

Thelephoraceae of New Zealand

Part I: Sub-family Cyphelloideae

By G. H. CUNNINGHAM

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Abstract

THE first part deals with the Thelephoraceae as a whole, especially criteria for their classification; the rest is a detailed taxonomic treatment of the New Zealand spp. of Cyphelloideae. It is held that macrofeatures like shape, size and colour of the hymenophore are of less value in classification of Thelephoraceae than microfeatures such as hyphal systems, arrangement of context, structure of hymenial layer, and type of ancillary organ—e.g., gloeocystidia, cystidia, dichophyses, acanthophyses, astero-physes, setae, pseudo-setae, fascicles and conducting vessels. These features, which are illustrated, were examined in hand sections of herbarium material, stained in aniline blue (0.1% in 50% lactic acid) and counterstained if greater contrast was required with 1% aqueous Safranin O. All N.Z. spp. and some hundreds examined at Kew have monomitic or dimitic hyphal systems, but both may occur in one genus. Presence or absence of clamp connections, and hyaline or brown hyphae, are also variable within most but not all genera. Ancillary organs provide some of the most useful features for generic segregation. *Merulius* and *Serpula* are treated as a sub-family Meruloideae of Thelephoraceae, instead of Polyporaceae as previously, because the hymenium is continuous. There is a key to the sub-families, tribes and genera (20) of Thelephoraceae. The sub-family Cyphelloideae is represented in N.Z. by 2 genera, *Solenia* Pers. (5 spp.) and *Cyphella* Fries (10 spp.). There are keys to the species of both genera, and each sp. has a full description with distribution and locality records. New species, with Latin and English descriptions, are *S. huia*, *C. hebe*, *C. totara*, *C. pyriforma*, *C. turbinata*, *C. tongariro* and *C. pseudopanaea*. Excluded species are *C. cookii* Sacc. & Syd., *cupulaeformis* Berk. & Rav., *C. discoidea* Cke., *C. filicicola* Cke., and *C. zealandica* Cke. & Phillips.

INTRODUCTION

THE traditional Thelephoreae was used by Persoon (1822, p. 109), and later by Fries (1874, p. 629) for a tribe to contain fungi with an even hymenial surface as opposed to plants with gills, pores, or definite spines. Later workers have shown that many diverse groups were so included, and have gradually eliminated certain ascomycetes, heterobasidiomycetes and other unrelated fungi. As defined to-day, the family Thelephoraceae contains species with the hymenial layer carried upon a resupinate or pileate hymenophore, and formed from a vertical palisade of basidia and paraphyses with which may be associated additional ancillary organs discussed below. Basidia are simple, one-celled, and produce spores on two or four apical sterigmata. Though nominally even the hymenial surface is seldom smooth; consequently the position of a few genera and species is still uncertain. In some species the hymenium is definitely papillate, and though the microstructure shows them to be members of the Thelephoraceae, on this one feature certain workers have removed them to the Hydnaceae. In *Epithela* fascicles of hyphae arise deeply within the context, pierce the hymenial layer, and project some distance, giving the hymenium an irregular tufted appearance. Because of this several authors have placed the genus also under the Hydnaceae. In *Cyphella* and *Solenia* the hymenial surface is concave and

borne on the inner surface of cupulate or cylindrical pilei. In consequence both have been placed by some taxonomists under the Cyphellaceae. *Aleurodiscus* and *Cytidia* contain species with a hymenial surface which may be patelliform, convex, or concave; in other species it may be reticulated through merging of several pilei with consequent raising of margins at points of fusion. On account of these features, they also have been placed by some authors under the Cyphellaceae. In *Merulius* the hymenial layer is thrown into rugulose-porose folds. Most workers have therefore placed it under the Polyporaceae, or another family, the Meruliaceae. A few species of *Stereum* and *Thelephora* with stipitate and lacinate pilei have been treated as members of the Clavariaceae. Other species of these genera, and of *Phlebia*, possess a hymenium which may be radiate-striate with raised folds, or folds may be modified into raised linear rows of papillae. By some workers they have been placed under the Meruliaceae.

