aurophora dochmia*.

Judging from Le Gal's (*1959*) extensive description, *Phillipsia carmenia* (Pat.) Le Gal is also congeneric with *Aurophora dochmia* and differs from the other species of *Aurophora* by its pigmentation and more cupulate apothecia.

SPECIMENS EXAMINED

AUSTRALIA. New South Wales. On dead wood, Clarence River, s. dat., Dr. Beckler 6.



Figs. 35–39. — *Aurophora dochmia*. 35. Habit sketch. 36. Diagramatic section of excipulum and hymenium. 37. Ascospores. (From Dr. Beckler 6). 38. Ascospores (From type). — *"Peziza" hirneoloides*. 39. Ascorpores (From type).

TROPICAL AMERICA. Cuba. Probably on rotten wood, November C. Wright 662 [type specimen of *Peziza dochmia* Berk. & Curt. apud Berk.].

SUBORDER PEZIZINEAE

The composite sets of characters that distinguish the suborder Pezizineae from the suborder Sarcoscyphineae have been outlined in the analytical key to the Australasian families of the Pezizales presented above (p. 14) and have been discussed in introducing the latter suborder. The scope of the present suborder is identical with that of the family Pezizaceae as conceived by Nannfeldt (*1937*, *1949*) and Korf (*1954*). The latter author divided his family Pezizaceae into eleven tribes, four of which correspond to the families Morchellaceae, Pyronemataceae, Pezizaceae and Ascobolaceae recognized below. From the available cytological evidence (Berthet, *1963*, *1964a*) it appears that Nannfeldt's and Korf's tribes Discineae, Gyromitreae and Acetabuleae (in part)—and possibly also the Rhizineae—should be united in a taxon equal in rank to the Morchellaceae or the Pezizaceae; for this reason they are considered to represent tribes of the Helvellaceae. The Humariaceae, another family of the Pezizineae accepted in the present study, covers Korf's tribes Ciliarieae and Octosporeae. Whether or not Korf's last tribe, the Psilopezieae—which has suboperculate asci and uninucleate ascospores—can also be classified as a member of this large family, or whether or not the scope of the Pezizaceae formulated below will have to be enlarged to cover this tribe as well, or whether or not a new family will have to be created for it is not yet clear to me.

With the exception of the Pyronemataceae and the Thelebolaceae, which have mostly been united and classified as a tribe of the Ascobolaceae, all families discussed above have also been accepted by Le Gal (*1947*, *1953*, *1959*, *1963*), Dennis (*1960*), Moser (*1963*), Gamundi (*1964*) and Berthet (*1964a*). I would like to hasten in pointing out, however, that the families of the Pezizineae treated here are intended for the reception of those genera occurring in Australasia only. There is no doubt that more families will have to be proposed in this suborder to accommodate some extra-Australasian genera such as *Svrcekia* Kubička, *Phaeodropezia* Le Gal, *Ascodesmis* van Tieghem and others whose affinity with the type genera of the existing families seems to be quite remote.

FAMILY MORCHELLACEAE

The most outstanding character of this family can be found in its ascospores. These are ellipsoidal, smooth, usually hyaline when viewed singly under the microscope but are appearing creamy in mass. Mature ascospores do not contain oil globules but during their development their polar regions are crowned with numerous external guttules. According to Berthet (*1963*, *1964a*) the ascospores of the Morchellaceae are invariably plurinucleate. These ascospores are produced by non amyloid asci which

are of the 'aporhynque' type; the asci of *Disciotis* Boud. are different from the other genera of the Morchellaceae in that they belong to the 'pleurorhynque' type. The apothecia of this family are large and vary greatly in shape. Their receptacle may be honeycomb-like (*Morchella*), campanulate (*Verpa*) – in both cases distinctly stipitate – or sometimes pezizoid and substipitate (*Disciotis*).

There are some superficial similarities between members of the present family and those of the Helvellaceae, especially in the possession of well developed stipes. For this reason the two families have often been united (Seaver, *1928*; Bessey, *1950*; Imai, *1954*; Alexopoulos, *1962*; Benedix, *1962*; Batra & Batra, *1963*). The ascospore characters of the two families, however, are very different because the ascospores of the Helvellaceae are always guttulate internally and not externally as in the Morchellaceae. According to Batra & Batra (*1963*) there is a slight difference in their tissue structure, the hyphae of the Morchellaceae being coarser. Furthermore the cytological evidence does not support the notion to merge these two families. Consequently the Morchellaceae and the Helvellaceae are treated here as two distinct families, as has also been done by Le Gal (*1947*, *1953*, *1963*), Dennis (*1960*), Berthet (*1963*, *1964a*) and Gamundi (*1964*).

Since in delimiting the combined families Morchellaceae and Helvellaceae Seaver (*1928*) put undue emphasis on the external or macroscopic appearance and ignored the anatomical and chemical characters, the sparassoid genus *Durandiomyces* Seaver was included here by him. This genus, however, cannot be separated from *Peziza* [Dill.] St-Amans, because it was based only on a form of *Peziza proteana* (Boud.) Seaver (Korf, *1956*). On the other hand Seaver left the genus *Disciotis* out of the present family and classified its type species as a member of the genus *Peziza*. Le Gal (*1953*) has remarked that this disposition is wholly unwarranted because the asci of *Disciotis venosa* (Pers. ex Pers.) Boud. are non-amyloid. The affinity of this species with the other genera of the Morchellaceae has been indubitably settled by Berthet (*1963*, *1964a*) by demonstrating that its ascospores are plurinucleate. The genus *Disciotis* probably should be accommodated in a separate tribe which differs from the tribes Morchelleae and Verpeae by the gross morphology of its apothecia and the ascus character.

The Herb. Kew. collections of the Morchellaceae from Australasia contain only species of the genus *Morchella*. The occurrence of *Disciotis venosa* in Australia was recorded by Cooke (*1892*) but the basis of this record cannot be traced at Herb. Kew., whereas later Australasian specimens forwarded under this name have been found to represent species of *Peziza* [Dill.] St-Amans.

Morchella [Dill.] St-Amans

Morchella Dill., Cat. Pl. Giss. 74. 1719. – *Morchella* [Dill.] St-Amans, Fl. agen. 591. 1821; Fr., Syst. mycol. 2: 6. 1822.

Phalloboletus Mich., Nov. Pl. Gen. 202. 1729. — *Phalloboletus* [Mich.] O. Kuntze, Rev. Gen. Pl. 2: 864. 1891.

Mitrophora Lév. *in* Ann. Sci. nat. (Bot.) III 5: 249. 1846.

Morilla Quél., Enchir. Fung. 270. 1886.

TYPE SPECIES: *Morchella esculenta* (L.) ex St-Amans.

Apothecia scattered to rarely gregarious, erect, distinctly stipitate, morchelloid, namely with modified disc and receptacle. Disc yellowish brown to brown, covering numerous shallow depressions on the surface of the subglobose, ovoid to narrowly conical receptacle which has either no distinct margin or with well developed and free margin; the depressions are separated from one another by anastomosing, sterile or rarely fertile-edged ridges, which are either honeycombed or irregular and concolorous or paler than the disc, or the ridges may run more or less longitudinally in which case their edges are often darker than the disc or even almost black. Stipes hollow, brittle, subcylindrical, sometimes distinctly bulbous at the base, occasionally furrowed, minutely scurfy, yellowish or whitish cream. The tissue between the two hymenial layers of the ridge (the hymenophoral trama) is composed of mostly horizontally running, septate, occasionally branched and rather large celled hyphae. Asci subcylindrical, narrower at the rounded base, 8-spored, pores not blued in Melzer's reagent. Ascospores broad ellipsoidal to oblong ellipsoidal, smooth walled, hyaline to subhyaline when viewed singly but appearing cream coloured in mass, without oil globules but during their development the polar regions are crowned with numerous external oil globules. Paraphyses stout, multiseptate near the base, branched, enlarged at the clavate apices.

HABITAT: on the ground in open woods, lawn, grassland etc.

The number of species that can be recognized in the genus *Morchella* is uncertain and varies from three (Groves & Hoare, *1953*), six (Seaver, *1928*) to thirty two (Boudier, *1907*) depending on how much weight one will give to the macroscopic characters of each collection as taxonomic evidence for discriminating them. Groves & Hoare (*1953*) and Batra & Batra (*1963*) have doubted the validity of species accepted by Seaver (*1928*) because they found that rather extensive field observations and abundant collections revealed the existence of intermediate or growth forms which makes Seaver's key to the species unworkable. Several recent authors (Dennis, *1960*; Bresinsky & Stangl, *1962*) have also arrived at the conclusion that this genus contains only three species.

It must be pointed out, however, that the possibility of this genus having numerous "micro-species" cannot be ruled out. Moser (*1951*), for example, stated that there was a minor but fundamental microscopic character which can be used in separating *Morchella semilibera* DC. ex Fr. and *Morchella rimosipes* DC. ex Fr. Unfortunately no comparative cultural studies have been undertaken except for the physiological studies published recently by Gilbert (*1961*). He pointed out that there were minor cultural characters which distinguished *Morchella crassipes* (Vent.) ex Fr. from *Morchella esculenta*. This latter approach may in the future offer some additional characters for taxonomic purposes.

It seems that with the present knowledge of the variability of the species or *Morchella*, the "species aggregate" concept is recommendable here. Three quite well defined species aggregates are accepted, which are in agreement with those recognized by Groves & Hoare (*1953*), Dennis (*1960*), Bresinsky & Stangl (*1962*), Batra & Batra (*1963*) and Moser (*1963*). The first species aggregate is characterised by its more or less longitudinal and dark coloured or almost black ridges with much paler and less prominent transverse ridges. The second species aggregate can be recognized by its irregular, reticulating or honeycombed, rather light coloured ribs. The third species aggregate has a half free margin and according to Boudier (*1907*) it is related to the first one. The first two species aggregates roughly correspond to the whole of Boudier's sections *Distantes* and *Adnatae* respectively, whereas the last one has often been accommodated in a separate genus *Mitrophora* Lév. (Boudier, *1907*; Le Gal, *1947*; Dennis, *1960*; Moser, *1963*).

The difference between *Morchella* and *Mitrophora* lies in the margin of their apothecia. Corner (*1930*) has pointed out that comparison between the campanulate apothecia of the genus *Verpa* Swartz ex Pers. with those of *Morchella semilibera* – which is the type species of the genus *Mitrophora* – shows that in the latter there is a reduced marginal growth. An extreme reduction of this growth can be observed in Boudier's (*1907*) section *Distantes* of the genus *Morchella* i.e. *Morchella elata* Fr., whereas in the type species of the genus *Morchella* itself no marginal growth takes place. It is evident that there is a continuous series of the reduction of marginal growth and for this reason *Morchella semilibera* is not considered to be generically distinct from *Morchella esculenta*. Since generally the former species has a narrower receptacle, however, it is proposed to treat *Mitrophora* as a subgenus of *Morchella*. Saccardo (*1889*), Seaver (*1928*), Imai (*1932, 1954*), Moser (*1951*), Groves & Hoare (*1953*) and Bresinsky & Stangl (*1962*) have also merged *Mitrophora* into *Morchella*.

In their treatments of the genus *Morchella* several infra-specific taxa were recognized by Bresinsky & Stangl (*1962*) and Moser (*1963*). Since an infra-specific taxon of a *Morchella* species may represent a micro-species – a fact admitted in the species aggregate concept – the classification proposed by these authors is not adopted here. For a similar reason no list of synonyms is given, except for the nomenclatural ones. Groves & Hoare (*1953*) have indicated how the species illustrated and accepted by Boudier (*1906, 1907*) should be allocated in a system which recognizes only three species.

About twenty five collections of *Morchella* from Australasian region are preserved at Herb. Kew. Most of these were labelled *Morchella conica* and are considered to belong to the *Morchella elata* aggregate. With the exception of the microscopic details, the excellent descriptions given by Groves & Hoare (*1953*) are reproduced here; the microscopic details are derived from the selected Australian specimens listed.

Subgenus Morchella

TYPE SPECIES: *Morchella esculenta* (L.) ex St-Amans.

MORCHELLA ELATA Fr. aggr.

Morchella elata Fr., Syst. mycol. 2: 8. 1822. — *Morilla elata* (Fr.) Quél., Enchir. Fung. 271. 1886. — *Phalloboletus elatus* (Fr.) O. Kuntze, Rev. Gen. Pl. 2: 865. 1891. — *Morchella conica* Pers. *ex* Pers. var. *elata* (Fr.) P. Henn. *in* Verh. bot. Ver. Brandenb. 36: 67. 1895.

Groves & Hoare (*1953*), who called this species *Morchella angusticeps* Peck, described its apothecia as ". . . about 4.5–10 cm. in height with the cap more or less elongated to narrowly conic, occasionally nearly ovoid, usually about 2–6 cm. in length and 1–3 cm. broad at the base, with the ribs more or less longitudinally arranged and 0.5–1.5 mm. in thickness, irregularly anastomosing or connected with cross ribs; the pits vertically elongated, 1–35 mm. long and 1–5 or occasionally up to 11 mm. wide, yellowish or yellowish brown within, becoming smoky brown to black at the margins and on the edges of the ribs; the stipe is white to yellowish, usually about 2–4 cm. long and 1–2 cm. broad, hollow, cylindric or sometimes broader below, often somewhat furrowed at the base, the surface strongly floccose-mealy . . .". In transverse sections of longitudinal ribs it can be seen that the tissue between the two hymenial layers is about 250 μ thick and composed of hyphae which more or less run horizontally and parallel with the surface of hymenium; the cells of these hyphae are mostly barrel shaped, sometimes much inflated or almost subglobose, up to 40 μ long by 4–20 μ diam.; towards the wider and sterile edge of the ribs these cells become more and more isodiametric, which makes the tissue often appear almost pseudoparenchymatous. Subhymenium about 35 μ thick, of smaller celled tissue, interspaced with delicate hyphae which take stain more deeply. Hymenium about 300 μ thick. Asci subcylindrical, narrower at the base, rounded below, 275–360 × × 18–25 μ, 8-spored. Ascospores uniseriate, hyaline to pale yellowish when viewed singly but appearing cream coloured in mass, smooth walled, oblong ellipsoidal, (18–)20–24.5(–27.3) × 12.7–15.5 μ, without oil guttules but with numerous external small oil globules around each pole. Paraphyses stout, septate, especially towards the base, about as long as the asci, branched below, 6–8 μ diam., apex enlarged and subclavate or irregularly lobed, 12 μ diam. On the edge of the ribs the hymenium is replaced by a palisade of modified paraphyses which differ from ordinary paraphyses in that they are shorter, their cells shorter but wider, their apices often distinctly capitate, sometimes mammillate and up to 35 μ diam., containing dark brown sap which makes the rib to appear almost black (Fig. 40–43).

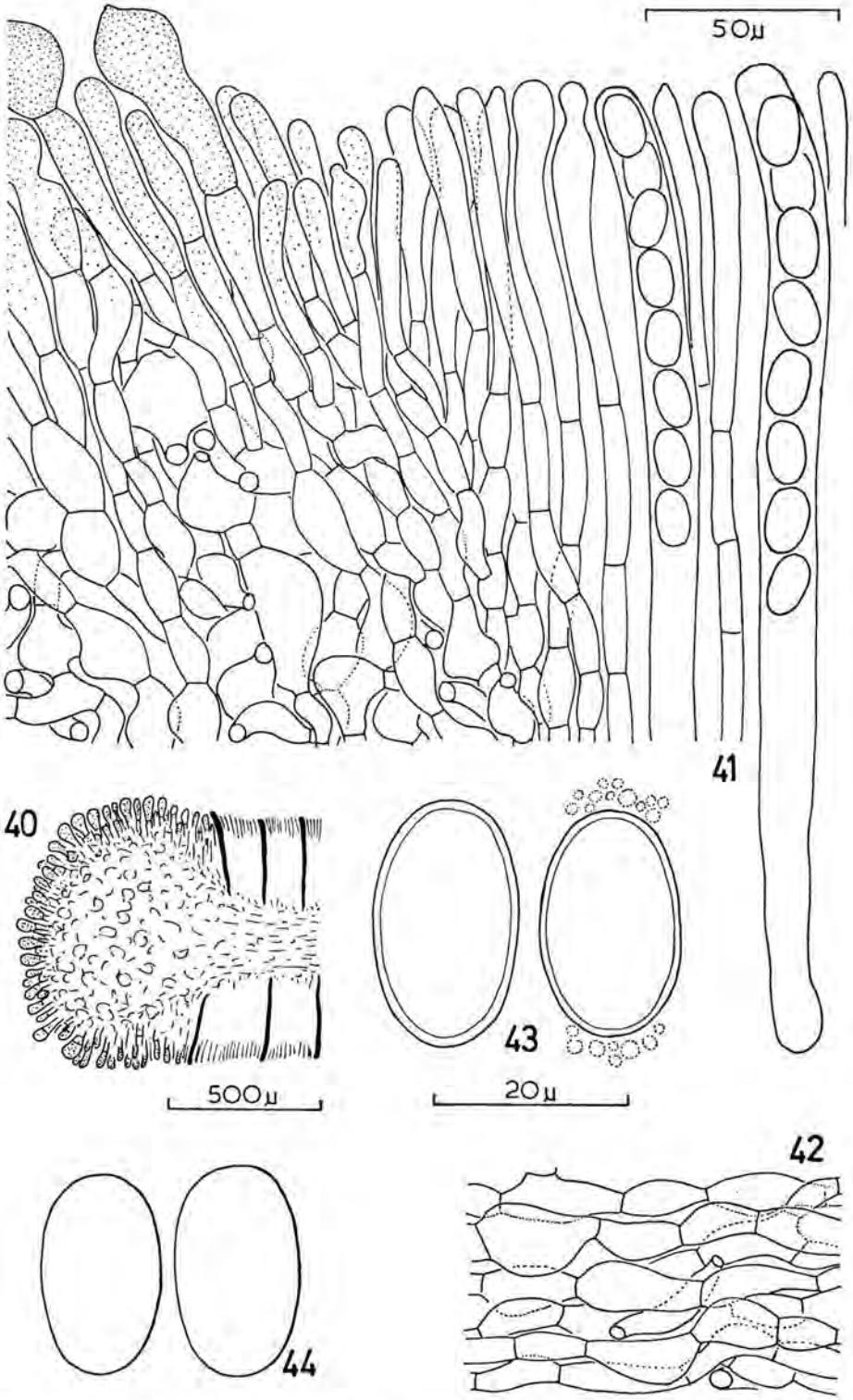
HABITAT AND DISTRIBUTION: on the ground in open woods, cosmopolitan but rarer in warmer areas.

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On the ground, Wangaratta, September 1955, M. R. Ferris.

MORCHELLA ESCULENTA (L.) ex St-Amans aggr.

Phallus esculentus L., Sp. Pl. 1: 1178. 1753. — *Helvella esculenta* (L.) Sow., Col. Fig. Engl. Fung. 1: *t. 52*. 1797; non *Helvella esculenta* Pers., Comm. Schaeff. Fung.



Figs. 40–44. — *Morchella elata*. 40. Diagramatic section of hymenophoral trama, hymenium and sterile rib. 41. Details of asci, paraphyses and part of the rib. 42. Details of hymenophoral trama. 43. Ascospores (From M. R. Ferris). — *Morchella esculenta*. 44. Ascospores (From C. T. White).

Bav. 64. 1800 [= *Gyromitra esculenta* (Pers. ex Fr.) Fr.]. — *Morchella esculenta* (L.) Pers., Syn. meth. Fung. 618. 1801. — *Morchella esculenta* (L.) *ex* St-Amans, Fl. agen. 591. 1821; Fr., Syst. mycol. 2: 6. 1822. — *Morilla esculenta* (L. ex St-Amans) Quél., Enchir. Fung. 271. 1886. — *Phalloboletus esculentus* (L. ex St-Amans) O. Kuntze, Rev. Gen. Pl. 2: 865. 1891.

According to Groves & Hoare (*1953*) the apothecia of *Morchella esculenta* are ". . . varying in height from 5–20 cm. tall or even taller, and the cap more or less ovoid to subglobose, or elongated to conic, usually about 2.5–10 cm. long and 1.5–6 cm. broad. The ribs are usually irregularly rather than longitudinally arranged and anastomose to form slightly elongated to isodiametric pits, giving rise to spong-like appearance. The pits are at first greyish within, with paler to nearly white ribs, then become more open and yellowish-brown with the ribs thinner and concolorous, finally broad and shallow with the ribs becoming very thin and lacerated. The stipe is white to cream or yellowish, hollow, at first cylindric usually about 2.5–10 cm. in length and 1–2 cm. in diameter, in age becoming more or less compressed and lacunose, and greatly thickened, up to 6 cm. in diameter at the base, surface glabrous to slightly floccose-mealy . . .". The tissue between the two hymenial layers of the ribs is composed of mostly large, 5–16 μ diam. septate hyphae, often slightly constricted at the septa, which run horizontally and parallel with the surface of hymenium. Hymenium about 275 μ thick. Asci subcylindrical, slightly narrower towards the rounded base, 250–325 × 16–21 μ, 8-spored. Ascospores 18.5–23.5 × 11–13.6 μ, uniseriate, ellipsoidal to oblong ellipsoidal, subhyaline when examined singly under the microscope but appearing cream coloured in mass, smooth walled, without oil globules but the polar regions are covered by external small oil globules. Paraphyses stout, 7–10 μ diam., many times septate towards their base, sometimes branched below, apex subclavate, up to 14 μ diam., about as long as the asci. The sterile edge of the ribs is covered by a palisade layer of large, modified paraphyses with large clavate terminal cells up to 25 μ diam. or more (Fig. 44).

HABITAT AND DISTRIBUTION: on the ground in wood, grassland etc., cosmopolitan but in tropics confined only to higher altitudes.

SPECIMEN EXAMINED

AUSTRALIA. Queensland. On the ground, Brisbane River, 5 July 1914, C. T. White.

Subgenus Mitrophora (Lév.) Sacc.

Mitrophora Lév. *in* Ann. Sci. nat. (Bot.) III 5: 249. 1846. — *Morchella* [Dill.] St-Amans subgen. *Mitrophora* (Lév.) Sacc. *in* Bot. Cbl. 18: 213. 1884. — *Morchella* [Dill.] St-Amans sect. *Mitrophora* (Lév.) Imai *in* Bot. Mag., Tokyo 46: 174. 1932. *Morchella* [Dill.] St-Amans sect. *Pileatae* Cooke, Mycograph. 1: 247. 1879 (pro parte).

TYPE SPECIES: *Morchella semilibera* DC. ex Fr.

Differs from subgenus *Morchella* in having a smaller receptacle with its lower half free from the stalk.

MORCHELLA SEMILIBERA DC. ex Fr. aggr.

Morchella semilibera DC., Fl. fr. 2: 212. 1815. — *Morchella semilibera* DC. *ex* Fr., Syst. mycol. 2: 10. 1822. — *Mitrophora semilibera* (DC. ex Fr.) Lév. *in* Ann. Sci. nat. (Bot.) III 5: 250. 1846. — *Morilla semilibera* (DC ex Fr.) Quél., Enchir. Fung. 271. 1886.

The Australasian specimens in Herb. Kew. identified by Berkeley and Cooke as *Morchella hybrida* (Sow.) ex S. F. Gray or *Morchella semilibera* and later recorded by Cooke (*1892*) as *Morchella semilibera* have been found to be misdeterminations. Consequently, until a collection of true *Morchella semilibera* is made in Australia this species has to be excluded from the list of fungi of this region.

This species can be easily recognized by its small receptacle which has a half free margin. Seaver (*1928*) and Dennis (*1960*) have given good illustrated descriptions of this species. Seaver (*1928*) called it *Morchella hybrida* but this name is untenable because it was not accepted by Fries (*1822*).

FAMILY HELVELLACEAE

The scope of the family Helvellaceae has been rather confused because it has been subjected to various emendations and interpretations. As has been hinted above, on cytological grounds the inclusion of the Morchellaceae here and the exclusion of the cupulate or sessile genera of the present family are unwarranted. Since the ascospores of *Discina* (Fr.) Fr., *Rhizina* Fr. ex Fr. and *Neogyromitra* Imai (=*Gyromitra* Fr. sensu Boud.) are apiculate or ornamented, Le Gal (*1947*) classified these genera in the Pezizaceae. This disposition is likewise unjustified, because these genera have not many characters in common with the type genus of the latter family. Berthet (*1964a*) has pointed out that it would be logical to accommodate these genera in the same family together with *Helvella* L. ex St-Amans (including its numerous segregates), *Wynnella* Boud. and *Gyromitra* Fr. (=*Physomitra* Boud.), because they always have tetranucleate ascospores. It appears that this unique ascospore character is associated with other features of taxonomic significance such as the habit, habitat and pigmentation of the apothecia, the guttulation of the ascospores and the internal structure of the receptacle, and for this reason Berthet's (*1964*) circumscription of the Helvellaceae has been followed by Dissing (*1966*) and is also accepted here. Nannfeldt (*1937*) and Dennis (*1960*) also included the genus *Pustularia* Fuckel emend. Boud. in the present family which on account of its uninucleate ascospores should be excluded and referred to the Humariaceae.

Three genera are now known to occur in Australasia but only two of these will be described below.

Helvella L. ex St-Amans emend. Nannf.

Elvela L., Sp. Pl. 2: 1180. 1753; Gen. Pl., Ed. 5, 493. 1754. — *Helvella* L., Sp. Pl., Ed. 2, 2: 1649. 1763. — *Helvella* L. *ex* St-Amans, Fl. agen. 537. 1821; Fr., Syst. mycol. 2: 15. 1822, emend. Nannf. *in* Svensk bot. Tidskr. 31: 54. 1937.

(*Peziza* [Dill.] L. [stirp sec.] *Pezizae pedicellate* Nees [fam. tert.] *Macroscyphi* Nees, Syst. Pilze Schwamme, Ueberbl. 70. 1817. —) *Macroscyphus* S. F. Gray, Nat. Arrang. Br. Pl. 1: 671. 1821 [ut *Macroscyphus* Esenb.].

Acetabula Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 330. 1870; non *Acetabulum* [Tourn.] Ludwig, Def. Gen. Pl. (ed. Boehmer) 504. 1760 (Algae). — *Peziza* [Dill.] St-Amans subgen. *Acetabula* (Fuckel) Sacc. *in* Bot. Cbl. 18: 215. 1884. → *Paxina* O. Kuntze.

Macropodia Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 331. 1870; non *Macropodia* R. Br. apud Ait., Hort. kew., ed. 2, 4: 108. 1812 (Angiosperm). → *Fuckelina* O. Kuntze.

Leptopodia Boud. *in* Bull. Soc. mycol. Fr. 1: 99. 1885. — *Helvella* L. ex St-Amans subgen. *Leptopodia* (Boud.) Imai *in* Sci. Rep. Yokohama natn. Univ. (II) 3: 21. 1954.

Fuckelina O. Kuntze, Rev. Gen. Pl. 2: 852. 1891 (a name change); non *Fuckelina* Sacc. *in* Nuovo G. bot. ital. 7: 326. 1875 (Hyphomycetes).

Paxina O. Kuntze, Rev. Gen. Pl. 2: 864. 1891 (a name change). → *Phleboscyphus* Clem.

Phleboscyphus Clem. *in* Bull. Torrey bot. Cl. 30: 93. 1903 (a name change).

Cyathipodia Boud., Hist. Class. Discom. Eur. 39. 1907.

Tubipeda Falck *in* Mycol. Unters. Ber. 1: 377. 1916.

Costapeda Falck *in* Mycol. Unters. Ber. 1: 377. 1916.

Globipila Beauseigneur, Contr. Etud. Fl. mycol. Landes 204. 1926.

LECTOTYPE SPECIES: *Helvella mitra* L. = *Helvella crispa* Scop. ex Fr. (*vide* Dissing, *1966*).

The following generic description is slightly modified and adapted from Nannfeldt (*1937*): Apothecia scattered to gregarious, medium sized to large, fleshy, usually brittle and fragile, rarely slightly leathery, subsessile to distinctly stipitate. Disc variable in shape depending on the type of the receptacle, yellowish white, grey, brownish grey, bistre, olivaceous brown, brownish or greyish black, rarely almost black. Receptacle either permanently cup shaped, sometimes compressed from two sides, or initially cup shaped and sooner or later becoming saddle shaped or mitrate, with the lobes often crisped and irregularly wavy and very rarely more or less attached to the stipe. Stipe usually elongate, sometimes short or almost lacking, either stout and strongly ribbed by often anastomosing ribs which may continue and branch on the undersurface of the receptacle, or slender and round or compressed with even or grooved or slightly veined surface or sometimes strongly ribbed, or more rarely stout, cylindrical and almost even. Stipe and undersurface of receptacle mostly much paler than the receptacle, almost smooth, sometimes velvety, furfuraceous, villose or scurfy. Ectal excipulum palisade-like or pseudoparenchymatous, made up of large angular or polygonal elongated or isodiametric light coloured to hyaline cells, usually arranged with their long axes at right angles to the surface of receptacle (textura prismatica or textura angularis), towards the surface often giving rise to clavate, cylindrical or moniliform chains of cells which often aggregate to form distinct warts or loose conical pustules of compound hair-like hyphae. Medullary excipulum of densely interwoven, slender, sparingly septate and branched hyphae (textura intricata), rarely interspaced with inflated cells, sometimes running in horizontal direction, especially those near the hymenium. Asci cylindrical, slightly narrower towards the base, 8-spored, apex not blued in Melzer's reagent. Ascospores uniseriate, ellipsoidal or oblong ellipsoidal, rarely subfusoidal, with one large central oil globule and a few smaller ones, hyaline, when fully mature tetranucleate, wall smooth or in some species may appear verrucose when young from the presence of large warts which are hydrolysed and disappear at maturity, or rarely covered by minute

crowded warts. Paraphyses slender to stout, sparingly septate, apex enlarged, straight, hyaline, brown or fuliginous.

HABITAT: on the ground, mostly in woods.

In 1937 it was pointed out by Nannfeldt that the segregation of several smaller genera from the genus *Helvella* as proposed by Boudier (*1885, 1907*) was difficult to maintain because the characters used in distinguishing them – the shape of the receptacle, the type and absence or presence of the stipe – were not of important taxonomic value at the generic level. It is true that when the type species of the genera *Helvella* (stout, ribbed or sulcate stipe and saddle shaped receptacle), *Leptopodia* Boud. (slender and terete stipe and also with saddle shaped apothecia), *Cyathipodia* Boud. and *Macropodia* Fuckel (leptopodioid stipe supporting permanently cup shaped receptacle) and *Paxina* O. Kuntze (almost sessile or with a stout, short and ribbed stipe and cupulate receptacle) are compared there appear to be marked differences between them. When a long series of species is studied, however, it becomes clear that many of these exhibit intermediate or overlapping characters which makes it impossible to classify them with a fair degree of certainty. Little by little the marked distinctions between these four type species are broken down so that the most logical course is to accommodate them in one genus. Since the apothecial construction and the other microscopic characters fail to vary with the macroscopic features of these species, Nannfeldt's (*1937*) contention that in this complex of species a wider generic concept should be adopted seems to be fully warranted and is accepted here. Batra & Batra (*1963*) and Dissing (*1964, 1966*) have also found this wide generic concept to be the most natural arrangement for this group of fungi. As Berthet (*1964a*) has stated, the classification of the helvelloid species proposed by Boudier (*1907*) has been adopted by him and other authors largely for convenience and also because of the traditional usage.

The segregation of the genus *Macropodia* Fuckel from *Helvella* based on the difference of their ascospore characters has been upheld by some authors (Batra & Batra, *1963*; Berthet, *1964a*; Raitviir, in herb.) As is well known the ascospores of *Peziza macropus* (Pers. ex S. F. Gray) Pers., which is the type species of *Macropodia*, are fusoidal and contain 1–3 large oil globules. When stained with cotton-blue in lactic acid and then gently heated it can be seen that at maturity the walls of these fusoidal ascospores are covered by numerous minute crowded warts, but unlike the large warts present on young ascospores of some species of *Helvella* they appear to be not subsequently hydrolysed. The peculiar ascospore characters of *Peziza macropus* have induced Le Gal (*1963*) to exclude this species from *Helvella* and she has suggested that it should be transferred to the humariaceous genus *Jafnea* Korf (*vide infra*). However, the structure of the stipe and the other microscopic characters of *Peziza macropus* are abundantly different from those of the type species of *Jafnea* and in fact show a stronger and unquestionable affinity with the other species

of *Helvella*. For this reason I have tentatively followed Nannfeldt (*1937*) in classifying *Peziza macropus* as a species of the present genus. In my opinion the specific delimitation of *Helvella macropus* (Pers. ex S. F. Gray) P. Karst. as conceived by Dissing & Nannfeldt (*1966*) is too wide or probably this species should be divided into several infraspecific taxa.

It must be noted that those authors who prefer to accommodate *Helvella macropus* in a separate genus cannot justifiably use the generic name *Macropodia* Fuckel (*1870*) for this interesting fungus species because it is a later homonym of *Macropodia* R. Br. apud Ait., a genus of flowering plants. Consequently the generic name *Fuckelina* O. Kuntze was proposed to replace it by Kuntze (*1891*), but likewise this new name is untenable because there was already *Fuckelina* Sacc., which is now commonly considered a synonym of the hyphomycete genus *Stachybotrys* Corda. Nevertheless there is no need to introduce a new generic name to replace *Macropodia* Fuckel and *Fuckelina* O. Kuntze, because it seems that the genus *Macroscyphus* S. F. Gray can be typified with *Peziza macropus*. As in the case of *Peziza* S. F. Gray (q.v., =*Cheilymenia* Boud.) and *Scodellina* S. F. Gray (= *Peziza* [Dill.] St-Amans), Gray (*1821*) attributed this name to the author of its protonym and he revalidated it as "*Macroscyphus* Esenb." The protonym of *Macroscyphus* appears to be Nees von Esenbeck's (*1817*) [genus] *Peziza* [stirps secunda] *Pezizae pedicellate* [familia tertia] *Macroscyphi*, which Nees never used as a generic name. Two out of four or five species included in this infrageneric grouping by Nees (*1817*) were accepted by Gray (*1821*) as species of *Macroscyphus*, namely *Macroscyphus coccineus* (Jacq.) ex S. F. Gray and *Macroscyphus macropus* (Pers.) ex S. F. Gray. Since the former species has been currently accepted as the type species of the genus *Sarcoscypha* (Fr.) Boud. (*vide supra*), and because Gray's genus has not been effectively typified before, it is proposed here to designate *Macroscyphus macropus* (Pers.) ex S. F. Gray as the lectotype species of the generic name *Macroscyphus* S. F. Gray.

Cooke (*1892*) reported the occurrence of *Helvella monachella* (Scop.) ex Fr. in Tasmania but it appears that this record has been based on a collection of *Gyromitra tasmanica* (Berk.) ex Berk. & Cooke apud Cooke. This is not described further here but an account of this interesting species has been published recently by Raitviir (*1965*).

Helvella villosa (Hedw. ex O. Kuntze) Dissing & Nannf.

Octospore villosa Hedw., Descr. Musc. frond. 2: 54. 1789. — *Fuckelina villosa* (Hedw.) *ex* O. Kuntze, Rev. Gen. Pl. 2: 851. 1891. — *Cyathipodia villosa* (Hedw. ex O. Kuntze) Boud., Icon. Fung. 2: *t. 240*. 1906; Hist. Class. Discom. Eur. 39. 1907. — *Helvella villosa* (Hedw. ex O. Kuntze) Dissing & Nannf. *in* Svensk bot. Tidskr. 60: 330. 1966; non *Elvela villosa* Schaeff., Icon. Fung. 4: 114. 1774, nec *Helvella villosa* Relh., Fl. cantab. 463. 1785 (= Basidiomycetes).

Macropodia minor Vel., Mon. Discom. Boh. 1: 342. 1934 (teste Dissing & Nannfeldt, *1966*).

Macropodia chinensis Vel., Novit. mycol. 200. 1939 (teste Dissing & Nannfeldt, *1966*).

Helvella vacini Vel., Novit. mycol. noviss. 156. 1947 (teste Dissing & Nannfeldt, *1966*).

Apothecia leptopodioid or cyathipodiod, scattered (but typically gregarious according to Dissing & Nannfeldt, *1966*). Disc dark grey brown, smooth. Receptacle up to 25 mm diam., shallow cup shaped to saucer shaped or sometimes with deflexed margin and hence may appear saddle shaped, contracted below into a distinct, slender, terete or subcylindrical, solid stalk up to 50 mm long by 3.5 mm diam.; the outer surface of the receptacle and the upper half of the stalk are distinctly villose (pubescent) from the presence of coarse and often aggregated hair-like hyphal projections, greyish brown or sometimes becoming pale olivaceous in dried specimen, without folds or ribs. Ectal excipulum proper about 80–110 μ thick, composed of a palisade-like layer made up of rows of subcylindrical or barrel shaped cells 20–40 × (8–)12–28 μ, often assuming a textura angularis tissue; at irregular intervals some of the cells of this palisade layer will continue to grow and form cells up to 60(–100) μ long by 20 μ diam. which often aggregated with each other to form narrow, conical, rather loose tufts of hyphae up to 250 μ long which cause the receptacle to appear villose. Medullary excipulum well developed, of textura intricata, hyphae tightly interwoven, sparingly septate and branched, 4–9 μ diam., occasionally lobed, sometimes with a few inflated cells up to 16 μ diam. Subhymenium of shorter and slightly wider celled hyphae 6–10 μ diam. Hymenium about 270 μ thick. Asci long cylindrical, distinctly narrower at the base, 8-spored, 275–360 × 14–17 μ. Ascospores uniseriate, hyaline, with one large oil globule and a few smaller ones, short oblong ellipsoidal, smooth but when young often covered by large warts, 17–19.5 × 11–12.7 μ. Paraphyses slender, 2–4 μ diam. below, distinctly enlarged to 6–10 μ diam. at the subclavate, clavate or lobed apices, septate, occasionally branched at the base, as long as or slightly longer than the asci (Figs. 45–48).

HABITAT AND DISTRIBUTION: on the ground in Europe, Siberia, China, West Pakistan, North America and Australia (Dissing, *1966*).

In proposing the combination *Helvella villosa*, Dissing & Nannfeldt (*1966*) have commented on the identity of the Australian specimen described above.

SPECIMEN EXAMINED

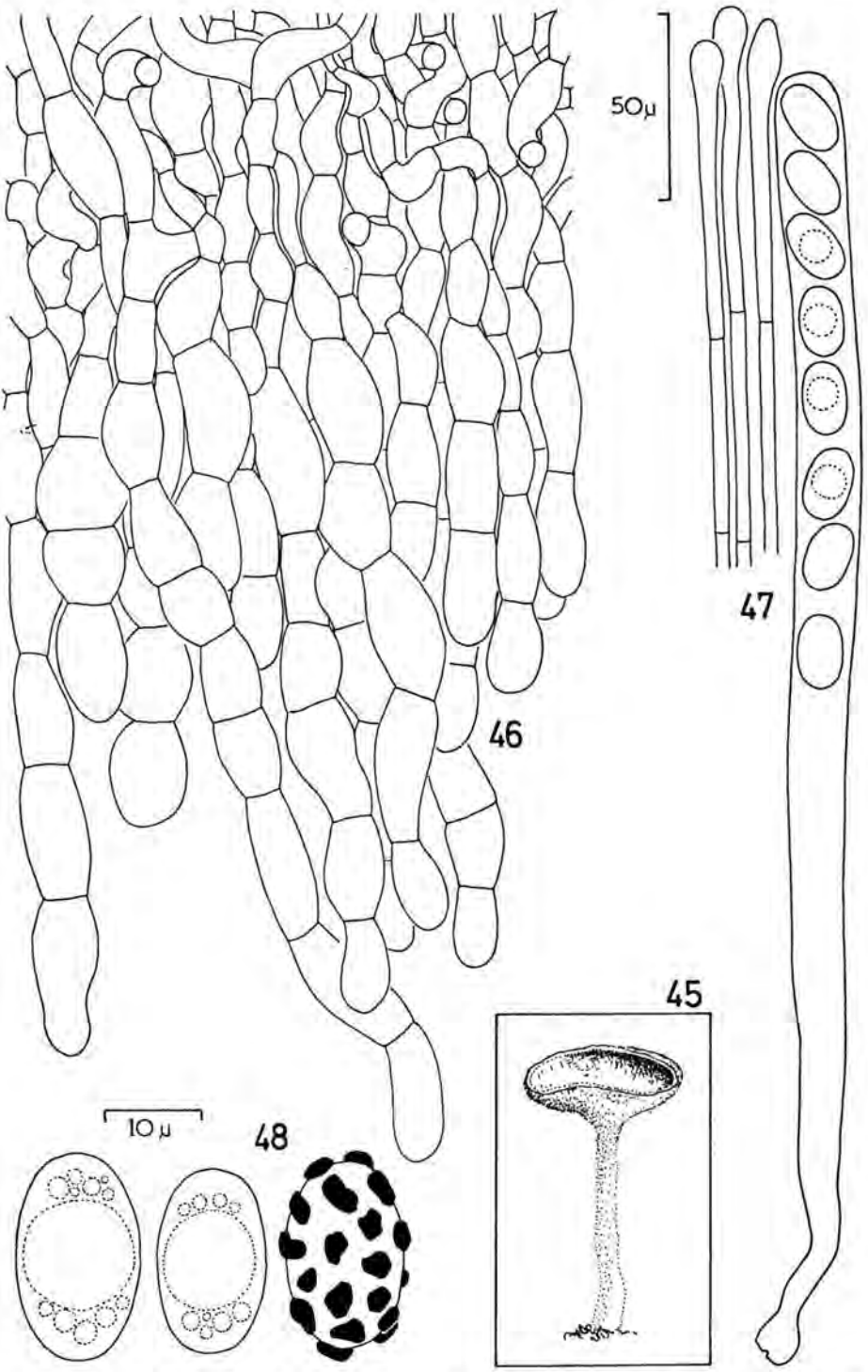
AUSTRALIA. Victoria. On mossy bank near a stream, Melba Gully near Laver's Hill, 9 March 1963, G. Beaton 71.

UNDERWOODIA Peck

Underwoodia Peck *in* Rep. N.Y. St. Mus. 43: 32. 1890.
Geomorium Speg. *in* An. Soc. cient. argent. 94: 79. 1922.

TYPE SPECIES: *Underwoodia columnaris* Peck.

Apothecia gregarious to caespitose, erect, large, elongated or columnar, sometimes horn-like, internally lacunose or alveolate, with a fleshy consistency. Disc covers the outer surface of the upper part of the apothecium,



Figs. 45–48. *Helvella villosa*. 45. Habit sketch. 46. Section of ectal and part of medullary excipulum. 47. Ascus and paraphyses. 48. Ascospores. (From G. Beaton 71).

which represents the receptacle, smooth or undulate, dull to dark brownish. The lower part of the apothecium constitutes the stipe, also lacunose or fluted, or almost cylindrical, minutely downy, whitish. The outer surface of the stipe and the innerside of apothecia are covered by cortical palisade-like layers consisting of septate clavate cells which arise from a thick prosenchymatous tissue sandwiched between the two layers. Asci long, subcylindrical and narrower towards the base, apex or wall not blued in Melzer's reagent, 8-spored. Ascospores uniseriate, hyaline to subhyaline, ellipsoidal, containing 1–3 large oil guttules, at maturity irregularly ornamented with warts. Paraphyses slender, septate, sometimes anastomosing or branched at the base, apex usually enlarged, straight or curved, brownish.

HABITAT: on the ground.

The identity of the genus *Geomorium* Speg. with the present genus has been discussed by Gamundi (*1957a*), who also transferred its type species to *Underwoodia*. This, together with the new Australian species described below, will bring the number of species of this curious genus up to three. As has been shown by Korf (*1956*) the other two species which have been assigned to *Underwoodia*, *Underwoodia campbellii* Sacc. and *Underwoodia sparassoides* (Boud.) Bánhegyi, are in fact species of *Peziza* and identical with *Peziza proteana* (Boud.) Seaver f. *sparassoides* (Boud.) Korf.

The genus *Underwoodia* has been classified as a member of the Helvellaceae by Seaver (*1928*), Gamundi (*1957a*) and Dissing (*1966*) and until the cytology of its ascospores has proven the contrary it is best to accept this disposition. The available morphological evidence does suggest that this genus is related to the other members of the Helvellaceae. Korf (*1956*), for example, already considered the fluted and lacunose sterile tissue of *Underwoodia columnaris* Peck analogous to the stipe tissue of some species of *Helvella* and *Neogyromitra* Imai. Anatomically the palisade-like cortex of species of *Underwoodia* is not unlike the ectal excipulum of some species of *Helvella* discussed by Kanouse (*1948*) and illustrated by Dissing (*1964*, *1966*). In both genera these palisade-like layers arise from an inner and distinctly differentiated prosenchymatous tissue. The guttulate ascospores exclude the possibility of *Underwoodia* being a member of the Morchellaceae. The presence of callose-pectic spore ornaments cannot be regarded as an obstacle for classifying this genus in the Helvellaceae because the ascospores of *Helvella macropus*, which is an unquestioned member of the Helvellaceae (Berthet, *1964a*), are also provided with minute callose-pectic warts.

KEY TO SPECIES OF UNDERWOODIA

1a. The cortical palisade-like layer beneath the hymenium less than 50 μ thick; prosenchymatous layer if the receptacle interspersed with large, thick walled, nematode-like cells up to 20 μ diam. Australia
Underwoodia beatonii Rifai

b. The cortical palisade-like layer beneath the hymenium more than 80 μ thick; large nematode-like cells absent from the prosenchymatous layer . . 2

2a. Paraphyses curved at the apex; ascospores ellipsoidal, obtuse at the ends. North America . . . . . [*Underwoodia columnaris* Peck]

b. Paraphyses straight at the apex; ascospores subfusoid ellipsoidal, sometimes asymmetrical. Argentina . . . [*Underwoodia fuegiana* (Speg.) Gamundi]

Underwoodia beatonii Rifai, *spec. nov.*

Apothecia gregaria vel caespitosa, elongata, conico columnaria, recta vel curvula, intus pluri-lacunoso-fistulosa, apice brunneola, basi albida. Cortex fertilis interior paliformis, usque 50 μ crassa, e cellulis clavatis constat. Pars medullaris textura intricata, hyphis hyalinis septatis (3–)4–10 μ crassis, cum cellulis nematoideis usque 20 μ crassis. Asci cylindracei, octospori, 320–400 × 16–20 μ. Ascospori ellipsoidei, guttulati, subhyalini, verrucosi, 22.7–25.4 × 10.9–12.5 μ. Paraphyses septatae, apice rectae subclavatae vel clavatae, 5–7.2 μ diam.

Hab. ad terram, prope Anglesea, Victoriae, 18 Julii 1964, G. Beaton 215 typus est [K].

Apothecia gregarious to caespitose, erect, tapering towards the apex which is often slightly curved and horn-like, up to 70 mm high by about 10 mm diam. or even more, internally lacunose, filled with large longitudinal alveole-like cavities. The more or less conical receptacle, which is the fertile upper half of the apothecia, is covered by the hymenium, the disc of which is smooth or undulate, greyish brown, becoming blackish brown when dried. The sterile lower half of the apothecia makes up the stipe; it is often fluted, minutely downy, creamy white. In section of the fertile region it can be seen that the hymenium arises from a thin layer of compact subhymenium which is made up of interwoven, delicate, septate hyphae 2.5–5 μ diam. Beneath the subhymenium there is a layer of prosenchymatous tissue up to 500 μ thick, its hyphae coarser than those of the subhymenium, (3–)4–10 μ diam., septate, infrequently branched; this layer is interspersed with massive, thick walled, long, nematode-like cells up to 20 μ diam. Bordering this prosenchymatous tissue from the innerside is a palisade-like layer less than 50 μ thick, made up of septate, clavate or obpyriform cells 7–14 μ diam.; probably this palisade-like tissue is homologous to the ectal excipulum of the apothecia of the genus *Helvella*. A section through the lower or sterile part of the apothecia show that instead of being covered by hymenium the outermost layer is made up of a palisade-like tissue up to 80 μ thick, with septate, clavate, branched cells 8–20 μ diam.; this layer covers a thick prosenchymatous tissue consisting of interwoven, septate and branched hyphae (3–)4–8 μ diam.; the innermost layer is also a palisade-like tissue similar to or sometimes slightly thicker than the outermost layer but much thicker than the palisade-like tissue bordering the inner-side of the fertile portion. Hymenium about 360 μ thick. Asci cylindrical, slightly narrower towards the base, 8-spored, 320–400 × 16–20 μ, wall rather thick. Ascospores uniseriate, ellipsoidal, rarely somewhat asymmetrical, hyaline or subhyaline, usually containing one large central oil globule and two smaller ones, at maturity covered by small, rounded, elongated or irregularly shaped warts less than 1.8 μ diam.; excluding the ornaments the ascospores measure 22.7–25.4 × 10.9–12.5 μ. Paraphyses slender, 2.7–3.6 μ diam. below, often anastomosing near the base, sparingly

septate, apex distinctly enlarged, subclavate or clavate, sometimes lobed, typically straight, 5–7.2 μ diam. (Fig. 49–54).

HABITAT AND DISTRIBUTION: on the ground in Australia.

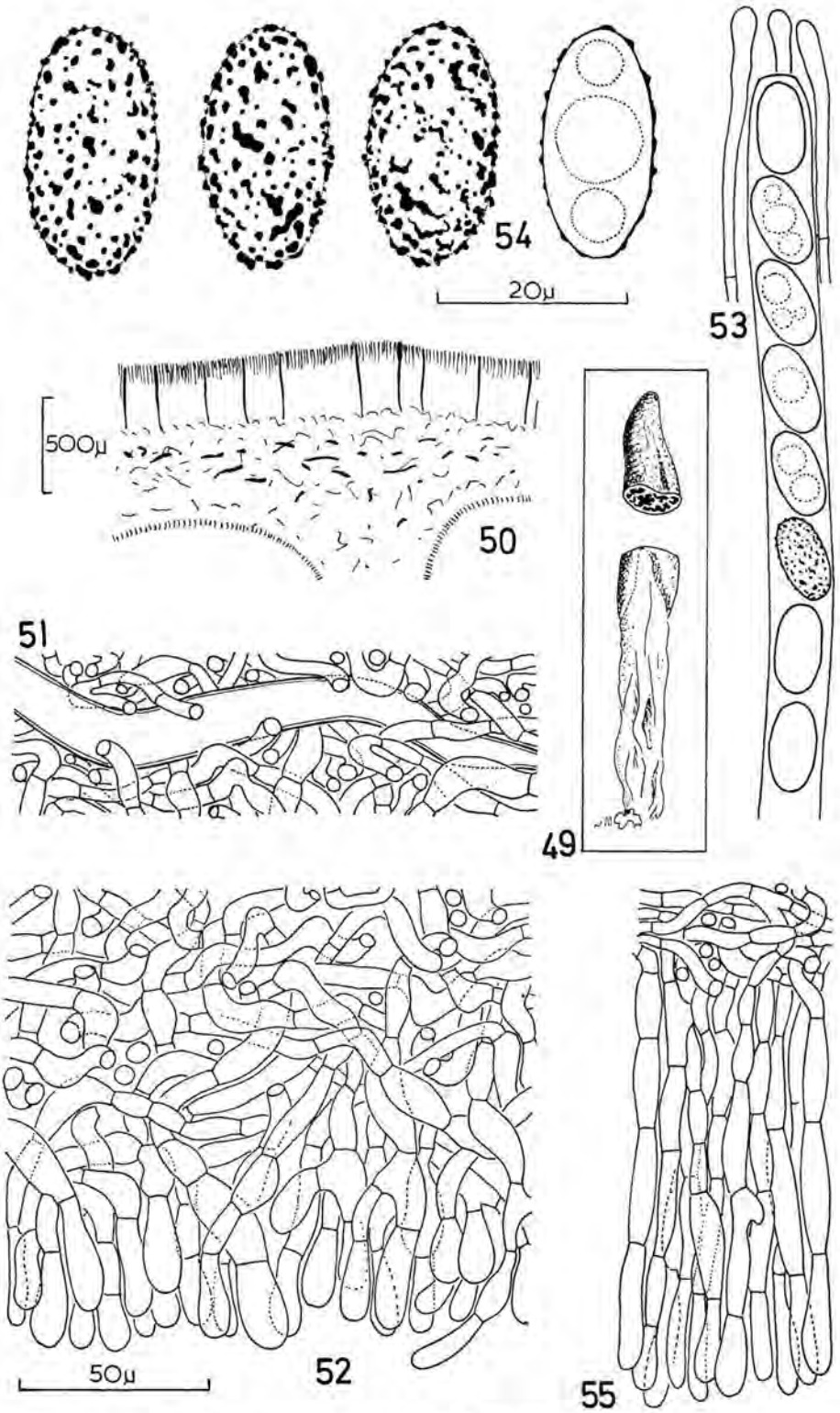
Superficially the present species strongly resembles the Argentinian species *Underwoodia fuegiana* (Speg.) Gamundi, the type of their paraphyses and the size of their ascospores are also very similar. The outer palisade layer of the stipe of *Underwoodia beatonii*, however, is much thinner than that of the Argentinian species, which according to Gamundi (*1957a*) is 145–174 μ thick. As has been described above the inner palisade layer of the receptacle of the present species is rather thin, less than 50 μ thick; unfortunately Gamundi did not give the measurement of the corresponding structure for the Argentinian species, but judging from Fig. 7b of her plate this layer appears to be over 100 μ thick. From the same figure it is evident that the construction and the components of this layer is similar to that of *Underwoodia columnaris* Peck shown in Fig. 55 (figured from specimen collected from the ground, Machinac City Hardwoods, Michigan, U.S.A., 20 July 1961, D. A. Reid). Comparison between Fig. 52 and Fig. 55 will reveal that the palisade layer of the receptacle *Underwoodia beatonii* is much thinner, less compact but its cells are wider than those of *Underwoodis columnaris* and *Underwoodia fuegiana*. Gamundi has reported that the prosenchymatous tissue beneath the hymenium of *Underwoodia fuegiana* was composed of slender hyphae 2.9–4.3 μ diam.; in the specimen of *Underwoodia columnaris* studied I found that the corresponding hyphae measured 2.5–5.5 μ diam. In contrast the Australian species has coarser hyphal components, varying from (3–)4–10 μ diam. Apparently the large nematode-like cells described above can only be found in the present species because I have not been able to detect their presence in *Underwoodia columnaris* and they were not mentioned by Gamundi (*1957a*) in describing the Argentinian species.

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On the ground under *Melaleuca pubescens*, Anglesea camping area, 18 July 1964, G. Beaton 215 [type specimen of *Underwoodia beatonii* Rifai].

FAMILY HUMARIACEAE

The Humariaceae is the largest and probably the most difficult family of the Pezizales, related to the Helvellaceae on the one hand and the Pyronemataceae on the other. Two lines of development can be distinguished. The first one shows a strong affinity with, and may be originated from, the Helvellaceae. It consists of genera with whitish, pale ochraceous or brownish discs with prosenchymatous medullary excipulum, the hyphae of which are slender. The second series of genera has bright coloured discs, red, orange or yellow, with paraphyses usually turning green in iodine. This latter group appears to be remotely related to the Sarcoscy-



Figs. 49–55. — *Underwoodia beatonii*. 49. Habit sketch. 50. Diagramatic section of receptacle. 51. Details of nematode-like cell. 52. Inner cortex of the receptacle. 53. Part of ascus and paraphyses. 54. Ascospores. (From type). — *Underwoodia columnaris*. 55. Inner cortex of the receptacle (From D. A. Reid). Figs. 51, 52, 53, 55 to same scale.

pheae, which also has a similar pigmentation. The presence of some intermediate genera such as *Sowerbyella* Nannf. and *Sphaerosporella* (Svrček) Svrček & Kubička makes it rather difficult to judge the importance and the taxonomic implication of these two possible phylogenetic lines of development, that until a more reliable taxonomic evidence becomes available it would be better to retain both groups in the same family. For this reason the suboperculate tribe Urnuleae has been retained in the Sarcoscyphaceae, but in the future it might be more appropriate to raise it to family rank, for which the name Sarcosomaceae (correctly, Sarcosomataceae) Kobayashi (*1937*) is available.

In Australasia this family is represented by four tribes which can be defined as follows:

KEY TO THE TRIBES OF HUMARIACEAE

1. Apothecia medium to large, rarely small, tomentose, discoid, cupulate or more often ear shaped or split down on one side, always terrestrial. Disc of some shade of yellow, ochraceous, grey, brown or purple. Ectal excipulum of textura globulosa to textura angularis, sharply differentiated from the prosenchymatous medullary excipulum. Ascospores mostly smooth walled, guttulate. Paraphyses slender, often curved or hooked, sometimes lobed or forked at the apex, not green with iodine . . . . . Tribe OTIDEAE
2. Apothecia small to large, cupulate to discoid, outer surface mostly covered by hyaline or brown thick walled hairs, also terrestrial. Disc white, pale grey, ochraceous, brown of reddish brown. Ectal excipulum of textura angularis to textura prismatica, hyaline to pale brown, medullary excipulum well differentiated, hyphae mostly slender. Ascospores smooth to coarsely but simply ornamented. Paraphyses subclavate, straight, not green with iodine . . . . Tribe LACHNEAE
3. Apothecia scutellate or discoid, sessile, small to medium sized, outer surface rarely smooth, mostly covered by characteristic, reddish brown, acuminate, basally forked rooting hairs, growing on dead wood, dung or other vegetable remains, rarely on the ground. Disc reddish orange, orange yellow or yellow. Ectal excipulum of angular, polygonal or globose cells, medullary excipulum of irregularly interwoven hyphae with cells often strongly inflated, or poorly differentiated. Ascospores ornamented with warts of various sizes, simple or complicated, or smooth but often their outer walls readily become loose when heated in lactic acid. Paraphyses straight, clavate to lobed, green in iodine . . . . . Tribe CILIAREAE
4. Apothecia discoid to cupulate, sessile or stipitate, small to large, outer surface with simple brown or hyaline, thin or thick walled hairs or the apothecia are hairless. Disc white, yellow, orange to red. Ectal excipulum variable, of textura intricata, textura angularis, rarely textura globulosa. Medullary excipulum well to poorly developed, also very variable, of interwoven delicate to coarse hyphae or pseudoparenchymatous. Ascospores smooth or covered by simple or complicated ornaments. Paraphyses delicate to stout, apex straight or curved, usually green in iodine. On the ground, often amongst mosses, rarely on mosses . . . . . Tribe ALEURIEAE

TRIBE OTIDEAE

The difficulty in delimiting the Helvellaceae, the presence of the otideoid but helvellaceous genus *Wynnella*, and the large *Peziza*-like

apothecia of some species of *Otidea* have baffled some mycologists who attempted to classify members of the tribe Otideae. Nannfeldt (*1937*, *1938*) and Korf (*1963*) would include the latter in the Acetabuleae near the genus *Helvella*. It appears that only the genus *Wynnella* can now be undoubtedly accommodated in the Helvellaceae because of its tetranucleate ascospores (Berthet, *1964a*), whereas the affinity of the remaining genera will have to be sought elsewhere. Le Gal (*1947*, *1953*) and Dennis (*1960*) placed the present tribe in the Pezizaceae. This disposition does not seem to be acceptable, because the asci of the Otideae are not amyloid. Furthermore the ectal and medullary excipulum of this tribe are well differentiated; the latter is made up of distinctly filamentous hyphae. In contrast the excipular structure of the Pezizaceae is often very complicated and mostly composed of large polygonal or subglobose cells. The cytology of the ascospores and the anatomy of the apothecia of members of the Otideae have much in common with the other genera of the Humariaceae so that it is classified in the latter family, as was already done by Berthet (*1964a*).

Otidea Fuckel

[*Peziza* [Dill.] St-Amans subgen. *Otidea* Pers., Mycol. eur. 1: 220. 1822. —] *Otidea* Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 329. 1870.

[Misapplied name: *Scodellina* S. F. Gray, Nat. Arrang. Br. Pl. 1: 668. 1821, emend. Seaver, N. Am. Cup Fungi (Operc.) 184. 1928; non *Scodellina* S. F. Gray sensu meo, = *Peziza* [Dill.] St-Amans].

Lectotype species: *Peziza onotica* (Pers. ex S. F. Gray) Pers.

Otidea was first used as a generic name by Fuckel in 1870 for the larger species of cup fungi with unequally split or ear-like apothecia. It has been found that this peculiar shape of apothecia is associated with other taxonomically important microscopic characters such as non-amyloid asci containing small, smooth-walled, ellipsoidal, guttulate ascospores, usually with curved paraphyses devoid of carotenoid pigmentation. The apothecia of this genus often have thin pseudoparenchymatous ectal excipulum and a well differentiated prosenchymatous medullary excipulum. It is not surprising therefore that the validity of this genus has been widely upheld by many authors (Saccardo, *1889*; Massee, *1895*; Rehm, *1896*; Boudier, *1907*; Clements & Shear, *1931*; Bresadola, *1934*; Nannfeldt, *1938*; Le Gal, *1947*; Kanouse, *1949*; Thind & Batra, *1957*; Dennis, *1960*; Batra & Batra, *1963*; Berthet, *1964a*; Svrček, *1965*).

Seaver (*1928*), followed by Groves & Hoare (*1954*), Korf (*1963*) and Kimbrough (*1966*), considered that the generic name *Scodellina* S. F. Gray (*1821*) was more appropriate nomenclaturally for the present genus. A reconsideration of the typification of *Scodellina* suggests, however, that Seaver's contention in this respect is unjustified. Gray (*1821*) originally described the genus *Scodellina* as follows: "Thallus fleshy, membranaceous, brittle, sessile, hemisphaerical, spreading; outside scaly or mealy." Gray

accepted nine species in this genus and by applying the now obsolete first species rule, the first species treated by Gray, *Scodellina leporina* (Batsch) ex S. F. Gray, was automatically accepted by Seaver (*1928*, *1942*) as the lectotype species of *Scodellina* S. F. Gray. *Scodellina leporina* cannot be accepted as the most typical member of this genus as understood by Gray, because in delimiting the genus *Scodellina* this author did not make any reference to the unequal splitting or the ear-like appearance of the apothecia of this species. Since in amending *Scodellina* the taxonomic value of the latter character was duly emphasized by Seaver, his conception of this genus was very different from that of Gray. Dr. R. W. G. Dennis (pers. comm., 1966) kindly pointed out to me that as a consequence of this the vernacular name "Spread Cup" coined by Gray for the genus *Scodellina* could not be applied to the group of fungi covered by Seaver's emendation of this genus. If in typifying the genus *Scodellina* its protonym is taken into consideration it becomes even more difficult to justify the acceptance of Seaver's emendation and typification of this genus. Although Micheli (*1729*) never proposed or used the name *Scodellina* as a generic name, in publishing this genus Gray (*1821*) attributed its authorship to him. In discussing *Fungoides coccineum, acetabuli forme* – for which *Parva concha marina, colore coccinea* Sterb., a descriptive specific name now commonly interpreted to represent *Aleuria aurantia* (Fries, *1822*), was cited as a synonym – Micheli did mention "Scodelline scarlatte," which was a vernacular name for this species of *Fungoides* Mich. [=*Peziza* s.l.]. Two other species of *Fungoides* – the identity of which is difficult to establish and both of them fimicolous, and both certainly not species of *Otidea* – had also Italian names beginning with the words "Scodellacia" and "Scodelle" respectively. Of these three "scodella"-like (Italian word for "soup plate" or "saucer") fungi, only the "Scodelline scarlatte" or *Aleuria aurantia* was included in the genus *Scodellina* by Gray, which he renamed *Scodellina aurantiaca*. Since Gray's description of this species also does not fit his generic description, it is suggested to me by Dr. M. A. Donk (pers. comm., 1967) to designate *Peziza vesiculosa* Bull. ex St-Amans as the lectotype species of the genus *Scodellina* S. F. Gray.

Fries (*1822*) did not make any reference to Gray's generic name and for this reason Thind & Batra (*1957*) rejected *Scodellina* S. F. Gray emend. Seaver in favour of *Otidea*. Since the name *Scodellina* was validly published after 1 January 1821 and because Fries (*1821–1932*) did not reject the name in favour of other name(s), under the rules of Botanical Nomenclature adopted since 1952 Fries' failure to "sanction" the use of *Scodellina* as a generic name in the "System mycologicum" does not make this name illegitimate. The name *Scodellina* is rejected here because as typified with *Peziza vesiculosa* it becomes a later synonym of *Peziza* [Dill.] St-Amans.

Several species of *Otidea* have been reported from Australasian regions but it has been found that all these records were based on members of other genera. *Otidea tasmanica* Rodway (*1925*), for example, is a later

synonym of *Peziza praetervisa* Bres. and the type specimen of *Otidea lobata* Rodway (*1925*) appears to represent a species of the inoperculate genus *Discinella* Boud., whereas the record of *Otidea phlebophora* (Berk. & Br.) Sacc. has been based on a specimen of *Peziza varia* (Hedw.) ex Fr. The type specimen of the Indian species *Peziza darjeelensis* Berk. (on the ground, Sikkim, Himalaya, s. dat., J. D. Hooker) has iodine positive asci and echinulate ellipsoidal ascospores. The Australian specimen (on the ground, Melbourne, Victoria, s. dat., F. Reader 19) referred to by Cooke (*1892*) as *Otidea darjeelensis* (Berk.) Sacc. is obviously a different species because it has iodine negative asci containing reticulate, biguttulate and ellipsoidal ascospores 14.5–16.5 × 8.1–10 μ and its apothecia have *Aleuria*-like excipular construction, are apparently rooted or may be stipitate, whereas its paraphyses are strongly curved. In the absence of better or fresh specimens, it is difficult to state whether this badly preserved collection represents a species of *Aleuria* or *Sowerbyella* Nannfeldt (*1938*). The Victorian and Queensland specimens described by Cooke (*1892*) as *Otidea hirneoloides* have not been preserved; the latter species, however, is a member of the sarcoscyphaceous genus *Aurophora* Rifai. Although Cooke (*1892*) stated that "*Peziza* (*Cochlearia*) *cochleata* Linn." occurred in Victoria, Queensland, South Australia and Tasmania, during the present study no specimen referable to this species of *Otidea* has been seen.

MARCELLEINA Brumm., Korf & Rifai, apud Brumm.

Marcelleina Brumm., Korf & Rifai *apud* Brumm. *in* Persoonia (Suppl.) 1: 233. 1967.

[Misapplied name: *Barlaeina* Sacc. emend. Le Gal *in* Revue Mycol. 18: 80. 1953; Gamundi *in* Lilloa 30: 307. 1960; Dennis, Brit. Cup Fungi 19. 1960; Moser *in* Gams, Kl. Kryptog.-Fl. 2a: 93. 1963; non *Barlaeina* Sacc., Tab. comp. Gen. Fung. 30. 1898 (= *Barlaea* Sacc., = *Crouania* Fuckel, = *Lamprospora* De Not.)].

TYPE SPECIES: *Ascobolus persoonii* Crouan.

Apothecia small to medium sized, gregarious, sessile. Disc concave or almost flat, purple. Receptacle saucer or shallowly cup-shaped, a little paler than the disc, smooth or nearly so. Ectal excipulum thin, composed of globose or angular cells (textura globulosa or textura angularis). Medullary excipulum made up of loosely intertwined septate hyphae (textura intricata). Asci narrowly clavate cylindrical, 8-spored, apex not blued in Melzer's reagent. Ascospores uniseriate, globose, hyaline, smooth walled or verrucose, containing one or more oil globules. Paraphyses slender, septate, unbranched, slightly enlarged at the straight, curved or almost hooked apices, containing purple granules.

HABITAT: on the ground amongst mosses or plant remains in damp places.

The new generic name *Marcelleina* is proposed to replace *Barlaeina* Sacc. emend. Le Gal, because under the current "International Code of Botanical Nomenclature" the latter name cannot be applied for species related to *Ascobolus persoonii* Crouan, which Le Gal (*1953a*) indicated as its lectotype

species. The reasons for this necessary name change will be fully explained under *Lamprospora*.

Largely because of their globose ascospores Seaver (*1928*) and Batra & Batra (*1963*) would range species of *Marcelleina* in the genus *Lamprospora*. As Le Gal (*1953a*) has stated this disposition is wholly unjustified because the latter genus has carotenoid pigmentation and pseudoparenchymatous medullary excipulum.

The Cuban species *Peziza lobata* Berk. & Curt. apud Berk. (Berkeley, *1868*) – *Peziza verruculosa* Berk. & Br. from Ceylon and the Javanese *Barlaeina albocaerulescens* Penz. & Sacc. (Petch, *1916*; Boedijn, *1951*) are probably only synonyms – cannot apparently be accommodated in the present genus, because it has a slightly different ectal excipular structure. Furthermore, the receptacle of this widely spread species has poorly developed hair-like projections. The bluish pigmentation and the structure of its medullary excipulum, however, preclude the possibility of it being a *Lamprospora*, where Seaver (*1928*) compiled it.

The genus *Marcelleina* is only provisionally referred to the tribe Otideae.

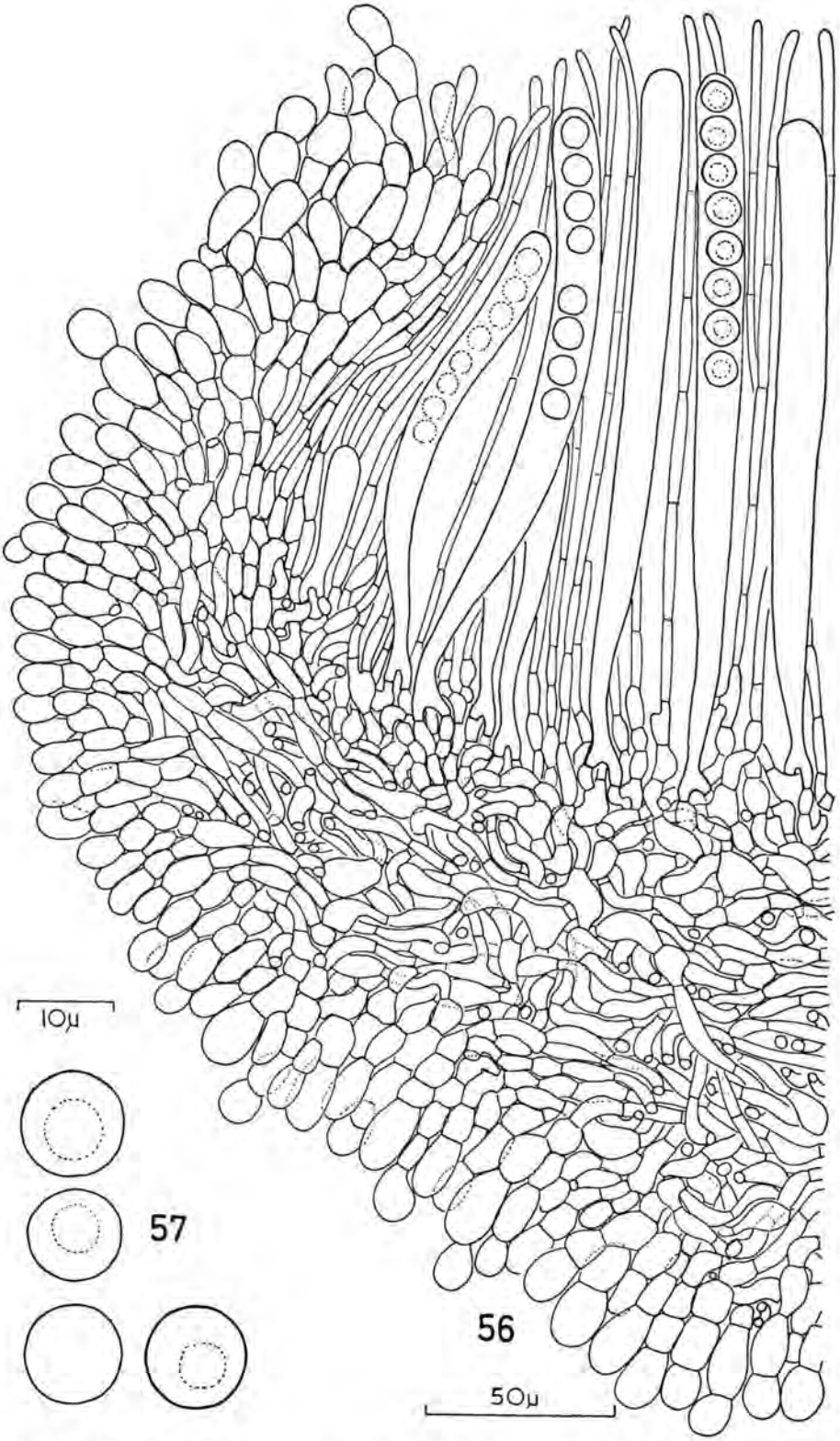
Marcelleina atroviolacea (Delile ex de Seynes) Brumm.

[*Peziza atroviolacea* Delile in herb. –] *Peziza atroviolacea* Delile *ex* de Seynes, Rech. Hist. nat. Veg. inf. 3: 84. 1886; non *Peziza atroviolacea* Bres., Fung. trid. 1: 24. 1882. – *Marcelleina atroviolacea* (Delile ex de Seynes) Brumm. *in* Persoonia (Suppl.) 1: 233. 1967.

[*Peziza planchonis* Dun. *in* herb. –] *Plicaria planchonis* (Dun.) *ex* Boud. *in* Bull. Soc. mycol. Fr. 3: 92. 1887. – *Barlaea planchonis* (Dun. ex Boud.) Sacc., Syll. Fung. 8: 116. 1889. – *Barlaeina planchonis* (Dun. ex Boud.) Sacc. & Trav. *in* Sacc., Syll. Fung. 19: 140. 1910. – *Lamprospora planchonis* (Dun. ex Boud.) Seaver *in* Mycologia 6: 21. 1914.

Barlaea cookei Massee *apud* Crossland *in* Naturalist **1900**: 9. 1900 (n.v.).

Apothecia scattered to gregarious, sessile or subsessile, up to 8 mm diam. (the Argentinian specimens sometimes reach 15 mm diam. according to Gamundi, *1960*). Disc concave or flat, smooth, dark purple. Receptacle shallowly cup-shaped, concolorous with the disc or slightly paler, sometimes blackish purple, outer surface almost smooth to minutely scurfy. Ectal excipulum relatively thin, 30–40 μ thick, the outer layer of pyriform, subglobose or sometimes polygonal cells 14–30 long by up to 20 μ diam. (textura globulosa); the inner layer composed of polygonal cells with smaller diam. and up to 14 μ long; all these cells are arranged with their long axis at right angles to the surface of the receptacle; the minute scurfy appearance of the receptacle is due to the aggregations of a few globular cells on the surface of the latter. Medullary excipulum pale purple, well developed, made up of loosely interwoven, septate and branched hyphae 3–10 μ diam., their cells occasionally becoming slightly inflated (textura intricata). Subhymenium of more compacted tissue sometimes assuming a pseudoparenchymatous tissue. Hymenium about 200 μ thick. Asci clavate cylindrical, distinctly attenuate below, apex rounded, 8-spored, 185–210 × 10–12.5 μ. Ascospores uniseriate, globose, hyaline or subhyaline, smooth walled, containing one large oil globule and several smaller ones, 8.5–10 μ diam. Paraphyses sparingly septate, slender,



Figs. 56, 57. *Marcelleina atroviolacea*. 56. Median section of margin. 57. Ascospores. (From G. Beaton 210).

2.5–3 μ diam. below, apex narrowly clavate and sometimes lobed, up to 4.5 μ diam., or sometimes more, straight or only slightly curved, longer than the asci (Fig. 56–57).

HABITAT AND DISTRIBUTION: on sandy ground amongst mosses in France (type locality), U.S.A., Bermuda, Argentina, India and Australia.

In recording the occurrence of this species in the United States, Hanlin (*1965*) reported that its ascospores grew rapidly in culture and produced somewhat variable colonies, but it failed to form a conidial state.

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On the ground amongst mosses, between road and dunes, 2 miles west of Anglesea, 5 July 1964, G. Beaton 210.

TRIBE LACHNEAE

The type genus of the tribe Lachneae is *Mycolachnea* Maire [=*Lachnea* (Fr.) Gill. emend. Boud., =*Humaria* Fuckel emend. Korf & Denison]. Since I have tentatively followed Le Gal (*1947*) in referring *Ciliaria confusa* (Cooke) Boud. and its closely related species to this tribe, three Australasian genera can now be recognized. Other genera which may also occur in Australasian regions or those which may be confused with the three genera treated below, are also included in the following key.

KEY TO GENERA OF THE LACHNEAE

1a. Apothecia at first subterranean . . . . . [*Sepultaria* (Cooke) Lamb.]
b. Apothecia superficial from the first 2
2a. Apothecia cupulate at maturity 3
b. Apothecia discoid at maturity. 5
3a. Apothecia sessile, without copious basal hyphae; disc white or whitish [*Mycolachnea* Maire]
b. Apothecia pseudostipitate, with basal hyphae; disc brownish at maturity 4
4a. Ascospore sufoidal, hairs brown walled . . . [*Jafnea* Korf emend. Rifai]
b. Ascospores ellipsoidal, hairs colourless but sometimes with brownish cell sap . . . . . *Nothojafnea* Rifai
5a. Ascospores globose . . . . . *Sphaerosporella* (Svrček) Svrček & Kubička
b. Ascospores ellipsoidal. 6
6a. Ascospores without oil globules . . . . . ["*Tricharia* Boud."]
b. Ascospores with oil globules 7
7a. Disc white, hairs present . . . . . [*Trichophaea* Boud.]
b. Disc brownish, hairs absent. . . . . *Jafneadelphus* Rifai

JAFNEA Korf emend. Rifai

Jafnea Korf *in* Nagaoa 7: 5. 1960.

TYPE SPECIES: *Peziza fusicarpa* Gerard.

As it is proposed here to exclude *Jafnea imaii* Korf from the present genus, Korf's (*1960*) original generic description will have to be slightly modified as follows:

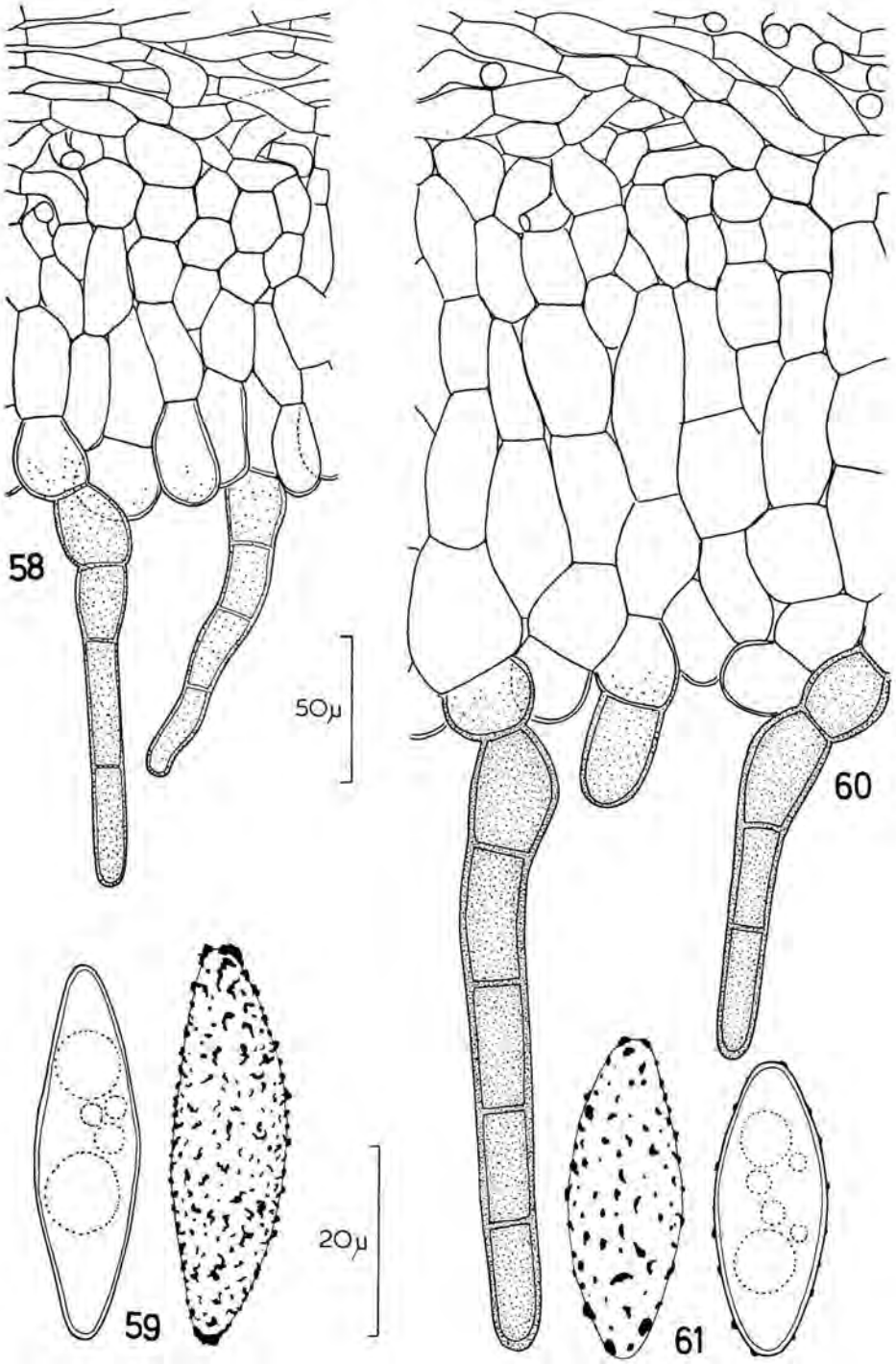
Apothecia gregarious, medium to large, subsessile. Disc deeply concave, creamy white when young, becoming brown at maturity or when dried. Receptacle deeply cup shaped, brown, sparsely and usually indistinctly hairy. Hairs few, short, pale brown to brown, septate, superficial, rather stout. Basal hyphae abundant, nearly hyaline, enmeshing particles of soil to form a pseudostipe or cushion. Ectal excipulum composed of cells elongated perpendicularly to the outer surface of the apothecium, outermost cells brown, inner cells hyaline or brown. Medullary excipulum well developed and sharply differentiated, of loose or compact textura intricata, with hyphae mostly running horizontally. Asci subcylindrical, apex or walls not blued in Melzer's reagent, 8-spored. Ascospores large, fusoid to fusiform-ellipsoid, hyaline, biguttulate when young, non-guttulate at maturity, marked with small elongated irregular warts, in one species often apiculate. Paraphyses sparingly septate, simple, apex subclavate, brownish.

HABITAT: on soil or duff.

The essential characters of the two accepted species, *Jafnea semitosta* (Berk. & Curt. apud Berk.) Korf from North America and *Jafnea fusicarpa* (Gerard) Korf from North America, Japan and India are illustrated in Figures 58–61 (figured from North American specimens: on the ground, Amana, Iowa, U.S.A., 5 October 1946, G. W. Martin 6306, and on the ground, Gatineau Park, Quebec, Canada, 24 September 1958, M. Elliott, ex DAOM 69838, respectively). So far this genus has not been represented in Australasia and Europe but Prof. Richard P. Korf (pers. comm., 1965) has kindly pointed out to me that the species described as *Lachnea oligotricha* Teodorowicz (*1936*) from Poland might prove to be a European representative of this interesting genus.

As Korf (*1960*) pointed out, the taxonomic position of the genus *Jafnea* was problematical. Korf placed it in the admittedly heterogeneous tribe Ciliarieae, a tribe which in Korf's (*1954*) scheme of classification roughly corresponds to the hairy Humariaceae of the present work. Since the fusoidal ascospores of *Helvella macropus* (Pers. ex S. F. Gray) Karst. are minutely warted Le Gal (*1963*) believed that this species should be transferred to *Jafnea* and the possibility of this genus being a member of the Helvellaceae was also suggested. According to Berthet (*1963*, *1964a*) mature ascospores of *Helvella macropus*, as in all species of the Helvellaceae, were 4-nucleate. Unfortunately the cytological characters of species of *Jafnea* and its related genera are as yet unknown, so that it cannot be said with certainty whether based on this character *Jafnea* can be included in the Helvellaceae or not. As far as the relationship of *Helvella macropus* is concerned the 4-nucleate ascospores, the not very compact ectal excipulum and the type of its hair appear to be more akin to some villose species of the genus *Helvella* rather than to *Jafnea fusicarpa*.

Gamundi (*1964*) has classified *Jafnea* as a genus of the Pezizaceae but this is wholly unjustified because the only character used by Gamundi in referring it to this family is the relative size of the apothecia, which is also the character upon which Gamundi (*1960*, *1964*) separated the



Figs. 58–61. — *Jafnea fusicarpa*. 58. Hairs and section of ectal and part of medullary excipulum. 59. Ascospores. (From M. Elliott). — *Jafnea semitosta*. 60. Hairs and section of ectal and part of medullary excipulum. 61. Ascospores. (From G. W. Martin 6303).

Pezizaceae from the Humariaceae! Since the apothecial construction of *Jafnea* and the type of its hairs are similar to those of *Mycolachnea hemisphaerica* (Wigg. ex S. F. Gray) Maire, this genus is accommodated in the Humariaceae tribe Lachneae. A similar conclusion has been reached by Nannfeldt (*1937*) when he suggested the removal of the two species of *Jafnea* from the Helvellaceae to a position near *Lachnea* (Fr.) Gill. [=*Mycolachnea* Maire, =*Humaria* Fuckel emend. Korf]. The latter genus can be separated from *Jafnea* by the absence of the pseudostipe, the subhyaline ectal excipulum, the whitish disc of its mature apothecia and by its ellipsoidal ascospores.

Jafneadelphus Rifai, *gen. nov.*

TYPE SPECIES: *Rhizina ferruginea* Phill. apud Cooke.

Apothecia gregaria, cupuliformia, denique discoidea, sessilia vel subsessilia, minuta vel mediocria, brunnea, extra verrucosa, basi tomentosa. Excipulum ectale e cellulis angularibus (textura prismatica vel textura angulari, interdum textura globulosa), excipulum medullare ex hyphis gracilibus septatis (textura intricata) compositum. Asci cylindracei, apice jodo haud tincti, octospori. Ascospori uniseriati, ellipsoidei, hyalini, juventute biguttulati, tuberculati vel verrucosi. Paraphyses ad apicem non septatae, rectae, brunneae, subclavatae vel subcapitatae.

Hab. ad terram humosam vel sabulosam.

Apothecia scattered to gregarious, subsessile, medium sized. Disc concave to almost flat at maturity, of some shade of brown. Receptacle at first cup shaped, becoming discoid at maturity, brown, exposed surface smooth but near the margin often covered with dark brown warts. Basal hyphae abundant, slender, subhyaline, undulate, sparingly septate, often enmeshing soil particles to form a pseudostipe. Ectal excipulum composed of regularly arranged angular or polygonal elongated or sometimes subglobose cells, their long axes usually lying at right angles to the surface of the receptacle (textura angularis to textura prismatica), light brown. Medullary excipulum well developed, of loose or compacted textura intricata, hyphae slender, sparingly septate and branched, often running in a horizontal direction. Asci cylindrical, long, narrower towards the base, wall or apex not blued in Melzer's reagent, 4–8-spored. Ascospores uniseriate, ellipsoidal, with two large oil globules which disappear at maturity, hyaline or pale yellowish, regularly covered with small or huge rounded warts or tubercles. Paraphyses simple, sparingly septate at the base, non septate above, apex subclavate or subcapitate, with brownish coloured contents.

HABITAT: on the ground or duff.

When the genus *Jafnea* was established to accommodate two species which between them have been assigned to seven genera (*Peziza*, *Paxina*, *Macropodia*, *Lachnea*, *Fuckelina*, *Sepultaria* and *Scutellinia*) belonging to three families (Pezizaceae, Helvellaceae and Humariaceae), Korf (*1960*) also introduced a third newly described species from Japan, *Jafnea imaii* Korf. This species shows some marked differences from the type species of *Jafnea*, especially in the absence of true or well defined apothecial hairs. During the course of the present study a few more species related

to *Jafnea imaii* have been found and it becomes apparent that the absence of true hairs is associated with the shape of apothecia (usually more or less discoid at maturity), the construction of the ectal excipulum (arranged in a more compact tissue and often in a more distinct textura prismatica), the shape of ascospores (ellipsoidal instead of fusoidal or fusiform ellipsoidal) and also in the type of the spore markings. These characters clearly separate these species generically from *Jafnea fusicarpa* and *Jafnea semitosta*. The discovery of still another species described below as *Nothojafnea cryptotricha* Rifai, which is similar but quite remotely related to *Jafnea fusicarpa* because of the difference in the nature of its hairs, ascospores and details of the surface of receptacle, seems to justify the exclusion of *Jafnea imaii* from Jafnea. Prof. Richard P. Korf kindly informed me (pers. comm., 1966) that he has been rather doubtful about the close affinity of this species with *Jafnea fusicarpa*, the type species of the genus. The distinction between *Jafnea* and *Jafneadelphus* is comparable to that between *Melastiza* and *Aleuria* of the tribe Aleurieae but in the latter case the ascospore characters are identical.

Since the specific delimitation in the genus *Jafneadelphus* has been based largely on ascospore characters, fully mature specimens are essential for a satisfactory identification of its species.

KEY TO SPECIES OF JAFNEADELPHUS

1a. When young medullary excipulum gelatinized; receptacle irregularly folded or wrinkled; basal hyphae mostly minutely warted
"Peziza" drummondii Berk.

b. Receptacle without gelatinized zone and not folded or wrinkled; basal hyphae smooth walled 2

2a. Spore ornaments large, up to 5 μ diam. 3

b. Spore ornaments small, mostly less than 1 μ diam.; apothecia usually occurring on sandy soil 6

3a. Ascospores verrucose; paraphyses subcapitate. Argentina
[*Jafneadelphus argentinus* Rifai]

b. Ascospores tuberculate; paraphyses subclavate 4

4a. Ascospores broadly ellipsoidal, 20–23.5 × 12–13.5 μ; apothecia dark rusty brown to purple brown . . . . . *Jafneadelphus calosporus* Rifai

b. Ascospores ellipsoidal; apothecia dark rusty greyish or light blackish brown to olivaceous brown 5

5a. Ascospores up to 29.1 μ long, tubercles flattened or pulvinate, up to 2.5 μ high. Australia . . . *Jafneadelphus ferrugineus* (Phill. apud Cooke) Rifai

b. Ascospores less than 25.3 μ long; tubercles rounded, up to 4 μ high. Japan
[*Jafneadelphus ferrugineus* (Phill. apud Cooke) Rifai subsp. *imaii* (Korf) Rifai]

6a. Asci 8-spored . . . . . *Jafneadelphus asperulus* Rifai

b. Asci 4-spored . . . *Jafneadelphus asperulus* Rifai var. *tetraspermus* Rifai

Jafneadelphus calosporus Rifai, *spec. nov.*

Apothecia gregaria, sessilia, cupulate, demum discoidea, usque 10 mm diam., purpureo-brunnea. Excipulum ectale e cellulis subangularibus vel pyriformibus 14–40 μ diam., excipulum medullare ex hyphis septatis pallide brunneis 2.5–5 μ diam.

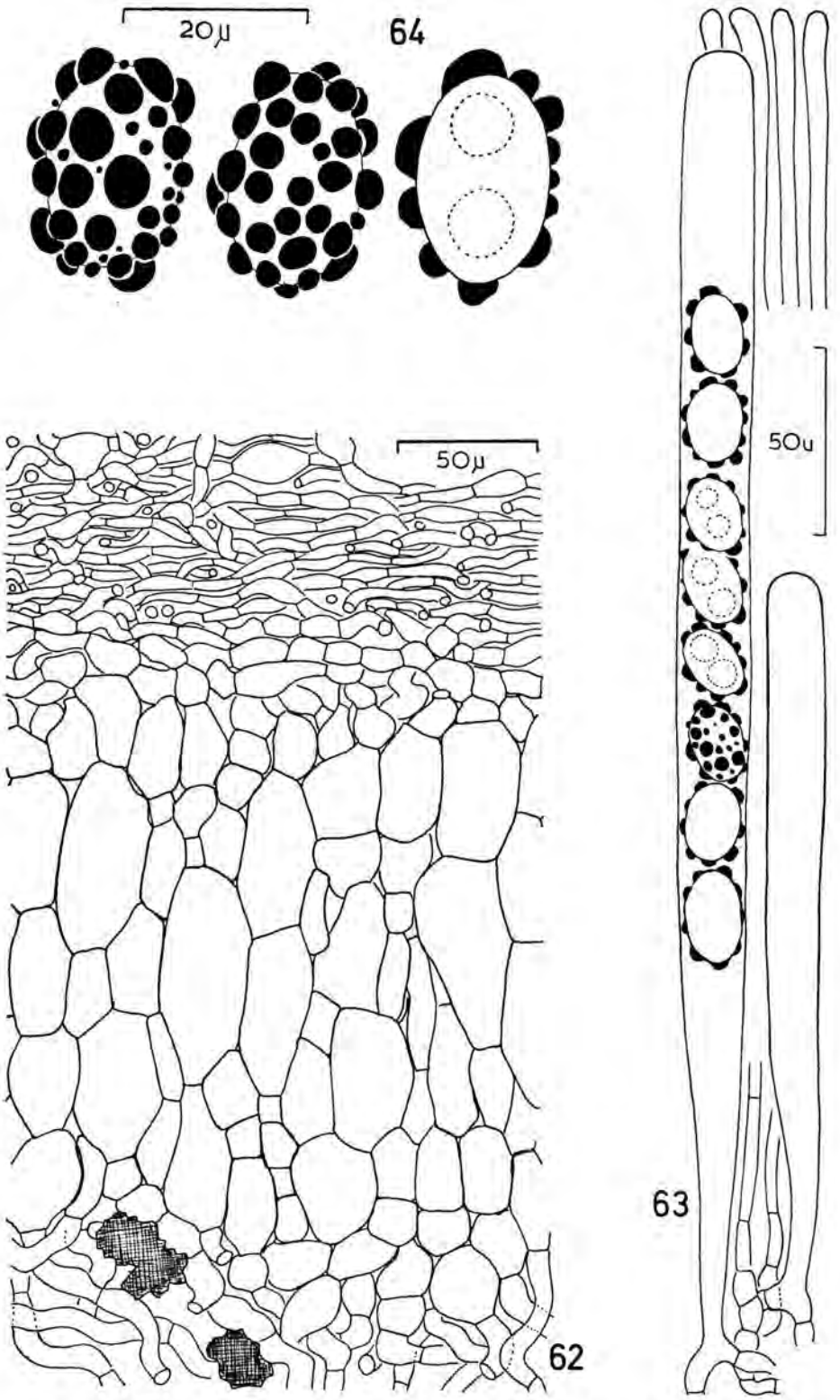
compositum. Asci cylindracei, octospori, 325–420 × 14–18 μ. Ascospori uniseriati, hyalini, late ellipsoidei, biguttulati, crasse tuberculati, 20–23.5 × 12–13.5 μ. Paraphyses 3–4 μ diam., ad apicem non septatae, incrassatae, subclavatae, usque 6 μ diam.

Hab. ad terram, prope Alexandram, Victoriae, 16 Septembri 1963, G. A. Crichton, comm. G. Beaton 235 typus est [K].

Apothecia gregarious, sessile, up to 10 mm in diam. Disc concave, dark rusty brown to purple brown. Receptacle when young deep cup shaped or turbinate, margin incurved, becoming discoid at maturity, irregularly crenate, outer surface brown, distinctly covered by numerous dark brown conical warts. Exposed receptacle hairless but towards the base of the cup abundant basal hyphae are found; these are hyaline, smooth walled, very sparingly septate, 3–7 μ diam., often enmeshing soil particles. Ectal excipulum up to 200 μ thick, pale yellowish brown; the outermost layer thin, one or two cells thick, made up of subglobose, thick walled, brown cells 10–25 μ diam; from the surface of this layer arise numerous low conical warts up to 80 μ high by 50–150 μ diam. at the base, also made up of subglobose, thick walled, dark brown cells up to 20 μ diam.; the main part of the ectal excipulum is composed of a thick layer of polygonal elongated or almost pear-shaped cells, 14–40 μ diam. by up 80 μ long, interspaced by several smaller angular cells; all of these are arranged with their long axes at right angles to the surface of receptacle; the innermost layer of the ectal excipulum is about 20 μ thick, of angular, lobed or subglobose yellowish brown cells up to 15 μ diam. by 25 μ long, usually irregularly orientated but often lying horizontally. Medullary excipulum sharply differentiated but poorly developed, usually less than 60 μ thick, of compact textura porrecta or textura intricata, hyphae pale brown, 2.5–5 μ diam., mostly running in a horizontal direction. Subhymenium up to 100 μ thick, pale yellowish to subhyaline, of interwoven hyphae 4–9 μ diam. with cells distinctly larger towards the hymenium, interspaced with numerous inflated, lobed or polygonal cells up to 20 μ diam. Hymenium about 360 μ thick. Asci long cylindrical, somewhat abruptly narrower near the base, 325–420 × 14–18 μ, 8-spored. Ascospore uniseriate, hyaline, broadly ellipsoidal, when young containing two large oil globules, at maturity covered by coarse pulvinate or rounded tubercles up to 4 μ high by 5 μ diam.; without the ornaments the ascospores measure 20–23.5 × × 12–13.5 μ. Paraphyses simple, 3–4 diam. below, non-septate except near the base, apex subclavate, sometimes slightly curved or lobed, up to 6 μ diam. (Fig. 62–64).

HABITAT AND DISTRIBUTION: on the ground in Victoria.

The shape of the spores, the massive spore ornaments and the construction of its receptacle distinguish this species from the other species of *Jafneadelphus*. Superficially this species resembles *Jafneadelphus argentinus* described below, especially because the relative spore size and the character of their receptacle are almost similar. The two species, however, differ markedly from each other in several important details. The size and the number of cells of their ectal excipulum (compare Fig. 62 and Fig. 68), for example, are very different. They also differ in the type of spore ornaments, the structure of the warts of the receptacle, the size and shape of the ascospores and in the apices of their paraphyses.