Genera are defined herein mainly by certain microfeatures, especially presence or absence of certain ancillary organs. When present, the latter usually form the greater part of the hymenial layer and, being constant for the species, serve both as specific and generic diagnostic characters. They are usually seen clearly in sections stained and mounted by methods outlined below. Other useful taxonomic features are arrangement of context, structure of the hymenial layer, type of ancillary organ and hyphal system. Of less value are such macrofeatures as shape, size and colour of the hymenophore, whether stipitate, sessile, or resupinate. In the past it has been customary to segregate genera on whether species are pileate or resupinate, and to ignore more constant microfeatures; an illogical treatment since at one stage in their development most plants are resupinate. Furthermore, related species are often placed under different genera because of this one growth condition. As examples may be taken the usual treatment of *Stereum cinerascens*, *S. vinosum*, *S. schomburgkii* and *Peniophora habgallae*. Though usually placed under *Stereum* because collections are often pileate, the first two possess typical cystidia and other microfeatures of *Peniophora*, so are obviously members of the latter genus. The third has the microstructure of *Duportella*. The fourth, though a typical *Peniophora*, has been placed by various workers under *Aleurodiscus* or *Cytidia*, with neither of which it agrees in microstructure.

TECHNIQUE

Descriptions in this and following papers have been drawn from freehand transverse sections cut to a thickness of 10–15 μ from selected dried herbarium material. Many sections are often needed before all details can be ascertained, especially of the fertile hymenium. Part of the substratum should be included in the section so that basal hyphae may be examined; and with pileate species sections should show surface hairs, cortex (when present), context and hymenial layer. Sections through the growing margin should also be examined, as in this region the hyphal system and series can be seen most readily, and details of ancillary organs examined since in mature fructifications they are often obscured by masses of crystals or gelatinous matter.

Sections are transferred from the razor to the slide on which has been placed two or three drops of a solution containing 50 per cent. lactic acid in water to which has been added 0.1 per cent of Aniline Blue. The slide is then heated over a flame until bubbles form in the section, cooled, and a coverslip placed in

position. When much mineral matter is present it may be necessary to remove it by boiling the section for two or three seconds over the flame. Where greater contrast is required, sections may be counterstained with 1 per cent. solution of Safranin 0 in distilled water. One drop is placed on the section while still wet with the previous solution, and immediately washed off with two drops of lactic acid aniline blue solution, which acts as a mordant. While colour is still coming away from the section the coverslip is placed in position and surplus stain removed so that the preparation is as thin as the section will allow. When it has not been possible to ascertain hyphal systems from sections hyphae may be teased apart on the slide under a dissecting microscope, then treated with stain and mounted.

HYPHAL SYSTEMS, TYPES AND SERIES

Hyphal systems in the Basidiomycetes were first described by Corner (1932a, 1932b), and their significance as aids in generic delimitation in the Polyporaceae in twelve papers written by myself (Cunningham, 1947–1950). Corner found that in one polypore three series of hyphae composed the fructification. These he named skeletal, binding and generative. Skeletal hyphae provided a rigid framework, binding hyphae held the first together, generative hyphae supplied tissues of the hymenium and surface. In two species of *Fomes* he found there were but two series, skeletal and generative. He therefore assumed that any one of three hyphal systems was involved in forming the hymenophore of species of the Polyporaceae. These he named respectively monomitic, dimitic and trimitic hyphal systems. His findings may be summarized as follows—

<i>Hyphal System</i>	<i>Hyphal Series</i>
Monomitic	Generative hyphae only
Dimitic	Skeletal and Generative hyphae
Trimitic			Skeletal, Binding and Generative hyphae

No attempt has been made hitherto to ascertain hyphal systems of the Thelephoraceae. Consequently these were carefully studied in species present within New Zealand, and some hundreds examined at Kew in 1951. Results show that two hyphal systems only are present in the family, monomitic and dimitic.

Of the New Zealand species examined to date 117 were found to be monomitic, 86 of which possess clamp connections, 108 hyaline hyphae, 9 brown. Generative hyphae are always branched, usually freely septate, and thin-walled. Of the 77 with dimitic hyphal systems 33 possess clamp connections, 48 have hyaline and 29 brown hyphae. Skeletal hyphae may be freely branched (bovista type) when rarely septate, or unbranched and freely septate. They are usually of greater diameter and often with thicker walls than generative hyphae.

There is not the marked differentiation in hyphal systems in the Thelephoraceae that is so noticeable a feature in the Polyporaceae; for the greater number of genera possess species with both monomitic and dimitic systems, hyaline and brown hyphae, and are with or without clamp connections. A few genera, however, do show some differentiation. All species examined of *Solenia*, *Cyphella*, *Pellicularia* and *Asterostroma* possess monomitic systems with hyaline hyphae; of *Thelephora* monomitic systems and brown hyphae with clamp connections; of *Duportella* dimitic systems with brown hyphae and clamp connections. In *Hymenochaete* 22 species possess dimitic systems, one only being monomitic; all have brown hyphae and are without clamp connections.

HYMENIAL LAYER AND ITS INCLUSIONS

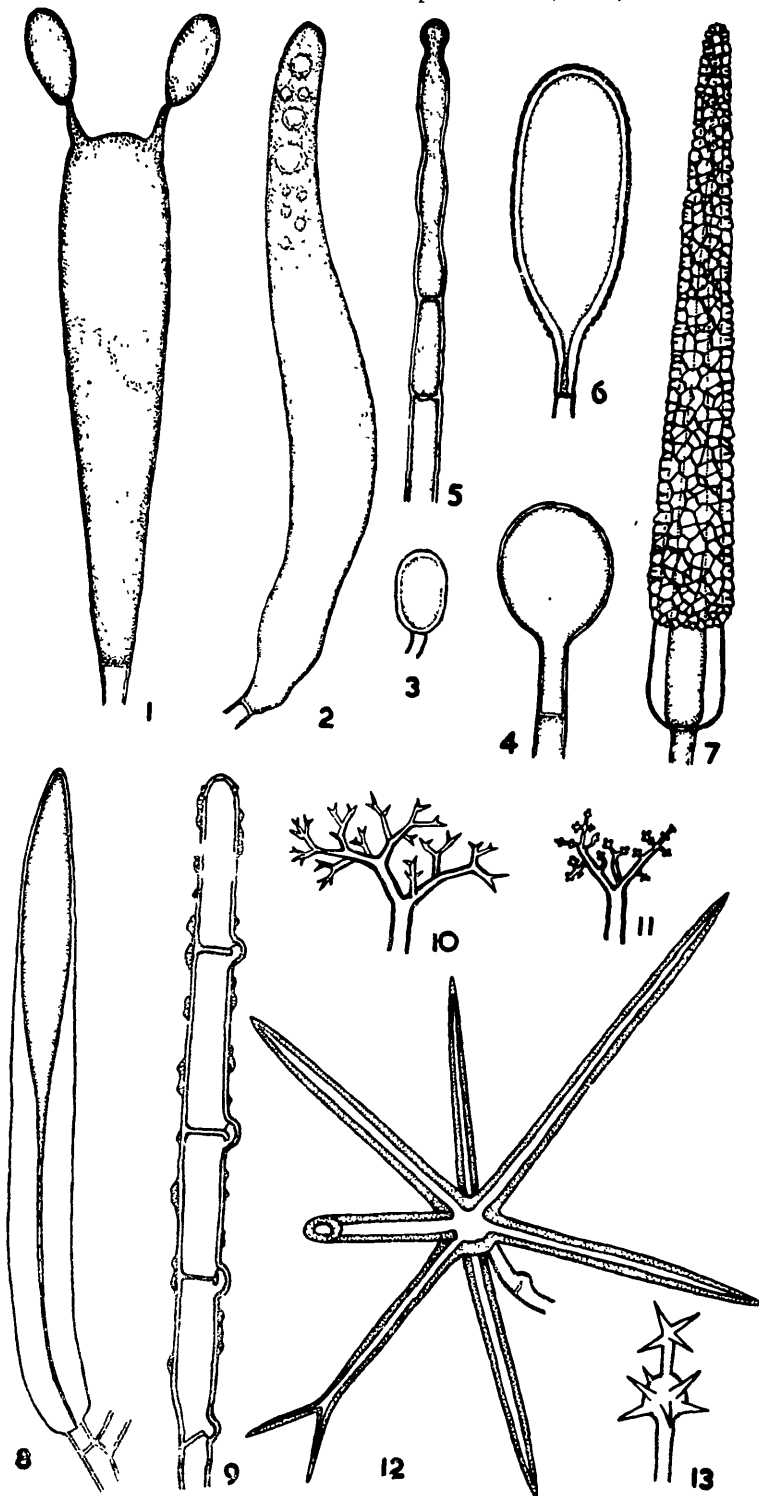
In all genera save *Pellicularia* the hymenium is composed of a dense palisade of basidia and paraphyses. Often associated with these, sometimes almost obscuring them because of their prolific development are ancillary organs which provide some of the most useful features for generic segregation. They may also develop in the context, especially in biennial or perennial species; and in a few genera (*Vararia*, *Asterostroma*) form the bulk of the context.