Figs. 62–64. *Jafneadelphus calosporus*. 62. Section of ectal and part of medullary excipulum. 63. Asci and paraphyses. 64. Ascospores. (From type).

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On the ground, Caveat-Molesworth Road, near Alexandra, 16 September 1963, G. A. Crichton [comm. G. Beaton 235; type specimen of *Jafneadelphus calosporus* Rifai].

Jafneadelphus ferrugineus (Phill. apud Cooke) Rifai, *comb. nov.*

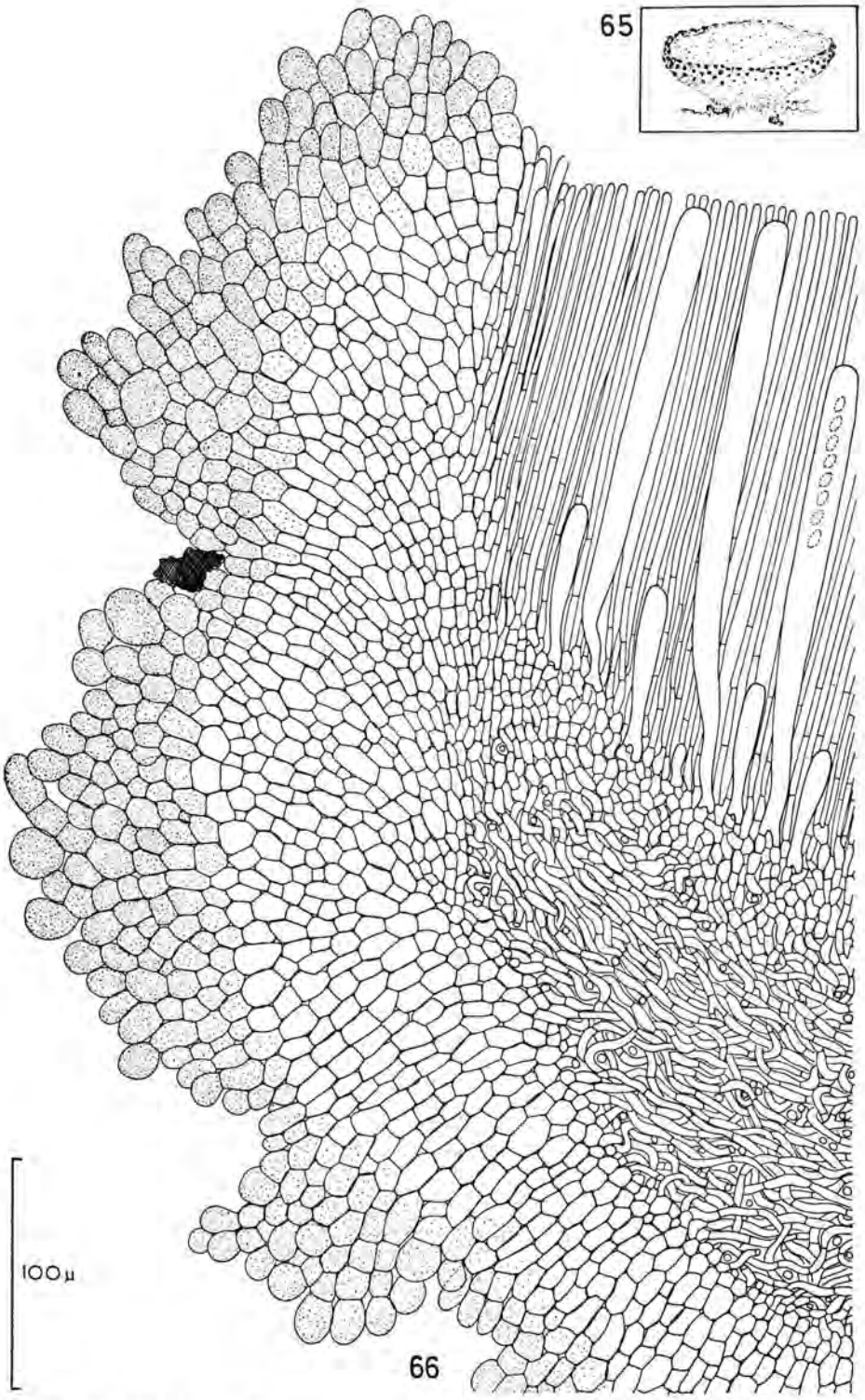
Rhizina ferruginea Phill. *apud* Cooke *in* Grevillea **16**: 74. 1888.

Aleurina tasmanica Massee *in* Bull. misc. Inf. Kew **1898**: 131. 1898 (nomen non rite publicatum?). — *Aleurina tasmanica* Massee *ex* Sacc. & Syd. *in* Sacc., Syll. Fung. **16**: 739. 1902. — *Jafnea tasmanica* (Massee ex Sacc. & Syd.) Gamundi *in* Darwiniana **13**: 584. 1964. [ut (Massee) Gamundi, nomen non rite publicatum?].

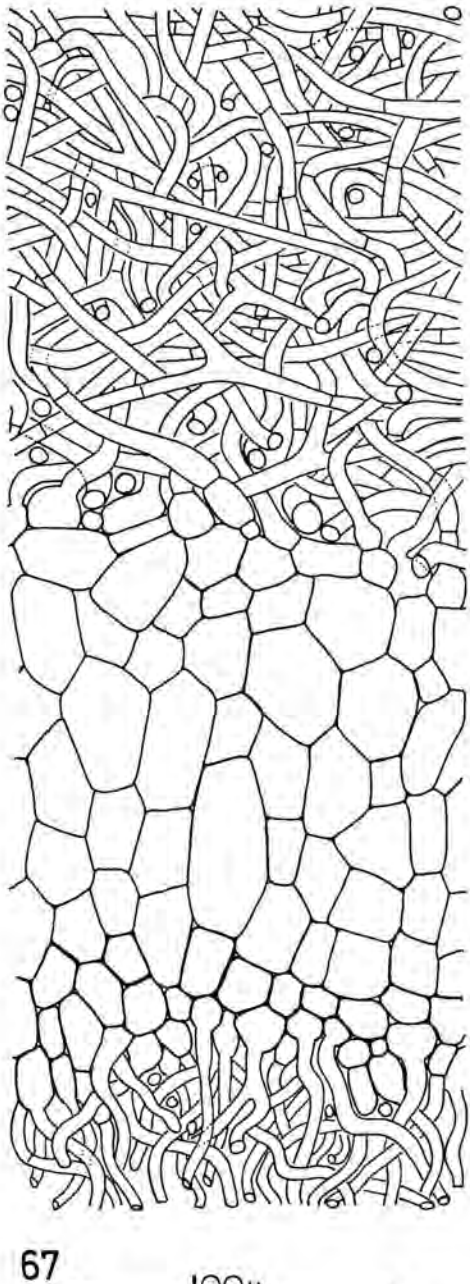
Apothecia scattered to gregarious, subsessile, medium size, up to 20 mm diam. or more. Disc at first concave, becoming almost flat at maturity, rusty, greyish to light blackish brown, sometimes olivaceous. Receptacle at first cupulate, becoming saucer shaped with age, rusty brown, minutely velvety below, margin sometimes somewhat inrolled and usually covered by scattered dark brown conical warts. Exposed receptacle devoid of well defined hairs, but towards the base the surface of receptacle is covered by masses of basal hyphae which are sparingly septate and sometimes branched, subhyaline, smooth walled, 3–6 μ diam., undulate and usually enmeshing soil particles to form a cushion-like pseudostipe. Ectal excipulum up to about 160 μ thick, composed of angular or polygonal elongated cells, pale brownish, 10–38 μ. diam. by up to 50 μ long, usually with their long axes at right angles to the surface of the receptacle (textura angularis to textura prismatica); towards the margin of the cup these cells become smaller and reorientate and run at a low angle with the surface of the receptacle; there is a thin outer layer, one or two cells thick, composed mostly of smaller but thicker walled, darker coloured and more globular cells 10–20 μ diam., from which the basal hyphae arise; near the margin of the cup these globular cells often aggregate and project beyond the surface of the receptacle and form low conical warts which are up to 90 μ high by 200 μ wide at the base. Medullary excipulum up to 1000 μ thick, sharply differentiated from the ectal excipulum, of loosely interwoven, subhyaline to pale yellowish brown, sparingly septate and branched hyphae 2.5–9 μ diam. (textura intricata). Subhymenium up to 100 μ thick, of more tightly interwoven hyphae with shorter, broader and often barrel shaped cells up to 13 μ diam., often like a pseudoparenchymatous tissue. Hymenium about 330 μ thick. Asci long clavate cylindrical, much narrower at the base, 8-spored, 270–360 × 14–21 μ. Ascospores uniseriate, hyaline to subhyaline, when young containing two large oil globules which may disappear at maturity, ellipsoidal, studded with numerous large pulvinate tubercles, which are largest at the polar region of the spore, up to 3.5 μ diam. by 2.5 μ high; without the ornaments the ascospores measure 21.8–29.1 × 11.8–14.5 μ. Paraphyses slender, 3–4.5 μ diam. below, sparingly septate at the base but non-septate above, simple, apex subclavate, up to 7.5 μ diam., containing yellowish brown granules (Fig. 65–67, 69–70).

HABITAT AND DISTRIBUTION: on the ground or on duff in Australia.

In the original description of *Rhizina ferruginea* (Cooke, *1888*) the ascospores is given as 20–23 × 4–5 μ, obviously through a slip of the pen. Both Saccardo (*1889*) and Cooke (*1892*) copied these incorrect and disproportionate spore measurements.



Figs. 65, 66. *Jafneadelphus ferrugineus*. 65. Habit sketch. 66. Median section of margin of apothecium. (From G. Beaton 23).



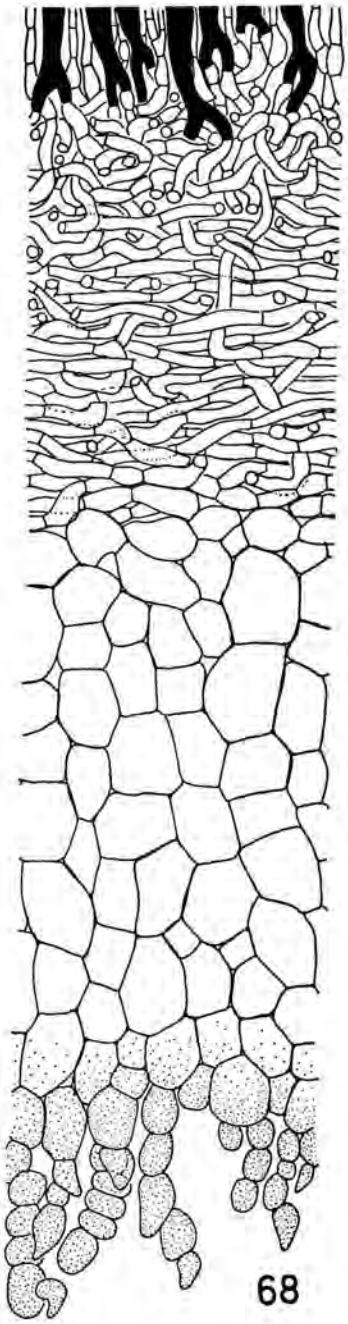
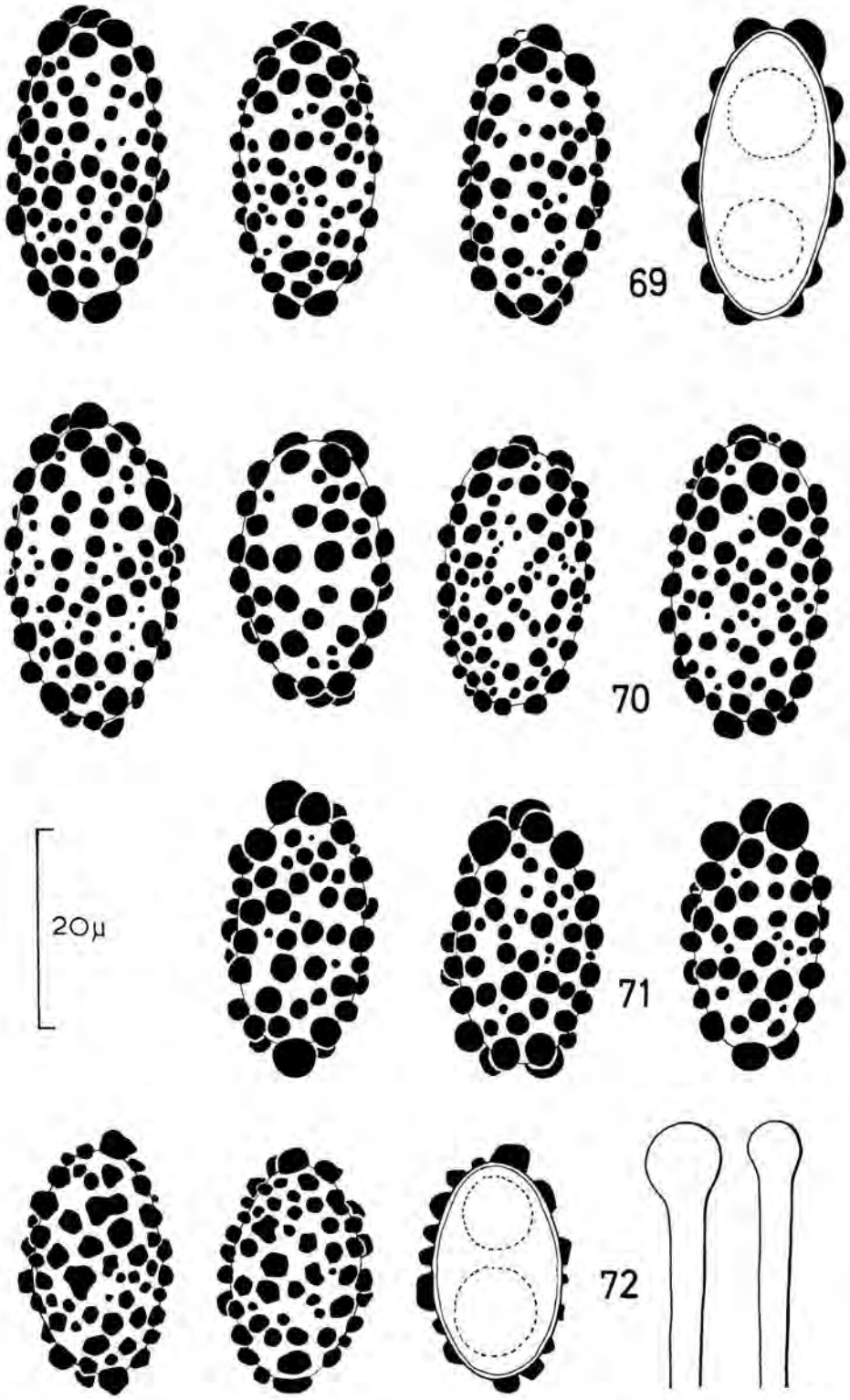


Fig. 67, 68. — *Jafneadelphus ferrugineus*. 67. Basal hyphae, ectal and part of medullary excipulum (From G. Beaton 23). — *Jafneadelphus argentinus*. 68. Part of warts, section of ectal and medullary excipulum, subhymenium and the lower part of hymenium (From type).



Figs. 69–72. — *Jafneadelphus ferrugineus*. 69. Ascospores (From type). 70. Ascospores (From type of *Aleurina tasmanica*). — *Jafneadelphus ferrugineus* subsp. *imaii*. 71. Ascospores (from CUP-Fungi of Japan 2808). — *Jafneadelphus argentinus*. 72. Ascospores and apices of paraphyses (From type).

Aleurina tasmanica Massee (June, *1898*) was probably described before the name *Aleurina* (Sacc.) Sacc. (Saccardo, *1898*) was validly published as a genus. In transferring this species to the genus *Jafnea* no reference was made by Gamundi (*1964*) to the publication where the name *Aleurina tasmanica* was definitely validly published (Saccardo, *1902*) and for this reason under the current "International Code of Botanical Nomenclature" the combination proposed by Gamundi and the new variety described by her may have not been validly published. Since Massee's (*1898*) species is a later synonym of *Jafneadelphus ferrugineus* there is no need to revalidate the combination proposed by Gamundi, but the variety described by her seems to deserve special consideration.

According to Gamundi (*1964*) the Argentinian *Jafnea tasmanica* (Massee) Gamundi var. *singeri* Gamundi differed from its corresponding Australian species – which has not been recorded for Argentina – in having much smaller ascospores. Through the kindness of Dr. Irma J. Gamundi (Buenos Aires) I have been able to study a collection of this interesting fungus (on soil besides a stream, Rio Grande, alrededores de Ushuvaia, Tierra del Fuego, Argentina, 18 January 1964, I. J. Gamundi & M. E. Ranalli, ex BAFC 21702, K, BO) and found that the relationship between these two geographically separate taxa is not as close as was suggested by Gamundi (*1964*). Besides the marked distinction in size, the ascospores of the Argentinian fungus have a slightly different type of ornamentation, because instead of being rounded as in *Jafneadelphus ferrugineus* their ornaments are often more or less angular in outline, so that these ascospores might be more properly described as verrucose instead of tuberculate (Fig. 78). Its medullary excipulum is also different from that of the Australian species, being poorly developed or much thinner but darker coloured and more compact. The surface of the exposed receptacle cannot also be said to be similar, because the conical warts of the Argentinian fungus are less compactly constructed and their individual hair-like, moniliform, brown hyphal components can be easily distinguished (Fig. 68). These warts can be found much further down the surface of receptacle, whereas in *Jafneadelphus ferrugineus* they are more or less confined to the marginal area. The subcapitate paraphyses of the Argentinian form (Fig. 72) are also different from those of *Jafneadelphus ferrugineus*, which are subclavate. This subcapitate character has been correctly illustrated by Gamundi (*1964*) but the presence of septa on the paraphyses shown in her illustration is erroneous; as in the other species of *Jafneadelphus* I find that in the Argentinian collection studied the septation is confined to the basal part of the paraphyses. I propose to call this Argentinian fungus *Jafneadelphus argentinus* Rifai [3]), because I believe that the morphological

[3]) **Jafneadelphus argentinus** Rifai, *spec. nov.* [Syn.: *Jafnea tasmanica* (Massee) Gamundi var. *singeri* Gamundi *in* Darwiniana 13: 584. 1964, nomen non rite publicatum?]. — Apothecia gregaria, cupuliformia vel discoidea, sessilia, brunnea, 2–8 mm diam., verrucosa, verrucae ex hyphis moniliformibus brunneis compositae.

distinctions between the Argentinian and the Australian collections are sufficiently wide to justify their recognition as two different species. Gamundi (*1964*) has provided an extensive illustrated description of this new species.

The Japanese species *Jafnea imaii* Korf (*1960*) was reduced to the synonymy of *Jafnea tasmanica* (=*Jafneadelphus ferrugineus*) by Gamundi (*1964*) although she noted that the spore size of the latter was slightly larger. A study of Korf's original description and illustration as well as of a Japanese collection of this fungus (on mossy soil, between Kiyomizu Temple and Maruyama Park, Kyoto, Hanshu, 4 November 1963, M. Hamada, T. Hongo, Y. Shidei, Y. Doi & R. P. Korf, ex CUP – Fungi of Japan 2808) shows that besides being smaller its ascospores have rounder and taller (up to 4 μ high) tubercles than those of *Jafneadelphus ferrugineus* (Fig. 71), so that the Japanese and the Australian forms should be considered different taxa. It is true that in some Australian collections the ascospores may also be shorter than those of the type specimen of *Jafneadelphus ferrugineus* but they never have ornaments as large as in the Japanese form. Since I have not been able to find further morphological characters with significant diagnostic value to maintain them as two distinct species, and because *Jafneadelphus ferrugineus* has not been found in Japan, it is best to classify the Japanese form as a subspecies of the latter which should be referred to as *Jafneadelphus ferrugineus* (Phill. apud Cooke) Rifai subsp. **imaii** (Korf) Rifai [4]), *stat.* & *comb. nov.*

In Australia this species appears to have been confused with *Peziza brunneo-atra* Desm. The Victorian specimen described by Cooke (*1892*) under the latter name has been found to be identical with *Jafneadelphus ferrugineus*. Since the asci of *Peziza brunneo-atra* are amyloid there should be no difficulty in separating the two species, though macroscopically they may look alike.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On naked ground, Horsham, Doncaster, October 1889, collector unknown, no. 476 [described by Cooke (*1892*) as *Peziza brunneo-atra* Desm.]; on decayed fragments of wood on the ground, Mordialloc, August 1887, C. French [type specimen of *Rhizina ferruginea* Phill. apud Cooke]; on soil on top of range, Caveat-Molesworth Road, 29 September 1962, G. Beaton 23; on soil and decayed plant remains, Forest area, Aboriginal Reserve, Framlingham, 9 August 1964, G. Beaton 238. – Tasmania. On the ground, Cascades, July 1921, L. Rodway; on the ground, Hobart, s. dat., L. Rodway 128 [type specimen of *Aleurina tasmanica* Massee ex Sacc. & Syd.].

Excipulum ectale 150–200 μ, e cellulis pallide brunneis 10–30 μ diam. (textura globulosa vel textura angulari) compositum. Excipulum medullare 80–120 μ, ex hyphis septatis brunneis 3–8 μ diam. (textura intricata) compositum. Asci cylindracei, octospori, 300–360 × 10–17 μ. Ascospori uniseriati, ellipsoidei, hyalini, verrucosi, juventute biguttulati, 17.5–21 × 10–12.7 μ. Paraphyses simplices, ad apicem subcapitatae, brunneae. – Hab. ad terram, prope Ushuaia Fuegiae, 18 Januarii 1964, I. J. Gamundi & M. E. Ranalli, ex BAFC 21702 typus est [BO, K].

[4]) *Jafnea imaii* Korf *in* Nagaoa 7: 7. 1960 (basionymum).

Jafneadelphus asperulus Rifai, *spec. nov.*

Apothecia gregaria, subsessilia, cupulata, demum discoidea, brunnea, extra verrucosa, basi tomentosa. Excipulum ectale e cellulis angularibus 15–40 μ diam. (textura prismatica), excipulum medullare ex hyphis septatis gracilibus 3–6.5 μ diam. constat. Asci subcylindracei, octospori, usque 340 μ longi, 11–15 μ diam. Ascospori ellipsoidei, hyalini, biguttulati, 18.2–22.7 × 9.5–11.8 μ, minute tuberculati. Paraphyses 2.7–3.6 μ diam., apice subclavatae, usque 6.5 μ diam.

Hab. ad terram sabulosam, Meningie, Australia australi, 7 Augusti 1954, L. D. William typus est [K].

Apothecia scattered to gregarious, subsessile or sessile, up to about 12 mm diam. Disc concave, becoming flat with age, dull brown, dark or of other shades of brown. Receptacle at first cup shaped, at maturity appearing saucer shaped, slightly paler than the disc, indistinctly warted near the margin, downy, especially towards the base. Ectal excipulum up to about 160 μ thick; there is a thin outer layer one or two cells thick, mostly of light brown, globose or subglobose cells 10–20 μ diam.; from this layer arise groups of globose, smaller but thicker walled brown cells which are loosely aggregated with each other to form the conical warts; numerous basal hyphae can also be observed to arise from this layer, they are flexous, sparingly septate, yellowish, up to about 6 μ diam. and may enmesh soil particles to form a pseudostipe at the base of receptacle; the inner layer of the ectal excipulum is yellowish, of large polygonal elongated cells 15–40 μ diam. by up to 70 μ long, arranged with their long axes perpendicular to the surface of the receptacle. Medullary excipulum of loose textura intricata or textura porrecta, less than 250 μ thick, hyphae subhyaline, sparingly septate and branched, 3–6.5 μ diam. Subhymenium well differentiated, of compactly interwoven hyphae with cells shorter but wider than those of the medullary excipulum, often irregularly inflated or lobed, 4–8 diam. (textura intricata but often assuming a textura epidermoidea tissue). Hymenium about 320 μ. Asci cylindrical, distinctly narrower near the base, 8-spored, up to 340 μ long by 11–15 μ wide. Ascospore uniseriate, hyaline, ellipsoidal, when young containing two large oil globules which usually disappear at maturity, regularly covered by numerous, small, rounded or pulvinate tubercles which are usually less than 1 μ diam. and high; excluding the markings the ascospores measure 18.2–22.7 × 9.5–11.8 μ. Paraphyses simple, non septate except at the base, slender, 2.7–3.6 μ diam. below, apex, subclavate, up to 6.5 μ diam. (Fig. 73–75).

HABITAT AND DISTRIBUTION: on sand or sandy ground in South Australia (type locality), Victoria and Tasmania.

In contrast to *Jafneadelphus ferrugineus*, the present species and its four-spored variety described below seem to prefer sandy ground. It differs from the former species in the much smaller ascospores and the type of their spore ornaments, these being smaller and more crowded.

The Tasmanian record of *Peziza brunneo-atra* Desm. (Rodway, *1925*) might have been based on *Jafneadelphus asperulus*, or *Jafneadelphus ferrugineus*, because two collections of the present species, one of which was collected in Tasmania, were identified with *Peziza brunneo-atra* by the late L. Rodway.

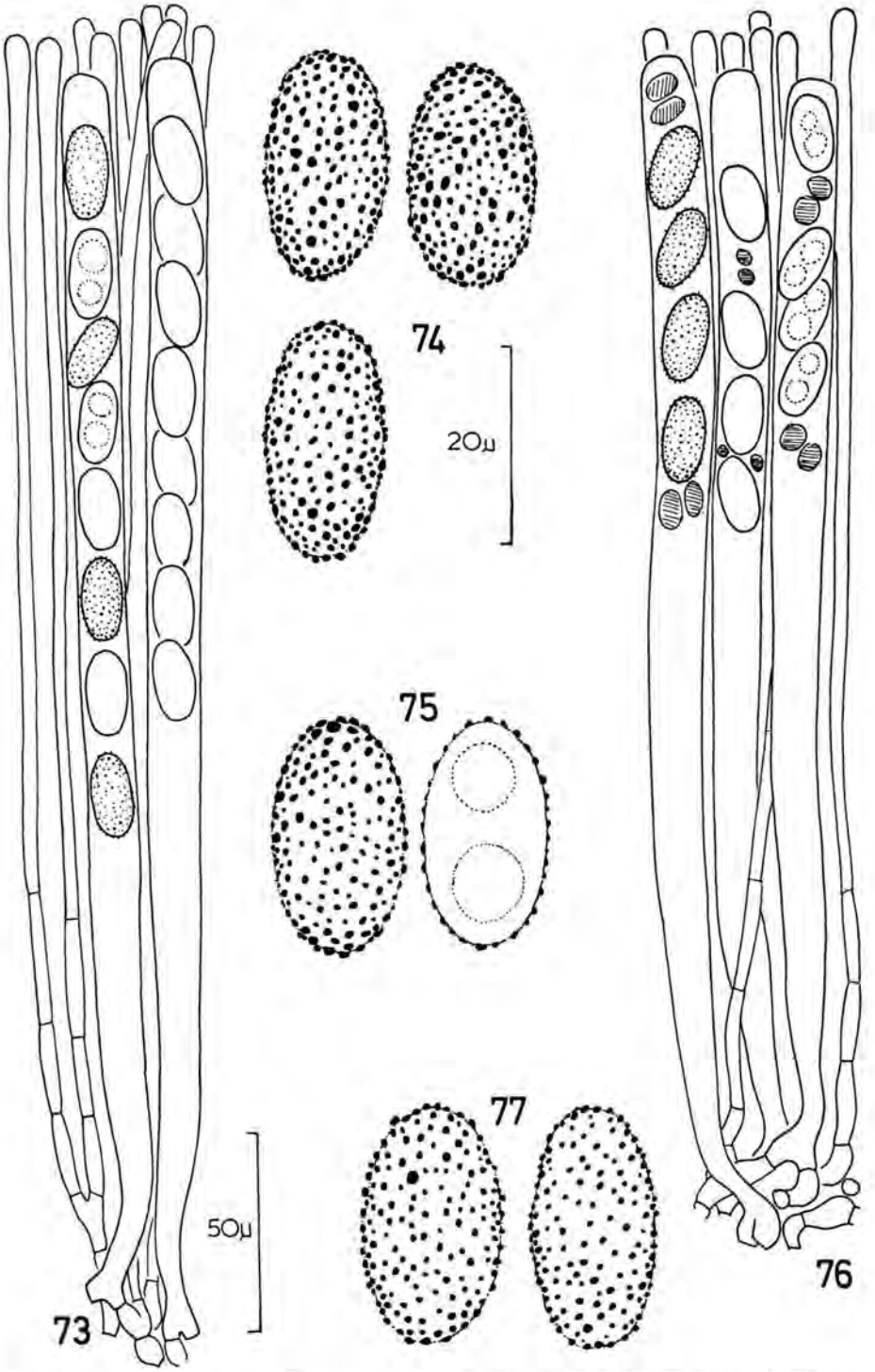


Fig. 73–77. — *Jafneadelphus asperulus*. 73. Asci and paraphyses. 74. Ascospores. (From G. Beaton 204). 75. Ascospores (From type). — *Jafneadelphus asperulus* var. *tetraspermus*. 76. Asci and paraphyses. 77. Ascospores. (From type). — Figs. 73, 76 to same scale.

SPECIMENS EXAMINED

AUSTRALIA. Tasmania. On the ground amongst mosses, Mt. Nelson, September 1922, L. Rodway. — Victoria. On sandy ground, Cheltenham, August, 1923, L. Rodway; on sandy ground, east side of proposed Lower Eleneld National Park, 27 June 1964, C. Beauglehole (comm. G. Beaton 204); on sand, off Moria—Anglesea Road, 4 August 1963, G. Beaton 151. — South Australia. On sandy soil in scrub, Meningie, 7 August 1954, L. D. Williams, ex WARI 3916 [type specimen of *Jafneadelphus asperulus* Rifai]; on sandy ground amidst moss, Meningie, August 1956, L. D. Williams, ex WARI 7523.

JAFNEADELPHUS ASPERULUS Rifai var. **tetraspermus** Rifai, *var. nov.*

A *Jafneadelpho asperulo* var. *asperulo* ascis 4-sporis recedit (Fig. 76–77).

Hab. ad terram sabulosam, Meningie, Australia australi, Julii 1956, L. D. Williams 40, ex WARI 7511 typus est [K].

This variety is segregated from *Jafneadelphus asperulus* var. *asperulus* mainly because its asci ultimately contain only four mature ascospores. The specimen J. H. Warcup has apothecia described on the label as "discoid to convex, not cupulate even when young" and was not stated to have been collected from sandy soil. Further collections and field observations should decide whether this specimen has been correctly classified here.

SPECIMENS EXAMINED

AUSTRALIA. South Australia. On sandy soil, Meningie, July 1956, L. D. Williams 40, ex WARI 7511 [type specimen of *Jafneadelphus asperulus* Rifai var. *tetraspermus* Rifai]; on soil, Delamere S.E., 2 July 1952, J. H. Warcup, ex WARI 2115. — Victoria. On sandy ground in roadside gutter, Mt. Oberon Road, Wilson's Prom., 24 June 1963, G. Beaton 133.

Nothojafnea Rifai, *gen. nov.*

TYPE SPECIES: *Nothojafnea cryptotricha* Rifai.

Apothecia gregaria, minuta vel mediocria, brunnea, subsessilia, cupulata, extra hirsuta. Pili rigidi, hyalini, crasse tunicati, septati. Excipulum ectale e cellulis angularibus (textura angulari), excipulum medullare ex hyphis septatis compositum. Asci cylindracei, octospori, apice jodo non caerulescentes. Ascospori ellipsoidei, hyalini, minute verrucosi, guttulati. Paraphyses septatae, apice incrassatae, brunneae.

Hab. ad terram.

Apothecia gregarious, small to medium size, subsessile. Disc deeply concave, reddish brown to dark brown. Receptacle cup shaped, paler than the disc, indistinctly hairy. Hairs rather short, slender, septate, straight, geniculate or curved, tapered into a fine blunt apex, wall thick, hyaline or subhyaline but the cells may contain brownish sap; numerous short, thick walled and clavate cells which also contain brownish sap can be found side by side with the hairs. Ectal excipulum of textura angularis, the cells arranged with their long axes usually at right angles to the surface of the receptacle. Medullary excipulum sharply differentiated, of compact textura intricata with hyphae mostly running horizontally, slender. Asci subcylindrical, long, 8-spored, wall rather thick, wall or apex not blued

in Melzer's reagent. Ascospore uniseriate, when young containing a few oil globules, hyaline, wall covered with minute warts not distinctly stained with cotton-blue in lactic acid, ellipsoidal. Paraphyses septate, typically unbranched, subclavate at the brownish apex.

HABITAT: on the ground.

The type of the hairs, the character of the ascospores and the structure of the surface of the receptacle distinguish this genus from "*Tricharia*", *Jafnea* and *Jafneadelphus*.

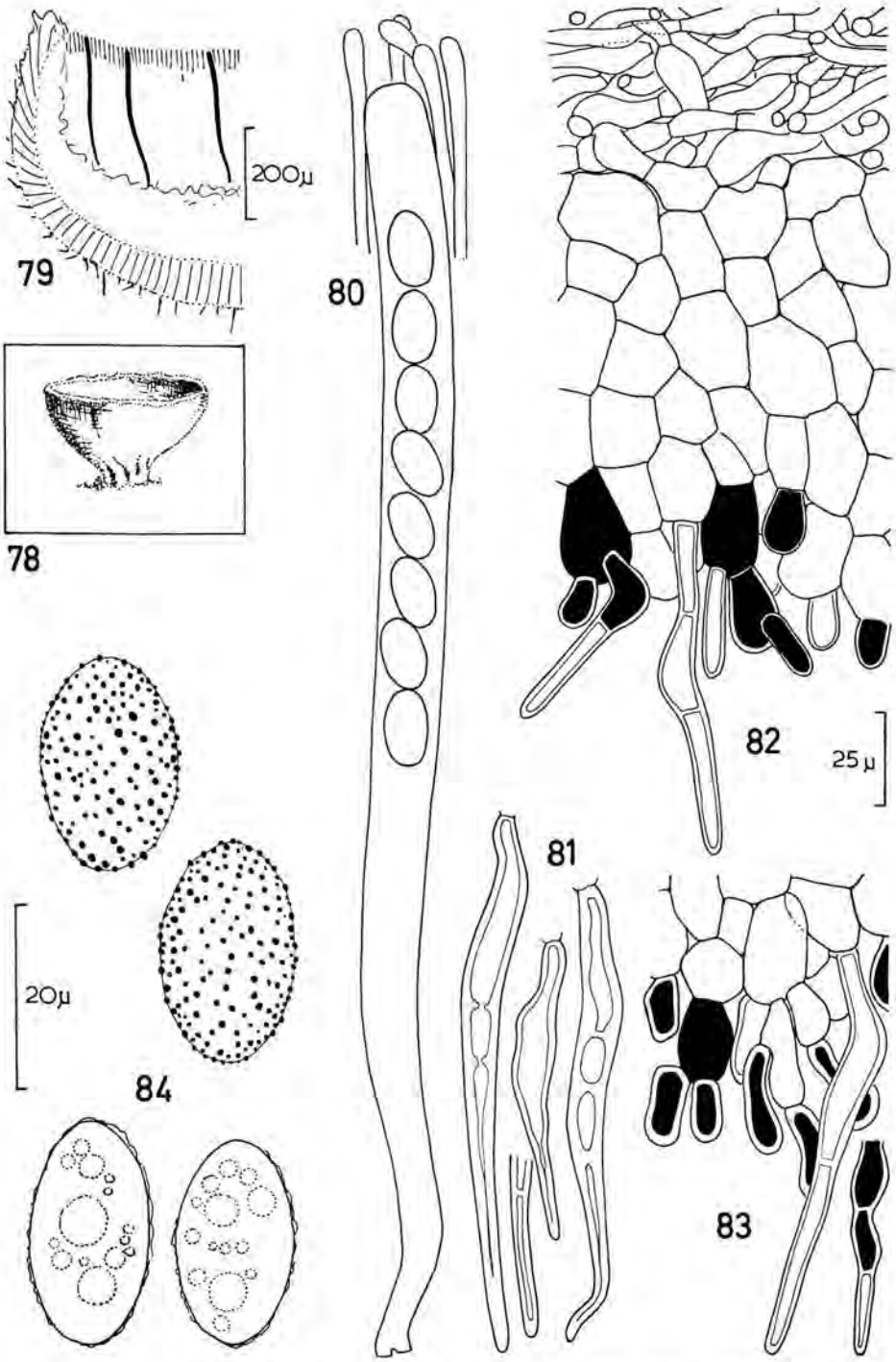
Nothojafnea cryptotricha Rifai, *spec. nov.*

Apothecia gregaria, cupulata, subsessilia, brunnea, usque 12 mm diam. Pili rigidi, hyalini, septati, 70–150(–200) × 8–15 μ, crasse tunicati, geniculati vel recti. Excipulum ectale e cellulis hyalinis, angularibus, 10–30 μ diam. (textura angulari), excipulum medullare ex hyphis septatis hyalinis 2.5–7.5 μ diam. compositum. Asci octospori, crasse tunicati, cylindracei, 290–370 × 15–20 μ. Ascospori ellipsoidei vel late ellipsoidei, minute verrucosi, hyalini, guttulati, 19–26 × 11.8–14.5 μ. Paraphyses graciles, septatae, apice subclavatae, usque 5 μ diam., brunneae.

Hab. ad terram, Rubicon Valley, Victoriae, 2 Octobri 1962, G. Beaton 27 typus est [K].

Apothecia gregarious, pseudostipitate, up to 12 mm diam. Disc deeply concave, dark reddish brown to dark brown. Receptacle cup shaped to almost funnel shaped, contracted below into a broad firm-fleshy pseudostipe, often rugose, especially near the base, slightly paler than the disc but much paler and almost yellowish brown at the bottom of the cup, margin entire or irregularly crenulate, outer surface appearing smooth to the unaided eye, indistinctly hairy under a hand lens. Hairs 70–150(–200) μ long by 8–15 μ diam. at the widest point, thick walled, hyaline or subhyaline but sometimes appearing brownish from the presence of coloured sap, geniculate or gently curved, rarely straight, gradually attenuate from the almost swollen base often into the fine blunt-tipped apex, where the lumen sometimes becomes almost obliterated; side by side with these hairs there are numerous clavate, thick walled cells up to 30 μ long by 10 μ wide which usually contain brownish sap and which often arise from the same cells as the hairs. The pseudostipe is composed of interwoven basal hyphae which are septate, sometimes branched, subhyaline or pale yellowish, 3.5–7 μ diam. and often enmeshing soil particles. Ectal excipulum about 100 μ thick, of large polygonal or subangular elongated cells 10–30 μ diam. by up to 40 μ long, arranged with their long axes at a right angle to the surface of receptacle (textura angularis). Medullary excipulum about 200 μ thick or more, made up of compacted textura intricata, hyphae hyaline, septate, sparingly branched, 2.5–7.5 μ diam.; the majority of these hyphae run in a more or less horizontal direction. Subhymenium of compacted angular elongated cells 4–8 μ diam. Hymenium 300–400 μ thick. Asci cylindrical, narrower towards the base, thick walled, 8-spored, 290–370 × 15–20 μ. Ascospores ellipsoidal to broad ellipsoidal, hyaline, when young containing a few oil globules, minutely and often somewhat indistinctly warted at maturity, 19–26 × 11.8–14.5 μ. Paraphyses slender, 2.5–3.6 μ diam. below, slightly enlarged above to about 5 μ, simple or rarely branched near the base, sparingly septate, with brownish contents (Fig. 78–84).

HABITAT AND DISTRIBUTION: on the ground in Victoria and South Australia.



Figs. 78–84. — *Nothojafnea cryptotricha*. 78. Habit sketch. 79. Diagramatic section of margin. 80. Ascus and paraphyses. 81. Hairs. 82. Hairs and section of ectal and part of medullary excipulum. 83. Hairs and section of ectal excipulum. 84. Ascospores. (78, 80, 81 and 84 from WARI 2536; 79 and 82 from WARI 3133; 83 from WARI 7678). — Figs. 80, 81, 82, 83 to same scale.

The report on the occurrence of *Leucoscypha albo-cincta* (see below under *Leucoscypha rutilans*) in Australia – recorded by Hansford (*1954*) as "*Patella* sp. near *P. albo-cincta* (Berk. & Curt.) Seaver" – appears to have been based on the present species. As far as I am aware all records of that species outside North America have been based on some other species.

The thickness of the hairs of *Nothojafnea cryptotricha* varies from one collection to the other, and in the future it may be worth-while to recognize infraspecific taxa based on this character. In the specimen G. Beaton 24, for example, the hairs are subcylindrical and the apical cells have much wider lumina (Fig. 82) than those of the type specimen.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On soil on top of range, Coveat–Molesworth Road, 29 September 1962, G. Beaton 24; on soil, Rubicon Valley, 2 October 1962, G. Beaton 27 [type specimen of *Nothojafnea cryptotricha* Rifai]; on road bank, off Airey's Inlet–Bambra Road, 4 August 1963, M. Hodges (comm. G. Beaton 154). – South Australia. On the ground amongst moss, Meningie, October 1956, L. D. Williams, ex WARI 7636; on the ground, Warri, October 1923, J. B. Cleland, ex WARI 2536; on mud, Hindmarsh Falls, October 1956, L. Sherwood, ex WARI 7679; on the ground, National Park, 4 October 1924, J. B. Cleland, ex WARI 2534; on the ground Mt. Lofty, 18 September 1920, J. B. Cleland, ex WARI 3133; on open ground, Mt. Lofty, 4 August 1922, J. B. Cleland, ex WARI 3134.

SPHAEROSPORELLA (Svrček) Svrček & Kubička

Sphaerospora (Sacc.) Sacc. subgen. *Sphaerosporella* Svrček *in* Acta Mus. nat. Pragae (B) 4 (6): 63. 1948. – *Sphaerosporella* (Svrček) Svrček & Kubička *in* Česká Mykol. **15**: 66. 1961.

TYPE SPECIES: *Peziza brunnea* Alb. & Schw. ex Fr.

Apothecia gregarious, small to medium size, broadly sessile. Disc concave, brownish coloured. Receptacle saucer shaped or shallowly cup shaped, usually appearing reddish brown from the presence of bunches of brown hairs. Hairs septate, short and sharp pointed in those formed near the margin of the receptacle, longer in those found towards the base of the latter, blunt-tipped, often flexuous and adpressed, superficial. Ectal excipulum of large polygonal or subglobose pale brown cells (textura angularis), arranged with their long axes at a right angle to the surface of receptacle. Medullary excipulum thin, of interwoven, inflated and short celled hyphae. Asci subcylindrical, 8-spored, apex not blued in Melzer's reagent. Ascospores uniseriate, globose, hyaline, containing oil globules, smooth walled but the outer wall occasionally loosens, giving rise to the rough appearance of the spores. Paraphyses slender, clavate at the apex, septate, brownish, unbranched.

HABITAT: on burnt ground, charcoal heaps or damp places amongst mosses.

In the past (Saccardo, *1889*; Massee, *1895*; Seaver, *1928*; Svrček, *1948*; Moser, *1963*) the globose spored and hairy species of operculate cup fungi have been commonly assigned to the genus *Sphaerospora* (Sacc.) Sacc.

Since not all of them are related to each other and the fact that *Sphaerospora* was typified by *Peziza trechispora* Berk. & Br., which is a good species of *Scutellinia*, it is necessary to abandon the name *Sphaerospora* and to reclassify the remaining species somewhere else. Of these there are three or four species which are closely related enough to be accommodated in a genus of their own. The generic name *Sphaerosporella* (Svrček) Svrček & Kubička, typified by the old species *Peziza brunnea*, is available for this group of fungi (Svrček & Kubička, *1961*).

The morphology of the last named species resembles those of some species of *Anthracobia* in some respects but differs in the characters of its hairs, paraphyses and ascospores. The adpressed and banched hairs of *Sphaerosporella* are stouter, and more well developed than those of *Anthracobia*; furthermore those near the margin have sharp pointed apices. The spore walls sometimes appear to loosen their outer layer, often causing the spore to have a rough appearance. These globose spores usually contain a highly refractive bubble, and also oil globules.

Boudier (*1907*) and Dennis (*1960*) classified *Peziza brunnea* as *Ciliaria* and *Scutellinia* respectively but the rooting and fork-based hairs which are so characteristic of *Scutellinia* are absent. The excipular structure and the colour of the apothecia of *Peziza brunnea* are likewise ill-fitting for a species of *Scutellinia*. Similarly this coloration and the type of hairs also seem to exclude this species from *Trichophaea* where Batra & Batra (*1963*) would range it.

Members of *Sphaerosporella* which have been successfully grown in culture produce similar "*Botrytis*"-type conidial states. As has been pointed out by Cain & Hastings (*1956*) these conidial states are not congeneric with *Botrytis cinerea* Pers. ex Fr., the type species of the genus *Botrytis*, because of the difference in the structure of their conidiophores. Dr. G. L. Hennebert of Heverlee, Belgium, who at present is engaged in a taxonomic revision of these groups of fungi, will propose a new genus for the conidial state of *Peziza brunnea* and its closely related forms (pers. comm., 1964).

SPHAEROSPORELLA BRUNNEA (Alb. & Schw. ex Fr.) Svrček & Kubička

Peziza brunnea Alb. & Schw., Consp. Fung. 317. 1805. — *Peziza brunnea* Alb. & Schw. *ex* Fr., Syst. mycol. **2**: 83. 1822. — *Lachnea brunnea* (Alb. & Schw. ex Fr.) Gill., Champ. Fr., Discom. 72. 1879. — *Humaria brunnea* (Alb. & Schw. ex Fr.) Karst. *in* Acta Soc. Fauna Fl. fenn. **2** (6): 121. 1885. — *Sepultaria brunnea* (Alb. & Schw. ex Fr.) Lamb., Fl. mycol. Belg., Suppl. **1**: 302. 1887 (misapplied). — *Scutellinia brunnea* (Alb. & Schw. ex Fr.) O. Kuntze, Rev. Gen. Pl. **2**: 869. 1891. — *Sphaerospora brunnea* (Alb. & Schw. ex Fr.) Massee, Brit. Fung.-Fl. **4**: 295. 1895. — *Ciliaria brunnea* (Alb. & Schw. ex Fr.) Boud., Hist. Class. Discom. Eur. 62. 1907. — *Sphaerosporella brunnea* (Alb. & Schw. ex Fr.) Svrček & Kubička *in* Česká Mykol. **15**: 65. 1961. — *Trichophaea brunnea* (Alb. & Schw. ex Fr.) Batra *apud* Batra & Batra *in* Univ. Kansas Sci. Bull. **44**: 167. 1963.

Peziza sphaeroplea Berk. & Curt. *apud* Cooke *in* Bull. Buffalo Soc. nat. Sci. **2**: 289. 1875. — *Barlaea globifera* (Berk. & Curt. apud Berk.) Sacc. var. *sphaeroplea* (Berk. &

Curt. apud Cooke) Sacc., Syll. Fung. 8: 114. 1889. — *Barlaeina globifera* (Berk. & Curt. apud Berk.) Sacc. & Trav. var. *sphaeroplea* (Berk. & Curt. apud Cooke) Sacc., Syll. Fung. 19: 139. 1910.

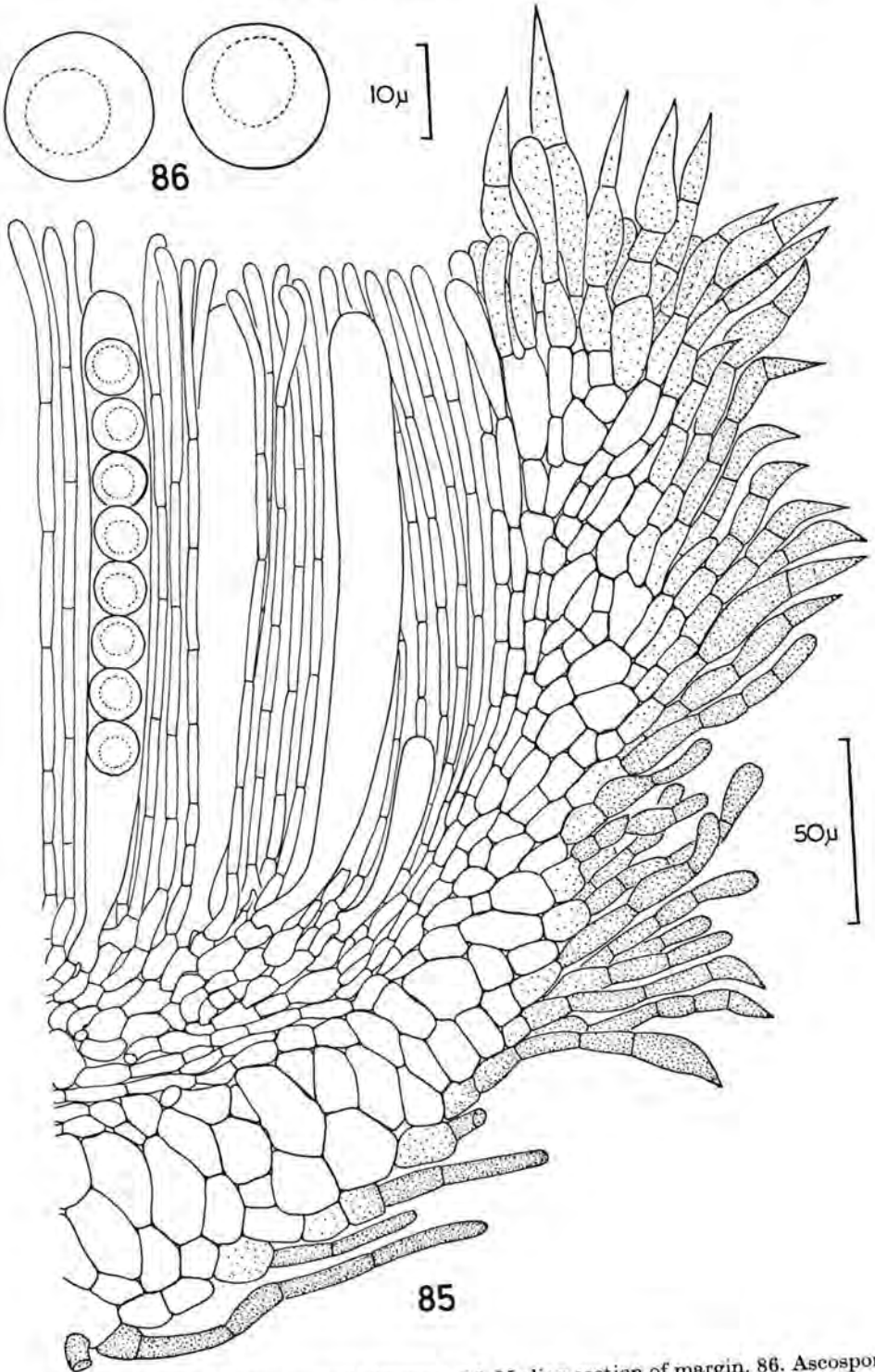
? *Sphaerospora phillipsii* Massee, Brit. Fung.-Fl. 4: 295. 1895.

Apothecia gregarious to densely crowded, broadly sessile, 3–6 mm diam. Disc concave, pale brown to brown or reddish brown. Receptacle saucer shaped or shallow cup shaped, brownish, a little darker or concolorous with the disc, covered by vertical bars of bunches of adpressed dark brown hairs, especially towards the margin, generally appearing more distinctly hairy towards the base. Margin of receptacle rather wide, covered by numerous, 1–4-celled, subhyaline or pale brown, fusiform or subulate and sharp pointed hairs 30–60 μ long by 7–12 μ diam., those on the surface of receptacle often geniculate at their base; immediately below the margin there are bunches of adpressed, blunt or sharp pointed, reddish or yellowish brown, cylindrical hairs up to 100 μ long and 6 μ diam.; still further below numerous superficial, blunt tipped, brown coloured hairs about 200×10 μ are formed, usually thicker walled, stout, straight, curved or flexuous; at the base of the receptacle numerous hairs with similar structure but mostly undulate and considerably elongate anchored the apothecia to the substrate. Ectal excipulum of pale brown, thin walled, large polygonal elongate cells up to 40 μ diam. with their long axes at right angles to the surface of receptacle. Medullary excipulum thin, of short celled, interwoven, branched hyphae 4–10 μ diam., with cells often inflated or irregularly lobed. These hyphae then pass into the more homogeneous (about 8 μ diam.) interlocked, even shorter celled subhymenium. Asci cylindrical or clavate cylindrical, rounded at the apex, gently narrower towards the base, then abruptly attenuate near the short stalk-like base, 8-spored, $180–210 \times 16–19$ μ. Ascospores uniseriate, hyaline, globose, with one or rarely more oil drops, more often with one highly refractive bubble, 13–16(–18) μ diam., smooth walled, but sometimes some of them appear to be covered by a loose coating which may cause the ascospores to appear asperate. Paraphyses slender, 2.5–4 μ diam. below, slightly enlarged to 6–7 μ diam. at the apex, sparingly septate, not branched, filled with brownish granules (Fig. 85–86).

HABITAT AND DISTRIBUTION: on burnt ground and charcoal heaps amongst mosses in Europe (type locality Germany), North America, India, Australia.

Dr. J. Webster and Dr. M. S. H. El-Abyad (Sheffield) showed me that in culture this species produce a "*Botrytis*"-type conidial state, similar in structure to those produced by *Trichophaea abundans* (Karst.) Boud. (Webster, Rifai & El-Abyad, *1964*) and "*Sphaerospora*" *minuta* Cain & Hastings (*1956*). The colonies grow rather slowly, are brownish white and produce rather scanty conidiophores and conidia. The blastogenous conidia are globose and smooth walled, subhyaline, 6–12.5 μ in diameter, produced singly but simultaneously by denticles on the vesicles that terminate the dichotomosly branched conidiophores.

There has been some confusion as to the limits of the species and the correct specific name of *Peziza brunnea*. von Albertini & von Schweinitz (*1805*) originally described this species from specimens collected "in carbonariis sylvaticis humidis vetustis" and part of von Schweinitz's



Figs. 85, 86. *Sphaerosporella brunnea*. 85. Median section of margin. 86. Ascospores. (From the Brisbane specimen).

collection in Herb. Kew. from North America (In carboneum, *Peziza brunnea*, Herb. Schwein.! [scripsit Berkeley]) is taken here as its neotype specimen. Seaver (*1928*) was apparently right when he used this name only for collections from burnt ground. The lectotype specimen of the pyrophilous species *Peziza sphaeroplea*, which was doubtfully reduced to the synonymy of the present species by Seaver, has been found to be indistinguishable from Schweinitz's material.

However, there are many collections from brunt places which were also identified as *Ciliaria hinnulea* or as *Sphaerospora confusa* or under the respective genera to which these two names have been transferred. Berkeley & Broome (*1871*) described *Peziza hinnulea* based on a specimen collected by Broome (on damp ground among grass, Powerscourt, Ireland, 27 September 1867, C. E. Broome; type specimen). Later Massee (*1895*) redescribed it more fully and remarked that this species was "very closely allied to *S*[*phaerospora*] *brunnea*, if indeed truly distinct; differing mainly in the reddish tone of the ascophore." He correctly indicated the substrate as damp ground. Ellis (*1882*) published a description of *Peziza scutelloides* and an examination of the original collection (on the ground, West Chester, Pennsylvania, July 1881, Everhart, Haines, Jafferis & Gray; Ellis, North American Fungi 838 sub *Peziza scutelloides*; cotype specimen) shows that this species is identical with *Peziza hinnulea* as has been suggested by Seaver (*1928*).

Seaver (*1928*) distinguished *Peziza brunnea* from *Peziza hinnulea* as follows: "– Apothecia small, 1–6 mm. in diameter, forming congested masses on burned places . . . (*Sphaerospora brunnea*). – Apothecia large, reaching 1 cm. in diameter, scattered, on sandy soil in woods . . . (*Sphaerospora hinnulea*)." He listed *Peziza confusa* Cooke, however, as a synonym of *Peziza brunnea* although Cooke (*1875*) originally introduced the former species for the specimen which was not collected from burnt places (on clay in loamy soil, Poughkeepsie, New York, U.S.A., s. dat., W. Gerard; type specimen). Cooke (*1875*) introduced this species on the assumption (quite correctly in the case of the type material!) that it had different pigmentation from the figure of *Peziza brunnea* given by von Albertini & von Schweinitz (*1805*). The specific epithet 'confusa' has been aptly used here since from the very beginning several pyrophilous collections have been confused with it by Cooke (*1875*), Phillips (*1887*), Massee (*1895*), Boudier (*1907*) and others. Since the type specimen of *Peziza confusa* is not specifically distinct from that of *Peziza hinnulea* it is proposed here to reduce the former name also to the synonymy of **Sphaerosporella hinnulea** (Berk. & Br.) Rifai, *comb. nov.* [5]). The specific delimitations

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[5]) *Peziza hinnulea* Berk. & Br. *in* Ann. Mag. nat. Hist. IV 7: 433. 1871 (basionym). – *Lachnea hinnulea* (Berk. & Br.) Phill., Brit. Discom. 219. 1887. – *Crouania hinnulea* (Berk. & Br.) Lamb., Fl. mycol. Belg., Suppl. 1: 319. 1887. – *Barlaea hinnulea* (Berk. & Br.) Sacc., Syll. Fung. 8: 117. 1889. – *Sphaerospora hinnulea* (Berk. & Br.) Massee, Brit. Fung.-Fl. 4: 294. 1895. – *Ciliaria hinnulea* (Berk. &

adopted for *Sphaerosporella brunnea* and *Sphaerosporella hinnulea* thus are in agreement with the ones formulated by Seaver (*1928*); as additional characters the more obvious reddish coloration of the discs of *Sphaerosporella hinnulea* and the presence of some shades of purple in its young apothecia should be mentioned. This species seems to be rarer than the pyrophilous one; Wolf (*1963*) reported that in culture *Sphaerosporella hinnulea* also formed a "*Botrytis*"-type conidial state which strongly resemble the conidial state of *Sphaerosporella brunnea*.

There are obvious variations in the macroscopic characters of *Sphaerosporella brunnea*. The Australian specimen, which has been recorded as *Lachnea confusa* by Cooke (*1892*), has whitish brown fruit bodies with rather scanty hairs. In contrast, a British collection (W. D. Graddon 939, described and illustrated as *Scutellinia hinnulea* by Dennis, *1960*) has dull reddish brown apothecia and numerous dark brown hairs, especially towards its base; transitional forms between these two collections, however, are numerous.

Phillips (*1887*) described the ascospores of *Sphaerosporella brunnea* as "globose, asperate, 15–18 μ", based on observations made by Broome. As has been pointed out earlier, there is a tendency in this species to loosen its outer spore coating and in doing so the spores may appear asperulate or sometimes almost tuberculate, which may also make the spores appear larger. The specimen used by Broome and Phillips (*1887*) in making their observations was apparently not preserved, but nevertheless because of the difference in the ascospore "roughening" and measurement, Massee (*1895*) proposed the new species *Sphaerospora phillipsii* Massee to accommodate it. From the above account it will be obvious that this difference has no diagnostic value for separating species. Although the substrate was merely indicated as the ground by Phillips (*1887*) it is proposed here to treat *Sphaerospora phillipsii* as a synonym of *Sphaerosporella brunnea* because in Phillips' description it was stated that its apothecia were gregarious to subcaespitose, varying in diameter from 1 to 2 lines (3–6 mm).

Peziza schizospora Phill. (*in* Grevillea 3: 31. 1874), has often been regarded as a synonym of the present species. Though closely related, *Peziza schizospora* does not seem to be identical with *Sphaerosporella*

Br.) Boud., Hist. Class. Discom. Eur. 62. 1907. — *Barlaeina hinnulea* (Berk. & Br.) Sacc. & Trav. *in* Sacc., Syll. Fung. 19: 139. 1910. — *Scutellinia hinnulea* (Berk. & Br.) Dennis, Brit. Cup Fungi 26. 1960 (misapplied, = *Sphaerosporella brunnea*).

Peziza confusa Cooke *in* Bull. Buffalo Soc. nat. Sci. 2: 291. 1875. — *Lachnea confusa* (Cooke) Phill. *in* Grevillea 18: 83. 1889. — *Sphaerospora confusa* (Cooke) Sacc., Syll. Fung. 8: 190. 1889. — *Sphaerosporula confusa* (Cooke) O. Kuntze, Rev. Gen. Pl. 3 (3): 530. 1898. — *Ciliaria confusa* (Cooke) Boud., Hist. Class. Discom. Eur. 62. 1907. — *Trichophaea confusa* (Cooke) Berthet *in* Bull. Soc. mycol. Fr. 82: 473. 1966.

Peziza scutelloides Ellis *in* Bull. Torrey bot. Club. 9: 18. 1882. — *Sphaerospora scutelloides* (Ellis) Sacc., Syll. Fung. 8: 188. 1889. — *Sphaerosporula scutelloides* (Ellis) O. Kuntze, Rev. Gen. Pl. 3 (3): 530. 1898.

brunnea because the former has hairless apothecia. So far it is only known from one collection (on burnt sandy soil, Wrekin, Salop, s. dat., W. Phillips; type specimen) and the decision on the affinity and identity of this species apparently has to be deferred until a careful search for it is made on burnt places in Great Britain.

SPECIMENS EXAMINED

AUSTRALIA. Queensland. On burnt ground, Brisbane, s. dat., collector unknown, no. 166.

EUROPE. Great Britain. On charcoal heaps, Birnam near Dunkeld, Perthshire, 12 August 1954, W. D. Graddon 939 .— Netherlands. On burnt ground in peat moss, de Peel, West of Helenaveen, prov. Noord-Brabant, 13 June 1961, C. Bas 2340. — Sweden. On burnt spot in coniferous wood, Stadsskogen, Uppsala, Uppland, 9 July 1949, Berit & J. Eriksson. — Belgium. Sur la terre brûlée, à Groenendael, près de Bruxelles, Octobre 1883, E. Bommer & M. Rousseau (C. Roumeguère, Fungi gallici exs. no. 2768 sub *Peziza hinnulea*).

AMERICA. U.S.A. On burnt earth, South Carolina, s. dat., Curtis 1991 [lectotype specimen of *Peziza sphaeroplea* Berk. & Curt. apud Cooke]; ibid., Curtis 2974; "in carboneum, *Peziza brunnea*, Herb. Schwein.!" [neotype specimen of *Peziza brunnea* Alb. & Schw. ex Fr.].

TRIBE CILIARIEAE

The tribe Ciliarieae was originally proposed by Boudier (*1885*) to accommodate the genera of the Humariaceae which have well developed hairs and mostly also carotenoid pigmentation. This circumscription is generally still adopted today (Le Gal, *1947*, *1953*; Dennis, *1960*) with the exception of Korf (*1954*, *1960*) who would classify in it some non-carotenoid genera as well, such as *Sepultaria* (Cooke) Lamb., *Mycolachnea* Maire (as *Humaria* Fuckel emend. Korf & Denison) and *Jafnea* Korf. In the present study the tribe Ciliarieae is restricted to those genera which are considered to be closely related to its type genus only, such as *Geneosperma* Rifai [6]), *Scutellinia* (Cooke) Lamb. emend. Le Gal [including *Sphaerospora* (Sacc.) Sacc. s. str. and *Melastiziella* Svrček], *Rhizoblepharia* Rifai, *Cheilymenia* Boud. and also the hairless genus *Coprobia* Boud. If *Trichophaea erinaceus* (Schw.) Le Gal sensu Le Gal (*1953*) is really not congeneric with *Scutellinia scutellata* because of its suboperculate asci, then a new genus will have to be created for it, because this species cannot

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[6]) **Geneosperma** Rifai, *gen. nov.* — Apothecia gregaria, mediocria, rubro-aurantiaca, sessilia, patelliformia, hirsuta. Pili rubro-brunnei, crasse tunicati, septati, acuminati, basi saepe appendice radiciformi aucti. Excipulum ectale ex cellulis crassis angularibus (textura angulari), excipulum medullare ex hyphis septatis compositum. Asci subcylindracei, octospori, apice jodo haud tincti. Ascospori uniseriati, hyalini, ellipsoidei, guttulati, verrucosi, utrinque appendiculati, processibus utrinque acutis lateraliter subappressis et apicibus conoideo-folliculatis. Paraphyses septatae, superne rectae, clavatae.

Hab. ad lignum putridum inter muscos in India orientali, Malesia et Japonia.

Species typica generis: *Peziza geneospora* Berk.

be accepted as a species of *Trichophaea* Boud. (Kanouse, *1958*; Denison, *1961*). The latter genus belongs to the tribe Lachneae.

The distinguishing character of this tribe as it is understood here lies in the combination of the habitat, apothecial construction, type of hair and ascospore, as well as the habit of the apothecia. To be excluded from the Ciliarieae are the genera *Melastiza* Boud., *Leucoscypha* Boud. [including *Neottiella* (Cooke) Sacc.], and *Anthracobia* Boud., which are being removed to the tribe Aleurieae. This is largely because the structure of the excipular tissue and the type of hair of these genera show closer similarity to those of the genus *Aleuria* Fuckel than to those of *Scutellinia*. The cells of the ectal excipulum of many genera of the tribe Aleurieae are smaller, more regular both in shape and arrangement and hence their tissue has a closer resemblance to the textura prismatica than that of the Ciliarieae has. Many genera of the Aleurieae have well developed prosenchymatous medullary excipulum with distinct filamentous, sometimes very delicate components. The habitat appears to be a valuable character in distinguishing the Ciliarieae from the Aleurieae, because the majority of species of the present tribe are either lignicolous or growing on spent hops, dung or other vegetable remains and only rarely have some of them a terrestrial habitat. In contrast almost all members of the Aleurieae are terricolous species, although some are known to live saprophytically or parasitically on mosses or hepatics.

The genera of the tribe Ciliareae are separated from each other by the characters of their ascospores such as the presence or absence of oil globules and the nature of their outer spore walls. In *Scutellinia* the ascospores are ellipsoidal or globose, distinctly guttulate, their outer walls are not readily separable when heated in lactic acid but are covered by callose-pectic spore ornaments of various sizes and shapes. The ascospores of *Rhizoblepharia* and *Cheilymenia* have no conspicuous oil globules. *Rhizoblepharia* has fusiform ascospores which are covered by delicate transverse ridges or folds which are not stained blue in cotton-blue in lactic acid and often form a germpore-like mark near each pole. Their outer walls are not separable when heated in lactic acid. In contrast, the ellipsoidal and mostly smooth walled ascospores of the genus *Cheilymenia* are provided with delicate outer walls which loosen and become visible when these ascospores are heated in lactic acid. **Geneosperma geneospora** (Berk.) Rifai [7]), *comb. nov.* has similar ascospores to members of *Scutellinia*

[7]) *Peziza geneospora* Berk. *in* Hook. J. Bot. 3: 203. 1851 (basionymum). — *Lachnea geneospora* (Berk.) Sacc., Syll. Fung. 8: 178. 1889. — *Scutellinia geneospora* (Berk.) O. Kuntze, Rev. Gen. Pl. 2: 896. 1891.

Lachnea appendiculata P. Henn. *in* Warburg, Monsunia 1: 35. 1900. — *Humaria appendiculata* (P. Henn.) Boedijn *in* Sydowia 5: 212. 1951.

Lachnea fleischeriana P. Henn. *in* Warburg, Monsunia 1: 35. 1900. — *Ciliaria fleischeriana* (P. Henn.) Overeem *in* Icon. Fung. mal. Hft 9: 1. 1925.

Lachnea folliculata von Höhnel *in* Sber. Akad. Wiss. Wien (Math.-nat. Kl., I) 117: 396. 1909.

in that they are guttulate and coarsely warted but these ascospores are enveloped by a thin, hyaline, loose, fusiform apiculate and membrane-like follicle (Fig. 87–88; figured from a specimen growing on decayed wood, Tjibodas, Java, 1907–1908, von Höhnel, which is part of the type specimen of *Lachnea folliculata* von Höhnel). The morphological distinction between *Geneosperma* and *Scutellinia* can apparently be regarded as almost analogous with the characters that separate the latter genus from *Cheilymenia*. With the exception of a few species of *Cheilymenia*, members of the Ciliarieae belonging to the genera discussed above have very characteristic rooting hairs which usually originate from deep within the excipular tissue. Despite the lack of hairs, however, there is no doubt that the genus *Coprobia* should be included in the present tribe because of its close relationship with *Cheilymenia*, an unquestioned member of the Ciliaricae. Denison (*1964*) has even remarked that it might be necessary in the future to merge these two genera.

KEY TO GENERA OF THE CILIARIEAE

1a. Ascospores enveloped by a thin, hyaline, loose, fusiform apiculate and membrane-like follicle . . . . . [*Geneosperma* Rifai]
b. Ascospores without loose, fusiform follicle 2
2a. Ascospores with delicate outer walls which loosen and become visible when heated in lactic acid 4
b. Ascospores with outer walls not loosened when heated in lactic acid . . . 3
3a. Ascospores fusoidal, non-guttulate, covered by delicate transverse ridges or wrinkles . . . . . *Rhizoblepharia* Rifai
b. Ascospores globose, subglobose or ellipsoidal, guttulate, ornamented with minute to coarse callose-pectic warts, spines or reticula *Scutellinia* (Cooke) Lamb. emend. Le Gal
4a. Apothecia hairy . . . . . *Cheilymenia* Boud.
b. Apothecia not hairy . . . . . *Coprobia* Boud.

Rhizoblepharia Rifai, *gen. nov.*

TYPE SPECIES: *Rhizoblepharia jugispora* Rifai.

Est *Scutellinia* sed ascosporae fusoideae eguttulatae, tunica sulcis transversis e materie non calloso-pectica compositis ornata.

Hab. ad terram humidam.

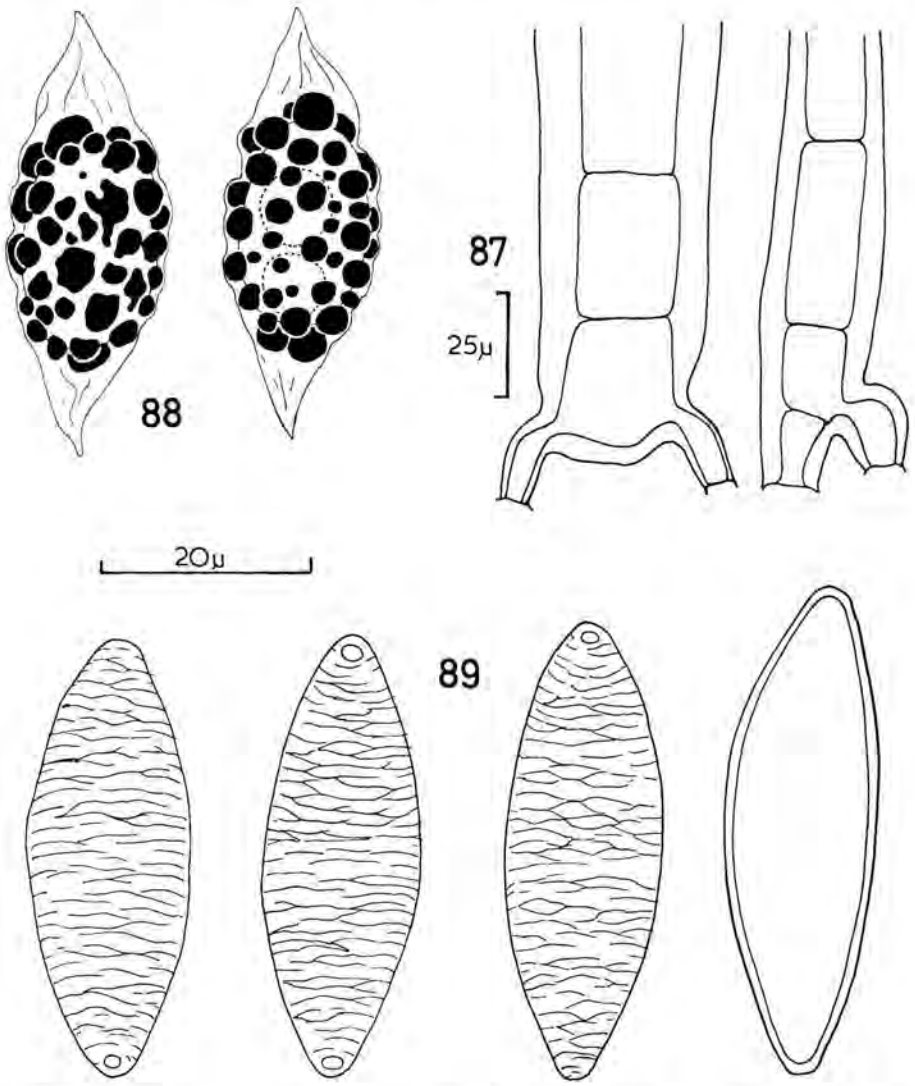
Apothecia gregarious, small, broadly sessile. Disc shallowly concave or flat. Receptacle saucer shaped, beset with brownish hairs which may form a fringe-like border. Rooting hairs numerous, acuminate, septate, originating from within the excipular tissue, base distinctly forked, walls thick, dark reddish brown; simple superficial apothecial hairs are also present. Ectal excipulum of large isodiametric or elongated polygonal or subglobose cells (textura angularis). Medullary excipulum well differentiated, of compact, intricate, coarse, short celled constricted hyphae. Asci cylindrical, 8-spored, apex not blued in Melzer's reagent. Ascospores uniseriate, fusoidal, non guttulate, subhyaline to pale yellowish, ornamented with delicate transverse and sometimes anastomosing wrinkles or ridges which

do not appear to be affected by cotton-blue in lactic acid and often form a germpore-like mark at the ends of the spores. Paraphyses slender, sparingly septate, apex slightly enlarged, straight.

HABITAT: on damp ground.

Rhizoblepharia jugispora Rifai, *spec. nov.*

Apothecia minuta 0.5–2.5 mm diam., gregaria vel caespitosa, patellariformiter expansa, hirsuta. Pili rigidi, crasse tunicati, rubro-brunnei, septati, usque 900 μ longi, 20–35 μ crassi, basi saepe appendicem radiciformem gerentes. Excipulum ectale e cellulis angularibus 20–40 μ diam. (textura angulari) compositum. Asci



Figs. 87–89. — *Geneosperma geneospora*. 87. Bases of rooting hairs. 88. Ascospores. (From type of *Lachnea folliculata*). — *Rhizoblepharia jugispora*. 89. Ascospores (From type).

subcylindracei, octospori, 180–200 × 16–20 μ. Ascospori 34.5–44.5 × 12–15 μ, uniseriati, subhyalini, eguttulati, fusoidei, tunica sulcis transversis ornata. Paraphyses septatae, rectae, 2.5–3.6 μ diam., superne incrassatae usque 5 μ diam.

Hab. ad terram, prope Lower Glenelg River, Victoriae, 21 Junii 1964, C. Beauglehole, comm. G. Beaton 202 typus est [K].

Apothecia gregarious to caespitose, small, 0.5–2.5 mm diam. Disc shallowly concave or flat or somewhat undulate, colour when fresh unknown, now appears pale yellowish brown. Receptacle saucer-shaped, broadly sessile, appearing brownish from the presence of numerous rigid bristle-like hairs which often form a fringe-like border around the margin of the cup. Rooting hairs numerous, base typically irregularly forked and deeply buried in the excipular tissue, dark reddish brown, acuminate, with up to 20 transverse septa, up to about 900 μ long by 20–35 μ diam. at the widest point. Apothecial hairs which arise from the surface layer of the ectal excipulum are also present; they are acuminate but less massive, pale brownish-yellow, thin-walled, 0–5-septate, 40–180 × 10–17 μ diam., base often bulbous to about 20 μ diam. Ectal excipulum made up of angular or subglobose cells, wall rather thick, very pale yellowish coloured, 20–40 μ diam. (textura angularis), towards the margin of the cup the cells becoming smaller and more angular. Medullary excipulum of compactly interwoven, coarse short-celled constricted hyphae. Hymenium about 195 μ thick. Asci subcylindrical, only slightly attenuate towards the base, 8-spored, 180–200 × 16–20 μ. Ascospores obliquely uniseriate, their ends usually overlapping, fusoidal, sometimes asymmetrical, without oil globules, hyaline, subhyaline or pale yellowish, at first smooth walled, but at maturity the outer walls, which do not loosen when heated in lactic acid, becoming finely subreticulate from the presence of transversely running, sometimes anastomosing delicate wrinkles or ridges which appear to be unstained with cotton-blue in lactic acid, barely visible in optical section of the spore, usually forming a germpore-like mark near each end of the spores; these ascospores measure 34.5–44.5 × 12–15 μ Paraphyses slender, 2.5–3.6 μ diam. below, sparingly septate, typically unbranched, apex straight, subclavate, up to about 5 μ diam. (Fig. 89).

HABITAT AND DISTRIBUTION: on the ground in Victoria.

The ascospore characters of this species are markedly different from those of *Geneosperma*, *Scutellinia* and *Cheilymenia* and for this reason it is proposed here to use it as the type species of a newly established genus allied to these three genera, although not without reluctance. The type of its spore ornament is unique among the Pezizineae and in fact it is probably analogous to the type of spore ornament of some species of *Plectania* described above. Unfortunately the fresh colour of the disc is not annotated but apparently it is safe to assume that their paraphyses contain carotenoid pigments as in related genera.

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On the ground, Lower Glenelg River area, 21 June 1964, C. Beauglehole [comm. G. Beaton 202, type specimen of *Rhizoblepharia jugispora* Rifai].

SCUTELLINIA (Cooke) Lamb. emend. Le Gal [8])

Patella Wigg., Fl. hols. 106. 1780. — *Patella* Wigg. *ex* Seaver, N. Am. Cup Fungi (Operc.) 156. 1928.

Humaria Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 320. 1870, emend. Sacc. *in* Bot. Cbl. 18: 216. 1884 (nom. gen. rej. prop.); non *Humaria* Fuckel emend. Korf *in* Nagaoa 7: 4. 1960, et Denison *in* Mycologia 51: 612. 1961 [= *Mycolachnea* Maire]; nec *Humaria* (Fr.) Boud. *in* Bull. Soc. mycol. Fr. 1: 106. 1885 [= *Octospora* Hedw. ex S. F. Gray emend. Korf]. — *Lachnea* (Fr.) Gill. subgen. *Humaria* (Fuckel) Sacc. *in* Bot. Cbl. 18: 216. 1884. — *Lachnea* (Fr.) Gill. subgen. *Humaria* (Fuckel) Sacc. [sect.] *Eu-Humaria* Sacc. *in* Bot. Cbl. 18: 216. 1884.

Peziza [Dill.] St-Amans ser. *Lachnea* Fr. [subser.] *Ciliaria* Quél. *in* Mém. Soc. Emul. Montbéliard II 5: 398. 1873. — *Ciliaria* (Quél.) Boud. *in* Bull. Soc. mycol. Fr. 1: 105. 1885; non *Ciliaria* Haworth, Saxifr. Enum. 21. 1821 [Saxifragaceae]. — *Humaria* (Fr.) Boud. subgen. *Ciliaria* (Quél.) Quél., Enchir. Fung. 284. 1886.

Peziza [Dill.] St-Amans [ser. *Lachnea* Fr.] subgen. *Scutellinia* Cooke, Mycograph. 1: 260. 1879. — *Scutellinia* (Cooke) Lamb., Fl. mycol. Belg., Suppl. 1: 299. 1887. emend. Le Gal, Discom. Madag. 116. 1953 (nom. gen. cons. prop.). — *Lachnea* (Fr.) Gill. subgen. *Scutellinia* (Cooke) Phill., Man. Brit. Discom. 217. 1887.

Lachnea (Fr.) Gill. subgen. *Humaria* (Fuckel) Sacc. [sect.] *Sphaerospora* Sacc. *in* Bot. Cbl. 18: 216. 1884. — *Sphaerospora* (Sacc.) Sacc., Syll. Fung. 8: 188. 1889. — *Lachnea* (Fr.) Gill. subgen. *Sphaerospora* (Sacc.) Cooke, Handb. Austral. Fungi 260. 1892. — *Scutellinia* (Cooke) Lamb. subgen. *Sphaerospora* (Sacc.) Svrček *in* Česká Mykol. 19: 34. 1965 (nomen non rite publicatum). → *Sphaerosporula* O. Kuntze.

Humariella Schroeter *in* Krypt.-Fl. Schles. 3 (2): 36. 1893.

Sphaerosporula O. Kuntze, Rev. Gen. Pl. 3 (3): 530. 1898 (a name change).

Stereolachnea von Höhnel *in* Annls mycol. 15: 353. 1917.

Melastiziella Svrček *in* Acta Mus. nat. Pragae (B) 4 (6): 61. 1948.

Schaerospora (Sacc.) Sacc. subgen. *Eusphaerosphora* Svrček *in* Acta Mus. nat. Pragae (B) 4 (6): 66. 1948.

TYPE SPECIES: *Peziza scutellata* L. ex St-Amans.

Apothecia small to medium sized, scattered, gregarious or rarely caespitose, broadly sessile. Disc concave, flat or undulate, red to orange, rarely almost yellow. Receptacle scutellate or discoid, beset with dark brownish hairs which often form an eye-lash or fringe-like border around the margin. Rooting hairs numerous, short to very long, base usually distinctly forked and deeply buried in the ectal excipulum, apex pointed or rarely blunt, wall thick; these hairs are stiff, acuminate, septate, typically unbranched, brownish black or opaque and shining under reflected light but appearing dark reddish brown under transmitted light. Simple superficial hairs which arise from surface cells of receptacle may also be present. Ectal excipulum of large polygonal to subglobose, somewhat thick walled and light coloured cells, arranged with their long axes at right angles to the surface of receptacle (textura angularis to textura globulosa). Medullary excipulum well differentiated, with cells smaller and thinner than those of the ectal excipulum, irregular in shape and often interspersed with distinct hyphal elements. Asci subcylindrical, slightly narrower towards the base, 4–8-spored, apex not blued in Melzer's reagent. Ascospores uniseriate, hyaline to pale yellowish, containing oil globules which may united into one or

[8]) Nom. gen. cons. prop.

two large oil guttules, globose, subglobose or ellipsoidal to oblong ellipsoidal, very rarely smooth walled or more commonly covered by various kinds of callose-pectic spore ornamentes, which vary from minute, discrete and often indistinct rounded warts to massive, pulvinate or amoeboid and anastomosing ridges which form broken or almost complete reticulum, or the spores may be covered by spine-like warts. Paraphyses slender, septate, unbranched except near their bases, apex distinctly enlarged, clavate to irregularly lobed, straight, slight longer than the asci, containing carotenoid pigments.

HABITAT: saprophytic on decayed wood and other vegetable matter, occasionally on soil etc.

With its characteristic habitat, habit, orange red apothecia with dark reddish brown eyelash-like hairs and the mostly ornamented and guttulate ascospores the genus *Scutellinia* can be easily recognized, but the difficulty in identifying its species is well known. Several regional treatises dealing with species from Madagascar, Argentina, North America and India have been published in the last ten years by Le Gal (*1953*), Gamundi (*1956*, *1960*, *1964*), Denison (*1961*) and Batra & Batra (*1963*) respectively. The number of species that can be accepted in this genus is unknown but the answer is forthcoming because *Scutellinia* is being monographed by Dr. Marcelle Le Gal (Paris).

The size and shape of hairs and ascospores and above all the type of ornament of the latter are characters which have been used in distinguishing species of *Scutellinia*. Admittedly it is very easy to detect a slight variation in the type of spore ornament and to correlate this with minor differences of other characters (Le Gal, *1953*) but it does not seem wise to use this slight variation as major taxonomic evidence in classifying species of *Scutellinia*. It has been found extremely difficult to construct an intelligible key to species based on these minor differences, especially because the variations do not seem to have a definite pattern. Since ascospores from the same hymenium sometimes show a wide range of variation, it is obvious that when the number of specimens examined is increased, the most distinctive character of a particular species will become more and more critical. For these reasons in the following a wider species concept is adopted, but since there is a possibility that we may be dealing with numerous very closely related micro-species, to avoid the possibility of describing a mixture of two or more similar species, the description of every species has been based on one specimen only. The genus *Scutellinia* is well represented in Australasia, and certainly the number of species occurring there is higher than those described below.

The genus *Melastiziella* Svrček (*1948*) was based on *Humariella pseudotrechispora* Schroeter (*1893*) and was distinguished from *Scutellinia* because of its reticulate ascospores. The reticulate spore character, however, is not of generic importance and in delimiting the genus *Scutellinia* species with perfectly or imperfectly reticulate ascospores have also been incorporated here by Denison (*1961*). Subsequently Le Gal (*1962*) classified

Humariella pseudotrechispora as a species of *Scutellinia*. Seaver (*1928*) ranged some of the reticulate spored species of *Scutellinia* in the genus *Melastiza* Boud. but the structure of their ectal excipulum and the type of their hairs do not in any way indicate an alliance to the latter genus. Because the only difference between *Peziza trechispora* Berk. & Br., which is the type species of the genera *Sphaerospora* (Sacc.) Sacc. and *Sphaerosporula* O. Kuntze, and the rest of species of *Scutellinia* can be found only in the globose shape of its ascospores, following Dennis (*1960*) and Denison (*1961*) these two globose spored genera have been listed as synonyms of *Scutellinia*. Massee (*1895*), Seaver (*1928*), Svrček (*1948*), Cain (*1956*) and Moser (*1963*) maintained the genus *Sphaerospora* for all globose spores species with hairy apothecia, but not all species of the latter are related to each other; some of these belong to *Sphaerosporella* (Svrček) Svrček & Kubička. The untenability of the generic names *Patella*, *Lachnea*, *Ciliaria* and *Humariella* has been fully discussed by Le Gal (*1953*) and Denison (*1961*).

I have reduced the older generic name *Humaria* Fuckel (*1870*) to the synonymy of *Scutellinia* (Cooke) Lamb. (*1877*), and at the same time would like to propose the conservation of the latter generic name. This move is taken because *Humaria* appears to have been effectively typified with *Scutellinia scutellata* by Saccardo (*1884*). It is true that Saccardo did not explicitly state that the "example" cited for each taxon in the scheme of classification proposed by him was a type species, but it is very difficult to escape from the conclusion that the listing of this example species was to indicate what in his opinion was the most typical representative of the taxon concerned. It must be noted that in most cases Saccardo cited only one example for each taxon, but in some cases he mentioned up to three species and that many of these examples correspond with the typification proposed or accepted by later authors. Korf (*1953*) and Dennis (*1956*), for example, have treated the example species indicated for *Velutaria* Fuckel and *Calycella* (Fr.) Boud. as effective typifications respectively.

Saccardo's (*1884*) proposal to reduce the names *Ciliaria* Quél. and *Scutellinia* Cooke (ut *Scutellaria*, *lapsus calami*) as synonyms of *Lachnea* (Fr.) subgen. *Humaria* (Fuckel) Sacc. and the designation of *Lachnea scutellata* as the only example of *Lachnea* subgen. *Humaria* sect. *Eu-Humaria* should leave no doubt about his conception and the application of the name *Humaria*. The advantage of accepting Saccardo's typification is that by conserving the generic name *Scutellinia* against *Humaria*, once and for all one can abandon this much confused name, as will be shown in the following paragraphs.

In 1885 Boudier used the name *Humaria* (Fr.) Boud. (*1885*) non *Humaria* Fuckel (*1870*) to accommodate the numerous glabrous small species of operculate cup fungi, typified by *Octospora leucoloma* Hedw. ex. S. F. Gray. In Quélet's (*1886*) "Enchiridion Fungorum", *Humaria* (Fr.) Boud.

was enlarged to cover not only the glabrous species but also species like *Scutellinia scutellata*. Boudier's conception and application of *Humaria* (Fr.) Boud. was accepted by Saccardo (*1889*, et seq.). This application had received wide acceptance and many species had been assigned to this generic name (Cooke, *1892*; Massee, *1895*; Rehm, *1896*; Boudier, *1907*; Clements, *1909*; Ramsbottom, *1914*; Clements & Shear, *1931*; Valenovský, *1934*; Le Gal, *1939*, *1947*; Ramsbottom & Balfour–Browne, *1951*). After realising that the name *Humaria* (Fr.) Boud was untenable for the glabrous species, Seaver (*1927*, *1928*) proposed the new name *Humarina* Seaver to replace it, and in this respect he has been followed by mycologists who have closely adopted his classification. As already pointed out by Korf (*1955*) the name *Humarina* is superfluous because it was antedated by *Leucopezis* Clem. (*1909*), a synonym of *Octospora* Hedw. ex S. F. Gray (*1821*) emend. Korf (*1955*).

In 1947 it was stated by Kanouse that all species classified as *Patella* Wigg. ex Seaver (*1928*) [9], which is typified by *Elvella ciliata* Schaeff. [=*Scutellinia scutellata*], should be transferred to *Humaria* Fuckel, because the pre-Friesian name *Patella* was not accepted by Fries (*1822*), and was not validly published until 1928. Kanouse (*1947*) did not indicate any type species for *Humaria* Fuckel and her generic concept of the latter was as wide as that of Seaver (*1928*). Since this is only a kind of name change, one may assume that the type species of *Humaria* Fuckel as conceived by Kanouse (*1947*) should be identical with the type of *Patella* as amended by Seaver (*1928*), namely *Scutellinia scutellata*, and this is similar to the one designated by Saccardo (*1884*). Cash (*1948*) and some Indian authors (Thind & Sethi, *1957*; Thind & Singh, *1959*) have used the name *Humaria* Fuckel in the sense proposed by Kanouse. In reply to this Seaver (*1948*) wrote that the application of the name *Humaria* in the sense of Fuckel (*1870*) was undesirable because of the confusion which might arise from the traditional usage of *Humaria* for the glabrous species.

Korf (*1960*) and Denison (*1961*) have recently chosen *Peziza hemisphaerica* Wigg. ex S. F. Gray as the type species of *Humaria* Fuckel; Dennis (*1960*) and Moser (*1963*) have also used the name *Humaria* Fuckel for the few species related to *Peziza hemisphaerica*. [10] The latter species was

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[9] Morgan (*in* J. Mycol. 8: 187. 1902) has often been credited as the author who revalidated this generic name after 1 January 1821, but this is obviously erroneous because Morgan (*1902*) merely used the name in listing species of Discomycetes from Miami Valley (Ohio). He transferred to it a few hairy species of operculate cup fungi without giving any remark, specific or generic description and he also failed to make a direct or indirect reference to Wiggers' (*1780*) publication, so that his use of the name *Patella* in 1902 does not seem to constitute a valid publication of this name.

[10] Batra & Batra (*1963*) also classified *Peziza hemisphaerica* in *Humaria* Fuckel, but I believe that the scope of this genus as understood by these authors is closer to the one formulated by Kanouse (*1947*) than to that adopted by Korf (*1960*) or Dennis (*1960*), because they also included the red coloured *Humaria ahmadii* Cash in this genus.

also selected by Boudier (*1885*) to serve as the type species of *Lachnea* (Fr.) Gill. (*1879*), but because it is a later homonym of *Lachnaea* L. (*1753*) the name *Mycolachnea* has been proposed by Maire (*1937*) to replace it. Svrček & Kubička (*1961*), Svrček (*1962*) and Berthet (*1964a*) recently referred to this species as *Mycolachnea hemisphaerica* (Wigg. ex S. F. Gray) Maire.

From the above discussion it is obvious that the name *Humaria* has been used in many different senses and for entirely different groups of fungi, and that to use it in the restricted sense as proposed by Dennis (*1960*), Korf (*1960*) or Denison (*1961*) will lead to further ambiguity and endless disagreement. Further disagreement can especially be expected from the French quarter because in French literature the name *Humaria* has always been associated with the glabrous species (from Boudier, *1885*, to Le Gal, *1947*), with the exception of Quélet (*1886a*) who would accept it as the correct genus for both the hairy and glabrous forms. To avoid further confusion a proposal to abandon the names *Humaria* Fuckel and *Humaria* (Fr.) Boud. may be put forward (Art. 69 of the Code), with a recommendation for replacing it with the already available name *Mycolachnea*. Such a proposal, however, is unnecessary because the acceptance of Saccardo's (*1884*) typification of *Humaria* Fuckel with *Scutellinia scutellata* will make it both unavoidable and commendable to conserve the later but now widely used generic name *Scutellinia*.

KEY TO SPECIES OF SCUTELLINIA

1a. Ascospores 24.5–31.8 μ long, covered by short, broken sinuate wavy and occasionally anastomosing ridges, sometimes imperfectly reticulate *Scutellinia pseudomargaritacea* Le Gal

b. Ascospores less than 25 μ long, covered by minute to large, discrete, angular, orbicular, amoeboid, sometimes anastomosing warts or crests 2

2a. Rooting hairs mostly less than 500 μ long; ascospores broadly ellipsoidal to almost subglobose, minutely warted; apothecia mostly on damp ground *Scutellinia kerguelensis* (Berk. apud Hook. f.) O. Kuntze

b. Rooting hairs mostly more than 500 μ long; ascospores ellipsoidal, minutely to coarsely ornamented; apothecia generally lignicolous, occasionally also on the ground 3

3a. Spore ornaments minute, barely visible in optical section *Scutellinia scutellata* (L. ex St-Amans) Lamb.

Spore ornaments large to very large, cleary visible in optical section . . . 4

4a. Ascospores oblong ellipsoidal, spore ornaments mostly less than 1.7 μ wide *Scutellinia colensoi* (Massee) Le Gal ex Rifai

b. Ascospores ellipsoidal, spore ornaments larger, up to 3 μ wide *Scutellinia badio-berbis* (Berk. ex Cooke) O. Kuntze

Scutellinia kerguelensis (Berk.) O. Kuntze

Peziza kerguelensis Berk. *in* Hook. f., Fl. Antarc. 2: 451. 1847. — *Lachnea kerguelensis* (Berk.) Sacc., Syll. Fung. 8: 176. 1889. — *Scutellinia kerguelensis* (Berk.) O. Kuntze, Rev. Gen. Pl. 2: 869. 1891.

Lachnea nympharum Vel., Monogr. Discom. Boh. 1: 307. 1934 (teste Le Gal, *1966*). — *Scutellinia nympharum* (Vel.) Svrček & Kubička *in* Česká Mykol. 15: 63. 1961.

Apothecia scattered to gregarious, sessile, up to 10 mm diam. or more. Disc shallowly concave, reddish orange. Receptacle shallowly obconical or more often saucer shaped, outer surface covered with brown short hairs which often form an indistinct fringe-like border around the margin. Rooting hairs numerous, straight, gently curved or acuminate, stiff, short but massive, 175–360(–650) μ long by 18–32 μ diam. at the widest point, base deeply immersed in the ectal excipulum, obconical, simple or rarely forked, septa thin and irregular and usually rather sparse, wall thick, light reddish brown, generally abruptly attenuate into the sharp pointed and almost subhyaline apex. Hymenium about 260 μ thick. Asci subcylindrical, slightly narrower towards the base, 8-spored, 240–300 × 15–18 μ. Ascospores uniseriate, hyaline or subhyaline, broadly ellipsoidal to almost subglobose, 19–24.5 × 13.5–15.4 μ, filled with oil globules, their surface covered by minute warts barely visible in optical section; the warts usually less than 1 μ wide and only about 0.5 μ high, sometimes slightly elongate and only very rarely anastomosing with one another. Paraphyses 2.7–3.6 μ diam. below, straight, septate, unbranched, apex clavate or lobed, 6.5–11 μ diam. (Fig. 90–92).

HABITAT AND DISTRIBUTION: on damp or boggy ground, twigs or rarely on dung in Kerguelen Is. (type locality), Australasia, Madagascar, Africa (Kenya, Tunisia), Czechoslovakia, Swedish Lapland and Argentina.

The wide distribution of *Scutellinia kerguelensis* has been discussed by Le Gal (*1966*) in some detail. From the data of the numerous specimens which she studied Le Gal (*1966*) drew the conclusion that this species was hygrophilous.

Scutellinia kerguelensis can be easily separated from the other species of *Scutellinia* by its broad ellipsoidal ascospores and by the short rooting hairs which usually have simple bases. The size and shape of hairs and ascospores of *Scutellinia umbrorum* (Fr.) Lamb. strongly resemble the present species but the former has much coarser ascospore ornamentation, which is clearly visible in optical sections (Denison, *1961*).

The above description has been drawn from specimen Gunn s.n. which was identified by Berkeley as *Peziza stercorea*; with the exception of the difference in habitat, this specimen agrees in all parts with the type specimen of *Peziza kerguelensis* and with the current conception of this species (Le Gal, *1953*, *1966*).