(1) *Basidia, Spores and Paraphyses* (Text-fig. A, fig. 1). Unicellular, mostly subclavate, basidia bear 2–4 spores on long or short simple apical sterigmata. They always arise from generative hyphae. In *Pellicularia* a true palisade is seldom formed, though sometimes appearing in rudimentary form, basidia developing on lateral branches, often in whorls from the repent hyphae of the context. Basidia with 6 or 8 spores are present in certain species of this genus. Several species of *Cytidia* and *Aleurodiscus* possess unusually large basidia, some exceeding 100μ in length with sterigmata extending $15\text{--}20\mu$ beyond their apices. In most species basidia are less than half this length. In a few species basidia are cylindrical, or slightly urceolate; some may be depressed below the level of the hymenial surface, or project some distance above it. Both shape and position are without taxonomic significance.

Spores are unicellular and may assume many shapes—globose, subglobose, oval, elliptical, allantoid, pip-shaped, tear-shaped, flask-shaped or turbinate. Commonly smooth, in species of two genera they are roughened; and in a few species of some other genera may be echinulate or verrucose. Usually hyaline, in two genera they are coloured brown.

Paraphyses in most species are similar in shape to the basidia, though usually of less diameter, and like basidia arise from generative hyphae. They usually far exceed in numbers the basidia. Some are filiform, in a few species may be moniliform (Text-fig. A, fig. 5) or branched at their apices. Most are hyaline, though in brown species may be coloured. A few bear lateral spines, or are coated with crystals. Basidia, spores and paraphyses are the only organs present in the hymenial layer of *Solenia*, *Cyphella* and *Thelephora*.

(2) *Gloeocystidia* (Text-fig. A, figs. 2, 3, 4). One-celled organs of diverse shape, gloeocystidia are present in some species of most genera, and in all species of *Asterostroma* and *Aleurodiscus* present in New Zealand. Like basidia, they arise from generative hyphae. Simple forms are subclavate or fusiform, little differentiated from paraphyses save in size and contents. In most species they are either long-cylindrical or flexuous bodies of considerable length; or pyriform or globose and of considerably greater diameter than paraphyses. Sometimes both types are present in the same species, and in a few form conspicuous zones of pyriform (*Stereum purpureum*) or flexuous (*Peniophora incarnata*) organs in the context. Invariably smooth, with contents coloured orange when fresh, staining blue in sections, they are conspicuous features readily seen under the microscope. In most species the wall is thin, 1μ or less, but in two species of *Aleurodiscus* is in excess of 4μ . Gloeocystidia may extend above the surface of the hymenium, remain plane with it, but most often are embedded in the hymenium and/or context, sometimes forming two or several palisade layers. In perennial species these layers are often a conspicuous feature. Gloeocystidia are the only ancillary organs in several species of *Corticium*, *Cytidia* and *Stereum*,



TEXT-FIG. A.—FIG. 1: Basidium of *Aleurodiscus* sp. bearing two spores. FIG. 2: Flexuous gloeocystidium of *Stereum moniliforme*. FIG. 3: Subglobose gloeocystidium of *Peniophora* sp. FIG. 4: Pyriform gloeocystidium of *Stereum purpureum*. FIG. 5: Moniliform paraphysis of *Stereum moniliforme*. FIG. 6: Pyriform crystal-coated cystidium of *Peniophora caesia*. FIG. 7: Fusiform crystal-coated cystidium of *Peniophora* sp. FIG. 8: Naked fusiform cystidium of *Peniophora subgracillima*. FIG. 9: Septocystidium with gelatinous warts and clamp connections of *Pellicularia zealandica*. FIG. 10: Dichophysis of *Vararia investiens*. FIG. 11: Dichophysis of *Vararia pectinata*. FIG. 12: Asterophysis of *Asterostroma persimile*. FIG. 13: Asterophysis from hymenial layer of same. Figures 1, 2, 3, 4, 5, 6, 10 and 11 $\times 1000$, Figures 7, 8, 13 $\times 750$; Figures 9 and 12 $\times 500$. Original.

may be accompanied by cystidia in several species of *Peniophora*, by asterophyses in *Asterostroma*, and acanthophyses in *Aleurodiscus*.