SPECIMENS EXAMINED

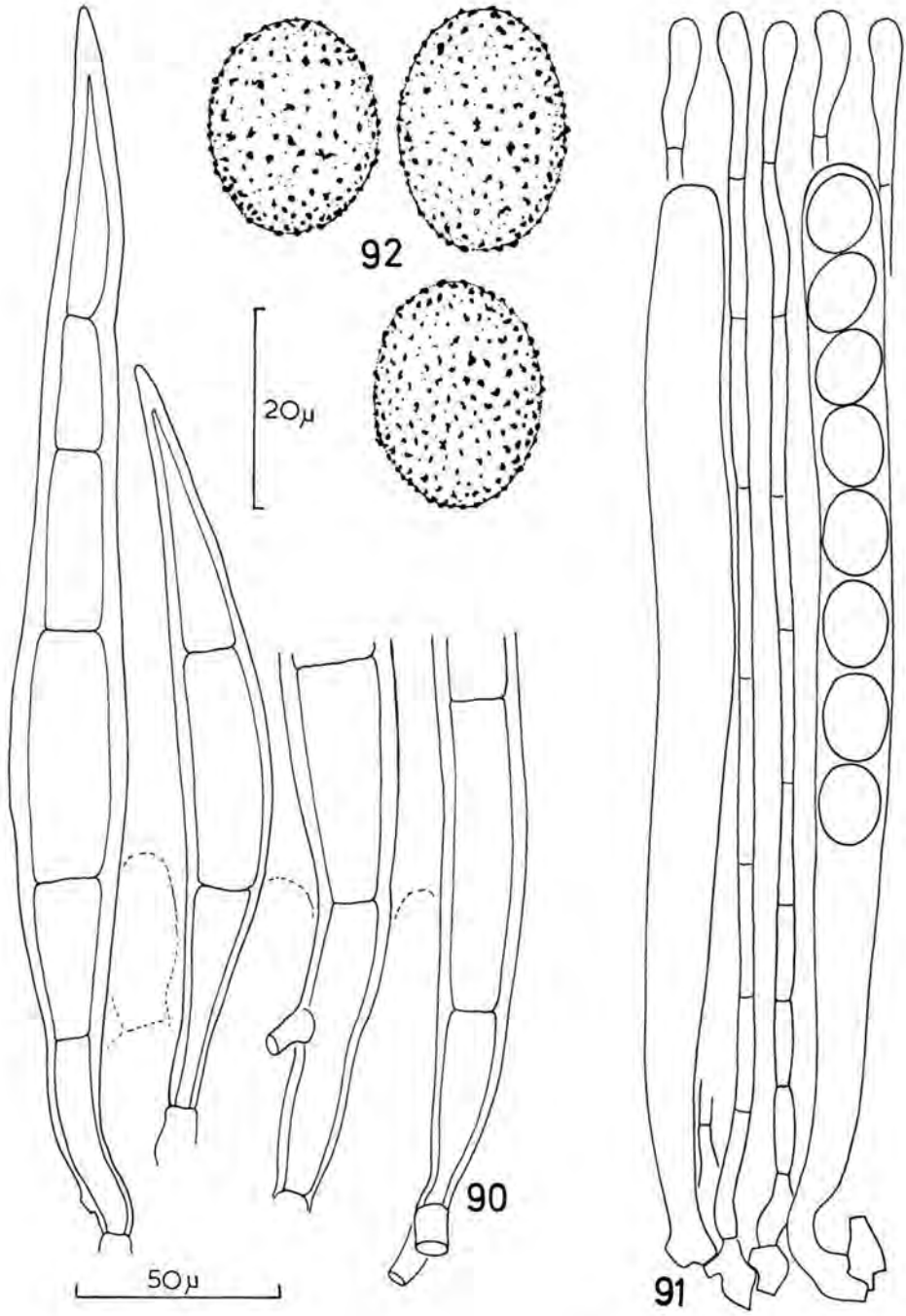
AUSTRALIA. Tasmania. On dung, St. Patrick's River, 1 November 1845, Gunn. s.n.

NEW ZEALAND. On sandy soil, s. dat., Berggren 274; on duff, s. dat., J. D. Hooker.

KERGUELEN IS. On boggy earth near the sea, Christmas Harbour, May–June 1840, coll. unknown, no. 638 [type specimen of *Peziza kerguelensis* Berk.].

SCUTELLINIA SCUTELLATA (L. ex St-Amans) Lamb.

Peziza scutellata L., Sp. Pl. 2: 1181. 1753. — *Octospora scutellata* (L.) Hedw., Desc. Musc. frond. 2: 10. 1788. — *Peziza scutellata* L. *ex* St-Amans, Fl. agen. 531. 1821; Fr., Syst. mycol. 2: 85. 1822. — *Humaria scutellata* (L. ex St-Amans) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 321. 1870. — *Lachnea scutellata* (L. ex St-Amans)



Figs. 90–92. *Scutellinia kerguelensis*. 90. Rooting hairs. 91. Asci and paraphyses. 92. Ascospores. (From Gunn s.n.). — Figs. 90, 91 to same scale.

Gill., Champ. Fr., Discom. 75. 1879. — *Scutellinia scutellata* (L. ex St-Amans) Lamb., Fl. mycol. Belg., Suppl. 1: 299. 1887. — *Humariella scutellata* (L. ex St-Amans) Schroeter *in* Krypt.-Fl. Schles. 3 (2): 37. 1893. — *Ciliaria scutellata* (L. ex St-Amans) Boud., Icon. mycol. 2: *pl. 368*. 1906; Hist. Class. Discom. Eur. 62. 1907. — *Patella scutellata* (L. ex St-Amans) Morgan *in* J. Mycol. 8: 187. 1902 (nomen non rite publicatum). — *Patella scutellata* (L. ex St-Amans) Morgan *ex* Seaver, N. Am. Cup Fungi (Operc.) 159. 1928.

Lachnea balnei Starb. *in* Bih. K. svenska Vetensk Akad. Handl. (III) 21 (5): 39. 1895 (teste Denison, *1961*).

[*Peziza scutellata* L. ex St-Amans f. *terrigena* Karst. in herb. —] *Scutellinia scutellata* (L. ex St-Amans) Lamb. f. *terrigena* (Karst.) ex Le Gal *in* Bull. Soc. mycol. Fr. 82: 312. 1966.

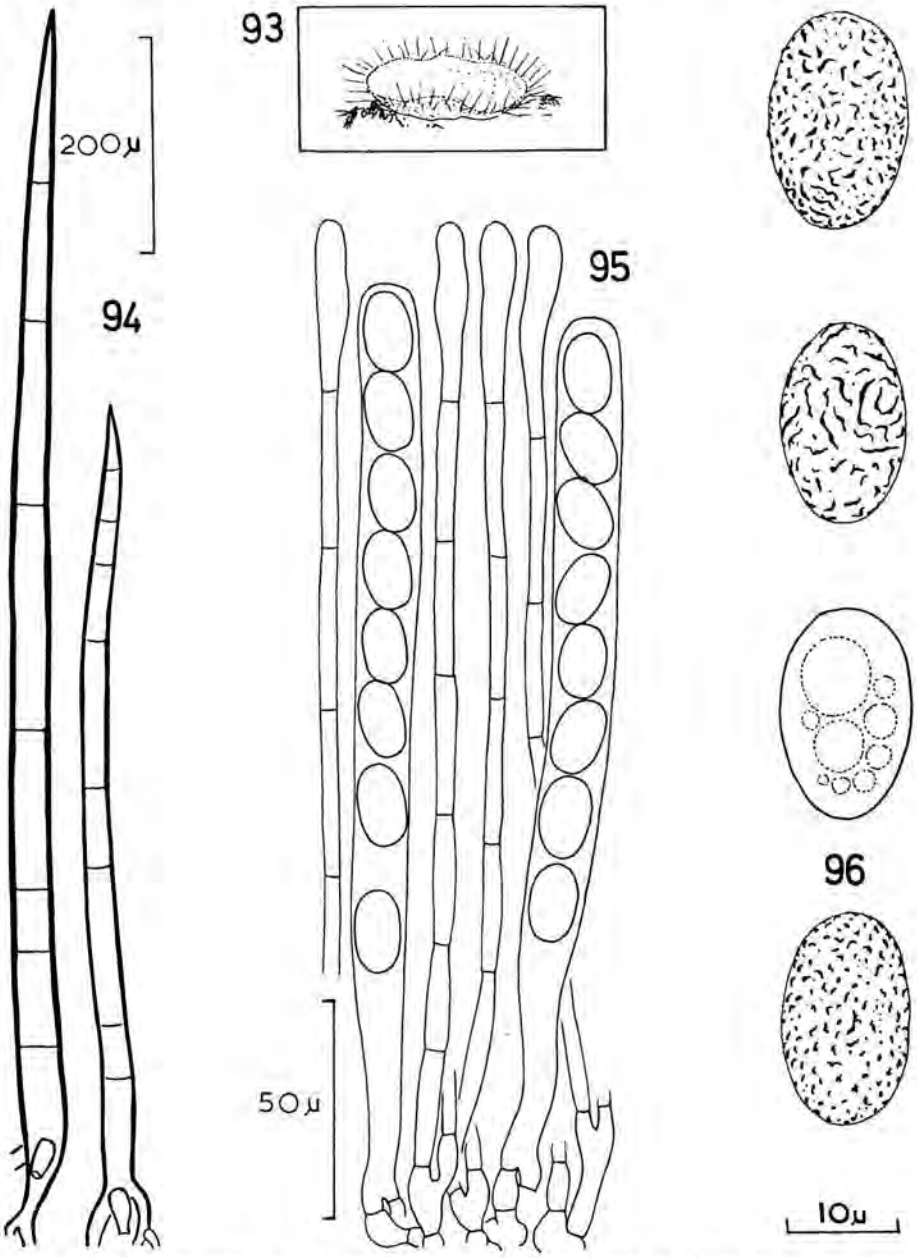
Apothecia scattered to gregarious or sometimes crowded, broadly sessile, 2–9 mm diam. (but may reach 12 mm diam. according to Denison, *1961*). Disc concave, flat or undulate, orange red to red. Receptacle scutellate to discoid, sometimes becoming irregular due to mutual pressure or the condition of the surface of the substrate, externally brownish due to the presence of stiff hairs which give rise to a distinct fringe-like border at the margin of the apothecia. Rooting hairs abundant, acuminate or rarely blunt tipped, straight or occasionally curved, dark reddish brown, walls up to 7 μ thick, with 2–10(–19) thin septa, base distinctly but irregularly forked, sometimes geniculate, 140–1650 × 16–40 μ. At the margin of the receptacle there are occasionally numerous club shaped, thick walled, brown but superficial hairs. Simple surface hairs present, subhyaline to very pale brown, blunt-tipped, septate, generally flexuous, up to 15 μ diam. Hymenium about 240 μ thick. Asci narrowly clavate cylindrical, 8-spored, 200–300 × 14–20 μ. Ascospores (16.4–)18–20(–22.7) × × 10–15.4 μ, uniseriate, ellipsoidal to oblong ellipsoidal, hyaline or subhyaline, containing one or more large oil globules, at first smooth walled but ultimately minutely ornamented; the ornaments taking the form of minute warts or crests usually less than 0.7 μ diam., irregular in shape, rather freely anastomosing with each other, not or hardly visible in optical section of the ascospores. Paraphyses slender, 3–4 μ diam. below, sparsely septate, occasionally branched near their base, apex distinctly enlarged, 7–10 μ diam., subclavate or lobed, filled with orange granules (Fig. 93–96).

HABITAT AND DISTRIBUTION: on rotten wood or bark, or on the ground or "less often on a variety of other substrates: e.g., wood ashes, decaying leaves, and rotting sporophores of *Fomes* spp." (Denison, *1961*) in Europe (type locality Sweden), North America, Argentina, India and Australia.

Denison (*1961*) reported that about ninety percent of all lignicolous specimens of *Scutellinia* collected in eastern North America were found to be *Scutellinia scutellata*. According to Batra & Batra (*1963*) it is abundant in the Himalayan areas and this species is also very common in Europe. Nevertheless there is no assurance that the specific epithet 'scutellata' which appeared in many earlier treatises, handbooks, floras or foray lists has been properly used since there are always chances that other species are involved.

I have not been able to study the specimen Lundell & Nannfeldt, Fungi exsiccati suecicae no. 1369 sub *Lachnea scutellata* which was designated by Denison (*1961*) as the neotype specimen of *Peziza scutellata*

L. ex St-Amans. The Victorian specimen G. Beaton 37 described above, however, has been kindly identified as *Scutellinia scutellata* by Dr. Marcelle Le Gal, and its morphological characters agree in all respects with the concept of *Scutellinia scutellata* adopted by modern authors (Seaver, *1928*; Le Gal, *1937*; Svrček, *1948*; Gamundi, *1956*; Dennis, *1960*; Denison, *1961*).



Figs. 93–96. *Scutellinia scutellata*. 93. Habit sketch. 94. Rooting hairs. 95. Asci and paraphyses. 96. Ascospores. (From G. Beaton 37).

I do not think that collections of *Scutellinia scutellata* that have been made from the ground are taxonomically distinct from those originated from other substrates, unless one is prepared to segregate and give separate infraspecific names to those collections that grow on fungus fructification, wood ashes, leaf litters and other types of substrate as well. For this reason Le Gal's (*1966a*) forma *terrigena* is listed as a synonym of the present species.

This species can be easily recognized by its ellipsoidal and indistinctly ornamented ascospores which in optical section may appear smooth walled. *Scutellinia hirta* (Schum. ex Fr.) O. Kuntze and its many closely related species strongly resemble the present species and they are separated from the latter mainly by the slight difference in spore shape and type of ornament (Le Gal, *1937*). Although in Herb. Kew. there are numerous Australasian specimens belonging to this complex of species they are not described further here largely because the taxonomy and nomenclature of these species are far from clear. It is hoped that they will be dealt with more fully in the monograph of *Scutellinia* which is being prepared by Dr. Marcelle Le Gal.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On fallen *Eucalyptus* trunk, Scott's Creek Road, 10 miles from Cobden, 13 October 1962, G. Beaton 37. — Western Australia. On bark, Swan River, s. dat., collector unknown. — South Australia. On ground among moss, Adelaide Hill, October 1953, Kilpatrick, ex WARI 3598; on soil, Delamere S.E., 2 September 1952, J. H. Warcup; on charred bark, Adelaide, September 1952, D. E. Symon, ex WARI 2790.

NEW ZEALAND. On bark?, s. dat., Colenso 4619.

Scutellinia colensoi (Massee) Le Gal ex Rifai, *spec. nov.*

[*Lachnea colensoi* Massee in herb. —] *Scutellinia colensoi* (Massee) Le Gal, Discom. Madag. 120. 1953 (sine diagnose Latina).

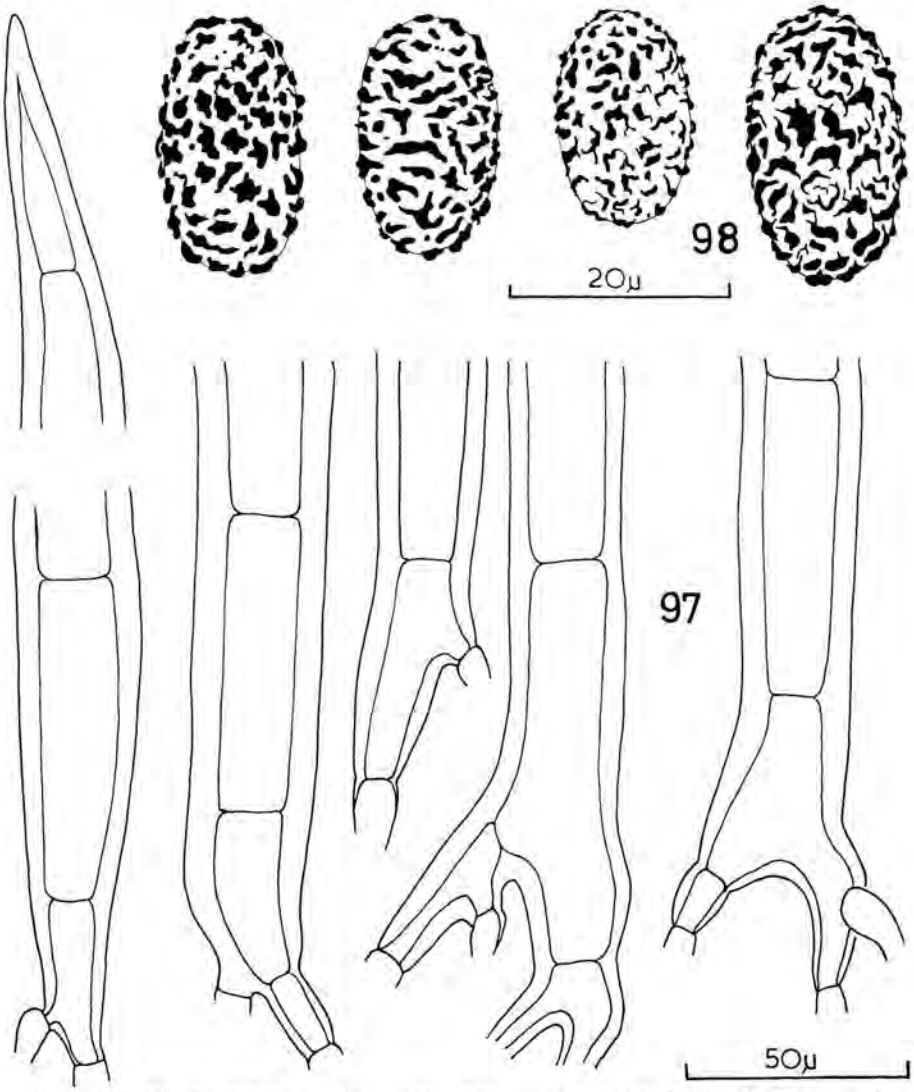
Apothecia 2–5 mm diam., rubro-aurantiaca, hirsuta. Pili 140–800 μ longi, 20–32 μ diam., recti vel flexuosi, septati, acuminati, crasse tunicati, rubro-brunnei, basi radicantes. Asci subcylindracei, octospori, 220–280 × 12–16.5 μ. Ascospori oblongo-ellipsoidei, 18.2–21.5 × 10–12.7 μ, guttulati, verrucosi, verrucae angulares vel leniter elongatae, sinuatae, interdum confluentes. Paraphyses septatae, superne dilatatae, subclavatae, 10 μ diam.

Hab. ad lignum putridum, Novae Zelandiae, s. dat., Colenso b-1013 typus est [K].

Massee's original specimen of the present species can be described as follows: Apothecia scattered to gregarious, broadly sessile, 2–5 mm diam. Disc at first concave, becoming flat, undulate, reddish orange. Receptacle saucer shaped, beset with brownish hairs which often form a distinct fringe-like border around the margin of the apothecia. Rooting hairs numerous, 140–800 μ long by 20–32 μ wide near the base, straight or slightly flexuous, gently attenuate into the sharp pointed apex, traversed by up to 10 thin septa, wall up to 6 μ thick, dark reddish brown, base deeply buried in the ectal excipulum, irregularly forked. Hymenium about 250 μ thick. Asci subcylindrical, narrower towards the base, 8-spored,

220–280 × 12–16.5 μ. Ascospores uniseriate, oblong ellipsoidal, hyaline, containing numerous small oil globules which may unite into one or two large ones, at first smooth but soon covered by amoeboid warts usually less than 1.7 μ diam. and up to 1.2 μ high, sometimes irregularly anastomosing with each other, or the warts angular and isolated, or sometimes the ornaments take the form of wavy, sinuate irregular and broken wide ridges; in all cases the ornaments are clearly visible in optical section of the ascospores; without the ornaments mature ascospores measure 18.2–21.5 × 10–12.7 μ. Paraphyses slender, unbranched, septate, 2.5–3.4 μ diam. below, apex distinctly enlarged, subclavate or lobed, up to about 10 μ diam. (Fig. 97–98).

HABITAT AND DISTRIBUTION: on wood or rarely on the ground in New Zealand (type locality), Australia and Madagascar.



Figs. 97, 98. *Scutellinia colensoi*. 97. Bases of rooting hairs. 98. Ascospores. (From type).

Since this species does not seem to have been validly published a Latin description is given here. The type of spore ornamention of *Scutellinia colensoi* is somewhat similar to that of *Scutellinia scutellata* but in the former species the ridges are much coarser and clearly visible in optical sections of the ascospores. Because of its rather coarse spore ornamention this species may also be confused with *Scutellinia badio-berbis*. The ascospores of the latter species, however, are ellipsoidal and not oblong ellipsoidal as in the present species and their ornamention is even more massive.

SPECIMENS EXAMINED

NEW ZEALAND. On rotten wood, s. dat., Colenso b-1013 [type specimen of *Scutellinia colensoi* (Massee) Le Gal ex Rifai]; on the ground, s. dat., Colenso b-875; on rotten wood in wet forest, s. dat., Colenso b-124; on wood, s. dat., J. B. Cleland, ex WARI 2552.

AUSTRALIA. New South Wales. On wood and soil, Datoomba, 9 December 1916, J. B. Cleland, ex WARI 3132; on wood, Leura, June 1916, J. B. Cleland, ex WARI 2757. — Tasmania. On mossy rotten bark, s. dat., W. Archer.

SCUTELLINIA BADIO-BERBIS (Berk. ex Cooke) O. Kuntze

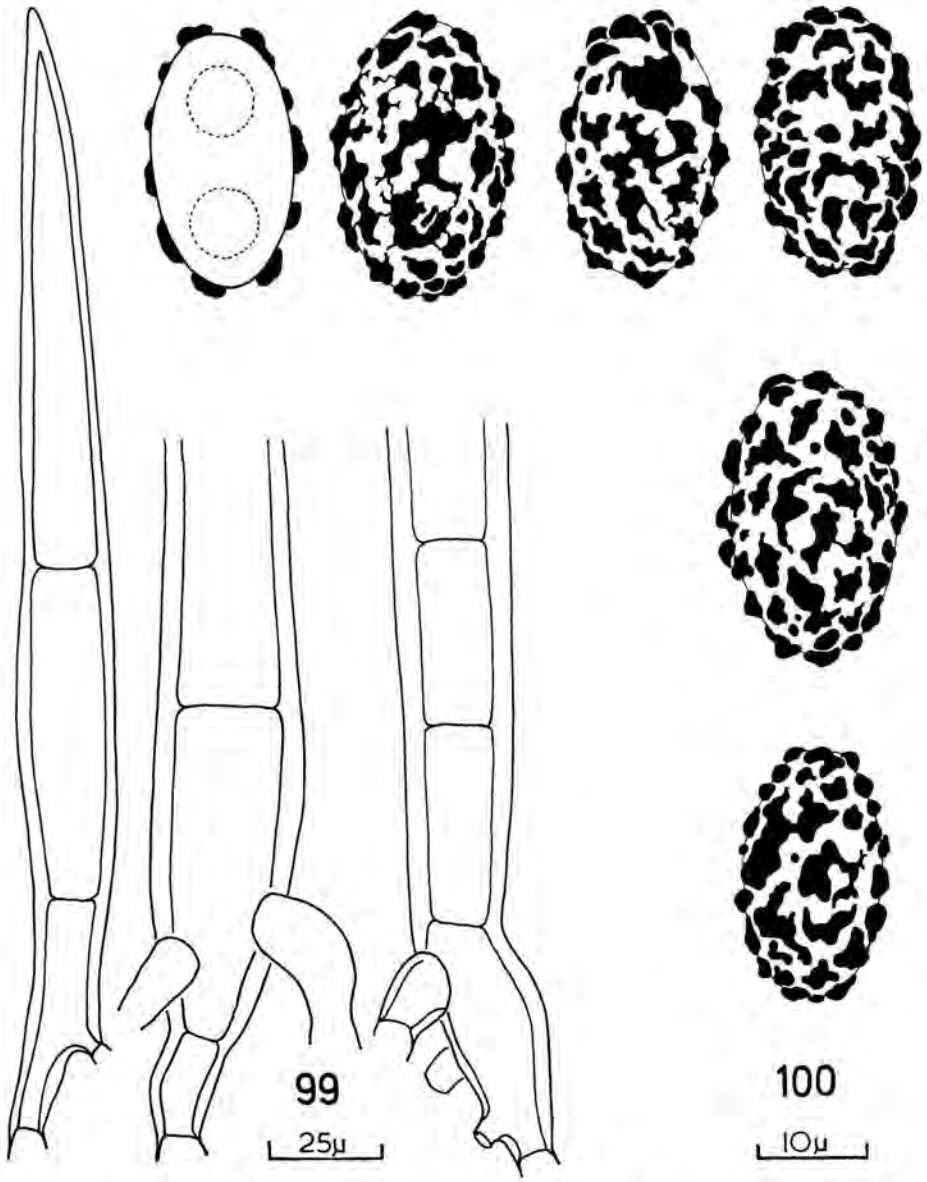
[*Peziza badio-berbis* Berk. in herb. —] *Peziza badio-berbis* Berk. *ex* Cooke *in* Grevillea 8: 61. 1879. — *Lachnea badio-berbis* (Berk. ex Cooke) Sacc., Syll. Fung. 8: 173. 1889. — *Scutellinia badio-berbis* (Berk. ex Cooke) O. Kuntze, Rev. Gen. Pl. 2: 869. 1891.

Apothecia gregarious, broadly sessile, 2–7 mm diam., distinctly hairy. Disc concave to flat, colour when fresh unknown but apparently of some shades of orange red, margin provided with fringe-like border. Receptacle saucer shaped, appear brownish from the presence of numerous hairs. Rooting hairs dark reddish brown, septate, acuminate, sometimes gently curved, cell-walls up to 6 μ thick, base narrowly obconical, simple or forked several times; hairs longest near the margin, up to 1500 μ long by 40 μ diam. at the widest part. Hymenium about 260 μ thick. Asci cylindrical, narrower towards the base, 230–280 × 14–18 μ, 8-spored. Ascospores uniseriate, ellipsoidal to rarely almost oblong ellipsoidal, hyaline, usually containing one or two large oil globules and several smaller ones, covered by large, convex sinuate, amoeboid and often anastomosing crests of up to 2.5 μ high by 3 μ wide; without the ornaments the ascospores measure 18–21.5(–23.6) × 10–12.7 μ. Paraphyses septate, unbranched, 2–3.5 μ diam. below, apex subclavate or lobed, up to 7.5 μ diam. (Fig. 99–100).

HABITAT AND DISTRIBUTION: on dead wood or branches in Australasia and Madagascar.

The above description has been exclusively based on specimen S. Berggren 206, which evidently should be accepted as the type specimen of *Peziza badio-berbis* Berk. ex Cooke. The basionym "*Lachnea badio-berbis* Berk. *in* Grevillea 8: 61. 1879" cited by Le Gal (*1953*) and Gamundi (*1964*) is erroneous, because Cooke (*1879*) originally introduced the present species as follows: "*Peziza* (*Sacroscypha*) *badio-berbis* Berk. in Herb. / On rotten wood. Ohaeawai (206). / Resembling *P. scutellata* in size and general

appearance, but with coarsely warted sporidia (.022–.025 × .012–.014 mm.), and very long marginal hairs." I have not been able to locate a specimen bearing Berkeley's annotation on its label, which may serve as the type specimen of this species. Although there is no evidence that Berkeley saw S. Berggren 206, namely the only specimen cited by Cooke (*1879*) in validating and introducing the name *Peziza badio-berbis*, this specimen should be accepted as the type specimen of the present species. Le Gal (*1953*) compared her Madagascar collection of *Scutellinia badio-berbis* with



Figs. 99, 100. *Scutellinia badio-berbis*. 99. Rooting hairs. 100. Ascospores. (From type).

two collections, Colenso b–124 and Colenso b–125, which she believed to be cotype specimens. She stated further that the former collection apparently was the original collection of *Peziza badio-berbis*. As can be seen from the original description, however, these two collections were not mentioned by Cooke (*1879*); on their labels it was stated that they were not received at Herb. Kew. until December 1885! Le Gal's conception of *Scutellinia badio-berbis* fits the specimen S. Berggren 206 but the collection Colenso b–124 which she considered as its type specimen is considered to belong to *Scutellinia colensoi*.

Scutellinia badio-berbis is understood here to cover not only those collections referred to as *Scutellinia badio-berbis* by Le Gal (*1953*) but also those described by her as *Scutellinia ischnotricha* Le Gal (*1953*) and probably also those of *Scutellinia phlyctispora* (Lepr. & Mont.) Le Gal.

SPECIMENS EXAMINED

NEW ZEALAND. On mossy dead wood, Ohaeawai, s. dat., S. Berggren 206 [type specimen of *Peziza badio-berbis* Berk. ex Cooke]; (on bark) among mosses, s. dat., Colenso b-125.

AUSTRALIA. Victoria. On mossy tree trunk, Mait's Rest Reservation, on Ocean Road between Apollo Bay and Horden Vale, 9 September 1962, G. Beaton 8 [det. as *Scutellinia ischnotricha* by Le Gal]; ibid., G. Beaton 10 [det. as *Scutellinia badio-berbis* by Le Gal].

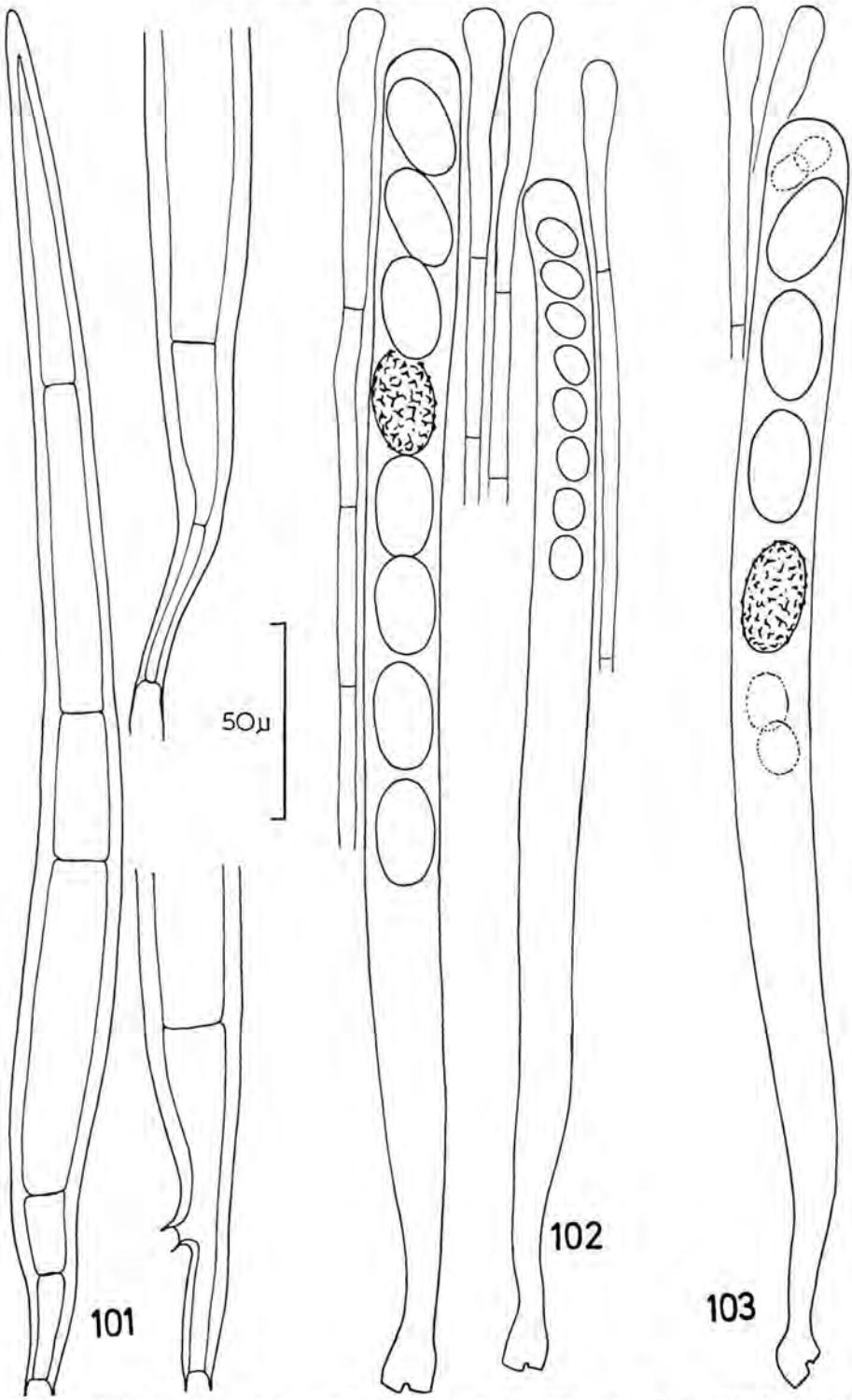
SCUTELLINIA PSEUDOMARGARITACEA Le Gal

Scutellinia pseudomargaritacea Le Gal *in* Bull. Soc. mycol. Fr. 82: 303. 1966 (ut *pseudo-Margaritacea*).

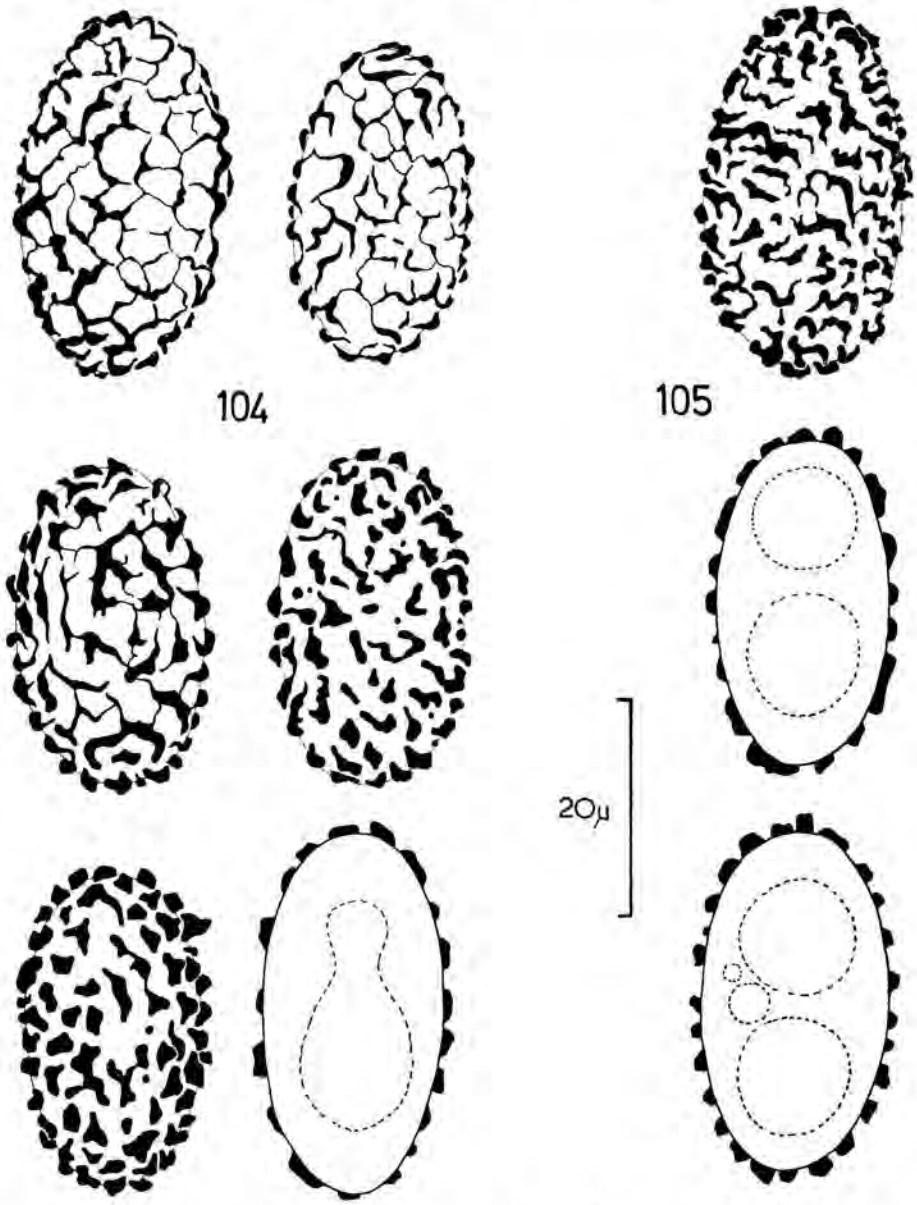
The following description is based on specimen Aldfield 23 (H), which was originally mentioned by Le Gal (*1953*) in discussing *Scutellinia margaritacea* (Berk. ex Cooke) O. Kuntze, but which later on (Le Gal, *1966a*) was designated as the holotype of the present species:

Apothecia medium size, up to 11 mm diam. Disc flat or shallowly concave, now appearing brownish or dirty orange yellow. Receptacle saucer shaped, beset with short brown hairs, broadly attached to the substrate. Rooting hairs numerous, usually form an indistinct fringe-like border around the margin of the receptacle, straight or somewhat flexuous, acuminate, septate, 120–650(–900) μ long by up to 40 μ diam. at the widest point, namely immediately after the hairs emerge from the ectal excipulum, wall 3–5 μ thick, dark reddish brown, base distinctly and deeply buried, narrowly obconical, simple or only rarely forked. Hymenium about 300 μ thick. Asci subcylindrical, distinctly narrower at the base, normally 8-spored, 290–320 × 18–23 μ. Ascospores uniseriate, often obliquely uniseriate, ellipsoidal, hyaline, with one or two large oil globules, ultimately covered by broken sinuate or wavy ridges, their edges thin and undulate, up to 1.8 μ high, the ridges discrete or sometimes anastomosing to form an irregular, usually incomplete reticulum; excluding the ornaments the ascospores are 24.5–31.8 × 14.5–17.2 μ. Paraphyses 2.7–4 μ diam. below, septate, unbranched except near the base, apex distinctly clavate or lobed, up to 11 μ diam. (Fig. 101–105).

HABITAT AND DISTRIBUTION: on the ground or on wood in Australia.



Figs. 101–103. *Scutellinia pseudomargaritacea*. 101. Rooting hairs. 102. Asci and paraphyses (From type). 103. 4-spored ascus and paraphyses. (From G. Beaton 72).



Figs. 104, 105. *Scutellinia pseudomargaritacea*. 104. Ascospores (From type). 105. Ascospores (From G. Beaton 72).

There has been some difficulty in typifying *Scutellinia margaritacea* (Berk. ex Cooke) O. Kuntze. Cooke (*1876*) indicated its substrate as rotten wood and his accompanying illustration (Mycograph. **1**: *t. 34 fig. 132.* 1876), which was claimed to be based on a specimen from Berkeley's herbarium, clearly shows pieces of wood. The original specimen of Berkeley appears to be the one annotated by him as "*Peziza margaritacea* B, 10

Müller", and provided with a pencil drawing of warted ellipsoidal ascospores "1/666" [= ± 37 μ] long. Unfortunately this specimen does not bear apothecia any longer. On the same herbarium sheet was mounted a cutting from the proof of Figure 132 of the "Mycographia" upon which is attached a specimen labelled by Cooke as "hairs short, *P. margaritacea.*" Although rather young, this specimen corresponds closely with the original description given by Cooke (*1876*). It is very likely that this specimen is part of Müller 10 forwarded by Berkeley to Cooke and is the specimen upon which Cooke based his description and illustration in validating the name *Peziza margaritacea* Berk. ex Cooke. The only discrepancy is that the specimen was growing on the ground and not on wood as stated by Cooke. It has been known that in preparing the illustration for "Mycographia" Cooke sometimes used his imagination (cf. Massee, *1896*, sub *Helvella pusilla* Berk. & Curt.). For these reasons there seems to be no serious objection for accepting the specimen labelled "hairs short, *P. margaritacea*" as the lectotype specimen of the name *Peziza margaritacea* Berk. ex Cooke.

There is another specimen collected by von Müller from New South Wales, which was identified as *Peziza margaritacea* by Cooke. This specimen, which is both undated and unnumbered, is short haired and lignicolous but its coarsely warted ascospores are only up to 20 μ long and thus outside the range of spore size of *Peziza margaritacea* given by Berkeley's note and by Cooke (*1876*). This collection is probably part of the many fungus collections sent by von Müller directly to Cooke in later years and probably was unknown to Berkeley. For these reasons this Müller s.n. specimen cannot be considered as an acceptable lectotype specimen of the present species. This specimen is identical with the one (on defunct *Cycas*, Brisbane, Queensland, s. dat., Bailey 557) wrongly recorded as *Lachnea erinaceus* (Schw.) Sacc. by Cooke (*1892*); its identity is unknown to me.

The immature lectotype specimen of *Scutellinia margaritacea* designated above produces only young ascospores which are broadly ellipsoidal to ellipsoidal and the oldest spores seen measure 24.5 μ long by up to 16 μ wide. They are covered by crowded, thin, broken, irregularly wavy ridges up to 2 μ high. During the course of this study no further specimen which can be definitely considered to be conspecific with this lectotype specimen has been found, so that it has not been possible to present a description of *Scutellinia margaritacea*. There is no doubt, however, that the latter species is closely related to—and may even conspecific with—*Scutellinia pseudomargaritacea* Le Gal (*1966a*) described above, because the only marked difference that can be detected between the two species is the shape of young ascospores, because in the present species they are always ellipsoidal. Whether Cooke had treated this young lectotype specimen with some chemicals I am unable to say. It must be pointed out that both Berkeley's pencil sketch and Cooke's (*1876*) illustration of the shape

of mature ascospores of *Scutellinia margaritacea* are similar to the shape of mature ascospores of *Scutellinia pseudomargaritacea*.

Scutellinia pseudomargaritacea is both terricolous and lignicolous and seems to prefer wet places. Its main distinguishing characters are the short rooting hairs which usually have simple of inconspicuously forked bases and the large, ridged or almost reticulated ascospores. The American and African species *Scutellinia asperrima* (Ell. & Everh. ex Seaver) Le Gal has more completely and regulary reticulated ascospores which are smaller in size, 19–23(–25) × 10–13 μ, and much longer rooting hairs with distinctly forked base (Le Gal, *1959*; Denison, *1961*).

Specimens examined

Australia. Victoria. On wet fallen branches amongst mosses and on the ground near stream, Melba Gully, near Laver's hill, 9 March 1963, G. Beaton 72 (this specimen produces predominantly 4-spored asci); on clay, near Melbourne, June 1923, E. McLennan; on log partially immersed in stream, Grey River Reserve, near Apollo Bay, 25 April 1963, G. Beaton 100; on log in stream, Arkins Creek below West Basin, 19 April 1964, G. Beaton 184; on log in stream bed, Grey River Reserve, 16 January 1965, K. & G. Beaton 270. — Tasmania. On the ground, s. dat., collector unknown (stated to be common in the bush in early spring); on wet ground, Shipioright's Pt., S. Huan, s. dat., Alfield 23 (H) [type specimen of *Scutellinia pseudomargaritacea* Le Gal]; on dead wood, National Park, 19 January 1928, J. B. Cleland.

Cheilymenia Boud.

Peziza S. F. Gray, Nat. Arrang. Br. Pl. 1: 664. November 1821; non *Peziza* [Dill.] St-Amans, Fl. agen. 530. April 1821 (*q.v.*).

Cheilymenia Boud. *in* Bull. Soc. mycol. Fr. 1: 105. 1885.

Type species: *Peziza stercorea* (Wigg.) ex S. F. Gray.

Apothecia very small to small, rarely medium sized, scattered, gregarious to densely crowded, broadly sessile. Disc concave to flat, occasionally slightly convex, yellow to orange or sometimes light red. Receptacle saucer shaped to shallow cup shaped, concolorous or paler than the disc but sometimes appearing distinctly brownish from the presence of coloured hairs which often form a fringe-like border around the raised margin. Rooting hairs either originate from deep within the excipular tissue with their forked, lobed or rarely simple base deeply buried in the ectal excipulum, in which case they are numerous, conspicuous, long, dark reddish brown, thick walled, septate and acuminate; or they are scanty, with a few septa, slender, relatively short, thinner walled, light brown to pale yellowish or almost hyaline and often not clearly visible to the unaided eye, their base usually swollen, simple or forked but not buried in the ectal excipulum; in some species two to six armed cruciate hairs which originate from superficial swollen basal cells are also present, especially towards the base of the receptacle. Ectal excipulum of a few layers of large polygonal elongated or isodiametric to subglobose cells (textura angularis to textura globulosa), often with their long axes at right angles to the surface of receptacle. Medullary excipulum well to very poorly differentiated, of irregularly shaped cells, polygonal elongated, subpyriform or sublogobose, sometimes interspaced with distinct hyphal elements,

their cells much smaller and thinner walled than those of the ectal excipulum. Asci subcylindrical, narrower towards the base, apex or walls not blued in Melzer's reagent, 8-spored. Ascospores ellipsoidal to oblong ellipsoidal, uniseriate, hyaline or subhyaline, wall smooth or in some species faintly ornamented, with a delicate outer coating that loosens easily and becomes visible when heated in lactic acid. Paraphyses slender, septate, only occasionally branched at the base, apex straight, slightly enlarged, subclavate, containing pigmented granules.

HABITAT: on dung, decaying vegetable matter such as spent hops and hay, or on rich soil.

Like the majority of Boudier's (*1885*) genera, the taxonomic validity of the genus *Cheilymenia* has not been widely accepted but following Le Gal (*1953*) and Dennis (*1960*) many recent authors now agree that this genus was well founded. The more common North American species of *Cheilymenia* were semi-monographically treated by Denison (*1964*). This work appears to be the first critical study since Boudier erected this genus almost eighty years ago and in it the importance of every morphological character has been carefully analysed and evaluated for taxonomic purposes.

Based on the characters of apothecial structure, type of hairs and the presence or absence of spore ornamentation Denison (*1964*) recognized three sub-groupings which he declined to formalize as infrageneric taxa. The first of these subgroups covers *Cheilymenia coprinaria*, *Cheilymenia stercorea* and their related species. These species are characterized by the possession of smooth ascospores, well differentiated ectal and medullary excipulum and thick walled, reddish brown, massive rooting hairs which have distinctly forked or lobed bases. The second group, which includes the terricolous species *Cheilymenia crucipila* (Cooke & Phill. apud Cooke) Le Gal and *Cheilymenia alleghenensis* Denison, has also a well differentiated ectal and medullary excipulum but its ascospores are ornamented and although the bases of its hairs are deeply buried in the ectal excipulum they are not distinctly lobed or forked as in the first group.

The apothecial construction, the type of hairs and the pigmentation of these two groups of species suggest that the genus *Cheilymenia* is closely related to *Scutellinia*. The two genera, however, can be easily separated by their ascospores, because unlike those of *Cheilymenia* the ascospores of species of *Scutellinia* contain oil globules and do not possess a readily separable delicate outer coating but are more distinctly and elaborately ornamented. Le Gal (*1947*, *1953*) has discussed and illustrated in detail the ascospore characters of both genera. Denison (*1964*) pointed out further that the discs of *Scutellinia* vary from red to reddish orange, whereas those of *Cheilymenia* are usually of lighter tone, often yellow or orange. Species of *Cheilymenia* do not normally occur on wood or bark like those of *Scutellinia* but in some cases the two genera may grow in the same type of habitat.

The third group of species recognized by Denison (*1964*) is rather

aberrant and the species included show a strong affinity with the hairless genus *Coprobia* Boud. both in the structure of their excipular tissue as well as in the type of their ascospores. There are many species that can be included in this group such as *Cheilymenia hyalochaeta* (Speg.) Gamundi, *Cheilymenia fraudans* (Karst.) Boud. (Gamundi, *1960*), *Cheilymenia theleboloides* and others. These species are characterized by the isodiametric-celled ectal excipulum and often poorly differentiated medullary excipulum. Their rooting hairs are usually bulbous but indistinctly lobed or forked at the base so that they might be mistaken for ordinary superficial hairs, especially because their bases are not buried in the ectal excipulum. They are scanty, slender, thin walled, light coloured and usually inconspicuous to the unaided eye. Nevertheless this group of species is considered to be congeneric with *Cheilymenia stercorea* (Le Gal, *1953*; Dennis, *1960*; Gamundi, *1960*; Denison, *1964*), largely because the marked differences between the hair and excipular characters of *Cheilymenia theleboloides* and its related species and those of the type species of *Cheilymenia* seem to be effaced by the characters exhibited by *Cheilymenia vitellina* (Pers.) Dennis and *Cheilymenia lemuriensis* Heim apud Le Gal (*1953*). The former species has an excipular structure like that of *Cheilymenia theleboloides* but although the bases of its hairs are not buried in the ectal excipulum they are massive, thicker walled and not swollen at the base like those of *Cheilymenia theleboloides*. The ectal excipulum and the size, shape and coloration of hairs of *Cheilymenia lemuriensis* are similar to those of the present group but its medullary excipulum is well differentiated (Le Gal, *1953*).

From the above discussion it is obvious that it would be possible to arrange species of *Cheilymenia* in several natural groups of related species, but their formal recognition as infrageneric taxa should be deferred until the characters of all species of *Cheilymenia* are more fully understood.

KEY TO AUSTRALASIAN SPECIES OF CHEILYMENIA

1a. Rooting hairs massive, conspicuous, distinctly forked at the base 2
b. Rooting hairs delicate, inconspicuous, base not distinctly forked, simple or bulbous 3
2a. Apothecia with stellate hairs *Cheilymenia stercorea* (Wigg. ex S. F. Gray) Boud.
b. Apothecia without stellate hairs . *Cheilymenia coprinaria* (Cooke) Boud.
3a. Apothecia less than 2 mm diam.; ascospores more than 20 μ long. . . . 4
b. Apothecia more than 2 mm diam.; ascospores up to 19 μ long *Cheilymenia theleboloides* (Alb. & Schw. ex Pers.) Boud.
4a. Ascospores 21–27.3 × 12–16 μ . . . *Cheilymenia raripila* (Phill.) Dennis
b. Ascospores 29–36.3 × 14–18 μ *Cheilymenia coprogena* (Berk. & Br.) Rifai

Cheilymenia coprinaria (Cooke) Boud.

Peziza coprinaria Cooke *in* Grevillea 4: 91. 1875. — *Lachnea coprinaria* (Cooke) Phill., Man. Brit. Discom. 224. 1887 .— *Scutellinia coprinaria* (Cooke) O. Kuntze, Rev. Gen. Pl. 2: 869. 1891. — *Cheilymenia coprinaria* (Cooke) Boud., Hist. Class.

Discom. Eur. 63. 1907. — *Patella coprinaria* (Cooke) Seaver, N. Am. Cup Fungi (Operc.) 171. 1928. — *Humaria coprinaria* (Cooke) Kanouse *in* Mycologia 39: 655. 1947.

Sepultaria pediseta Clem. *in* Bot. Surv. Nebraska 4: 13. 1896 (teste Denison, 1964). — *Lachnea pediseta* (Clem.) Sacc., Syll. Fung. 14: 758. 1899.

Patella michiganensis Povah *in* Mycologia 24: 240. 1932 (teste Denison, *1964*). — *Scutellinia michiganensis* (Povah) Povah *in* Pap. Mich. Acad. Sci. 20: 130. 1935.

Apothecia scattered to gregarious, small to medium sized, 2–5(–7.5) mm diam. Disc shallowly concave or flat, orange coloured. Receptacle saucer or cup-shaped, broadly sessile, slightly paler than the disc but distinctly clothed with reddish brown stiff hairs. Rooting hairs originating deep within the tissue of the excipulum, distinctly forked several times at the base, straight, 110–800 μ long by 18–35 μ diam. near the base, then gently tapering into the sharp pointed apex, 1–10-septate, septa thin, wall dark reddish brown and up to 4 μ thick. Ectal excipulum of two or three or more layers of large, subglobose to polygonal elongated to almost ellipsoidal cells 30–80 μ diam. by up to 100 μ long, mostly arranged with their long axes at right angles to the surface of receptacle, except near the margin where they lie at a low angle with the latter. Medullary excipulum of irregularly arranged and shaped cells, polygonal elongated, lobed or subpyriform, 10–30 μ diam. and occasionally up to 50 μ long, interspaced with hyphae 5–10 μ diam. Hymenium about 200 μ thick. Asci cylindrical, slightly narrower at the base, 8-spored, 175–220 × 10–14 μ. Ascospores uniseriate, oblong ellipsoidal, smooth walled, with a delicate outer wall separable when heated in lactic acid, hyaline, without oil globules 16–21 × × 8–11 μ. Paraphyses sparingly septate, occasionally branched at the base, slender, 3 μ diam. below, apex clavate, 6–8 μ diam., containing orange granules (Fig. 106–108).

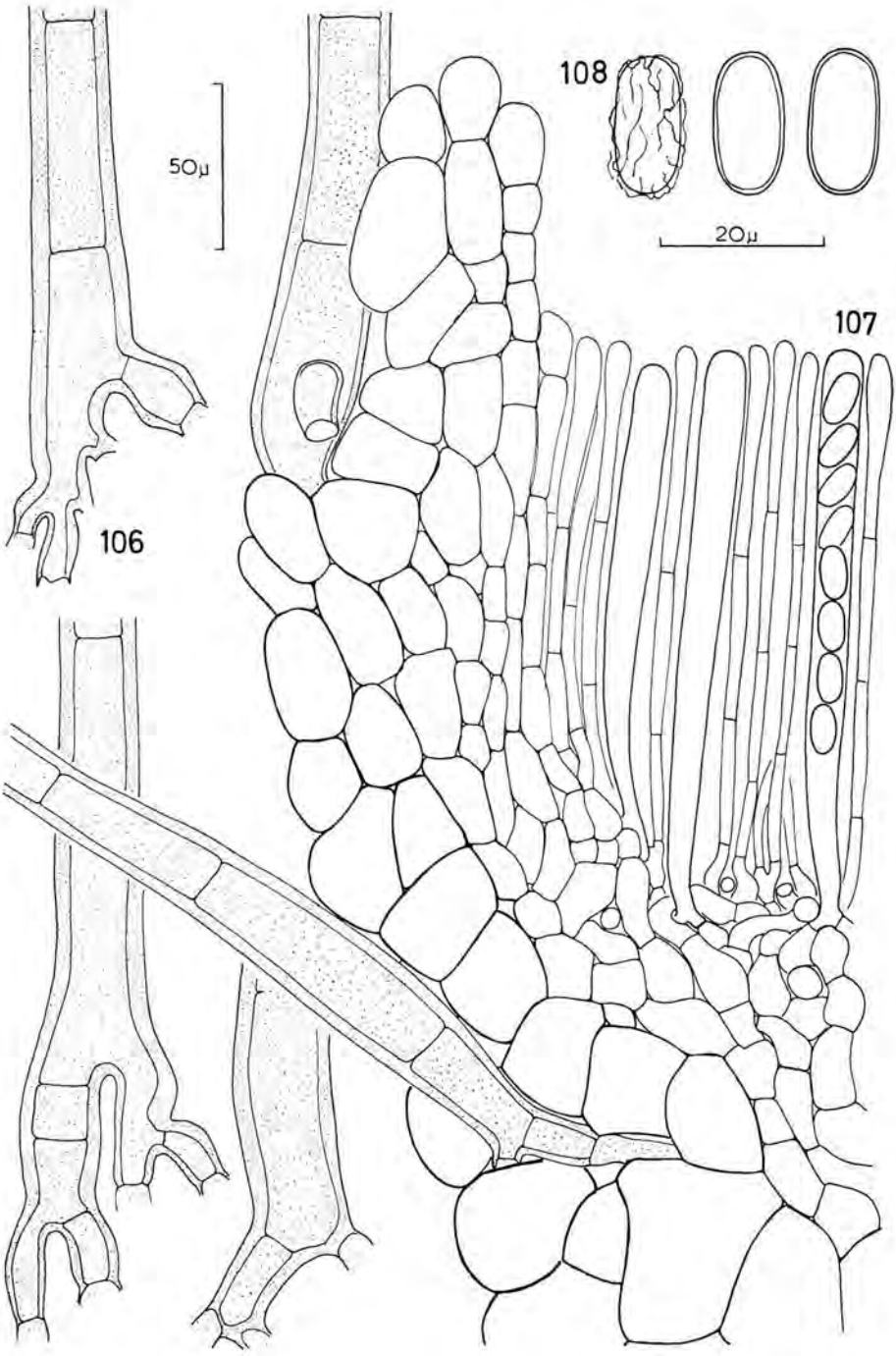
HABITAT AND DISTRIBUTION: on dung of various animals, occasionally on stercoreated mud in Europe (type locality Scotland), North and Central America, India, Australia and probably cosmopolitan.

Cheilymenia coprinaria is the most widely distributed species of the genus and judging from the specimens available at Herb. Kew. it is probably not uncommon in Australia. In the field this species may be confused with *Coprobia granulata* but the absence of hairs on the receptacle of the latter should cause no difficulty in distinguishing to two species. *Cheilymenia stercorea* is also very similar and separated because of the stellate hairs.

Cooke (*1879*) identified and recorded two of the specimens listed below as *Peziza dalmeniensis* Cooke, which now is generally regarded as a synonym of *Cheilymenia vitellina* (Dennis, *1960*; Denison, *1964*). That species however, has rather large and sulphur yellow apothecia and is terricolous. Cooke (*1892*) also recorded the occurrence of *Lachnea dalmeniensis* (Cooke) Phill. in Australia based on a collection from the ground in Victoria but this specimen cannot be located at Herb. Kew.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On cow manure, Melba Gully, near Laver's Hill, 16 June 1963, G. Beaton 128; on cow manure on open heath, head of McPherson Creek, N.E. of Cape Liptrap Lighthouse, 2 June 1963, R. Filson (comm. G. Beaton



Figs. 106–108. *Cheilymenia coprinaria*. 106. Bases of rooting hairs. 107. Median section of margin. 108. Ascospores, heated and unheated in lactic acid. (From WARI 2152).

125); on dung, West Melbourne, s. dat., S. Berggren 396 [sub *Peziza dalmeniensis*]. — South Australia. On cow dung, Mt. Lofty, 13 July 1953, C. G. Hansford, ex WARI 2152; on dung, Meningie, 1955, L. D. Williams, ex WARI 6692. — Queensland. On dung, Nambour, Black all Range, 1914, W. N. Cheesman. — Tasmania. On cow dung, Cheshunt, s. dat., W. Archer [sub *Peziza stercorea*].

New Zealand. On dung, Kanvarra, s. dat., T. Kirk 92; on dung, Waitaki, s. dat., S. Berggren 299 [sub *Peziza dalmeniensis*].

Cheilymenia stercorea (Wigg. ex S. F. Gray) Boud.

Patella stercorea Wigg., Prim. Fl. hols. 106. 1780. — *Peziza stercorea* (Wigg.) Pers., Obs. mycol. 2: 89. 1799. — *Peziza stercorea* (Wigg.) *ex* S. F. Gray, Nat. Arrang. Br. Pl. 1: 665. 1821; Fr., Syst. mycol. 2: 87. 1822. — *Humaria stercorea* (Wigg. ex S. F. Gray) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 321. 1870. — *Lachnea stercorea* (Wigg. ex S. F. Gray) Gill., Champ. Fr., Discom. 76. 1880. — *Lasiobolus stercoreus* (Wigg. ex S. F. Gray) Karst. *in* Acta Soc. Fauna Fl. fenn. 2: 122. 1885. — *Scutellinia stercorea* (Wigg. ex S. F. Gray) O. Kuntze, Rev. Gen. Pl. 2: 869. 1891. — *Humariella stercorea* (Wigg. ex S. F. Gray) Schroeter *in* Kryptog.-Fl. Schles. 3 (2): 37. 1893. — *Cheilymenia stercorea* (Wigg. ex S. F. Gray) Boud., Hist. Class. Discom. Eur. 63. 1907. — *Patella stercorea* (Wigg. ex S. F. Gray) Seaver, N. Am. Cup Fungi (Operc.) 169. 1928 [ut *Patella stercorea* (Pers.) Weber].

Elvela lutea Scop., Fl. carn. 2: 481. 1772. — *Peziza lutea* (Scop.) Reich. *in* Beschäft. berlin. Ges. naturf. Fr. 3: 216. 1775. — *Patella lutea* (Scop.) Morgan *in* J. Mycol. 8: 188. 1902 (nomen non rite publicatum).

Humaria stercorea (Wigg. ex S. F. Gray) Fuckel var. *aurantiaca-flava* Fuckel. *in* Jb. nassau. Ver. Naturk. 27–28: 64. 1873. → *Humaria alpina* Fuckel.

Peziza scubalonta Cooke & Gerard *apud* Cooke *in* Grevillea 4: 92. 1875. — *Lachnea scubalonta* (Cooke & Gerard apud Cooke) Sacc., Syll. Fung. 8: 179. 1889. — *Scutellinia scubalonta* (Cooke & Gerard apud Cooke) O. Kuntze, Rev. Gen. Pl. 2: 869. 1891.

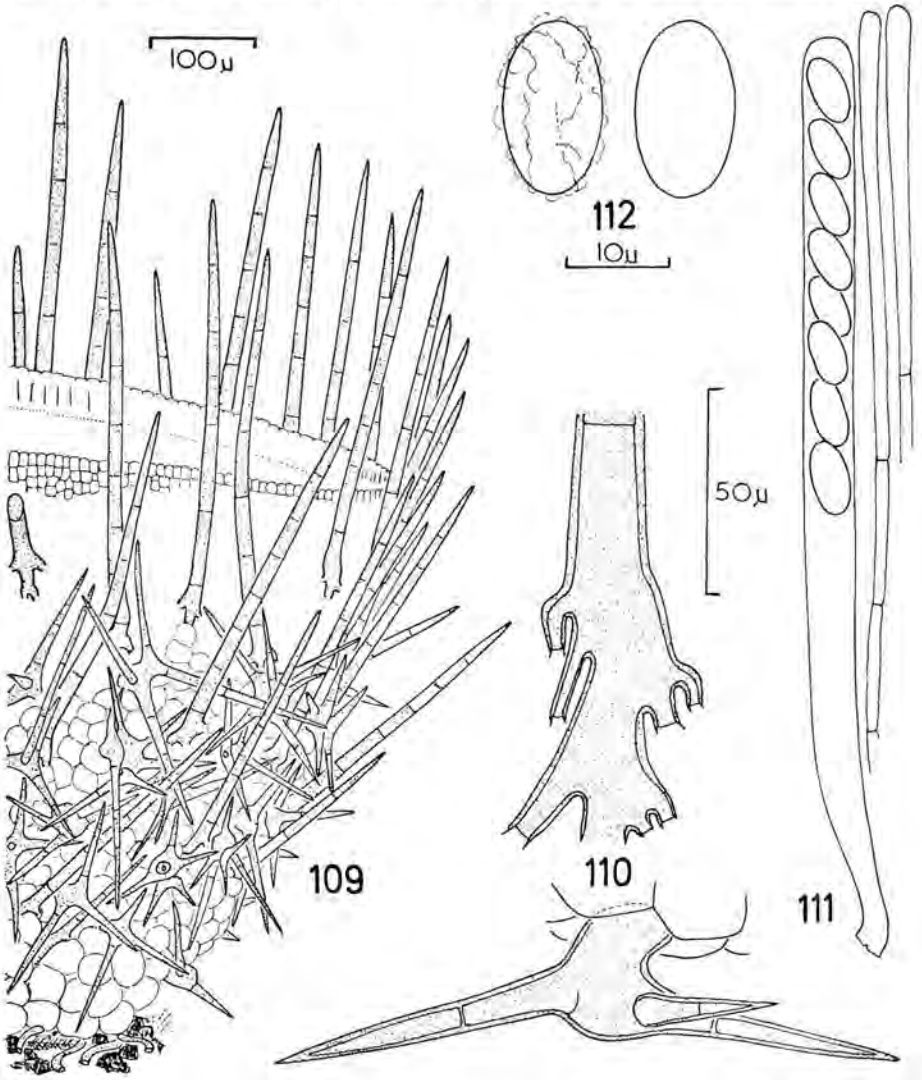
Humaria alpina Fuckel *in* Jb. nassau. Ver. Naturk. 29–30: 32. 1875. — *Peziza alpina* (Fuckel) Cooke, Mycograph. 1: 148. 1877. — *Lachnea alpina* (Fuckel) Sacc., Syll. Fung. 8: 180. 1889. — *Scutellinia alpina* (Fuckel) O. Kuntze, Rev. Gen. Pl. 2: 869. 1891. — *Cheilymenia alpina* (Fuckel) Boud., Hist. Class. Discom. Eur. 63. 1907.

Apothecia scattered to gregarious, small, 0.4–3 mm in diam. Disc shallowly concave or flat, reddish or yellowish orange. Receptacle saucer shaped, sessile, appearing brownish from two kinds of hairs. Rooting hairs occupy the upper part of receptacle and form a fringe-like border around the margin of apothecia; they are straight, acuminate, 0–14-septate, distinctly forked several times at the base, with thick dark reddish brown cell walls, up to 560 μ long or more by 10–20 μ diam. immediately above the base. Stellate hairs also reddish brown, arise from a superficial, polygonal basal cell up to 30 μ diam., with 2–5(–6) acuminate, 0–3-septate, 30–175 × 7–11 μ arms. Ectal excipulum thin, textura angularis, of one or two or rarely more layers of angular elongated, polygonal, subcuboidal or subglobose cells 15–40(–50) μ diam.; towards the margin of receptacle the cells become smaller, 10–15 μ diam., regularly arranged so that from surface view they appear like a textura prismatica tissue, and usually form a distinct, 40–70 μ wide collar. Medullary excipulum of irregularly arranged, subglobose, polygonal elongated or lobed cells 12–18 μ diam. by up to 28 μ long, interspaced by distinct hyphal elements 5–10 μ diam. Subhymenium of tightly intertwined short-celled, about 7 μ diam. hyphae. Hymenium about 210 μ thick. Asci clavate cylindrical, distinctly narrower at the flexuous base, 200–230 × 12–15 μ, 8-spored. Ascospores uniseriate,

hyaline, ellipsoidal to oblong ellipsoidal, smooth walled, without oil globules but with a thin outer coating which loosens and becomes visible when heated in lactic acid, 16–20.5 × 9–12 μ. Paraphyses 3–4 μ diam. below, slightly enlarged to about 6 μ diam. at the subclavate apex, sparingly septate, containing orange granules (Fig. 109–112).

HABITAT AND DISTRIBUTION: on cow or horse dung in Europe, America, Madagascar, India and Australia and probably cosmopolitan.

This species commonly is cited as *Cheilymenia stercorea* (Pers. ex Fr.) Boud. but in describing it as a species of *Peziza* a reference to Wiggers' (*1780*) work was made by Persoon (*1799*) and in fact he cited *Patella*



Figs. 109–112. *Cheilymenia stercorea*. 109. Surface view of receptacle, showing the distribution of rooting and stellate hairs. 110. Details of bases of rooting and stellate hairs. 111. Ascus and paraphyses. 112. Ascospores, heated and unheated in lactic acid. (From G. Beaton 119).

stercorea as its synonym (or rather as its basionym). As has been pointed out by Denison (*1964*) the lectotype specimen in Persoon's herbarium in Leiden could not be readily demonstrated to be identical with the present species. Nevertheless in the last ninety years there has been an almost complete unanimity in using the epithet 'stercorea' for this species, which undoubtedly has been influenced by Cooke's illustration in the "Mycographia".

The Australian specimen recorded by Cooke (*1892*) as *Lachnea alpina* is not preserved at Herb. Kew. The type specimen of the latter, however, has been found to be within the variation of *Cheilymenia stercorea* so that it is proposed to reduce that species and its protonym (*Humaria stercorea* var. *aurantiaca-flava* Fuckel) to the synonymy of the present species. Judging from their original descriptions *Peziza stercorea* var. *gemella* Karst. (Karsten, *1871*) and *Humaria stercorea* var. *glacialis* Rehm (Rehm, *1881*)—which according to Rehm (*1895*) were identical with *Humaria alpina*—seem to be unrelated to *Cheilymenia stercorea*.

Although widely distributed, this species appears to be rarer than *Cheilymenia coprinaria*. It can be easily distinguished from the latter on account of its stellate hairs, smaller celled ectal excipulum and much smaller apothecia.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On dried cow manure, Mt. Pourdon, near Cobden, 22 May 1963, J. H. Willis (comm. G. Beaton 119). — Tasmania. On dung, s. dat., W. Archer; on cow dung, Cheshunt, s. dat., W. Archer.

NEW ZEALAND. On dung, Waitaki, s. dat., collector unknown, no. 84.

EUROPE. Germany. Ad fimum vaccinum putridum, aestate, ca. St. Moritz, frequens [Fuckel, Fungi Rhenani 2687 sub *Humaria alpina*; isotype specimen].

AMERICA. U.S.A. On horse dung, Catskill Mts., s. dat., W. Gerard [type specimen of *Peziza scubalonta* Cooke & Gerard apud Cooke].

CHEILYMENIA THELEBOLOIDES (Alb. & Schw. ex Pers.) Boud.

Peziza theleboloides Alb. & Schw., Consp. Fung. 321. 1805. — *Peziza theleboloides* Alb. & Schw. *ex* Pers., Mycol. eur. 1: 246. 1822; Fr., Syst. mycol. 2: 88. 1822. — *Lachnea theleboloides* (Alb. & Schw. ex Pers.) Gill., Champ. Fr., Discom. 74. 1879. — *Humaria theleboloides* (Alb. & Schw. ex Pers.) Quél., Enchir. Fung. 285. 1886. — *Scutellinia theleboloides* (Alb. & Schw. ex Pers.) Lamb., Fl. mycol. Belg., Suppl. 1: 300. 1887. — *Cheilymenia theleboloides* (Alb. & Schw. ex Pers.) Boud., Hist. Class. Discom. Eur. 62. 1907. — *Patella theleboloides* (Alb. & Schw. ex Pers.) Seaver, N. Am. Cup Fungi (Operc.) 170. 1928.

Peziza (*Lachnea*?) *ascoboloides* Bert. *apud* Mont. *in* Ann. Sci. nat. (Bot.) II 8: 363. 1837. — *Humaria ascoboloides* (Bert. apud Mont.) Quél., Enchir. Fung. 288. 1886. — *Leucoloma ascoboloides* (Bert. apud Mont.) Lamb., Fl. mycol. Belg., Suppl. 1: 318. 1887. — *Neottiella ascoboloides* (Bert. apud Mont.) Sacc., Syll. Fung. 8: 193. 1889. — *Lachnea ascoboloides* (Bert. apud Mont.) Massee, Brit. Fung.-Fl. 4: 314. 1895. — *Cheilymenia ascoboloides* (Bert. apud Mont.) Boud. apud Ramsb. *in* Trans. Br. mycol. Soc. 4: 367. 1914.

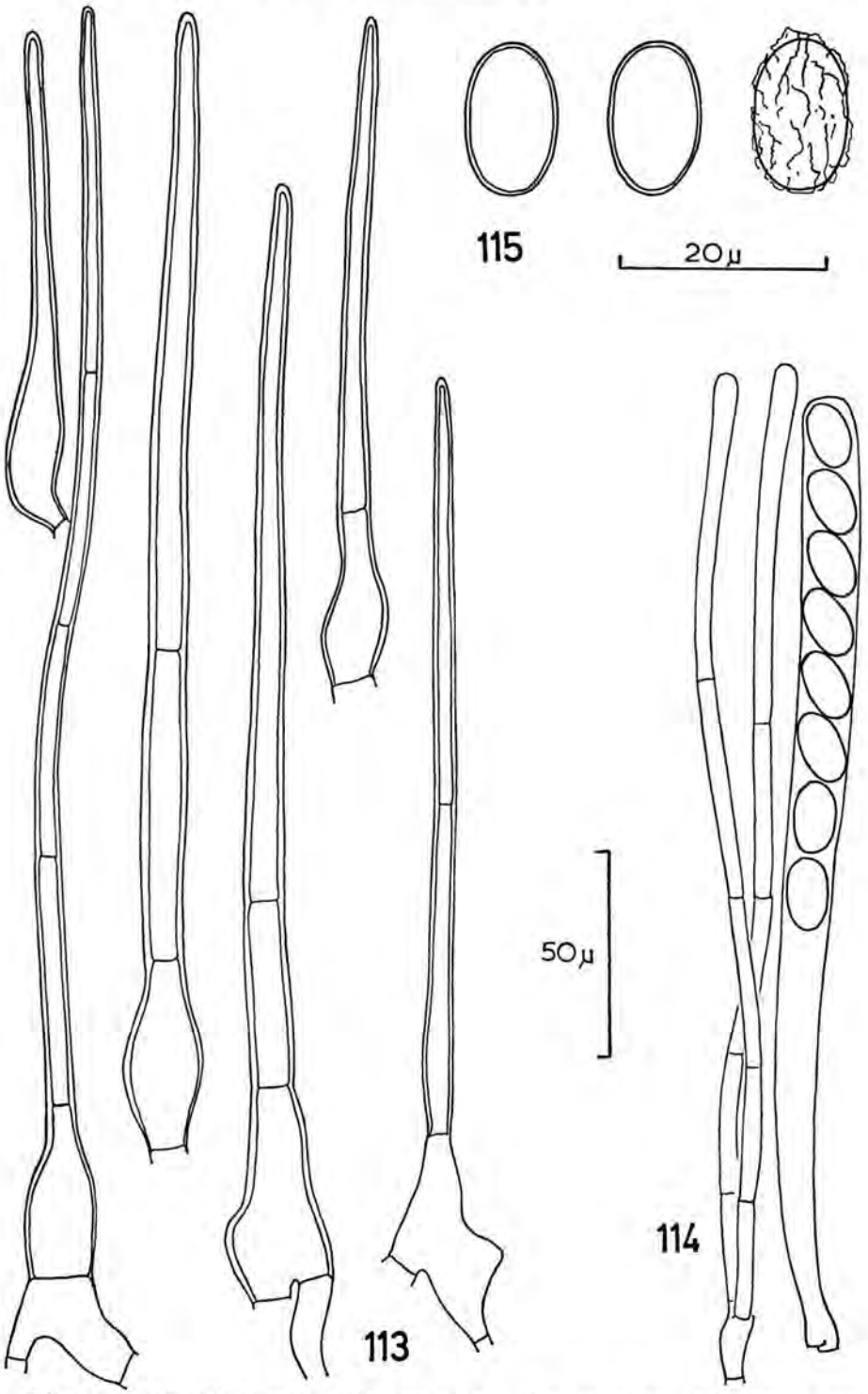
Peziza eclecta Berk. & Cooke apud Cooke *in* Grevillea 5: 60. 1876.

Apothecia gregarious to densely crowded, 2–5(–9) mm diam., anchored to the substratum by coarse radiating hyphae 5–10 μ in diam. Disc shallowly concave to flattened, yellow or golden yellow, turning to dull orange or orange brown in dried specimens. Receptacle shallowly cup- to saucer-shaped, concolorous or slightly paler than the disc, inconspicuously covered by light brownish yellow hairs. Rooting hairs acuminate, straight or rarely gently curved, slender, up to 375 μ long by 3–10 μ diam., 1–5-septate, wall thin and commonly less than 1.5 μ thick, base bulbous, superficial, sometimes indistinctly forked and up to 20 μ diam. Ectal excipulum up to 250 μ thick, of subglobose or polygonal large cells (25–)30–65 μ diam., sometimes elongated up to 75 μ long, in which case their long axes stand at right angles to the surface of receptacle (textura globulosa to textura angularis). Medullary excipulum of slightly thinner walled subglobose cells 10–25 μ diam., interspaced by 4–10 μ diam. hyphal elements whose cells may be considerably inflated and much constricted at the septa. Hymenium about 200 μ thick. Asci narrowly clavate cylindrical, 8-spored, 200–230 × 12–14 μ. Ascospores uniseriate, ellipsoidal, 15–19 × 8–10 μ, without oil globules, smooth walled, with a delicate outer wall which becomes visible and separable when heated in lactic acid. Paraphyses slender, 3–4 μ diam., sometimes branched near the base, septate, apex subclavate, about 7 μ diam., filled with yellow or orange yellow granules (Fig. 113–115).

HABITAT AND DISTRIBUTION: on various kinds of substrates (bare rich soil, hay, spent hops, dung and other herbaceous remains) in Europe (type locality, Germany), North and South America, South Africa, India, Australia and probably cosmopolitan.

The Victorian specimen described by Cooke (*1892*) as *Lachnea theleboloides* was no longer available at Herb. Kew. and the above description has been drawn up from specimens reported by Hansford (*1954*) as "*Patella* sp. near *P. theleboloides* (Alb. & Schw. ex Fr.) Seaver." From this description it can be seen that the result of my observations on the structure of the ectal and medullary excipulum of this species is slightly different from that of Denison's (*1964*). According to Denison the two layers of excipulum were hardly or not sharply differentiated but as Gamundi (*1960*) has already showed the size of cells of the respective layers is different. Furthermore the outer layer seems to stain more deeply and has – as already noted by Denison – a slightly thicker cell wall. The differentiation into two layers, however, is not as sharp as in *Cheilymenia coprinaria*. It should be noted that in studying species of *Cheilymenia* I have used a simpler method than the one recommended by Denison (*1964*). After the material was soaked in 10 % KOH for 10–15 minutes and washed with tap water, sections were prepared by the help of a freezing microtome and by free hand. The sections obtained were directly mounted in lactic acid with and without cotton-blue and then gently heated.

I substantiate Denison's view on the synonymy between *Peziza ascoboloides* Bert. apud Mont. and the present species. The type specimen of *Peziza eclecta* Berk. & Cooke apud Cooke has also been found to be



Figs. 113–115. *Cheilymenia theleboloides*. 113. Rooting hairs. 114. Ascus and paraphyses. 115. Ascospores. (From L. D. Williams).

conspecific with Rehm, Ascomyceten no. 604C which Denison chose as the neotype specimen of *Peziza theleboloides* Alb. & Schw. ex Pers.

SPECIMENS EXAMINED

AUSTRALIA. South Australia. On hay, Meningie, July 1953, L. D. Williams; on cow dung, Meningie, 4 August 1953, L. D. Williams, ex WARI 3517.

EUROPE. Germany. Auf feuchtem Lehmboden an einem Waldrand bei Pohlenz (Leipzig) in Sachsen, Mai 1884, G. Winter [Rehm, Ascomyceten no. 604C sub *Humaria theleboloides*; neotype specimen of *Peziza theleboloides* Alb. & Schw. ex Pers.] — Great Britain. On spent hops, Bolton Percy, Yorkshire, October 1944, W. G. Bramley; on the ground, Sibbertoft, s. dat., M. J. Berkeley [type specimen of *Peziza eclecta* Berk. & Cooke apud Cooke].

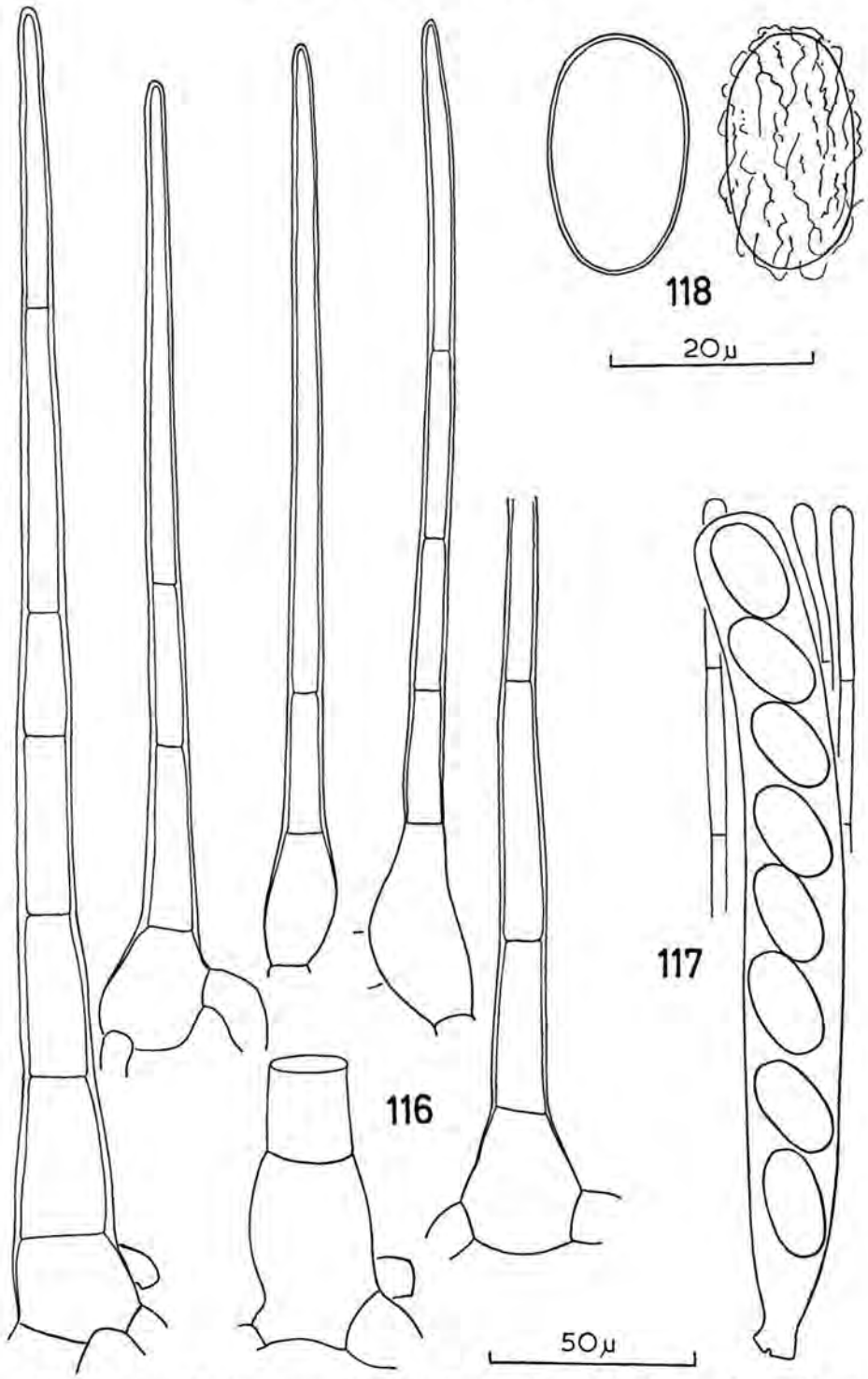
SOUTH AMERICA. Chile. In vinaceis decompositis, Rancagua, s. dat., Bertero [type specimen of *Peziza ascoboloides* Bertero apud Mont.]. — Argentina. On cow dung in forest, ca. 1100 m alt., Sierra de San Javier, Tucumán, 26 May 1957, R. Singer T-3083.

CHEILYMENIA RARIPILA (Phill.) Dennis

Ascobolus (*Ascophanus*) *raripilus* Phill. *in* Grevillea 7: 23. 1878. — *Lasiobolus raripilus* (Phill.) Sacc., Syll. Fung. 8: 537. 1889. — *Patella raripila* (Phill.) Seaver, N. Am. Cup Fungi (Operc.) 173. 1928. — *Cheilymenia raripila* (Phill.) Dennis *in* Kew Bull. 14: 428. 1960.

Apothecia gregarious to densely crowded, small, 0.7–1.7 mm in diam. Disc concave or flattened, pale orange yellow to pale yellow, often becoming brownish yellow when dried. Receptacle saucer shaped to cup shaped, sometimes deformed by mutual pressure, concolorous or a little darker or duller than the disc, sparsely clothed with light brown hairs which are usually inconspicuous to the unaided eye. Rooting hairs straight, 0–9-septate, up to 340 μ long by 8–16(–20) μ wide near the base, with light brown cell walls up to 2 μ thick, paler and narrower towards the blunt or rarely pointed apices; the bases of these hairs are superficial and have thinner and paler cell walls, usually bulbous, up to 26 μ diam. or more, occasionally forked. Ectal excipulum made up of large subglobose or polygonal isodiametric or elongated cells 25–80 μ diam. by up to 95 μ long (textura globulosa to textura angularis). Medullary excipulum rather poorly differentiated, also of polygonal elongated but more irregularly orientated, slightly thinner walled and smaller sized cells 20–45 μ diam. (textura angularis); from about 600 μ towards the margin of the cup the cells of medullary excipulum become smaller in diam. and longer and mostly lie at a low angle with the surface of receptacle, interspaced with distinct 6–10 μ diam. hyphal elements. Subhymenium of short celled, tightly intertwined 4–8 μ diam. hyphae. Hymenium about 200 μ thick. Asci broad clavate cylindrical, 180–210 × 18–24 μ, 8-spored. Ascospores uniseriate, ellipsoidal or oblong ellipsoidal, hyaline, without distinct oil globules, smooth walled or sometimes appearing very minutely warted, with a delicate coating separable and visible when heated in lactic acid, 21–27.3 × 12–16 μ. Paraphyses slender, 2.7–3.8 μ diam., enlarged to about 8 μ at the subclavate, straight apices, sparingly septate, typically unbranched (Fig. 116–118).

HABITAT AND DISTRIBUTION: on cow dung in North America (type locality California), Venezuela and Australia.



Figs. 116–118. *Cheilymenia raripila*. 116. Rooting hairs. 117. Ascus and paraphyses. 118. Ascospores. (From L. D. Williams).

The excipular construction and the hairs of this species strongly resemble those of *Cheilymenia theleboloides*. Some of its hairs have root-like processes but unlike the hairs of *Cheilymenia coprinaria*, their bases are superficial, namely they are not deeply buried in the ectal excipulum.

The wide asci, the rather large ascospores and the small yellow apothecia with the few inconspicuous hairs make *Cheilymenia raripila* a readily recognizable species. Although it does not seem to be very common, this species appears to have a wide distribution in Australia.

Cheilymenia coprogena redescribed below is very closely related to the present species and the two species are kept separate because the former species has larger ascospores. Furthermore its hairs are far more delicate, more uniformly thin-walled and fewer.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On cow manure in open forest, 9 June 1963, G. Beaton 126; on cow manure, Melba Gully, 30 March 1964, G. Beaton 183; on cow dung, Dimboola, 10 July 1898, F. Reader 56 [sub *Humaria macrospora* Massee, a manuscript name]. — Queensland. On dung 1914, W. N. Cheesman. — South Australia. On old dung, Meningie, June 1953, L. D. Williams.

NORTH AMERICA. U.S.A. On cow dung, California, s. dat., Harkness 509 [type specimen of *Ascobolus raripilus* Phill.].

Cheilymenia coprogena (Berk. & Br.) Rifai, *comb. nov.*

Peziza (*Lachnea*) *coprogena* Berk. & Br. *in* Trans. Linn. Soc. Lond. II 2: 69. 1882. — *Lachnea coprogena* (Berk. & Br.) Sacc., Syll. Fung. 8: 181. 1889. — *Scutellinia coprogena* (Berk. & Br.) O. Kuntze, Rev. Gen. Pl. 2: 869. 1891.

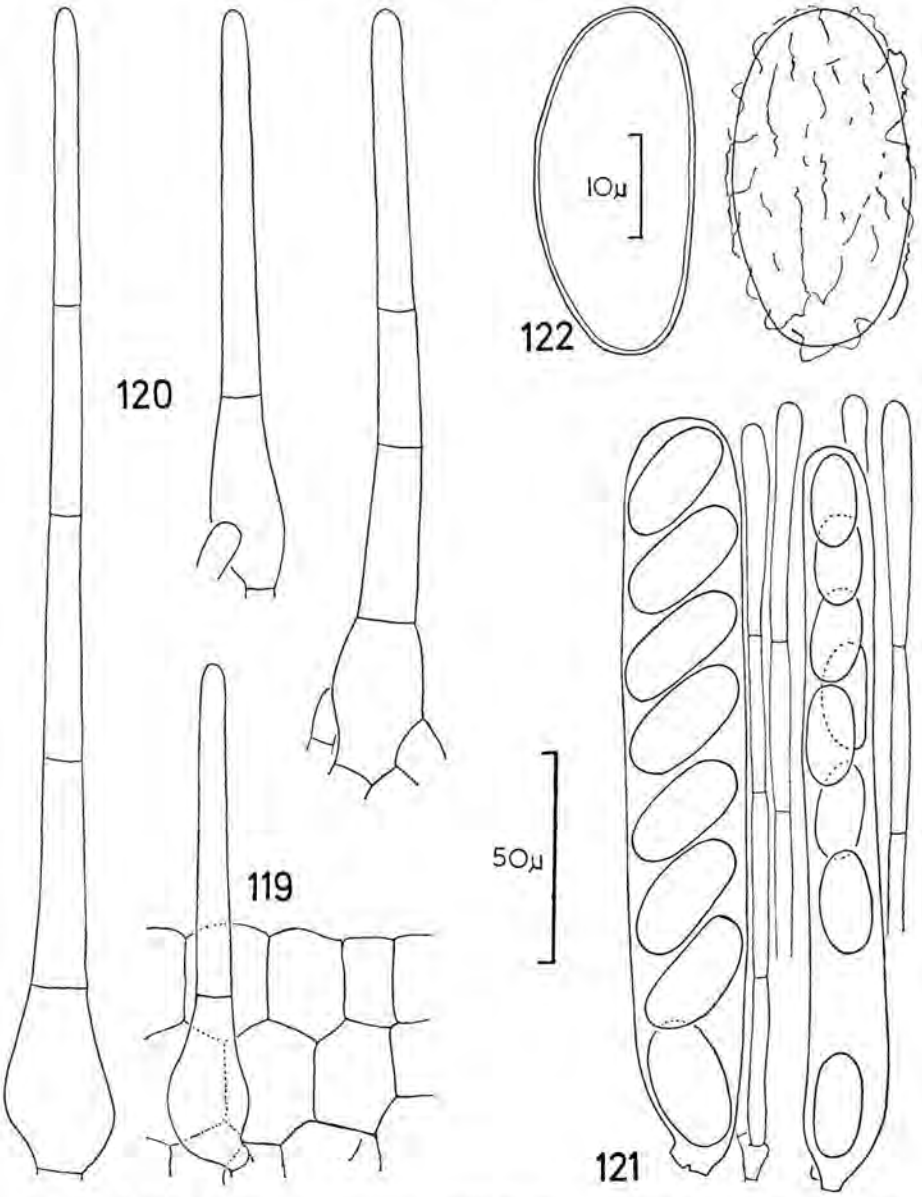
Apothecia gregarious, very small to small, 0.3–1.5 mm diam. Disc "subaurantiaca" according to Berkeley & Broome (*1882*), becoming pale reddish brown when dried, concave or flat, smooth. Receptacle shallowly cup shaped or discoid, attached to the substratum with a broad base, concolorous or paler than the disc, sparingly and indistinctly clothed with subhyaline to very pale yellowish brown hairs. Rooting hairs thin walled, sparingly (1–4)-septate, straight, acuminate, 80–290 μ long by (8–)14–20 μ diam., base usually superficial, often swollen up to 30 μ diam. and sometimes indistinctly forked or lobed. Ectal excipulum of thin walled, subglobose or polygonal, isodiametric or sometimes elongated cells 30–60 μ diam., usually with their long axes at right angles to the surface of receptacle (textura globulosa to textura angularis), towards the margin of the receptacle the cells become smaller in size, more rectangular and regularly arranged so that from surface view they often assume a textura prismatica tissue. Medullary excipulum rather poorly differentiated, of smaller but longer celled tissue, with angular or lobed, irregularly orientated cells 15–25 μ diam. by about 50 μ long sometimes interspaced with rather distinct hyphal elements, especially near the margin of receptacle. Hymenium about 180 μ thick. Asci broad subcylindrical, hardly narrower towards the base, 8-spored, 170–190 × 20–30 μ. Ascospore uniseriate or rarely biseriate above, hyaline to subhyaline, oblong ellipsoidal, sometimes somewhat asymmetrical, 29–36.3 × 14–18 μ, smooth, with a delicate outer wall which becomes loose and detectable when heated in lactic acid.

Paraphyses slender, 3–4 μ diam. below, gradually enlarged up to 7 μ diam. at the apex, sparingly septate, unbranched (Fig. 119–122).

HABITAT AND DISTRIBUTION: on dung in Queensland; known only from one collection.

SPECIMEN EXAMINED

AUSTRALIA. Queensland. On dung, Brisbane, s. dat., F. M. Bailey 205 [type specimen of *Peziza coprogena* Berk. & Br.].



Figs. 119–122. *Cheilymenia coprogena*. 119. Surface view of margin of receptacle. 120. Rooting hairs. 121. Asci and paraphyses. 122. Ascospores. (From type).

COPROBIA Boud.

Coprobia Boud. *in* Bull. Soc. mycol. Fr. 1: 107. 1885.

TYPE SPECIES: *Peziza granulata* Bull. ex Mérat.

Apothecia gregarious to densely crowded, small, sessile. Disc concave or almost flat, ochraceous orange, often appearing uneven from protruding ripe asci. Receptacle saucer shaped, scurfy, devoid of hairs, usually paler than the disc. Ectal excipulum of large globular cells. Medullary excipulum not sharply differentiated, mostly also of globular cells but slightly smaller in size than those of the ectal excipulum. Asci subcylindrical, wall or apex not blued in Melzer's reagent, 8-spored. Ascospores uniseriate, hyaline, oblong ellipsoidal, without oil guttules, smooth walled, with a delicate outer coating which becomes easily loosened when heated in lactic acid. Paraphyses stout, sparingly septate, apex enlarged, clavate or even capitate, containing orange granules.

HABITAT: on cow dung and manure.

The validity of the genus *Coprobia* has not been generally accepted but many recent authors (Le Gal, *1953*; Dennis, *1960*; Denison, *1964*; Berthet, *1964a*) have recognized it in describing or referring to its cosmopolitan type species, *Coprobia granulata*. Snyder (*1938*) and Lundell & Nannfeldt (*1946*) preferred to accommodate this species in the genus *Humarina* Seaver [=*Octospora* Hedw. ex S. F. Gray emend. Korf] but the type species of the latter, *Octospora leucoloma* Hedw. ex S. F. Gray, has a completely different apothecial construction and its ascospores lack the characteristic outer coating. Seaver (*1928*), Kanouse (*1947*) and more recently Batra & Batra (*1963*) have classified *Coprobia granulata* as a species of *Ascophanus*. This disposition is unnatural because apart from the fact that the type species of *Ascophanus* is in no way related to *Coprobia*, without the inclusion of *Coprobia granulata* the genus *Ascophanus* is already a heterogeneous assemblage. It is possible, however, that among the numerous species which have been assigned to *Ascophanus* there are some which may prove to be congeneric or at least allied to *Coprobia granulata*.

The genus *Coprobia* can be recognized easily by its hairless apothecia with large- and globose-celled excipulum and the ascospores which loosen their outer delicate wall when gently heated in lactic acid.

COPROBIA GRANULATA (Bull. ex Mérat) Boud.

Peziza granulata Bull., Herb. Fr. *t. 438 fig. 3*. 1790; Hist. Champ. Fr. 258. 1791. — *Peziza granulata* Bull. *ex* Mérat, Nouv. Fl. Paris, 2e Ed., 1: 22. 1821 (ut *granulosa*, lapsus calami; cf. Dennis, *1960a*); Pers., Mycol. eur. 1: 298. 1822 (ut *granulosa*, lapsus calami; non *Peziza granulosa* Pers., Mycol. eur. 1: 225. 1822); Fr., Syst. mycol. 2: 67. 1822. — *Ascobolus granulatus* (Bull. ex Mérat) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 288. 1870. — *Aleuria granulata* (Bull. ex Mérat) Gill., Champ. Fr., Discom. 56. 1879. — *Ascophanus granulatus* (Bull. ex Mérat) Speg. *in* Michelia 1: 235. 1879; non *Ascophanus granulatus* Vel., Monogr. Discom. Boh. 1: 359. 1934. — *Humaria granulata* (Bull. ex Mérat) Quél., Enchir. Fung. 290. 1886. — *Coprobia granulata* (Bull. ex Mérat) Boud., Hist. Class. Discom. Eur. 69. 1907. — *Humarina*

granulata (Bull. ex Mérat) Snyder *in* Univ. Washington Publ. Biol. 8 (1): 26. 1938.

Humaria gollmeri P. Henn. *in* Hedwigia 36: 233. 1897 (teste Dennis, *1960a*).

Humaria granulata (Bull. ex Mérat) Quél. var. *robusta* Starb. *in* Bot. Notiser 1898: 211. 1898. — *Ascophanus granulatus* (Bull. ex Mérat) Speg. var. *robustus* (Starb.) Kanouse *in* Mycologia 39: 640. 1947.

Apothecia gregarious to densely crowded, 1–3 mm diam. Disc concave or almost flat, ochraceous orange, at maturity often appearing rough from protruding asci. Receptacle sessile, saucer shaped or shallow cup shaped, orbicular or lobed in outline or slightly deformed by mutual pressure, concolorous or a little paler than the disc, externally scurfy from the presence of large (up to 110 μ diam.), globose thin walled cells, but devoid of any hairs or hyphal outgrowth. Ectal excipulum of large globose or subglobose cells (textura globulosa), the cells larger towards the base of the cup, thin walled. Medullary excipulum not cearly differentiated, also of large subglobose or sometimes elongated cells which are usually smaller in size than the cells of the ectal excipulum. Subhymenium of interlocked, angular, subglobose or lobed cells 5–10 μ diam. Hymenium about 170 μ thick. Asci subcylindrical, slightly narrower at the base, 8-spored, 150–180 × 10–14.5 μ. Ascospores obliquely or irregularly uniseriate, oblong ellipsoidal or ellipsoidal, hyaline, without oil globules, smooth walled, with a delicate outer coating which can be loosened easily by heating the spores in lactic acid, 15.5–17.5 × 6–8.5 μ. Paraphyses stout, 5–7 μ diam. below, sparingly septate, typically unbranched, markedly enlarged above to form a clavate or capitate apex of up to 15 μ diam., containing orange granules (Fig. 123–125).

HABITAT AND DISTRIBUTION: on cow dung, probably cosmopolitan though apparently rarer in warmer areas.

The occurrence of *Coprobia granulata* in Australia was first recorded by Rodway (*1925*), who described Tasmanian collections under the name *Humaria granulata*. Detailed descriptions and illustrations of the anatomy of this species have been given by Corner (*1929a*) and Le Gal (*1953*).

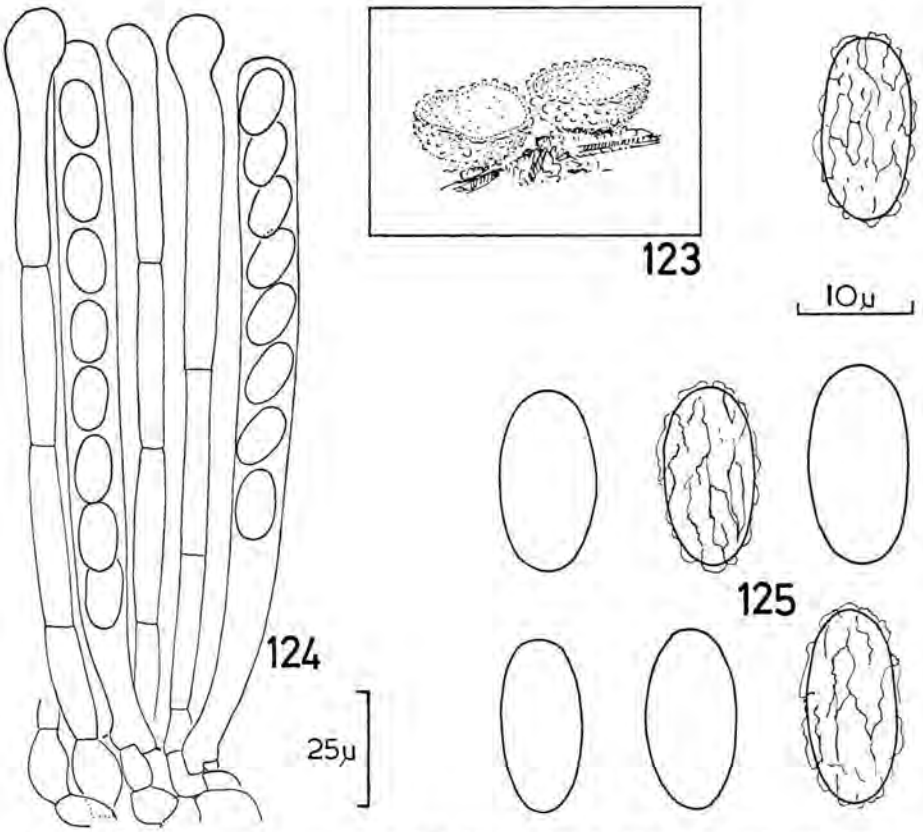
There is no doubt that the collection described above is identical with the ones referred to as *Ascophanus granulatus* var. *robustus* by Kanouse (*1947*) because it has the same broad paraphyses. I have reduced this variety to the synonymy of the present species because the more commonly encountered collections have these broad paraphyses (Rodway, *1925*; Seaver, *1928*; Le Gal, *1953*; Dennis, *1960*; Denison, *1964*) and I believe that these are the ones which should be regarded as representing the typical form of this species. The collections with more slender paraphyses do not seem to deserve a rank higher than a form unless other characters can be found to be correlated with it (compare also Le Gal, *1953*).