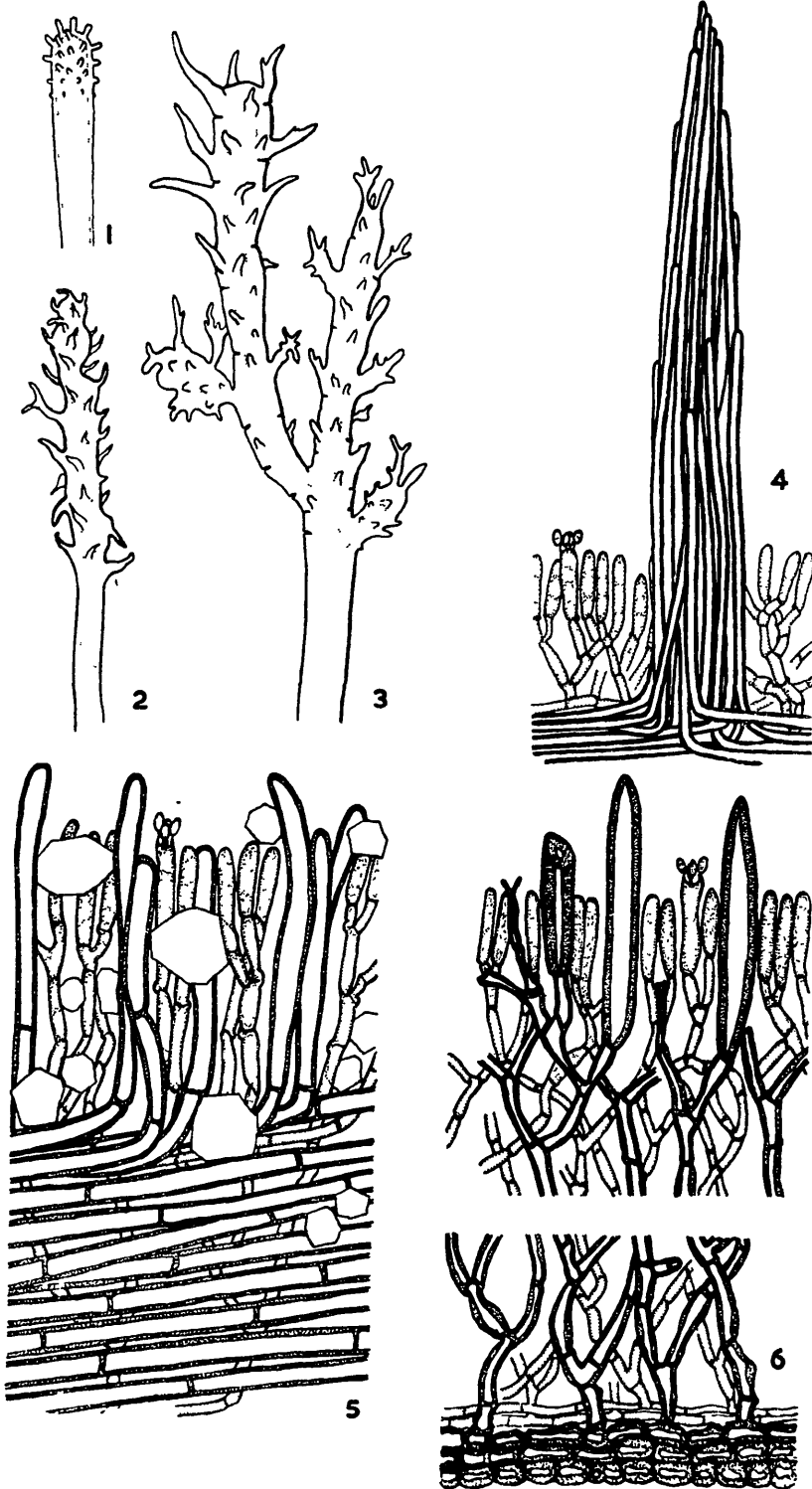
(3) *Cystidia* (Text-fig. A, figs. 6, 7, 8). The term is so loosely applied as to have lost its concise meaning. As used herein it covers both the organs in *Peniophora* Cooke termed "metuloids," and naked projecting bodies characteristic of *Peniophora subalutacea* and related species. "Metuloids" are thick-walled, highly refractive and coated externally wholly or in part with coarse calcium crystals, often deciduous; a few bear fine crystals often associated with mucilage which may form a tunic over part or the entire organ; others may be coated with fine or coarse granules of mucilage, often pigmented. In *P. subalutacea* and related species cystidia are naked, project for the greater part of their length, and possess highly refractive walls which, greatly thickened below, usually become progressively thinner towards the apex. Typical forms may be held to differ sufficiently from "metuloids" to warrant a distinctive name; but when many species are examined intermediates are found with fine crystals coating their exterior walls, either of calcium salts or mucilage, linking the two. Both forms develop from generative hyphae. Cystidia are constant ancillary organs in the hymenium of all species of *Peniophora*, alone or associated with gloeocystidia. Thin-walled cystidia of different type occur in certain species of *Pellicularia* and *Coniophora*. They are septate, often coated with coarse warts of mucilage and scarcely differentiated from context hyphae. They therefore require a differential name, for which is suggested septo-cystidia (Text-fig A, fig. 9).