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On cow manure, Melba Gully parking area, 7 April 1963, G. Beaton 91.

TRIBE ALEURIEAE

This tribe is undoubtedly related to the preceding one. The two tribes, however, should be separated on composite sets of characters rather than



Figs. 123–125. *Coprobia granulata*. 123. Habit sketch. 124. Asci and paraphyses. 125. Ascospores, heated and unheated in lactic acid. (From G. Beaton 91).

on a single character—the presence or absence of well developed hairs—as has been done previously (Le Gal, *1947*, *1953*; Dennis, *1960*). Consequently I do not hesitate in transferring the genus *Coprobia* to the Ciliarieae and in incorporating the genera *Melastiza* Boud., *Anthracobia* Boud. and *Leucoscypha* Boud. in the present tribe. On the other hand the genera *Boudiera* Cooke, *Fimaria* Velenovský (van Brummelen, *1962a*) and *Psilopezia* Berk. will have to be excluded from the Aleurieae.

KEY TO AUSTRALASIAN GENERA OF ALEURIEAE

1a. Apothecia with well developed hairs 2
b. Apothecia nominally hairless 4
2a. Hairs thick walled, hyaline . . . . . *Leucoscypha* Boud. emend. Rifai
b. Hairs brown 3
3a. Apothecia large, spores reticulate . . . . . [*Melastiza* Boud.]
b. Apothecia small, spores smooth; on burnt ground . *Anthracobia* Boud.
4a. Ascospores ellipsoidal 5
b. Ascospores globose 8
5a. Ascospores without oil globules . . . . . *Geopyxis* (Pers.) Sacc.
b. Ascospores with oil globules 6

6a. Apothecia small to large, ascospores reticulate . . . . . *Aleuria* Fuckel
b. Apothecia small, ascospores mostly smooth or rarely ornamented 7
7a. Ectal excipulum prosenchymatous, medullary excipulum prosenchymatous or pseudoparenchymatous, margin of receptacle composed of long clavate cells, often dentate-fimbriate. *Octospora* Hedw. ex S. F. Gray emend. Korf
b. Ectal and medullary excipulum as well as the margin of receptacle pseudoparenchymatous . . . . . *Inermisia* Rifai
8a. Ascospores smooth walled; medullary excipulum prosenchymatous, of delicate hyphae; paraphyses thread-like, often hooked . *Pulvinula* Boud.
b. Ascospores mostly ornamented; medullary excipulum pseudoparenchymatous; paraphyses slender to stout, straight . . *Lamprospora* de Not.

Anthracobia Boud.

Anthracobia Boud. *in* Bull. Soc. mycol. Fr. 1: 106. 1885.

Type species: *Peziza melaloma* Alb. & Schw. ex Fr.

Apothecia small to medium size, gregarious, sessile. Disc mostly concave or flat, rarely convex, yellowish, ochraceous orange, reddish orange or brown. Receptacle cup shaped or saucer shaped, paler than the disc but covered by dark brown and adpressed bunches of hairs, especially towards the margin of the cup. Hairs superficial, delicate, few celled, sometimes rudimentary, flexuous or straight but not stiff, ends obtuse. Ectal excipulum of subglobose or angular elongated cells (textura angularis) arranged perpendicularly to the surface of receptacle. Medullary excipulum of indistinct textura intricata hyphae consisted of large cells. Asci cylindrical, narrower towards the base, 8-spored, pores not turning blue in Melzer's reagent. Ascospores uniseriate, hyaline, smooth walled, oblong ellipsoidal, with one large oil globule near each end, and often with a highly refractive bubble. Paraphyses slender septate, apex clavate, containing coloured granules.

Habitat: on burnt ground or charred wood.

Anthracobia muelleri (Berk.) Rifai, *comb. nov.*

Peziza muelleri Berk. *in* J. Linn. Soc. (Bot.) 13: 176. 1872. — *Humaria muelleri* (Berk.) Sacc., Syll. Fung. 8: 119. 1889.

Apothecia gregarious to densely crowded, 1–3(–4) mm diam., sessile. Disc yellow to yellowish ochre, concave or flat, sometimes undulate. Receptacle saucer shaped or cup shaped, concolorous or slightly paler than the disc, but usually appearing brownish from the presence of wart-like patches of bunches of adpressed and not well developed hairs, especially towards the margin of the receptacle. Hairs superficial, up to 3-septate, simple, cylindrical, ends obtuse and sometimes somewhat clavate, flexuous or often straight but not stiff, with light brown thin walls, short, up to 65 μ long by 8–13 μ diam., aggregating with each other. Apothecia anchored to the substratum by coarse, flexuous to rather stiff, sometimes warted and thick walled, subhyaline to pale brownish, septate and rarely branched basal hyphae about 15 μ diam. Ectal excipulum of a few layer of large subglobose, polygonal elongated cells (textura angularis) 10–50 μ diam. by up to 80 μ long, running more or less parallel with each other with their long axes at right angles to the surface of receptacle. Medullary excipulum of indistinct prosenchymatous large hyphae, their cells irregular

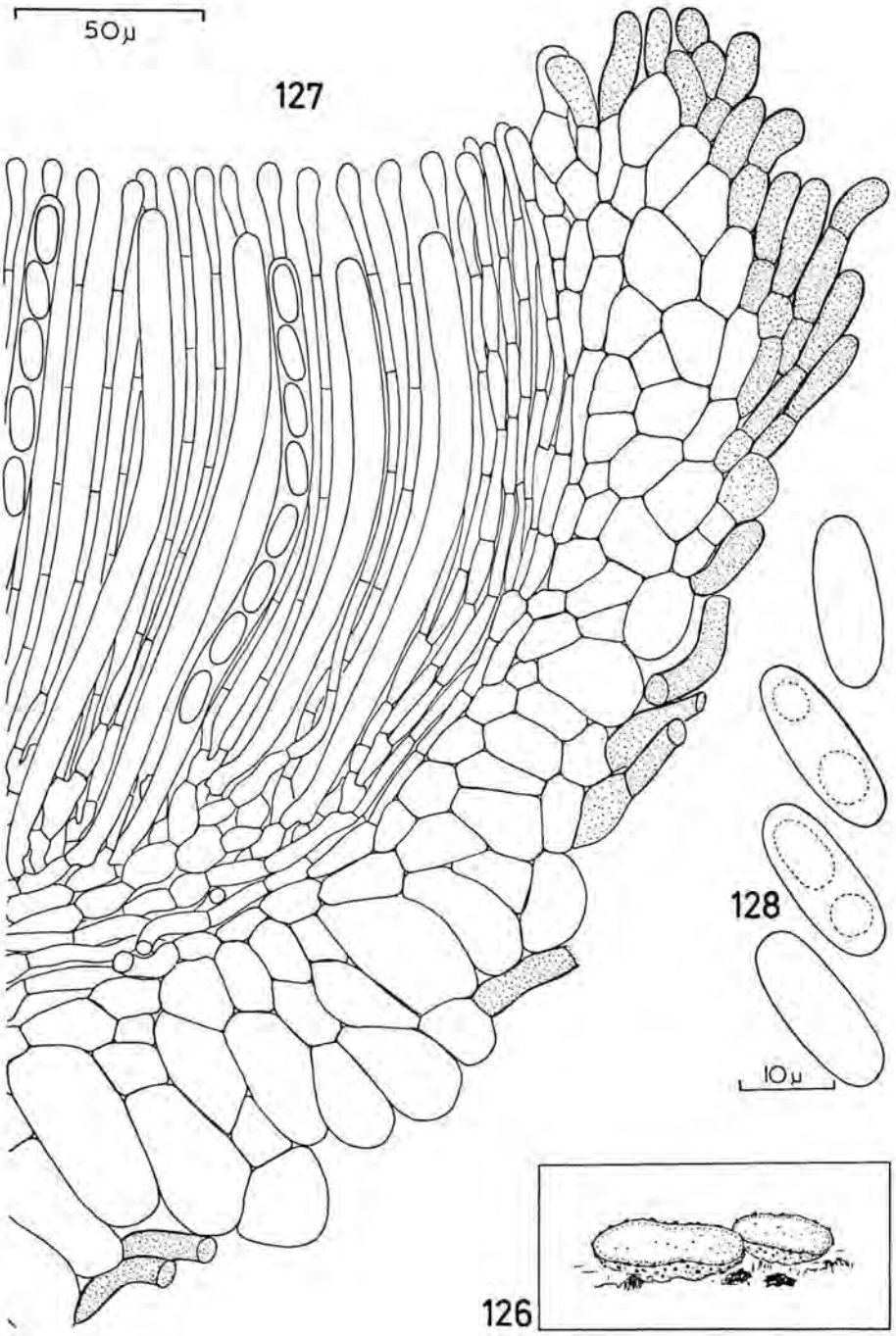
in shape and size, subglobose, polygonal, barrel shaped or much lobed, 16–50 μ diam., but towards the hymenium and the margin of the receptacle the hyphae becoming more distinctly filamentous, branched, smaller in size, 6–17 μ diam. Subhymenium of compactly interwoven, shorter and smaller celled hyphae 5–12 μ diam. Hymenium about 180 μ thick. Asci cylindrical or narrowly clavate cylindrical, 8-spored, 160–210 × 8–12 μ. Ascospores uniseriate, oblong ellipsoidal, smooth walled, hyaline, with one large oil drop near each end and often also with a highly refractive bubble, 16.5–19.5 × 6.3–8.1 μ. Paraphyses slender, septate, simple, 2–3.5 μ diam. below, apex distinctly enlarged, subclavate to clavate, 4–8.5 μ diam. (Fig. 126–128).

HABITAT AND DISTRIBUTION: on burnt ground in Australia and New Zealand.

The collection originating from mycelia isolated from Australian soil and identified with the north temperate species *Anthracobia melaloma* (Alb. & Schw. ex Fr.) Boud. by Warcup & Talbot (*1963*) probably represents the present species. It must be admitted, however, that the distinction between these two species, as well as between the other species of *Anthracobia*, is very critical. From Boudier's (*1905–1910*) illustrations and from Dennis' (*1960*) and Moser's (*1963*) account it is evident that in delimiting species of this genus one has to rely largely on field characters (such as the colour of the discs) and on the type of hairs, but a thorough reapprisal of the validity of these characters and their correlation – if any – with the other morphological features as well as the investigation into the possibility of using the cultural, physiological and ecological characters of its species for taxonomic purposes are wanting. For this reason it has sometimes not been possible to identify inadequately documented collections of species of *Anthracobia* with any degree of certainty.

It seems that the hairs of the present species are slightly shorter than those of *Anthracobia melaloma* so that its bunches of hairs cause the surface of its receptacle to appear warted instead of striate as in the latter species. Furthermore the more yellowish tone of the disc of *Anthracobia muelleri* apparently differs from the orange tinge found in *Anthracobia melaloma* but it must be noted that Berkeley (*1872*) originally described the colour of the disc of the present species as "coccinea." A specimen from Victoria (on the ground, near Melbourne, 4 August 1886, F. Reader 23) was included in the present species by Cooke but this has been found to be an inoperculate species.

Cooke's (*1892*) record of *Anthracobia melaloma* for Australia has been based partially on a collection of the present species as well as on a collection of a species of *Anthracobia* (on burnt ground, Swan River, Western Australia, s. dat., ? Drummond 189), the identity of which has not been satisfactorily solved because of the absence of a colour annotation. *Anthracobia melaloma* and its closely related species *Anthracobia maurilabra* (Cooke) Boud. should also be sought for in burnt places in Australia. The latter species has brownish or fawn coloured apothecia with dark



Figs. 126–128. *Anthracobia muelleri*. 126. Habit sketch. 127. Median section of margin. 128. Ascospores. (From G. Beaton 120).

brown adpressed hairs. Seaver (*1928*) apparently lumped the two species, because although he did not formally list *Anthracobia maurilabra* as a synonym of *Anthracobia melaloma*, he described the disc of the latter as ". . . very variable in color, ranging from pale to bright-orange or dark-brown . . .". In Herb. Kew., however, there is an American specimen (on burnt ground by oak trees and stumps, Glen Ellen, Illinois, 28 May 1909, E. T. & S. A. Harper; already determined by E. J. Durand as *Humaria maurilabra*) which falls into the current conception of *Anthracobia maurilabra*. The Argentinian specimen referred to the latter species by Gamundi (*1960*) may represent a different taxon because of its larger length and breadth ratio of its ascospores.

It is probable that there was a mixing up in recording the locality or in labelling the type specimen of *Peziza muelleri*. From the original description (Berkeley, *1872*) one can gather that the type specimen should be labelled "on the ground, Plenty Creek, Müller 9." The specimen bearing this label, however, was identified by Berkeley as "*Peziza velutina* Berk. & Müll." which appears to be an unpublished name; this specimen is a short haired species of *Scutellinia*, related to *Scutellinia kerguelensis*, which does not in any way answer to Berkeley's (*1872*) description or unpublished pencil sketch of *Peziza muelleri*. In the absence of other evidence to the contrary, von Müller's unnumbered collection from Sealers' Cove labelled "*Peziza mülleri* Berk." in Berkeley's own handwriting is accepted here as an authentic specimen of the present species.

SPECIMENS EXAMINED

NEW ZEALAND. On [burnt] ground, Sealers' Cove (near Stewart Island), s. dat., collector unknown, no. 123; on burnt ground, Sealers' Cove, May 1853, von Müller s.n. [authentic—or probably type—specimen of *Peziza muelleri* Berk.].

AUSTRALIA. South Australia. On burnt soil, Waterfall Gally near Adelaide, 1962, P. H. B. Talbot 6. — Victoria. On burnt soil beside stream, Moorhouses Bridge, Curdies River, Glenfyne-Timboon Road, 1 June 1963, G. Beaton 120.

MELASTIZA Boud.

Melastiza Boud. *in* Bull. Soc. mycol. Fr. **1**: 106. 1885.

TYPE SPECIES: *Humaria miniata* Fuckel.

Although no representative of *Melastiza* has been reported from Australasia, this genus is briefly discussed here because there seems to be some disagreement on its affinity with the other genera. It has been generally accepted that *Aleuria* and *Melastiza* are closely related (Dennis, *1960*; Le Gal, *1963*) but nevertheless the two genera have been kept in different tribes (Le Gal, *1947*; Dennis, *1960*). This is largely due to the fact that technically species of *Aleuria* are hairless so that this genus cannot be accommodated in the Ciliarieae, a tribe originally characterized mainly by the presence of well developed hairs with bright coloured apothecia. In contrast *Melastiza* has brown coloured hairs so that this genus can be referred to the Ciliarieae sensu lato.

The hairs of species of *Melastiza* are commonly somewhat poorly developed, and according to Dennis (*1960*), easily overlooked; they vary in colour from pale to dark brown (Le Gal, *1958*; Graddon, *1961*) and often are adpressed to the surface of the pseudoparenchymatous ectal excipulum. The presence of these brown hairs appears to be the leading character which distinguishes *Melastiza* from *Aleuria*, because the ascospores, asci, paraphyses, excipular tissue, apothecia as well as the habitat of the two genera are similar (Fig. 129–132). The colour of their discs may offer additional taxonomic evidence for keeping the two genera apart. Generally in species of *Aleuria* the discs are of some shade of orange, whereas those of *Melastiza* are mostly red, and thus are slightly darker than in *Aleuria*; *Melastiza scotica* Graddon (Graddon, *1961*), with its orange discs, is a notable exception. It is evident that the taxonomic position of *Melastiza* is near *Aleuria*. Since the type specimen of *Aleuria rubra* Batra (on soil, Municipal Gardens, Mussoorie, India, s. dat., L. R. Batra 141, CUP 1–6) has vivid red discs and adpressed dark brown hairs (Fig. 129–130), this species should be referred to the genus *Melastiza*. Besides *Aleuria aurantia* and *Melastiza rubra*, [11]) *Peziza rutilans* Fr. – which will be transferred to *Leucoscypha* below – was also included in *Aleuria* by Batra & Batra (*1963*). Although these dispositions are unsatisfactory, indirectly they support the view expressed above on the close affinity between *Melastiza*, *Leucoscypha* and *Aleuria*.

Scutellinia asperrima (Ell. & Everh. ex Seaver) Le Gal and *Scutellinia pennsylvanica* (Seaver) Denison (Le Gal, *1959*; Denison, *1961*) have reticulate ascospores like those of *Melastiza* and for this reason Seaver (*1928*) had classified them as species of the latter genus. Since these two species have rooting hairs and excipular layers characteristic of the genus *Scutellinia* the combinations proposed by Le Gal and Denison are fully justified.

Aleuria Fuckel

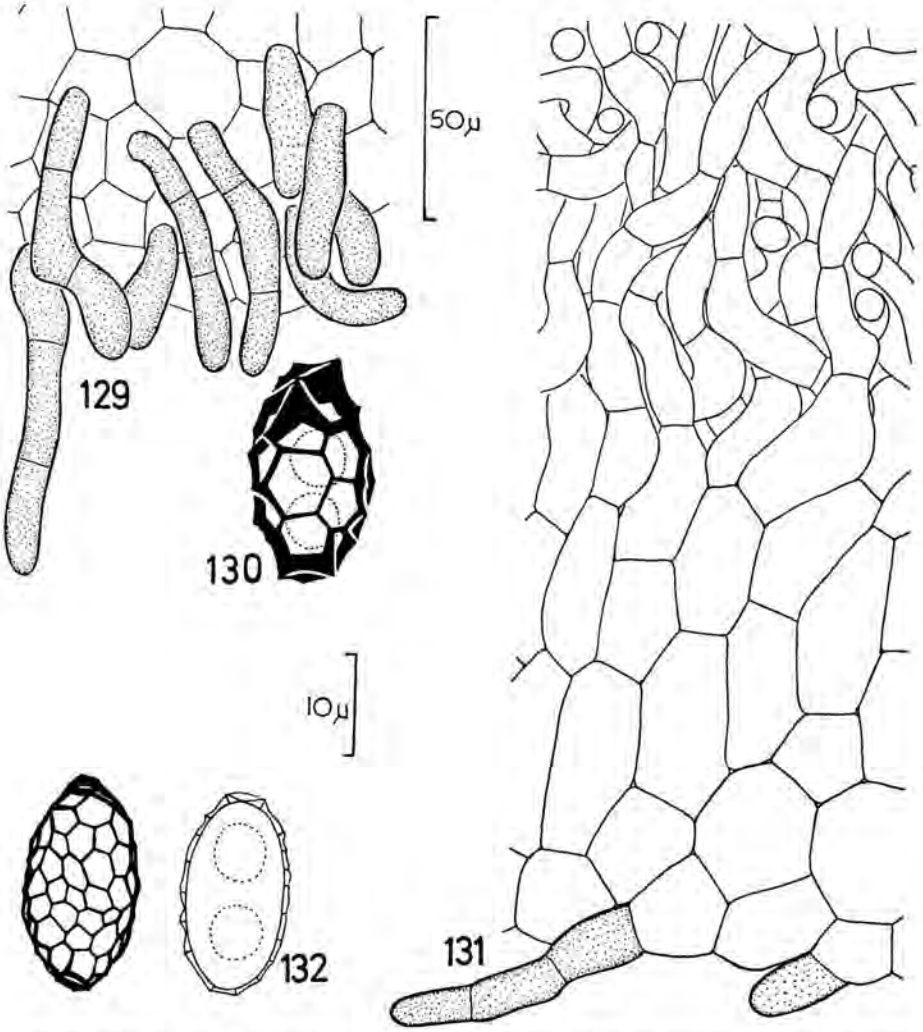
Peziza [Dill.] St-Amans "div." *Discina* Fr. "ser." *Aleuria* Fr., Syst. mycol. 2: 41. 1822. — *Aleuria* (Fr.) Gill., Champ. Fr., Discom. 30. 1879; non *Aleuria* (Fr.) Gill. emend. Boud. *in* Bull. Soc. mycol. Fr. 1: 101. 1885 (misapplied, = *Peziza* [Dill.] St-Amans). — *Peziza* [Dill.] St-Amans subgen. *Aleuria* (Fr.) Sacc. [sect.] *Eu-Aleuria* Sacc. *in* Bot. Cbl. 18: 215. 1884.

Aleuria Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 325. 1870. — *Peziza* [Dill.] St-Amans subgen. *Aleuria* (Fuckel) Lindau *in* Nat. Pflanzenfam. I 1: 187. 1897.

Peziza [Dill.] St-Amans [ser. *Aleuria* Fr.] subgen. *Cochlearia* Cooke, Mycograph. 1: 252. 1879. — *Cochlearia* (Cooke) Lamb., Fl. mycol. Belg., Suppl. 1: 323. 1887; non *Cochlearia* L., Spec. Pl. 2: 647. 1753 (= Cruciferae).

[Misapplied name: *Peziza* [Dill.] St-Amans emend. Boud. *in* Bull. Soc. mycol. Fr. 1: 103. 1885; Boud., Hist. Class. Discom. Eur. 54. 1907; McLennan & Halsey *in* Proc. R. Soc. Victoria 49: 54. 1936; Le Gal *in* Ann. Sci. nat. (Bot.) XI 8: 285. 1947; Ramsbottom & Balfour-Browne *in* Trans. Br. mycol. Soc. 34: 49. 1951; Heim *in* Bull. Soc. mycol. Fr. 77: 304. 1962 (= *Aleuria* Fuckel)].

[11]) The recombination *Melastiza rubra* (Batra) Maas Geesteranus was published *in* Persoonia 4: 417. 1967.



Figs. 129–132. — *Melastiza rubra*. 129. Surface view of receptacle with brown hairs. 130. Ascospores. (From type). — *Melastiza chateri*. 131. Hairs, section of ectal and part of medullary excipulum. 132. Ascospores. (From a specimen collected from the ground, Dorking, Surrey, England, 4 January 1965, R. W. G. Dennis).

TYPE SPECIES: *Peziza aurantia* Pers. ex Hook.

Apothecia small to very large, scattered, gregarious or rarely caespitose, sessile to stipitate. Disc concave, smooth, brightly coloured, orange red, orange or yellow. Receptacle deep cup-shaped to saucer-shaped, sometimes unequal sided which may be due to mutual pressure, outer surface paler than the disc, mostly whitish, smooth, mealy or minutely scurfy, in some species tomentose from poorly developed, hyaline, hair-like hyphae. Ectal excipulum pseudoparenchymatous, mostly of subglobose or polygonal elongated cells. Medullary excipulum well differentiated, of textura intricata, hyphae rather coarse, hyaline, septate and infrequently branched. Asci cylindrical, slightly narrower towards their base, 8-spored, apex not

blued in Melzer's reagent. Ascospores uniseriate, hyaline, ellipsoidal or oblong ellipsoidal, ornamented with warts, or simple or elaborate reticulations, sometimes apiculate, containing one or two large oil globules. Paraphyses simple, sparingly septate, slender, apex enlarged, subclavate or lobed, straight, curved or even hooked, with orange coloured granular contents.

HABITAT: on bare damp ground or on rich humus.

When Fuckel (*1870*) published the genus *Aleuria* he did not ascribe it to any of his predecessors, notwithstanding the fact that Fries (*1822*) had used the name *Aleuria* for an infrageneric grouping within the genus *Peziza*. In 1879 Gillet elevated Fries' "series" *Aleuria* to the generic level and he included in it numerous hairless but otherwise unrelated operculate species of cup fungi such as *Peziza vesiculosa*, *Aleuria aurantia*, *Coprobia granulata*, *Anthracobia melaloma*, *Pyronema omphalodes*, *Octospora leucoloma*, *Pustularia catinus*, *Lamprospora miniata* and many others. The ectotype species of *Aleuria* (Fr.) Gill. seems to have been effectively designated by Saccardo (*1884*) when he quoted *Peziza aurantia* as the only example of *Peziza* [Dill.] St-Amans subgen. *Aleuria* Fr. sect. *Eu-Aleuria* Sacc. This typification made *Aleuria* (Fr.) Gill. (*1879*) not only a later homonym but also an obligate synonym of *Aleuria* Fuckel (*1870*).

Boudier (*1885*, *1907*) employed the name *Aleuria* (Fr.) Gill. for an emended circumscription which included only species with asci having positive iodine reaction and producing smooth walled ascospores (i.e. smooth spored species of the genus *Peziza* of the present paper). For the present genus Boudier used the name *Peziza* and in this respect he was followed by McLennan & Halsey (*1936*), Le Gal (*1947*), Ramsbottom & Balfour-Browne (*1951*) and Heim (*1962*). Since in both cases Boudier misapplied the names by excluding their respective type species, there is no justification for adopting and maintaining his nomenclature. For a further discussion on the nomenclatural confusion in the *Aleuria–Plicaria–Galactinia–Peziza* complex, see under the last named genus.

Saccardo (*1884*) reduced the preoccupied name *Cochlearia* (Cooke) Lamb. to the synonymy of *Peziza* subgen. *Aleuria* and for nomenclatural purpose it is advisable to designate *Peziza aurantia* Pers. ex Hook. as the lectotype species of *Cochlearia*. Cooke (*1879*), Phillips (*1887*) and Lambotte (*1887*) included this species in *Peziza* [ser. *Aleuria*] subgen. *Cochlearia*, *Peziza* subgen. *Cochlearia* and the genus *Cochlearia* respectively. In reducing *Cochlearia* to *Otidea*, Massee (*1895*) stated: ". . . in other species [of *Otidea*] the ascophore is only slightly oblique and incised on one side; others again are very much contorted, vertically involute, and often clustered, forming the genus *Cochlearia* of some authors . . .". To reduce *Cochlearia* as a synonym of *Otidea* it is necessary to choose *Cochlearia cochleata* (L. ex St-Amans) Lamb. as its type species. Since there have been some doubt concerning the identity of this species (Seaver, *1928*; Le Gal, *1953*), it is desirable to avoid choosing this species to serve

as the type of *Cochlearia*. It must be pointed out that in merging the latter genus with *Otidea*, Massee (*1895*) also transferred *Aleuria aurantia* to *Otidea*. Ainsworth (*1961*) doubtfully reduced the genus *Cochlearia* to the synonymy of *Lamprospora* but none of Cooke's original species can be referred to the latter genus.

The name *Aleuria* is used here in the same sense as Fuckel (*1870*), Rehm (*1894*), Seaver (*1914*, *1928*), Dennis (*1960*), Gamundi (*1960*, *1964*), Moser (*1963*) and more recently also Le Gal (*1963*).

ALEURIA AURANTIA (Pers. ex Hook.) Fuckel

Peziza aurantia Pers., Obs. mycol. 2: 76. 1799. — *Peziza aurantia* Pers. *ex* Hook., Fl. scot. 2: 33. 1821 (pro parte, excl. syn.); Fr., Syst. mycol. 2: 49. 1822. — *Aleuria aurantia* (Pers. ex Hook.) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 325. 1870. — *Cochlearia aurantia* (Pers. ex Hook.) Lamb., Fl. mycol. Belg., Suppl. 1: 323. 1887. — *Otidea aurantia* (Pers. ex Hook.) Massee, Brit. Fung.-Fl. 4: 448. 1895.

Elvella coccinea Schaeff., Icon. Fung. Bavar. 4: 100. 1774. — *Peziza coccinea* (Schaeff.) Bull., Herb. Fr. *t. 474*. 1790; Hist. Champ. Fr. 269. 1791. — *Peziza coccinea* (Schaeff.) *ex* St-Amans, Fl. agen. 533. 1821; non *Peziza coccinea* (Jacq. ex S. F. Gray) Pers., Mycol. eur. 1: 258. 1822 [= *Sarcoscypha coccinea* (Jacq. ex S. F. Gray) Lamb.]. — *Aleuria coccinea* (Schaeff. ex St-Amans) Moesz, Schedis Fl. hung. exsicc., Cont. 5: no. 488. 1918.

Scodellina aurantiaca S. F. Gray, Nat. Arrang. Br. Pl. 1: 668. 1821.

Peziza aurantiaca Pers., Mycol. eur. 1: 222. 1822 (sphalm.?).

Peziza pseudoaurantia Crouan, Fl. Finist. 54. 1867 (teste Le Gal, *1953a*).

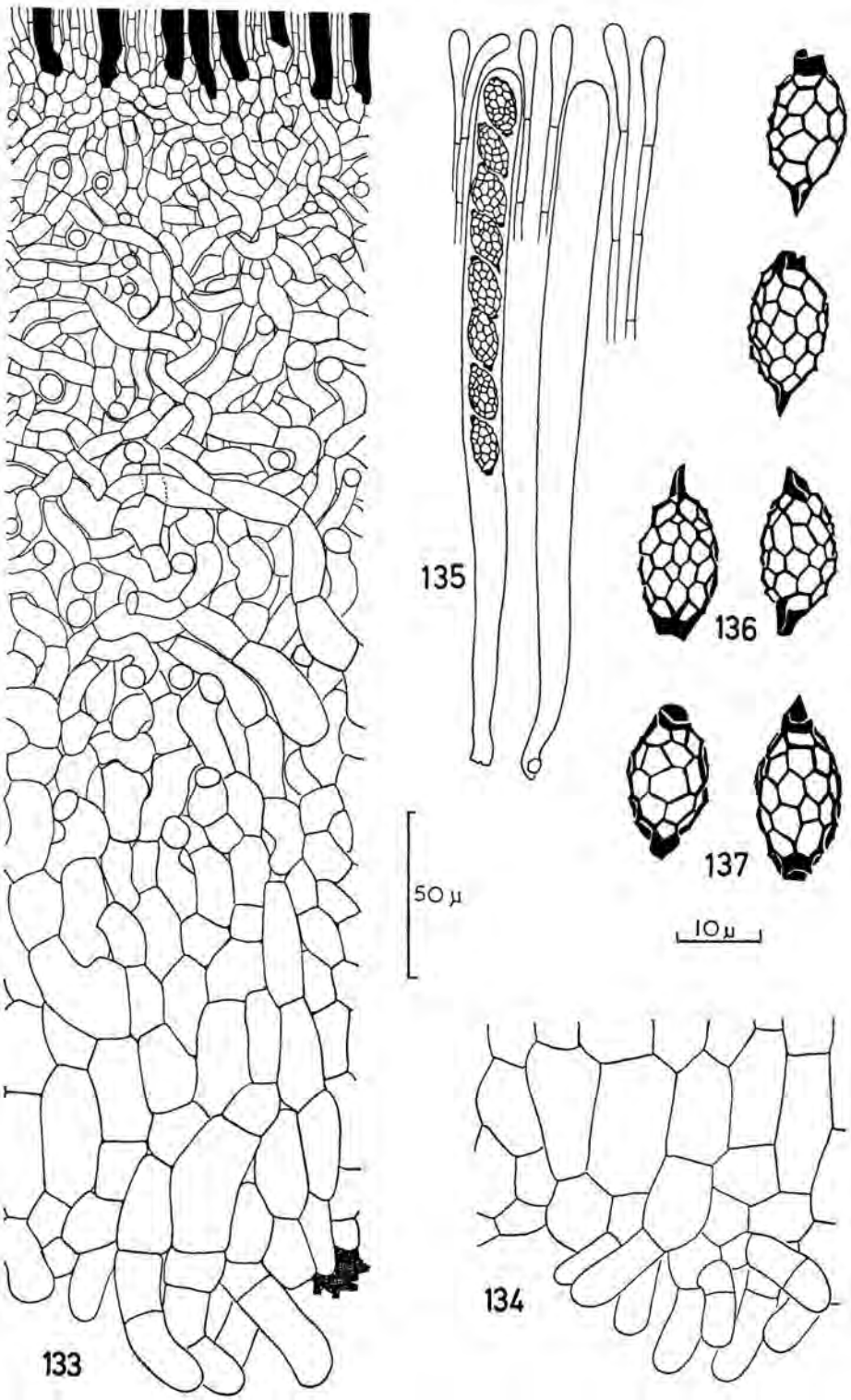
Peziza aurantia Pers. ex Hook. forma *minor* Cooke *in* Grevillea 8: 61. 1879.

Peziza antarctica Speg. *in* Boln Acad. nac. Ci. Córdoba 11: 256. 1887. — *Humaria antarctica* (Speg.) Sacc., Syll. Fung. 8: 121. 1889. — *Octospora antarctica* (Speg.) Gamundi *in* Lilloa 30: 302. 1960 (teste Gamundi, *1964*).

? *Humaria phoenicea* Speg. *in* An. Mus. nac. Hist. nat. B. Aires II 6: 303. 1899.

Humaria etilis Speg. *in* Physis 7: 13. 1923 (teste Gamundi, *1960*, *1964*).

Apothecia gregarious or sometimes caespitose, sessile or subsessile, 10–70 mm diam. Disc concave at first, then becoming flat or undulate, with beautiful bright orange colour. Receptacle shallow cup-shaped, especially in young or small specimens, becoming irregular and much contorted by mutual pressure in larger and mature specimens, sometimes almost flat, occasionally torn or one-sided like typical apothecia of *Otidea*, whitish orange, minutely downy. Ectal excipulum of polygonal or rectangular cells running at a right angle to the surface of the receptacle, 16–50 × 8–20 μ, occasionally with a few subglobose cells (textura angularis); towards the margin of the cup the cells tend to become isodiametric, then elongate again but run at a low angle or parallel with the surface of the receptacle, with cells 16–25 × 8–14 μ, terminated by short clavate cells 10–18 μ diam. which constitute the sterile margin of the cup. On the surface of the receptacle there are a few one or two-celled, hyaline, blunt tipped, smooth and thin walled hair-like hyphae 8–12 μ diam. and up to 50 μ long, which arise in the close vicinity of each other or sometimes agregate, causing the mealy or downy appearance of the receptacle. Medullary excipulum of intricate hyphae with barrel-shaped or sometimes lobed cells 6–14 μ diam., often constricted at the septa, infrequently interspaced by polygonal or subglobose cells up to 30 μ diam. Subhymenium also of interwoven hyphae with lobed subpyriform or elongated cells 4–12 μ diam. Hymenium about 200–225 μ thick. Asci cylindrical, only



Figs. 133–137. *Aleuria aurantia*. 133. Section of ectal and medullary excipulum, subhymenium and the lower part of hymenium. 134. Section of ectal excipulum, showing the poorly developed hairs (From G. Beaton 29). 135. Asci and paraphyses. 136. Ascospores. (From J. B. Cleland, 18 June 1952). 137. Ascospores (From Stewart Isl. Museum 85).

slightly attenuate below, 8-spored, 200–250 × 10–13 μ. Ascospores usually obliquely uniseriate, ellipsoid or sometimes somewhat obovoid, hyaline, when young with 2 distinct oil globules, covered by rather regular shallow reticulation of mostly 6-sided meshes 1.5–3 μ diam.; at the ends of each spore the ridges of reticulations usually extended considerably and appearing like an apicule, but rather irregular in shape and size; without the reticulations the spores measure 14–16.5 × 7–9 μ or 18–21 × 9–11 μ including them. Paraphyses stout, septate, sometimes branched near their base, 2.5–4 μ diam., distinctly enlarging at the clavate apex to 5–9 μ diam., exceeding the asci by about 25 μ, filled with orange granules. (Fig. 133–137).

HABITAT AND DISTRIBUTION: on bare clayey soil in woods or open places or among grass in lawns or road sides in Europe (type locality), North America, Argentina, Australia and New Zealand.

In older literature (Fuckel, *1870*; Phillips, *1887*; Saccardo, *1889*; Rehm, *1893* etc.) the authorship of this specific name was often wrongly attributed to Oeder or Müller. In proposing the name *Peziza aurantia*, however, Persoon (*1799*) originally did not give a reference to Müller's (*1775*; not Oeder's!) publication, but in 1801 he did cite the corresponding figure of the latter [*in* Fl. dan. **4** (11): 8 *t. 657 fig. 2*]. This figure represents *Aleuria aurantia* but in referring to it Müller used the descriptive name "*Parva concha marina colore coccineo* Sterb. . . .?" instead of a binomial name.

"The orange peel Peziza" is one of the more easily recognizable large cup fungi on account of its peculiar and conspicuous coloration of its apothecia. Judging from the number of collections available this species is probably also fairly common in Australia. For an excellent account of the construction of its fruit-bodies the reader is referred to the work of Corner (*1929a*), while Le Gal (*1947*) has described the nature of its spore marking rather fully.

Phillips (*1887*) and Rodway (*1925*) described a variety and forma *stipitata* respectively but the short stipitate form of this species does not seem to deserve recognition as a separate taxon; it is also probable that they based this variety or form on collections of *Aleuria rhenana* (Ramsbottom and Balfour-Browne, *1951*).

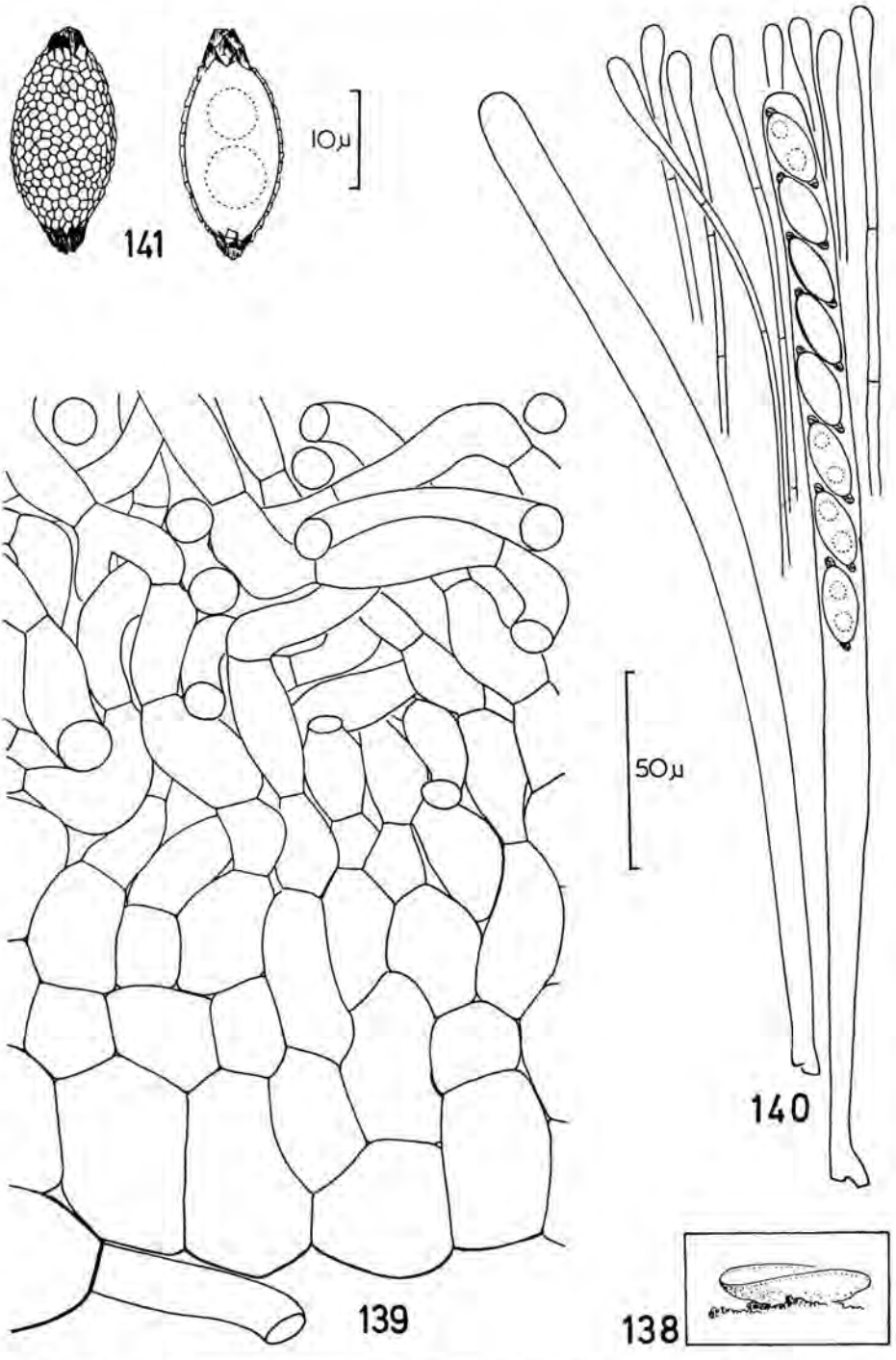
SPECIMENS EXAMINED

AUSTRALIA. Victoria. On soil in River valley near Rubicon, 2 October 1962, G. Beaton 29. – New South Wales. On the ground, Richmond River, s. dat., collector unknown. – South Australia. On the ground, Stirling, 10 June 1944, J. B. Cleland; on the ground, National Park, July 1953, J. B. Cleland; on the ground, National Park, 18 June 1952, J. B. Cleland.

NEW ZEALAND. On the ground, Poreura Valley, North Ireland, April 1885, T. Kirk 229; on the ground, Waikati, s. dat., S. Berggren 37 [type specimen of *Peziza aurantia* Pers. ex Hook. forma *minor* Cooke]; on the ground, Stewart Island, 8 July 1960 (comm. Stewart I. Museum 85); on the ground, Sealers' Cove, Stewart Island, s. dat., Müller 120.

Aleuria exigua Rifai, *spec. nov.*

Apothecia gregaria, minuta, usque 5 mm diam., sessilia, discoidea, disco aurantiaco. Excipulum ectale e cellulis subglobosis vel subangularibus 15–40 × 60 μ, excipulum



Figs. 138–141. *Aleuria exigua*. 138. Habit sketch. 139. Section of ectal and part of medullary excipulum. 140. Asci and paraphyses. 141. Ascospores. (From type).

medullare e hyphis septatis, ramosis, hyalinis, 7–20 μ diam. compositum. Asci cylindracei, octospori, usque 280 × 9.5–12 μ. Ascospori uniseriati, ellipsoidei, hyalini, biguttulati, apiculati, subtiliter reticulati, 14.5–18.2 × 7.2–9.1 μ. Paraphyses septatae, 2–2.7 μ, diam., superne clavatae, usque 6.2 μ diam., vix hamatae.

Hab. ad terram, Mt. Lofty, Australia australi, 24 Julii 1920, J. B. Cleland typus est [K].

Apothecia gregarious, broadly sessile, small, only up to 5 mm diam. Disc orange, shallowly concave or nearly flat. Receptacle saucer shaped, paler than the disc, surface almost smooth or covered with flexuous, sparingly septate, hyaline, hair-like hyphae 6–16 μ diam. Ectal excipulum up to about 125 μ thick, made up of large polygonal or subglobose cells 15–40 μ diam. by up to 60 μ long, usually arranged with their long axes at right angles to the surface of the receptacle (textura angularis to textura globulosa). Medullary excipulum well differentiated, prosenchymatous, of thinner walled, septate, branched, interwoven, coarse hyphae 7–20 μ diam. (textura intricata). Subhymenium of compact short celled tissue, cells lobed, angular or subglobose, 5–15 μ diam. Hymenium about 230 μ thick. Asci cylindrical or subcylindrical, only slightly narrower towards the base, 8-spored, up to 280 μ long by 9.5–12 μ diam. Ascospores uniseriate, often obliquely uniseriate, ellipsoidal or fusiform–ellipsoidal, hyaline, usually biguttulate when young, at maturity apiculate and covered by a delicate network of reticulum, with meshes of reticulations regular, more or less 5–6 sided, 0.9–1.5 μ wide, ridges only about 0.4 μ thick and not more than 0.7 μ high; under a low power microscope the spore walls usually give the impression of being minutely warted instead of reticulate, especially in an unstained preparation; apiculi distinctive, pronounced, up to 3.6 μ long; without the ornaments the ascospores measure 14.5–18.2 × 7.2–9.1 μ. Paraphyses septate, 2–2.7 μ diam., apex distinctly enlarged up to about 6.3 μ diam., straight or nearly so, clavate (Fig. 138–141).

HABITAT AND DISTRIBUTION: on the ground in Australia.

On account of its relatively very small apothecia under a casual examination or in the field the close relationship of this species with *Aleuria aurantia* may pass unnoticed and in fact the type specimen described above was found among the indetermined specimens of *Humaria* (Fr.) Boud. (= *Octospora* of the present work). A careful analysis of its microstructures shows that despite of the habit and the small size of its apothecia the affinity of *Aleuria exigua* with species of *Octospora* is as remote as the relationship between the genera *Aleuria* and *Octospora* themselves. Except for some salient details, the excipular construction and the characters of the ascospores and the paraphyses of the present species are remarkably similar to those of *Aleuria aurantia*. For this reason I do not hesitate in placing *Aleuria exigua* next to the latter species and when an infrageneric rearrangement of the genus *Aleuria* is attempted in the future, the two species should be placed in the same infrageneric grouping.

SPECIMEN EXAMINED

AUSTRALIA. South Australia. On the ground, Mt. Lofty, 24 July 1920, J. B. Cleland [type specimen of *Aleuria exigua* Rifai].

Aleuria venustula Rifai, *spec. nov.*

Apothecia minuta, usque 10 mm diam., stipitata, cupulata, disco concavo, aurantiaco. Excipulum ectale e cellulis subangularibus vel subpyriformibus 18–25(–50) μ diam. (textura angulari), excipulum medullare ex hyphis septatis, ramosis, hyalinis, 6–14 μ diam. constat. Asci cylindracei, octospori, 265–340 × 12–15 μ. Ascospori uniseriati, ellipsoidei, guttulati, reticulati, 18.5–22.7 × 8.5–11 μ. Paraphyses septatae, interdum ramosae, 2.7–3 μ diam., apice rectae, clavatae vel subcapitatae, 6.5–10 μ diam.

Hab. ad terram, Delamere, Australia australi, 2 Julii 1952, J. H. Warcup typus est [K].

Apothecia scattered, stipitate, small, the type specimen measures only up to 10 mm diam. Disc deeply concave, smooth, orange coloured. Receptacle deep cup shaped, almost turbinate but asymmetrical, supported by an excentric stipe about 3 mm long by 1.5 mm diam., outer surface scurfy, whitish, margin even, incurved, thick. On the flank of the apothecia there are a few inconspicuous, feebly developed, delicate, minutely rough but very thin walled, septate hair-like hyphae about 10 μ diam. by up to 200 μ long. Ectal excipulum 70–100 μ thick, of a few layers of large, polygonal elongated, lobed or subpyriform, rarely isodiametric cells 18–25(–50) μ diam., usually with their long axes at right angles to the surface of receptacle; the outer surface of ectal excipulum, especially near the margin of the cup, bears numerous rough walled, polygonal or angular elongated cells up to 20 μ diam. which aggregate with each other to form more or less conical warts which give the receptacle a scurfy appearance. Medullary excipulum well differentiated, up to about 350 μ thick, of rather loosely interwoven, septate, branched, hyaline, hyphae, 6–14 μ diam., which become more compactly arranged and narrower in diam. as they approach the subhymenium. Subhymenium of tightly intertwined septate hyphae 4–8 μ diam. Hymenium about 300 μ thick. Asci cylindrical, slightly narrower towards the base, 265–340 × 12–15 μ, 8-spored. Ascospores uniseriate, often obliquely uniseriate, ellipsoidal, with one or two large oil globules, wall at first smooth but ultimately covered by perfect reticulations; meshes of reticulum rather irregular, mostly 6-sided, hardly isodiametrical, 1.5–3 μ diam., their ridges delicate, often wavy, about 1 μ high but sometimes up to 1.8 μ high at the ends of the spore; without the reticulations the ascospores measure 18.5–22.7 × 8.5–11 μ. Paraphyses slender, 2.7–3.6 μ diam. below, apex clavate to subcapitate, 6.5–10 μ diam., generally straight, sparingly septate, often forked at the base, containing orange granules (Fig. 142–145).

The outstanding characters of this species are the scurfy receptacle, the straight paraphyses and the characters of its ascospores; whether the asymmetrical and the small sized apothecia will also be a specific character is yet to be demonstrated by further collections.

HABITAT AND DISTRIBUTION: on the ground in Australia.

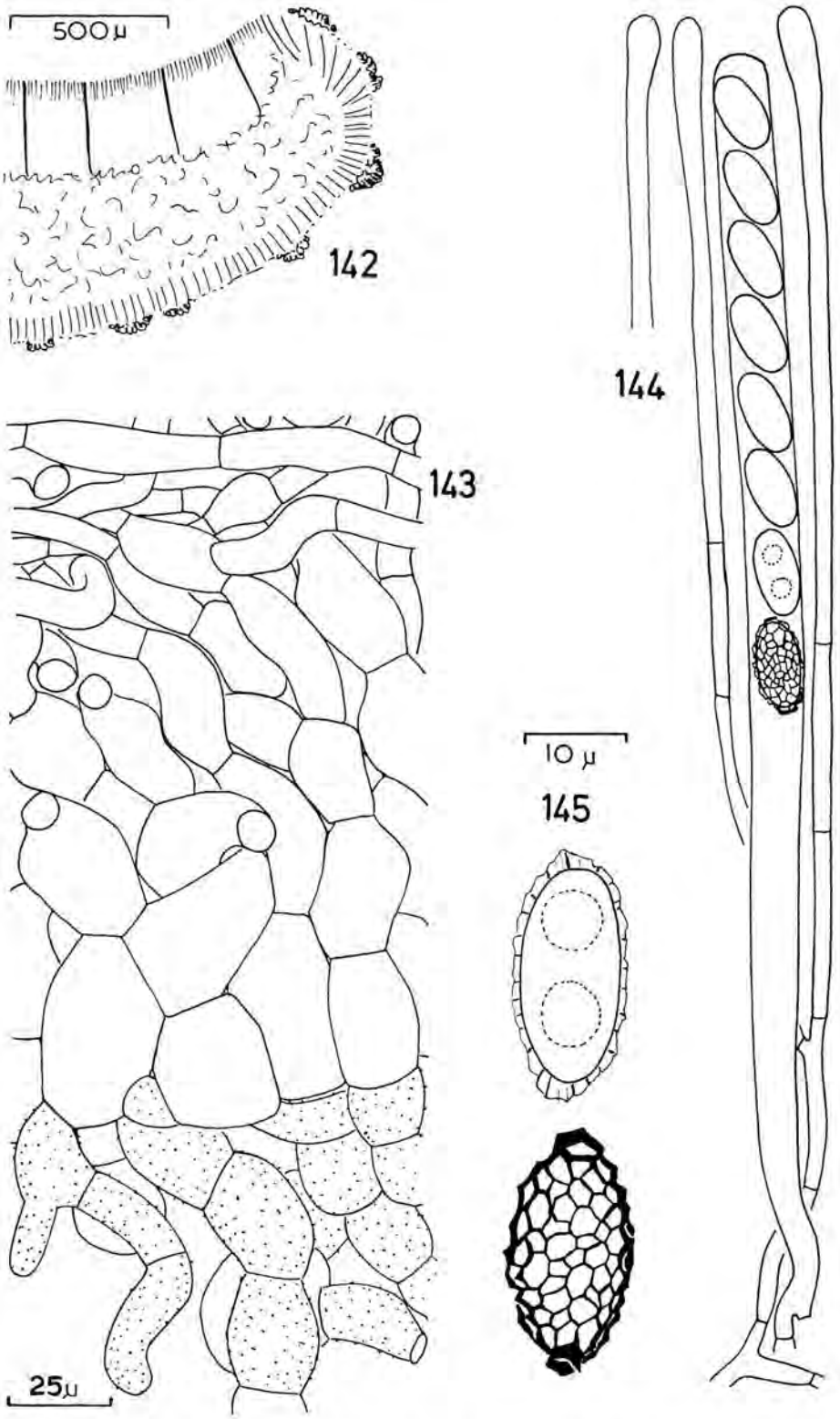
SPECIMEN EXAMINED

AUSTRALIA. South Australia. On soil under *Eucalyptus*, Delamere, 2 July 1952, J. H. Warcup, ex WARI 2117 [type specimen of *Aleuria venustula* Rifai].

ALEURIA RHENANA Fuckel

Aleuria rhenana Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 325. 1870. — *Sarcoscypha rhenana* (Fuckel) Sacc., Syll. Fung. 8: 157. 1889. — *Peziza rhenana* (Fuckel) Boud., Icon. mycol. 2: *t. 314*. 1906.

Peziza splendens Quél. *in* Mém. Soc. Emul. Montbeliard II 5: 394. 1873.



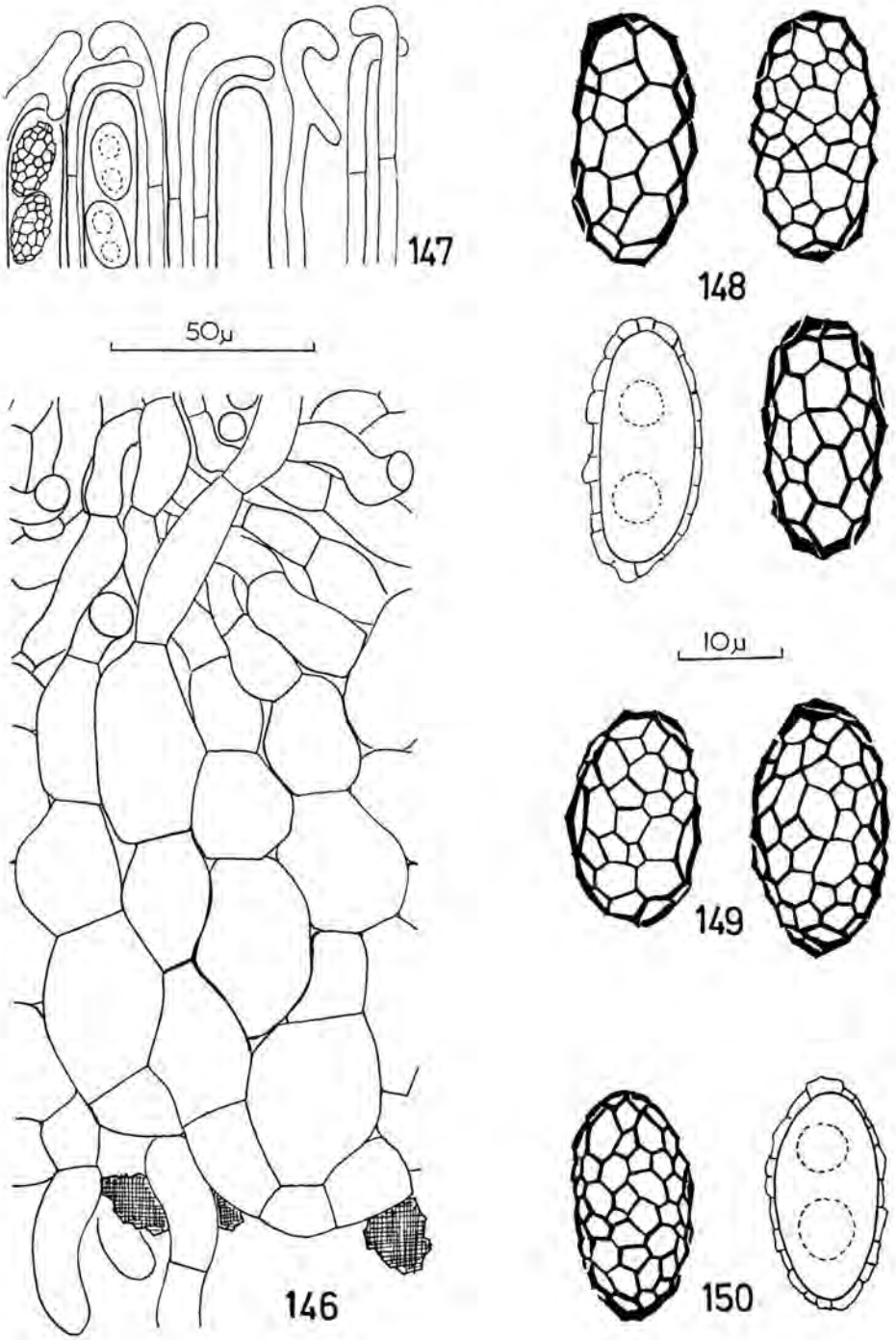
Figs. 142–145. *Aleuria venustula*. 142. Diagramatic median section of margin. 143. Section of wart, ectal and part of medullary excipulum. 144. Ascus and paraphyses. 145. Ascospores. (From type).

Apothecia substipitate or more commonly distinctly spititate, gregarious to caespitose, 10–25 mm diam. Disc deeply concave, orange coloured, smooth. Receptacle cup shaped, rather abruptly contracted below into a stipe which is up to 20 mm long by 5 mm diam., whitish or yellowish, almost smooth or tomentose and mealy. Tomentum hair-like, superficial, of coarse, thin-walled and probably living hyphae 7–16 μ diam., sparingly septate, occasionally branched, undulate, hardly narrower towards the blunt apex, 40–350 μ long. Ectal excipulum 80–130 μ thick, of a few layers of subglobose, polygonal, elongated or pear shaped cells 16–40 μ diam. by up to 55 μ long, mostly with their long axes at right angles to the surface of the receptacle (textura globulosa to textura angularis); towards the margin of the cup the cells are often smaller but longer and sometimes form a prosenchymatic tissue. Medullary excipulum of interwoven, septate, sparingly branched, hyaline hyphae 6–15 μ diam., their cells sometimes lobed and rather strongly constricted at the septa (textura intricata). Subhymenium also of similar construction but with shorter celled and narrower, 3–7 μ diam., hyphae. Hymenium about 280 μ thick. Asci cylindrical, slightly narrower at the base, 8-spored, 270–350 × 11–15 μ. Ascospores uniseriate, or sometimes obliquely uniseriate, ellipsoidal or oblong ellipsoidal, sometimes somewhat asymmetrical, hyaline, with one or two large oil globules, at first smooth, ultimately becoming reticulate; meshes of reticulum 1.5–4 μ wide, mostly 6-sided or somewhat irregular, ridges thin and narrow (up to 1.5 μ wide near the poles of the spore); without the reticulations the spores measure 18–23.6(–26.3) × 9–11.8 μ. Paraphyses rather stout, sparingly septate, branched near the base, 2.7–4 μ diam. below, apex enlarged, up to 8.1 μ diam., mostly curved or hooked, occasionally straight and clavate, filled with orange granules (Fig. 146–150).

HABITAT AND DISTRIBUTION: on the ground in Europe (type locality Germany), U.S.A., Mexico, Argentina, India and Australia.

As can be seen from the above description the concept of *Aleuria rhenana* adopted here is slightly wider than the one currently accepted in the literature (Seaver, *1928*; Thind & Singh, *1959*; Gamundi, *1960*; Heim, *1962*). When more collections become available it may be worthwhile to regroup the Australian representatives into two or three infraspecific taxa.

The specimen Thomas Muir *s.n.* from Western Australia has ascospores which, excluding the ornamentations, measure 20–26.3 μ in length, and therefore are slightly longer than the typical representatives of *Aleuria rhenana*. According to Heim (*1962*) the ascospores of the type specimen of *Aleuria rhenana* were 20–23.5 × 9.5–11 μ and 17–20 × 8–9.8 μ with and without their reticulum respectively. An authenticated specimen of *Peziza splendens* Quél., which generally has been regarded as a synonym of *Aleuria rhenana* (Saccardo, *1889*; Rhem, *1894*; Seaver, *1928*; Heim, *1962*), yielded ascospores which, without their ornamentations, were 17.5–23.6 × × 10–13.6 μ. Since the Western Australian specimen might have been treated with some sort of chemical and as its other characters are wholly in agreement with the more typical collections of *Aleuria rhenana*, it is also referred to the present species, as was already done by Cooke (*1892*).



Figs. 146–150. *Aleuria rhenana*. 146. Section of ectal and part of medullary excipulum. 147. Part of asci and paraphyses. 148. Ascospores. (From Thomas Muir). 149. Ascospores (From type of *Peziza splendens*). 150. Ascospores (From J. B. Cleland).

The two South Australian specimens have substipitate apothecia that grow on bare ground, but otherwise they are similar to *Aleuria rhenana*. The small number of collections available makes it rather difficult to assess the importance of this stipe character as well as the habitat for taxonomic purposes. The leading character of *Aleuria rhenana* as this species is understood here is the mostly curved or hooked paraphyses.

SPECIMENS EXAMINED

AUSTRALIA. Western Australia. On the ground, Lake Muir, s. dat., Thomas Muir s.n. — Victoria. On the ground, Rose's Gap, Grampians, 24 June 1962, N. S. Bennett (comm. G. Beaton 59). — South Australia. On bare ground, Mt. Lofty, 16 June 1917, J. B. Cleland; on the ground among mosses, Mt. Lofty, 13 July 1952, J. H. Warcup.

EUROPE. France. On the ground, Hérimoncourt, s. dat., Quélet [probably part of the type specimen of *Peziza splendens* Quél.].

LEUCOSCYPHA Boud. emend. Rifai

Peziza [Dill.] St-Amans [ser. *Lachnea* Fr.] subgen. *Neottiella* Cooke, Mycograph 1: 261. 1879. — *Lachnea* (Fr.) Gill subgen. *Neottiella* (Cooke) Phill., Man. Brit. Discom. 229. 1887 [misapplied, = *Cheilymenia* Boud.]. — *Neottiella* (Cooke) Sacc., Syll. Fung. 8: 190. 1889. → *Neottiopezis* Clem.

Leucoscypha Boud. *in* Bull. Soc. mycol. Fr. 1: 104. 1885.

Neottiopezis Clem. *in* Bull. Torrey bot. Cl. 30: 89. 1903 (a name change).

Muscia Gizhitskaya *in* Mater. Mikol. Fitopat. Ross. 8: 103. 1929.

Neottiella (Cooke) Sacc. sect. *Leucoscyphae* Le Gal *in* Bull. Jard. bot. Brux. 27: 728. 1957 (ut "*leucoscyphae*", nomen nudum).

TYPE SPECIES: *Peziza leucotricha* Alb. & Schw. ex Fr.

Apothecia scattered or gregarious, small to medium size, sessile or stipitate, hairy. Disc concave, white, pale bluish white, yellowish or reddish orange, often with distinct fringe-like border. Receptacle cup shaped, contracted below into a broad base or a distinct stalk. Hairs superficial, hyaline, thin or thick walled, usually rather stiff, sometimes flexuous, sparingly septate, tapered into blunt or pointed apices. Ectal excipulum either prosenchymatous, of thin walled, rather short celled, broad and tightly intertwined hyphae, or pseudoparenchymatous with thick walled, polygonal or subglobular cells. Medullary excipulum well developed, of loose textura intricata, hyphae hyaline, septate and branched. Asci cylindrical, only slightly narrower at the base, 8-spored, apex not blued in Melzer's reagent. Ascospores uniseriate, hyaline, ellipsoidal to broad subfusoidal, containing one or more often two oil globules, smooth or ornamented with warts or reticulum. Paraphyses slender, sparingly septate, sometimes forked near the base, apex slightly enlarged, hyaline or with orange coloured granular contents.

HABITAT: on damp ground among mosses, sometimes on mosses, less often on rotten vegetable matters.

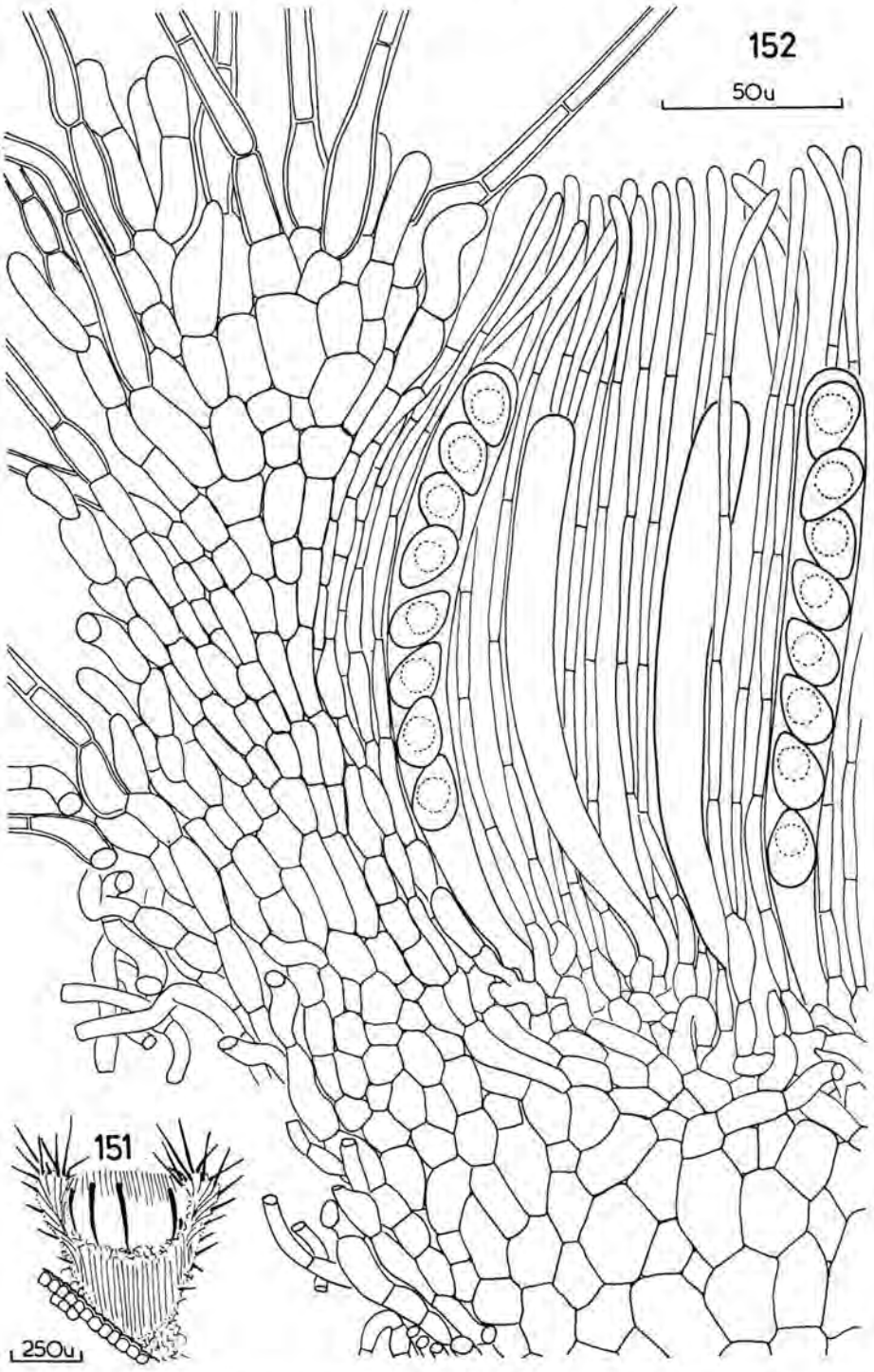
The emended generic description given above actually is not a newly proposed circumscription, because Saccardo (*1889*), Massee (*1895*) and more recently also Le Gal (*1957*) have already classified the white (i.e. members of *Leucoscypha*) and the pigmented (i.e. species of *Neottiella*)

forms in one genus. This somewhat wide generic concept seems to be justified by the fact that white forms of the typically reddish coloured *Melastiza chateri* and *Sarcoscypha coccinea* do occur in nature (Phillips, *1887*; Nannfeldt, *1949*; Le Gal, *1953*, *1957*). However, for the present genus Saccardo (*1889*), Massee (*1895*) and Le Gal (*1957*) used the name *Neottiella* (Cooke) Sacc. (*1889*) instead of *Leucoscypha* Boud. (*1885*), which according to the current "International Code of Botanical Nomenclature" has to be adopted because of its priority.

Clements & Shear (*1931*) quoted *Neottiella callichroa* (Boud.) Sacc. as the lectotype of the genus *Neottiella*. There seems to be no ground for accepting this typification because this species was unknown to Cooke (*1879*); furthermore, Boudier (*1881*, *1907*) did not classify his species as a *Neottiella* but as a *Humaria* (Fr.) Boud. (= *Octospora* of the present paper). In the "Manual of the British Discomycetes" Phillips (*1887*) treated three species of *Lachnea* subgen. *Neottiella*, namely *Lachnea cornubiensis* (Berk. & Br.) Phill., *Lachnea crucipila* (Cooke & Phill. apud Cooke) Gill. and *Lachnea caerulea* (Bolt. ex Fr.) Gill. The identity of the last species is uncertain whereas the first two species, which were among Cooke's (*1897*) original species of the subgenus *Neottiella*, have been transferred to *Cheilymenia* by Le Gal (*1953*, *1953a*). Since Phillips' work is of floristic nature, in which only a small part of Cooke's original species were found in the area concerned, to preserve current usage and to avoid confusion in selecting the lectotype species of *Neottiella* it would be preferable to choose a species other than one of those treated by Phillips, otherwise *Neottiella* will become a synonym of *Cheilymenia*. For these reasons, *Peziza albo-cincta* Berk. & Curt. apud Berk., one of Cooke's (*1879*) species which was also classified as a *Neottiella* by Saccardo (*1889*), Massee (*1895*; as a synonym of *Neottiella polytrichi* sensu Massee; see under *Leucoscypha rutilans*) and Boudier (*1907*) is designated here as the lectotype species of *Neottiella* (Cooke) Sacc. This new typification does not affect the view expressed by Le Gal (*1957*) on the synonymy between *Neottiella* and *Leucoscypha*, and for those who prefer to keep the white and the pigmented species in different genera, the name *Neottiella* is still available for the latter group.

Clements (*1903*) introduced the generic name *Neottiopezis* Clem. together with a description of a new species, *Neottiopezis macrospora* Clem. However, this descriptio generico-specifica cannot be accepted as a valid publication for the name *Neottiopezis*, because the latter name is an avowed new name (or rather a correction) for *Neottiella*, and was proposed solely on linguistic grounds. *Neottiopezis* should probably be considered as a mere variant spelling, and therefore an obligate or nomenclatural synonym of *Neottiella*. Clements & Shear (*1931*) also indicated *Neottiopezis callichroa* (Boud.) Clem. as the lectotype species of *Neottiopezis*, thus using the same type species as that of *Neottiella*.

The main characters of *Leucoschypha* as this genus is understood here



Figs. 151, 152. "*Peziza*" *ricciae*. 151. Diagramatic median section. 152. Details of part of excipular tissue and hymenium. (From O. M. Crowson).

are the hyaline, straight or sometimes flexuous and rather stiff hairs, the white or brightly coloured apothecia and the well-developed prosenchymatous medullary excipulum. Their ascospores are uni- or more commonly biguttulate, ellipsoidal, smooth or variously ornamented. The ectal excipulum varies from prosenchymatous tissue to pseudoparenchymatous tissue, with some intermediate forms. With the exception of the well developed hairs, all these characters indicate that *Leucoscypha* has a close affinity with *Aleuria*. Until all species are better understood, it does not seem worthwhile to subdivide this genus into two sections based solely on the pigmentation of the disc. The anatomy of apothecia of the pigmented *Peziza rutilans* Fr., for example, more closely resembles the white *Leucoscypha leucotricha* than the other pigmented species.

It is likely that the hepaticolous species commonly accommodated in *Neottiella* may deserve a genus of their own. This view has been expressed by Corner (*1929*) when he described the pyrenomycete-like *Neottiella crozalsiana* Quél. Schweers (*1945*) showed that the anatomy and the mode of life of *Humaria ithacaensis* Rehm [=*Humarina ithacaensis* (Rehm) Seaver, =*Neottiella ithacaensis* (Rehm) Schweers] strongly resembled *Neottiella crozalsiana*. A British specimen (on *Riccia sarcocarpa* from Cornwall and grown in the Botany Department, University of Reading, England, 18 October 1962, comm. O. M. Crowson) which agrees in every respect with Le Gal's (*1953a*) redescription of *Peziza ricciae* Crouan, has also been found to be closely related to the preceeding two species; although seldom collected, *Peziza ricciae* seems to be very widely distributed; its type locality is France, and Seaver (*1928*) had material from America which he described as a new species, *Patella ricciophila* Seaver; its occurrence in India was recorded by Sanwal (*1953*) under the latter name. *Neottiella crozalsiana*, *Humaria ithacaensis* and *Peziza ricciae* differ from the other species of *Leucoscypha* in their small (usually less than 1.3 mm diam.) apothecia, in the poorly developed medullary excipulum (Fig. 151–152), and, as Corner (*1929*) puts it, in the possession of vegetative mycelium of a mildew, which is probably due to their peculiar habitat, growing directly on hepatics rather than among mosses.

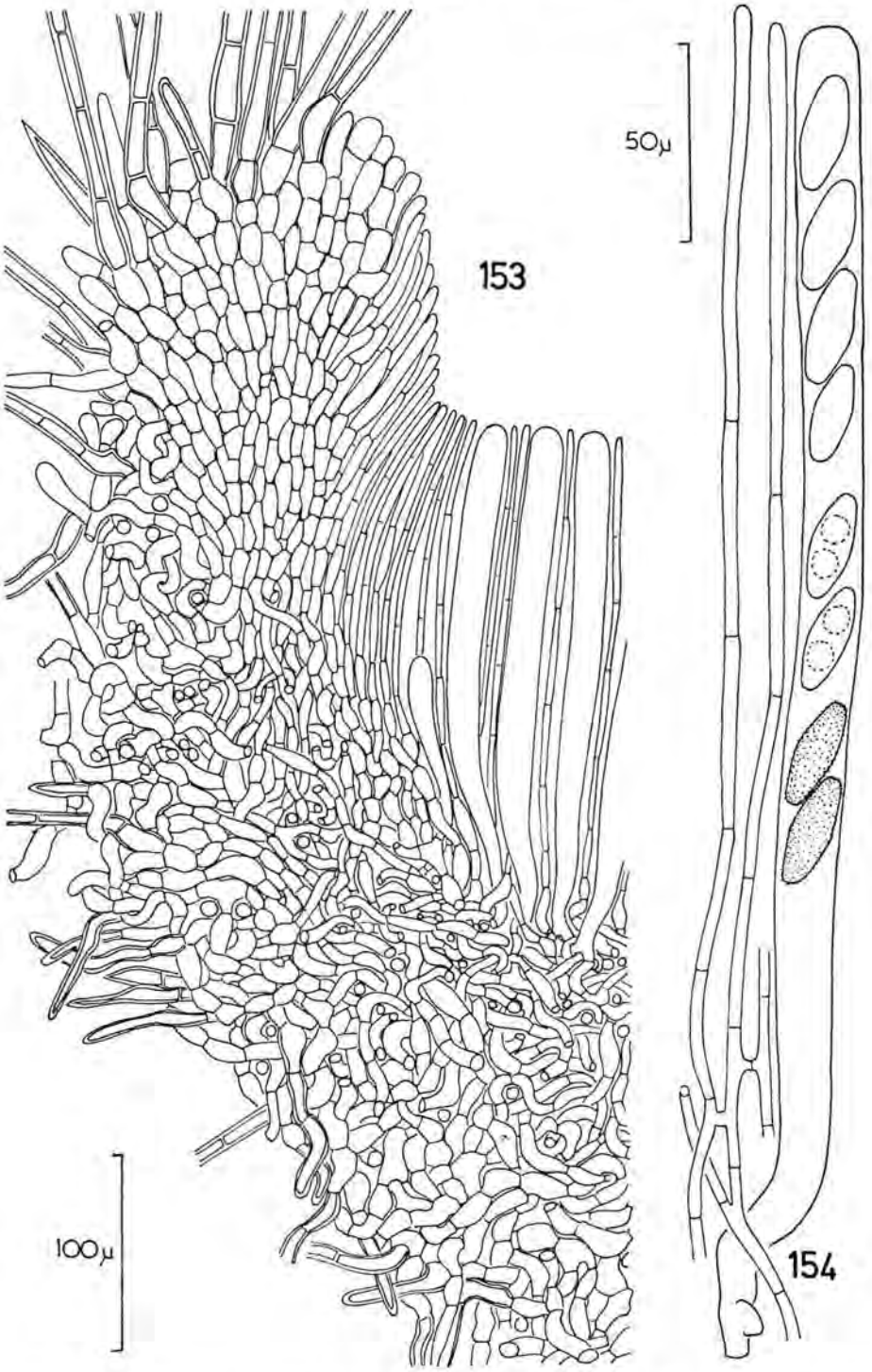
Two out of approximately ten species of *Leucoscypha* are now known to occur in Australasia. For comparison and to clear up some confusion it has been found necessary to describe two other extra-Australasian species.

Leucoscypha leucotricha (Alb. & Schw. ex Fr.) Boud.

Peziza leucotricha Alb. & Schw., Consp. Fung. 322. 1805. — *Peziza leucotricha* Alb. & Schw. *ex* Fr., Syst. mycol. 2: 82. 1822. — *Lachnea leucotricha* (Alb. & Schw. ex Fr.) Quél., Enchir. Fung. 284. 1886. — *Neottiella leucotricha* (Alb. & Schw. ex Fr.) Sacc., Syll. Fung. 8: 194. 1889. — *Leucoscypha leucotricha* (Alb. & Schw. ex Fr.) Boud., Hist. Class. Discom. Eur. 57. 1907.

Humaria albo-strigosa Rehm apud Sydow, Mycoth. march. no. 880. 1885.

Peziza nivea Romell *in* Bot. Notiser **1889**: 26. 1889. — *Neottiella nivea* (Romell) Sacc., Syll. Fung. 8: 192. 1889. — *Leucoscypha nivea* (Romell) Boud., Hist. Class. Discom. Eur. 57. 1907.



Figs. 153, 154. *Leucoscypha leucotricha*. 153. Section of margin. 154. Ascus and paraphyses. (From J. J. Jeffries).

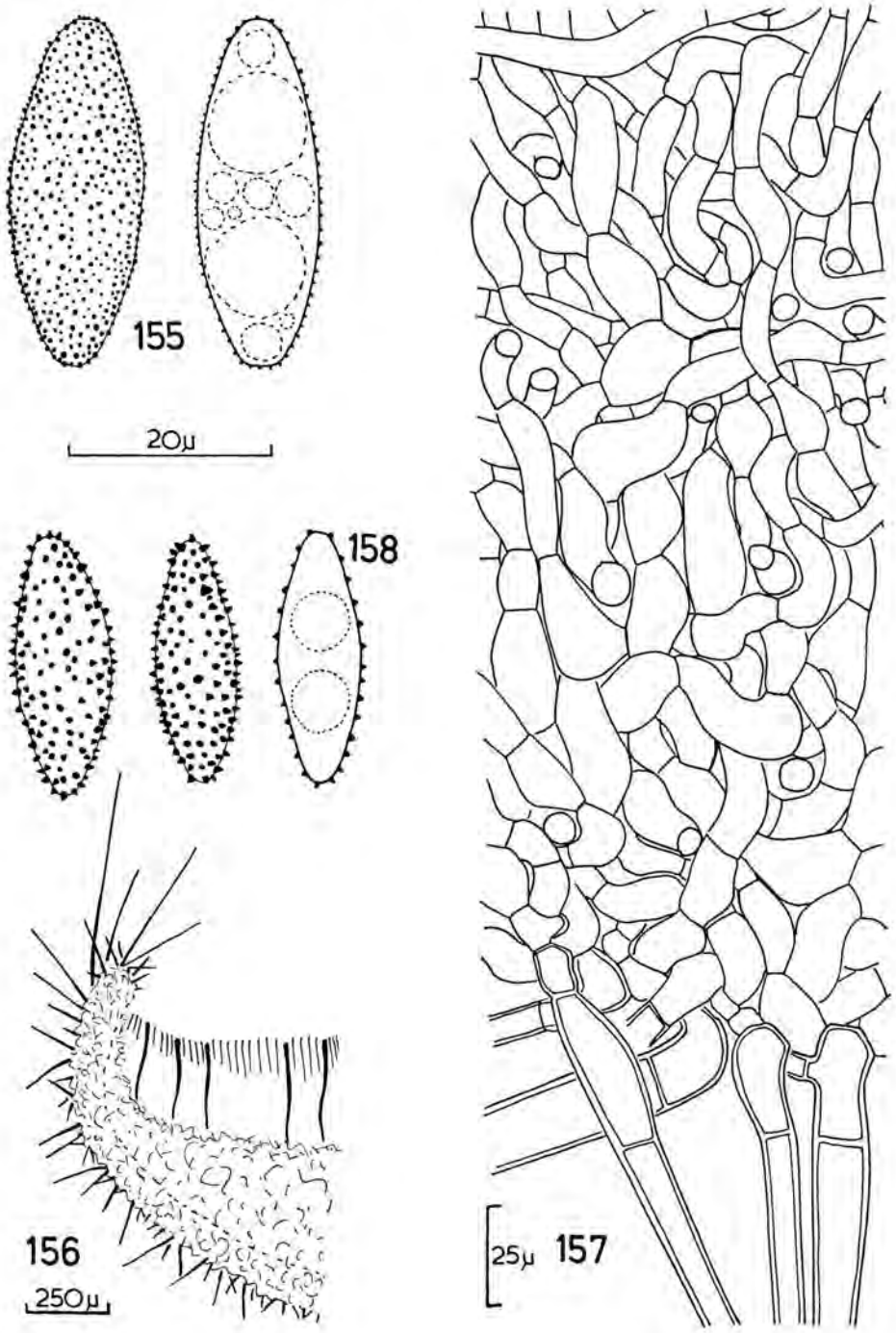


Fig. 155–158. — *Leucoscypha leucotricha.* 155. Ascospores (From J. J. Jeffries). — *Leucoscypha virginea.* 156. diagramatic median section of margin. 157. Section of ectal and part of medullary excipulum. 158. Ascospores. (From type).

Apothecia scattered to gregarious, rather broadly sessile, 2–6 mm diam., white and hairy throughout. Disc concave, watery white, white or pale bluish white, with a fringe-like border. Receptacle thick, saucer shaped to shallowly cup shaped, contracted below into a broad base, densely clothed with white hairs. Hairs superficial, hyaline, sparingly septate, thick walled, straight or sometimes flexuous, mostly geniculate at the base, tapering from 8–18 μ diam. at the hardly or only rarely bulbous base to about 3.8–6 μ diam. blunt tipped apices; marginal hairs up to 650 μ long, sometimes up to 850 μ long according to Le Gal (*1957*), whereas the hairs from the surface of receptacle may vary in length from 50 to 350 μ. Ectal excipulum 75–100 μ thick, of textura intricata, hyphae compactly interwoven, hyaline, thin walled, short celled, 10–20 μ diam., sometimes with some lobed or elongated polygonal cells up to 30 μ diam. Medullary excipulum well developed, of loosely interlacing, thin walled, sparingly septate, sometimes strongly constricted at the septa, occasionally branched hyphae 6–16 μ diam. Subhymenium quite distinct, also of intricately interwoven but much smaller, 3–7 μ diam. hyphae. Hymenium about 350 μ thick. Asci long cylindrical, slightly narrower near the base, 290–410 × 14–18 μ, 8-spored. Ascospores uniseriate, hyaline, containing two large oil drops and a few smaller ones, narrowly ellipsoidal or subfusoidal, sometimes appearing asymmetrical, often almost truncate at each end, at maturity covered by minute, rounded or angular warts, 25.4–33.6 × 10.5–12 μ. Paraphyses slender, sparingly septate, occasionally forked or more rarely anastomosing with each other at the base, 2.7–3.6 μ diam., apex slightly enlarged, mostly subclavate, sometimes cylindrical or lobed, 4–5 μ diam. (Fig. 153–155).

HABITAT AND DISTRIBUTION: on damp ground, sometimes among mosses or on rotten vegetable matter in Europe (type locality Germany).

The above description has been drawn from a fresh British specimen. I have not been able to locate the publication of *Humaria albo-strigosa* Rehm, but the specimen distributed by Sydow under this name has been found to be identical with the current conception of *Leucoscypha leucotricha*. Rehm (*1895*) already indicated that these two species were synonymous. *Leucoscypha ermenia* (Bomm. & Rouss.) Boud. was also reduced to the synonymy of the present species by Rehm but this does not seem to be justified because according to Le Gal (*1957*) the former species had smaller apothecia, smaller and less fusoidal ascospores.

SPECIMENS EXAMINED

EUROPA. Great Britain. On mossy ground in mixed wood, Claybidon, Cullompton, Devon, 30 August 1965, J. J. Jeffries. — Germany. In einem Torfstumpfe im Forstrevier, Cladow, Landsberg, August 1885, P. Sydow [Sydow, Mycotheca marchica no. 880 sub *Humaria albo-strigosa* Rehm; isotypus].

Leucoscypha virginea Rifai, *spec. nov.*

Apothecia tota albida, discoidea vel subcupulata, 2–3.5 mm diam., sessilia, extra albo-strigosa. Pili hyalini, rigidi, septati, recti vel subrecti, basi interdum geniculati, 900 × 12–20 μ. Excipulum ex hyphis hyalinis, septatis, tenui-tunicatis, 6–20 μ diam, compositum. Asci cylindracei, octospori, usque 325 μ longi, 10–14 μ diam. Ascospori uniseriati, fusoidei vel ellipsoideo-fusoidei, hyalini, biguttulati, verrucosi.

17.5–25.5 × 6.7–8.1 μ. Paraphyses septatae, 2.5–3.5 μ diam., apice subclavatae, 4–5 μ diam.

Hab. in ligno putrido *Nothofagi*, Te Anau, Novae Zelandiae, 11 Decembri 1963, K. Tubaki — IFO 10783 typus est [K].

Apothecia gregarious, distinctly hairy, pure white, broadly sessile, 2–3.5 mm diam. Disc concave, white when fresh, becoming creamy or pale yellowish brown in dried condition, margin distinct, with a fringe-like border. Receptacle saucer shaped to shallowly cup shaped, clothed throughout with dense hairs. Hairs superficial, hyaline, septate, stiff, straight or flexuous, sometimes geniculate at the base, up to 900 μ long by 12–20 μ wide below, gradually but distinctly becoming narrower towards the blunt tipped apices. Ectal excipulum colourless, up to about 125 μ thick, of compact prosenchymatous tissue which often appears pseudoparenchymatous, hyphae short celled but wide, 12–20 μ diam., wall thin and sometimes undulate. Medullary excipulum well developed, also hyaline, of interwoven sparingly septate and branched hyphae 6–16 μ diam. Subhymenium composed of intricately intertwined hyphae 3–8 μ diam. Hymenium about 300 μ thick. Asci cylindrical, slightly narrower at the base, 8-spored, up to 325 μ long by 10–14 μ wide. Ascospores mostly obliquely uniseriate, fusoidal or elliptic-fusoidal, sometimes asymmetrical, 17.5–25.5 × 6.7–8.1 μ, hyaline, with two large oil globules and a few smaller ones, especially when young, covered by coarse, angular, subconical or rarely pulvinate warts 0.5–1.2 μ diam. Paraphyses slender, septate, 2.5–3.5 μ diam. below, sparingly branched or rarely anastomosing with each other near the base, apex subclavate, sometimes lobed, straight, 4–5 μ diam. (Fig. 156–158).

HABITAT AND DISTRIBUTION: on rotten wood in New Zealand.

Superficially *Leucoscypha virginea* strongly resembles *Leucoscypha leucotricha* described in the preceding pages, both in its macroscopic as well as the microscopic characters. The ascospores of the present species, however, are more coarsely but less crowdedly warted, more fusoidal in outline and smaller than those of *Leucoscypha leucotricha*. These ascospore characters also distinguish this species from *Leucoscypha ermenia*.

SPECIMEN EXAMINED

NEW ZEALAND. On rotten wood of *Nothofagus*, Te Anau, 11 December 1963, K. Tubaki IFO 10783 [type specimen of *Leucoscypha virginea* Rifai].

Leucoscypha rutilans (Fr.) Dennis & Rifai, *comb. nov.*

Peziza rutilans Fr., Syst. mycol. 2: 68. 1822. — *Leucoloma rutilans* (Fr.) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 318. 1870. — *Aleuria rutilans* (Fr.) Gill., Champ. Fr., Discom. 53. 1879. — *Scypharia rutilans* (Fr.) Quél. *in* C.r. Ass. fr. Av. Sci. 14 (2): 551. 1886 (misapplied). — *Sepultaria rutilans* (Fr.) Lamb., Fl. mycol. Belg., Suppl. 1: 302. 1887. — *Humaria rutilans* (Fr.) Sacc., Syll. Fung. 8: 133. 1889. — *Neottiella rutilans* (Fr.) Dennis, Br. Cup Fungi 28. 1960.

Neottiella ovilla (Peck) Sacc. var. *flavodisca* Cooke & Massee *apud* Cooke *in* Grevillea 21: 71. 1895.

? *Sarcoscypha albo-villosa* Rehm *in* Annls mycol. 2: 33. 1904.

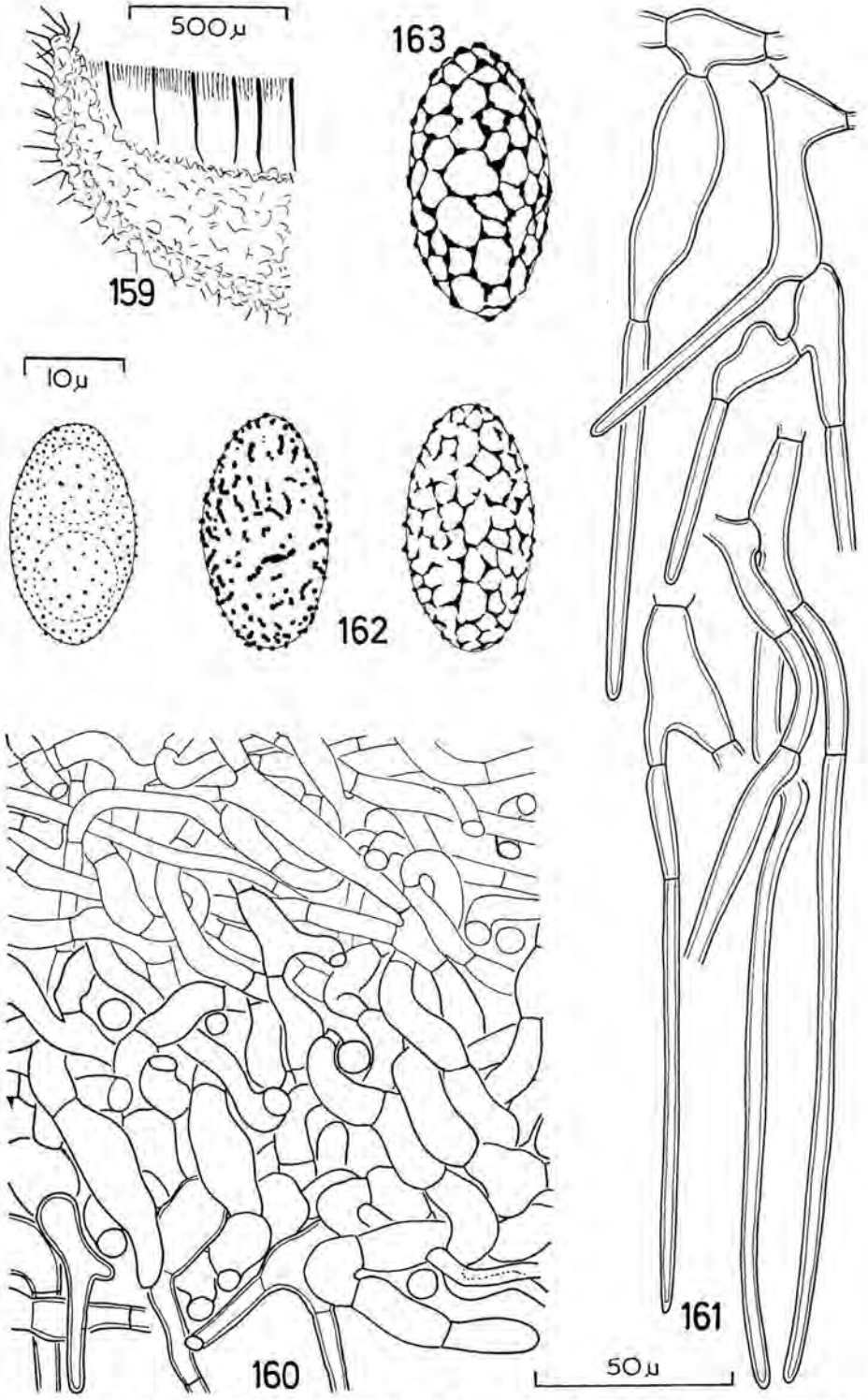
Apothecia scattered to gregarious, subsessile or with a distinct stalk, 5–13 mm diam. Disc smooth, reddish orange, concave. Receptacle cup shaped, contracted below into a broad short stalk, margin even, outer surface whitish, softly and sparsely hairy. Hairs arising from the surface of the receptacle, hyaline, thin to rather thick walled, sparsely (0–3)-septate, gently undulate or straight, basal cell often bulbous or lobed, sometimes appearing branched near the base, up to 250 μ long by 3.5–10 μ wide at the base, gradually tapering towards the blunt tipped apices. Ectal excipulum about 70–100 μ thick, of compactly interwoven, short celled, thin walled, hyaline, hyphae 10–18 μ diam. (textura intricata), sometimes forming a pseudoparenchymatic tissue. Medullary excipulum of loosely interlacing, hyaline, sparingly septate and branched hyphae 6–12 μ diam. (textura intricata). At the margin of receptacle the excipulum consists of mostly parallel running hyphae with barrel shaped cells about 40 μ long by 10 μ wide. Subhymenium not well differentiated from the medullary excipulum except that the former appears more compactly arranged. Hymenium about 270 μ thick. Asci cylindrical, only slightly narrower towards the base, 270–310 × 15–20 μ, 8-spored. Ascospores uniseriate, hyaline, with one or two large oil globules, ellipsoidal, or broad fusoid ellipsoidal, 20–24.5(–27) × 11.8–13.6 μ, when young smooth, then appearing rough from warts or short wart-like ridges, ultimately covered by an imperfect and broken reticulum; meshes of reticulations irregular, mostly 6-sided, about 3 μ diam., the ridges delicate, about 0.5 μ high. Paraphyses slender, usually forked near the base, sparingly septate, 3–4 μ diam., straight at the slightly enlarged (up to 5 μ diam.) apices (Fig. 159–163).

HABITAT AND DISTRIBUTION: Europe (type locality Sweden), North America, India and probably also Australia.

The occurrence of *Leucoscypha rutilans* in Australia has been recorded by Cooke (*1892*) and Rodway (*1925*). I have not been able to verify the identity of Rodway's specimen, but the one described as *Humaria rutilans* by Cooke (*1892*) was based on a collection (on the ground, Swan River, Western Australia, s. dat., collector unknown, no. 190; identified by Berkeley as *Peziza rutilans* Fr.) which now does not bear apothecia any longer. Since this species might have been confused with small species of *Aleuria* described above, and because its taxonomic position as well as its identity have been much confused, an illustrated description drawn from British specimens would seem to be valuable.

As has been discussed earlier under *Sarcoscypha*, *Peziza rutilans* Fr. sensu Quélet (*1873*, *1886*) has globose ascospores; therefore this species is neither conspecific nor congeneric with the concept of *Leucoscypha rutilans* adopted by Boudier (*1907*), Seaver (*1928*), Le Gal (*1947*) and Dennis (*1960*).

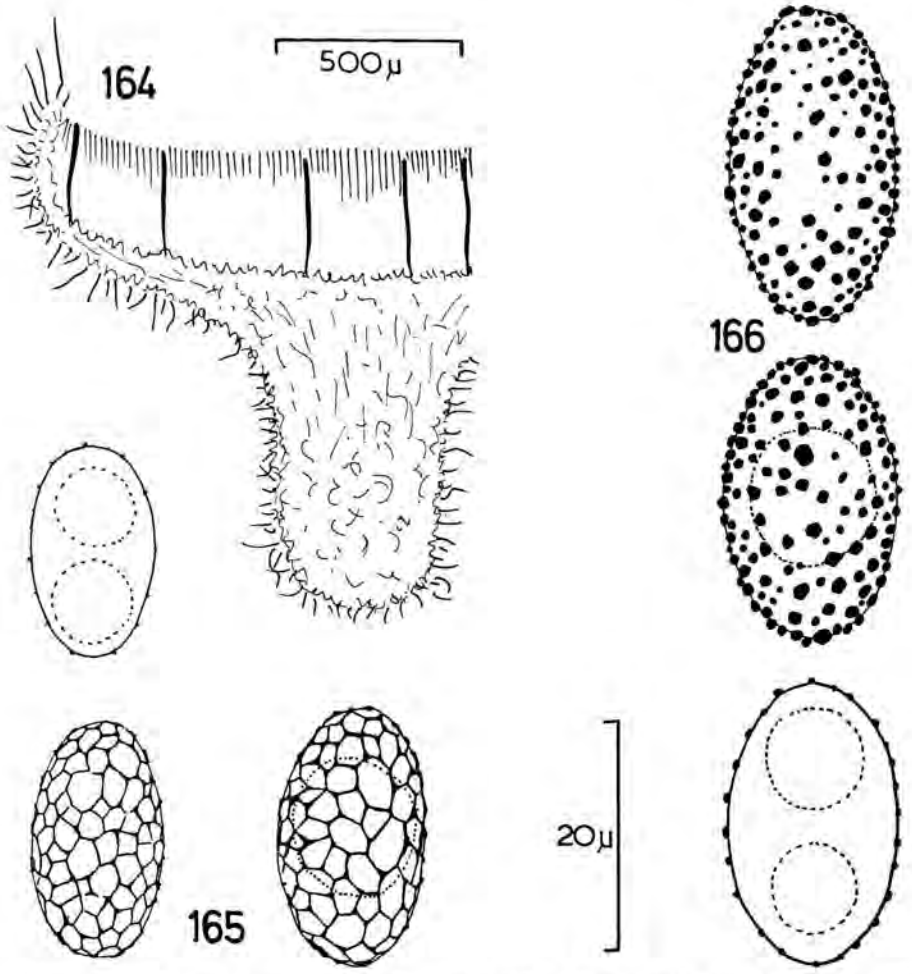
The imperfect reticulations of the ascospores of *Leucoscypha rutilans*, which when young appear as warts or irregularly orientated and much broken short ridges, are very characteristic for this species. On account of these reticulate ascospores and probably influenced by Boudier's (*1906*) illustration, Seaver (*1928*), followed by Thind & Batra (*1957a*) and Batra & Batra (*1963*) classified *Leucoscypha rutilans* as a species of *Aleuria*. As has been pointed out by Le Gal (*1957*) the prosenchymatic ectal



Figs. 159–163. *Leucoscypha rutilcans*. 159. Diagramatic median section of margin. 160. Section of ectal and part of medullary excipulum. 161. Hairs. 162. Ascospores. (From R. E. D. Baker). 163. Ascospores (From F. Currey).

excipulum of the present species is very similar to that of *Leucoscypha leucotricha* and markedly different from the pseudoparenchymatic ectal excipulum of *Aleuria aurantia*. Furthermore the presence of well developed, pointed and stiff, thick walled, hyaline hairs indicate that the affinity of *Leucoscypha rutilans* with the genus *Aleuria* is quite remote.

Although in the original description of *Neottiella ovilla* (Peck) Sacc. var. *flavodisca* Cooke & Massee apud Cooke the ascospores were given as 40–45 × 17–20 μ, its type specimen has yielded ascospores which agree in every respect with *Leucoscypha rutilans*, so that this variety is considered here to be conspecific with the latter. Seaver (*1928*) listed this variety as a synonym of *Patella albo-cincta* (Berk. & Curt. apud Berk.) Seaver, but this does not appear to be justified because the type specimen of *Peziza albo-cincta* Berk. & Curt. apud Berk. (on the ground among



Figs. 164–166. — *Leucoscypha albo-cincta*. 164. Diagramatic median section of part of apothecium. 165. Ascospores. (From type). — *Leucoscypha vivida*. 165. Ascospores (From type).

mosses, South Carolina, U.S.A., s. dat., collector unknown, no. 2592) has smaller ascospores (18.2–21.8 × 10–12.5 μ), which are ornamented with complete or perfect reticulations; these perfect reticulations are already detectable in younger ascospores (Fig. 164–165). It is obvious that the spore ornamentation of **Leucoscypha albo-cincta** (Berk. & Curt. apud Berk.) Rifai, *comb. nov.* [12]) develops somewhat differently from that of *Leucoscypha rutilans*.

Seaver (*1928*) wrongly used the name *Patella albo-cincta* for a species with warted ellipsoidal ascospores, which obviously is not conspecific with the type specimen of *Leucoscypha albo-cincta*. Seaver's description neatly fits the specimen issued in Rabenhorst, Klotzschii Herbarium mycologicum, Ed. 2, no. 310 sub *Peziza polytrichi* Schum. which is the type specimen of **Leucoscypha vivida** (Nyl.) Dennis & Rifai, *comb. nov.* [13]). Superficially the latter species resembles *Leucoscypha rutilans* but differs markedly in its ascospore ornamentations (Fig. 166). Massee (*1894*, *1895*, sub *Neottiella*), Boudier (*1906*, *1907*, sub *Peziza*) and von Höhnel (*1917*, sub *Sarcoscypha*) employed the specific epithet 'polytrichi' for this warted ellipsoidal spored species, but in 1865 Nylander, adopted by Le Gal (*1940*), Dennis (*1960*) and Moser (*1963*), already interpreted *Peziza polytrichi* Schum. ex Fr. as a species of *Lamprospora*. Rehm (*1896*), who originally (Rehm, *1894*) followed Nylander and classified Schumacher's species in *Barlaea*, renamed this *Lamprospora* species *Detonia polytrichina* Rehm because he believed that Massee's (*1894*) interpretation of Schumacher's species was the correct one. To avoid further confusion it seems to be preferable to follow Nylander (*1865*) and Le Gal (*1940*) in interpreting *Peziza polytrichi* as a species of *Lamprospora* and to refer to the species with warted ellipsoidal ascospores as *Leucoscypha vivida*.

Seaver (*1914*, *1928*) transferred *Detonia polytrichina* Rehm to *Lamprospora* but his concept of this species appears to be rather inconsistent (Seaver, *1914*: spores 15–17 μ diam.; Seaver, *1928*: spores 10–13 μ diam.; in both cases smooth walled, with straight, slightly curved or more rarely hooked paraphyses). According to Le Gal (*1940*) the ascospores of *Lamprospora polytrichi* (Schum. ex Fr.) Le Gal measured 10–13(–15.5) μ diam. and were finely reticulated. In Australia the name *Lamprospora poly-*

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[12]) *Peziza albo-cincta* Berk. & Curt. *apud* Berk. *in* Grevillea 3: 154. 1875 (basionymum). — *Humaria albo-cincta* (Berk. & Curt. apud Berk.) Rehm *in* Ber. naturhist. Ver. Augsburg 26: 110. 1881. — *Neottiella albo-cincta* (Berk. & Curt. apud Berk.) Sacc., Syll. Fung. 8: 190. 1889. — *Lachnea albo-cincta* (Berk. & Curt apud Berk.) Starb. *in* Bot. Notiser 1898: 215. 1898 (misapplied?). — *Patella albo-cincta* (Berk. & Curt. apud Berk.) Seaver, N. Am. Cup Fungi (Operc.) 163. 1928 [misapplied, = *Leucoscypha vivida* (Nyl.) Dennis & Rifai].

[13]) *Peziza vivida* Nyl. *in* Flora 48: 467. 1865 (basionymum). — *Aleuria vivida* (Nyl.) Gill., Champ. Fr. Discom. 54. 1879. — *Humaria vivida* (Nyl.) Quél., Ench. Fung. 290. 1886. — *Humaria rutilans* (Fr.) Sacc. var. *vivida* (Nyl.) Rehm *in* Rabenh. Kryptog.-Fl. I 3: 961. 1894. — *Neottiella vivida* (Nyl.) Dennis, Br. Cup Fungi 28. 1960.

trichina (Rhem) Seaver was used by McLennan & Halsey (*1936*) for the species described in the present paper as *Pulvinula miltina*.

I have not seen the type specimen of *Sarcoscypha albo-villosa* Rehm, which has been reduced to the synonomy of *Leucoscypha rutilans* by Seaver (*1928*). Rehm (*1904*) compared his new species with *Aleuria rhenana* and pointed out that the two species were distinguishable on account of the well developed hairs and the non hooked paraphyses of the new species. As his description corresponds very closely with the characters of the present species, it is tentatively regarded as a possible synonym of *Leucoscypha rutilans*, pending further study of its type specimen.

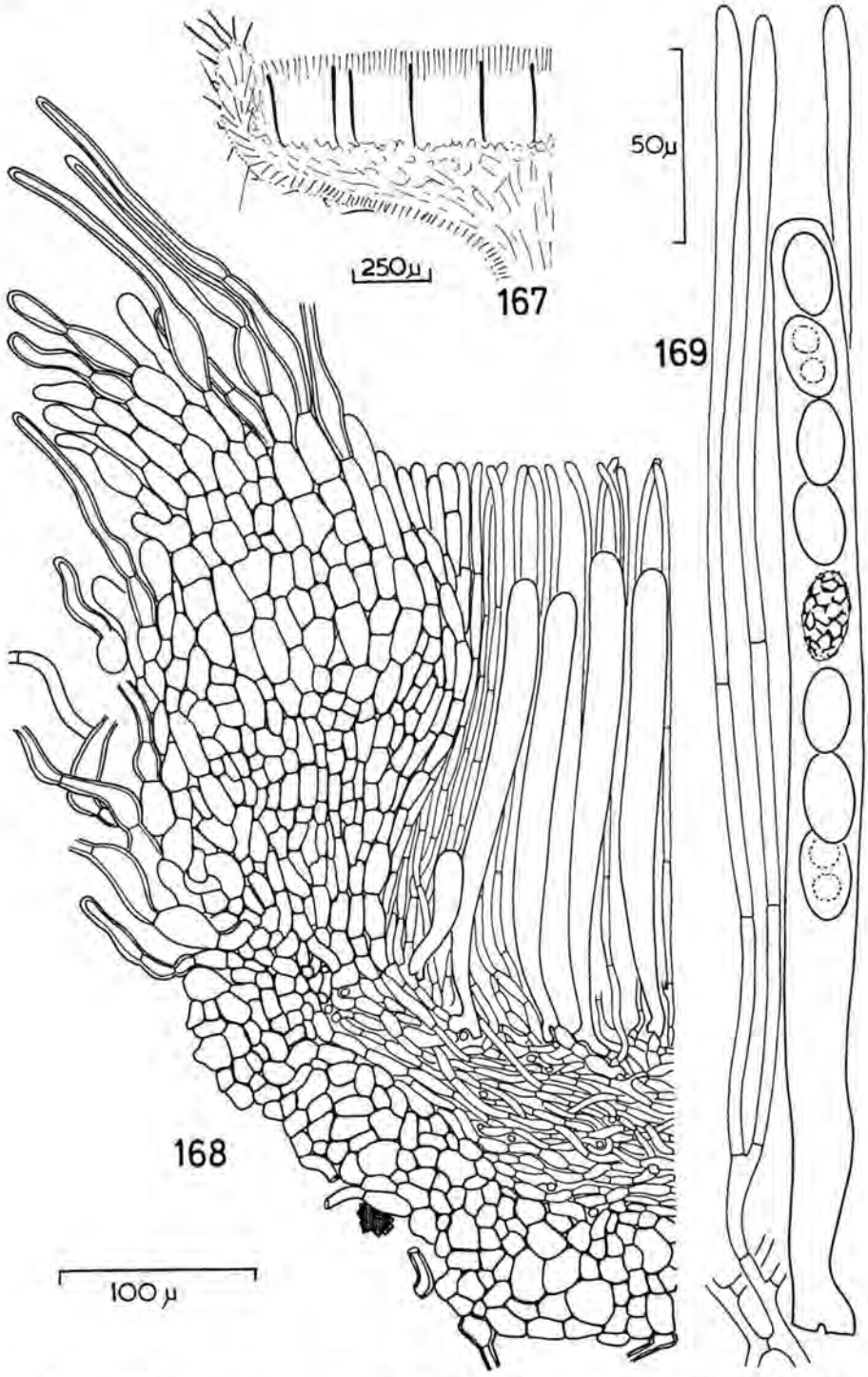
SPECIMENS EXAMINED

EUROPE. Great Britain. On sandy soil amongst *Polytrichum*, Formby, Lancashire, 14 October 1946, R. E. D. Baker; habitat not indicated, Hanham near Bristol, October 1863, F. Currey [sub *Peziza fibrillosa* Curr., but already identified and annotated by Prof. J. A. Nannfeldt of Uppsala as *Neottiella rutilans*], on the ground amongst mosses, Ben Lawers (2500 ft.), Scotland, s. dat., collector unknown [type specimen of *Neottiella ovilla* (Peck) Sacc. var *flavodisca* Cooke & Massee apud Cooke].

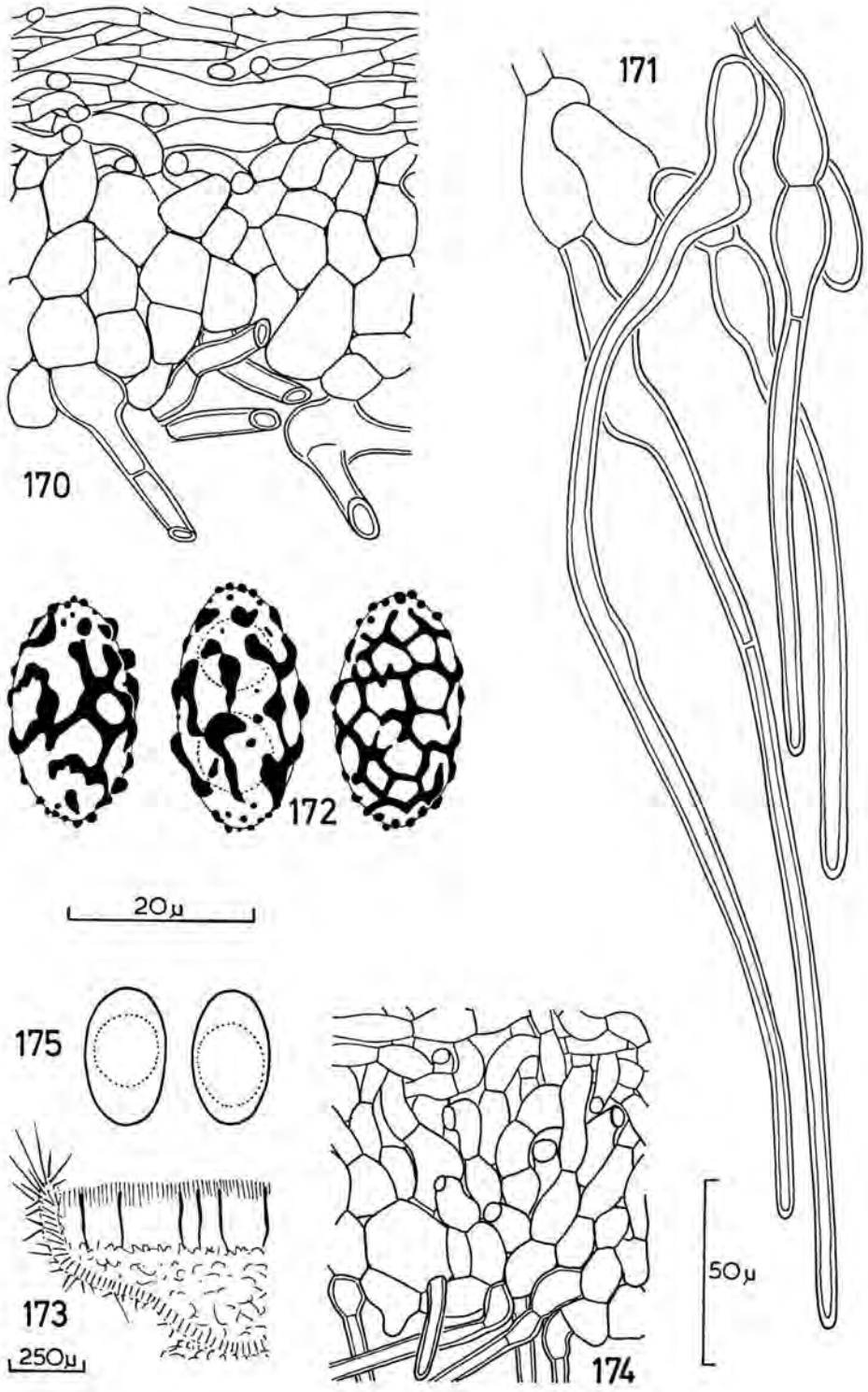
Leucoscypha catharinaea (McLennan & Halsey) Rifai, *comb. nov.*

Neottiella catharinaea McLennan & Halsey *in* Proc. R. Soc. Victoria **49**: 56. 1936 (ut *Neotiella*).

Apothecia arise singly in the axils of leaves of the moss, subsessile to stipitate, small, up to 5 mm diam. Disc saucer shaped or sometimes flattened, with a fringe-like margin, capucine yellow to orange. Receptacle shallowly cup shaped, contracted below into a distinct short stalk, distinctly hairy, whitish. Hairs numerous, covering almost the whole receptacle and its stalk, up to 400 μ long, enlarged to about 20 μ diam. at the bulbous, lobed or pear shaped base, then gently attenuate from 5.5–9 μ diam. immediately near the bulbous base to 2.5–3.5 μ diam. blunt tipped apex, thick walled, only sparingly (0–3)-septate, straight or more commonly undulate, sometimes with indistinct branch near the base. Ectal excipulum pseudoparenchymatous, 70–100 μ thick, of large globular elongated or polygonal, thick walled cells 16–30 μ diam. which are irregularly orientated. Medullary excipulum well differentiated, of septate, hyaline, rather thick walled hyphae 4–7 μ diam. (but may be up to 10 μ diam. in the stipe) which mostly run horizontally. Subhymenium also well differentiated, of rather loosely intertwined, septate hyphae 4–7 μ diam. (textura intricata). Hymenium about 350 μ thick. Asci cylindrical, only slightly narrower at the base, 8-spored, 280–360 × 15–20 μ. Ascospores uniseriate, hyaline, ellipsoidal to broad fusoidal, containing one or more often two large oil globules, at first smooth, soon becoming warted and ultimately covered by reticulum, with meshes of reticulations more or less 6-sided, 3–4 μ diam., ridges uneven in thickness and at the polar regions usually broken and replaced by warts; without the reticulum the ascospores measure 20–25.4 × 10.5–12.7 μ. Paraphyses stout, sparingly septate, at their base sometimes repeatedly forked, occasionally anastomose, 2.5–4 μ diam., apex slightly enlarged to about 7 μ diam., subclavate or lobed, or more often lanceolate, about 50 μ longer than the asci (Fig. 167–172).



Figs. 167–169. *Leucoscypha catharinaea*. 167. Diagramatic median section of margin of apothecium. 168. Details of section of margin. 169. Ascus and paraphyses. (From G. Beaton 110).



Figs. 170–175. — *Leucoscypha catharinaea*. 170. Details of section of ectal and part of medullary excipulum. 171. Hairs. 172. Ascospores. (From G. Beaton 110). — *Leucoscypha hetieri*. 173. Diagramatic section of margin. 174. Details of ectal and part of medullary excipulum. 175. Ascospores. (From burnt ground, at the head of Glen More, Aviemore, Inverness-shire, Great Britain, 14 April 1949, R. W. G. Dennis). — Figs. 170, 171, 174 to same scale.

HABITAT AND DISTRIBUTION: in the leaf axils of living moss (*Atrichum ligulatum*) in Victoria.

On the label of the specimen studied it was stated that this fungus lived epiphytically on the moss, but further observations and collections are required to elucidate the mode of life of this curious species. Its paraphyses are considerably longer than the asci and the structure of its ectal excipulum is different from that of *Leucoscypha leucotricha*. An intermediate type of ectal excipulum structure, however, is exhibited by the smooth spored **Leucoscypha hetieri** (Boud.) Rifai, *comb. nov.*[14]) (Fig. 173–175). The structure of the ectal excipulum of *Leucoscypha catharinaea* resembles that of *Aleuria* but the presence of well developed and distinctive hairs and its close association with mosses seem to prevent the inclusion of this species in the latter genus. *Leucoscypha* is not the only genus having two (textura intricata and angularis) types of ectal excipulum, because a similar situation can be found in *Sarcoscypha* and *Galiella*.

SPECIMEN EXAMINED

AUSTRALIA. Victoria. In the leaf axils of *Atrichum ligulatum* (syn. *Catharinaea muelleri*), Hilton Road, Ferny Creek, Dandenong Range, 24 August 1945, J. H. Willis (comm. G. Beaton 110).

GEOPYXIS (Pers.) Sacc. emend. Boud. [15])

Peziza [Dill.] St-Amans subgen. *Geopyxis* Pers., Mycol. eur. 1: 224. 1822. — *Peziza* [Dill.] St-Amans. "div." *Discina* Fr. "ser." *Aleuria* Fr. "trib." *Geopyxis* (Pers.) Fr., Syst. mycol. 2: 42. 1822. — *Geopyxis* (Pers.) Sacc., Syll. Fung. 8: 63. 1889, emend. Boud., Hist. Class. Discom. Eur. 53. 1907 (nom. gen. cons. prop.).

Peziza [Dill.] St-Amans [ser. *Aleuria* Fr.] subgen. *Tarzetta* Cooke, Mycograph. 1: 251. 1879. — *Tarzetta* (Cooke) Lamb., Fl. mycol. Belg., Suppl. 1: 325. 1887 (nom. gen. rej. prop.); non *Tarzetta* (Cooke) Rehm *in* Rabenh. Kryptog.-Fl. I 3: 1021. 1894 [= *Stromatinia* (Boud.) Boud.]. — *Peziza* [Dill.] St-Amans subgen. *Geopyxis* Pers. sect. *Tarzetta* (Cooke) Schroeter in Kryptog.-Fl. Schles. 3 (2): 44. 1893.

LECTOTYPE SPECIES: *Peziza carbonaria* Alb. & Schw. ex Pers.

The commonly accepted circumscription of the genus *Geopyxis* is that proposed by Boudier (*1907*), and to it should be assigned terrestrial species with subsessile or more often stalked, brightly coloured, cup shaped and hairless apothecia which produce small, smooth, hyaline ellipsoidal and non-guttulate ascospores. This genus, however, has never been critically revised so that the actual number of its species and its limits are far from being clear. For this reason no formal generic description is given here but in its place the lectotype species will be described and illustrated although at Herb. Kew. this species has not been represented

[14]) *Neottiella hetieri* Boud. *in* Bull. Soc. mycol. Fr. 12: 12. 1896 (ut *Neotiella*) (basionymum). — *Patella hetieri* (Boud.) Seaver, N. Am. Cup Fungi (Operc.) 164. 1928.

[15]) Nom. gen. cons. prop.

by an Australasian collection. The two Australasian species which have been referred to *Geopyxis* both show some anomalies and they are retained here because the available material makes it impossible to reach a better and more satisfactory solution on their taxonomic position.

Peziza carbonaria Alb. & Schw. ex Pers. is designated here as the lectotype species of *Peziza* [Dill.] St-Amans [ser. *Aleuria* Fr.] subgen. *Tarzetta* Cooke, so that the tradition set out by Saccardo (*1889*) in treating the latter taxon as a synonym of *Geopyxis* can be followed. In 1887 Lambotte gave *Tarzetta* generic rank and transferred to it four species, three of which – including *Peziza carbonaria* – were already included in this taxon by Cooke (*1879*). Some years later Rehm (*1894*), who apparently was unaware of Lambotte's treatment of *Tarzetta*, also recognized it as a distinct genus and accepted only one species, *Peziza rapulum* Bull. ex Fr., which was also one of Cooke's original species. In the meantime Boudier (*1885*) had included this latter inoperculate species in *Ciboria* Fuckel subgen. *Stromatinia* Boud. Later on (Boudier, *1907*) this subgenus was separated as a genus of its own with *Peziza rapulum* as the type species. Clements & Shear (*1931*), Nannfeldt (*1932*) and Ainsworth (*1961*) mentioned only *Tarzetta* (Cooke) Rehm, and *Peziza rapulum* was correctly indicated as its type species. It is obvious that *Stromatinia* (Boud.) Boud. (*1907*) is a later nomenclatural or obligate synonym of *Tarzetta* (Cooke) Rehm (*1894*). The new typification proposed above for *Tarzetta* (Cooke) Lamb. (*1887*), however, will make *Tarzetta* (Cooke) Rehm a later homonym, so that there will be no question of replacing the much used name *Stromatinia* with *Tarzetta* (Cooke) Rehm. Since the name *Tarzetta* has not been widely and consistently used, it is advisable to abandon it by conserving the universally accepted name *Geopyxis* (Pers.) Sacc. (*1889*) against *Tarzetta* (Cooke) Lamb. (*1887*).

Geopyxis carbonaria (Alb. & Schw. ex Pers.) Sacc.

Peziza carbonaria Alb. & Schw., Consp. Fung. 34. 1805. — *Peziza carbonaria* Alb. & Schw. *ex* Pers., Mycol. eur. 1: 228. 1822; Fr., Syst. mycol. 2: 62. 1822. — *Peziza cupularis* L. ex Pers. var. *carbonaria* (Alb. & Schw. ex Pers.) Weinm., Hym.- Gastro-m. ross. 424. 1836. — *Aleuria carbonaria* (Alb. & Schw. ex Pers.) Gill., Champ. Fr., Discom. 39. 1879. — *Tarzetta carbonaria* (Alb. & Schw. ex Pers.) Lamb., Fl. mycol. Belg., Suppl. 1: 325. 1887. — *Geopyxis carbonaria* (Alb. & Schw. ex Pers.) Sacc., Syll. Fung. 8: 71. 1889.

Peziza lepida Berk. & Curt. *in* Proc. Am. Acad. Arts Sci. 4: 127. 1860. — *Sarcoscypha lepida* (Berk. & Curt.) Sacc., Syll. Fung. 8: 154. 1889.

Apothecia gregarious, medium sized, mostly less than 10 mm diam. but occasionally up to 17 mm diam. Disc deep cup shaped, smooth, ochraceous red to light red. Receptacle thin, campanulate, often resembling an acorn cupule, outer surface smooth or nearly so, dirty yellowish brown, margin distinctly but irregularly crenulate, often somewhat whitish, contracted abruptly below into a slender stalk of up to about 10 mm or more long, less commonly subsessile. Ectal excipulum 25–45 μ thick or more, of textura globulosa to almost textura angularis, cells subglobose, polyg-

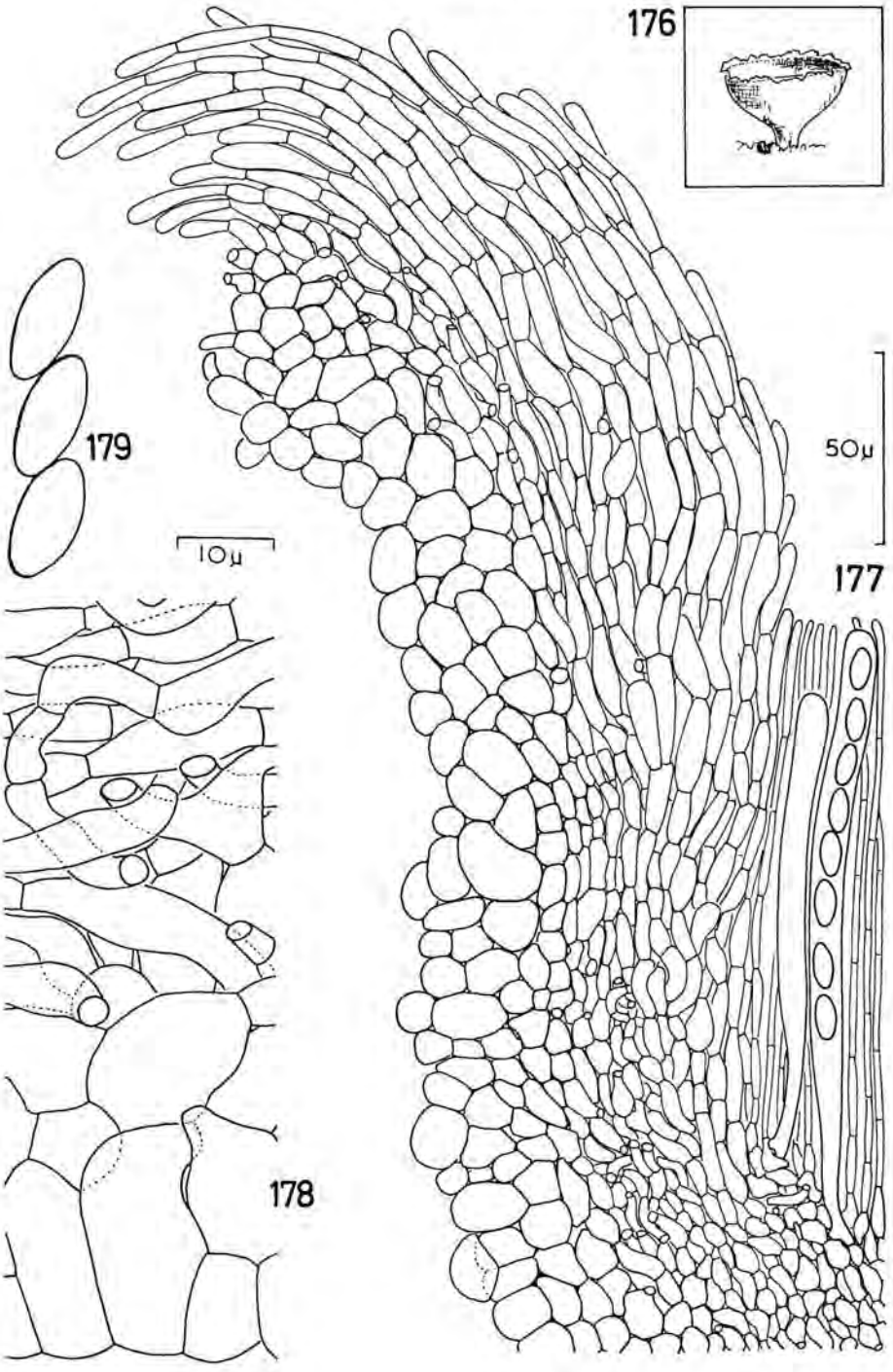
onal or pear shaped, 10–20 μ diam.; on the outer side a few cells sometimes aggregate to form small conical pustules. Immediately inside the ectal excipulum the cells become thinner walled, smaller, only up to 15 μ diam., more irregular in shape, mostly asymmetrically pear-shaped or lobed, interspaced by hyphal elements with barrel shaped cells about 6 μ diam., which pass into an inner layer of tightly interwoven hyphae; the latter mostly horizontally orientated, septate, sparingly branched, 2.5–5 μ diam.; together these two layers make up the medullary excipulum which is about 75–175 μ thick. Around the margin, between the hymenium and the excipular tissue there is a thick layer of hyphae which mostly run parallel with the surface of receptacle, with their barrel shaped cells up to 35 μ long by 5–10 μ diam. and terminated by subcylindrical blunt apices; the whitish and crenulate appearance of the margin of receptacle is probably due to this layer of hyphae. Subhymenium of compacted textura intricata, hyphae 3.5–6 μ diam. Hymenium about 210 μ thick. Asci cylindrical, slightly narrower at the base, 180–220 × 8–10 μ, 8-spored. Ascospores uniseriate, ellipsoidal to blunt and broad fusoidal, smooth walled, without oil globules, hyaline, 12.5–15 × 6–8 μ. Paraphyses slender, septate, sometimes branched near the base, 2–2.7 μ diam., apex slightly enlarged to about 3.6 μ diam., subclavate or subcylindrical (Fig. 176–179).

HABITAT AND DISTRIBUTION: on burnt ground in Europe (type locality Germany), North America and Japan.

The ascospore size, the thickness of the excipulum and the macroscopic characters of this species seem to be rather variable. It is probable that the type specimen of *Peziza vulcanalis* Peck apud Haydin (on [burnt?] ground among conifer needles in the crater of an extinct volcano in Colorado, U.S.A., s. dat., J. M. Coulter), is only a luxuriant form of *Geopyxis carbonaria*. All apothecia in this type collection are distinctly stipitate; their ascospores are slightly larger, 13.6–16.3 × 7–8.5 μ and their ectal excipulum is also slightly thicker than that of *Geopyxis carbonaria* described above, but otherwise they are similar. I do not formally list this species as a synonym of *Geopyxis carbonaria* because of the uncertainty concerning its habitat and because the variability of the present species needs further study. Seaver (*1928*) used the name *Geopyxis vulcanalis* (Peck apud Haydin) Sacc. for a different species which was subsessile and growning among mosses and leaf mould in coniferous wood; according to Grove & Hoare (*1954*) it has ascospores which measure 15–20 × 8–10 μ.

Berkeley & Curtis (*1860*) compared the newly described Japanese species *Peziza lepida* Berk. & Curt. with *Sarcoscypha coccinea* (Jacq. ex S. F. Gray) Lamb., which led Saccardo (*1889*) to compile the former species also as a *Sarcoscypha*. The type specimen of *Peziza lepida* has operculate asci and was collected from burnt ground; it is not specifically different from *Geopyxis carbonaria*. Massee already annotated the label of the Australian specimen recorded by Cooke (*1892*) as *Sarcoscypha lepida* (Berk. & Curt.) Sacc. that it was different from the type specimen of the latter; this specimen is described below under *Geopyxis majalis* (Fr.) Sacc.

Seaver (*1928*) has merged *Pustularia* Fuckel in *Geopyxis*. The apothecial



Figs. 176–179. *Geopyxis carbonaria*. 176. Habit sketch. 177. Section of margin. 178. Details of section of ectal and part of medullary excipulum. 179. Ascospores. (From D. A. Reid).

construction of the former genus, however, is quite different from that of *Geopyxis carbonaria*, and their ascospores are distinctly guttulate. Seaver (*1928*) also reduced *Geopyxis carbonaria* to the synonymy of *Geopyxis cupularis* (L. ex Fr.) Sacc. but this is wholly unjustified because most European mycologists (Boudier, *1907*; Nannfeldt, *1938*; Dennis, *1960*) had unanimously interpreted Linnaeus' species as a *Pustularia*.

SPECIMENS EXAMINED

AMERICA. U.S.A. On burnt ground, Berry Creek, Wolverine, Michigan, 1 August 1961, D. A. Reid; in burnt spruce woods on the ground, Maine, York, 12 September 1911, R. Thaxter [Reliquiae farlowianae 119 sub *Geopyxis carbonaria*].

JAPAN. On burnt earth, 1853–1856, C. Wright 149 [type specimen of *Peziza lapida* Berk. & Curt.]

EUROPE. In silvis in terra carbonaria, s. loc., s. dat., L. Rabenhorst [Rabenhorst, Fungi europaei no. 2512 sub *Peziza carbonaria*].

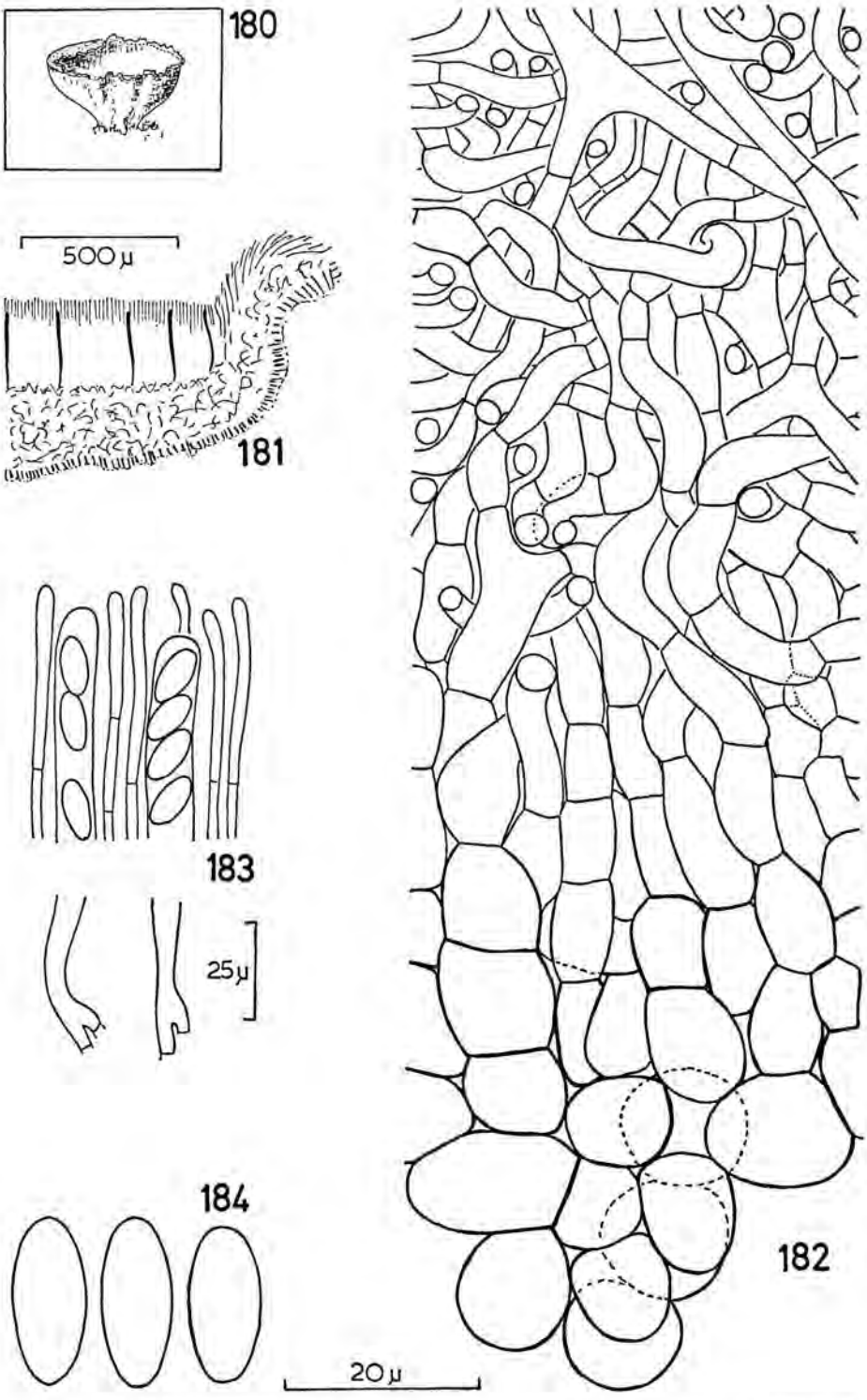
GEOPYXIS MAJALIS (Fr.) Sacc.

Peziza majalis Fr. *in* Nova Acta Soc. Sci. upsal. III 1: 120. 1851. — *Geopyxis majalis* (Fr.) Sacc., Syll. Fung. 8: 72. 1889.

Apothecia scattered, sessile, up to 10 mm diam. Disc deeply cup-shaped, smooth, now appearing dirty yellowish brown, becoming brownish yellow when moistened. Receptacle thin, cup shaped, margin irregularly crenulate, contracted below into a broad stem-like base, outer surface concolorous with the disc or slightly darker, especially near the margin; towards its base sometimes ridged but otherwise appearing smooth to the unaided eye. Ectal excipulum 30–40 μ thick, the outer layer of one to three cells thick, composed of subglobose or polygonal and rather thick-walled pale yellowish cells 12–20 μ diam. (textura globulosa); the inner layer of angular or almost pear shaped cells 7–10 μ diam., arranged with their long axes at right angles to the surface of the receptacle; on the latter a few globose cells often aggregate with each other and form small conical projections. Medullary excipulum well developed, up to 300 μ thick, of loose textura intricata, hyphae hyaline, sparingly septate and branched, 3–7.5 μ diam.; towards the hymenium the hyphae become more homogeneous and mostly run horizontally. At the margin of the cup between the hymenium and the excipulum there is a thick layer of paraphysis-like hyphae which run parallel with each other and sometimes overarch the margin of the excipulum; this layer is composed of hyphae with long barrel shaped cells 4–8 μ diam. and may cause the inner side of the margin of apothecia to appear whitish. Subhymenium of interwoven hyphae with short cylindrical or barrel-shaped cells 3.5–6.5 μ diam. Hymenium about 250 μ thick. Asci cylindrical, narrower at the base, 8-spored, up to 330 μ long by 9–12 μ wide. Ascospores uniseriate, ellipsoidal or broadly fusoidal, 14.5–16.5 × 6.3–8 μ, smooth walled, hyaline, without oil globules. Paraphyses slender, straight, septate, branched near the base, only slightly enlarged at the subcylindrical or lobed apex which is 2.5–3 μ diam. (Fig. 180–184).

HABITAT AND DISTRIBUTION: on damp ground in Sweden (type locality) and Australia.

The isotype specimen of *Peziza majalis* Fr. at Herb. Kew. has smaller and more turbinate fruit bodies with narrower and more distinct stems,



Figs. 180–184. *Geopyxis majalis*. 180. Habit sketch. 181. Diagramatic section of margin. 182. Details of ectal and part of medullary excipulum. 183. Part of asci and paraphyses. 184. Ascospores. (From Miss Webb).

but otherwise it agrees well with the Australian specimen. In the original description this species was said to have "disco aurantiaco"; whether the Australian specimen had also the same pigmentation when fresh remains to be found out when it is collected again.

As has been stated earlier this specimen was the basis of the Australian record of *Sarcoscypha lepida* (Berk. & Curt.) Sacc. (Cooke, *1892*), a species which has been shown to be a synonym of *Geopyxis carbonaria*. Besides the difference in habitat, the excipulum of the present species is also quite different from that of *Geopyxis carbonaria*, and in fact it shows some resemblance to those of some species of the tribe Otideae. Consequently *Geopyxis majalis* cannot be considered as a synonym of *Geopyxis vulcanalis* as has been suggested by Seaver (*1928*), because the latter differs only critically from *Geopyxis carbonaria*.

SPECIMENS EXAMINED

AUSTRALIA. South Australia. On the ground on ferny gully, Lake Bonney, s. dat., Miss Webb.

EUROPE. Sweden. On the ground, Uppsala, s. dat., Th. M. Fries [part of type collection of *Peziza majalis* Fr.].

LAMPROSPORA De Not.

Lamprospora De Not. *in* Commentario Soc. critt. ital. 1: 388. 1864.

Crouania Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 320. 1870; non *Crouania* Agardh, Alg. Mar. medit. adr. 83. 1842 (= Algae). — *Peziza* [Dill.] St-Amans subgen. *Crouania* (Fuckel) Sacc. *in* Bot. Cbl. 18: 218. 1884. — *Humaria* (Fr.) Boud. [sect.] *Crouania* (Fuckel) Cooke, Handb. Austral. Fungi 256. 1892. → *Barlaea* Sacc.

Barlaea Sacc., Syll. Fung. 8: 111. 1889 (a name change); non *Barlaea* Reichenb. f. *in* Linnaea 41: 54. 1877 (= Orchidaceae). → *Barlaeina* Sacc.

Barlaeina Sacc., Tab. comp. Gen. Fung. 30. 1898 (a name change); non *Barlaeina* Sacc. emend. Le Gal *in* Revue Mycol. 18: 80. 1953 = *Marcelleina* Brumm., Korf & Rifai.

? *Ramsbottomia* Buckley *in* Trans. Br. mycol. Soc. 9: 44. 1923.

TYPE SPECIES: *Lamprospora miniata* De Not.

Apothecia small, sessile. Disc flat or convex, often appearing rough from protruding asci, yellowish to bright reddish orange. Receptacle saucer shaped or shallow cup shaped, concolorous or mostly paler than the disc, smooth but often with loose whitish hyphal elements, usually extended beyond the hymenial level to form a distinct dentate-fimbriate margin. Ectal excipulum of a thin outer layer of short celled intricate hyphae and a thicker inner layer of textura angularis tissue. Medullary excipulum of angular or subglobose large cells (textura angularis or textura globulosa). Asci long clavate cylindrical, 8-spored, apex not blued in Melzer's reagent. Ascospores globose or subglobose, hyaline, with one or more large oil drops which may disappear at maturity, their walls usually ornamented with tubercles, warts, spines, anastomosing or non-anastomosing ridges of various construction, size and shape. Paraphyses stout, sparingly septate, cylindrical, with clavate apices, filled with orange coloured granules.

HABITAT: on the ground among mosses.

With the exception of *Ramsbottomia* all synonyms listed above seem to represent nomenclatural or obligate synonyms, because all of these generic names were based on the same type species, *Lamprospora miniata*. In proposing the genus *Lamprospora*, De Notaris (*1864*) gave a descriptio generico-specifica. It is probably for this reason that this name was not taken up by Saccardo (*1884*, *1889*).

The genus *Crouania* was introduced by Fuckel (*1870*) originally for two species: *Ascobolus miniatus* Crouan and *Peziza humosa* Fr. On account of its homonymy with an earlier species, the former species was renamed *Ascobolus crouani* by Cooke (*1864*); this species has been generally accepted as a synonym of *Lamprospora miniata* De Not. Several other species were added later to this genus by Lambotte (*1887*). The first mycologist who effectively typified the generic name *Crouania* seems to be Saccardo who in 1884 designated *Peziza crouani* (Cooke) Cooke as an example species of *Peziza* subgen. *Crouania*. The choice of this species as the type species is fully justified because it is one of the original species included in the genus *Crouania* by Fuckel (*1870*); furthermore it is logical to conceive that Fuckel would consider Crouan's species as the most typical representative of this genus, because he dedicated it to Crouan. Since the identity of the second species, *Peziza humosa* Fr., has been differently interpreted by some authors it was fortunate that Saccardo (*1884*) did not choose this species as the type of *Crouania*. By accepting Saccardo's typification, there is no obstacle to rejecting the name *Crouania* in favour of the earlier name *Lamprospora*, since both of them are typified by the same species.

In 1889 Saccardo adopted new generic conceptions in operculate Discomycetes and treated *Crouania* as a distinct genus. Since this name had been preoccupied by the algal genus *Crouania* Agardh, in its place he proposed the generic name *Barlaea*. There is no doubt that *Peziza crouani* must be taken as the type species of *Barlaea*, because *Barlaea* is only a name change, thus it is an obligate synonym of *Crouania*. Clements & Shear (*1931*) then were right when they listed *Barlaea miniata* (Crouan) Sacc. as the type species of *Barlaea*.

When Saccardo (*1898*) realized that the generic name *Barlaea* was also preoccupied by the orchid genus *Barlaea* Reichenb. f., he substituted it once again with *Barlaeina* which he introduced in his "Tabulae comparativae genericum omnium" merely as follows: "*Barlaeina* Sacc. '98 / (*Barlaea* Sacc. '89 / non Reich. '79)". Once again it is obvious and there should be no question that the type species of *Barlaeina* is the same as that of *Barlaea* and *Crouania*, as already indicated by Clements & Shear (*1931*). Seaver (*1914*, *1928*) and McLennan & Cookson (*1926*) correctly listed both *Barlaea* and *Barlaeina* as synonyms of *Lamprospora*.

Madame Le Gal (*1953a*) took up the name *Barlaeina* and emended it to accommodate a group of fungi related to the non-carotenoid *Ascobolus persoonii* Crouan, which she designated as the lectotype species of *Bar-*

laeina. Since *Barlaeina* is only a name change of *Barlaea* and because the latter is an avowed new name for *Crouania*, indirectly Le Gal also designated *Ascobolus persoonii* as the lectotype species of both *Barlaea* and *Crouania*. The new typification proposed by Le Gal (*1953a*) is unacceptacle because *Ascobolus persoonii* was not one of the original species of *Crouania* and because Saccardo (*1884*) and Clements & Shear (*1931*) had already effectively typified these three generic names with *Lamprospora miniata* De Not., according to Articles 7–10 of the "International Code of Botanical Nomenclature" this has to be followed. For these reasons, to replace *Barlaeina* Sacc. emend. Le Gal (*1953a*) non Saccardo (*1898*) the new generic name *Marcelleina* Brumm., Korf & Rifai has been proposed in the tribe Otideae.

The limits of the genus *Lamprospora* outlined in the above generic description is in agreement with that formulated by Boudier (*1907*), Le Gal (*1947*), Dennis (*1960*) and Moser (*1963*). Seaver (*1914*, *1928*) and Snyder (*1938*) used the name *Lamprospora* in a very wide sense and accepted in it all or almost all hairless species of operculate cup fungi which produced globose ascospores. Of the many species treated by Seaver (*1928*) only those species with carotenoid pigmentation and pseudoparenchymatous excipulum can be retained in this genus, and the affinity of the remaining species has to be sought elsewhere. Species having carotenoid pigmentation but with filiform paraphyses and delicate textura intricata medullary excipulum should be referred to *Pulvinula* Boud. whereas those showing iodine positive ascus reaction have been generally classified as *Plicaria* Fuckel emend. Boud. of the Pezizaceae. There are also a few species which have to be transferred to *Marcellinia* because they have otideoid apothecial construction.

Batra & Batra (*1963*) seem to have no clear conception of *Lamprospora*, and the distinction between this genus and *Pulvinula* was confused. Although in the same paper these authors proposed two new combinations in the genus *Pulvinula* and also described – but did not validly publish (Art. 37) – a new small spored variety of *Pulvinula carbonaria* (Fuckel) Boud., the type specimen of what they referred to as *Lamprospora multiguttula* Batra (on the ground, Mussoorie, Uttar Pradesh, India, s. dat., L. R. Batra 1176 CUP 1–104) represents a species of *Pulvinula* and is in no way related to *Lamprospora miniata*. *Lamprospora chopraina* Batra (Batra, *1960*; Batra & Batra, *1963*) has a prosenchymatous medullary excipulum and a brown disc so that this species should also be excluded from *Lamprospora*.

Ramsbottomia lamprosporoidea Buckley (*1923*) – together with its probable earlier synonyms *Peziza asperior* Nyl. (*1869*) and *Sphaerospora perplexa* Seaver (Ramsbottom & Balfour–Browne, *1951*; Denison, *1961*) – is closely related to *Lamprospora crec'hqueraultii* and for this reason the genus *Ramsbottomia* Buckley is tentatively regarded as a synonym of *Lamprospora*. When all members of the *Lamprospora–Octospora* complex are critically

revised, however, it might well be necessary to uphold *Ramsbottomia* for the reception of *Lamprospora crec'hqueraultii* and its related species now classified as *Lamprospora* or *Octospora*, which should be distinguished from the last two genera by the differences in the structure of its excipular tissue, especially in the absence of a thin and compact prosenchymatous layer on the outer surface of the receptacle.

The genus *Lamprospora* is well represented in Australasia and is quite well known due to the works of McLennan & Cookson (*1923*, *1926*). Although they followed Seaver (*1914*) in listing *Plicaria* and *Pulvinula* as its synonyms, they described only those species which were really referable to *Lamprospora*. Seven species are now known to occur in Australasia but only four of these are represented at Herb. Kew.

KEY TO AUSTRALASIAN SPECIES OF LAMPROSPORA

1a. Ascospores echinulate. . . *Lamprospora crec'hqueraultii* (Crouan) Boud.
b. Ascospores reticulate 2
c. Ascospores tuberculate 4
2a. Meshes of reticulations irregular, their ridges extending across the surface of the spore in various directions and resembling a cord wound about its surface . . . . . [*Lamprospora funigera* McLennan & Cookson]
b. Meshes of reticulations more or less regular, mostly 6-sided 3
3a. Meshes of reticulations 2–4 μ wide . . [*Lamprospora miniata* de Not.]
b. Meshes of reticulations 4–8 μ wide
Lamprospora australis (McLennan & Cookson) Rifai
4a. Tubercles small, mostly less than 2 μ diam.
[*Lamprospora tuberculatella* Seaver]
b. Tubercles large, more than 3 μ diam. 5
5a. Individual tubercles appearing translucent and reticulate from the presence of numerous internal globules . . . . . *Lamprospora maireana* Seaver
b. Individual tubercles simple . . . . . *Lamprospora tuberculata* Seaver

LAMPROSPORA MINIATA De Not.

Ascobolus miniatus Crouan *in* Ann. Sci. nat. (Bot.) IV **10**: 197. 1858; non *Ascobolus miniatus* Preuss *in* Linnaea **24**: 147. 1851. — *Crouania miniata* (Crouan) Fuckel *in* Jb. nassau. Ver. Naturk. **23–24**: 320. 1870. — *Humaria miniata* (Crouan) Quél., Enchir. Fung. 288. 1886. — *Barlaea miniata* (Crouan) Sacc., Syll. Fung. **8**: 111. 1889. — *Plicariella miniata* (Crouan) Lindau *in* Nat. Pflanzenfam. I **1**: 180. 1897. — *Barlaeina miniata* (Crouan) Sacc. & Trav. *in* Sacc., Syll. Fung. **19**: 140. 1910. — *Detonia miniata* (Crouan) Rehm apud Dodge *in* Trans. Wis. Acad. **17**: 1037. 1914. → *Ascobolus crouani* Cooke.

Lamprospora miniata de Not. *in* Commentario Soc. critt. ital. **1**: 388. 1864.

Ascobolus crouani Cooke *in* J. Bot., Lond. **2**: 151. 1864 (a name change); non *Ascobolus crouani* Boud. *in* Ann. Sci. nat. (Bot.) V **10**: 216. 1869, nec *Ascobolus* (*Ascozonus*) *crouani* Renny *in* J. Bot., Lond. **12**: 356. 1874. — *Peziza crouani* (Cooke) Cooke *in* Grevillea **3**: 31. 1874. — *Aleuria crouani* (Cooke) Gill., Champ. Fr., Discom. 50. 1879. — *Crouania crouani* (Cooke) Lamb., Fl. mycol. Belg., Suppl. **1**: 319. 1887. — *Lamprospora crouani* (Cooke) Seaver *in* Mycologia **6**: 8. 1914.

Apothecia scattered to gregarious, 1–3 mm diam. Disc flat or convex, sometimes concave, bright reddish orange. Receptacle sessile, saucer

shaped, pale orange or whitish from the presence of loose scanty hyphal elements on the otherwise smooth surfaced receptacle, with distinct whitish dentate-fimbriate border. Ectal excipulum of thick walled intricate hyphae 4–10 μ diam. (textura intricata); inside this there is a much thicker layer of globose or angular cells 8–16 μ diam. (textura angularis to textura globulosa). Towards the margin of the cup these cells are arranged in a more regular manner, mostly almost rectangular in shape (textura prismatica), measuring 20–40 × 10–16 μ; the hyphal elements on the outer side also more regular and running almost parallel with the surface of the receptacle, the hyphae become thicker walled and wider, up to 14 μ diam., their free ends continue beyond the general level of the hymenium to form the dentate-fimbriate wide margin of the receptacle. Medullary excipulum of angular elongated thin walled cells with their long axes parallel with the axis of the apothecium, up to 70 long by 10–30 μ diam. Subhymenium about 100 μ thick, of compacted intricate hyphal elements 4–12 μ diam., with the cells larger in size with the distance from the hymenium. Hymenium about 350 μ thick. Asci clavate cylindrical, attenuate below into a long flexuous base, up to 380 μ long by 20–26 μ wide, 8-spored. Ascospores uniseriate, hyaline, globose, at first smooth and containing one big oil globule, becoming reticulate at maturity, meshes of reticulations 3–6-sided, sometimes irregular, 2–4 μ wide, occasionally also up to 6 μ wide, with ridges of different thickness, sometimes up to 1.5 μ high; the whole spore measure 19–22 μ diam. Paraphyses rather stout, 2–4 μ diam. below, enlarged to 6 μ at the clavate apices, sparingly septate, filled with orange granules when fresh (Fig. 185–186).

HABITAT AND DISTRIBUTION: on the ground among mosses in Europe (type locality Italy), North America and probably also Australia.

The above description has been based on the specimen Rabenhorst, Fungi europaei no. 658 sub *Ascobolus miniatus*. Cooke's (*1864*) description was apparently also based on this collection. No Australian specimen has been seen, and the collections described by McLennan & Cookson (*1926*) under this name have much smaller spores (13–15 μ diam.) and thus probably represent a different species. The Victorian specimen recorded by Cooke (*1892*) as *Humaria* (*Crouania*) *miniata* is referred to the next species.

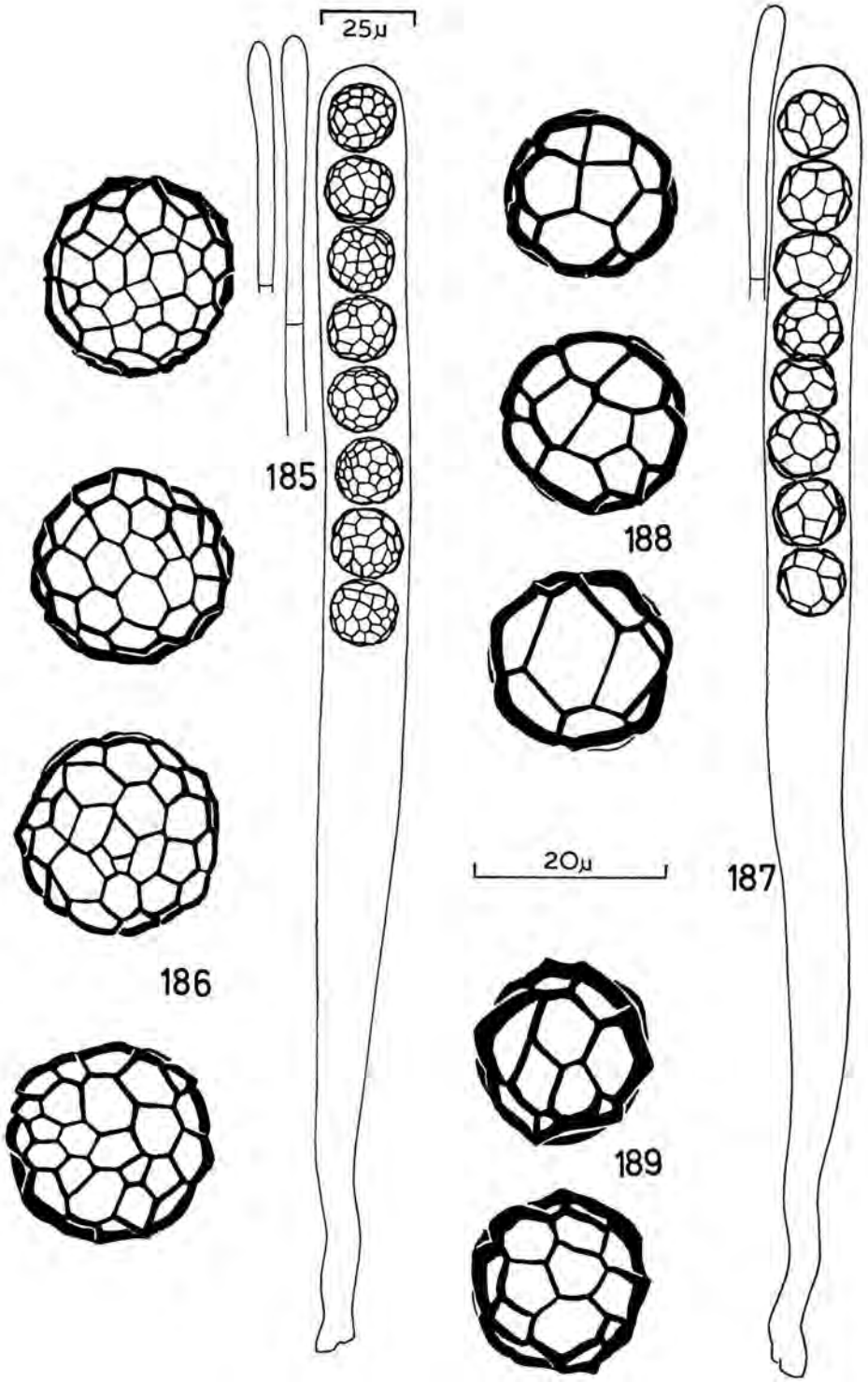
Boudier (*1907*), Clements & Shear (*1931*), Svrček & Kubička (*1961*) and van Brummelen (*1962a*) cited the present species as *Lamprospora miniata* (Crouan) De Not., but from the way De Notaris (*1864*) wrote the author citation it is clear that although he stated that his species might be identical with Crouan's species, he did not transfer Crouan's species to his new genus *Lamprospora*.

SPECIMEN EXAMINED

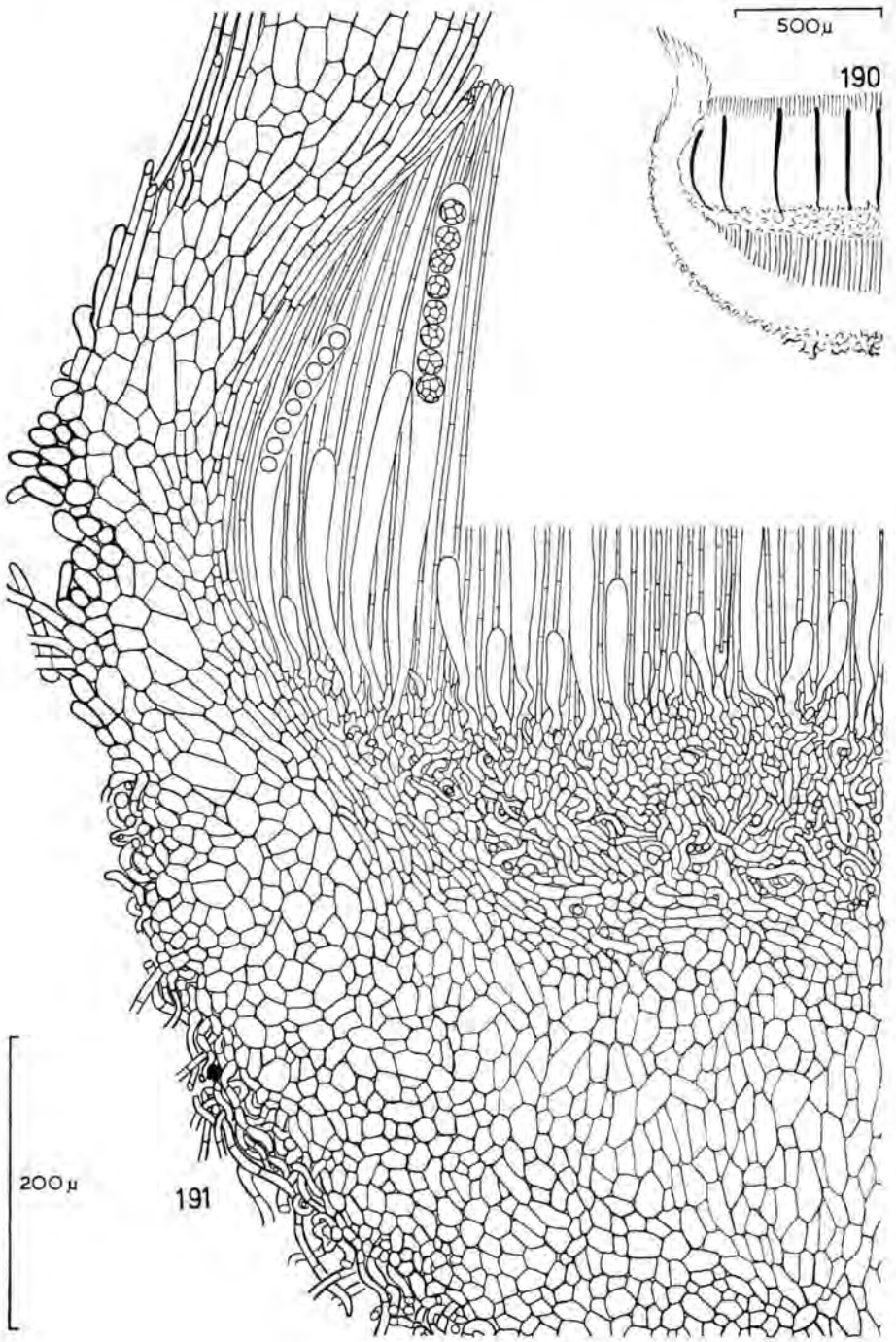
EUROPE. Great Britain. On the ground amongst mosses, Ascot Heath, Berkshire, 1863, C. E. Broome [Rabenhorst, Fungi europaei no. 658 sub *Ascobolus miniatus*].

Lamprospora australis (McLennan & Cookson) Rifai, *comb. nov.*

Lamprospora areolata Seaver var. *australis* McLennan & Cookson *in* Proc. R. Soc. Victoria II 35: 155. 1923.



Figs. 185–189. — *Lamprospora miniata*. 185. Ascus and paraphyses. 186. Ascospores. (From C. E. Broome). — *Lamprospora australis*. 187. Ascus and part of paraphysis. 188. Ascospores. (From G. Beaton 169). 189. Ascospores (From F. Reader 10). — Figs. 185, 187 and Figs. 186, 188, 189 to same scale.



Figs. 190, 191. *Lamprospora australis*. 190. Diagramatic section of margin. 191. Median section of margin. (From G. Beaton 169).

Apothecia gregarious, 1–3 mm diam. Disc flat, convex or slightly concave, reddish or yellowish orange, becoming paler when dried. Receptacle shallow cup shaped or saucer shaped, whitish and paler or rarely almost concolorous with the disc, with distinct whitish dentate-fimbriate margin. Ectal excipulum of a thin outer layer of interwoven thick walled septate hyphae 6–12 μ diam., covering a thicker layer of angular, elongate or rarely subglobose cells 10–20 μ in diam. (textura angularis), both layers pass into the margin of the cup as a tissue with rectangular and regularly arranged cells 20–50 × 8–25 μ (almost textura prismatica), with their free ends forming the fimbriate-dentate margin of the apothecia. Medullary excipulum of angular elongated thin-walled cells 20–60 × 10–25 μ (textura angularis) with their long axes running parallel with the axis of the apothecium, becoming irregular and passing into the thick subhymenium layer as textura intricata, hyphae 4–10 μ diam. Hymenium about 350 μ thick. Asci cylindrical, attenuate below into the long flexuous base, 8-spored, 300–375 × 20–25 μ. Ascospores uniseriate, globose, hyaline, with one big oil drop (at least when young), rather regularly reticulate at maturity; meshes of reticulations 4–8 μ wide, 3–6-sided, with ridges about 2 μ wide or more; the whole spore measure 16–19 μ diam. Paraphyses straight, sparingly septate, filled with orange granules, 3–5 μ diam. below, only slightly enlarged above to about 6 μ diam. (Fig. 187–191).

HABITAT AND DISTRIBUTION: on the ground among mosses in Australia.

Lamprospora areolata Seaver is a minute species less than 1 mm in diam. (Seaver, *1912*, *1914*, *1928*), and its apothecia lack the distinctive fimbriate-dentate margin. For these reasons and because this corresponding species has not been reported from Australia I prefer to consider the present species as a distinct one. According to McLennan & Cookson (*1926*) and Mr. G. Beaton (pers. comm., 1966) fresh and fully mature ascospores of the present species sometimes had a smaller and more delicate secondary reticulum. This character will certainly support the recognition of *Lamprospora australis* as a separate species. The anatomy of its apothecia strongly resembles that of *Lamprospora miniata*, and the two species are distinguishable only by the character of their ascospore ornamentations.

Cooke (*1892*) recorded *Humaria miniata* for Australia, based on specimen F. Rehder 10. The meshes of reticulations of the ascospores of this specimen, however, are much wider and quite different from those of the typical *Lamprospora miniata* and in fact resemble the present species, so that it is also included here.

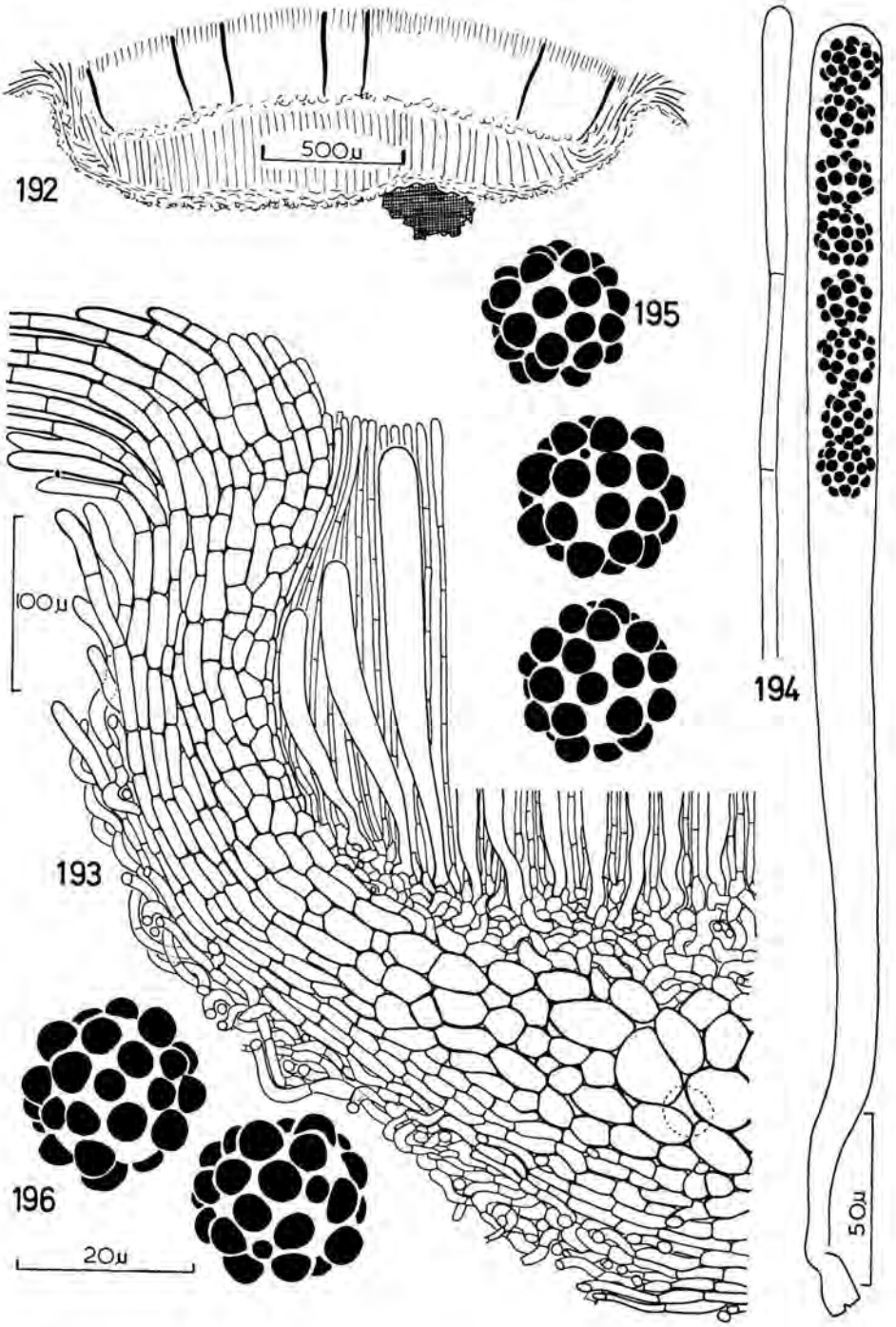
SPECIMENS EXAMINED

AUSTRALIA. Victoria. On damp sandy soil amongst mosses, near Melbourne, 3 August 1886, F. Rehder 10; on mossy log, 19 miles from Benalla on the Yea Road, 19 August 1963, G. Beaton 169; on sand amongst moss, Bambra area near Anglesea, 4 August 1963, G. Beaton 152.

LAMPROSPORA TUBERCULATA Seaver

Lamprospora tuberculata Seaver *in* Mycologia **4**: 47. 1912.

Barlaea verrucosa Rodway *in* Pap. Proc. R. Soc. Tasmania **1920**: 158. 1921 (cf. McLennan & Cookson, *1923*, *1926*; Rodway, *1925*). — *Barlaeina verrucosa* (Rodway) Sacc., Syll. Fung. **24**: 1168. 1929.



Figs. 192–196. — *Lamprospora tuberculata*. 192. Diagramatic median section of apothecium. 193. Section of margin. 194. Ascus and paraphysis. 195. Ascospores. (From L. D. Williams 49). 196. Ascospores (From type of *Barlaea verrucosa*). — Figs. 195, 196 to same scale.

Apothecia scattered to gregarious, 1–2 mm diam. Disc convex or flat, orange coloured. At maturity receptacle saucer shaped, with a distinct subfimbriate broad margin, paler than the disc. The outer layer of the ectal excipulum is made up of compacted to loose textura intricata hyphae 6–12 μ diam.; the inner layer is composed of angular, polygonal or subglobose cells less than 30 μ diam.; towards the margin of the receptacle these cells become more regular, often assuming a textura prismatica with cells 20–35 × 14–20 μ; the fimbriate margin is composed of thick walled (walls up to 4 μ thick), septate, subhyaline to pale yellowish hyphae about 14 μ diam. with obtuse ends. Medullary excipulum of globose or subangular cells 15–45 μ diam. (textura globulosa). Subhymenium about 60 μ thick, of interlocked hyphae or elongated cells 6–12 μ diam. In the middle of the apothecia the hymenium is about 325 μ thick. Asci clavate cylindrical, narrower towards their flexuous base, 320–375 × 20–25 μ, 8-spored. Ascospores uniseriate, globose, hyaline, with one big oil drop, at first smooth, ultimately studded with rounded or subangular pulvinate tubercles 3–4 μ diam.; including the tubercles the spore diameter varies between 18 and 20 μ. Paraphyses straight, sparingly septate 4–6 μ diam. below, slightly widened to 6–8 μ at their clavate apices, filled with orange contents (Fig. 192–196).

HABITAT AND DISTRIBUTION: on the ground among mosses in North America (type locality) and Australia.

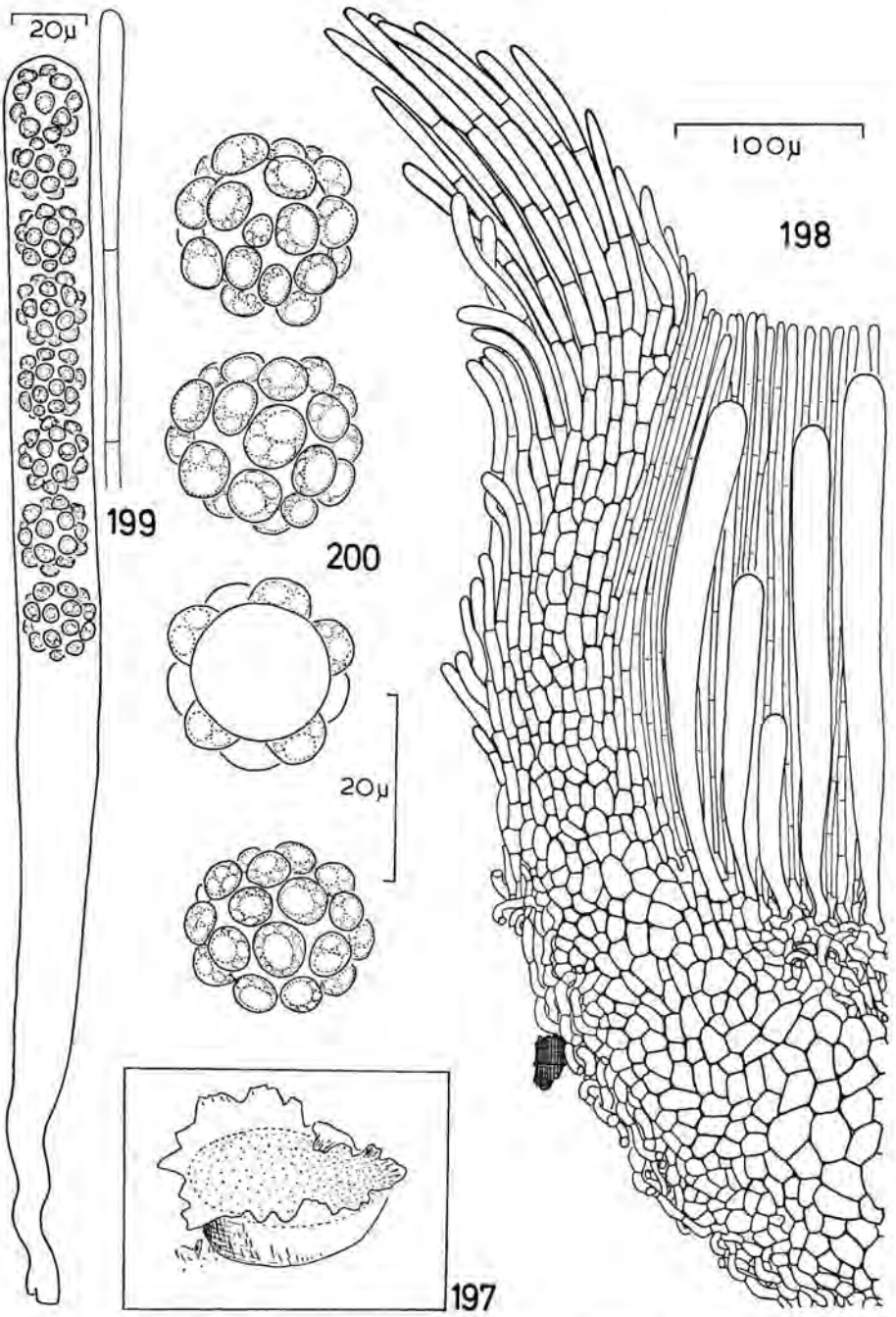
SPECIMENS EXAMINED

AUSTRALIA. Tasmania. On the ground amongst *Eutosthodon* and Hepatics, Cascades, Hobart, October 1927, L. Rodway [type specimen of *Barlaea verrucosa* Rodway]. — South Australia. On sandy soil among mosses, Meningie, July 1956, L. D. Williams, 49 ex WARI 7517.

LAMPROSPORA MAIREANA Seaver

Lamprospora maireana Seaver *in* Mycologia 6: 14. 1914.

Apothecia gregarious or scattered, 1–2 mm diam. or more. Disc flat or convex, yellowish orange. Receptacle slightly paler than the disc, saucer shaped or shallow cup-shaped, with a broad dentate-fimbriate margin. Ectal excipulum of angular cells up to 20 μ in diam., covered on the outside with a thin layer of interwoven hyphae 6–12 μ in diam.; towards the margin of the receptacle these hyphae reorientate and run mostly parallel with the surface of the receptacle, becoming thicker (up to 4 μ thick) walled, subhyaline or yellowish, their free ends obtuse or subconical, giving rise to the dentate-fimbriate margin; inside this there is a distinct retangular (textura prismatica) celled tissue. Medullary excipulum of subglobose, angular and slightly elongated cells 10–30 μ diam. (textura angularis), subhyaline. Subhymenium of interlocked hyphal elements 4–10 μ diam. Hymenium about 310 μ thick. Asci clavate cylindrical, narrower towards the flexuous base, 280–315 × 20–24 μ, 8-spored. Ascospores uniseriate, globose, at first with one large oil globule, hyaline, when young smooth walled, becoming tuberculate; tubercles rounded or somewhat flattened, up to 6 μ diam., usually appearing translucent and reticulate from the presence of numerous globules inside them; the whole spore measures 20–23 μ diam. Paraphyses 4–6 μ diam. below, usually increasing to about 8 μ at their apices, sparingly septate, straight, containing orange granules (Figs. 197–200).



Figs. 197–200. *Lamprospora maireana*. 197. Habit sketch. 198. Section of margin. 199. Ascus and paraphysis. 200. Ascospores. (From G. Beaton 156).

HABITAT AND DISTRIBUTION: on the ground among mosses in Algeria (type locality), North America and Australia.

The "secondary sculpturing" which according to Seaver (*1914, 1928*) and McLennan & Cookson (*1926*) gives rise to the minutely verrucose appearance to each tubercle is apparently due to the presence of globules inside these tubercles, and is not caused by other smaller ornaments on the outside of the tubercles as has been assumed by McLennan & Cookson. In optical section it can be seen that these tubercles are smooth. In fact Seaver's and McLennan & Cookson's illustrations of the ascospores of this species show the true nature of its spore markings, although their descriptions are not quite correct. This will also explain the fact that this kind of spore marking may cause the whole spore to appear translucent or bright.

This species differs only critically from *Lamprospora tuberculata*.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On sand among moss, Bambra area near Anglesea, 11 August 1963, G. Beaton 156; among moss, 5 miles from Anglesea on Bambra Road, 5 July 1964, G. Beaton 212.

LAMPROSPORA CREC'HQUERAULTII (Crouan) Boud.

Ascobolus crec'hqueraultii Crouan *in* Ann. Sci. nat. (Bot.) IV **10**: 194. 1858. — *Mollisia crec'hqueraultii* (Crouan) Gill., Champ. Fr., Discom. 118. 1882. — *Humaria crec'hqueraultii* (Crouan) Quél., Enchir. Fung. 288. 1886. — *Barlaea crec'hqueraultii* (Crouan) Sacc., Syll. Fung. **8**: 113. 1889. — *Lamprospora crec'hqueraultii* (Crouan) Boud., Hist. Class. Discom. Eur. 69. 1907. — *Barlaeina crec'hqueraultii* (Crouan) Sacc. & Trott. *in* Sacc., Syll. Fung. **22**: 612. 1913. → *Peziza auriflava* Cooke.

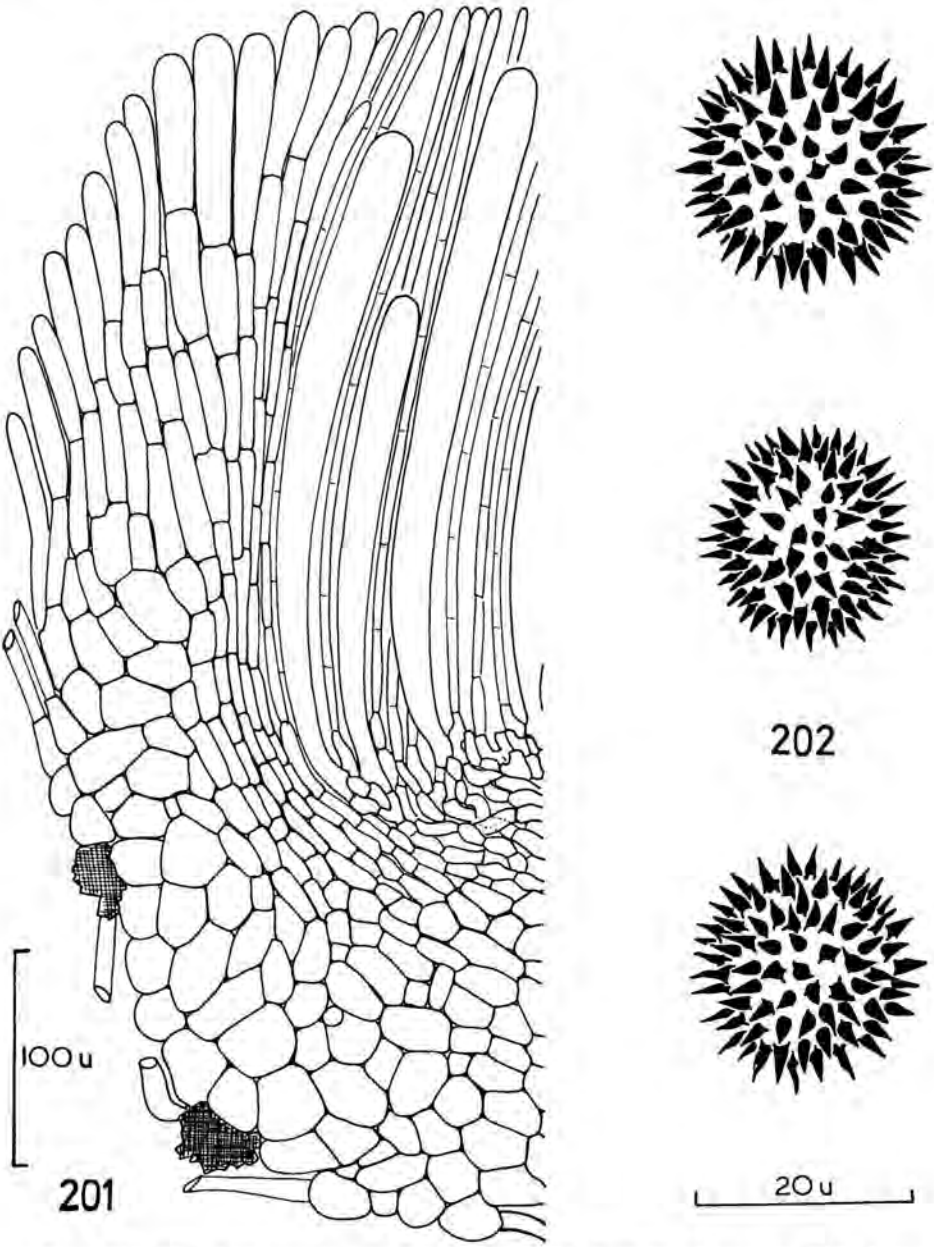
Peziza auriflava Cooke, Mycograph. **1**: 16. 1875 (a name change, non *Peziza crec'hqueraultii* Crouan). — *Aleuria auriflava* (Cooke) Gill., Champ. Fr., Discom. 50. 1879.

Apothecia scattered to gregarious, up to 3 mm diam. Disc flat to convex, light orange. Receptacle saucer shaped, paler than the disc, externally smooth or with loose hyphal elements which may entangle soil particles, margin even, rather thick but somewhat indistinct macroscopically because it does not exceed the hymenium level. Ectal excipulum of polygonal and somewhat elongated cells (textura angularis), 15–40 μ diam. Towards the margin of the cup these cells become more angular and more regularly arranged and elongate and are terminated by club shaped, pale brownish cells 12–20 μ diam. Medullary excipulum of polygonal or angular elongated and thinner walled cells (textura angularis) 18–28 μ diam. Subhymenium of interlocked intricate elongated and angular cells 4–8 μ diam. Hymenium in the centre of the disc about 320 μ thick. Asci clavate cylindrical, attenuate below into a flexuous long base, 300–375 × 22–26 μ, 8-spored. Ascospores uniseriate, hyaline, globose or occasionally subglobose, at first smooth walled, with a large oil globule, later becoming spiny, spines sharp, pointed, 1.5–4 μ long by up to 2 μ wide, crowded; without the sculpturing the spores measure 17–20 μ diam., and on the whole they are 22–25 μ diam. Paraphyses 3–4 μ diam. below, enlarged to about 7 μ wide at the tip, sparingly septate, typically unbranched, straight, when fresh containing orange granules (Fig. 201–202).

HABITAT AND DISTRIBUTION: on the ground amongst mosses in Europe (type locality France), North America, Argentina and Australia.

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On the ground, Splitter's Creek, 2 miles N.W. of Wulgul-merang, Eastern Victoria, 3 December 1962, J. H. Willis (comm. G. Beaton 60).



Figs. 201, 202. *Lamprospora crec'hqueraultii*. 201. Section of margin. 202. Ascospores. (From G. Beaton 60).

OCTOSPORA Hedw. ex S. F. Gray emend. Korf

Octospora Hedw., Descr. Musc. frond. 2: 4. 1789. — *Octospora* Hedw. *ex* S. F. Gray, Nat. Arrang. Br. Pl. 1: 666. 1821, emend. Korf *in* Mycologia **46**: 838. "1954" [1955].

Peziza [Dill.] St-Amans "div." *Discina* Fr. "ser." *Aleuria* Fr. "trib." *Humaria* Fr., Syst. mycol. 2: 42. 1822. — *Humaria* (Fr.) Boud. *in* Bull. Soc. mycol. Fr. 1: 106. 1885; non *Humaria* Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 320. 1870, emend. Sacc. *in* Bot. Cbl. 18: 216. 1884 [= *Scutellinia* (Cooke) Lamb.]; nec *Humaria* Fuckel emend. Korf *in* Nagaoa 7: 4. 1960 [= *Mycolachnea* Maire].

Leucoloma Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 317. 1870; non *Leucoloma* Brid., Bryol. univ. 2: 218. 1827.

Leucopezis Clem., Gen. Fung. 90. 1909; Clem. *in* Minn. bot. Stud. 4: 187. 1911.

Humarina Seaver *in* Mycologia 19: 87. 1927 (nomen nudum). — *Humarina* Seaver ex Seaver, N. Am. Cup Fungi (Operc.) 121. 1928.

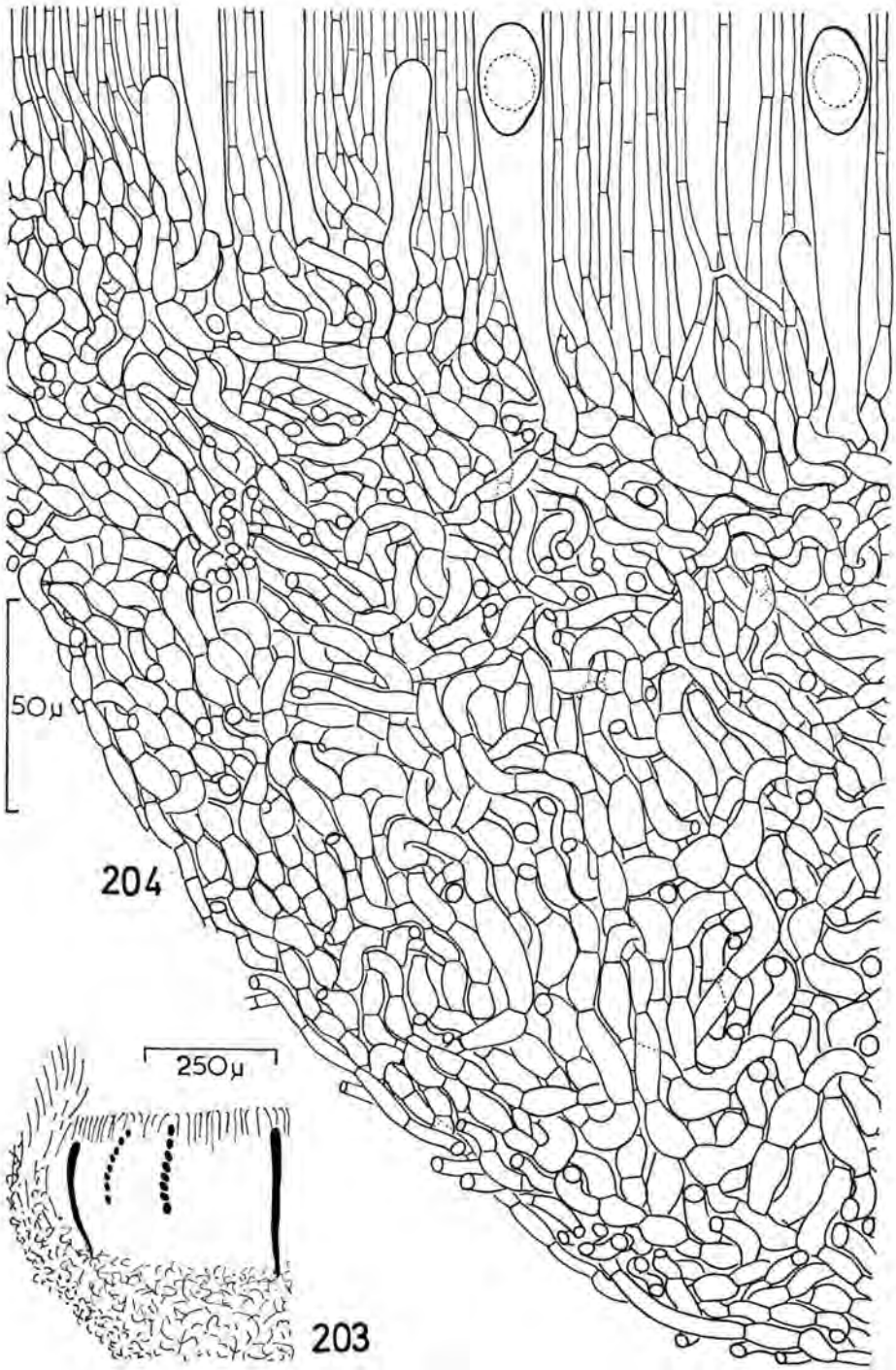
LECTOTYPE SPECIES: *Octospora leucoloma* Hedw. ex S. F. Gray.

The genus *Octospora* – which for a long time was known as *Humaria* (Fr.) Boud. (*1885*) non *Humaria* Fuckel (*1870*) or *Humarina* Seaver ex Seaver – is inherently a very difficult one, as are most genera with reduced or simplified apothecial structure. Its scope is understood here to be essentially identical with that of *Lamprospora*, except that *Octospora* has ellipsoidal and mostly smooth or less elaborately ornamented ascospores, gently to strongly curved paraphyses and sometimes more distinctly filamentous (prosenchymatous) medullary excipulum. The habit of fresh apothecia, the appearance and texture of preserved or dried herbarium material are similar to those of *Lamprospora*. Although the number of species which have these sets of characters is apparently rather high, some of the species which in recent years have been transferred to, or described as members of, the present genus will have to be excluded again. This is largely due to the fact that in referring a species to *Octospora* the structure of its excipular tissue has not been given appropriate consideration.

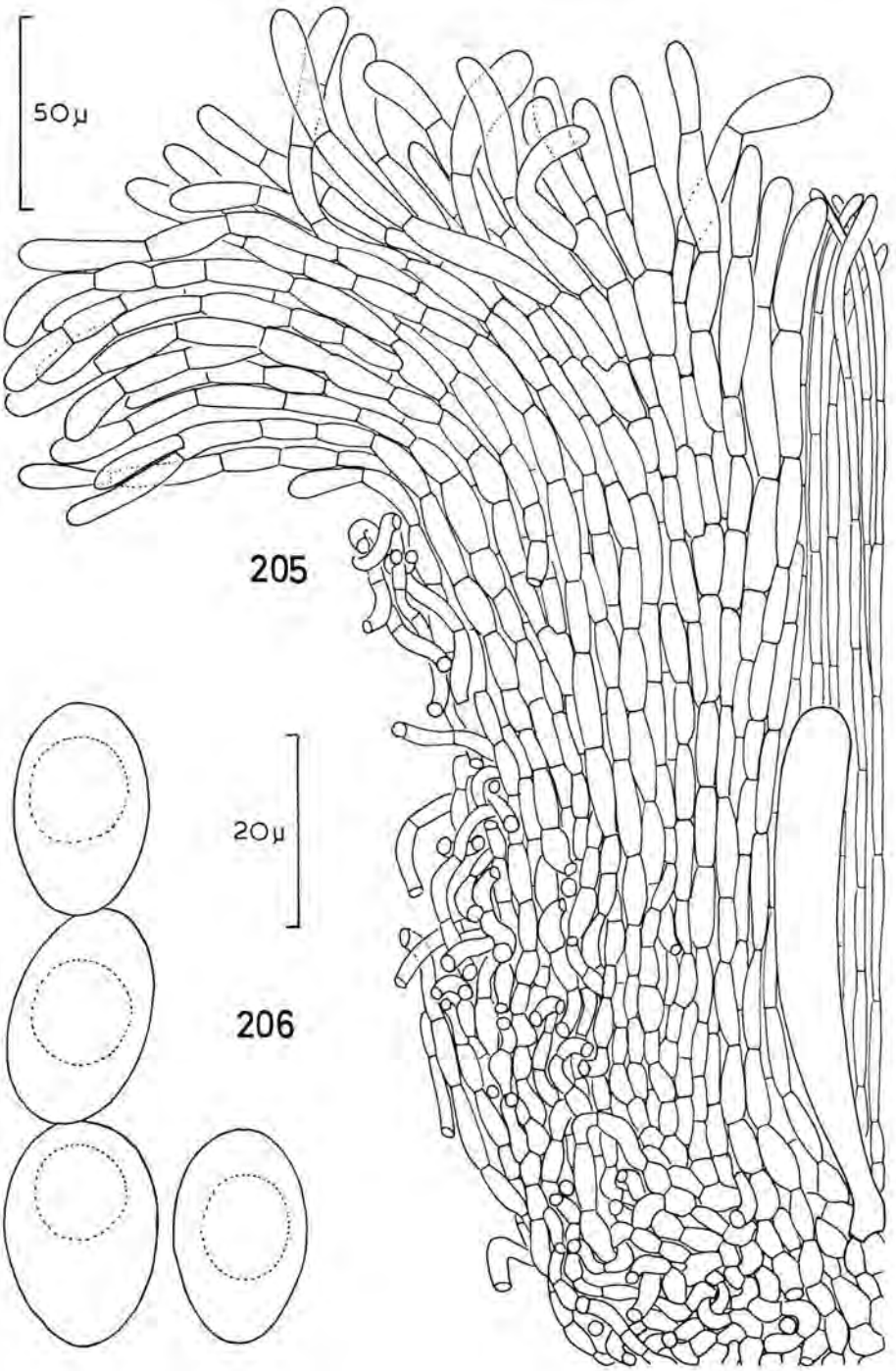
During the present study only one Australasian species has been found to be referable to *Octospora*. Since the taxonomy and the anatomy of the type species of this genus, *Octospora leucoloma* Hedw. ex S. F. Gray, is poorly understood, it will also be fully described and illustrated from extra-Australasian collections.

OCTOSPORA LEUCOLOMA Hedw. ex S. F. Gray

Octospora leucoloma Hedw., Descr. Musc. frond. 2: 13. 1789. — *Peziza leucoloma* (Hedw.) Rebent., Fl. neom. 386. 1805. — *Octospora leucoloma* Hedw. *ex* S. F. Gray, Nat. Arrang. Br. Pl. 1: 667. 1821. — *Peziza leucoloma* (Hedw. ex S. F. Gray) Pers., Mycol. eur. 1: 296. 1822; Fr., Syst. mycol. 2: 71. 1822. — *Aleuria leucoloma* (Hedw. ex S. F. Gray) Gill., Champ. Fr., Discom. 56. 1879. — *Humaria leucoloma* (Hedw. ex S. F. Gray) Quél., Enchir. Fung. 289. 1886. — *Neottiella leucoloma* (Hedw. ex S. F. Gray) Massee, Brit. Fung.-Fl. 4: 374. 1895. — *Humarina leucoloma* (Hedw. S. F. Gray) Seaver, N. Am. Cup Fungi (Operc.) 129. 1928. → *Leucoloma hedwigii* Fuckel.



Figs. 203, 204. *Octospora leucoloma*. 203. Diagramatic section of margin. 204. Details of ectal and medullary excipulum, subhymenium and part of hymenium. (From M. K. Corbett & R. P. Korf).



Figs. 205, 206. *Octospora leucoloma*. 205. Details of section of margin. 206. Ascospores. (From R. J. Friend).

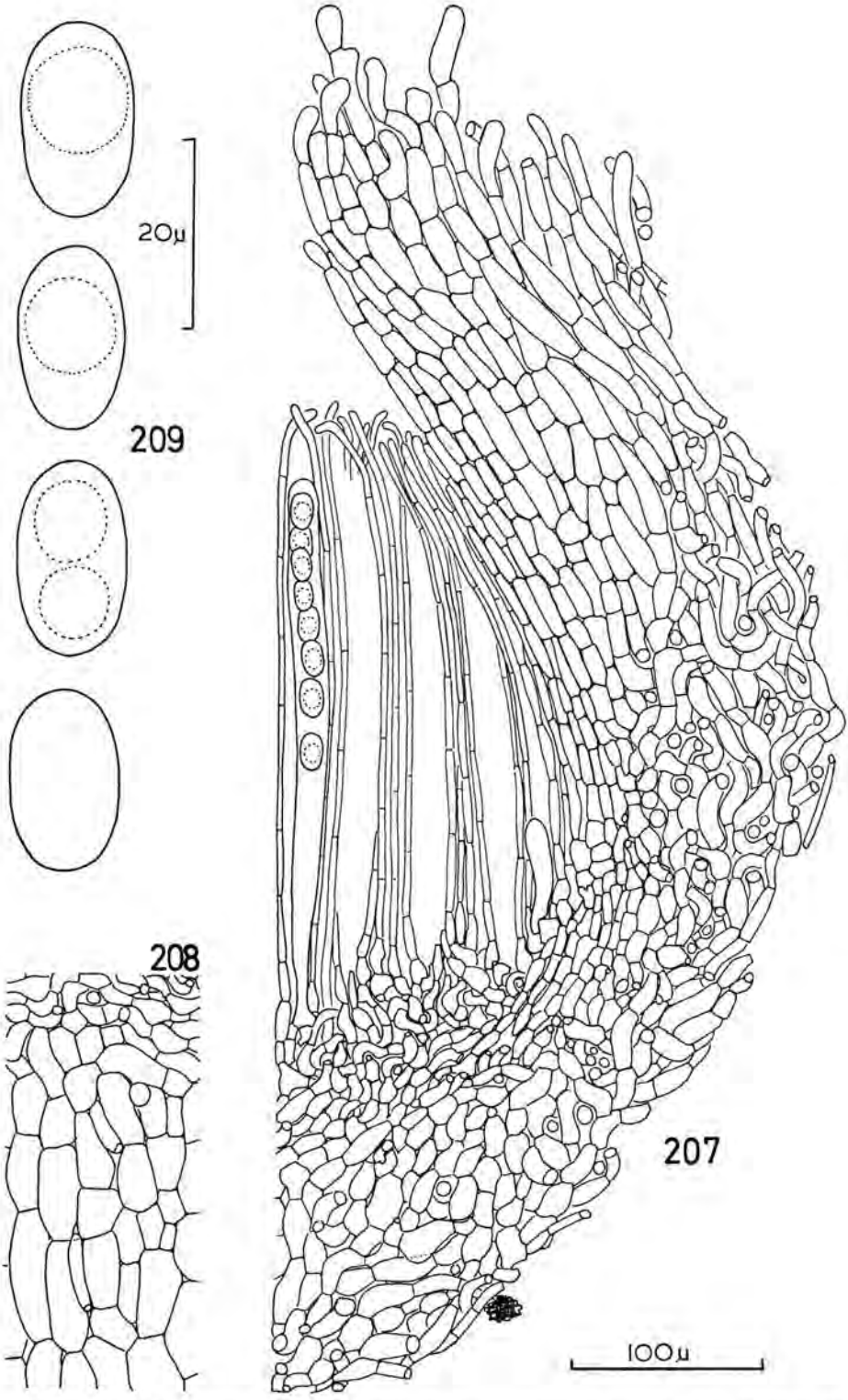
Leucoloma hedwigii Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 317. 1870 (a name change).

Apothecia scattered to gregarious, mostly sessile, small, usually less than 3 mm diam. Disc concave, flat or slightly convex, dull to bright orange. Receptacle saucer shaped to deeply saucer shaped, margin wide, distinctly whitish and dentate-fimbriate, outer surface pale orange or pale ochraceous orange, technically smooth but near the base usually appearing minutely downy from the presence of superficial, septate, coarse, hair-like hyphae 4–7 μ diam., which anchored the apothecia to the substratum. Ectal excipulum up to 50 μ thick, of compactly interwoven hyphae 5–10 μ diam. (textura intricata or textura epidermoidea); towards the margin of the receptacle these hyphae reorientate, their cells becoming longer and more distinctly angular, regularly arranged and running parallel with the surface of the receptacle, terminated by long cylindrical clavate cells up to 40 μ long by 10 μ wide; the latter cells make up the dentate-fimbriate margin of the receptacle. Medullary excipulum made up of compactly interwoven coarse hyphae (textura intricata), cells subcylindrical, sinuate or lobed, up to 40 μ long by 8–14 μ diam., thin walled. Subhymenium well developed, up to about 100 μ thick, also composed of interwoven but shorter celled hyphae 4–10 μ diam. Hymenium about 270 μ thick. Asci cylindrical, narrower towards the base, up to 265 μ long by 16–20 μ diam., 8-spored. Ascospores uniseriate, hyaline, smooth walled, broadly fusiform-ellipsoidal, sometimes ovoid, mostly with one or sometimes two large oil globules, 20–23.6(–26.3) × 11–13.6 μ. Paraphyses septate, slender, 2.7–3.6 μ diam. below, occasionally anastomosed or branched near the base, apex simple, gently curved or sometimes almost straight, hardly enlarged, subcylindrical, usually not exceeding 4.5 μ diam. (Fig. 203–206).

HABITAT AND DISTRIBUTION: on damp mossy ground, sometimes on moss in Europe (type locality Germany) and North America.

Hedwig's (*1789*) original illustration of *Octospora leucoloma* clearly shows broadly fusiform-ellipsoidal ascospores, which seems to justify the application of this name to the present species. Le Gal (*1939*), Korf (*1955*) and Dennis (*1960*) have also interpreted *Octospora leucoloma* to possess such ascospores.

Seaver (*1928*) reduced *Leucopezis excipulata* Clem. (Clements, *1911*) as a synonym of *Octospora leucoloma*. I have not seen the type specimen of the former (Clements, Crypt. Form. colorad. no. 117 sub *Leucoscypha excipulata*) but judging from Clements' original description and illustration it is evident that the two species are quite different, because *Leucopezis excipulata* has ellipsoidal ascospores with broad rounded ends. It is probably conspecific with *Octospora humosa* (Fr.) Dennis (Fig. 207–209), which Seaver (*1928*) has wrongly considered another synonym of *Octospora leucoloma*. Besides the difference in the ascospore shape, *Octospora humosa* can be distinguished from the latter species by its larger apothecia (which sometimes reach 5 mm diam.) and by the more regularly arranged and pseudoparenchymatous medullary excipulum. It is probable that the Argentinian record of *Octospora leucoloma* (Gamundi, *1960*) has been based on some other species. From Gamundi's description and illustration it can be seen that the ascospores of this Argentinian collection have much



Figs. 207–209. *Octospora humosa*. 207. Median section of margin. 208. Section of medullary excipulum immediately beneath the subhymenium at the centre of the disc. 209. Ascospores. (From sandy soil amongst *Polytrichum*, Shefford, Bedfordshire, England, 15 October 1950, R. W. G. Dennis). — Figs. 207, 208 to same scale.

a larger length and breadth ratio and that they are more fusoidal than those of the present species. Furthermore its apothecial construction is very different from that of the typical collections of *Octospora leucoloma*.

SPECIMENS EXAMINED

NORTH AMERICA. U.S.A. On soil among mosses and algae in Potato Greenhouse, Cornell University, Ithaca, New York, 16 April 1954, M. K. Corbett & R. P. Korf (Korf, Discomycetae exisccatae no. 7 sub *Octospora leucoloma*).

EUROPE. Great Britain. On soil in pots of *Funaria hygrometrica* and *Leptobryum pyriforme* in glass house, Hatherly Labs., University of Exeter, 17 February 1964, R. J. Friend.

Octospora microspora Rifai, *spec. nov.*

Apothecia minuta, usque 1 mm diam., sessilia, marginata, disco aurantiaco. Excipulum ex hyphis septatis 4–10 μ diam. et cellulis subangularibus 10–25 μ diam. compositum. Asci cylindracei, octospori, 150–185 × 10–12.5 μ. Ascospori uniseriati, late ellipsoidei, hyalini, guttulati, primum laeves, denique minute irregulariter reticulati, 10.5–12.7 × 8.1–10 μ. Paraphyses septatae, 2.5–3 μ diam., superne curvatae, vix incrassatae.

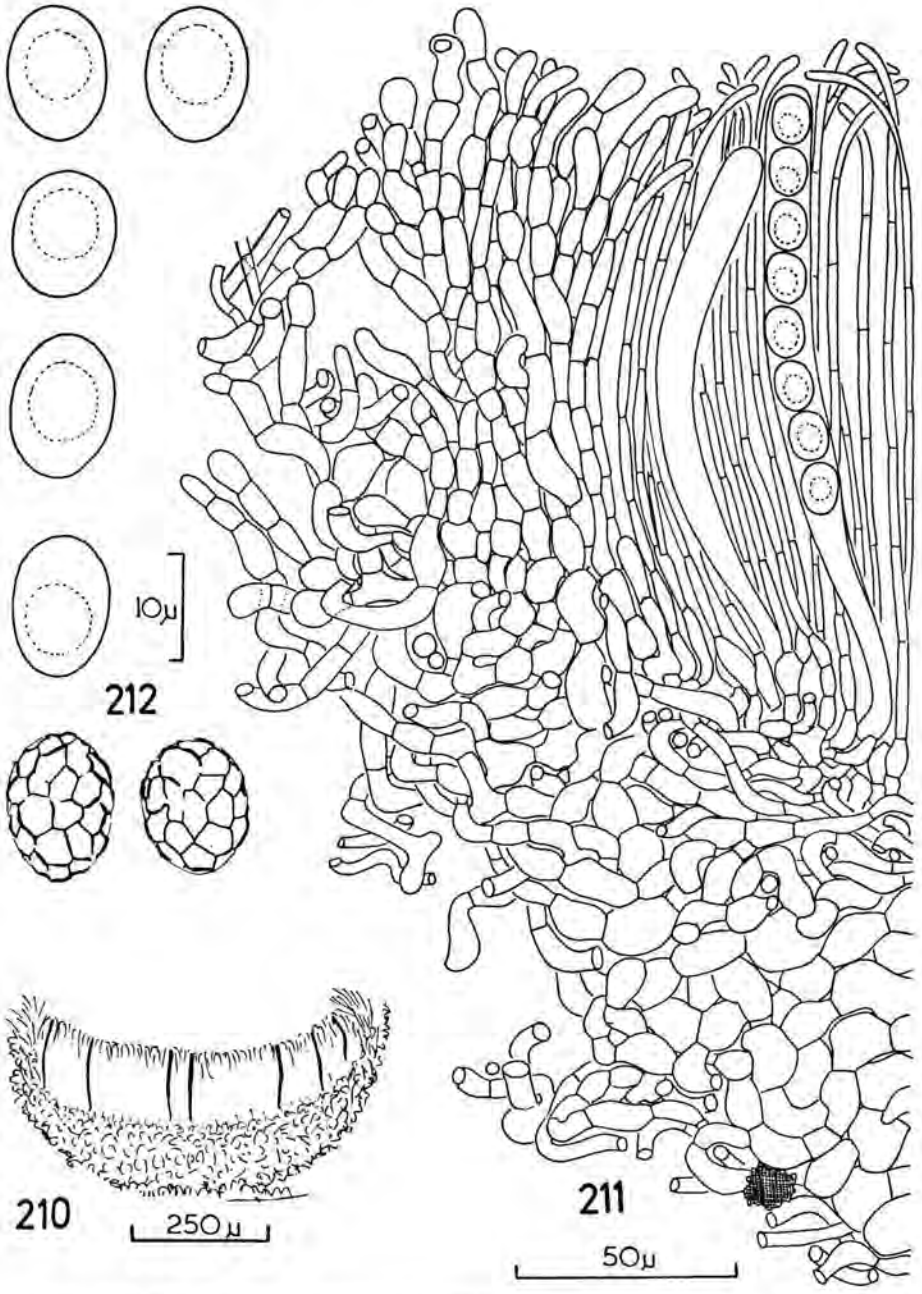
Hab. in fimo putrescente inter muscos, prope Airey's Inlet-Bambra, Victoriae, 4 Augusti 1963, G. Beaton 155 typus est [K].

Apothecia gregarious, small, up to about 1 mm diam., broadly sessile. Disc concave to flat, orange, smooth, Receptacle saucer shaped to shallow cup shaped, margin thick but not distinctly dentate-fimbriate. The outermost layer of the ectal excipulum thin, of loosely to tightly interwoven hyphae 4–10 μ diam., which often produce loose irregular tomentum which near the base of the receptacle sometimes appear hair-like and enmesh particles of the substrate; the inner layer of the ectal excipulum thick, made up of angular to polygonal elongated or subcylindrical lobed cells 10–25 μ diam. by up to 45 μ long, forming a pseudoparenchymatous or compact prosenchymatous tissue; towards the margin of the cup the shape and arrangement of these cells become more regular; the cells are cylindrical or barrel shaped and reorientate so as to run parallel with the surface of the receptacle and terminate in subclavate long cells 6–8 μ diam. Medullary excipulum not sharply differentiated, thin, made up of more distinctly prosenchymatous and slightly smaller celled tissue. Subhymenium up to about 75 μ thick, of compactly interwoven hyphae 3.5–9 μ diam. Hymenium about 180 μ thick. Asci cylindrical, only slightly narrower towards the base, 8-spored, 150–185 × 10–12.5 μ. Ascospores uniseriate, broadly ellipsoidal, rounded at each end, hyaline, containing one large oil globule, walls smooth, but at complete maturity appear to be covered by irregular, indistinct reticulum with wide meshes, 10.5–12.7 × × 8.1–10 μ. Paraphyses septate, slender, 2.5–3 μ diam. below, apex hardly enlarged, only up to about 3.6 μ diam., mostly gently curved (Fig. 210–212).

HABITAT AND DISTRIBUTION: on old dung amongst mosses in Australia.

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On a piece of old cow manure, covered by moss, off Airey's Inlet-Bambra Road, 4 August 1963, G. Beaton 155 [type specimen of *Octospora microspora* Rifai].



Figs. 210–212. *Octospora microspora*. 210. Diagramatic median section of apothecium. 211. Details of median section of margin. 212. Ascospores. (From type).

Inermisia Rifai, *gen. nov.*

TYPE SPECIES: *Peziza fusispora* Berk.

Apothecia gregaria vel subcaespitosa, minuta, obconica vel discoidea, subsessilia, basi tomentosa, disco plano, lutea vel rubro-aurantiaca. Excipulum e cellulis subangularibus (textura angulari) compositum. Asci cylindracei, octospori, apice jodo non caerulescentes. Ascospori fusoidei vel fusoideo-ellipsoidei, laeves, hyalini, guttulati. Paraphyses septatae, apice subclavatae, rectae vel curvatae.

Hab. ad terram vel humosam.

Apothecia densely gregarious to subcaespitose, small, subsessile, often arising from poorly developed subiculum. Disc flat or concave, yellow, orange yellow to reddish orange, rarely almost white. Receptacle obconical, turbinate or saucer shaped, slightly paler than the disc, smooth or sometimes with numerous thin walled coarse hair-like tomentum, especially towards the base. Ectal excipulum of polygonal or subglobose cells (textura angularis to textura globulosa); margin of receptacle also of similar but smaller cells. Medullary excipulum thick, pseudoparenchymatous. Asci cylindrical, 8-spored, apex not blued in Melzer's reagent. Ascospores uniseriate, fusoid-ellipsoidal to fusoidal, often appearing thicker walled at the polar regions, hyaline, smooth walled, guttulate. Paraphyses slender, septate, apex subclavate, straight or curved.

The excipular construction and the structure of the margin of the receptacle separate this genus from *Octospora*.

HABITAT: on the ground or on plant remains.

Inermisia fusispora (Berk.) Rifai, *comb. nov.*

Peziza fusispora Berk. *in* Lond. J. Bot. **5**: 5. 1846. — *Humaria fusispora* (Berk.) Sacc., Syll. Fung. **8**: 133. 1889. — *Leucoloma fusispora* (Berk.) Rehm *in* Hedwigia **31**: 301. 1892. — *Humarina fusispora* (Berk.) Seaver, N. Am. Cup Fungi (Operc.) 136. 1928. — *Octospora fusispora* (Berk.) Brumm. *in* Persoonia (Suppl.) **1**: 213. 1967.

Peziza carbonigena Berk. *in* Hook. f., Fl. Tasman. **2**: 274. 1860. — *Humaria carbonigena* (Berk.) Sacc., Syll. Fung. **8**: 130. 1889. — *Octospora carbonigena* (Berk.) Dennis, Br. Cup Fungi 33. 1960.

Peziza aggregata Berk. & Br. *in* Ann. Mag. nat. Hist. III **18**: 123. 1866. — *Peziza fusispora* Berk. var. *aggregata* (Berk. & Br.) Cooke, Mycograph. **1**: 20. 1875. — *Humaria aggregata* (Berk. & Br.) Sacc., Syll. Fung. **8**: 133. 1889. — *Humaria fusispora* (Berk.) Sacc. var. *aggregata* (Berk. & Br.) Rehm *in* Rabenh. Kryptog.-Fl. I **3**: 957. 1894. — *Humarina aggregata* (Berk. & Br.) Seaver, N. Am. Cup Fungi (Operc.) 136. 1928.

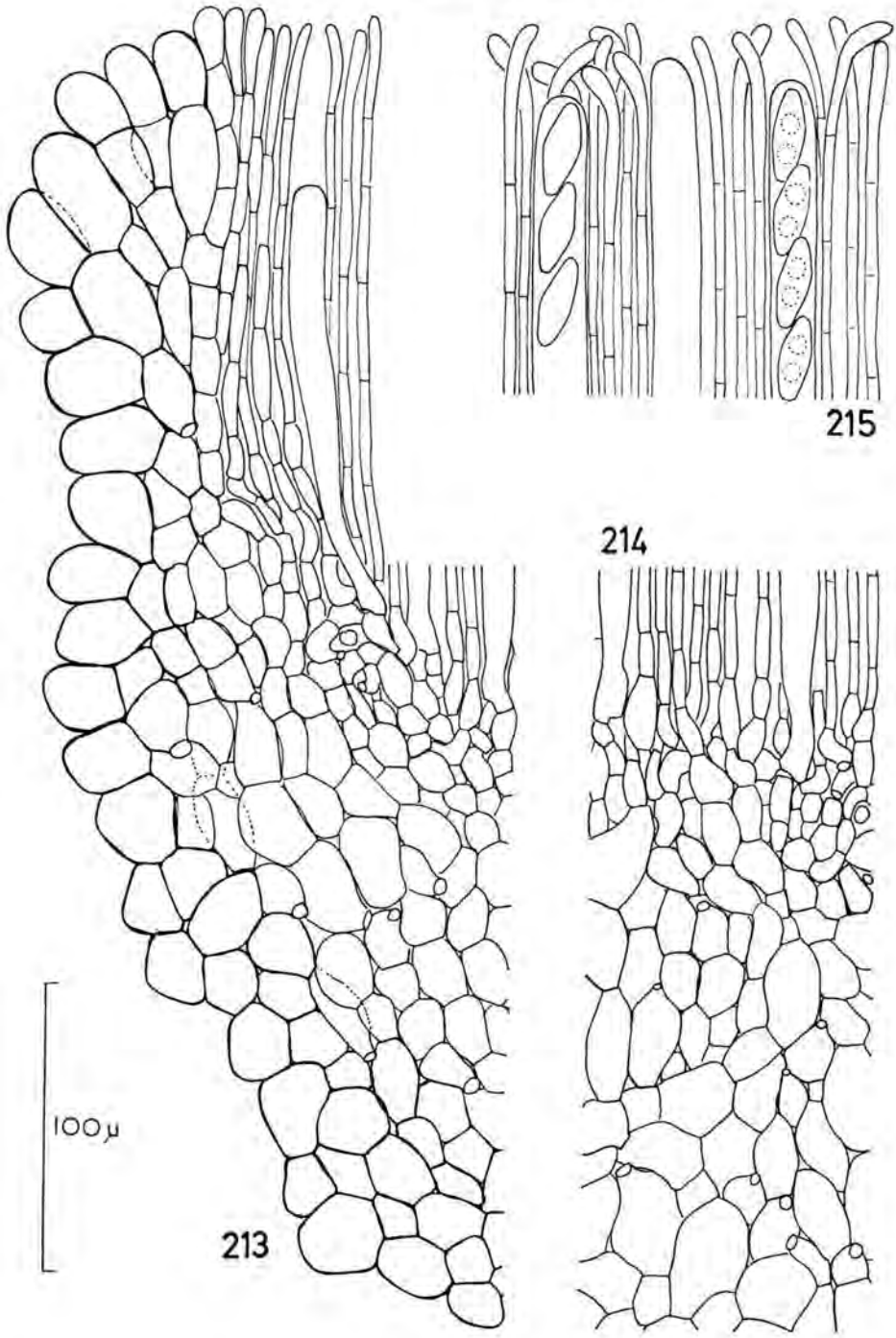
Peziza fusispora Berk. var. *scotica* Rabenh., Fungi eur. no. 1812. 1874 (nomen nudum). — *Peziza fusispora* Berk. var. *scotica* Rabenh. *ex* J. Stev., Mycol. scot. 305. 1879.

Peziza roumegueri Karst. *in* Grevillea **7**: 64. 1878. — *Humaria roumegueri* (Karst.) Sacc., Syll. Fung. **8**: 132. 1889.

[*Peziza permunda* Cooke, Mycograph. **1**: *t. 98 fig. 353.* 1878 (nomen provisorium). —] *Peziza fusispora* Berk. var. *permunda* Cooke, Mycograph. **1**: 209. 1878. — *Humaria permunda* (Cooke) Sacc., Syll. Fung. **8**: 134. 1889. — *Humarina permunda* (Cooke) Seaver, N. Am. Cup Fungi (Operc.) 134. 1928 [ut "*permuda*"].

Peziza roumegueri Karst. var. *carnosissima* Phill. *apud* Phill. & Plow. *in* Grevillea **10**: 67. 1881. — *Humaria roumegueri* (Karst.) Sacc. var. *carnosissima* (Phill. apud Phill. & Plow.) Sacc., Syll. Fung. **8**: 132. 1889.

Orbilia crystallina Rodway *in* Pap. Proc. R. Soc. Tasmania **1919**: 114. 1920.

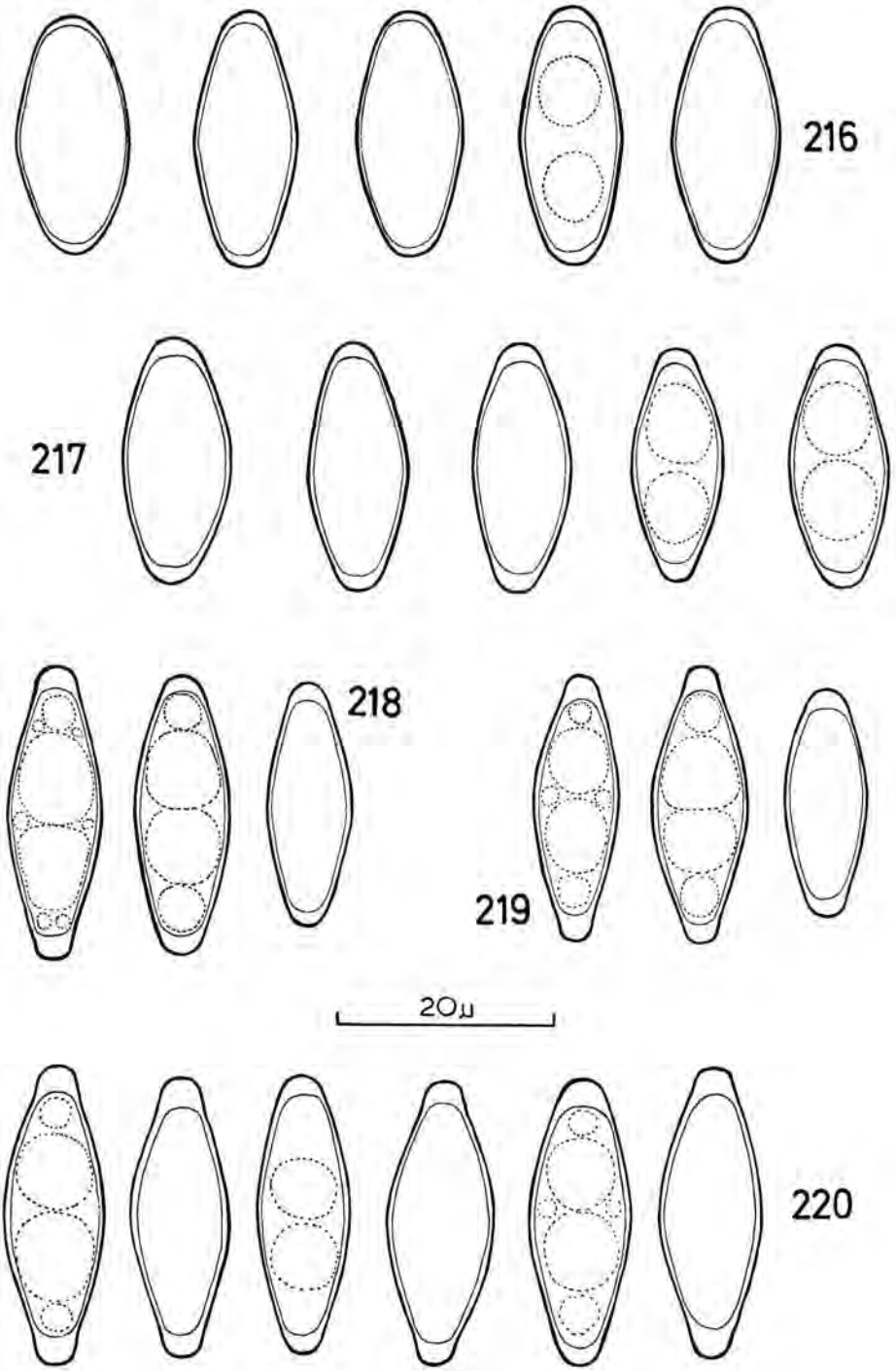


Figs. 213–215. *Inermisia fusispora*. 213. Section of margin of receptacle and part of hymenium. 214. Section of medullary excipulum, subhymenium and part of hymenium close to the centre of the disc. (From type of *Peziza carbonigena*). 215. Part of asci and paraphyses (From F. Reader 52).

Apothecia gregarious to densely crowded or almost caespitose, small, 1–3 mm diam., often seated on scanty but conspicuous subiculum-like mycelial growth made up of hair-like, coarse, sparingly septate, flexuous or geniculate, thin walled hyphae 8–10 μ diam. Disc slightly concave or flat, variable in colour, mostly bright orange yellow or golden yellow, sometimes bright orange, occasionally red or rarely also whitish. Receptacle smooth or tomentose towards the base, slightly paler than the disc, obconical, turbinate, subcylindrical or thick discoid, margin entire, rarely with a narrow collar, neither fimbriate nor denticulate. Ectal excipulum composed of mostly isodiametric, sometimes elongated polygonal or subglobose cells 20–60 μ diam.; margin of receptacle also pseudoparenchymatous, but its cells smaller in size. Medullary excipulum very thick, pseudoparenchymatous, composed of thinner walled, angular or polygonal elongated or subpyriform cells 15–35(–40) μ diam. by up to 55 μ long. Subhymenium up to 90 μ thick, of compact short celled hyphae 6–10 μ diam. Hymenium about 225 μ thick. Asci cylindrical, slightly narrower towards the base, 8-spored, 180–230 $\times$ 10–13 μ. Ascospores obliquely uniseriate, fusoid-ellipsoidal, elliptic-fusoidal to fusoidal, hyaline, smooth walled, mostly with two large oil globules and several smaller ones, their ends often almost truncate and at maturity appear much thicker walled, (18.2–)21–24.5(–26.3) $\times$ 7.5–9.5(–11) μ. Paraphyses slender, septate, 2.7–3.6 μ diam. below, apex enlarged to about 6 μ diam., straight or curved (Fig. 213–220).

HABITAT AND DISTRIBUTION: on damp or burnt ground, on plant debris etc. in Australasia (type locality Tasmania), Europe and North America.

Inermisia fusispora is a variable species, and as can be seen from the list of synonyms given above several names have been proposed for it. Admittedly it is easy to separate the type specimens of *Peziza carbonigena* and *Inermisia fusispora* by the shape of their ascospores, but when a long series of collections is studied the existing distinction becomes less and less clear. It is difficult, for example, to assign the type specimen of *Peziza roumegueri* var. *carnosissima* to any of these two species, because the shape of its ascospores (Fig. 217) seems to be intermediate between the distinctly fusoidal ascospores of *Inermisia fusispora* (Fig. 220) and the more ellipsoidal ascospores of *Peziza carbonigena* (Fig. 216). *Peziza aggregata* was segregated from the present species on account of the aggregate habit of its apothecia but almost all collections of *Inermisia fusispora* have densely crowded apothecia. Seaver (*1928*) interpreted *Peziza aggregata* as a species with ascospores 22–25 $\times$ 8–9 μ, and he distinguished it from *Inermisia fusispora* because according to him the latter has larger ascospores, 30–33 $\times$ 8–10 μ. This is pure fantasy since I find that the specimen Ravenel, Fungi americani exsiccati no. 174 sub *Peziza fusispora* (Fig. 218), which he assigned to the present species has ascospores which are not longer than 26.3 μ! The apices of the paraphyses show some variation; in some collections they are decidely curved, whereas in others they are straight. This character, however, does not seem to be correlated with other morphological characters. Two probably identical taxa, *Peziza fusispora* var. *scotica* and *Peziza fusispora* var. *permunda*,



Figs. 216–220. *Inermisia fusispora*. 216. Ascospores (From type of *Peziza carbonigena*). 217. Ascospores (From type of *Peziza roumegueri* var. *carnosissima*). 218. Ascospores (From Ravenel, Fungi americani exsiccati no. 174). 219. Ascopores (From type of *Peziza roumegueri*). 220. Ascospores (From type of *Inermisia fusispora*).

were separated from the present species by the coloration of the disc, which is said to vary from whitish to blood red. Since I have not been able to study this species in fresh condition, the taxonomic implication of this colour variation is not clear to me but I do not think that it has diagnostic value at the specific level. According to Nannfeldt (*in* Lundell & Nannfeldt, *1941*) *Pyronema thuemenii* (Karst.) Karst. is also a synonym of the present species.

SPECIMENS EXAMINED

AUSTRALIA. Tasmania. On the ground, Van Diemen's Land, s. dat., R. Gunn [type specimen of *Peziza fusispora* Berk.]; on the ground amongst mosses, Cheshunt, s. dat., W. Archer; on the ground amongst moss and on moss, Cheshunt, s. dat., collector unknown; on the ground [amongst mosses], Mount Nelson, July 1915, L. Rodway [identified as *Orbilia crystallina* Rodway by Rodway]; on burnt [fragments of charcoal on the] ground amongst grasses, s. dat., W. Archer [type specimen of *Peziza carbonigena* Berk.]. — Victoria. On decayed vegetables, s. dat., F. Reader 52. — Western Australia. On burnt sandy ground, near Port Phillips, October 1884, Henry Watts.

NEW ZEALAND. On the ground, s. dat., S. Berggren 212; overrunning wood, moss, leaves, etc., Winton, s. dat., S. Berggren 124.

EUROPE. Finland. On humid ground, Tammela, 1 June 1878, P. A. Karsten [isotype specimen of *Peziza roumegueri* Karst.]. — Great Britain. On decayed vegetation, Glamis, Scotland, s. dat., J. Stevenson [type specimen of *Peziza roumegueri* Karts. var. *carnosissima* Phill. apud Phill. & Plow.]; on heathy ground, Menmuir-Brechin, Scotland, s. dat., M. L. Anderson [Rabenhorst, Fungi europaei no. 1812 sub *Peziza fusispora* var. *scotica*; isotype specimen]; on heathy ground, Bewick, England, Dr. Johnson [not fully mature; type specimen of *Peziza aggregata* Berk. & Br.].

AMERICA. U.S.A. Ad terram, South Carolina, s. dat., H. W. Ravenel [Ravenel, Fungi americani exsiccati no. 174 sub *Peziza fusispora*]; on the ground, South Carolina, s. dat., H. W. Ravenel 2184 [type specimen of *Peziza fusispora* Berk. var. *permunda* Cooke].

PULVINULA Boud.

Pulvinula Boud. *in* Bull. Soc. mycol. Fr. 1: 107. 1885.

LECTOTYPE SPECIES (Le Gal, *1953*): *Peziza convexella* Karst.

Apothecia discoid, pulvinate, scattered, gregarious or crowded, sessile or broadly sessile, small to medium size. Disc yellow, orange yellow, crimson or red, shallowly concave, flat or rarely convex, smooth. Receptacle saucer shaped to scutellate, rarely shallowly cup shaped, smooth or tomentulose, paler or rarely concolorous with the disc. Ectal excipulum of small, subglobose, pear shaped or polygonal elongated cells (textura globulosa to textura angularis) or sometimes appearing prosenchymatous. Medullary excipulum well-developed, of compact or loosely interwoven, mostly delicate, septate hyphae (textura intricata). Asci long cylindrical or clavate cylindrical, base subcylindrical or distinctly forked, 4–8-spored, pores or walls not blued in Melzer's reagent. Ascospores uniseriate, globose, hyaline, smooth-walled, containing one or more large and several smaller oil globules. Paraphyses delicate, filiform, septate, longer than the asci, apex hardly or distinctly enlarged, almost straight or gently to strongly curved or even hooked, sometimes forked.

HABITAT: on damp or burnt ground sometimes amongst mosses.

Although the natural genus *Pulvinula* was proposed by Boudier as early as 1885, its validity as a taxonomic entity was not generally accepted until 1953 when Madame Le Gal showed that there were many characters which would fully justify its recognition as a distinct genus. The globose, smooth-walled ascospores which contain numerous oil globules, the rather short asci which are interspaced by thread-like, often curved or hooked paraphyses, the small-celled ectal excipulum and the delicate prosenchymatous medullary excipulum distinguish this genus from other genera of the Humariaceae.

Seaver (*1914*, *1928*, *1942*), whose convenient but unsound generic concept was largely responsible for the reluctance of some mycologists (Snyder, *1938*; Kanouse, *1947*; Hansford, *1954*; Thind & Singh, *1959*) to recognize *Pulvinula*, lumped the latter in the genus *Lamprospora*, which he also emended to include species of *Plicaria* and *Marcelleina*. Apart from the similarity in the shape of their ascospores, the genus *Pulvinula* is only remotely related to *Lamprospora*. Unlike those of *Pulvinula*, species of *Lamprospora* in the restricted sense have a large-celled, mostly pseudoparenchymatous medullary excipulum. In *Pulvinula* the dentate-fimbriate margin of the apothecia, which is so characteristic of the majority of species of *Lamprospora*, is lacking, as is the elaborate spore ornamentation. The discs of species of *Pulvinula* are smooth in contrast to those of *Lamprospora*; in some British species of the latter genus which I have studied in the fresh condition the discs are minutely roughened by the protruding, maturing large clavate-cylindrical asci. Another character which has been found to be useful in distinguishing species of *Pulvinula* from *Lamprospora* is the macroscopic appearance of dried herbarium specimen. Dried apothecia of *Pulvinula* usually appear dull and darker coloured than when they were fresh, with a firm horny consistency and mostly retaining their shape or sometimes become irregularly cup shaped. In contrast, the dried specimens of *Lamprospora* give the impression of being soft, collapsed from their original shape and paler or almost diaphanous.

The affinity of *Pulvinula* with other genera is not very clear. The structure of the ectal and medullary excipulum and the curved paraphyses recall those of the tribe Otideae but the pigmentation and the characteristic apical apparatus of their asci (Chadefaud, *1942*) seem to be rather aberrant for that tribe. Following Dennis (*1960*) the genus is placed in the Aleurieae but it must be pointed out that in this tribe the genus *Pulvinula* occupies an isolated position.

There are about fifteen or more good species of *Pulvinula* which now are still slumbering in the *Lamprospora–Barlaeina* complex. The species are distinguished from one another by their spore characters, type of ascus and paraphyses, pigmentation and size of apothecia, and the substrate. Further reappraisal on these characters and more field observations would be valuable for future work in this genus, which is rather badly understood.

Pulvinula miltina (Berk.) Rifai, *comb. nov.*

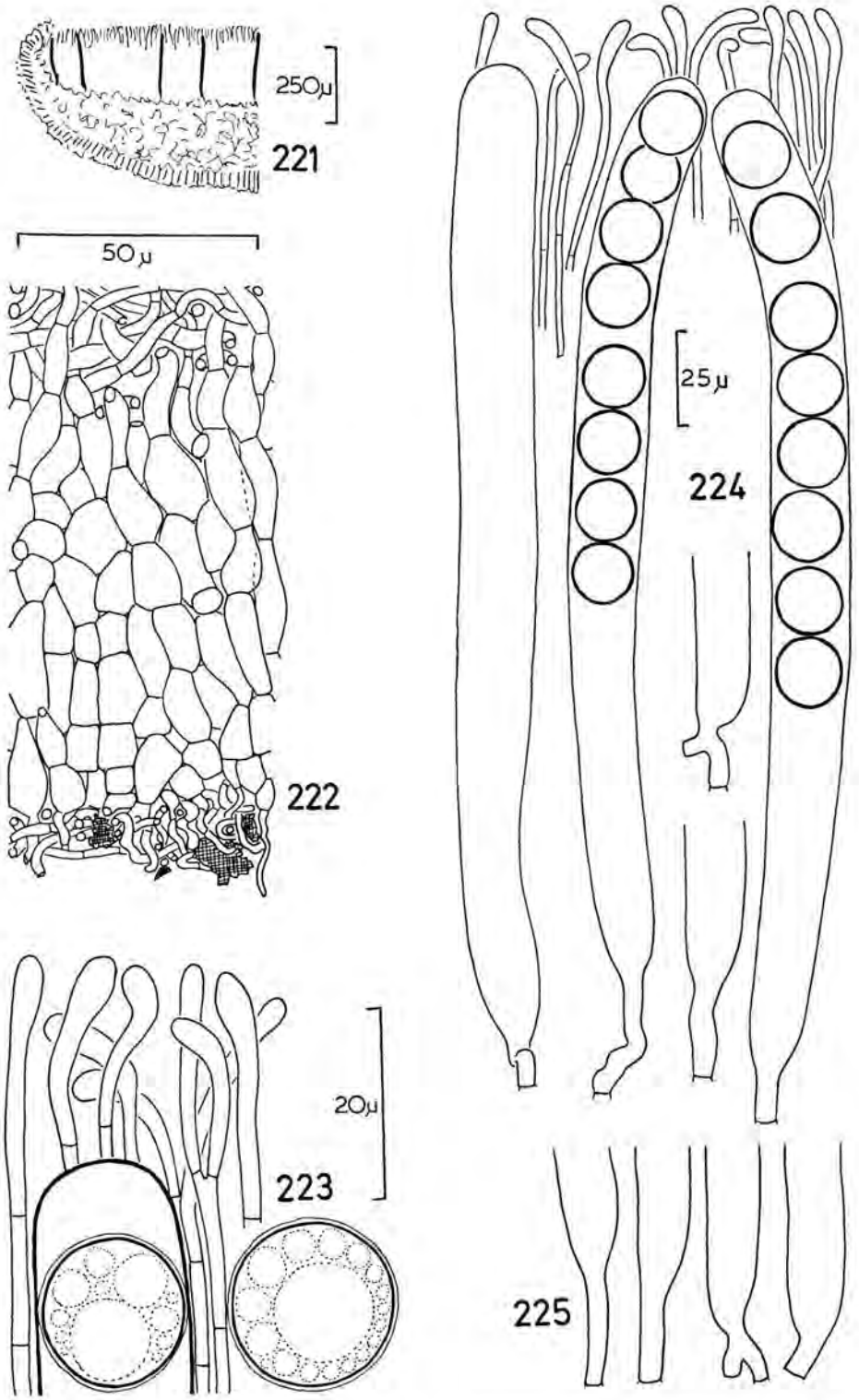
Peziza miltina Berk. *in* Hook. f., Fl. Nov. Zealand. 2: 199. 1855. — *Barlaea miltina* (Berk.) Sacc., Syll. Fung. 8: 113. 1889. — *Humaria* (*Crouania*) *miltina* (Berk.) Cooke, Handb. Austral. Fungi 256. 1892. — *Barlaeina miltina* (Berk.) Sacc. & Trav. *in* Sacc., Syll. Fung. 19: 139. 1910.

Apothecia scattered to gregarious or rarely caespitose, 3–8 mm diam. or more. Disc concave or flat, sometimes convex or undulate, crimson, drying yellowish or brownish red, margin often distinct and rather thick, paler. Receptacle paler than the disc, scutellate or saucer shaped, often lobed at the margin, or occasionally deformed by mutual pressure, smooth or minutely tomentulose. Ectal excipulum 60–90 μ thick, of angular elongated or pear shaped thin-walled cells 7–14 μ diam. by up to about 25 μ long, arranged with their long axes at right angles to the surface of receptacle. The latter is covered by delicate, short hair-like hyphae about 2.5 μ diam. The lower part of medullary excipulum is composed of interwoven, septate and branched hyphae 4–8 μ diam., with cells often inflated or lobed; as they pass into the upper layer of medullary excipulum these hyphae become smaller in diam. (2–3.6 μ) and more tightly intertwined with each other. Subhymenium not clearly separated from medullary excipulum. Hymenium about 225 μ thick. Asci cylindrical, only slightly narrower below, then abruptly contracted into a narrower short subcylindrical stalk-like base, 8-spored, 190–265 × 15–19 μ. Ascospores uniseriate, globose, hyaline, with one or more large oil globules and numerous smaller ones, smooth walled, 13.8–16.3(–17.5) μ diam. Paraphyses filiform, 1.2–1.8 μ diam., mostly distinctly enlarged up to about 3.5 μ at the apex, subclavate, slightly to strongly curved, or occasionally hooked and forked, filled with reddish granules, usually slightly longer than the asci (Fig. 221–225).

HABITAT AND DISTRIBUTION: on the ground, sometimes among mosses in New Zealand (type locality) and Australia.

McLennan & Halsey (*1936*) identified the present species with *Lamprospora polytrichina* (Rehm) Seaver. This does not seem to be justifiable because apart from the fact that Berkeley's specific epithet has priority, *Detonia polytrichina* Rehm (*1896*) is only a renaming of *Peziza polytrichi* Schum. ex Fr. sensu Nylander (*1865*) non sensu Massee (*1894*), which now is generally accepted as a species of *Lamprospora*. See further discussion on this nomenclatural problem under *Leucoscypha rutilans*.

The two South Australian specimens were described by Hansford (*1954*) as "*Lamprospora* near *L. constellatio* (Berk. & Br.) Seaver" and there are indeed some similarities between *Pulvinula miltina* and *Pulvinula constellatio* (Berk. & Br.) Boud. The two species, however, differ markedly in the shape of their asci. A study on an authenticated specimen of *Peziza constellatio* Berk. & Br. (on the ground, Addington, Kent, England, 28 September 1876, collector unknown) as well as other collections shows that this species has clavate-cylindrical asci (Fig. 227), which gently attenuate towards the distinctly forked base. Several other European species including the lectotype species of the genus, *Pulvinula convexella* (Karst.) Boud. (auf feuchten Lehmboden, Baumschulen zu Tamzel,



Figs. 221–225. *Pulvinula miltina*. 221. Diagramatic median section of margin. 222. Section of ectal and part of medullary excipulum. 223. Ascospores and apices of paraphyses. (From WARI 2550). 224. Asci and paraphyses (From WARI 2543). 225. Bases of asci (From type).

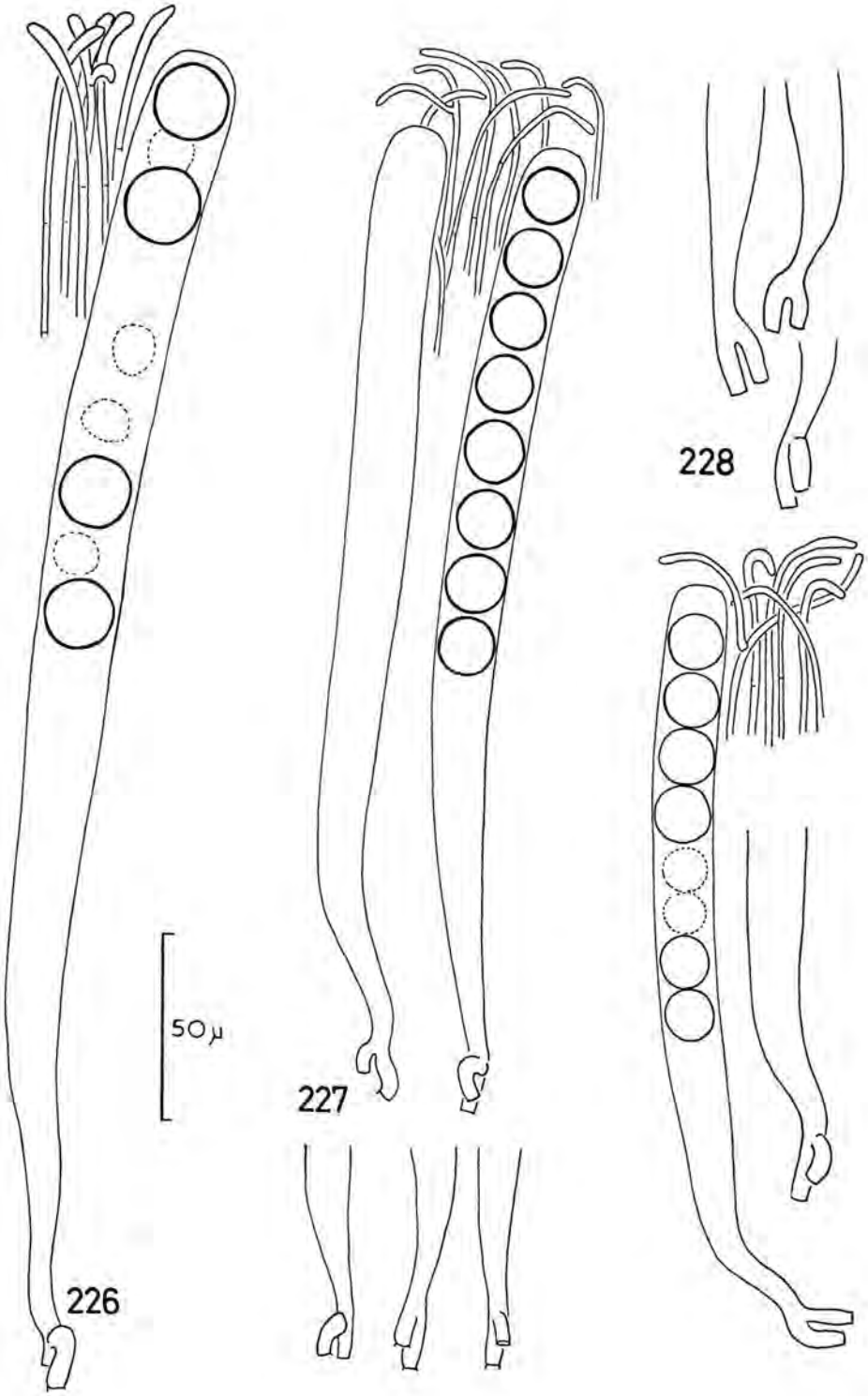


Fig. 226–228. — *Pulvinula cinnabarina*. 226. Ascus and paraphyses (From Fuckel, Fungi rhenani no. 2481). — *Pulvinula constellatio*. 227. Bases of asci, asci and paraphyses (From the ground, Addington, Kent, England, 28 September 1876). — *Pulvinula carbonaria*. 228. Bases of asci, ascus and paraphyses (From Fuckel, Fungi rhenani no. 2482).

Brandenburg, 24 Oktober 1905, P. Vogel; Sydow, Mycotheca germanica no. 496 sub *Barlaea convexella*) have been found to have similar asci. In *Pulvinula cinnabarina* (Fuckel) Boud. (ad arenam humosam, humidam, ad Rheni ripas ca. Ragaz, autumno, Fuckel, Fungi rhenani no. 2481 sub *Crouania cinnabarina*) the clavate cylindrical asci are up to 320 μ long and contain 8, rarely 4, ascospores up to 18 μ diam. (Fig. 226); its paraphyses are much less strongly curved than those of *Pulvinula constellatio* and apparently never hooked, but more distinctly enlarged at the apex. The pyrophilous species *Pulvinula carbonaria* (Fuckel) Boud. (in locis adustis, raro, ca. Budenheim et in sylva Hostrichiensi, autumno, Fuckel, Fungi rhenani no. 2482 sub *Crouania carbonaria*) has also these characteristic clavate cylindrical and basally forked asci (Fig. 228). It must be noted that von Höhnel (*1917*) thought that *Crouania cinnabarina* Fuckel, *Crouania carbonaria* Fuckel, *Crouania humosa* (Fr.) Fuckel, *Peziza constellatio* Berk. & Br. and *Peziza convexella* Karst. represented only varying states of *Lamprospora haemastigma* (Hedw. ex Fr.) Seaver [= *Pulvinula haemastigma* (Hedw. ex Fr.) Boud.] but nobody seems to share von Höhnel's view.

As can be seen from Figures 224–225 the subcylindrical asci of *Pulvinula miltina* are rather abruptly contracted into a short subcylindrical stem-like base, which typically is not forked. Besides this ascus character, the rather large ascospores and apothecia serve to distinguish this species from the other members of *Pulvinula*. Further collections are required to decide whether the specimen G. Beaton 127 will have to be described as a distinct taxon. This collection differs in having slightly smaller apothecia and more distinctly curved paraphyses which are often only slightly enlarged at the apex.

Specimens examined

New Zealand. On the ground amongst mosses, Hawker's Bay, s. dat., Colenso [type specimen of *Peziza miltina* Berk.]; on the ground, without any further particulars, no. 1309, ex Herb. Berk. (probably part of the type collection).

Australia. South Australia. On sand, Mt. Compass, 8 October 1924, J. B. Cleland, ex WARI 2543; on sand, Encounter Bay, 30 may 1924, J. B. Cleland, ex WARI 2550. — Victoria. On sand amongst mosses and *Selaginella*, Carlisle River-Chapple Vale Rd., 16 June 1963, G. Beaton 127.

Pulvinula tetraspora (Hansf.) Rifai, *comb. nov.*

Lamprospora tetraspora Hansf. *in* Proc. Linn. Soc. N.S.W. 79: 126. 1954.

[Misapplied name: *Pulvinula etiolata* (Cooke) Le Gal sensu Le Gal, Discom. Madag. 91. 1953; non sensu Cooke, Mycograph. 1: 236. 1879].

Apothecia gregarious to rather crowded, broadly sessile, 1–5 mm diam. Disc concave, according to Hansford (*1954*) "deep yellowish when moistened after drying (possibly orange when fresh)", becoming pale yellowish brown when dried. Receptacle saucer shaped or shallowly cup shaped, margin rather thick, often undulate or lobed from mutual pressure, the surface almost smooth or tomentulose, slightly paler than the disc but

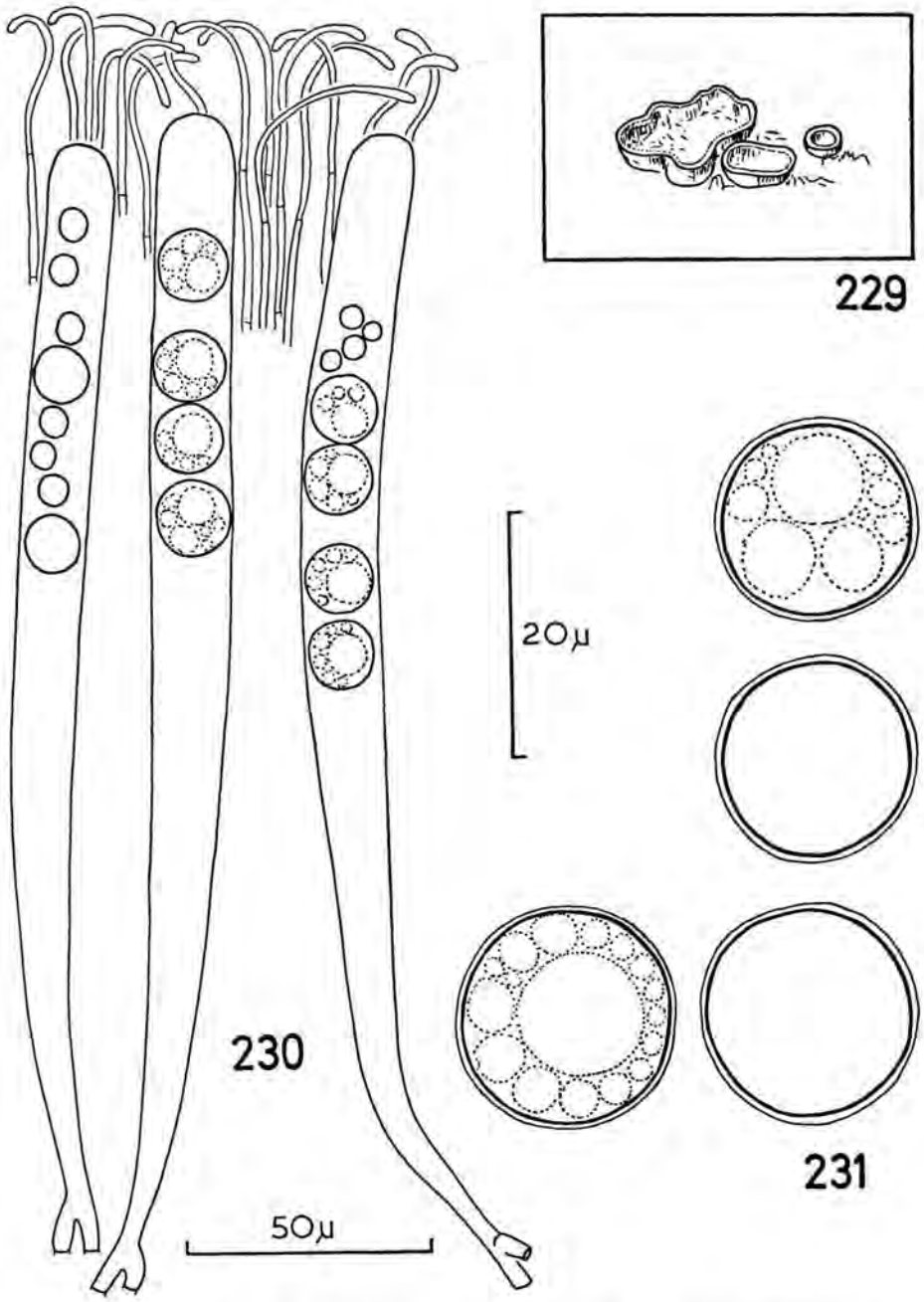
usually appearing whitish towards the base from the presence of the anchoring hyphae. Ectal excipulum of subglobose, pear shaped, or polygonal elongated cells up to 15 μ diam. or sometimes more; towards the margin of the cup the cells become smaller and the margin itself is composed of compacted delicate hyphae. The surface of receptacle is covered by delicate short hair-like hyphae which are sometimes aggregated into small tufts. Medullary excipulum of compacted interwoven delicate, hyphae 2–5 μ diam. (textura intricata), often interspaced with subglobose or pear shaped cells, especially immediately inside the ectal excipulum. Subhymenium poorly differentiated. Hymenium about 240 μ thick. Asci long clavate cylindrical, distinctly attenuate towards the forked base, 200–250 × 15–20 μ, at first 8-spored, but at maturity mostly 4-spored, or occasionally 2-, 3- or 5-spored. Ascospores uniseriate, globose, hyaline, smooth walled, typically containing one or more large and several smaller oil globules, 14.5–17 μ diam. Paraphyses filiform, delicate, 1–1.5 μ diam., septate, generally unbranched, hardly enlarged at the strongly curved or hooked apex, longer than the asci, with fine granular contents (Fig. 229–231).

HABITAT AND DISTRIBUTION: on the ground in Australia (type locality), Guiana and Madagascar, and probably also Malay Peninsula.

With the exception of pigmentation, for which no field note is available, this species appears to be identical with the one extensively described and illustrated by Le Gal (*1953*) from Madagascar under the name *Pulvinula etiolata* (Cooke) Le Gal.

When Cooke (*1879*: 236 *fig. 399*) described *Peziza flobifera* var. *etiolata* Cooke he listed as its synonym "*Peziza* sp. Leprieur, No. 888, in Herb. Paris". Furthermore he stated: "Cups 2–3 mm. Sporidia .01 mm.—A note attached to the specimens states that they were white when fresh. They do not appear to differ except in colour from *Peziza globifera*, Berk. of which we regard them as a white variety.—Figures from specimens (Leprieur, 888) in Herb. Paris." In Herb. Kew. in the *Pulvinula globifera* folder there is an envelope mounted together with cuttings from proofs of Page 236 and Figure 399 of Cooke's "Mycographia". This envelope bears the following annotation: "*Peziza* [scripsit Cooke?]—*Humaria* [scripsit Cooke]—Leprieur 888". Inside this envelope there is another smaller envelope containing three apothecia with the following annotation in pencil: "*P.* (*alba*)—Leprieur 888—Guiana [scripsit?]." These apothecia are pale yellowish brown coloured, with asci which contain 8 ascospores which measure 10–13.6 μ diam. Their paraphyses are slightly curved to almost straight, 1.8–2.2 μ diam. below, enlarged to about 2.7 μ at their apices. It is obvious that this specimen is markedly different from the one described as *Pulvinula etiolata* by Le Gal (*1953*).

Le Gal's reasons for using the name *Pulvinula etiolata* for the present species are found in the following statement: "Ces échantillons malgaches sont conformes à la récolte originale de Leprieur, que nous avons retrouvée dans l'herbier Montagne, au Muséum, (paquet no. 32) Coll. Guy. no. 888, portant référence: Montg. Crypt. Guyan. no. 449. / Elle est classée dans le genre *Pyronema*, d'une part, sous le nom de *Peziza omphalodes* Bull.,



Figs. 229–231. *Pulvinula tetraspora*. 229. Habit sketch. 230. Asci and paraphyses. 231. Ascospores. (From type).

d'après la fiche accompagnant le dessin d'une thèque à huit spores rondes, et, d'autre part, sous le nom d'*albo-cretea*, d'après l'inscription figurant sur le paquet d'exsiccata, où l'on peut lire également: « ad terram sabulosam in silvis ».''

It is rather difficult to decide which specimen, whether the one in Herb. Kew. or that preserved in Paris, should be used as the type specimen of Cooke's variety, especially when bearing in mind the last sentence of Cooke's statement. After some consideration it is proposed here to accept the Kew material as the lectotype specimen for the name *Peziza globifera* Berk. & Curt. apud Berk. var. *etiolata* Cooke, because of the following reasons: (a) Cooke's description and illustration were more likely to be based on the Kew specimen, and it is difficult to ascertain whether Cooke also studied the one preserved in Paris; (b) the Kew specimen fits Cooke's account better than the Paris one; Cooke gave the spore measurement as .01 mm (= 10 μ), and the Kew specimen has ascospores which measure 10–13.6 μ in diameter whereas in the one in Paris the ascospores are 12.5–16.5 μ in diameter according to Le Gal (*1953*), who thought that Cooke's spore measurement was erroneous because it was outside the range of spore measurement of the Paris specimen; (c) Cooke drew straight paraphyses for his new variety although in fact they are somewhat curved; in contrast the Paris specimen has strongly curved or hooked, thread-like paraphyses.

Apart from the annotation "alba" on this lectotype specimen I cannot find any character which will justify the recognition of this variety as taxonomically different from *Pulvinula globifera*. The specimen from Trinidad (on sandy soil on side of ditches, Bamboo plantation, St. Joseph, 20 September 1949, R. W. G. Dennis 13) listed by Dennis (*1954a*) as *Pulvinula etiolata* has slightly larger apothecia, paler coloration and mostly 4-spored asci but it seems likely that it is also not specifically distinct from *Pulvinula globifera*. It may represent a 4-spored form or variety of the latter species, but the varietal epithet "etiolata" cannot be applied to it because this collection is not identical with the lectotype specimen of Cooke's variety. It must be noted that for variety *etiolata* Cooke (*1879*) drew a 4-spored ascus side by side with the 8-spored one, but I cannot find the former type of ascus in any of the three apothecia of the type collection.

Pulvinula tetraspora can be easily recognised by its 4-spored asci, large ascospores and by the thread like and hooked paraphyses. Cash & Corner (*1958*) recorded the occurrance of this species (as *Pulvinula etiolata*) from the Malay Peninsula.

SPECIMEN EXAMINED

AUSTRALIA. New South Wales. On the ground, Milson Island, Hawkesburg River, 24 May 1915, J. B. Cleland, ex WARI 2737 [type specimen of *Lamprospora tetraspora* Hansf.].

PULVINULA GLOBIFERA (Berk. & Curt. apud Berk.) Le Gal sensu meo

Peziza (*Humaria*) *globifera* Berk. & Curt. apud Berk. *in* J. Linn. Soc. (Bot.) 10: 366. 1868. — *Barlaea globifera* (Berk. & Curt. apud Berk.) Sacc., Syll. Fung. 8: 114. 1889. — *Humaria* (*Crouania*) *globifera* (Berk. & Curt. apud Berk.) Cooke, Handb. Austral. Fungi. 256. 1892. — *Barlaeina globifera* (Berk. & Curt. apud Berk.) Sacc. & Trav. *in* Sacc., Syll. Fung. 19: 139. 1910. — *Pulvinula globifera* (Berk. & Curt. apud Berk.) Le Gal., Discom. Madag. 94. 1953 [misapplied, = *Pulvinula orichalcea* (Cooke) Rifai].

Peziza (*Humaria*) *globifera* Berk. & Curt. apud Berk. var. *etiolata* Cooke, Mycograph. 1: 236. 1879. — *Barlaea globifera* (Berk. & Curt. apud Berk.) Sacc. var. *etiolata* (Cooke) Sacc., Syll. Fung. 8: 114. 1889. — *Barlaeina globifera* (Berk. & Curt. apud Berk.) Sacc. & Trav. apud Sacc. var. *etiolata* (Cooke) Sacc., Syll. Fung. 19: 139. 1910. — *Pulvinula etiolata* (Cooke) Le Gal, Discom. Madag. 91. 1953 [misapplied, = *Pulvinula tetraspora* (Hansf.) Rifai].

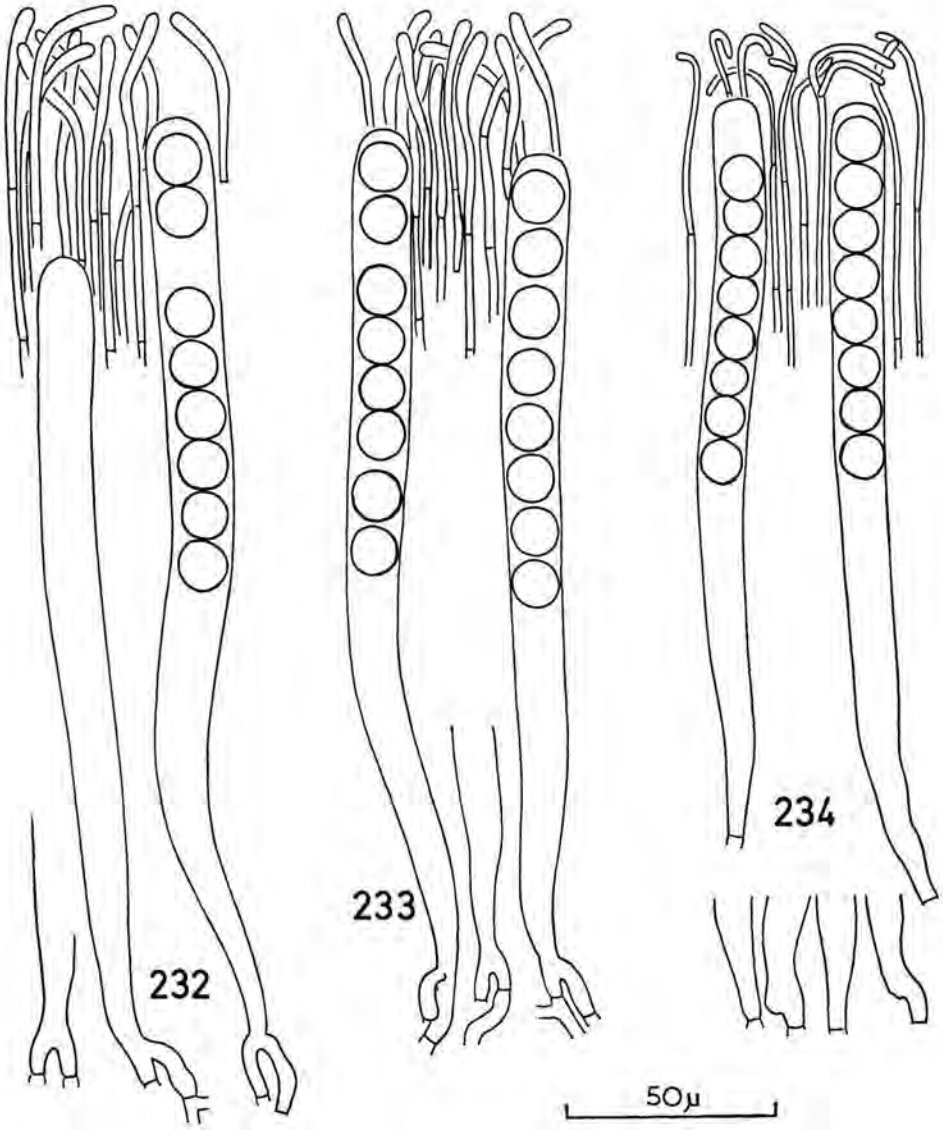
Apothecia gregarious, 2–4.5 mm diam. or sometimes more. Disc yellow, orange-yellow to light red, smooth, concave to flattened, margin even. Receptacle saucer shaped or subscutellate, typically smooth or rarely minutely tomentose, concolorous or a little paler than the disc. Ectal excipulum about 90 μ thick, of subglobose, pear shaped or polygonal elongated thin walled cells 5–12 μ diam. by up to 18 μ long, arranged with their long axes at right angles to the surface of receptacle (textura globulosa to textura angularis). Medullary excipulum of compactly intertwined, delicate, 2–4.5 μ diam. hyphae, the lower part often interspaced with a few pear shaped or subglobose cells up to about 9 μ diam. Subhymenium not clearly distinguishable from medullary excipulum. Hymenium about 220 μ thick. Asci clavate cylindrical, much narrower at the forked base, 8-spored, 185–245 × 12–15 μ. Ascospores uniseriate, globose, hyaline, smooth-walled, when young containing a few large oil globules and several smaller ones, 10–13.8 diam. Paraphyses rather stout, 1.8–2.2 μ diam. below, gradually enlarging to about 2.8 μ at the almost straight or more commonly slightly curved apex, septate, typically not branched, generally slightly longer than the asci (Fig. 232–233).

HABITAT AND DISTRIBUTION: on damp or sometimes on scorched ground in tropical America (type locality Cuba) and Ceylon.

The Victorian specimen recorded by Cooke (*1892*) as *Humaria globifera* cannot be traced at Herb. Kew. so that its identity cannot be verified. Since the identity and the nomenclature of this species have been somewhat confused the redescription of the type specimen is given above. Berkeley (*1868*) originally cited three collections, of which the specimen C. Wright 363 is designated here as the lectotype specimen for *Peziza globifera* Berk. & Curt. apud Berk. As has been pointed out earlier the lectotype specimen of *Peziza globifera* var. *etiolata* does not seem to differ taxonomically from C. Wright 363 so that the former taxon is treated here as a synonym of *Pulvinula globifera*.

From the description and illustration it is evident that the specimen from Madagascar referred to as *Pulvinula globifera* by Le Gal (*1953*) is not conspecific with C. Wright 363 or with Fungi Cubensis 669 sub *Peziza globifera* (these two specimens are conspecific and Le Gal compared her

Madagascar specimen with the latter). As already noted by Le Gal, the Madagascar collection has much finer paraphyses, 0.5 μ thinner than those of Fungi cubensis no. 669, which are occasionally forked at the apex. Its asci are somewhat different, because instead of being distinctly forked at the base as in the present species, they gradually taper into a subcylindrical base. Since in *Pulvinula* the ascus character appears to be



Figs. 232–234. — *Pulvinula globifera.* 232. Asci and paraphyses (From lectotype). 233. Asci and paraphyses (from Leprieur 888, type of *Peziza globifera* var. *etiolata*). — *Pulvinula orichalcea.* 234. Bases of asci, asci and paraphyses (From type).

quite reliable, the name **Pulvinula orichalcea** (Cooke) Rifai[16]), *comb. nov.* seems to be more appropriate for the Madagascar specimen described by Le Gal as *Pulvinula globifera*. The type specimen of *Peziza orichalcea* Cooke (on the ground, Guiana, South America, s. dat., Leprieur 899) shows this subcylindrical ascus base as well as the finer, curved, sometimes forked paraphyses, but the spores are slightly smaller than those given by Le Gal (Fig. 234).

Cash & Corner (*1958*) recorded the occurrence of *Pulvinula globifera* from Malay Peninsula but since they did not describe their specimen, its identity has yet to be verified. The Ceylon specimen identified by Berkeley & Broome (*1873*) as *Peziza globifera* and the collection from West Indies reported by Dennis (*1954a*) under the present species have been found to be in agreement with the concept of *Pulvinula globifera* described above.

SPECIMENS EXAMINED

TROPICAL AMERICA. Cuba. On the ground, s. dat., C. Wright 363 [lectotype specimen of *Peziza globifera* Berk. & Curt. apud Berk.]; on the ground, s. dat., C. Wright [Fungi cubensis wrightiani no. 669 sub *Peziza* (*Humaria*) *globifera*]. — Guiana. On the ground, s. dat., Leprieur 888 [lectotype specimen of *Peziza globifera* Berk. & Curt. apud Berk. var. *etiolata* Cooke]. — Trinidad. On burnt ground, Caroni River near Southern main road, 14 October 1949, R. W. G. Dennis 178.

CEYLON. On the ground, Central Province, December 1868, collector unknown, no. 1060.

Pulvinula archeri (Berk.) Rifai, *comb. nov.*

Peziza archeri Berk. *in* Hook. f., Fl. Tasman. 2: 274. 1860. — *Barlaea*? *archeri* (Berk.) Sacc., Syll. Fung. 10: 5. 1892. — *Humaria* (*Crouania*) *archeri* (Berk.) Cooke, Handb. Austr. Fungi 256. 1892. — *Barlaeina*? *archeri* (Berk.) Sacc. & Trav. *in* Sacc., Syll. Fung. 20: 138. 1910.

Apothecia sessile, gregarious, often caespitose, mostly orbicular in outline, 2–6 mm diam. Disc concave, flat or undulate, often becoming convex or pulvinate, dark reddish orange, crimson to pale brick red coloured. Receptacle paler, saucer shaped or scutellate, attached with a broad base to the substrata and anchored by hyaline to subhyaline, branched, stiff or undulate septate hyphae 1.5–2 μ diam. which usually enmesh soil particles; margin acute, free, wavy and irregular or torn from mutual pressure. Ectal excipulum well differentiated, about 130 μ thick, of subangular or subglobose elongated cells (textura angularis to textura globulosa), arranged with their long axes at right angles to the surface of the receptacle, 10–20 μ diam. by up to 35 μ long. Medullary excipulum of textura intricata hyphae 3–8 μ diam., with cells often inflated to about 14 μ diam., and interspaced by subglobose cells up to 20 μ diam. Subhymenium of compacted subangular or elongated cells about 6 μ diam.

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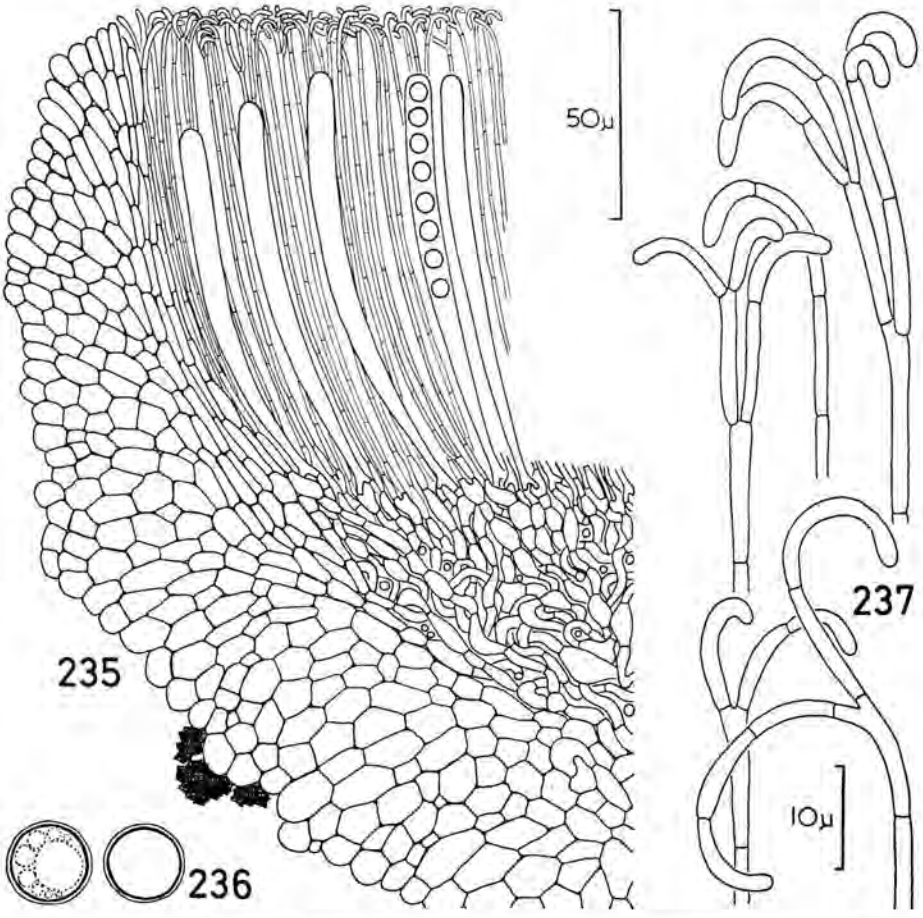
16) *Peziza* (*Humaria*) *orichalcea* Cooke, Mycograph. 1: 235. 1879 (basionymum). — *Barlaea orichalcea* (Cooke) Sacc., Syll. Fung. 8: 114. 1889. — *Barlaeina orichalcea* (Cooke) Sacc. & Trav. *in* Sacc., Syll. Fung. 19: 140. 1910. — [Misapplied name: *Pulvinula globifera* (Berk. & Curt. apud Berk.) Le Gal sensu Le Gal, Discom. Madag. 94. 1953; non sensu Berk. *in* J. Linn. Soc. (Bot.) 10: 366. 1868].

Hymenium about 160 μ thick. Asci narrow clavate cylindrical, gently attenuate towards their forked base, 8-spored, 130–150 × 7–9 μ. Ascospores uniseriate, globose, hyaline, usually with one big and numerous smaller oil globules, 6–7.5 μ diam., smooth walled. Paraphyses filiform, 1–1.8 μ diam. below, enlarged to about 2.5 μ at the strongly curved or hooked and forked apices, septate, sometimes constricted at the septa near the apex overarching the asci and forming a dense layer about the ascus tips, containing reddish granules (Fig. 235–237).

HABITAT AND DISTRIBUTION: on burnt ground in Tasmania and Victoria and probably also in North America.

As has been pointed out by Cooke (*1892*) the type specimen of this species [on dead leaves of some succulent plant, Tasmania, s. dat., W. Archer] does not bear apothecia any longer. On its packet, however, Berkeley left a pencil sketch showing the distinctive bifurcate paraphyses and an ascus with ascospores. The spore measurement was given as



Figs. 235–237. *Pulvinula archeri*. 235. Median section of margin. 236. Ascospores. 237. Apices of paraphyses. (From L. Rodway 686, neotype). — Figs. 236, 237 to same scale.

1/3500 inch which is equal to about 7 μ. Therefore the absence of apothecia on the type specimen does not seem to prevent the application of Berkeley's specific epithet for the present species because it agrees in all essential details, except in the substrate. Most of the collection listed below, as well as the collection Rodway 686 which is designated here as neotype specimens of *Peziza archeri* Berk., have been made on burnt ground.

The concept of *Pulvinula archeri* adopted here is in accordance with those already formulated by Cooke (*1892*), Massee (*1901*) and in part also Rodway (*1925*). It must be noted that Rodway extended the range of ascospores dimensions to 12 μ; part of his collections of this species which are preserved at Herb. Kew. fail to produce ascospores which are larger than 7.5 μ diam. Furthermore Rodway stated that this species was "very close to *B. miniata*" [*Lamprospora miniata*] which he described as having paraphyses which were "filiform curved at the end" and ascospores which were "alveolate when mature". Exactly what his concept is of *Lamprospora miniata* is not clear to me, because the latter species never has curved paraphyses.

The characteristic forking paraphyses of this species was neither mentioned nor illustrated by Massee (*1901*) but he made a correct observation on the structure of the excipulum.

Lamprospora pyrophila Snyder (Snyder, *1936*, *1938*) with small ascospores 7–9 μ diam. and hooked, often forked filiform paraphyses is closely related or probably a synonym. As its name implies it also occurs on burnt ground in the western United States.

SPECIMENS STUDIED

AUSTRALIA. Tasmania. On burnt ground, Cascades, Hobart, September 1898, L. Rowday 686 [neotype specimen of *Peziza archeri* Berk.]; on burnt ground, Cascades, Hobart, August 1920, L. Rodway; on the ground, Forestier Peninsula, April 1924, L. Rodway. — Victoria. On the ground in burnt area, 5 miles east of Lorme, 5 July 1964, G. Beaton 211.

FAMILY PEZIZACEAE

As is understood here the family Pezizaceae is characterized chiefly by the positive iodine reaction of its asci. These contain uninucleate ascospores which are usually thin walled, guttulate or non guttulate, globose, ellipsoidal, oblong ellipsoidal or subfusoidal, hyaline or pale brown, smooth or ornamented. The spore ornamentations are simple or very rarely complicated and as a rule they consist of callose-pectic material which is not of extra-sporal or vacuolar origin as in the Ascobolaceae. The size and shape of apothecia of the Pezizaceae are very variable, very small to large, ranging from one or two millimetres to more than ten centimetres, lenticular, scutellate, discoid or deeply cupulate, appressed to the substratum, broadly sessile or sometimes distinctly stipitate. The apothecial construction is also very variable, but at least some part of their receptacle is made up of pseudoparenchymatous tissue consisting of large isodiametric

cells often arranged in a textura globulosa. In cultures many species of the Pezizaceae produce *Oedocephalum* or *Ostracoderma* conidial states.

Traditionally the genera *Peziza* [Dill.] St-Amans, *Plicaria* Fuckel emend. Boud., *Sarcosphaera* Auersw. and *Pachyella* Boud. emend. Le Gal have been included in this family. Recently Kimbrough (*1966*) has referred the pseudo-ascoboloid genera *Iodophanus* Korf apud Kimbrough & Korf (*1967*) and *Thecotheus* Boud. to this family, and I believe that the genera *Gelatinodiscus* Kanouse & A. H. Smith (*1940*), *Boudiera* Cooke and probably also *Sphaerosoma* Klotzsch (Rouppert, *1909*) should be classified as members of the Pezizaceae as well, because their respective type species have amyloid asci which contain ascospores ornamented with material which stain with cotton-blue in lactic acid.

The characters used in separating the genera of the Pezizaceae do not always produce well defined entities and the presence of aberrant species may make these genera appear to overlap. The sand-loving species *Peziza ammophila* Dur. & Mont. and its closely related taxa, for example, are not classified as species of the subterranean genus *Sarcosphaera*, despite the fact that the young apothecia of the former group are also subterranean (Dennis, *1960*). Seaver (*1942*) and Kotlaba & Pouzar (*1963*) placed *Peziza ammophila* in *Sarcosphaera* but apart from the subterranean habit, the type species of the latter genus is very different from *Peziza ammophila* because the former has biguttulate ascospores, branched or lobed paraphyses and very large apothecia which grow in humus, on chalk and limestone. *Peziza psammobia* Rifai and *Peziza retispora* Rifai described below probably have also a subterranean habit when young but likewise these species are good members of the genus *Peziza*. It is probable that the subterranean habit of these sand-loving species of *Peziza* is an ecological adaptation and that they might have evolved independently from *Sarcosphaera*. The distinction between the two globose spored genera *Plicaria* and *Boudiera* is not yet clear, largely because the anatomy of the type species of the latter genus is not fully understood. Svrček (*1965*) keyed out the two genera by the size of their apothecia and by the type of their spore markings but it seems to be doubtful that the former character can be used as a valid taxonomic evidence to separate *Boudiera* from *Plicaria*. In this respect the complicated type of spore ornamentations of *Boudiera areolata* Cooke (Le Gal, *1947*) apparently offers a more reliable diagnostic character. The inclusion of *Boudiera* in the Pezizaceae appears to justify the separation of the globose spored genus *Plicaria* from the ellipsoidal spored genus *Peziza* which according to many recent authors (Korf, *1961*; Le Gal, *1962*; Denison, *1963*; Berthet, *1964a*) should be united.

KEY TO AUSTRALASIAN GENERA OF THE PEZIZACEAE

1a. Apothecia very small to small, asci broadly clavate, ascospores usually irregulary biseriate at maturity

Iodophanus Korf apud Kimbrough & Korf

b. Apothecia medium sized to very large, rarely small, asci subcylindrical or cylindrical, mature ascospores uniseriate 2

2a. Ascospores ellipsoidal to broadly ellipsoidal or sometimes almost subglobose, hyaline to brownish . . . . . *Peziza* [Dill.] St-Amans

b. Ascospores globose, brownish . . . . . *Plicaria* Fuckel emend. Boud.

PEZIZA [Dill.] L. ex St-Amans [17])

Peziza Dill., Cat. Pl. Giss. 194. 1719; App. 76. 1719. — *Peziza* [Dill.] L., Sp. Pl. 2: 1180. 1753; Gen. Pl., Ed. 5, 493. 1754. — *Peziza* [Dill.] L. *ex* St-Amans, Fl. agen. 530. April 1821; Fr., Syst. mycol. 2: 38. 1822; non *Peziza* S. F. Gray, Nat. Arrang. Br. Pl. 1: 664. November 1821 [= *Cheilymenia* Boud.]; nec *Peziza* Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 306. 1870 [= Helotiaceae]; nec *Peziza* [Dill.] L. ex St-Amans emend. Boud. *in* Bull. Soc. mycol. Fr. 1: 103. 1885 [= *Aleuria* Fuckel].

Scodellina S. F. Gray, Nat. Arrang. Br. Pl. 1: 668. November 1821; non *Scodellina* S. F. Gray emend. Seaver, N. Am. Cup Fungi (Operc.) 184. 1928 (misapplied, = *Otidea* Fuckel).

Phaeopezia Sacc. *in* Michelia 1: 71. 1877 (nomen nudum et provisorium). — *Peziza* [Dill.] L. ex St-Amans subgen. *Phaeopezia* (Sacc.) ex Sacc. *apud* Vido *in* Michelia 1: 594. 1879. — *Phaeopezia* (Sacc. ex Sacc. apud Vido) Sacc. *apud* Vido *in* Michelia 1: 595. 1879; Sacc. *in* Bot. Cbl. 18: 218. 1884; non *Phaeopezia* (Sacc., Syll. Fung. 8: 471. 1889) Sacc., Tab. comp. Gen. Fung. 30. 1898; nec *Phaeopezia* (Sacc.) Sacc. emend. Clem. & Shear, Gen. Fung. 328. 1931 [= *Crouaniella* (Sacc.) Lamb.].

Peziza [Dill.] L. ex St-Amans [ser. *Aleuria* Fr.] subgen. *Galactinia* Cooke, Mycograph. 1: 253. 1879. — *Galactinia* (Cooke) Boud. *in* Bull Soc. mycol. Fr. 1: 101. 1885, emend Le Gal, Discom. Madag. 27. 1953.

Peziza [Dill.] L. ex St.-Amans [ser. *Aleuria* Fr.] subgen. *Pustularia* Cooke, Mycograph. 1: 253. 1879; non *Pustularia* Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 328. 1870; nec *Peziza* [Dill.] L. ex St-Amans subgen. *Pustularia* (Fuckel) Sacc. *in* Bot. Cbl. 18: 215. 1884.

Peziza [Dill.] L. ex St-Amans [ser. *Aleuria* Fr.] subgen. *Geoscypha* Cooke, Mycograph. 1: 254. 1879. — *Peziza* [Dill.] L. ex St. Amans subgen. *Aleuria* (Fr.) Sacc. [sect.] *Geoscypha* (Cooke) Sacc. *in* Bot. Cbl. 18: 215. 1884. — *Geoscypha* (Cooke) Lamb., Fl. mycol. Belg., Suppl. 1: 320. 1887.

Phaeopezia (Sacc. ex Sacc. apud Vido) Sacc. apud Vido subgen. *Aleurina* Sacc. *in* Bot. Cbl. 18: 218. 1884. — *Aleurina* (Sacc.) Sacc., Tab. comp. Gen. Fung. 30. 1898; Sacc. & Syd. *in* Sacc., Syll. Fung. 16: 738. 1902.

Phaeopezia (Sacc. ex Sacc. apud Vido) Sacc. apud Vido subgen. *Geoscyphula* Sacc. *in* Bot. Cbl. 18: 218. 1884.

Heteroplegma Clem. *in* Bull. Torrey bot. Club 30: 92. 1903.

Daleomyces Setchel *in* Mycologia 16: 241. 1924. → *Napomyces* Clem. & Shear.

Durandiomyces Seaver, N. Am. Cup Fungi (Operc.) 242. 1928.

Napomyces Clem. & Shear, Gen. Fung. 333. 1931.

[Misapplied names: *Peziza* [Dill.] L. ex St-Amans subgen. *Discina* Fr. [sect.] *Eu-Discina* Sacc. *in* Bot. Cbl. 18: 215. 1884; non *Discina* (Fr.) Fr., Summ. Veg. Scand. 348. 1849.

Aleuria (Fr.) Gill. emend. Boud. *in* Bull. Soc. mycol. Fr. 1: 101. 1885, non emend. Sacc. *in* Bot. Cbl. 18: 215. 1885; nec *Aleuria* Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 325. 1870.

Plicaria Fuckel emend. Rehm in Rabenh. Kryptog.-Fl. 1 3: 1000. 1894, non emend. Boud. *in* Bull. Soc. mycol. Fr. 1: 101. 1885].

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[17]) Anywhere else in this work this genus is cited as *Peziza* [Dill.] St-Amans.

LECTOTYPE SPECIES: *Peziza vesiculosa* Bull. ex St-Amans.

Apothecia scattered to gregarious, or sometimes caespitose, medium to large, mostly superficial and sessile or substipitate, in some species submerged in the ground when young. Disc smooth, deeply or shallowly concave, sometimes undulate, flattened or rarely becoming convex, of various shades of white, brown, violet, almost black or other colours. Receptacle deeply or shallowly cupulate, sometimes saucer shaped, margin free, entire or irregularly crenate or crenulate, outer surface smooth, sometimes minutely downy to distinctly scurfy, usually much paler than the disc, consistency soft fleshy, fragile. The micro-structure of the receptacle varied considerably, in some species distinctly stratified into up to five or six layers of both prosenchymatous and pseudoparenchymatous tissue; the cells of the latter are usually globose or polygonal, large, thin walled and occasionally interspersed with numerous delicate hyphal elements. Asci cylindrical, slightly narrower towards the base, 8-spored, apex turned blue in Melzer's (iodine) reagent. Ascospores uniseriate, mostly ellipsoidal, occasionally subfusoidal, broadly ellipsoidal or rarely almost subglobose, hyaline or subhyaline to brownish, with or without oil globules, walls smooth or ornamented with callose-pectic spore markings of various size, shape and construction. Paraphyses slender, septate, typically unbranched, apex subclavate to clavate or subcylindrical, straight or gently to strongly curved, often containing coloured granules.

HABITAT: on damp or burnt places, sometimes on decaying wood or bark, a few on manured ground or on dung.

The scope of the old genus *Peziza*, like those of the other classical genera, has been subjected to various interpretations and frequent emendations, so that one can expect that confusion and disagreement of its application would be tremendous. It is not surprising, therefore, that in recent years suggestions have been put forward to abandon the name *Peziza* and to replace it with a later name, *Galactinia* (Cooke) Boud. emend. Le Gal (Le Gal, *1953*, *1959*, *1962*; Gamundi, *1960*, *1964*; Svrček & Kubička, *1961*; Svrček, *1962*, *1965*; Berthet, *1964*, *1964a*). This last move, however, has not received wide reception (Groves & Hoare, *1954*; Hansford, *1954*; Korf, *1955*, *1956*, *1961*; Thind & Batra, *1957*; Dennis, *1960*; Denison, *1963*; Batra & Batra, *1963*; Moser, *1963*; Webster, Rifai & El-Abyad, *1964*). The reluctance of these authors to drop the name *Peziza* completely is largely due to the fact that in the last seventy years this name has been consistently used for a large group of species of cup fungi which have characters mentioned in the generic description presented above. After considerable thought it has been decided to adopt the generic name *Peziza* for this group of fungi because an investigation into the history and the cause of the disagreement, a consideration of the typification of the generic names which have been confused with *Peziza* and the impriorability of the name which has been suggested to replace it, show that the retention of *Peziza* in this sense is fully justified.

The name *Peziza* is an old one, and was originally coined by Dillenius (*1719*) who derived it from the name *Pezica* of Pliny (*ca.* AD 79). Dillenius' name was accepted by Linnaeus (*1753*, *1754*) in his "Species Plantarum"

and "Genera Plantarum" and since then the generic name *Peziza* has firmly established itself in botanical literature. Almost all pre-Friesian mycologists had used *Peziza* to accommodate not only those species which now are accepted as species of the present genus but also the majority of Discomycetes as well as some discoid or cupulate Basidiomycetes.

The first author who revalidated the generic name *Peziza* [Dill.] L. after 1 January 1821 appears to be St-Amans (*1821*) [18]. It is true that in the introduction of the first volume of "Systema mycologicum" the name *Peziza* was listed by Fries (*1821*) but I consider this a nomen nudum, because there is no direct or indirect reference to an earlier publication and Fries failed to provide a description for it. St-Amans (*1821*) attributed this genus to Linnaeus and he assigned to it twenty three species, many of which are now generally considered to be unrelated to each other. Most of the species treated by St-Amans (*1821*) were those species illustrated and described previously by Bulliard (*1780–1791*), including *Peziza vesiculosa* Bull. ex St-Amans, which has been designated as the lectotype species of the present genus by Clements & Shear (*1931*), Wakefield (*1939*), Korf (*1955*) and Denison (*1963*).

The wide generic concept of *Peziza* adopted by St-Amans was not very different from that of his contemporaries such as Hooker (*1821*), Mérat (*1821*), Persoon (*1822*) and Fries (*1822*). Only Gray (*1821*) had a completely different and much narrower circumscription; his genus *Peziza*, for which he coined the vernacular name "Rough Cup," was intended for the reception of a few small hairy species. Gray did not attribute this name to Dillenius or Linnaeus but instead he wrote Pliny as the author of the name *Peziza*. For this reason it is proposed here to treat *Peziza* [Dill.] L. ex St-Amans (April 1821) and *Peziza* S. F. Gray [19]) (November 1821) as two independent homonymous generic names. As the lectotype species of *Peziza* S. F. Gray I would like to designate *Peziza stercorea* (Wigg.) ex S. F. Gray. Consequently *Peziza* S. F. Gray has been listed above as a synonym of *Cheilymenia* Boud.

For the subsequent fifty years or so St-Amans' or Fries' original broad generic concept of *Peziza* remained more or less unaltered. In 1864 De Notaris described several segregate genera but these did not receive immediate recognition. A more radical rearrangement – in which operculate and inoperculate genera were beginning to take shape – was proposed some years later by Fuckel (*1870*), and with it the controversy over the application of the generic name *Peziza* started. Fuckel, for one, added a

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[18]) It is not clear whether St-Amans' "Flore agenaise" did really antedate Hooker's "Flora scotica" 2, because Prof. Donald P. Rogers (Illinois) has kindly informed me that 20–28 April 1821 and 10 April-10 May 1821 were the respective probable dates of publications of these two books.

[19]) Compare also with *Scodellina* S. F. Gray (discussed under *Otidea* Fuckel) and *Macroscyphus* S. F. Gray (discussed under *Helvella* L. ex St-Amans) which Gray attributed to the authors of their respective protonym.

further source of confusion by creating yet another homonymous genus *Peziza* Fuckel, based on several inoperculate cup fungi now commonly referred to the Helotiaceae. For those species related to the ones treated here as species of *Peziza*, Fuckel (*1870*) introduced the generic name *Plicaria* Fuckel. *Peziza vesiculosa* was transferred to the newly established genus *Pustularia* Fuckel, which more recent authors, following the emendation proposed by Boudier (*1885*), have typified by *Peziza catinus* Holmsk. ex Fr. *Peziza aurantia* Pers. ex Hook. was also excluded from *Peziza* and was accommodated in the new genus *Aleuria* Fuckel, together with the newly described species *Aleuria rhenana* Fuckel.

Like that of De Notaris (*1864*), Fuckel's classification was also not immediately accepted and in fact there were some prominent authors who still preferred to maintain and even advocated the retention of the broad generic delimitation of *Peziza* (Cooke, *1879*; Quélet, *1886a*; Phillips, *1887*; Lindau, *1897*). Their contribution to the problems of the nomenclature of *Peziza* is therefore of little importance. For convenience the discussion on the different applications of the generic name *Peziza* and its substitutes by subsequent authors prior to the publication of Le Gal's (*1953*) "Les Discomycètes de Madagascar" will be arranged by linguistic groups instead of the traditional chronological sequence.

In 1879 Gillet raised Fries' infrageneric names *Aleuria* and *Lachnea* to generic level to accommodate the majority of species of operculate cup fungi with smooth and hairy apothecia respectively. Gillet's failure to retain the name *Peziza* for one of these groups had contributed much to the confusion of the application of this generic name in French literature. Boudier (*1885*) took up both Gillet's two names but with a drastic emendation. The genus *Lachnea* (Fr.) Gill. – which is untenable because of *Lachnaea* L. (*1753*) – was emended to accept a small group of species related to *Mycolachnea hemisphaerica* (Wigg ex S. F. Gray) Maire. All large operculate species which have iodine positive asci containing nonguttulate and mostly smooth walled ascospores were assigned to *Aleuria* (Fr.) Gill. emend. Boud., which was typified with *Peziza vesiculosa*. Under the current "International Code of Botanical Nomenclature" the name *Aleuria* (Fr.) Gill. (*1879*) cannot be used for these iodine positive species because it is a later homonym of *Aleuria* Fuckel (*1870*); furthermore Boudier's (*1885*) emendation of *Aleuria* (Fr.) Gill. was antedated by Saccardo's (*1884*) designation of *Aleuria aurantia* as the lectotype species of Fries' infrageneric name. The name *Peziza* which was suppressed by Gillet (*1879*), was revived and emended by Boudier (*1885*) to accommodate *Aleuria aurantia* and related taxa. Since the latter species has been widely accepted as the type species of *Aleuria* Fuckel (Rehm, *1894*; Seaver, *1914a*, *1928*; Clements & Shear, *1931*; Lundell & Nannfeldt, *1934*; Wakefield, *1939*; Thind & Batra, *1957a*; Dennis, *1960*; Gamundi, *1960*, *1964*; Denison, *1963*; Batra & Batra, *1963*; Moser, *1963*), outside France *Peziza* [Dill.] L. ex St-Amans emend. Boud. has been generally regarded

as a misapplied name. *Peziza* [Dill.] L. ex St-Amans [ser. *Aleuria* Fr.] subgen. *Galactinia* Cooke was given generic status by Boudier (*1885*) for the reception of those large operculate species with iodine positive asci which contain guttulate and mostly rough walled ascospores and often with juicy apothecia. It has been generally agreed to accept *Peziza succosa* Berk. as the type species of *Galactinia* (Cooke) Boud. (Cooke, *1879*; Saccardo, *1884*; Boudier, *1885*; Clements & Shear, *1931*; Le Gal, *1953*). The genus *Plicaria* Fuckel (*1870*), which originally covered all species classified later as members of *Aleuria* (Fr.) Gill. emend. Boud. and *Galactinia* (Cooke) Boud. by Boudier (*1907*), was redelimited and restricted to those species with globose ascospores related to *Peziza trachycarpa* Curr. by Boudier (*1885*).

The wide acceptance of Boudier's nomenclature and classification of operculate cup fungi in French literature is well known. Undoubtedly much of its success is due to the unsurpassed excellence of the illustrations published by Boudier (*1906–1910*) in the second volume of his "Icones mycologicae", and also to the simplicity of the presentation of the almost complete enumeration of European species brought together by Boudier (*1907*) in his "Histoire et classification des Discomycètes d'Europe". Boudier's untenable application of the name *Aleuria* had always been accepted without any reservation by the French school of mycologists and there have been a number of excellent contributions dealing with this genus and its close relative *Galactinia* (Le Gal, *1937*, *1941*, *1947*; Malençon, *1939*). Similarly the name *Peziza* has always been associated with *Aleuria aurantia* and it is still so used in very recent French literature (Heim, *1962*; Berthet, *1964a*) and also by the Czechoslovakian mycologist Svrček (*1965*). It is gratifying to note that in its place Madame Le Gal (*1963*) already started using the more correct name *Aleuria* Fuckel.

The influence of Fuckel's (*1870*) nomenclature and classification in the German literature is not unexpected, especially because it was fostered by the publication of Rehm's (*1887–1896*) monumental treatise on Discomycetes. Although Rehm (*1894*) was fully aware that Boudier (*1885*) had used the name *Plicaria* for those species with globose ascospores only, nevertheless he preferred to adopt Fuckel's (*1870*) original intention in using the name *Plicaria* to accommodate the ellipsoidal spored species with asci turning blue in iodine, which corresponded to Boudier's *Aleuria* and *Galactinia* and to the scope of the genus *Peziza* adopted in the present study. Rehm (*1894*) indicated that *Galactinia* was not distinct from *Plicaria* Fuckel emend. Rehm and he correctly used the name *Aleuria* in the original sense of Fuckel (*1870*). To accommodate the globose spored species classified by Boudier (*1885*) in *Plicaria* Fuckel emend. Boud. the generic name *Plicariella* (Sacc.) Rehm was established by Rehm (*1894*). The name *Peziza* was rejected; in this respect he was followed by von Höhnel (*1917*) who was of the opinion that the application of the name *Peziza* had been very badly confused. Until as recently as 1954 the name

Plicaria in the sense formulated by Fuckel (*1870*) and Rehm (*1894*) was still used in German literature as is evident from the publication of the new species *Plicaria fulva* Schneider (*1954*), a species with iodine positive asci containing ellipsoidal ascospores which was later transferred to the genus *Peziza* by Korf (*1961*) and renamed *Peziza ostracoderma* Korf. An obvious departure from the German tradition of using the name *Plicaria* for the present genus can be found in the work of Schroeter (*1893*), whose *Peziza* subgen. *Eupeziza* contained *Peziza vesiculosa* and its similar forms.

In the scheme of classification proposed by Saccardo (*1884*) almost all operculate species with hairless apothecia and hyaline ascospores were assigned to the genus *Peziza*. Saccardo divided this comprehensive genus into many infrageneric taxa, for each of which he designated an example or basic species, which appears to be acceptable as an effective typification of the taxon concerned. Consequently *Galactinia* (Cooke) Boud. (*1885*), *Geoscypha* (Cooke) Lamb. (*1887*) and the brown spored *Aleurina* (Sacc.) Sacc. (*1898*) as well as *Phaeopezia* (Sacc. ex Sacc. apud Vido) Sacc. apud Vido subgen. *Geoscyphula* Sacc. (*1884*) have been listed above as synonyms of *Peziza* [Dill.] L. ex St-Amans (*1821*) because directly or indirectly Saccardo (*1884*) had typified them with *Peziza succosa* Berk., *Peziza violacea* Pers. ex Pers., *Peziza retiderma* Cooke and *Peziza apiculata* Cooke respectively. In compiling the eighth volume of "Sylloge Fungorum", however, Saccardo (*1889*) abandoned his earlier scheme of classification and adopted narrower generic concepts. He retained the name *Peziza* and classified under it the larger operculate species of cup fungi, including *Peziza vesiculosa*. Following Boudier (*1885*), he referred species with "succoso-lactescens" character to the genus *Galactinia* but he seemed to be rather doubtful about the distinction between the latter genus and *Peziza*. In the subsequent volumes of "Sylloge Fungorum" (Saccardo, *1902*, *1906*, *1913*, *1928*) species described by Boudier and his followers as members of *Aleuria* (Fr.) Gill. emend. Boud. and those assigned to *Plicaria* Fuckel emend. Rehm by Rehm, Hennings and others were transferred to the genus *Peziza*. By retaining this name and associating it with *Peziza vesiculosa* and its related species, Saccardo had contributed much towards the stabilization of the nomenclature of this group of fungi.

In writing the "Handbook of Australian Fungi" Cooke (*1892*) employed the name *Peziza* with a scope more or less similar to that formulated by Saccardo (*1889*). *Peziza vesiculosa*, which does occur in Australia, was also included in this genus. It is very likely that it was Saccardo (*1889*), through Cooke (*1892*) and supported by Massee (*1895*), Seaver (*1915*, *1928*) and others, who firmly established the application of the generic name *Peziza* for the present genus. In the last volume of the "British Fungus-Flora" Massee (*1895*) emended the genus *Peziza* to accommodate only those species with large cupulate or discoid apothecia. Since in delimiting this genus Massee did not take the iodine reaction into consideration, the genus *Peziza* as conceived by him contained also a few

species which now are classified somewhere else. However, *Peziza vesiculosa* was covered by this emended circumscription and was entered as the first species. Ramsbottom (*1914*) introduced Boudier's (*1885, 1907*) nomenclature into English literature, which was later adopted by Corner (*1929a*), McLennan & Halsey (*1936*) and Ramsbottom & Balfour–Browne (*1951*). In 1915 it was pointed out by Seaver that it was desirable to retain the name *Peziza* for the present genus because it was still much used then. Therefore, in his treatise of North American species Seaver (*1928, 1942*) consistently used this name. His conception of this genus, however, was based on the gross morphology of the apothecia so that he included in it some unrelated species, whereas true species of *Peziza* such as *Peziza atrovinosa* Cooke was excluded because of its dark brown reticulate ascospores. Several later authors such as Clements & Shear (*1931*), Snyder (*1938*), Wakefield (*1939*), Lundell & Nannfeldt (*1941*) and Kanouse (*1947*) have also used the name *Peziza* for species related to *Peziza vesiculosa*.

The generic names which have been used for the present genus until 1953 can thus be summarized as follows: to those who followed Fuckel and Rehm, the species of this genus should be referred to *Plicaria* Fuckel emend. Rehm. In recent years Boudier's (*1885*) emendation of the latter genus has mostly been adopted (Maas Geesteranus, *1955*; Dennis, *1960*; Batra, *1961*; Batra & Batra, *1963*; Moser, *1963*). Boudier (*1885, 1907*) and his followers would classify members of the present genus in two genera, *Aleuria* (Fr.) Gill. emend. Boud. (non *Aleuria* Fuckel) and *Galactinia* (Cooke) Boud.; in place of *Aleuria* Fuckel the French school used the name *Peziza* [Dill.] L. ex St-Amans emend. Boud. With some reservation Saccardo (*1889*) accepted *Galactinia*, but the bulk of species of the present genus was accommodated in *Peziza*. In the English literature the name *Peziza* has been consistently used for the present genus.

The publication of Le Gal's "Les Discomycètes de Madagascar" in December 1953 marked a new turning point in the nomenclature of the present genus. For the first time the genera *Aleuria* (Fr.) Gill. emend. Boud. and *Galactinia* were united by her. In choosing the name which should be used for these combined genera Le Gal accepted the generic name *Galactinia* (Cooke) Boud. emend. Le Gal and at the same time proposed the rejection of the generic name *Peziza* as a nomen confusum. Although one may sympathize with Le Gal's decision and can see that the adoption of the name *Peziza* for the present genus is disagreeable to French tradition and hence will not be readily accepted by the French school of mycologists, the three main arguments which she put forward to justify the abandonment of the name *Peziza* cannot be fully defended. According to Le Gal (*1953*) the name *Peziza* could not be used for those species with iodine positive asci firstly because it would become a later homonym of the name *Peziza* adopted by Boudier (*1885*) for a completely different group. Already in 1939 it was pointed out by Wakefield that Boudier's emendation of *Peziza* should be rejected because it included

the type species of an earlier and validly published genus *Aleuria* Fuckel. Since there are many modern authors who accept the latter genus, and since they have also consistently used the name *Peziza* for species related to *Peziza vesiculosa*, the rejection of Boudier's (*1885*) typification seems to be fully warranted. Le Gal's second objection for the retention of the generic name *Peziza* was that its type species – as indicated by Seaver (*1928*) – was a doubtful species. Admittedly Seaver's designation of *Peziza cochleata* L. as the lectotype species of *Peziza* [Dill.] L. ex St-Amans was an unfortunate choice, but it is fully warranted by the "American Code of Botanical Nomenclature", under the rules of which Seaver (*1915*, *1928*) prepared his treatise. The listing of the name *Peziza cochleata* L. as the type species of the present genus by Seaver probably should be considered as a mere legislative gesture, and what matters most is his understanding of that species. Since Seaver (*1915*, *1928*) had every reason to believe that *Peziza cochleata* L. [20]) was probably identical with *Peziza badia* Pers. ex Mérat or even with *Peziza vesiculosa*, the view advocated by Donk (*1952*), Bullock & Hunt (*1966*) and Bullock (*1966*) on misapplied names for generic types can apparently be applied here. The uncertain identity of both Dillenius' and Linnaeus' original species of *Peziza*, however, does not justify the attempt to typify this genus by an original species of these authors. Therefore Clements & Shear (*1931*) selected *Peziza vesiculosa* Bull. ex St-Amans as the lectotype species of *Peziza* [Dill.] L. ex St-Amans, a choice which will ensure the availability of this generic name for the present genus and also satisfy the requirement of Recommendation 7B of the Code in preserving the current and widely accepted usage. Wakefield (*1939*) has already presented a lengthy and favourable argument to show that when Fries (*1822*) accepted the genus *Peziza* and assigned to it over three hundred species, the one which should be regarded as the most typical representative of this genus to Fries' conception of *Peziza* was also *Peziza vesiculosa*. Korf (*1955*) and Denison (*1963*) later joined with Clements & Shear (*1931*) and Wakefield (*1939*) in designating *Peziza vesiculosa* as the lectotype species of *Peziza*. Since Bulliard (*1780*), Sowerby

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[20]) The true identity of *Peziza cochleata* L. is still open to question. It was simply diagnosed as "*Peziza turbinata cochleata*" by Linnaeus (*1753*). As its synonym he cited de Vaillant's figure (*1727*: *t. 11 fig. 8*) and the corresponding descriptive name "*Fungoides auriculam judae referens, intus rufescens, extus candicans & quasi farinosum.*" It has not been possible to identify this species from de Vaillant's illustration with any degree of certainty. According to Persoon (*1799*, *1801*) *Helvella cochleata* (L.) Bolton sensu Bolton (*1789*)—who gave a reference to de Vaillant's illustration—was identical with *Peziza badia*. Fries (*1822*) also listed de Vaillant's descriptive name and illustration as a synonym of *Peziza badia*. Thus Seaver (*1928*) was not the only author who considered Linnaeus' species being conspecific with *Peziza badia*. There are about eight pre-Friesian interpretations of *Peziza cochleata* L. which were reduced to the synonymies of some other species by Fries (*1822*), and the authorship of the species of *Otidea* which has been associated with that name probably should not be attributed to Linnaeus.

(*1797*), Persoon (*1801*, *1822*), St-Amans (*1821*), Hooker (*1821*), Mérat (*1821*), Fries (*1822*), Berkeley (*1860*), Cooke (*1879*, *1892*), Quélet (*1886a*), Phillips (*1887*), Saccardo (*1889*), Schroeter (*1893*), Massee (*1895*), Lindau (*1897*), Seaver (*1915*, *1928*), Rodway (*1925*), Lundell & Nannfeldt (*1936*), Snyder (*1938*), Bessey, (*1950*), Dennis (*1960*), Batra & Batra (*1963*) and Moser (*1963*) have also classified *Peziza vesiculosa* as a species of *Peziza* this typification is fully endorsed here.

Le Gal's (*1953*) last argument to support her decision in suppressing the generic name *Peziza* was that this genus was composed of a rather heterogeneous assemblage. Le Gal pointed out that the genus *Peziza* as conceived by Seaver (*1928*) covered not only species with iodine negative asci but also species belonging to other families such as *Disciotis venosa* (Morchellaceae), *Discina melaleuca* Bres. (Helvellaceae) and *Pseudotis abietina* (Pers. ex Pers.) Boud. (Humariaceae). That the early conception of the genus *Peziza* was unwieldy is not very surprising, because being the oldest genus of cup fungi it had a similar fate to the other pioneer genera such as *Polyporus* [Mich.] Fr., *Clavaria* [Vaill.] Fr., *Agaricus* L. ex Fr. etc., which the majority of mycologists find it most desirable to retain in a restricted sense. The unsoundness of Seaver's taxonomic judgement in this connection cannot be considered as valid nomenclatural argument for rejecting the name *Peziza*.

Without carefully considering its priorability the generic name *Galactinia* as emended by Le Gal was accepted by Gamundi (*1960*) and Svrček & Kubička (*1961*). This favourable reception has prompted Le Gal (*1962*) to transfer almost all West European species of *Peziza* to the genus *Galactinia*. As understood by Le Gal (*1953*, *1953a*, *1962*), however, the genus *Galactinia* (Cooke) Boud. (*1885*) includes also *Peziza trachycarpa*, which is the lectotype species of an earlier and validly published genus *Plicaria* Fuckel (*1870*)! It is obvious that even if the generic name *Peziza* is to be considered a nomen dubium or confusum the name *Galactinia* is incorrect and under the current "International Code of Botanical Nomenclature" it cannot be justifiably used. It may be argued that since *Plicaria* can be recognized as a separate genus, it will not endanger the use of the name *Galactinia*. Nevertheless the exclusion of the globose spored species from *Peziza* still does not make *Galactinia* the correct name for the present genus, because it still includes *Peziza apiculata* Cooke, which is the type species of yet another earlier validly published genus *Phaeopezia* (Sacc. ex Sacc. apud Vido) Sacc. apud Vido (*1879*) [21]). It is obvious that the

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[21]) The generic name *Phaeopezia* was introduced originally as a nomen provisorium by Saccardo (*1877*) when he redescribed the brown spored Italian species *Peziza apiculata* as follows: "*Peziza* (*Phaeopezia* nov. gen.?) *apiculata* Cooke . . . ." Two years later the name *Phaeopezia* was validly published as a subgenus of *Peziza*, typified by *Peziza apiculata* (Vido, *1879*: 594). On the next page (Vido, *1879*: 595) *Phaeopezia* was also used as a generic name, with its type species duly transferred as *Phaeopezia apiculata* (Cooke) Sacc. apud Vido. In 1884 Saccardo enlarged the

rejection of the generic name *Peziza* will not in any way help in stabilizing the nomenclature of fungi but it will only create further confusion. Since *Galactinia* is not the earliest synonym available, if the name *Peziza* is abandoned all its species will have to be transferred to *Plicaria* if one follows Le Gal (*1953a*, *1962*) and Korf (*1961*) in considering that the spore shape is not a good generic character (see below under *Plicaria*), but for those who keep the ellipsoidal and the globose spored species in two genera (Dennis, *1960*; Batra & Batra, *1963*; Moser, *1963*), another set of transfers from *Peziza* to *Phaeopezia*, or even to *Scodinella* S. F. Gray (*1821*; see under *Otidea*), will have to be made. Since the genus may well conatin over one hundred and fifty species the number of new combinations which will have to be proposed is very large. Only the conservation of the generic name *Galactinia* will justify its application for the present genus, but it is unlikely that a proposal to conserve it against *Phaeopezia*, *Plicaria* and *Peziza* will receive enough support, especially because in recent years many modern authors believe that the retention of the latter name is fully justified.

The large genus *Peziza* is very poorly known, partly because colour and other ephemeral characters lost in preserved material are of prime importance and the existing arrangement of its species is far from being satisfactory. The works of Le Gal (*1941*), Dennis (*1960*) and Moser (*1963*) are very helpful in identifying Western European species whereas those of Seaver (*1915*, *1928*, *1942*) are totally unreliable both in their generic and specific delimitations as well as in their nomenclature. The number of species occurring in Australasia is obviously larger than that admitted and described in the following pages.

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scope of the genus *Phaeopezia* and he divided it into four subgenera, *Crouaniella*, *Aleurina*, *Plicariella* and *Geoscyphula*, and *Peziza apiculata* was included in the last subgenus. In "Sylloge Fungorum" Saccardo (*1889*) only admitted two subgenera, *Eu-Phaeopezia* for the globose spored species and *Aleurina* for the ellipsoidal ones. *Plicaria murina* Fuckel, which originally was designated as type species of the globose spored subgenus *Crouaniella* Saccardo, (*1884*), was included in this subgenus *Eu-Phaeopezia*. For this reason Clements & Shear (*1931*) have indicated *Plicaria murina* as the type species of *Phaeopezia* (Sacc., *1889*) Sacc. (*1898*), a later homonym of *Phaeopezia* (Sacc. ex Sacc. apud Vido) Sacc. apud Vido (*1879*); both Saccardo (*1898*, *1902*) and Clements & Shear (*1931*) were obviously unaware of the existence of these homonymous generic names. Clements & Shear's typification has made *Phaeopezia* (Sacc.) Sacc. (*1898*) an obligate synonym of *Crouaniella* (Sacc.) Lambotte (*1887*), which probably is a later synonym of *Sphaeridiobolus* Boud. (*1885*). There is no doubt that *Peziza apiculata* Cooke should be accepted as the type species of the genus *Phaeopezia* (Sacc. ex Sacc. apud Vido) Sacc. apud Vido; the acceptance of this species as its type seems to be the most logical one because it was this brown spored species which had led Saccordo (*1877*) to create the generic name *Phaeopezia*.

KEY TO AUSTRALASIAN SPECIES OF PEZIZA

1a. Apothecia when young submerged in sandy soil, ascospores large, 23.6–27.3 μ long, hyaline, smooth walled but usually indistinctly apiculate at both ends . . . . . *Peziza austrogeaster* (Rodway) Rifai
b. Not as above 2
2a. Ascospores without oil globules, mostly smooth walled or rarely ornamented 3
b. Ascospores with oil globules, minutely to coarsely ornamented 7
3a. Apothecia on burnt ground, ascospores warted. *Peziza echinospora* Karst.
b. Apothecia not on burnt ground, ascospores smooth walled. 4
4a. Ascospores 20–25 × 10–12.7 μ . *Peziza vesiculosa* Bull. ex St. Amans
b. Ascospores less than 18 μ long 5
5a. Paraphyses moniliform, with lower cells inflated *Peziza varia* (Hedw.) ex Fr.
b. Paraphyses not moniliform 6
6a. Apothecia chestnut brown . . . . . *Peziza repanda* Pers. ex Pers.
b. Apothecia pale ochraceous or yellowish brown, often growing in damp cellars, green houses, between paving stones etc. *Peziza cerea* Bull. ex Mérat
7a. Ascospores warted, not apiculate 8
b. Ascospores reticulate 10
c. Ascospores either covered by sinuate ridges, or warted and apiculate 12
8a. Ascospores broadly ellipsoidal, 13.8–16.3 × 10–11.5 μ, apothecia dark blackish brown, on sand or sandy soil . . *Peziza psammobia* Rifai
b. Ascospores ellipsoidal, less than 13 μ long, apothecia purplish, on burnt ground 9
9a. Ascospores smooth or at complete maturity very minutely warted *Peziza tenacella* Phill. apud Cooke
b. Ascospores distincly covered by minute warts . *Peziza praetervisa* Bres.
10a. Ascospores subglobose . . . . . *Peziza subaurantiaca* (Massee) Rifai
b. Ascospores ellipsoidal 11
11a. Meshes of reticulations more or less regular, isodiametric *Peziza retispora* Rifai
b. Meshes of reticulations elongated, longitudinally orientated *Peziza badia* Pers. ex Mérat
12a. Ascospores apiculate . . . . . *Peziza thozetii* Berk.
b. Ascospores not apiculate 13
13a. Ascospores hyaline . . . . . *Peziza petersii* Berk.
b. Ascospores brown . . . . . *Peziza retiderma* Cooke

Peziza austrogeaster (Rodway) Rifai, *comb. nov.*

Sepultaria austrogeaster Rodway *in* Pap. Proc. R. Soc. Tasmania 1920: 154. 1921.

Apothecia scattered to gregarious, subterranean, medium sized. Disc deeply concave, at first pale buffy yellowish to ochraceous umber, becoming darker to umber with age. Receptacle up to 30 mm diam., when young globose and closed and completely immersed in sand, then emerged from it and becoming half free and at the same time stellately bursting above into a few irregular lobes in a *Geastrum*-like manner, turbinate or deep cupulate but ultimately may become expanded or almost flattened, contracted below into a distinct, short, thick, rooted stem-like base up to 15 mm long by 5–10 mm diam.; the outer surface of the receptacle dirty whitish or brownish, usually with soil particles adhering to the loose,

copious, hair-like hyphal elements which clothed the surface. Hymenium about 360 μ thick. Asci large, cylindrical, abruptly attenuate below into a short narrow base, apex turning blue in Melzer's reagent, 8-spored, 350–390 × 20–25 μ. Ascospores uniseriate, broadly ellipsoidal, hyaline, without oil globules, smooth walled but at maturity their polar regions usually have indistinct, irregularly shaped apicule-like ornaments which stain blue in cotton-blue in lactic acid; without the ornaments the ascospores measure 23.6–27.3 × 14–16.3 μ. Paraphyses slender, septate, 2.5–4.5 μ diam. below, apex enlarged, 6–7.2 μ diam., often slightly curved (Fig. 238).

HABITAT AND DISTRIBUTION: in sandy soil in Australia.

In Australian literature the taxonomy and nomenclature of this native species have been confused with the North African and European species *Peziza ammophila* Dur. & Mont. and the North American *Peziza funerata* Cooke, two small spored species which according to Seaver (*1942*) were conspecific, with ascospores only up to 18 μ long. Tepper (*1885*) recorded the occurrence of *Peziza funerata* in Australia based on a specimen (on sand in scrub in open spots, Clarendon, South Australia, 3 September 1882, J. G. O. Tepper 895) he forwarded to Herb. Kew. which Cooke identified with the North American species. On the label of this specimen Cooke indicated that it was a variety of *Peziza funerata* because of its slightly larger spore size. I believe that this specimen represents a small spored variety of *Peziza austrogeaster* because I found that its ascospores had also apicule-like ornaments but measured only up to 21 μ long. Since the condition of the material is too poor to serve as a type specimen it is not described further.

McLennan & Halsey (*1936*) described and illustrated the present species under *Sarcosphaera funerata* (Cooke) Seaver and reduced *Sepultaria austrogeaster* Rodway to its synonymy. These two species, however, differ markedly in their ascospore characters so that to regard them as one species is wholly unwarranted.

Hansford's (*1954*) record of *Peziza ammophila* has been based on specimens described below as *Peziza psammobia* Rifai.

SPECIMENS EXAMINED

AUSTRALIA. Tasmania. In sandy soil, s. dat., L. Rodway [type specimen of *Sepultaria austrogeaster* Rodway]. — Western Australia. In sandy soil, South Perth, 26 July 1924, Wm. Carne. — South Australia. In sandy soil, Keith, 6 August 1952, J. Warcup, ex WARI 2938; in sandy soil, Port Lincoln, 16 July 1952, N. T. Flentje, ex WARI 2141. — Victoria. Partially immersed in sandy soil, 2 miles west of Anglesea, between dunes and road, 5 July 1964, G. Beaton 208.

PEZIZA ECHINOSPORA Karst.

Peziza echinospora Karst., Fung. Fenn. exs. no. 541, 1861; *in* Notis. Sällsk. Fauna Fl. fenn. **10**: 115. 1869. — *Plicaria echinospora* (Karst.) Rehm *in* Ber. naturhist. Ver. Augsburg **26**: 122. 1881. — *Aleuria echinospora* (Karst.) Boud., Hist. Class. Discom. Eur. 46. 1907. — *Galactinia echinospora* (Karst.) Svrček & Kubička *in* Česká Mycol. **15**: 74. 1961.

Peziza umbrina Boud. *apud* Cooke, Mycograph. 1: 226. 1879; non *Peziza umbrina* Pers., Mycol. eur. 1: 220. 1822. — *Aleuria umbrina* (Boud. apud Cooke) Gill., Champ. Fr., Discom. 42. 1879. → *Peziza anthracophila* Dennis.

Peziza anthracophila Dennis, Br. Cup Fungi 13. 1960 (a name change).

Apothecia gregarious, occasionally caespitose, usually rather large, up to 70 mm diam. or more. Disc concave, undulate, smooth, brown to dark brown. Receptacle cup shaped, sometimes becoming contorted to almost *Otidea*-like by mutual pressure, broadly sessile, margin often crenate, outer surface much paler than the disc, often whitish, scurfy to furfuraceous. The outermost layer of the excipular tissue is composed of interwoven, septate, short celled hyphae 6–13 μ diam., which often give rise to groups of hyphae which irregularly aggregate and cause the surface of receptacle to appear scurfy. The lower pseudoparenchymatous layer is thick, of large subglobose or polygonal cells 25–60 μ diam. or sometimes more. This layer is separated from the upper pseudoparenchymatous tissue by a layer of compact textura intricata or textura epidermoidea with cells 8–15 μ diam. by up to 50 μ long. The upper pseudoparenchymatous layer is also thick, of large subangular or polygonal, thinner walled cells 20–50 μ diam. Subhymenium of compact angular or lobed and sinuate cells 8–15 μ diam. Hymenium about 280 μ thick. Asci cylindrical, slightly narrower below, apex blued in Melzer's reagent, 8-spored, up to 300 μ long by 10–12.5 μ diam. Ascospores uniseriate, hyaline, without oil guttules, ellipsoidal to oblong ellipsoidal, at maturity completely covered by minute echinulations, 14.5–18.2 × 6.3–8 μ. Paraphyses slender, septate, 2.5–3.6 μ diam. below, apex straight or sometimes indistinctively curved, subclavate, up to 7.5 μ diam. (Fig. 239–240).

HABITAT AND DISTRIBUTION: on burnt ground in Europe (type locality Finland), the United States, Argentina and Australia.

The apothecium now present in the Herb. Kew. example of Karsten, Fungi Fenniae exsiccati no. 541 sub *Peziza echinospora* has smooth ellipsoidal ascospores. This specimen is part of the type collection of the present species which was not received by Herb. Kew. until 1883. Obviously there had been some mistakes in preparing this exsiccatum, or the apothecia have subsequently been misplaced and it is also probable that Karsten had confused and mixed it with the genuine *Peziza echinospora* in the field because on the disc of this specimen free and typical ascospores of the present species have been observed. There is another specimen labelled by Cooke as Karsten 541 which I believe to be the collection upon which Cooke (*1877*) based the description and illustration of this species in his "Mycographia"; Cooke stated that his illustration was based on the original specimen of *Peziza echinospora*. This specimen has indeed rough ascospores as illustrated by Cooke and as described by Karsten (*1869*). Le Gal (*1962*) has also used Karsten's specific epithet for the present species.

It is possible that the present species might have an earlier name, because it is not uncommon on burnt ground in Europe. In American literature this species had been commonly known as *Peziza pustulata* (Hedw.) ex Pers. largely because Seaver (*1928*) used the latter name in

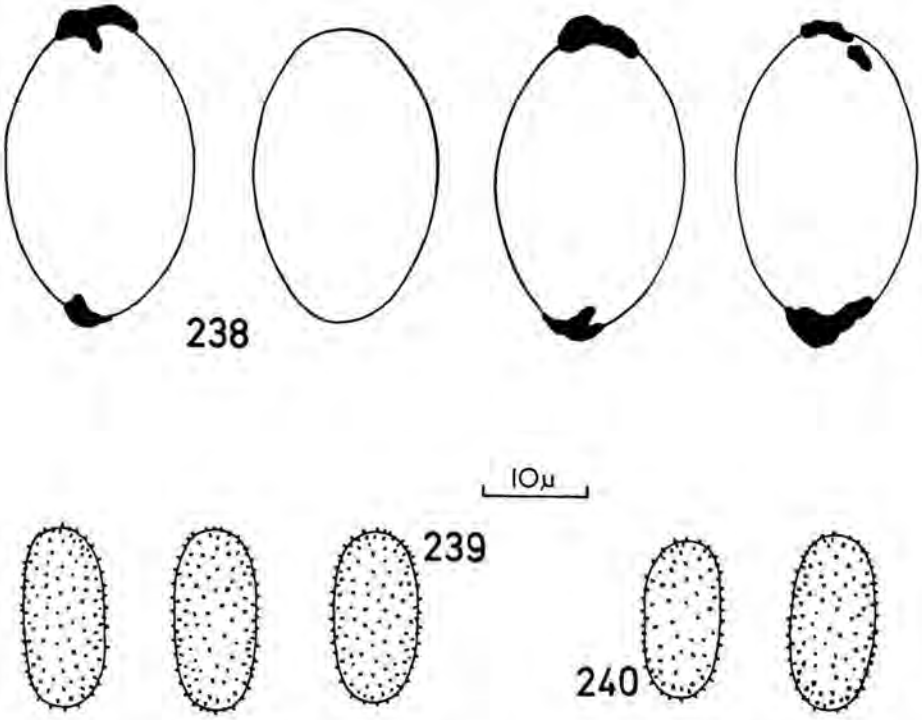


Fig. 238–240. — *Peziza austrogeaster*. 238. Ascospores (from WARI 2938). — *Peziza echinospora*. 239. Ascospores (From G. Beaton 3). 240. Ascospores (From type).

his monograph. From Hedwig's (*1789*) illustration it is evident that the commonly accepted practice to treat *Peziza pustulata* as a synonym of *Pustularia catinus* (cf. Dennis, *1960*) is fully justified.

The Australian specimen described above has slightly larger ascospores than the European collections. Cooke's example of Karsten 541 has ascospores which measure 13.6–16.3 μ long. Whether the Australian representatives will have to be recognized as a geographically distinct taxon or not depends upon the result of further observations on the morphological variation of its population and on its cultural behaviour. It is well known that the typical form of the present species has an *Oedocephalum* conidial state (Dodge, *1937*; Webster, Rifai & El-Abyad, *1964*; Berthet, *1964*; as *Peziza pustulata*, *Peziza anthracophila* and *Galactinia echinospora* respectively.)

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On burnt ground at the base of *Acacia longifolia*, about 6 miles from Cobden on Kennedy's Creek Road, near Camperdown, 2 September 1962, G. Beaton 3.

EUROPE. Finland. [On burnt ground] Mustiala, på svedjel., September 1866 [Karsten, Fungi Fenniae exsiccati no. 541 sub *Peziza echinospora*; ex Herb. M. C. Cooke, isotype specimen].

PEZIZA VESICULOSA Bull. ex St-Amans

Peziza vesiculosa Bull., Herb. Fr. *t. 457, f. 1.* 1789; Hist. Champ. Fr. 270. 1791. — *Peziza vesiculosa* Bull. *ex* St-Amans, Fl. agen. 534. 1821; Fr., Syst. mycol. 2: 52. 1822. — *Scodellina vasiculosa* (Bull. ex St-Amans) S. F. Gray, Nat. Arrang. Br. Pl. 1: 669. 1821. — *Pustularia vesiculosa* (Bull. *ex* St-Amans) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 329. 1870. — *Aleuria vesiculosa* (Bull. ex St-Amans) Gill., Champ. Fr., Discom. 45. 1879. — *Galactinia vesiculosa* (Bull. ex St-Amans) Le Gal, Discom. Madag. 33. 1953.

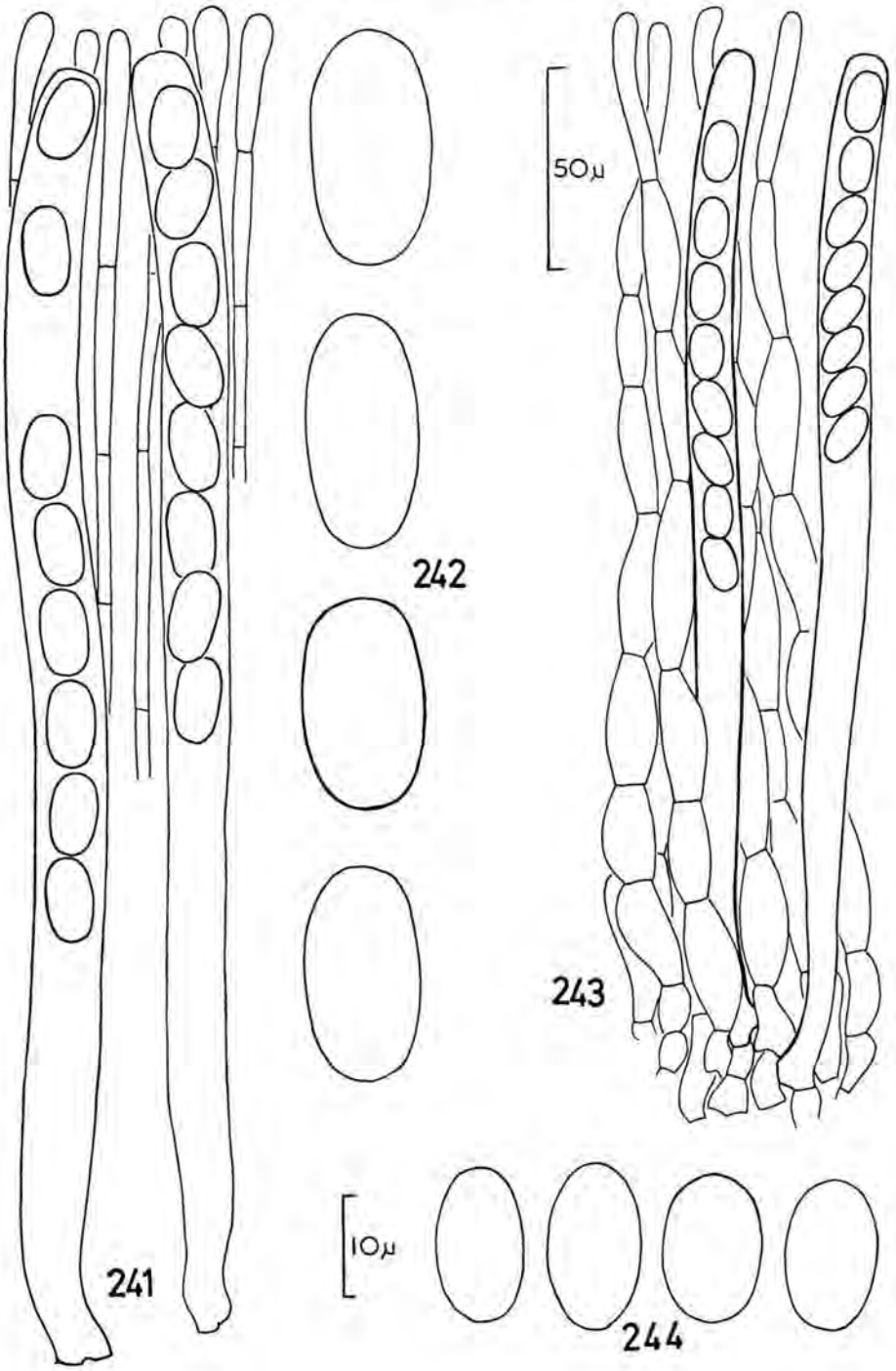
Peziza spenceri Colenso *in* Trans. Proc. N.Z. Inst. 22: 458. 1890 [ut "*Peziza* (*Lachnea*) *spencerii*"]. — *Lachnea spenceri* (Colenso) Sacc., Syll. Fung. 11: 400. 1895.

Apothecia gregarious, or more often clustered, large, up to 80 mm diam., sessile or subsessile. Disc light yellowish brown, deeply concave. Receptacle at first hemisphaerical, then becoming and permanently remaining cup shaped, or sometimes irregularly contorted from mutual pressure, margin usually inrolled, entire or irregularly incised, pale to yellowish fawn, scurfy, brittle. Flesh chiefly composed of large polygonal or subglobose thin walled cells about 100 μ diam. or more, interspersed by a few delicate, septate and branched hyphal elements; on the surface of receptacle there is usually a thin layer of intertwined flexuous hyphae 4–8 μ diam. Subhymenium up to 65 μ thick, of angular cells 6–18 μ diam. which mostly lie horizontally but occasionally also assume a prosenchymatous tissue. Hymenium about 300 μ thick. Asci cylindrical, slightly contracted below into a short base, apex truncate and turning deep blue in Melzer's reagent, 8-spored, 280–340 × 14–19 μ. Ascospores uniseriate sometimes obliquely uniseriate, ellipsoidal to oblong ellipsoidal, smooth walled, without oil globules, hyaline, 20–22.7(–25) × 10–12.7 μ. Paraphyses slender, 2.5–4 μ diam. below, septate, typically unbranched, apex straight or gently curved, enlarged, subclavate, up to 7.5 μ diam. (Fig. 241–242).

HABITAT AND DISTRIBUTION: on manure or richly manured soil or rarely on the ground, mushroom beds etc. in Europe (type locality France), North America, Madagascar, Tristan da Cunha, India and Australasia.

According to Berthet (*1964*) in culture this species produced an *Oedocephalum* conidial state with finely warted conidia 6–8(–11) × 3–3.5 μ. *Peziza vesiculosa* is quite widely spread all over the world and it is probably not uncommon in Australasia. The Argentinian record of this species might have been based on a different taxon, because the spore measurement given for it by Gamundi (*1960*), 17.4–19.2 × 8.4–9 μ, is appreciably smaller and well outside the range of the spore size of *Peziza vesiculosa* given by Seaver (*1928*), Le Gal (*1953*), Dennis (*1960*) or Batra & Batra (*1963*).

The Rev. W. Colenso forwarded to Herb. Kew. two authentic specimens of *Peziza spenceri* Colenso (*1890*), namely Colenso b–664, and Colenso b–889. In a letter sent by W. Phillips to Cooke it was indicated that these specimens were a mixture of two different species. Phillips consequently divided the latter specimen into two lots and for convenience these are designated here as Colenso b–889 and Colenso b–889bis. The specimens Colenso b–664 and Colenso b–889 both have brownish subreticulate ascospores 10–12.7 × 5.5–6.7 μ and are referable to *Peziza retiderma* Cooke.



Figs. 241–244. — *Peziza vesiculosa*. 241. Asci and paraphyses. 242. Ascospores. (From WARI 2237). — *Peziza varia*. 243. Asci and paraphyses. 244. Ascospores. (From F. Martin 479). — Figs. 241, 243 and Figs. 242, 244 to same scale.

The specimen Colenso b–889 bis has smooth, oblong ellipsoidal, and hyaline ascospores 20–25 μ long and is identical with *Peziza vesiculosa*. In the original description of *Peziza spenceri* the size of its ascospores was given by Colenso (*1890*) as 1/1200 inch [= ± 21 μ] long and it was stated further that this species could only be found in that part of a garden which had received a quantity of fresh stable manure, which is a typical habitat of *Peziza vesiculosa*. Because of the close agreement in spore size, type of habitat and the other characters mentioned in the original description, it seems fully justified to designate the specimen Colenso b–889bis as the lectotype specimen of *Peziza spenceri* Colenso and at the same time to reduce the latter species to the synonymy of *Peziza vesiculosa*.

SPECIMENS EXAMINED

NEW ZEALAND. On manured ground in a garden, Scinde Island, Napier, September 1889, W. I. Spencer [comm. Colenso b-889bis; the collection data are obtained from Colenso's published account—lectotype specimen of *Peziza spenceri* Colenso ; on the ground on horse dung, Lincoln, June 1882, T. Kirk 137.

AUSTRALIA. Queensland. On the ground, Brisbane, s. dat., collector unknown; recorded by Cooke (1892) as *Peziza cochleata*. — Western Australia. In terram et lignum putre, Swan River, s. dat., no. 210 (?Drummond coll.). — New South Wales. On dung, Yanco, July 1915, D. Smith (ex Herb. Cleland 125, ex WARI 3124, already identified as *Peziza vesiculosa* by C. G. Lloyd); substrate not stated, Guntawang, Hamilton, s. dat., collector unknown, no 25. — South Australia. On the ground, s. dat., Mr. Ziety (comm. J. B. Cleland, ex WARI 3120); on the ground, Adelaide, 18 June 1952, Mrs. Robertson, ex WARI 2237. — Victoria. Terrestrial in bark mulch, Botanic Gardens, Melbourne, 21 September 1962, G. Beaton 16; on the ground Horsham, April-June, collector unknown, no. 474; on humous ground, s. dat., collector unknown, no. 475; — Tasmania. On manured ground, s. dat., L. Rodway 23.

PEZIZA VARIA (Hedw.) ex Fr.

Octospora varia Hedw., Descr. Musc. frond. 2: 22. *t. 6 f. D.* 1789. — *Peziza varia* (Hedw.) ex Fr., Syst. mycol. 2: 61. 1822. — *Humaria varia* (Hedw. ex Fr.) Sacc., Syll. Fung. 8: 142. 1889. — *Geopyxis varia* (Hedw. ex Fr.) Rehm *in* Rabenh. Kryptog.-Fl. I 3: 957. 1894. — *Aleuria varia* (Hedw. ex Fr.) Boud., Icon. mycol. 2: *t 267*. 1906; Hist. Class. Discom. Eur. 46. 1907. — *Galactinia varia* (Hedw. ex Fr.) Le Gal *in* Bull. Soc. mycol. Fr. 78: 210. 1962.

Apothecia scattered to gregarious, medium sized, rarely exceeding 50 mm diam., subsessile or mostly stipitate. Disc generally concave but sometimes also almost convex, light greyish to dark greyish brown. Receptacle when young cupulate, but mostly becoming flattened, repand or revolute in age, seated on a central stipe which sometimes becomes obscure, outer surface scurfy, whitish. In section it can be seen that the outermost layer of the excipular tissue is composed of small angular cells 10–18 μ diam.; immediately inside this layer there is a layer of large angular or polygonal cells 20–50 μ diam.; on top of this lies a thin prosenchymatous layer of intertwined, branched, septate hyphae 4–10 μ diam.; this prosenchymatous tissue separates the lower pseudoparenchymatous tissue from the upper pseudoparenchymatous tissue which is also com-

posed of large elongate angular cells 30–50 μ or more diam. by up to 100 μ long, arranged with their long axes perpendicular to the surface of the receptacle. Subhymenium also pseudoparenchymatous, its cells angular, short barrel shaped or pyriform, 6–10 μ diam. Hymenium about 225 μ diam. Asci cylindrical, narrower towards the base, apex blued in Melzer's reagent, 8-spored, up to 270 μ long by 9–12 μ diam. Ascospores uniseriate, ellipsoidal, hyaline, without oil globules, smooth walled, 12.5–16 × 8–10 μ. Paraphyses septate, moniliform, i.e. with the lower cells strongly inflated (sometimes up to 18 μ diam.) and much constricted at the septa, upper cells slender, cylindrical or barrel shaped, apex subclavate, up to 4 μ diam. (Fig. 243–244).

HABITAT AND DISTRIBUTION: on rich soil in Europe (type locality Germany) and Australia, and probably also North America (cf. Gamundi, *1964*).

This species is related to *Peziza repanda* and it differs from the latter chiefly in the structure of its paraphyses, which, at least at maturity, become moniliform. The stratifications of its excipular tissue are similar to that of *Peziza repanda*. This latter character was also known to Hedwig (*1789*) as is evident from his illustration of the section of the apothecium. Seaver (*1928*) tentatively reduced the present species of the synonymy of *Peziza domiciliana* Cooke but this is wholly unjustified, because *Peziza domiciliana* has rough ascospores.

Cooke (*1892*) identified the specimen F. Martin 479 with *Otidea phlebophora* (Berk. & Br.) Sacc. but the lectotype specimen of the latter (on clay banks, King's Cliffe, England, s. dat., M. J. Berkeley) has iodine negative asci with smaller and smooth biguttulate ascospores which measure 9–12.2 × 5–8.1 μ.

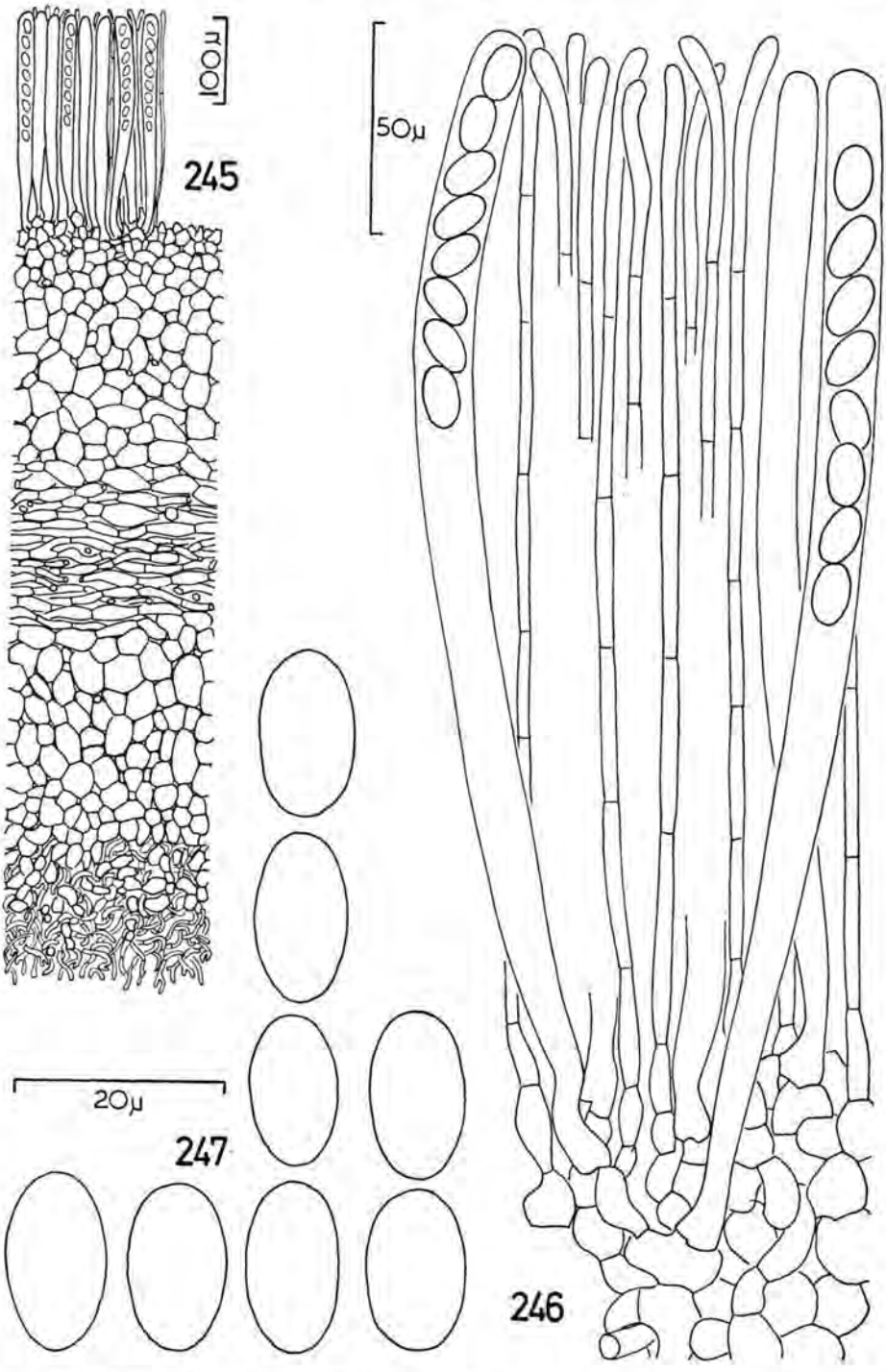
SPECIMEN EXAMINED

AUSTRALIA. Victoria. On crucible under a drip, centre of Melbourne, s. dat., F. Martin 479.

PEZIZA REPANDA Pers. ex Pers.

Peziza repanda Pers., Icon. pict. Fung. 49 *t. 20 fig. 2.* 1806. — *Peziza repanda* Pers. *ex* Pers., Mycol. eur. **1**: 231. 1822; Fr., Syst. mycol. **2**: 51. 1822. — *Plicaria repanda* (Pers. ex Pers.) Fuckel *in* Jb. nassau. Ver. Naturk. **23–24**: 328. 1870 [misapplied?]. — *Aleuria repanda* (Pers. ex Pers.) Gill., Champ. Fr., Discom. **43**. 1879. — *Pustularia repanda* (Pers. ex Pers.) Rehm, Ascom. Lojk. **3**. 1882 (n.v.; cf. Rehm, *1894*). — *Discina repanda* (Pers. ex Pers.) Sacc., Syll. Fung. **8**: 100. 1889. — *Galactinia repanda* (Pers. ex Pers.) Le Gal *in* Bull. Soc. mycol. Fr. **78**: 210. 1962.

Apothecia gregarious, sessile or subsessile, usually rather large, up to 100 mm diam. Disc concave, becoming flat, sometimes convex or undulating, light chesnut brown. Receptacle at first cupulate, then expanded, repand, margin entire or crenate, externally dirty white or fawn coloured, usually minutely scurfy or downy. The outer layer of the ectal excipulum is made up of loosely interwoven hyphae with their branched and septate free ends usually directed outward perpendicularly to the surface of the receptacle and causing the latter to appear downy or scurfy; these hyphae are about 5–10 μ diam., usually arising from an inner, not clearly differentiated layer of compact, irregularly moniliform hyphae with cells mostly



Figs. 245–247. *Peziza repanda*. 245. Section of receptacle and hymenium. 246. Asci and paraphyses. 247. Ascospores. (From Miss Adcock).

strongly inflated up to about 25 μ diam.; immediately inside this prosenthymatous layer there is a pseudoparenchymatous layer about 200 μ thick, consisting of large polygonal, subglobose or subpyriform cells 15–40(–50) μ diam.; on top of this layer lies a thin layer of hyphae which mostly run in a horizontal direction, their cells 8–14 μ diam. but some of them may become strongly inflated to about 30 μ diam.; the inner side of this prosenchymatous tissue the cells of the hyphae becoming more frequently inflated and they gradually reorientate into a vertical direction and then pass into the upper pseudoparenchymatous tissue; the latter is made up of polygonal elongated or subglobose cells 15–70 μ diam. by up to 50 μ long, interspaced by delicate hyphal elements. Subhymenium of compact angular or polygonal cells 8–18 μ diam. Hymenium about 240 μ thick. Asci cylindrical, narrower towards the base, apex blued in Melzer's reagent, 8-spored, up to 300 μ long by 9–13 μ diam. Ascospores uniseriate, ellipsoidal, hyaline, smooth walled, without oil globules, 13.6–15.4 $\times$ 8–9 μ. Paraphyses septate, slender, 3–4 μ diam. below, apex indistinctly enlarged, subcylindrical or subclavate, up to 4.5 μ diam. (Fig. 245–247).

HABITAT AND DISTRIBUTION: on the ground or on decayed wood in Europe, North America, India and Australia.

The taxonomy of species of *Peziza* which have ellipsoidal, smooth, small (about 15 μ long) and non guttulate ascospores is very unsatisfactory. Seaver (*1928*) only recognized one species in this complex of species, but Dennis (*1960*) has shown that at least there are three rather common species involved here which can be easily recognized by the structure of their excipular tissues. A prolonged field and laboratory studies of the *Peziza repanda–varia–micropus–cerea* complex would be very valuable in establishing the limits of these species, which are very badly understood. A preliminary cultural observation in Sheffield has shown that the conidial states of species which superficially resemble *Peziza repanda* exhibit a considerable variation, which obviously will have to be taken into consideration in distinguishing between these closely related species.

The above description has been drawn from the South Australian specimen Miss Adcock, which appears to agree fairly well with the modern conception of *Peziza repanda* (Dennis, *1960*). In Herb. Kew. there are a few Australasian specimens with ascospores similar to those of Miss Adcock's collection, but since they exhibit some morphological variations which might be of diagnostic value, they are not included in the present species. In the specimen ex WARI 7466 (on wood, Wangaratta, Victoria, July 1956, M. Ferris 52), for example, the paraphyses are quite different from those of the typical collection of *Peziza repanda*, because instead of subcylindrical and straight their apices are strongly enlarged and curved. In the specimen ex WARI 7470 (on the ground, near a wood pile, Adelaide, South Australia, July 1956, J. B. Cleland) the prosenchymatous tissue that separate the lower and the upper pseudoparenchymatous tissue is thin or very poorly differentiated; however, it is not referable to the European species *Peziza micropus* Pers. ex Pers. because of its terricolous habitat, sessile and larger apothecia. These specimens

are not dealt with further because information on their fresh characters are wanting.

SPECIMENS EXAMINED

AUSTRALIA. South Australia. On soil, Adelaide, September 1956, Miss Adcock.

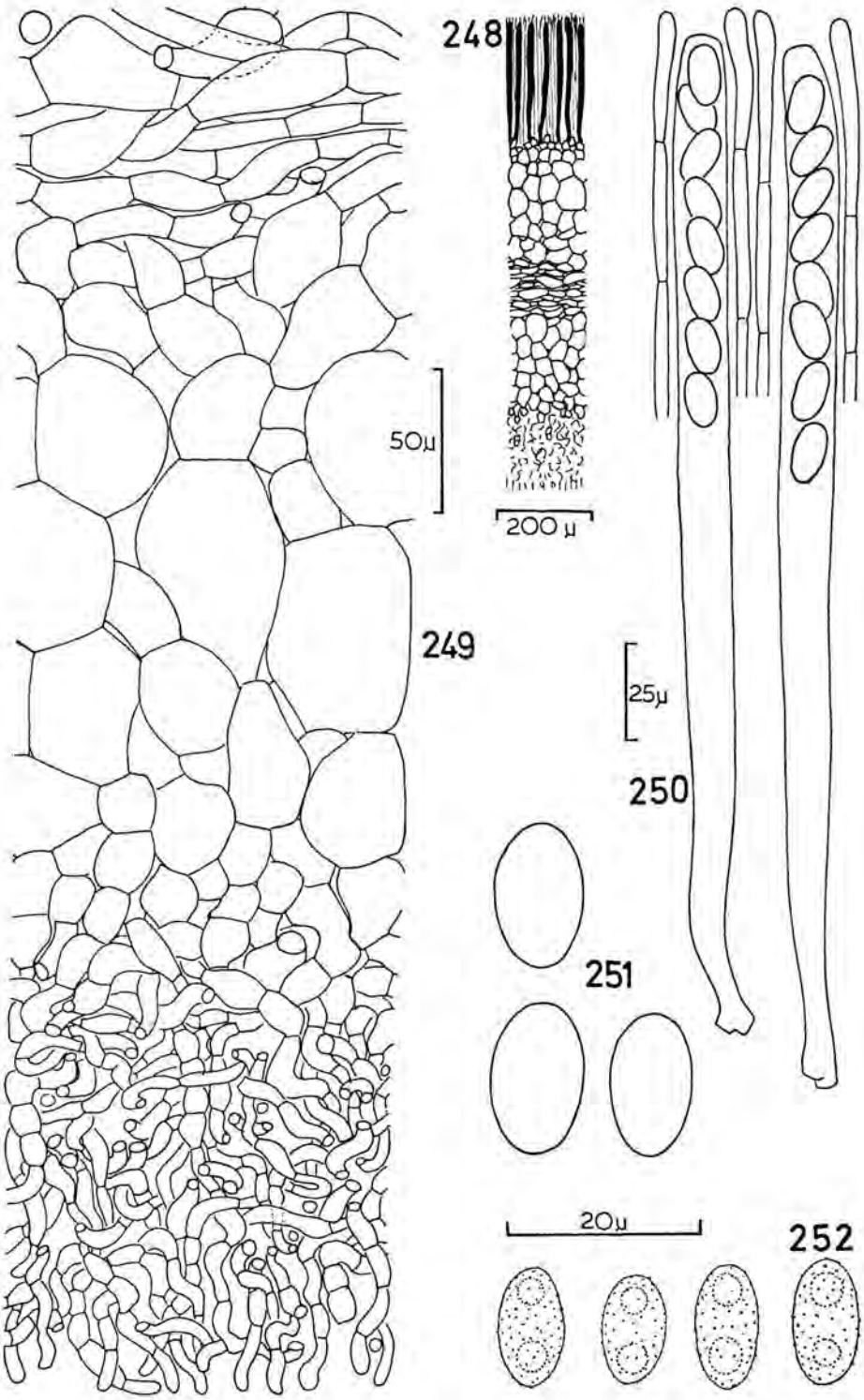
EUROPE. Great Britain. On the inner surface of fallen and charred bark of *Fagus sylvatica*, Burnham Beeches, Buckinghamshire, 20 October 1956, D. A. Reid.

PEZIZA CEREA Bull. ex Mérat

Peziza cerea Bull., Herb. Fr. *t. 44.* 1780; Sow., Col. Fig. Engl. Fung. 1: *t. 3.* 1797. — *Peziza vesiculosa* Bull. var. *cerea* (Bull.) Bull., Hist. Champ. Fr. 270. 1791. — *Peziza cerea* Bull. ex Mérat, Nouv. Fl. Paris, 2e Ed., 1: 25. 1821; Fr., Syst. mycol. 2: 52. 1822. — *Macroscyphus cereus* (Bull. ex Mérat) S. F. Gray, Nat. Arrang. Br. Pl. 1: 672. 1821. — *Plicaria cerea* (Bull. ex Mérat) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 327. 1870 (misapplied, = *Peziza domiciliana* Cooke?). — *Pustularia vesiculosa* (Bull. ex St-Amans) Fuckel var. *cerea* (Bull. ex Mérat) Rehm, Ascomyceten no. 201. 1875; Rehm *in* Rabenh. Kryptog.-Fl. I 3: 1016. 1894. — *Aleuria cerea* (Bull. ex Mérat) Gill., Champ. Fr., Discom. 44. 1879. — *Pustularia cerea*, (Bull. ex Mérat) Rehm *in* Ber. naturhist. Ver. Augsburg 26: 51. 1881. — *Galactinia vesiculosa* (Bull. ex St-Amans) Le Gal f. *cerea* (Bull. ex Mérat) Svrček *in* Česká Mycol. 14: 219. 1960. — *Galactinia cerea* (Bull. ex Mérat) Le Gal *in* Bull. Soc. mycol. Fr. 78: 208. 1962.

Apothecia usually gregarious, often shortly stipitate when young, medium to large, up to 50 mm or more diam. Disc at first concave, then expanded and sometimes irregular at maturity, colour when fresh not indicated on the label but in European material it is pale ochraceous or yellowish brown according to Dennis (*1960*). Receptacle cup shaped when young, at maturity becoming shallower and expanded, outer surface whitish, minutely downy to almost scurfy. The receptacle is composed of five or six distinct layers: the outermost layer is made up of loosely interwoven hyphae 3–10 μ diam., their free ends often perpendicular to the surface of receptacle. These hyphae sometimes arise from a more compact layer of shorter and broader celled hyphae 10–18 μ diam., but these two layers are often not very sharply differentiated and together they are about 70–130 μ thick; immediately inside this there is a pseudoparenchymatous layer about 175 μ thick, composed of large polygonal elongated cells 18–45 μ diam. by up to 60 μ long, usually arranged with their long axes at right angles to the surface of the receptacle; on top of this pseudoparenchymatous tissue lies a band about 80–100 μ thick, consisting of intricate or mostly horizontally running, septate and short celled hyphae 5–10 μ diam. or sometimes more; then follows an upper pseudoparenchymatous tissue made up of thin walled, polygonal or subglobose lobed cells up to 50 μ diam. by 80 long, infrequently interspersed by delicate hyphal elements. Subhymenium consisting of compact, angular, polygonal or pear shaped cells 8–16 μ diam. Hymenium about 230 μ thick. Asci 225–265 × 11–15 μ, subcylindrical, narrower towards the base, apex blued in Melzer's reagent, 8-spored. Ascospores uniseriate, hyaline, ellipsoidal, smooth walled, without oil globules, 13–15.7(–17.2) × 8–9.5 μ. Paraphyses septate, 3–4 μ diam. below, apex slightly enlarged, straight, up to 6.5 μ diam. (Fig. 248–251).

HABITAT AND DISTRIBUTION: on woody debris or bark, or often between



Figs. 248–252. — *Peziza cerea*. 248. Semi-diagramatic section of receptacle and hymenium. 249. Details of outer prosenchymatous layer, the lower pseudoparenchymatous layer and part of the inner layer of prosenchymatous tissue. 250. Asci and paraphyses. 251. Ascospores. (From J. G. Gibbs). — *Peziza domiciliana*. 252. Ascospores (From type).

paving stones in damp cellars, greenhouses etc. in Europe (type locality France), the United States and Australia.

The Australasian specimens described above have no colour annotation, but because the structure of their receptacle is similar to the British specimen J. M. B. King which has been described and illustrated by Dennis (*1960*) as *Peziza cerea*, and because of the characteristic habitat these specimens are assigned to the present species. It has also been found that these specimens fall within the limits of variation of numerous collections of *Peziza cerea* which I have studied in fresh condition.

McLennan & Halsey (*1936*) recorded the occurrence of *Peziza domiciliana* in Victoria and they classified it as species of *Aleuria* (Fr.) Gill. They described the apothecia of this species as having a "clay colour to tawny olive" disc, producing smooth ascospores 14–18 × 8–10.5 μ, but they did not indicate whether the latter were guttulate or not. It is very likely that this Victorian record was based on specimens of *Peziza cerea*. There has been some confusion on the scope of the species and the correct application of the specific epithets 'cerea', 'domiciliana' and 'adae'. The latter was an unnecessary revival of an older unpublished manuscript name and has always been treated as an obligate synonym of *Peziza domiciliana* (Gamundi, *1960*). According to Seaver (*1914*) the colour of the latter species is not always tinged with violet as was originally mentioned and illustrated by Cooke (*1879*). The fact that *Peziza cerea* and *Peziza domiciliana* grow in the same habitat makes the confusion even worse and some authors might have unintentionally merged the two species. Seaver (*1942*), for example, doubted whether these two species were really distinct. The separation of *Peziza cerea* and *Peziza domiciliana* can easily be confirmed by studying their ascospores, because in the type specimens of both *Peziza domiciliana* Cooke and its synonym *Peziza adae* Sadler apud Cooke (on wall paper in old house, Botanic Gardens, Edinburgh, Scotland, s. dat., collector unknown, and Inverleith House, Edinburgh, s. dat., Mr. Callender, respectively) the ascospores are biguttulate and at complete maturity their walls are minutely warted (Fig. 252). In contrast, the ascospores of *Peziza cerea* are smooth walled and devoid of oil globules. These distinguishing characters have been well illustrated by Le Gal (*1941*).

The original authorship of this species has always been attributed to Sowerby (*1797*). However, Sowerby himself unmistakenly indicated that it was both Bulliard's species and name which he dealt with, as is evident from his account which reads: "*Peziza cerea* Bulliard t. / Surely sufficiently distinct from *vesiculosa* & *cochleata* as the two following plates will shew. It is found on tan-beds." The number of the corresponding plate of Bulliard (*t. 44*) was not added by Sowerby but there is no doubt that his intention was to refer to Bulliard's plate 44. Sowerby's remark and illustration were published to show that it was unjustified to regard *Peziza cerea* as a variety of *Peziza vesiculosa* as was suggested by Bulliard

(*1791*). In validating the name *Peziza cerea* no reference was made by Mérat (*1821*) to Sowerby's publication; instead he ascribed this species to De Candolle, but like the latter he did cite plate 44 of Bulliard's Herbier de la France.

SPECIMENS EXAMINED

AUSTRALIA. South Australia. On wood in garage floor, Stirling, October 1953, Mr. Kirkpatrick, ex WARI 3575. — Victoria. On sandy floor of hollow concrete tank stand, Nirranda near Warrnambool, 22 June 1965, Mrs. Wilbur Matheson (comm. G. Beaton 293).

NEW ZEALAND. On clayey soil in glasshouse, Tiritea area, Winter 1931, J. G. Gibbs; on damp wood beneath leaking pipe, Church Street, Palmerston, October 1932, J. G. Gibbs.

EUROPE. Great Britain. On mortar in basement, Highgate Hospital, London, 3 July 1947, J. M. B. King.

PEZIZA TENACELLA Phill. apud Cooke

Peziza tenacella Phill. *apud* Cooke *in* Grevillea **15**: 100. 1887. — *Humaria tenacella* (Phill. apud Cooke) Sacc., Syll. Fung. **8**: 145. 1889.

Apothecia gregarious, sessile or rarely substipitate, medium size, 10–30 mm diam. or sometimes more. Disc mostly concave, brownish purple to umber, smooth. Receptacle shallow cup shaped, becoming repand at maturity, outer surface mostly purplish white, minutely scurfy to almost smooth. The outermost layer of the receptacle is up to 100 μ thick, of polygonal or pear shaped cells 12–30 μ diam. by up to 40 μ long, the surface cells tend to be smaller, often aggregating to form irregular small pustules; immediately inside this layer there is a layer of prosenchymatous tissue made up of tightly interwoven hyphae 4.5–7 μ diam.; the rest of the receptacle is occupied by a layer of large subglobular cells about 50 μ diam. or more, interspersed with a few, septate and branched hyphal elements 4–8 μ diam. Subhymenium about 50 μ thick, of compact polygonal, pyriform or barrel shaped cells up to 10 μ diam. Hymenium approximately 200 μ thick. Asci cylindrical, only slightly narrower towards their base, apex blued in Melzer's reagent, 8-spored, 185–220 × 7–8.5 μ. Ascospores uniseriate, hyaline, with two oil globules, ellipsoidal, smooth walled but at complete maturity they appear very minutely warted when examined under an oil immersion lens, 10.5–12 × 5.4–6.5 μ. Paraphyses slender, septate, typically unbranched, 1.8–2.5 μ diam. below, gradually enlarged above, apex clavate, curved or almost hooked, 3.6–6 μ diam., with coloured granular contents (Fig. 253).

HABITAT AND DISTRIBUTION: on burnt ground in Australia (type locality Victoria).

Mr. G. Beaton (pers. comm., 1966) wrote that when fresh the colour of the disc of *Peziza tenacella* "is a beautiful translucent violet when immature, becoming deep violet through to brownish black when old . . .". It is very likely that this species is identical with the one described by McLennan & Halsey (*1936*) as *Aleuria violacea* (Pers. ex Pers.) Gill. They correctly pointed out that their specimens did not fit Boudier's (*1885*, *1907*) conception of *Aleuria* (Fr.) Gill. emend. Boud. very well because of the presence of oil globules in the ascospores. If Boudier's system of classifi-

cation is followed, the present species will have to be classified as a species of *Galactinia* because of its guttulate ascospores. It is evident that here we are dealing with two different species. Study of a British specimen (on burnt ground amongst *Funaria* at the head of Glen More, Aviemore, Scotland, 14 April 1949, R. W. G. Dennis) identified by Dr. Marcelle Le Gal as *Peziza violacea* Pers. ex Pers. and described and illustrated by Dennis (*1960*) under the latter name shows that this European species has perfectly smooth but slightly larger ascospores, 12.7–15.4 × 6.5–8 μ, which at maturity appear to be non-guttulate (Fig. 254). As has been described above the ascospores of the Australian species *Peziza tenacella* has distinctly biguttulate ascospores which are very minutely rough walled. Other European mycologists such as Boudier (*1906*), Le Gal (*1941*)

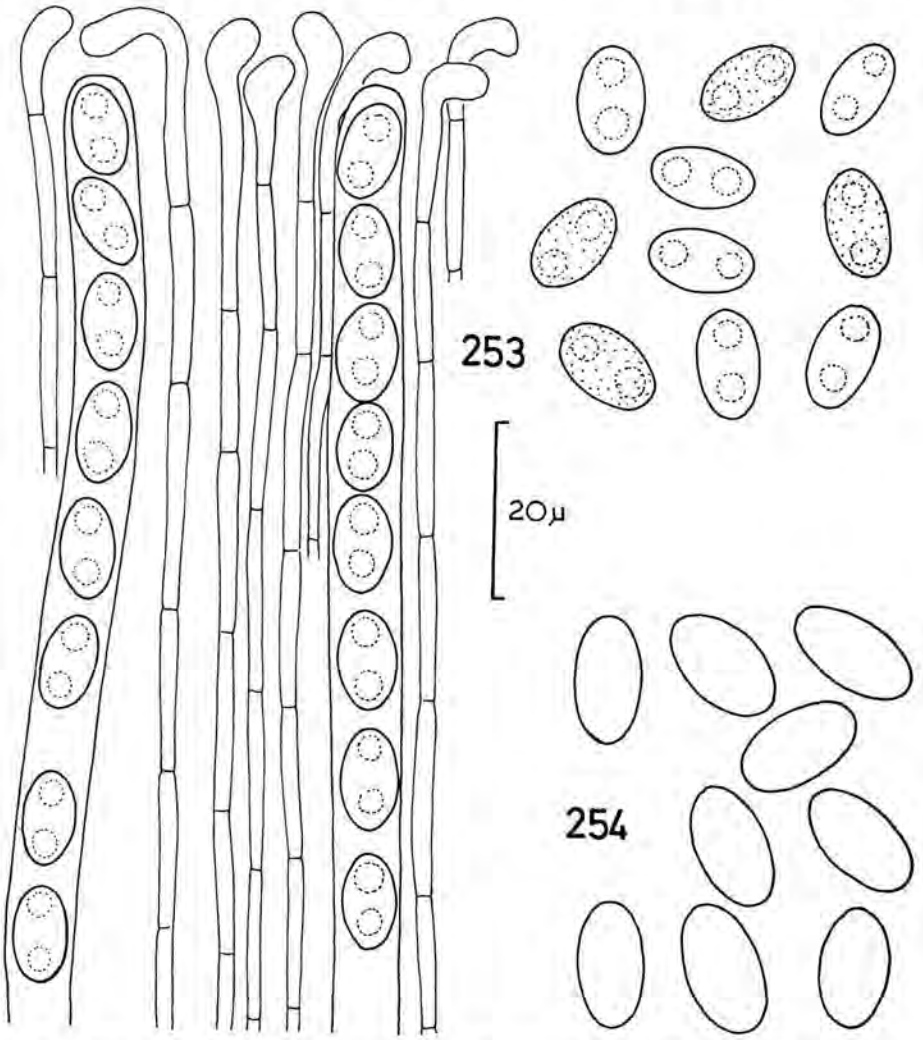


Fig. 253, 254. — *Peziza tenacella*. 253. Ascospores, part of asci and paraphyses (From type). — *Peziza violacea*. 254. Ascospores (From R. W. G. Dennis).

and Moser (*1963*) had used the name *Peziza violacea* for the rather rare smooth spored species.

Seaver (*1928*) misapplied the name *Peziza violacea* for a species with biguttulate and distinctly but minutely warted ascospores which probably is conspecific with the common (at least in Great Britain) *Peziza praetervisa* Bres. There have been indeed many specimens of the latter species which have been passed under the name *Peziza violacea*, but there should be no difficulty in distinguishing these two species by their spore wall characters.

Peziza tenacella is closely related to *Peziza praetervisa* since both species have a similar type of habitat, colour of apothecia, internal structure of the receptacle, ascus, ascospore and paraphysis characters. They are maintained as two different species because the latter species has coarser ascospores and less strongly curved paraphyses.

SPECIMENS EXAMINED

AUSTRALIA. Tasmania. On burnt ground, near Blackmans Bay, July 1927, L. Rodway (sent as *Otidea tasmanica* Rodway). — Victoria. On [burnt] ground, Melbourne, s. dat., F. Reader 15 [type specimen of *Peziza tenacella* Phill. apud Cooke]; on charcoal in burnt over area, Erskine River Valley, near Lorne, 27 July 1963, Mrs. K. Beaton (comm. G. Beaton 149).

PEZIZA PRAETERVISA Bres.

Peziza praetervisa Bres. *in* Malphigia 11: 266. 1897. — *Galactinia praetervisa* (Bres.) Boud., Icon. mycol. 2: *pl. 292*. 1906; Hist. Class. Discom. Eur. 48. 1907. — *Aleuria praetervisa* (Bres.) Bres., Icon. mycol. 24: 1217. 1933.

Otidea tasmanica Rodway *in* Pap. Proc. R. Soc. Tasmania 1924: 116. 1925.

Rodway's original description of *Otidea tasmanica* reads as follows: "Sessile, concave, then plane but when mature strongly recurved, about 1 cm. diameter, attachment marginal or nearly so, delicately fleshy, dull lilac colour, externally glabrous, spores oblong, obtuse, smooth, 12–16 × × 5 μ." In Herb. Kew. there is part of its type specimen consisting of one apothecium. In section it appears that the outer layer of its receptacle is composed of large subglobose to polygonal elongated cells about 25 μ diam. Inside this there is a thin layer of compactly interwoven short celled hyphae 8–16 μ diam. The rest of receptacle is made up of larger but thinner walled cells which are subglobose or polygonal, 20–42 μ wide by up to 60 μ long, interspersed by numerous slender septate hyphal elements 3–7(–10) μ diam. Subhymenium of a compact short celled tissue, individual cells 6–12 μ diam., subglobose, polygonal, barrel shaped or even pyriform. Hymenium about 175 μ thick. Asci cylindrical, slightly narrower towards the base, apex blued in Melzer's reagent, 8-spored, 160–185 × 7.5–9 μ. Ascospores uniseriate, hyaline, biguttulate, ellipsoidal to oblong ellipsoidal, distinctly covered by minute warts, 10–12.7 × × 5.4–6.5 μ. Paraphyses slender, septate, 2–2.7 μ diam. below, apex strongly inflated, up to 5.5 μ in diameter, gently curved. According to Webster, Rifai & El-Abyad (*1964*) *Peziza praetervisa* has an *Oedocephalum* conidial state (Fig. 255).

HABITAT AND DISTRIBUTION: on burnt ground in Europe (type locality Italy), probably also in North America and Tasmania.

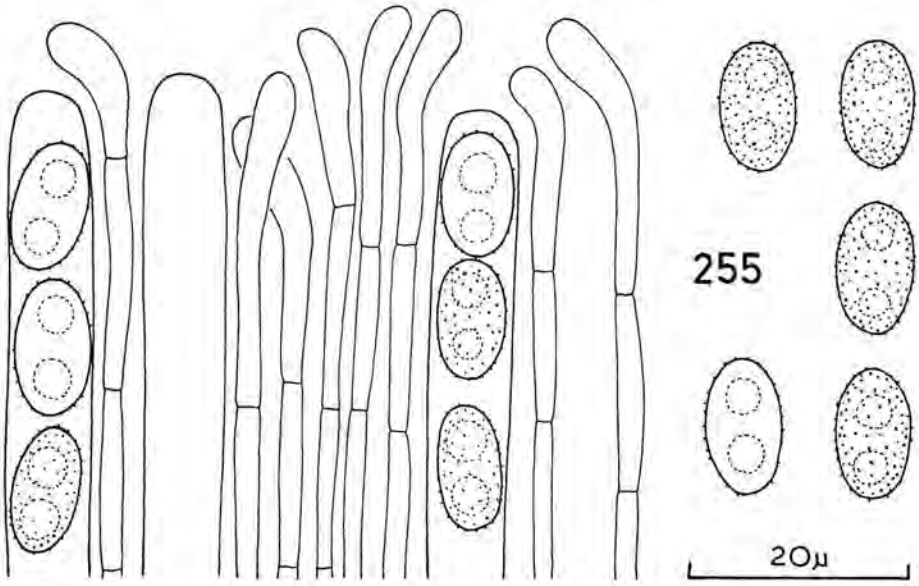


Fig. 255. *Peziza praetervisa*. Ascospores, part of asci and paraphyses (From type of *Otidea tasmanica*).

SPECIMENS EXAMINED

AUSTRALIA. Tasmania. On burnt ground, West Coast, November 1923, L. Rodway [type specimen of *Otidea tasmanica* Rodway].

EUROPE. Great Britain. On burnt ground, Longshaw Pastures, near Sheffield, 13 November 1963, J. Webster (SHD M-2754).

Peziza psammobia Rifai, *spec. nov.*

Apothecia gregaria, mediocria, usque 25 mm diam., cupulata, disco concavo, atro-brunnea. Asci cylindracei, apice jodo caerulescentes, octospori, 280–330 × 12–15.5 μ. Ascospori uniseriati, hyalini vel subhyalini, late ellipsoidei, uni-guttulati, regulariter verrucosi, 13.8–16.3 × 10–11.5 μ. Paraphyses septatae, 3–4 μ diam., apice subclavatae, 5 μ diam.

Hab. ad terram sabulosam, prope Adelaide, Australia australi, 29 Septembri 1923, J. B. Cleland typus est [K].

Apothecia scattered to gregarious, medium size, up to 25 mm diam. (at first immersed?). Disc deeply concave, smooth, dark blackish brown. Receptacle cup shaped to urn shaped, "contracted below into a rooting stem-like base up to 1" long" (J. B. Cleland's field notes), slightly paler than the disc but much paler towards the base, margin incurved, outer surface indistinctly villose. The excipular tissue is composed of a thin outer layer of brown coloured, coarse, septate, often short celled and interwoven hyphae (8–)10–18 μ diam., which envelops a thicker inner layer made up of coarser but much paler hyphae interspaced by inflated polygonal cells about 30 μ diam., often simulating a pseudoparenchymatous tissue; the rest of the receptacle is similarly constructed but less obviously prosenchymatous because most of the cells are inflated up to about 40 μ diam. and are polygonal, pear shaped or subglobose and irregularly orientated, interspersed with narrow hyphal elements about

10 μ diam. Subhymenium also appearing almost pseudoparenchymatous, with subglobose, pyriform or subcylindrical-celled hyphae 8–15 μ diam. Hymenium about 300 μ thick. Asci cylindrical, slightly narrower towards the base, apex blued in Melger's reagent, 8-spored, 280–330 × 12–15.5 μ. Ascospores uniseriate, hyaline or subhyaline, very broadly ellipsoidal, 13.8–16.3 × 10–11.5 μ, with one large oil globule, sparsely but regularly covered by small pulvinate or rounded warts 0.5–1 μ diam. Paraphyses septate, unbranched except near the base, 3–4 μ diam. below, apex only slightly enlarged, subclavate up to about 5 μ diam., showing a tendency to aggregate with each other (Fig. 256–258).

HABITAT AND DISTRIBUTION: on sand or sandy soil in Australia.

The European species *Peziza badiofusca* (Boud.) Dennis somewhat resembles the present species but they can be easily separated from each other by their microscopical characters. The ascospores of *Peziza psammobia* are broader, hence they have a slightly smaller length and breadth ratio and appear rounder. Maas Geesteranus (*1955*) gave the range of the spore size of Dutch collections of *Peziza badiofusca* as 13.4–15.2 × × 8.1–10.3 μ, and the figures given by Dennis (*1960*), 13–15 × 9–10 μ, also fall within this range. As illustrated by Maas Geesteranus the spore sculpture of *Peziza badiofusca* takes the form of slightly elongated warts which are not always rounded as in this Australian species.

The habitats of the two species are also quite different because *Peziza badiofusca* prefers bare or mossy clayey soil, whereas all collections of *Peziza psammobia* listed below came from sand or sandy soil. Hansford (*1954*) identified all these collections as *Sarcosphaera ammophila* (Dur. & Mont.) Seaver [= *Peziza ammophila* Dur. & Mont.] but the latter species has completely smooth ascospores. It is not known whether or not the apothecia of the present species were immersed in the ground when they were young, as is often the case with fungi growing in loose sands.

SPECIMENS EXAMINED

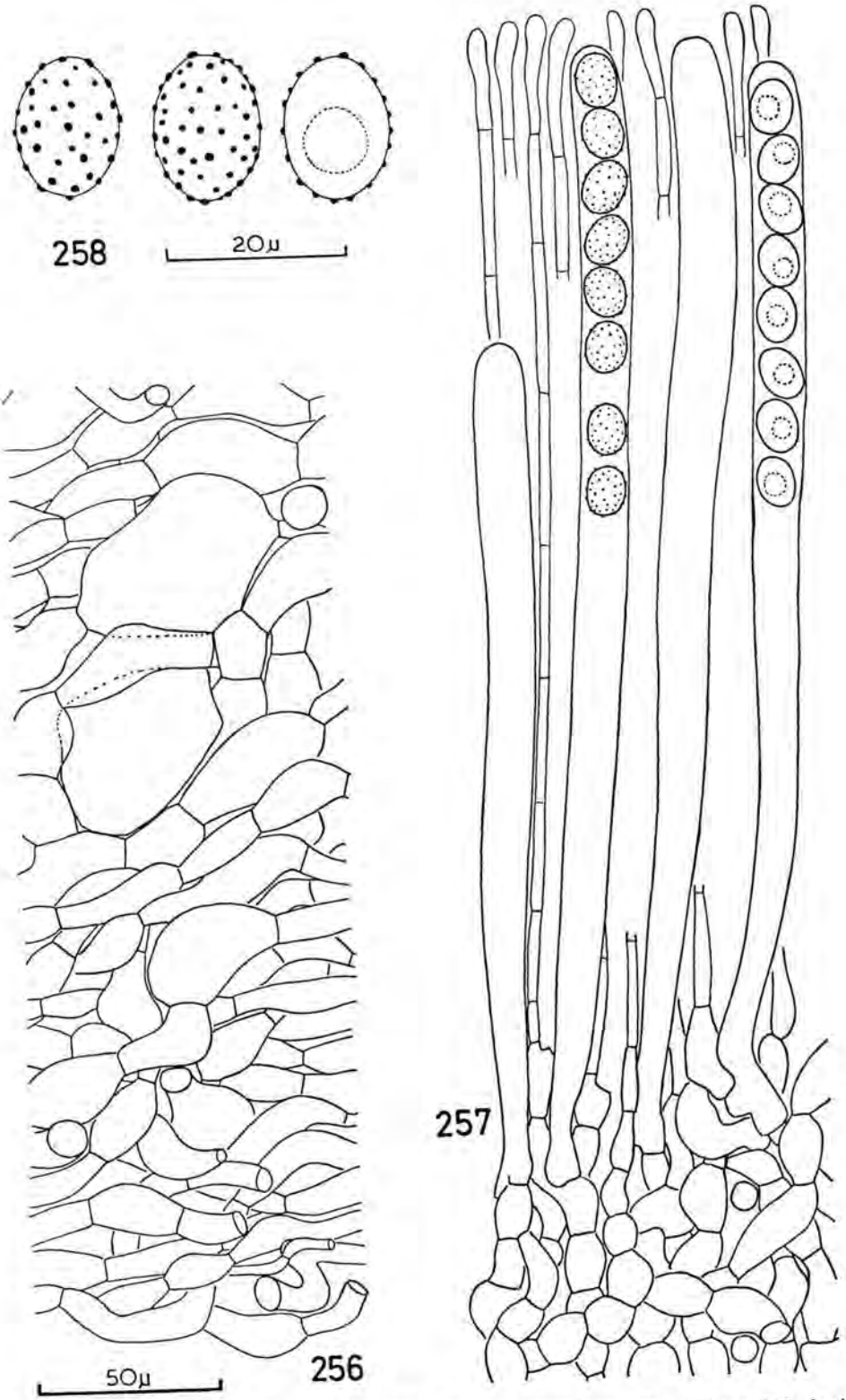
AUSTRALIA. South Australia. On sand, Mt. Compass, 8 October 1924, J. B. Cleland; on sand, Encounter Bay, September 1924, J. B. Cleland, ex WARI 3129; on sandy soil, Happy Valley, near Adelaide, 29 September 1923, J. B. Cleland, ex WARI 2538 [type specimen of *Peziza psammobia* Rifai]. — Western Australia. In sand, Narrogin, 30 August 1926, J. B. Cleland, ex WARI 3502.

Peziza retispora Rifai, *spec. nov.*

Apothecia gregaria, brunnea, usque 20 mm diam., cupulata. Subhymenium e cellulis subangularibus 14–40 μ diam. compositum. Asci cylindracei, apice jodo caerulescentes, usque 460 μ longi, 12–16 μ diam., octospori. Ascospori ellipsoidei, uniguttulati, 17.2–20 × 10–11.8 μ, reticulati, hyalini. Paraphyses 2.7–4 μ diam., septatae, apice subclavatae vel subcapitatae, recti, brunnei, usque 7 μ diam.

Hab. ad terram sabulosam, prope Anglesea, Victoriae, 5 Julii 1964, G. Beaton 207 typus est [K].

Apothecia said to be almost completely immersed in sandy soil, gregarious, medium size, up to 20 mm diam. Disc deeply concave, when fresh apparently of some shades of brown, becoming dark blackish brown when dried. Receptacle deeply cupulate, margin entire or irregularly



Figs. 256–258. *Peziza psammobia*. 256. Section of outer layer of receptacle. 257. Asci and paraphyses. 258. Ascospores. (From type). — Figs. 256, 257 to same scale.

crenate or torn, contracted below into a short stem-like base, outer surface yellowish brown, downy to scurfy. Subhymenium about 100 μ thick or even more, of large angular or polygonal to subpyriform cells 14–40 μ diam., mostly isodiametric but sometimes also elongate to about 50 μ long. Below this there is a thick layer of large subglobose cells 15–30 μ diam., interspersed by numerous compactly interwoven delicate hyphal elements with barrel shaped cells 5–10 μ diam.; this layer is enveloped from the outside by a layer of thin walled, large polygonal or pear shaped cells up to about 45 μ diam., and towards the surface of the receptacle the cells usually become longer and slightly narrower, often forming a prosenchymatous tissue. Hymenium about 420 μ thick. Asci long cylindrical, only slightly narrower towards the base, 8-spored, apex blued in Melzer's reagent, up to 460 μ long by 12–16 μ diam. Ascospores uniseriate, ellipsoidal, containing one large oil globule, hyaline 17.2–20 × 10–11.8 μ, covered by a delicate reticulum, meshes of reticulations rather irregular, 1–3 μ diam., their ridges often broken, uneven and less than 0.5 μ high. Paraphyses septate, unbranched, 2.7–4 μ diam., apex subclavate to subcapitate, straight, up to 7 μ diam., containing brownish granules.

This is one of the *Peziza badia* complex and can be distinguished from all described species of this complex by its long asci, more or less completely reticulate ascospores and the large celled subhymenium (Fig. 259–261).

HABITAT AND DISTRIBUTION: in sandy soil in Australia.

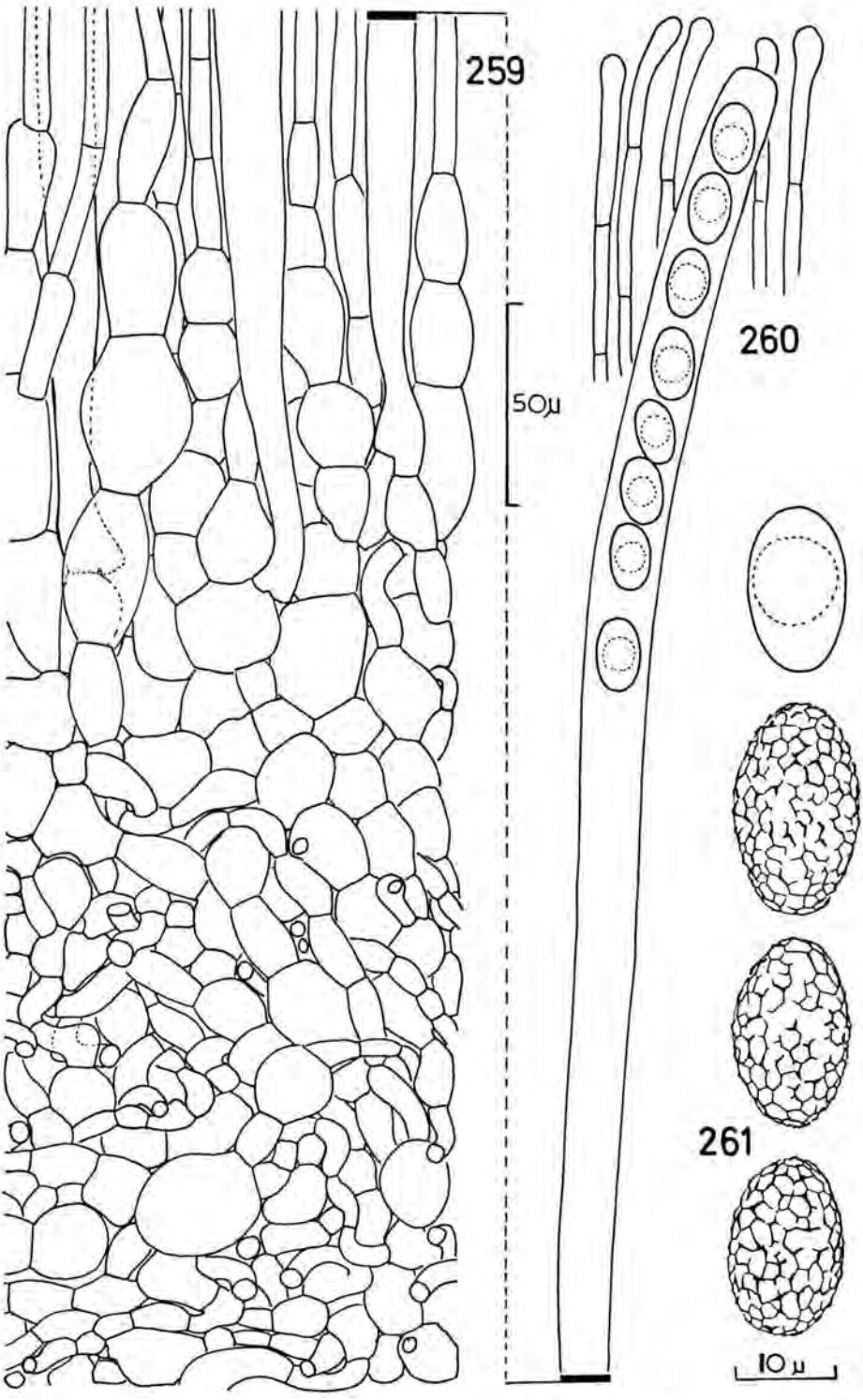
SPECIMEN EXAMINED

AUSTRALIA. Victoria. In sandy soil between dunes and road, 2 miles west of Anglesea, 5 July 1964, G. Beaton 207 [type specimen of *Peziza retispora* Rifai].

PEZIZA BADIA Pers. ex Mérat

Peziza badia Pers., Obs. mycol. 2: 78. 1799. — *Pezia badia* Pers. *ex* Mérat, Nouv. Fl. Paris, 2e Ed., 1: 24. 1821; Fr., Syst. mycol. 2: 46. 1822. — *Scodellina badia* (Pers. ex Mérat) S. F. Gray, Nat. Arrang. Br. Pl. 1: 669. 1821. — *Plicaria badia* (Pers. ex Mérat) Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 327. 1870. — *Aleuria badia* (Pers. ex Mérat) Gill., Champ. Fr., Discom. 43. 1879. — *Galactinia badia* (Pers. ex Mérat) Boud., Hist. Class. Discom. Eur. 48. 1907.

Apothecia gregarious, medium to large, up to 80 mm diam., sessile. Disc concave or undulate, olive brown, darker when dried. Receptacle cup shaped, often somewhat expanded or irregularly contorted at maturity, outer surface reddish or chestnut brown and, especially towards the margin of the cup, distinctly scurfy. The outer layer of the excipular tissue is made up of large polygonal cells which arise from an inner layer of compactly interwoven coarse hyphae (6–)9–16 μ diam., often interspersed by larger subglobular cells up to 22 μ diam. The subhymenium is not always sharply differentiated from the latter layer except that its cells are shorter, more isodiametric or sometimes pear shaped, more regularly orientated and usually less than 19 μ diam., occasionally forming a pseudoparenchymatous tissue. Hymenium about 280 μ thick. Asci cylindrical, slightly narrower towards the base, apex turning blue in Melzer's reagent, 8-spored, 270–310 × 11–14 μ. Ascospores uniseriate, 17–20 × 9.1–11.5 μ, ellipsoidal, hyaline, usually with one large oil globule, covered by delicate, about 0.5 μ diam., short ridges which often anastomose to form an incomplete and irregular reticulum, the meshes of which usually elongate and are orientated longitudinally. Paraphyses simple,



Figs. 259–261. *Peziza retispora*. 259. Section of upper part of excipulum, large celled subhymenium and lower part of hymenium. 260. Ascus and paraphyses. 261. Ascospores. (From type).

septate, 3–4.5 μ diam. below, apex only slightly enlarged, about 6 μ diam., subclavate, straight (Fig. 262).

HABITAT AND DISTRIBUTION: on the ground, often in sandy soil in woods in Europe (type locality Germany), North America and probably also Australia.

The occurrence of this species in Australia has been frequently reported, the latest record being that of Rodway (*1925*). The specimens from Western Australia described by Cooke (*1892*) as *Peziza badia* have been found to be immature; one of them, listed below, probably does represent this species. I have not seen any of Rodway's specimens but the one recorded by Tepper (*1885*) is also immature and very likely to represent a different species. The above description has been exclusively drawn from a British specimen which agrees in all respects with the current conception of *Peziza badia* (Le Gal, *1941, 1947*; Korf, *1955*; Dennis, *1960*).

SPECIMENS EXAMINED

EUROPE. Great Britain. On bare sandy soil, Oxshott, Surrey, 13 October 1946, P. H. B. Talbot.

AUSTRALIA. Western Australia. On the ground, South West Australia, 1881, T. Muir (Comm. Baron v. Müller).

Peziza subaurantiaca (Massee) Rifai, *comb. nov.*

Barlaea subaurantiaca Massee *in* J. Bot., Lond, **34**: 147. 1896. — *Barlaeina subaurantiaca* (Massee) Sacc. & Syd. *in* Sacc., Syll. Fung. **14**: 749. 1899.

The type and only specimen available for the present study consists of an apothecium which is not in a very good shape. This was described by Massee as follows: "Ascophore subsessile, contracted into a very short, stem-like base; at first convex and closed, then expanding and becoming plane, the entire margin frequently drooping; disc umbilicate and usually furnished with a few radiating shallow furrows, tan-colour with a tinge of orange; externally whitish, very minutely scurfy, about 1 cm. across; excipulum formed of densely interwoven, septate hyphae about 6–7 μ thick, cortex pseudoparenchymatous, and running out into minute, irregular groups of cells that give the scurfy appearance to the outside; asci cylindrical, apex subtruncate, base narrowed into a long pedicel, 8-spored; spores obliquely 1-seriate, hyaline, 1-guttulate, rather coarsely warted, globose or subglobose, 14 μ diam.; paraphyses septate, the clavate tip 7–8 μ thick." To this rather extensive description I can only add the following observations: In Melzer's reagent the hymenium gives a very weak positive reaction, but the specimen may have been tampered with by chemicals of some sort. Unlike those of species of *Plicaria*, the ascospores of the present species are hyaline, subglobose to broadly ellipsoidal, but never globose and measure 17–20 × 13.5–16.5 μ; they are covered with a fine reticulum, whose meshes mostly are 6-sided or sometimes rather irregular and measure 1.5–3 μ diam. The ectal excipulum consists of thin walled large subglobose cells up to 40 μ diam. (Fig. 263).

HABITAT AND DISTRIBUTION: on the ground in Victoria.

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On the ground, Hamilton, s. dat., collector unknown [type specimen of *Barlaea subaurantiaca* Massee].

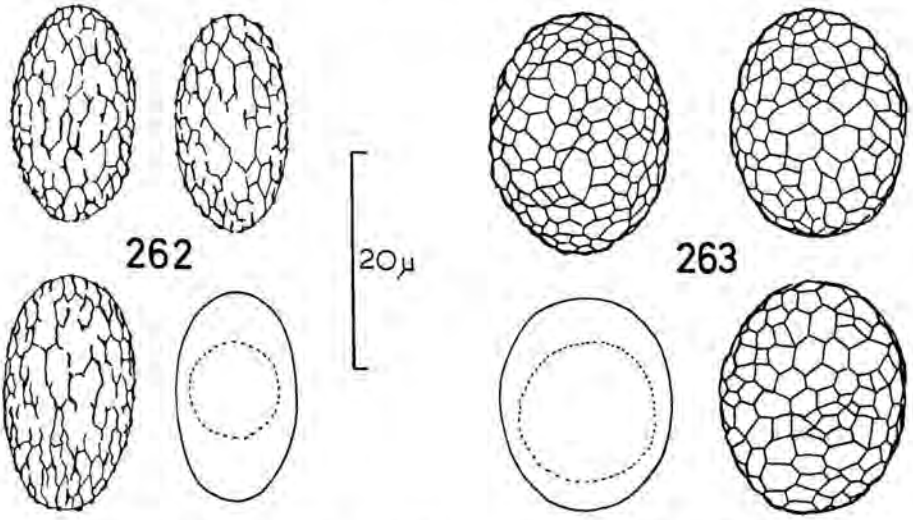


Fig. 262, 263. — *Peziza badia*. 262. Ascospores (From P. H. B. Talbot). — *Peziza subaurantiaca*. 263. Ascospores (From type).

Peziza petersii Berk.

Peziza petersii Berk. *in* Grevillea 3: 150. 1875. — *Galactinia petersii* (Berk.) Le Gal, Discom. Madag. 51. 1953.

Peziza lumbricalis Cooke *in* Grevillea 8: 61. 1879. — *Discina lumbricalis* (Cooke) Sacc., Syll. Fung. 8: 101. 1889.

Galactinia sarrazini Boud. *in* Bull. Soc. mycol. Fr. 3: 147. 1887.

Apothecia scattered to gregarious, large, up to 75 mm diam. according to Cooke (*1879*). Disc rather deeply concave, pale greyish brown to pale reddish brown. Receptacle cup shaped, margin sometimes undulate, outer surface much paler than the disc, darker towards the margin of the cup, somewhat scurfy. Hymenium about 250 μ thick. Asci cylindrical, slightly narrower towards the base, apex turned blue in Melzer's reagent, 8-spored, 200–260 × 6.5–8.5 μ. Ascospores 10–12.7 × 5–6.3 μ, uniseriate, ellipsoidal to oblong ellipsoidal, hyaline, with two large oil globules, covered by warts and short sinuate broken ridges which sometimes anastomose with each other but these do not normally form a reticulum. Paraphyses slender, 2–3.6 μ diam. below, septate, unbranched, apex distinctly enlarged to about 6.5 μ diam., slightly curved, containing brownish granules (Fig. 264).

Habitat and distribution: on burnt ground in the United States (type locality Alabama), Argentina, Europe, Madagascar and Australasia.

Though widely spread this species seems to be always rare. Its distinctive features are the large cupulate apothecia and the small biguttulate ascospores covered by elongated wavy, rarely anastomosing ridges. *Peziza petersii* was originally described from Alabama, but this name does not appear in recent North American literature apparently because Seaver (*1928*) confused it with the common pyrophilous species *Peziza echinospora* Karst., which he called *Peziza pustulata* Hedw. *Peziza echinospora*, however, has larger ascospores which bear small and simple warts.

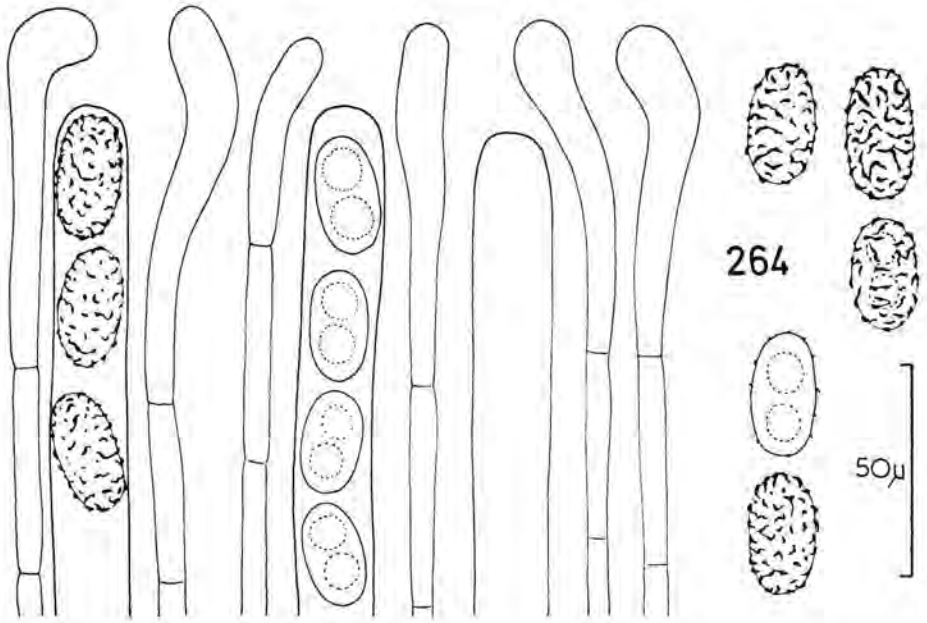


Fig. 264. *Peziza petersii*. Ascospores, part of asci and paraphyses (From type of *Peziza lumbricalis*).

SPECIMENS EXAMINED

NEW ZEALAND. On [burnt] ground, Waitaki, s. dat., S. Berggren 72 [type specimen of *Peziza lumbricalis* Cooke].

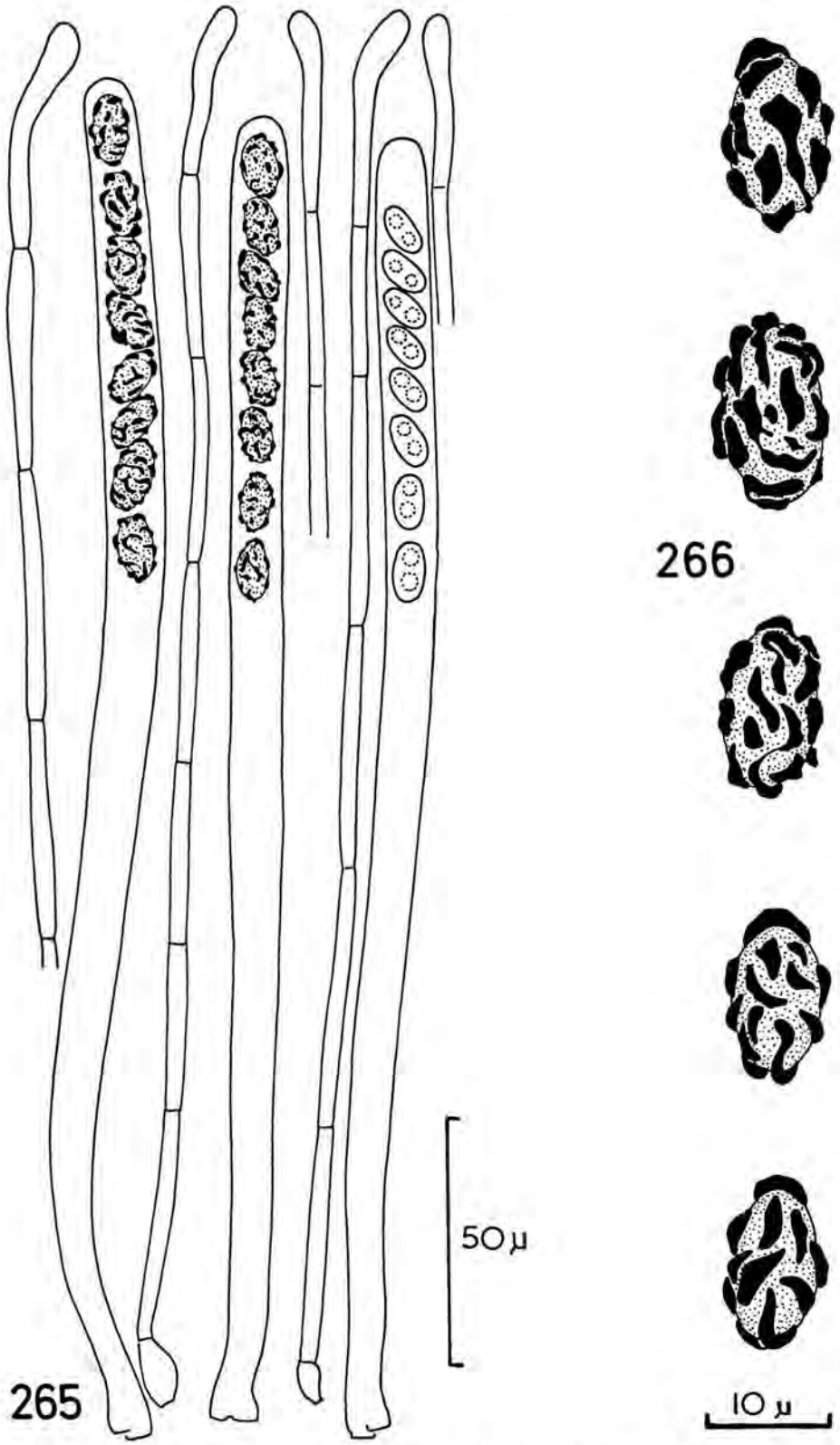
NORTH AMERICA. U.S.A. On burnt soil, Alabama, s. dat., Peters 6063 [type specimen of *Peziza petersii* Berk.].

PEZIZA RETIDERMA Cooke

Peziza retiderma Cooke, Mycograph. 1: 176. 1877. — *Phaeopezia retiderma* (Cooke) Sacc., Syll. Fung. 8: 472. 1889. — *Aleurina retiderma* (Cooke) Sacc. & Syd. *in* Sacc., Syll. Fung. 16: 739. 1902. — *Galactinia retiderma* (Cooke) Le Gal, Discom. Madag. 57. 1953.

Galactinia cristulata Le Gal *in* Ann. Sci. nat. (Bot.) XI 8: 98 *fig. 5A*. 1947 (nomen nudum).

Apothecia gregarious to caespitose, medium size, up to about 40 mm diam. Disc reddish or rusty brown to yellowish brown, deeply concave, often undulate. Receptacle about 1 mm thick, cup shaped but often becoming lobed or irregular through mutual pressure, sometimes one sided, obliquely seated and subauriculate, margin entire but irregularly wavy, outer surface minutely scurfy or furfuraceous, slightly paler than the disc. Hymenium up to about 270 μ thick. Asci cylindrical, slightly narrower towards the base, 8-spored, apex blued in Melzer's reagent, 225–280 μ long by 8–10 μ wide. Ascospores uniseriate, at first hyaline but ultimately become brown coloured, ellipsoidal, containing two large oil globules, when young smooth walled, coarsely sculptured at maturity; spore sculpturing usually taking the form of large interrupted wavy ridges up to 2 μ high, occasionally irregularly anastomosing with each other to form



Figs. 265, 266. *Peziza retiderma*. 265. Asci and paraphyses. 266. Ascospores. (From Colenso b-889).

an imperfect reticulum; the spores sometimes appear apiculate and without the ornamentation they measure 10–12.7 × 5.5–6.7 μ. Paraphyses stout, about 4 μ diam. below, wall undulate, often constricted at the septa, typically unbranched, apex enlarged to about 6 μ diam. (Fig. 265–266).

HABITAT AND DISTRIBUTION: on the ground in North America (type locality Alabama), Argentina, Madagascar and New Zealand.

As has been discussed earlier under *Peziza vesiculosa* the two New Zealand specimens listed below were originally sent as part of the type specimen of *Peziza spenceri*. These specimens are rather badly preserved so that details of the apothecial construction of the present species had to be omitted from the above description. Le Gal (*1953*) has provided an extensive illustrated description of the structure of the excipular tissue of *Peziza retiderma* based on collections from Madagascar.

Seaver (*1928*) listed the present species as a synonym of *Peziza atrovinosa* Cooke (*1875*, *1875a*, *1876*) but as Le Gal (*1953*) already pointed out this is obviously erroneous. An examination of the collection designated here as the lectotype specimen of the latter (on the ground, Poughkeepsie, New York, U.S.A., s. dat., W. Gerard) shows that though its ascospores are also brown coloured like those of *Peziza retiderma*; they are slightly larger in size, 11.75–16 × 7.5–9.5 μ according to Le Gal, and covered by a more complicated reticulum with ridges or meshes of a reticulum which varies considerably in thickness. In recent European literature (Dennis, *1960*; Moser, *1963*; C. M. I. Cat. Cult. Coll., 4th Ed., 1964) *Peziza atrovinosa* has been regarded as an older name for *Peziza ostracoderma* Korf (≡ *Plicaria fulva* Schneider; Korf, *1961*). These two species, however, are quite different, because the ascospores of the authenticated specimen of the latter (auf gedämpfter Erde in einem Gewächshaus der Biologischen Bundesanstalt, Berlin–Dahlem, März 1953, R. Schneider) are always hyaline and never dark coloured like those of *Peziza atrovinosa*; its spore markings are also much finer and the reticulum is more regular. As far as I am aware the true *Peziza atrovinosa* is not known to occur outside North America.

SPECIMENS EXAMINED

NEW ZEALAND. On the ground, s. dat., Colenso b-664; ibid., Colenso b-889.

NORTH AMERICA. U.S.A. On the ground, Portland, Mains, s. dat., Fuller 64 [type specimen of *Peziza retiderma* Cooke].

PEZIZA THOZETII Berk.

Peziza thozetii Berk. *in* J. Linn. Soc. (Bot.) **18**: 388. 1881. — *Humaria thozetii* (Berk.) Sacc., Syll. Fung. **8**: 144. 1889.

Apothecia gregarious, medium size, up to about 25 mm diam., sessile or subsessile. Disc shallowly concave, smooth, colour when fresh unknown, in one specimen (J. H. Warcup) appearing olivaceous brown when dried, usually becoming dark greyish or purplish brown when moistened. Receptacle saucer shaped to shallowly cupulate (pateriform according to Berkeley, *1881*), margin entire, outer surface generally minutely rough,

reddish brown, paler than the disc. The receptacle is made up of large, subglobose or polygonal cells 20–60 μ diam. infrequently interspersed by about 8 μ diam. hyphal elements; towards the surface of receptacles these cells become smaller and darker coloured and usually more angular. Subhymenium of angular or pear shaped to short barrel shaped cells 7–12 μ diam. Hymenium about 350 μ thick. Asci cylindrical, apex blued in Melzer's reagent, 300–400 × 13–15 μ, 8-spored. Ascospores usually obliquely uniseriate, when young distinctly biguttulate, fusiform ellipsoidal, at first hyaline and smooth walled, but soon covered by minute elongated or rounded warts and pulled out truncated conical apiculus at each end which is 3–4.5 μ wide at the base by up to 2.7 μ high; mature ascospores are pale brown coloured and without the apiculi they measure (20–)23.5–26.7 × 9–11 μ. Paraphyses stout, many septate, typically unbranched, 4–6.3 μ diam. below, apex hardly enlarged and in fact almost subcylindrical, containing brownish granules (Fig. 267).

HABITAT AND DISTRIBUTION: on plant debris and on the ground in Australia (type locality Victoria).

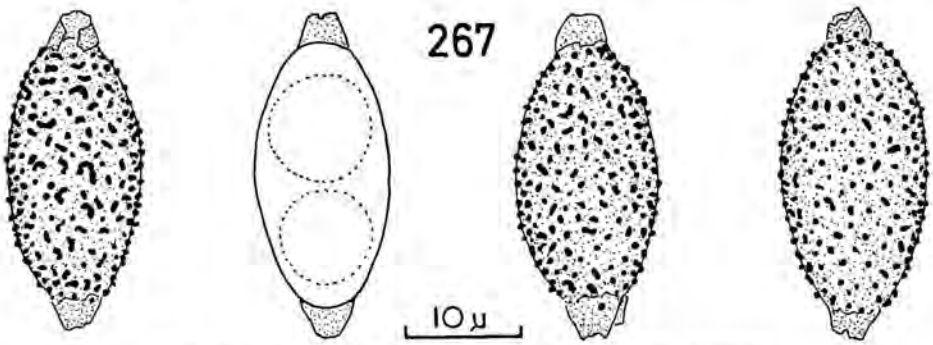


Fig. 267. *Peziza thozetii*. Ascospores (From H. Tisdall).

Cooke's (*1892*) contention that *Peziza thozetii* was only an immature state of the European species *Peziza apiculata* Cooke (*1877*) does not seem to be supported by the specimens studied. As Malençon (*1939*) has already indicated, the Australian collections identified and recorded by Cooke (*1892*) as *Peziza apiculata* are slightly different from the type specimen of the latter (in cortice putre abietino silva, August 1875, Italia, P. A. Saccardo). In general it can be stated that the European species has slightly smaller apothecia and ascospores but the latter usually have longer apiculi. The minute warts that cover the surface of its ascospores are always rounded and not elongated as in *Peziza thozetii*. Since the variation of *Peziza apiculata* is not yet fully known, the Australian specimens are referred to Berkeley's species, which was based on a specimen from Australia.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On the ground, North Gipps Land, s. dat., H. Tisdall; on the ground amongst mosses, Omso, s. dat., Müller; on roadside cutting, Caveat–Molesworth Road, 22 August 1963, G. Beaton 167. — New South Wales. On rotten wood, Upper Hunter River, s. dat., Carter. — South Australia. On the

ground, Keith, 6 August 1952, J. H. Warcup; on the ground, Port Lincoln, 16 July 1952, N. T. Flentje.

Plicaria Fuckel emend. Boud.

Plicaria Fuckel *in* Jb. nassau. Ver. Naturk. 23–24: 325. 1870, emend. Boud. Bull. Soc. mycol. Fr. 1: 101. 1885; non *Plicaria* Fuckel emend. Rehm in Rabenh. Kryptog.-Fl. I 3: 1000. 1894 (misapplied, = *Peziza* [Dill.] St-Amans). — *Peziza* [Dill.] St-Amans subgen. *Aleuria* (Fr.) Sacc. [sect.] *Plicaria* (Fuckel) Sacc. *in* Bot. Cbl. 18: 215. 1884 (misapplied, = *Caloscypha* Boud.). — *Peziza* [Dill.] St-Amans. subgen. *Plicaria* (Fuckel) Lindau *in* Nat. Pflanzenfam. I 1: 182. 1897 (misapplied, = *Peziza* [Dill.] St-Amans).

Peziza [Dill.] St-Amans subgen. *Discina* Fr. [sect.] *Discaria* Sacc. *in* Bot. Cbl. 18: 215. 1884. — *Discaria* (Sacc.) Sacc., Syll. Fung. 8: 105. 1889 (pro syn.); non *Discaria* Hook., Bot. Misc. 1: 156. 1830.

Phaeopezia (Sacc. ex Sacc. apud Vido) Sacc. apud Vido subgen. *Plicariella* Sacc. *in* Bot. Cbl. 18: 218. 1884. — *Plicariella* (Sacc.) Rehm *in* Rabenh. Kryptog.-Fl. I 3: 993. 1894.

Detonia Sacc., Syll. Fung. 8: 105. 1889. — *Plicariella* (Sacc.) Rehm subgen. *Detonia* (Sacc.) Lindau *in* Nat. Pflanzenfam. I 1: 179. 1897 (misapplied, = *Lamprospora* de Not.)

Curreyella Massee, Brit. Fung.-Fl. 4: 401. 1895.

Galactinia (Cooke) Boud. emend. Le Gal sect. *Sphaerosporae* Le Gal *in* Rev. Mycol. 18: 79. 1953 (sine diagnose Latina).

Lectotype species: *Peziza trachycarpa* Curr.

Apothecia medium to large size, rarely small, sessile or substipitate. Disc concave, undulate or almost flat, dark brownish coloured. Receptacle saucer shaped to shallow cup shaped, usually slightly paler than the disc, smooth or minutely scurfy. Excipulum light brown, pseudoparenchymatous or plectenchymatous, of thin walled subglobose, angular or elongated cells often interspaced by distinct hyphal elements, especially towards the hymenium. Asci cylindrical, slightly narrower towards the base, 8-spored, blued in iodine. Ascospores uniseriate, perfectly globose, at first hyaline, ultimately becoming light yellowish brown to pale brown at complete maturity, containing oil globules, smooth or ornamented with warts, spines, broken ridges and reticulum. Paraphyses slender, septate, simple or rarely branched, apex enlarged, brown coloured, often aggregated or sometimes encrusted and held together by amorphous brownish substance.

Habitat: on burnt or damp ground.

The existing confusion in application of the generic name *Plicaria* has been amply discussed by Korf (*1961*). Many recent authors (Le Gal, *1953*, *1962*; Korf, *1961*; Denison, *1963*; Berthet, *1964a*) have maintained that *Plicaria* should be merged with *Peziza*, because the main distinction between these two genera is the shape of their ascospores. Although it is not disputed that *Plicaria* is very closely related to *Peziza*, for the present *Plicaria* is treated as a distinct genus, as has also been done by Maas Geesteranus (*1955*), Dennis (*1960*), Batra (*1961*), Batra & Batra (*1963*) and Moser (*1963*). In the Australasian as well as the other species of *Plicaria* which I studied, the following characters seem to be shared

by all: the paraphyses show a tendency to adhere to each other, a character which occurs only rarely in species of *Peziza*; at complete maturity their spores become pale brown, while in *Peziza* the spores vary from hyaline to light brown; the spores always contain oil globules whereas those of *Peziza* may be guttulate or non-guttulate; the apothecia of species of *Plicaria* are invariably dark coloured in contrast to *Peziza* which contains both dark and light coloured species but in this respect it is of interest to note that the dark spored *Peziza atrovinosa* also has dark coloured apothecia.

Apart from being convenient the separation of the globose spores species from *Peziza* proper is advisable because it appears that *Plicaria* represents an intermediate taxon between *Peziza* and *Boudiera*. The fact that Le Gal (*1953a, 1962*) accommodated these globose spored species in a section of its own probably reflects her view on the close affinity between species of *Plicaria*, and their exclusion from *Peziza* will make the last genus more homogenous.

Plicaria endocarpoides (Berk.) Rifai, *comb. nov.*

Peziza endocarpoides Berk. *in* Hook. f., Fl. Nov. Zeal. 2: 199. 1855. — *Barlaea endocarpoides* (Berk.) Sacc., Syll. Fung. 8: 118. 1889. — *Barlaeina endocarpoides* (Berk.) Sacc. & Trav. *in* Sacc., Syll. Fung. 19: 139. 1910.

Peziza leiocarpa Curr. *in* Trans. Linn. Soc. Lond. 24: 493. 1864. — *Aleuria leiocarpa* (Curr.) Quél., Enchir., Fung. 280. 1886. — *Detonia leiocarpa* (Curr.) Sacc., Syll. Fung. 8: 105. 1889. — *Plicariella leiocarpa* (Curr.) Rehm *in* Rabenh. Kryptog.-Fl. 1 (3): 994. 1894. — *Plicaria leiocarpa* (Curr.) Boud., Icon. mycol. 2: *pl. 304.* 1906; Hist. Class. Discom. Eur. 50. 1907. — *Lamprospora leiocarpa* (Curr.) Seaver *in* Mycologia 6: 21. 1914. — *Galactinia leiocarpa* (Curr.) Le Gal *in* Bull. Soc. mycol. Fr. 78: 212. 1962.

Apothecia gregarious, sometimes crowded, 10–35 mm or more in diam. Disc concave, sometimes undulate or almost flat, blackish brown. Receptacle slightly paler than the disc, minutely scurfy, sessile, shallow cup shaped or sometimes becoming irregular by mutual pressure. Ectal excipulum of angular elongated or subglobose cells up to about 18 μ diam., usually encrusted with brownish amorphous substance, towards the margin of the cup becoming more or less regularly orientated, parallel with each other and lying at a low angle with the surface of receptacle, mostly terminated by clavate cells up to 15 μ diam. Medullary excipulum of thin walled, subangular elongated, lobed or barrel shaped cells 8–30 μ diam., often forming an indistinct textura intricata tissue; towards the subhymenial layer the cells become smaller in diam. (only up to 16 μ), the hyphal elements and their intricate arrangements are more distinctive. Subhymenium also of textura intricata, hyphae 6–9 μ diam. Hymenium about 200 μ thick. Asci subcylindrical, slightly narrower towards the base, 180–220 × 10–13 μ, 8-spored, turned blue in Melzer's reagent. Ascospores uniseriate, globose, smooth walled, at first hyaline but ultimately become pale brownish yellow, 8.5–11.8 μ diam., containing a few oil globules and occasionally with a highly refractive bubble as well. Paraphyses slender, about 3 μ diam. below, sparingly septate, containing yellowish brown sap, their apices distinctly clavate, up to 6.8 μ diam., sometimes rather compactly aggregated with each other (Fig. 268–269).

HABITAT AND DISTRIBUTION: on burnt ground in Europe, North America, Australia and New Zealand.

The original description of *Peziza endocarpoides* reads as follows: "... Cupula irregulari concave vel demum convexa expansa spadicea sessili, sporidiis globosis ... Hab. On the ground amongst moss and fern, Mission Station, Colenso ... Cup 1/3 of an inch across, sessile, but fixed by a central floccose mass, with the margin free, concave but at length convex and expanded, so as to resemble a little *Endocarpon*, obscurely floccose externally. Asci cylindrical containing eight globose sporidia, with a single large nucleus in each ...". Its type specimen in Herb. Kew. consists of fragments of apothecia which are dark brown to blackish brown. In section it can be seen that these fragments have a hymenium about 200 μ thick with subcylindrical, 8-spored asci which are up to 215 μ long by 10–13 μ diam. and stained blue in Melzer's reagent. The ascospores are uniseriate, globose, smooth walled, subhyaline to light brownish yellow, 9–11.8 μ diam. The slender paraphyses are distinctly clavate at the apices and aggregated with each other.

With the exception of Berkeley's (*1855*) observation that this species has apothecia only up to about 8 mm diam. and growing amongst mosses and ferns there is nothing to suggest that *Plicaria endocarpoides* can be considered as specifically distinct from the European and North American species currently known as *Plicaria leiocarpa* (Curr.) Boud., which typically grows on burnt ground. The habitats of the more recent Australian collections, which agree in every respect with European collections, were not fully annotated by their collector, but by studying the soil particles that attached to the apothecia in some of them it can be shown that these collections were made from burnt ground. For these reasons *Plicaria leiocarpa* has been considered a synonym of the present species. I have not seen the type specimen of *Plicaria foveata* Fuckel which according to Seaver (*1928*) was a synonym of *Plicaria leiocarpa*.

SPECIMENS EXAMINED

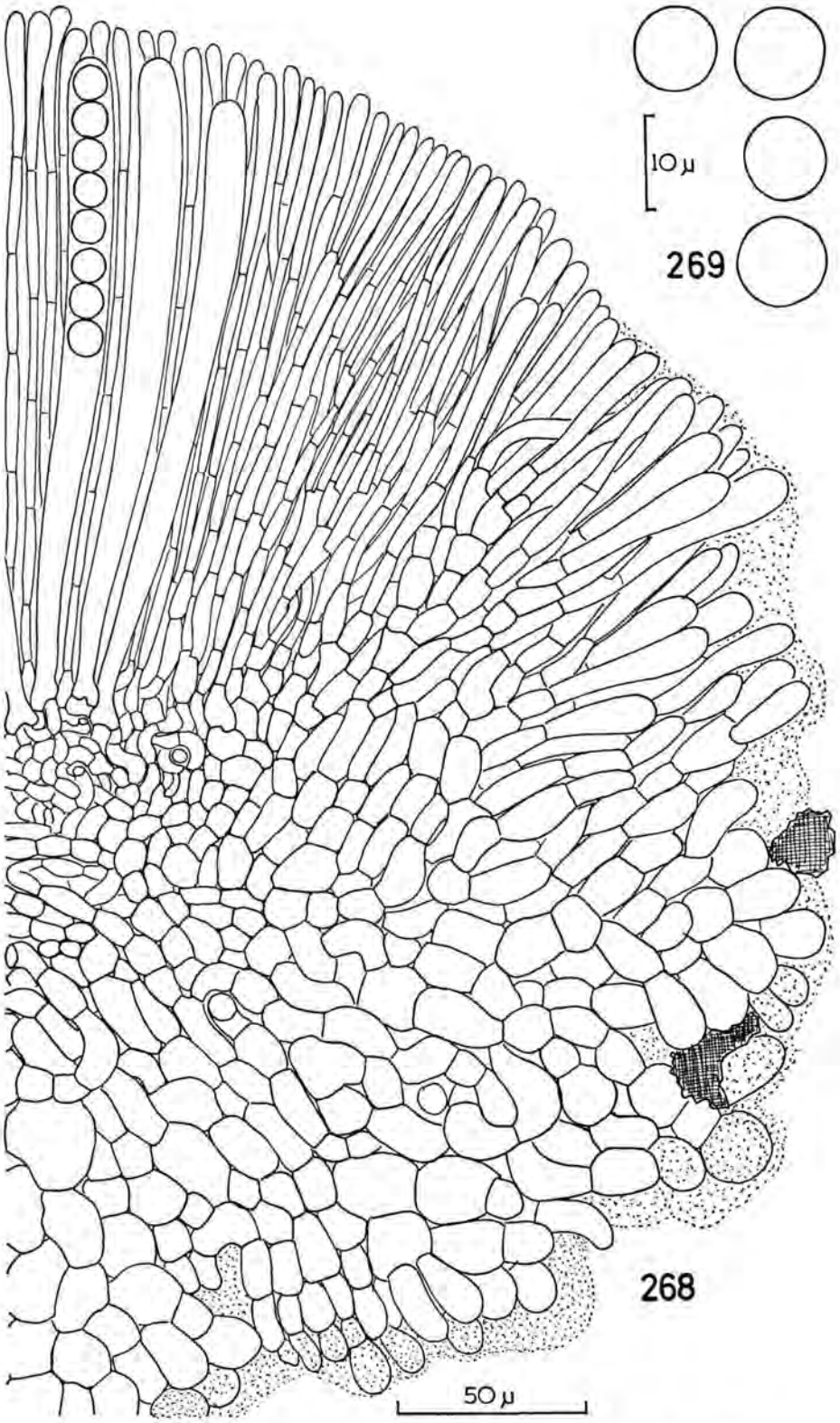
AUSTRALIA. South Australia. On [burnt] ground, Mt. Lofty, 8 September 1920, J. B. Cleland; on [burnt] ground, Meningie, June 1955, L. D. Williams, ex WARI 6288; on [burnt] ground, National Park, June 1955, L. D. Williams, ex WARI 6287. — Victoria. On rubbish dump, Big River camping ground, Eildon-Jamieson Road, 20 August 1963, G. Beaton 172.

NEW ZEALAND. On [burnt?] sandy ground, said to be amongst mosses and ferns, Mission Station, s. dat., Colenso 3030 [type specimen of *Peziza endocarpoides* Berk.].

EUROPE. Great Britain. On burnt ground, Ascot Heath, Berkshire, November 1863, C. E. Broome [type specimen of *Peziza leiocarpa* Curr.; also issued as Rabenhorst, Fungi europaei no. 622 sub *Peziza leiocarpa*].

Plicaria recurva (Berk.) Rifai, *comb. nov.*

Peziza recurva Berk. *in* Hook. f., Fl. Tasman. 2: 273. 1860. — *Barlaea recurva* (Berk.) Sacc., Syll. Fung. 8: 116. 1889. — *Humaria* (*Crouania*) *recurva* (Berk.)



Figs. 268, 269. *Plicaria endocarpoides*. 268. Section of margin. 269. Ascospores. (From WARI 6288).

Cooke, Handb. Austral. Fungi 257. 1892 [ut *Peziza* (*Crouania*) *recurva*]. — *Barlaeina recurva* (Berk.) Sacc. & Trav. *in* Sacc., Syll. Fung. 19: 140. 1910.

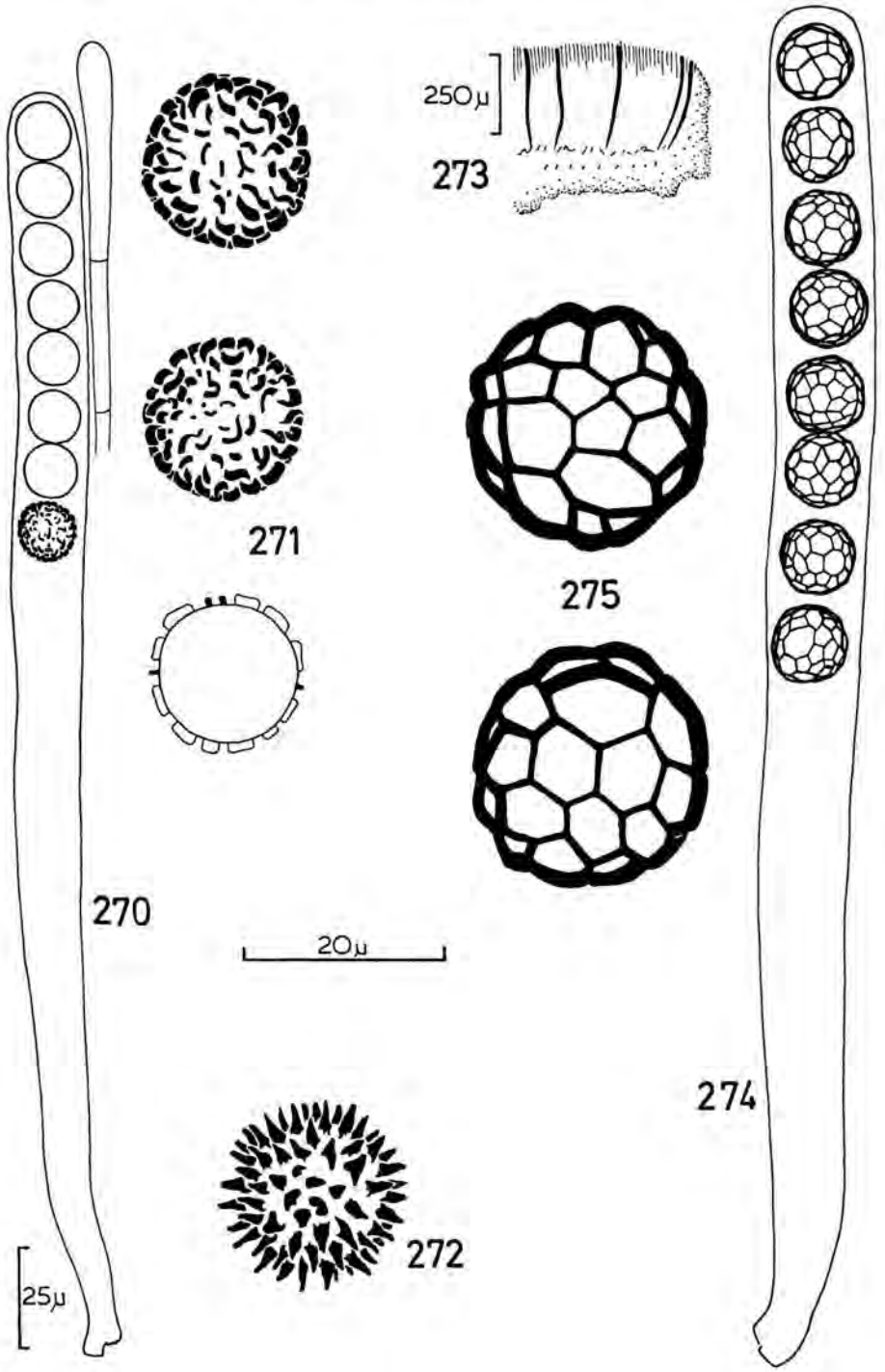
Apothecia scattered to gregarious, subsessile, 8–18 mm diam. Disc bay brown to reddish brown, concave, depressed in the middle, undulate. Receptacle cup shaped, turbinate, contracted below into a not very well developed stipe, margin typically recurved, slightly paler than the disc. The outermost layer of the excipular tissue is made up of angular to subglobose and rather thick walled cells 15–20 μ diam., often encrusted with intercellular amorphous brownish substance. The rest of the receptacle is composed of thin walled polygonal elongated or subglobose pale brown coloured cells 10–20 μ diam., interspaced with hyphal elements of about 6 μ diam., sometimes assuming indistinct textura intricata, especially toward the subhymenial layer. Subhymenium of rather compacted subglobose or angular or elongated cells 8–14 μ diam. Hymenium about 275 μ thick. Asci cylindrical with rounded apex, slightly attenuate below, 8-spored, 265–330 × 13.5–15.5 μ, their walls, especially near the apex stained blue in Melzer's reagent. Ascospores uniseriate, globose, containing several oil globules of different sizes, at first hyaline, becoming pale yellowish brown at maturity, rather closely covered by short, curved or wavy and occasionally branched but non-anastomosing ridges, which are 1–1.5 μ high and about 0.5 μ thick; without the ornamentations the ascospores measure 11–13.8 μ diam. Paraphyses slender, septate, 2.7–3.5 μ diam. below, enlarged and becoming clavate at the tips, up to 8 μ diam., containing brownish sap and usually held together or encrusted by a brownish amorphous substance (Fig. 270–271).

HABITAT AND DISTRIBUTION: on the ground in Tasmania and Victoria.

The ascospores of this species somewhat resemble those of the European species commonly known as *Plicaria trachycarpa* (Curr.) Boud. var. *muricata* Grelet, the correct name of which appears to be *Plicaria carbonaria* (Fuckel) Fuckel. The latter, however, has slightly larger overall ascospore size, whereas its spore ornamentations typically take the form of distinct trigonal flattened spines and not of wavy ridges like in the present species, as is shown in Fig. 272 (figured from specimen from burnt ground, on the site of a hedge cutting fire, Marton, Cheshire, England, 14 July 1954, W. D. Graddon 933). Furthermore, *Plicaria carbonaria* has differently shaped fruit bodies.

According to Seaver (*1928*), Le Gal (*1947*), Maas Geesteranus (*1955*) and Wolf (*1958*) the ascospores of *Plicaria trachycarpa* (Curr.) Boud. are also ornamented with warts or short ridges but these ridges are much shorter than those of *Plicaria recurva*, so that there should be no difficulty in distinguishing the two species. Macroscopically *Plicaria recurva* can also be easily separated from *Plicaria trachycarpa* because of its medium sized and recurved apothecia.

Rodway (*1925*) described collections of *Plicaria trachycarpa* from Tasmania with apothecia up to 80 mm diam.; I have not been able to verify his determination and at Herb. Kew. there is no Australasian collection of this species.



Figs. 270–275. — *Plicaria recurva*. 270. Ascus and paraphysis. 271. Ascospores. (From type). — *Plicaria carbonaria*. 272. Ascospores (From W. D. Graddon 933). — *Plicaria alveolata*. 273. Diagramatic section of margin. 274. Ascus. 275. Ascospores. (From type). — Figs. 270, 274 and Figs. 271, 272, 275 to same scale.

SPECIMENS EXAMINED

AUSTRALIA. Tasmania. On the ground [burnt?], s. dat., W. Archer [type specimen of *Peziza recurva* Berk.]; on the ground, s. dat., coll. unknown (identified as *Peziza recurva* by Berkeley). — Victoria. On the ground in burnt area, 5 miles east of Lorne on Ocean Road, 5 July 1964, G. Beaton 213.

Plicaria alveolata (Rodway) Rifai, *comb. nov.*

Curreyella alveolata Rodway *in* Pap. Proc. R. Soc. Tasmania **1924**: 73. 1925.

Rodway's original description of this species runs as follows: "Sessile, plane to convex, rather tough, 1–2 cm diam. externally verrucose; spores globose, light brown, alveolate, 24 μ, paraphyses slender filiform, not enlarged at the apex." A portion of the type collection in Herb. Kew. bears an apothecium approximately 12 mm diam., with brownish black flattened disc. Receptacle saucer shaped, sessile with a broad basal attachment, paler than the disc, minutely scurfy. In section it can be seen that the excipular tissue is brown coloured, and the whole part of the 350 μ thick hymenium stained blue in Melzer's reagent. Asci long cylindrical, slightly attenuate below, walls and especially region near the apex blued in Melzer's reagent, 8-spored, 320–360 × 22–28 μ. Ascospores uniseriate, globose, with one to several oil globules, at first hyaline, becoming pale yellowish brown in age, reticulate, the meshes of reticulation about 6 μ in diam. and up to 3 μ deep, mostly 6-sided; without the reticulum the ascospores measure 18–21 μ diam. Paraphyses not very clear, but a few have been observed to be slender, sparingly septate, about 4.5 μ diam. below, held together by an amorphous brown substance (Fig. 273–275).

HABITAT AND DISTRIBUTION: on the ground in Tasmania.

Fresh collections are needed to elucidate the anatomy of the receptacle and the paraphyses of this species, because the presence of amorphous brown substance makes it rather difficult to get a good impression from the sections which have been prepared from the meagre type specimen available. There should be no difficulty in distinguishing this species from the other species of *Plicaria* on account of its reticulate ascospores.

SPECIMEN EXAMINED

AUSTRALIA. Tasmania. On the ground, Bellerive, August 1921, L. Rodway [type specimen of *Curreyella alveolata* Rodway].

Plicaria columnifera Rifai, *spec. nov.*

Apothecia sessilia, discoidea, atro-brunnea, minuta, usque 7 mm diam. Asci cylindracei, octospori, 300–400 × 22–30 μ, apice jodo caerulescentes. Ascospori uniseriati, globosi, 22–25 μ diam., pallide brunnei, echinulati. Paraphyses septatae, ramosae, subclavatae, apice in substantia amorpha brunnea aggregatae.

Hab. ad terram, Meningie, Australia australi, Julii 1956, L. D. Williams 54 typus est [K].

Apothecia sessile, up to 7 mm diam. Disc flattened or concave, sooty brown, drying brownish black. Receptacle a little paler than the disc, saucer shaped. Ectal excipulum about 40 μ thick, of interwoven hyphae 4–10 μ diam., brown coloured and thick walled; toward the margin of

the cup these hyphae become more regularly orientated, running parallel with each other, occasionally branched; fine, colourless hyphae often can be seen coming out from the excipulum, anchoring the apothecia to the soil; the rest of the receptacle is made up of a rather thin layer of subglobose or angular elongated, thin walled, subhyaline to pale yellowish cells 16–40 μ diam., the cells thinning towards the subhymenial layer. Subhymenium of interlocked thin walled angular or elongated cells 6–15 μ diam. Hymenium about 350 μ thick. Asci cylindrical, slightly attenuate below, 8-spored, 300–400 × 22–30 μ, wall, especially the apical part, stained blue in Melzer's reagent. Ascospores uniseriate, globose, at first hyaline, at maturity appearing pale yellowish brown, covered by numerous columnar or subcylindrical, blunt or rarely flat tipped spines up to 2.7 μ long by 1–1.8 μ wide diam.; including the ornamentations the ascospores vary in diam. from 22–25 μ. Paraphyses slender, 2.5–3.5 μ diam. below, enlarged to about 7 μ diam. at the apex, often forkedly branched, especially toward the brown apex, sparingly septate, much longer than the asci, rather compactly aggregated and encrusted by an amorphous brown film-like substance (Fig. 276–278).

HABITAT AND DISTRIBUTION: on the ground in South Australia.

The rather small apothecia and the large asci show some resemblance to *Lamprospora* and at a glance its spiny ascospores are not unlike those of *Lamprospora crec'hqueraultii*. Its dark coloured and non-carotenoid apothecia, the pale brownish ascospores and the iodine positive reaction of its asci, however, certainly point to its affinity with species of *Plicaria*; nevertheless it should be regarded as an aberrant member of this genus.

SPECIMEN EXAMINED

AUSTRALIA. South Australia. On the ground, Meningie, July 1956, L. D. Williams 54, ex WARI 7522 [type specimen of *Plicaria columnifera* Rifai].

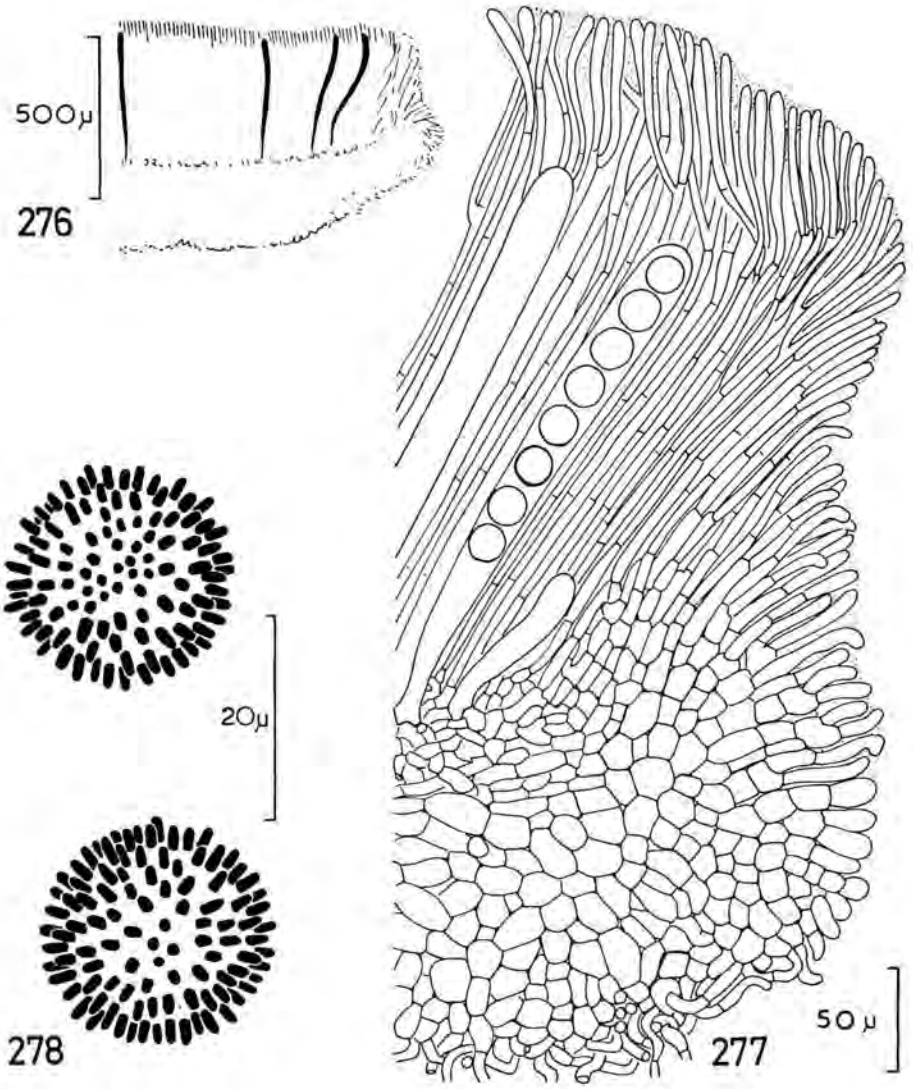
IODOPHANUS Korf apud Kimbrough & Korf

Iodophanus Korf *apud* Kimbrough & Korf *in* Am. J. Bot. **54**: 18. 1967.

TYPE SPECIES: *Ascobolus carneus* Pers. ex Pers.

Iodophanus is a small genus segregated from the heterogeneous *Ascophanus* Boud., which on account of its iodine positive asci and other anatomical characters is placed in the Pezizaceae. Berthet (*1964*) and Webster, Rifai & El-Abyad (*1964*) showed that there were many species of *Peziza* which had *Oedocephalum* conidial states and the occurrence of a similar type of conidial state in species of *Iodophanus* (Korf, *1958*; Gamundi & Ranalli, *1964*) provides additional evidence to support this disposition.

It has been well known that *Ascophanus* is an assemblage of unrelated species (Korf, *1954*; Dennis, *1960*; Denison, *1963*; Batra & Batra, *1963*; Kimbrough, *1966*) referred there merely because they cannot be accepted as species of other classical genera. Macroscopically these species do resemble one another in lacking such distinctive features as hairs, stalk and others, but in those species which have been thoroughly investigated microscopically it has been shown that many of them belong to different



Figs. 276–278. *Plicaria columnifera*. 276. Diagramatic section of margin. 277. Details of section of margin. 278. Ascospores. (From type).

families. Boudier (*1885*) took *Ascophanus granulatus* (Bull. ex Pers.) Speg. out of this genus and he assigned it to *Coprobia* Boud. – another small segregate genus based on this species and belonging to the Humariaceae – a disposition which has been widely accepted by many authors (Le Gal, *1947*, *1953*; Dennis, *1960*; Gamundi, *1960*; Moser, *1963*; Denison, *1964*; Kimbrough, *1966*). Recently van Brummelen (*1962a*) singled out four closely related components of this complex of fungi which he referred to *Fimaria* Vel., a well founded but almost forgotten genus, also of the Humariaceae. From his studies on this complex of fungi it was concluded by Kimbrough (*1966*) that the lectotype species of *Ascophanus*, *Peziza*

subfusca Crouan, fell within the natural limits of the genus *Thelebolus* Tode ex Fr. and that those species of *Ascophanus* having hooked paraphyses and smooth ascospores which often contain conspicuous gaseous bubbles should be transferred to another genus. A synopsis of the rearrangement of species of *Ascophanus* and its related genera based on more reliable microscopic characters can be found in Kimbrough & Korf's (*1967*) paper.

IODOPHANUS CARNEUS (Pers. ex Pers.) Korf apud Kimbrough & Korf

Ascobolus carneus Pers., Syn. meth. Fung. 676. 1801. — *Ascobolus carneus* Pers *ex* Pers., Mycol. eur. 1: 341. 1822; Fr., Syst. mycol. 2: 165. 1822. — *Ascophanus carneus* (Pers. ex Pers.) Boud. *in* Ann. Sci. nat. (Bot.) V 10: 250. 1869. — *Peziza carnea* (Pers. ex Pers.) Karst. *in* Notis. Sällsk. Fauna Fl. fenn. 10: 120. 1869. — *Pyronema carneum* (Pers. ex Pers.) Schroeter *in* Kryptog.-Fl. Schles. 3 (2); 34. 1893. — *Iodophanus carneus* (Pers. ex Pers.) Korf *apud* Kimbrough & Korf *in* Am. J. Bot. 54: 19. 1967.

Ascobolus saccharinus Berk. & Curr. *apud* Berk., Outl. Brit. Fung. 374. 1860 (nomen nudum). — *Ascobolus saccharinus* Berk. & Curr. *ex* Cooke *in* J. Bot., Lond. 2: 154. 1864. — *Ascophanus saccharinus* (Berk. & Curr. ex Cooke) Boud. *in* Ann. Sci. nat. (Bot.) V 19: 251. 1869. — *Ascophanus carneus* (Pers. ex Pers.) Boud. var. *saccharinus* (Berk. & Curr. ex Cooke) Phill., Man. Br. Discom. 310. 1887.

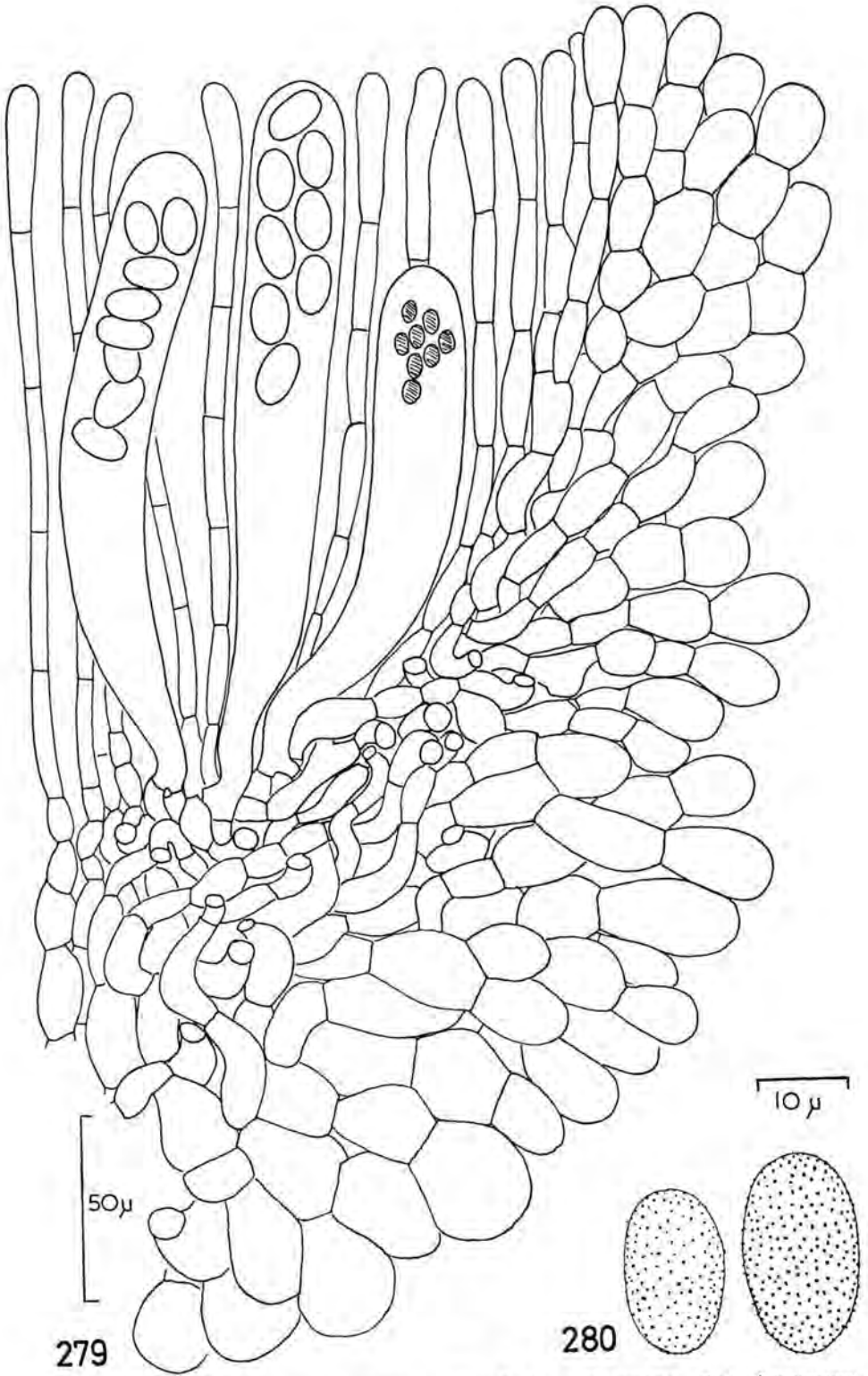
Peziza (*Humaria*) *salmonicolor* Berk. & Br. *in* Ann. Mag. nat. Hist. III 18: 124. 1866. — *Humaria salmonicolor* (Berk. & Br.) Sacc., Syll. Fung. 8: 123. 1889. — *Ascophanus salmonicolor* (Berk. & Br.) Boud., Hist. Class. Discom. Eur. 76. 1907.

Ascobolus thwaitesii Berk. & Br. *in* J. Linn. Soc. (Bot.) 14: 109. 1873.

Apothecia gregarious, lenticular, pulvinate or discoid, sessile, 0.5–1.7 mm diam. Disc flat, sometimes becoming convex, appearing rough and papillate from protruding and maturing asci, flesh coloured or pinkish. Receptacle saucer shaped or scutellate, concolorous or slightly paler than the disc, smooth except near the broad base from which arise subhyaline, septate and flexuous anchoring hyphae 4.5–9 μ diam. Ectal excipulum of several layers of subglobose, lobed or pyriform to short barrel-shaped cells 12–20 μ diam. (textura globulosa), sometimes interspaced by connective hyphae. Flesh and subhymenium not well differentiated, of loose intertwined hyphae with their cells lobed, much constricted at the septa, often with undulate walls, up to 12 μ diam., becoming narrower towards the hymenium. Hymenium about 210 μ thick. Asci cylindrical clavate to rather broadly clavate, somewhat narrowed below into a short stalk-like base, wall blued in Melzer's reagent, 8-spored, 180–264 × 20–36 μ. Ascospores 16.3–22.7(–24) × 10–13.6(–16), mostly irregularly bi- or uniseriate, ellipsoidal or broad ellipsoidal with rounded ends, hyaline or subhyaline, without oil globules, at first smooth but ultimately becoming verrucolose from numerous minute warts. Paraphyses rather stout, 3.5–5 μ diam., apex septate, sometimes forked from the base (Fig. 279–280).

HABITAT AND DISTRIBUTION: on soil and rotten vegetable matter, dung, leather etc. in Europe, North America, Argentina, Madagascar, Ceylon, Australia and probably cosmopolitan.

The possible identity of *Ascobolus saccharinus* Berk. & Curr. ex Cooke and *Peziza salmonicolor* Berk. & Br. with the present species has been suggested by Dennis (*1960*) and a study of their respective type specimens



Figs. 279–280. *Iodophanus carneus*. 279. Section of margin. 280. Ascospores. (From J. H. Warcup).

shows that they are indeed conspecific. According to Massee (*1895*) *Peziza salmonicolor* has an apothecium up to 3 mm diam. but the intact and only available apothecium in the poorly preserved type specimen measures only 1.6 mm diam. The type specimen of *Ascobolus thwaitesii* Berk. & Br. has also been studied by van Brummelen and he identified it with *Iodophanus carneus*. I have not seen the type specimen of *Peziza testacea* Moug. apud Fr. which according to Dennis may fall within the limits of variation of the present species.

Gamundi & Ranalli (*1964*) demonstrated that in culture this species produced a conidial state which they referred to as *Oedocephalum glomerulosum* (Bull. ex Harz.) Sacc. They also stated that *Oedocephalum coprophilum* Kobayashi might be identical with the conidial state of *Iodophanus carneus* but this seems to be unlikely because no associated apothecium was reported from cultures of *Oedocephalum coprophilum*, whereas according to Gamundi & Ranalli *Iodophanus carneus* is a homothallic species. Since there are several species of Pezizaceae which produce *Oedocephalum*-type conidial states, it is probable that *Oedocephalum coprophilum* is the conidial state of some other species.

Gamundi & Ranalli described the *Oedocephalum* state of *Iodophanus carneus* as having erect and septate conidiophores measuring 100–300 (–1200) × 8–12 μ, terminated by a unicellular globose or pyriform vesicle 36–48 × 30–36 μ which in turn was covered by numerous small sterigma-like projections on which conidia were born singly. The blastogenous conidia arise simultaneously, are pinkish in mass but appear hyaline or subhyaline when viewed singly, ovoid, smooth walled, 20–26.6(–28) × × 8.3–13.3 μ.

SPECIMENS EXAMINED

AUSTRALIA. South Australia. On sterilised soil in greenhouse, Waite Agricultural Research Institute, Adelaide, July 1953, C. G. Hansford, ex WARI 3459; on dead wood, Meningie, June 1953, L. D. Williams 28, ex WARI 3482; on substrate not stated, wheat fields, Waite Agricultural Research Institute, Adelaide, 1962, J. H. Warcup. — Victoria. On stale dog dung, Anglesea cliff walk, 18 July 1964, R. Filson (comm. G. Beaton 221).

CEYLON. On rotten wood, Central Province, December 1868, Thwaites 1059 [type specimen of *Ascobolus thwaitesii* Berk. & Br.].

EUROPE. England. On old shoe and rugs, Pauls Cray Commons, Chiselhurst, Kent, November 1859, F. Currey [syntype specimens of *Ascobolus saccharinus* Berk. & Curr. ex Cooke]; on soil on the side of a ditch, Woodnewton, October 1858, collector unknown [type specimen of *Peziza* (*Humaria*) *salmonicolor* Berk. & Br.].

FAMILY ASCOBOLACEAE

The ascospores of the Ascobolaceae – as this family is understood here – are unique among the Discomycetes because their purple or dark brown outer layer, the epispore, originates from extra sporal or vacuolar material (Le Gal, *1947*). As Le Gal (*1953*) has pointed out, the genera with this spore character – which makes up the "Ascoboleae vraies" of Boudier –

form a homogeneous and natural entity which is related to the Pezizaceae. The relationship with the latter family is indicated by the iodine positive reaction of the majority of their asci as well as by the anatomy of the receptacle, which is mostly composed of globose or isodiametric polygonal cells similar to those found in the receptacle of the genus *Peziza*.

Based on the similarity of the ascus shape and the general habit, habitat and size of their apothecia, the genera of the Pyronemataceae and the Thelebolaceae are often included in a tribe (the Pseudoascoboleae) of the present family. The inclusion of these two families in the Ascobolaceae will only turn the latter into an unwieldy taxon. As has been generally known the ascospores of the genera which have been classified in the Pseudoascoboleae are not as characteristically ornamented as those of the Ascobolaceae in the restricted sense; furthermore their asci are not amyloid and often thick walled and multisporous. For these reasons I am in complete agreement with Denison (*1963*) to reserve the Ascobolaceae for the reception of those genera having this peculiar type of ascospore ornaments only.

As is understood here the family Ascobolaceae contains only three genera, namely *Ascobolus* Pers. ex Hook. [including *Dasyobolus* (Sacc.) Sacc.], *Saccobolus* Boud. and *Sphaeridiobolus* Boud.; the latter most probably should also be united with *Ascobolus*.

Ascobolus Pers. ex Hook.

Ascobolus Pers. *in* Neues Mag. Bot. 1: 116. 1794. — *Ascobolus* Pers. *ex* Hook., Fl. scot. 2: 33. 1822; Fr., Syst. mycol. 2: 161. 1822.

Ascobolus Pers. ex Hook. subgen. *Dasyobolus* Sacc., Syll. Fung. 8: 523. 1889. — *Dasyobolus* (Sacc.) Sacc., Syll. Fung. 11: 421. 1895.

Type species: *Ascobolus furfuraceus* Pers. ex Hook.

The Herb. Kew. collections of the Australasian Ascobolaceae have been revised by Dr. J. van Brummelen (Leyden), whose world monographic study was published recently. The following enumeration is based chiefly on his identifications.

Ascobolus furfuraceus Pers. ex Hook. — Fig. 281

Ascobolus furfuraceus Pers., Obs. mycol. 1: 33. 1796. — *Ascobolus furfuraceus* Pers. *ex* Hook., Fl., scot. 2: 33. 1821; Fr., Syst. mycol. 2: 163. 1822.

Habitat and distribution: on cow dung, very widely distributed.

Specimens examined

Australia. South Australia. On cow dung, Meningie, 4 August 1953, L. D. Williams. — Queensland. On cow dung, Swan River, s. dat., Drummond; on cow dung, Brisbane River, July 1912, J. H. Simmonds (comm. F. M. Bailey 2).

Ascobolus crenulatus Karst. — Fig. 282

Ascobolus crenulatus Karst. *in* Notis. Sällsk. Fauna Fl. fenn. 11: 202. 1870.

HABITAT AND DISTRIBUTION: on rodent and bird dung in Europe (type locality Finland), North America and Australia.

SPECIMEN EXAMINED

AUSTRALIA. Victoria. On *Trichosorus caninus* (Mountain Possum) dung, at the edge of a stand of *Pinus radiata*, Crystal Creek Road, near Alexandra, 2 October 1962, G. Beaton 30.

ASCOBOLUS ARCHERI Berk. – Fig. 283

Ascobolus archeri Berk. *in* Hook. f., Fl. Tasman. 2: 276. 1860.

HABITAT AND DISTRIBUTION: on charcoal in Tasmania.

SPECIMEN EXAMINED

AUSTRALIA. Tasmania. On charcoal, s. dat., W. Archer [type specimen of *Ascobolus archeri* Berk.].

ASCOBOLUS LEIOCARPUS Berk. & Br. [22]) – Fig. 284

Ascobolus leiocarpus Berk. & Br. *in* J. Linn. Soc. (Bot.) 14: 109. 1873.

Ascobolus major Berk. & Curt. *in* Grevillea 4: 6. 1875.

Ascobolus australis Berk. *in* J. Linn. Soc. (Bot.) 18: 389. 1881.

Phaeopezia orientalis Pat. *in* J. Bot. (ed Morot), Paris 4: 59. 1890. — *Aleurina orientalis* (Pat.) Sacc. & Syd. *in* Sacc., Syll. Fung. 16: 739. 1902. — *Ascobolus orientalis* (Pat.) Le Gal, Discom. Madag. 75. 1953.

Ascobolus phillipsii Berk. *apud* Cooke, Handb. Austral. Fungi 268. 1892.

Ascobolus sarawacensis Cesati *apud* Cooke *in* Grevillea 21: 74. 1893.

Ascobolus magnificus Dodge *in* Mycologia 4: 218. 1912.

HABITAT AND DISTRIBUTION: on dung of horse, buffalo, cow in tropical Asia, America, Australia and Madagascar.

SPECIMENS EXAMINED

AUSTRALIA. Queensland. On dung, Brisbane, s. dat., collector unknown, no. 538 [identified as *Ascobolus australis* by Phillips]; on dung?, without any particular [Dr. van Brummelen noted: "this collection very probably is the type of *Ascobolus phillipsii* Berk. apud Cooke = part of the type collection of *Ascobolus australis Berk.* [Thozet 851] = *Ascobolus leiocarpus* Berk. & Br."].

ASIA. Ceylon. On dung, Peradeniya, November 1867, G. H. K. T[hwaites] [type specimen of *Ascobolus leiocarpus* Berk. & Br.]. — Sarawak. On buffalo dung, s. dat., Beccari 226 [type specimen of *Ascobolus sarawacensis* Ces. apud Cooke].

AMERICA. U.S.A. On dung?, South Carolina, s. dat., [type specimen of *Ascobolus major* Berk. & Curt.]; on horse dung in damp chamber cultures, April 1912, B. O. Dodge [type specimen of *Ascobolus magnificus* Dodge].

ASCOBOLUS IMMERSUS Pers. ex Pers. – Fig. 285

Ascobolus immersus Pers., Obs. mycol. 1: 35. 1796. — *Ascobolus immersus* Pers. *ex* Pers., Mycol. eur. 1: 341. 1822; Fr., Syst. mycol. 2: 164. 1822. — *Dasyobolus immersus* (Pers. ex Pers.) Sacc., Syll. Fung. 11: 421. 1895.

Ascobolus macrosporus Crouan *in* Ann. Sci. nat. (Bot.) IV. 7: 173. 1857 (teste Seaver, *1928*). — *Ascobolus immersus* Pers. ex Pers. var. *macrosporus* (Crouan) Rehm *in* Rabenh. Kryptog.-Fl. I 3: 1128. 1894.

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[22]) The correct name of this species is *Ascobolus scatigenus* (Berk.) Brumm. *in* Persoonia (Suppl.) 1: 159. 1967 *q.v.*

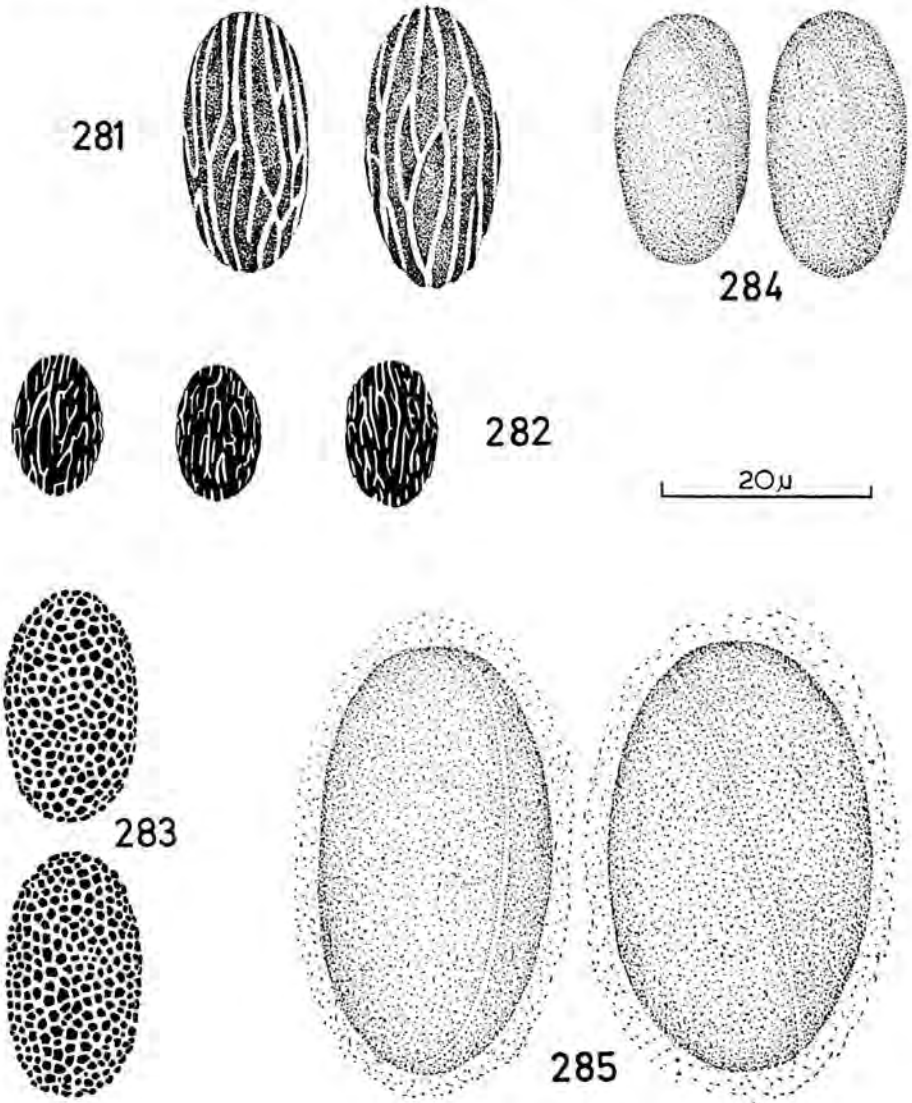
Ascobolus gigasporus de Not. *in* Commentario Soc. critt. ital. 1: 360. 1863 (teste Saccardo, 1889).

Ascobolus immersus Pers. ex Pers. var. *andinus* Speg. *in* An. Mus. nac. Hist. nat. B. Aires 19: 452. 1909 (teste van Brummelen, 1962).

HABITAT AND DISTRIBUTION: on dung of various kinds in Europe, America and Australia.

SPECIMEN EXAMINED

AUSTRALIA. Queensland. On cow dung, Brisbane River, July 1912, J. H. Simmonds (comm. F. M. Bailey 2).



Figs. 281–285. Ascospores of species of *Ascobolus*. — 281. *Ascobolus furfuraceus* (From L. D. Williams). — 282. *Ascobolus crenatus* (From G. Beaton 30). — 282. *Ascobolus archeri* (From type). — 284. *Ascobolus leiocarpus* (From Brisbane specimen). — 285. *Ascobolus immersus* (From J. H. Simmonds).

FAMILY PYRONEMATACEAE

Although the morphology, anatomy, cytology and ontogeny of the type genus of this family have been thoroughly investigated, it has not been possible to assess the taxonomic implication of all available information satisfactorily, largely because there is no comparable data from those genera which in the past have been considered to be closely related to *Pyronema*. The true relationship of the present family with the others can be established only when the anatomy and the ontogeny of the many brightly pigmented species of the Humariaceae and the Thelebolaceae are more fully understood. It is probable that the Pyronemataceae – which for the time being is treated as a monotypic family – should be regarded only as a tribe of the Humariaceae, but since the latter family (*vide supra*) appears to be already polyphyletic the introduction of another aberrant element there seems to be unwarranted.

PYRONEMA Carus

Pyronema Carus *in* Nova Acta Leop. dt. Akad. Naturf. 17 (1): 370. 1835. — *Lecanidion* Endlich. subgen. *Pyronema* (Carus) Roum., Crypt. illust. 2: 79. 1870. — *Peziza* [Dill.] St-Amans [ser. *Aleuria* Fr.] subgen. *Pyronema* (Carus) Cooke, Mycograph. 1: 255. 1879 [ut "*Pyronema* (Car.) Fuckel"].

TYPE SPECIES: *Pyronema marianum* Carus.

Moore & Korf (*1963*), who studied the two common species of this genus extensively, gave the following generic diagnosis: "Apothecia minute, red, pink, orange, ivory, or white, scattered to gregarious, sometimes confluent and forming crusts of fused apothecia, borne on a more or less prominent subiculum, always on recently sterilized substrata (particularly fireplaces, charcoal kilns, steam-sterilized soil, new plaster), of very simple structure, at first conical, expanding to turbinate, with or without delicate hairs on the ectal excipulum, arising from one or more pairs of large sex organs supported by conspicuous stalk cells, each pair consisting of a clavate, unicellular antheridium and a globose, unicellular ascogonium surmounted by a tubular, unicellular trichogyne; asci operculate, 8-spored, clavate, not blueing in iodine, arising from croziers; ascospores uniseriate, hyaline, elliptic, 1-celled, non-guttulate, smooth or very faintly punctate at complete maturity; paraphyses filiform, seldom branching except at the very base, sparingly septate, slightly or not enlarged above, about as long as the asci. Conidia not formed. Sclerotia known only in culture, in a single species."

HABITAT: on recently sterilized substrata, such as burnt places, new plaster etc.

As Boedijn (*1940*) and Moore (*1963*) already indicated, the bibliography on the anatomy, cytology and ontegeny of *Pyronema*, especially of *Pyronema omphalodes*, is voluminous. Moore & Korf (*1963*) stated, however that there was no guarantee that all these works were actually based on species of *Pyronema* as they are generally understood at present. The claim by Schmidt (*1909*) that *Pyronema omphalodes* had an *Oedocephalum* conidial state, for example, cannot be substantiated because obviously

Schmidt was not working with a species of *Pyronema* but with one of *Iodophanus*.

Two widely distributed species of *Pyronema* are commonly found but the possibility of this genus having more than two species cannot be ruled out (Moore & Korf, *1963*). During the present study no collection of *Pyronema domesticum* (Sow. ex S. F. Gray) Sacc. has been seen from Australasia. According to Moore & Korf (*1963*) the two species can be keyed out as follows:

A. Apothecia densely gregarious, often fusing and forming confluent masses. No hairs formed. No sclerotia formed in culture
Pyronema omphalodes (Bull. ex St-Amans) Fuckel

Aa. Apothecia separate to gregarious, rarely 2 or 3 apothecia fusing. Distinct hairs almost always formed in nature, but frequently inconspicuous or lacking in culture. Sclerotia formed in culture on rich media
Pyronema domesticum (Sow. ex S. F. Gray) Sacc.

Pyronema omphalodes (Bull. ex St-Amans) Fuckel

Peziza omphalodes Bull., Herb. Fr. *t. 485 f. 1.* 1790; Hist. Champ. Fr. 264. 1791. — *Peziza omphalodes* Bull. *ex* St-Amans, Fl. agen. 531. 1821; Fr., Syst. mycol. **2**: 73. 1822. — *Pyronema omphalodes* (Bull. ex St-Amans) Fuckel *in* Jb. nassau. Ver. Naturk. **23–24**: 319. 1870. — *Aleuria omphalodes* (Bull. ex St-Amans) Gill., Champ. Fr., Discom. 48. 1879. — *Humaria* (*Tapesia*) *omphalodes* (Bull. ex St-Amans) Quél., Enchir. Fung. 291. 1886.

Pyronema marianum Carus *in* Nova Acta Leop. dt. Akad. Naturf. **17** (1): 375. 1835. — *Lecanidion* (*Pyronema*) *marianum* (Carus) Roum., Crypt. illust. **2**: 79. 1870 [ut "*mariauum*"].

Peziza confluens Pers., Obs. mycol. **2**: 81. 1799. — *Peziza confluens* Pers. *ex* Pers., Mycol. eur. **1**: 274. 1822. — *Pyronema confluens* (Pers. ex Pers.) Tul., Sel. Fung. Carp. **3**: 197. 1865. — *Pyronema omphalodes* (Bull. ex St-Amans) Fuckel var. *confluens* (Pers. ex Pers.) Sacc. & Trav. *in* Sacc., Syll. Fung. **20**: 649. 1911 [ut "var. *confluens* (Pers.) Tul."].

Peziza omphalodes Bull. ex St-Amans [var.] *aurantio-lutea* Fr., Syst. mycol. **2**: 73. 1822. — *Pyronema omphalodes* (Bull. ex St-Amans) Fuckel [var.] *aurantio-luteum* (Fr.) Fuckel *in* Jb. nassau. Ver. Naturk. **23–24**: 320. 1870.

Individual apothecia small, 300–1100 μ diam., lenticular, but mostly becoming irregular by mutual pressure, aggregated or confluent with each other to form an extensive mass of apothecia, seated on distinct white networks of hyphae. Disc mostly convex, sometimes flat or undulate, of various shades of pink, usually without a distinct margin. Receptacle concolorous or a little paler than the disc, shallow cup shaped or discoid, anchored to the subtratum by flexuous, rather stiff, hyaline, non- or only sparingly septate, occasionally branched, with undulately thick walled hyphae 3–14 μ diam. Ectal excipulum not very conspicuous and rather poorly developed, of a few layers of elongated cells 10 μ diam., running parallel to the surface of the receptacle. Medullary excipulum of globose or subglobose cells around 30 μ diam., interspaced with elongated cells with smaller diam. Subhymenium of compacted angular cells 6–10 μ diam. Hymenium about 150 μ thick. Asci cylindrical, only slightly narrower towards the base, 8-spored, 120–154 × 8–11 μ. Ascospores uniseriate, ellipsoid or sometimes somewhat obovoid, without oil drops, hyaline,

smooth walled, 11.8–15.4 × 6.5–8.1 μ. Paraphyses rather sparse, slender 2–3 μ diam. below, enlarged at the apex to about 4.5 μ diam., straight, only sparingly septate. The anatomy of this cosmopolitan species has been excellently illustrated by Le Gal (*1953*).

HABITAT AND DISTRIBUTION: on new plaster, recently burnt ground or sterilized soil, world wide (type locality France).

SPECIMEN EXAMINED

NEW ZEALAND. On wood ashes after forest fire, Manaia, February 1886, T. Kirk 284.

FAMILY THELEBOLACEAE

The scope of this family is narrower than that of the Ascobolaceae tribe Pseudoascoboleae of Boudier (*1907*), Le Gal (*1947*, *1953*) and Dennis (*1960*) or the Pezizaceae tribe Pyronemeae of Korf (*1954*), but more or less it corresponds to the Pezizaceae tribe Theleboleae of Kimbrough & Korf (*1967*). The latter authors have given a synopsis of the genera and species of this family.

Members of this coprophilous family have tiny (often less than 500 μ diam.), very small to small apothecia which sometimes are inconspicuous even under a lower power binocular microscope; the dull coloration of the discs of these apothecia makes the task of finding them in poor herbarium specimen even more difficult. In some species each apothecium produces only one ascus, in others three to five asci may be formed but there are many species of the Thelebolaceae which have regularly polyascal apothecia. The paucity of the ascus formation in some of these species is compensated by the production of hundreds of small ascospores in each ascus. Most genera of this family have thick ascus walls, which often consist of two to three layers; these are as a rule insensitive to Melzer's reagent but mostly react characteristically with Congo red and acid fuchsin. My experiences with British representatives of the Thelebolaceae which I studied in fresh condition fully substantiate Kimbrough's (*1966*) conclusions that the genera of this family should be founded on qualitative microscopic and microchemical characters – especially those of the asci and ascospores – rather than on quantitative and superficial evidence such as the number of asci and ascospores as has been generally accepted.

The genera of the Thelebolaceae seem to fall naturally into two groups; the first group usually have thick walled asci which produce ascospores which do not contain any detectable globules; the second group sometimes has hairy apothecia with thinner walled asci which form ascospores which usually contain a conspicuous, highly refractive gaseous bubble now often referred to as de Bary bubble. The Australasian Pezizales collections in Herb. Kew. contain a thelebolaceous genus of the latter group, but there is no doubt that a special search for these minute fungi will show that many more occur in this area.

Lasiobolus Sacc.

Lasiobolus Sacc. *in* Bot. Cbl. 18: 220. 1884.

Lectotype species: *Ascobolus pilosus* Fr.

Apothecia minute, gregarious to densely crowded, sessile to subsessile. Disc flat or more commonly convex, at maturity minutely roughened by protruding asci, variable in colour, yellowish or reddish orange, red, or rarely whitish. Receptacle obconical or almost turbinate, sometimes shallowly funnel shaped, sparsely but distinctly hairy. Hairs superficial, thick walled, acuminate, non-septate, hyaline, short to relatively long. Ectal excipulum around the hymenial layer very thin, becoming thicker towards the base, of angular or isodiametric cells (textura angularis). Medullary excipulum well developed, of textura intricata but often simulating a pseudoparenchymatous tissue. Asci clavate cylindrical, with a distinct narrow base, 8–many-spored, apex not blued in Melzer's reagent. Ascospores uniseriate to irregularly biseriate, smooth walled, hyaline to subhyaline, without oil globules but sometimes with a highly refractive bubble, oblong ellipsoidal. Paraphyses slender, sparingly septate, sometimes branched, only slightly enlarged at the apex.

Habitat: on various kinds of dung.

Lasiobolus is a small but well characterized coprophilous genus. Its small apothecia, which are simply constructed, and the colourless, stiff, one celled, acuminate hairs are very distinctive. Superficially it resembles the small species of the genus *Cheilymenia* and in fact Saccardo (*1889*) classified *Cheilymenia raripila* as a *Lasiobolus*. With the exception of the similarity in habitat and macroscopic appearance the two genera seem to be unrelated, because their ascospore characters, the anatomy of their apothecia and the structure of their hairs are markedly different.

Species of *Lasiobolus* are rather variable and their nomenclature is somewhat confused. So far only one species is known to occur in Australasia (Rodway, *1925*) and this will be further described below.

Lasiobolus ciliatus (Schmidt ex Pers.) Boud.

Ascobolus ciliatus Schmidt *in* Mycol. Hefte 1: 90. 1817. — *Ascobolus ciliatus* Schmidt *ex* Pers., Mycol. eur. 1: 340. 1822; Fr., Syst. mycol. 2: 164. 1822. — *Ascophanus ciliatus* (Schmidt ex Pers.) Boud. *in* Ann. Sci. nat. (Bot.) V 10: 354. 1869. — *Peziza equina* (Müll.) ex S. F. Gray var. *ciliata* (Schmidt ex Pers.) Karst., Mycol. fenn. 1: 73. 1871. — *Ascophanus pilosus* (Fr.) Boud. var. *ciliatus* (Schmidt ex Pers.) Phill., Man. Br. Discom. 312. 1887 [ut var. *ciliatus* (Berk. & Br.)]. — *Lasiobolus equinus* (Müll. ex S. F. Gray) Karst. [subsp.]**Lasiobolus ciliatus* (Schmidt ex Pers.) Sacc., Syll. Fung. 8: 537. 1889 [ut "* *L. ciliatus* (Berk.) Sacc."]. — *Lasiobolus ciliatus* (Schmidt ex Pers.) Boud., Hist. Class. Discom. Eur. 78. 1907.

Elvella equina Müll. *in* Fl. dan. 5 (13): 8 *t. 779 fig. 3.* 1778. — *Peziza equina* (Müll.) *ex* S. F. Gray, Nat. Arrang. Br. Pl. 1: 666. 1821. — *Ascobolus equinus* (Müll. ex S. F. Gray) Karst. *in* Notis. Sällsk. Fauna Fl. fenn. 11: 209. 1870. — *Lasiobolus equinus* (Müll. ex S. F. Gray) Karst. *in* Acta Soc. Fauna Fl. fenn. 2: 122. 1885.

?*Peziza papillata* Pers. *in* Neues Mag. Bot. 1: 115. 1794. — *Peziza papillata* Pers. *ex* Fr., Syst. mycol. 2: 88. 1822. — *Ascobolus papillatus* (Pers. ex Fr.) Wallr., Fl. crypt. Germ. 2: 514. 1833. — *Ascophanus papillatus* (Pers. ex Fr.) Boud *in* Ann.

Sci. nat. (Bot.) V **10**: 252. 1869 [misapplied?]. — *Lachnea papillata* (Pers. ex Fr.) Gill., Champ. Fr., Discom. 74. 1880 [misapplied?]. — *Lasiobolus papillatus* (Pers. ex Fr.) Sacc. *in* Bot. Cbl. **18**: 220. 1884.

Ascobolus pilosus Fr., Syst. mycol. **2**: 164. 1822. — *Ascophanus pilosus* (Fr.) Boud. *in* Ann. Sci. nat (Bot.) V **10**: 254. 1869. — *Ascobolus equinus* (Müll. ex S. F. Gray) Karst. [subsp.] **Ascobolus pilosus* (Fr.) Karst. *in* Notis. Sällsk. Fauna Fl. fenn. **11**: 210. 1870. — *Peziza equina* (Müll.) *ex* S. F. Gray var. *pilosa* (Fr.) Karst., Mycol. fenn. **1**: 73. 1871. — *Lasiobolus pilosus* (Fr.) Sacc. *in* Bot. Cbl. **18**: 220. 1884. — *Lasiobolus equinus* (Müll. ex S. F. Gray) Karst. [subsp.] **Lasiobolus pilosus* (Fr.) Sacc., Syll. Fung. **8**: 537. 1889.

? [*Peziza cervina* Pers., Mycol. eur. **1**: 254. 1822. —] *Peziza diversicolor* Fr., Syst. mycol. **2**: 88. 1822. — *Lachnea diversicolor* (Fr.) Gill., Champ. Fr., Discom. 81. 1880. — *Scutellinia diveriscolor* (Fr.) Lamb., Fl. mycol. Belg., Suppl. **1**: 301. 1887.

Peziza stercorea (Wigg.) ex S. F. Gray var. *equina* Pers., Mycol. eur. **1**: 247. 1822 (sensu Boudier, *1869*). — *Ascophanus pilosus* (Fr.) Boud. var. *equinus* (Pers.) Boud. *in* Ann. Sci. nat. (Bot.) V **10**: 255. 1869. — *Ascophanus pilosus* (Fr.) Boud. f. *equinus* (Pers.) Rehm *in* Ber. naturhist. Ver. Augsburg **26**: 28. 1881 [ut f. *equinus* Boud.].

Ascophanus pilosus (Fr.) Boud. var. *vaccinus* Boud. *in* Ann. Sci. nat. (Bot.) V **10**: 255. 1869. — *Ascophanus pilosus* (Fr.) Boud. f. *vaccinus* (Boud.) Rehm *in* Ber. naturhist. Ver. Augsburg **26**: 28. 1881. — *Lasiobolus pilosus* (Fr.) Sacc. var. *vaccinus* (Boud.) Gamundi *in* Darwiniana **13**: 602. 1964.

Apothecia gregarious to densely crowded, sessile or substipitate, very small, 300–700 μ diam. Disc flat or convex, minutely roughened by protruding mature asci, very variable in colour, pale yellowish to orange. Receptacle shallow funnel shaped, obconical or sometimes almost turbinate, whitish and paler than the disc, occasionally with an indistinct stipe-like base, distinctly hairy, anchored to the substratum by undulating, stiff, somewhat thick-walled, generally non-septate and unbranched, subhyaline to yellowish hyphae 2–4.5 μ diam. Hairs arise from the lower part of the receptacle, with hyaline or very pale yellowish thick walls, non-septate, stiff, acuminate, base often somewhat swollen or ventricose, sometimes lobed but superficial in origin, up to 360 μ or more long by 10–40 μ diam. at the widest part. Ectal excipulum around the hymenial layer thin, only 10–17 thick, of a few layers of small, angular or lobed elongated cells about 10×5 μ arranged horizontally with their long axes parallel with the surface of receptacle so that from surface view they give an impression of a textura epidermoidea tissue; towards the base of the receptacle ectal excipulum becomes thicker, up to 50 μ thick, of lobed or angular and almost isodiametric cells 9–20 μ diam. (textura angularis). Medullary excipulum of narrower (up to 12 μ diam.) but longer celled tissue (almost textura angularis), often interspaced with distinct hyphal elements, especially towards the subhymenium. Subhymenium not very sharply differentiated from medullary excipulum except that it is more compactly arranged and sometimes smaller celled. Hymenium about 200 μ thick. Asci subcylindrical or broad clavate cylindrical, abruptly attenuate below into a narrow and short stem-like base, $140–260 \times 17–25$ μ, 8-spored. Ascospores uniseriate or irregularly biseriate, hyaline to subhyaline, oblong ellipsoidal, without oil globules but sometimes containing a highly refractive bubble, $19–23.6 \times 10–12.3$ μ, smooth walled and apparently covered by a thin and indistinct mucous sheath. Paraphyses slender, sparingly septate, 1.8–2.7 μ diam. below, only slightly enlarged to about 3.5 μ at the apex, which is sometimes forked (Fig. 286–291).

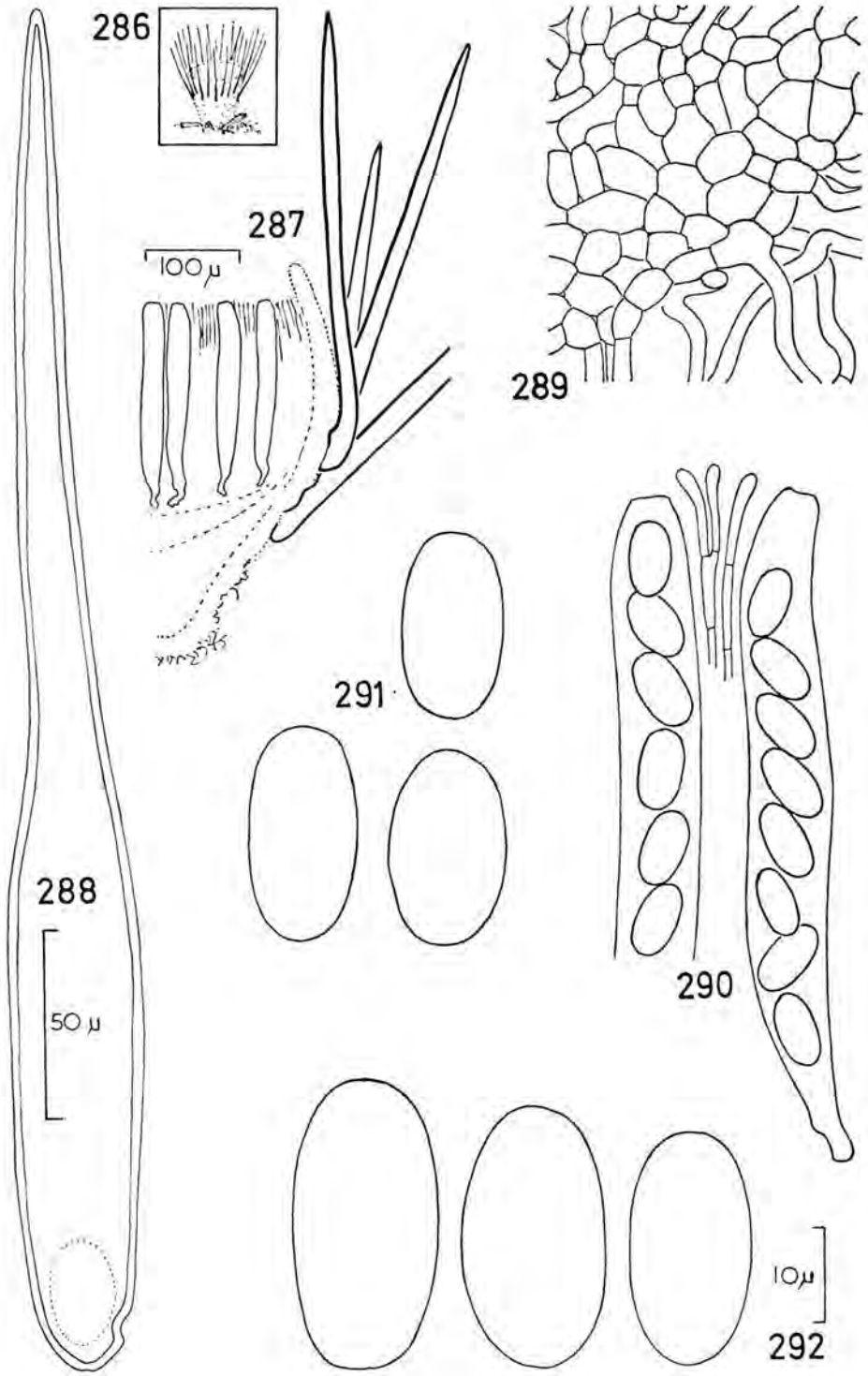
HABITAT AND DISTRIBUTION: on various kinds of dung in Europe (type locality, Germany), North America, Argentina, India and Australia.

As has been remarked by Dennis (*1960*), this species is somewhat variable. The hairs and the ascospores of some specimens may be somewhat narrower than in the typical representatives of this species but it has not been found possible to correlate the variation of one character with the other. Boudier (*1869*) recognized three varieties which were separated mainly on their habitat, namely whether they grew on horse, cow or sheep dung but in this genus the difference in the substrate does not seem to have any taxonomic significance.

Rehm (*1895*) and Seaver (*1928*) reduced *Ascobolus diversisporus* Fuckel to the synonymy of the present species but an authenticated specimen in Herb. Kew. (ad fimum vaccinum, vere, s. dat., Frankensteiner Kopf; Fuckel, Fungi rhenani no. 2570 sub *Ascobolus diversisporus*) has been observed to have larger ascospores, which measure 23–30 × 11.5–15 μ (Fig. 292). In the original description of this species Fuckel (*1870*) mentioned the presence of a secondary type of ascospore which were smaller in size than the ones given above, and he described the asci as 4–8-spored. These characters, however, cannot be found on the slide prepared from this authentic specimen. The American specimen described as *Lasiobolus pilosus* by Snyder (*1938*) may be identical with Fuckel's species.

It has been found difficult to choose the correct name of the present species from the synonymies listed above. In the past each specific epithet has been considered a synonym of one species or the other and has been either accepted or rejected with similar frequency (Boudier, *1869*; Saccardo, *1889*; Rehm, *1895*; Seaver, *1928*; Snyder, *1938*). The oldest post-Linnean name appears to be *Elvella equina* Müller (*1778*) and it is also the first one to be validated after 1 January 1821 (by Gray, probably in November 1821). Karsten (*1871*), Saccardo (*1889*), Rehm (*1895*), Massee (*1895*), Seaver (*1928*) and more recently Batra & Batra (*1963*) and Kimbrough (*1966*) accepted the specific epithet 'equinus', but since Fries (*1822*) rejected it, under the current "International Code of Botanical Nomenclature" this epithet should be abandoned in favour of the one(s) used by Fries. Phillips (*1887*), Snyder (*1938*), Lundell & Nannfeldt (*1941*) and Gamundi (*1964*) used the one coined by Fries (*1822*) himself, namely 'pilosus', whereas Dennis (*1960*), Moser (*1963*), Denison (*1963*) and Berthet (*1964a*) referred to the present species as *Lasiobolus ciliatus*. Both the epithets 'pilosus' and 'ciliatus' were accepted by Fries, but since Persoon's (*1822*) revalidation of the name *Ascobolus ciliatus* has priority over the name *Ascobolus pilosus* proposed by Fries (*1822*), the correct name of the present species appears to be *Lasiobolus ciliatus*.

Peziza diversicolor and *Peziza papillata* are listed here as possible synonyms of *Lasiobolus ciliatus*, as has also been done by Rehm (*1895*) and Seaver (*1928*), largely because several published exsiccata under these



Figs. 286–292. — *Lasiobolus ciliatus*. 286. Habit sketch. 287. Diagramatic section of half of apothecium. 288. Hair. 289. Section of ectal and part of medullary excipulum. 290. Asci and paraphyses. 291. Ascospores. (From G. Beaton 296). — *Lasiobolus diversisporus*. 292. Ascospores (From Fuckel, Fungi rhenani no. 2570). — Figs. 288, 289, 290 and Figs. 291, 292 to same scale.

names which I could study have been found to be conspecific with the present species.

SPECIMENS EXAMINED

AUSTRALIA. Victoria. On cow dung, Melbourne, December 1885, comm. F. Reader 9; on cow manure, mouth of Aire River, 26 June 1965, G. Beaton 296.

EUROPE. Finland. På hästexkrem, Wasa, 23 July 1867 [Karsten, Fungi Fenn. exs. no. 758 sub *Ascobolus papillatus*]. — France. En automne, sur la bouse de vache, sur les crottes du cheval, de l'âne et du mouton [Desmazieres, Crypt. France no. 1743 sub *Peziza diversicolor*]. — Germany. Ad finum equinum, frequens, autumno [Fuckel, Fungi rhenani no. 1860 sub *Ascobolus ciliatus*]; ad fimum vaccinum putridum, frequens, autumno [Fuckel, Fungi rhenani no. 1133 sub *Ascobolus papillatus*]; auf Eselexkrementen (fimo asinino), Forstrevier "Lotsche" bei Klosterfelde, Neider-Barnini, Brandenburg, 30 March 1918, H. P. Sydow [Sydow, Mycotheca germanica no. 1642 sub *Lasiobolus equinus*]. — Russia. Ad stercus alceum in alneto humido, Distr. Radvere, Karepa, Estonia, 18 Julius 1957, A Raitviir [Raitviir, Mycotheca estonica no. 52 sub *Lasiobolus pilosus*].

LITTLE KNOWN OR EXCLUDED SPECIES

On several occasions it has been indicated above that a number of species of the Pezizales recorded by Cooke (*1892*) and other authors were based on specimens which cannot be located in Herb. Kew. Therefore the following list of little known or excluded species is by no means an exhaustive one, because it contains mostly those species for which there are specimens to substantiate the report of their occurrence in Australasia. Most of these species are endemic in Australasia but the poor state of their type specimens makes it difficult to dispose of them with any degree of certainty so that until freshly collected specimens become available it will be better not to propose any transfer.

SEPULTARIA AURANTIA Rodway *in* Pap. Proc. R. Soc. Tasmania **1920**; 154. 1921.

Although this species has a subterranean habit, the ascospore characters and probably the colour of its discs seem to suggest that it is not a species of *Sepultaria*; this genus, by the way, is very poorly understood.

DISCINA AUSTRALICA Cooke, Handb. Austral. Fungi 225. 1892.

This name is to be discarded because it was based only on a drawing which cannot be satisfactorily identified.

ASCOBOLUS BARBATUS Massee & Crossland *apud* Massee *in* Grevillea **22**: 99. 1894; Rodway *in* Pap. Proc. R. Soc. Tasmania **1924**: 99. 1925.

Denison (*1961*) has shown that this species was based on an immature species of *Scutellinia* contaminated with ascospores of an *Ascobolus*. Consequently the Australasian record of this species must be deleted as well.

PEZIZA BRUNNEOATRA Desm. *in* Ann. Sci. nat. (Bot.) II **6**: 1836; Cooke, Handb. Austral. Fungi 254. 1892; Rodway *in* Pap. Proc. R. Soc.

Tasmania **1924**: 113. 1925 (as a synonym of *Humaria macrospora* Fuckel); Hansford *in* Proc. Linn. Soc. N.S.W. **79**: 128. 1954.

None of the Australasian specimens identified with this species can be considered to be congeneric, let alone conspecific, with its type specimen, which has been redescribed and illustrated by Dennis (*1960*). Both Cooke's and Rodway's records were based on one or two species of *Jafneadelphus* (*q.v.*), whereas Hansford's specimen has been found to be *Nothojafnea cryptotricha*; Hansford also confused the latter species with *Leucoscypha albo-cincta*.

HUMARIA CANDIDA Rodway *in* Pap. Proc. R. Soc. Tasmania **1924**: 114. 1925.

The type specimen of this species has asci which are blued in Melzer's reagent, but no mature ascospores were found; most probably it is a good species of *Peziza*.

PEZIZA DRUMMONDII Berk. *in* Lond. J. Bot. **4**: 71. 1845.

This species apparently will have to be made the type species of a new genus, which in turn is probably allied to *Galiella* or *Urnula*. It has a terrestrial habitat, hyaline warted hairs, warted guttulate ascospores but there are no hymenial hairs. Superficially it resembles species of *Jafneadelphus* but this species – at least when young – appears to have gelatinized medullary excipulum. The nature of this gel layer needs to be elucidated before this new genus can be satisfactorily characterized.

RHIZINA LIGNICOLA Rodway *in* Pap. Proc. R. Soc. Tasmania **1924**: 117. 1925.

This is *Sorokina lignicola* (Rodway) Dennis *in* Kew Bull. **13**: 353. 1958, an inoperculate species.

OTIDEA LOBATA Rodway *in* Pap. Proc. R. Soc. Tasmania **1924**: 116. 1925.

This species is a member of the inoperculate family Helotiaceae and probably should be included in the genus *Discinella* Boud.

GEOPYXIS PALLIDA Rodway *in* Pap. Proc. R. Soc. Tasmania **1920**: 154. 1921 (ut *pallidus*).

Fresh collections are needed before the affinity of this humariaceous species can be satisfactorily solved. Its ascospores are distinctly warted, subfusoidal and not oblong as originally described by Rodway; its ectal excipulum is composed of large, light brown, thin walled cells.

PEZIZA PLICATA Massee & Rodway *apud* Massee *in* Bull. misc. Inf. Kew **1901**: 158. 1901.

This species should be transferred to either *Hymenoscyphus* S. F. Gray emend. Dennis or *Discinella* Boud. of the Helotiaceae.

HUMARIA STIPITATA Rodway *in* Pap. Proc. R. Soc. Tasmania **1924**: 114. 1925.

This is also an inoperculate species, belonging to either Helotiaceae or Sclerotiniaceae.

SPHAEROSOMA TRISPORA McLennan & Cookson *in* Proc. R. Soc. Victoria **38**: 73. 1926.

This species cannot be classified as a *Sphaerosoma* Klotzsch because of its iodine negative asci. The complicated ornaments of its ascospores strongly resemble those of *Boudiera* Cooke, but this genus has iodine positive asci as well. It is very likely that this curious fungus represents a species of the genus *Svrcekia* Kubička (*1960*) but I have not been able to study the type species of the latter genus.

PEZIZA VINOSO-BRUNNEA Berk. & Br. *in* Trans. Linn. Soc. Lond. II **1**: 404. 1879.

The ascospores of the type specimen of this species are smooth walled and probably non-guttulate, 20–24.5 × 11–13.6 μ. The hairy apothecia are cup shaped and growing on burnt ground. The hairs are subhyaline to pale yellowish and narrow. This species seems to oscillate between *Nothojafnea* and *Tricharia* Boud. but more information on the excipular and ascospore character are required before this species can be satisfactorily classified. The specimens described under *Lachnea vinoso-brunnea* (Berk. & Br.) Sacc. by McLennan & Halsey (*1936*) probably belong to *Nothojafnea cryptotricha* rather than to the present species.

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