(4) *Dichophyses* (Text-fig. A, figs. 10, 11). Repeatedly branched, often dendri-form, dichophyses are confined to and thus characterize the genus *Vararia*. Walls are usually hyaline, stain blue, and the branches terminate either in long acuminate points or brief secondary branchlets. Dichophyses form the bulk of the context and hymenial layer in all species of the genus, basidia usually being buried among them. In some species they are accompanied by gloeocystidia.

(5) *Acanthophyses* (Text-fig. B, figs. 1, 2, 3). Present in all species of *Aleurodiscus* and one New Zealand species of *Stereum* acanthophyses are the main ancillary organ of the former genus. They are formed either from modified filiform paraphyses arising from generative hyphae, or skeletal hyphae branched and angled to produce large irregular structures with thick, refractive walls. In the former type, named by Burt (1918, p. 183) "bottle-brush paraphyses," the apical part may be closely beset with digitate processes or hooked spines; or the entire organ may be so covered (Text-fig. B, figs. 1, 2). The latter appear to be associated with resupinate effused species and were named by Burt (l.c., p. 203) "cockroach shaped" paraphyses (Text-fig. B, fig. 3).

(6) *Asterophyses* (Text-fig. A, figs. 12, 13). The bulk of the context and hymenial layer of species of *Asterostroma* is composed of these organs. They are confined to this genus of the Thelephoraceae, though present in *Asterodon* of the Hydnaceae. Coloured stellate bodies, with 5-9 long arms tapering to fine, sometimes bifid apices, arising from a common thickened centre, they occur massed and parallel in the context. In the hymenium they form a vertical palisade, often in chains of two or three small, nearly orbicular, coarsely verrucose bodies. In some species they are associated with gloeocystidia.

(7) *Setae* (Text-fig. B, fig. 6). In *Hymenochaete* the hymenial layer contains coloured, aculeate, thick-walled smooth or verruculose setae. They occur crowded



TEXT-FIG B—FIG. 1: Acanthophysis of *Aleurodiscus berggremi*. FIG. 2: Acanthophysis of *Aleurodiscus* sp. FIG. 3: Acanthophysis of *Aleurodiscus* sp., branched type. FIG. 4: Fascicle of *Epithele fulva*. FIG. 5: Section through hymenial layer of *Dupontella schomburgkii* showing pseudosetae and embedded crystals. FIG. 6: Section through hymenial layer of *Hymenochaete mougeotii* showing true setae; branched paraphysis on left; coloured cemented zone at base. Figures 1, 2 and 3 \times 1000; Figures 5 and 6 \times 400; Figure 4 \times 350.
Original

in a palisade, scattered, or arranged in small tufts. Several zones are present in stratose species, forming conspicuous layers in the context. Setae arise from skeletal hyphae of species with a dimitic hyphal system, and generative hyphae in monomitic species.

(8) *Pseudo-setae* (Text-fig. B, fig. 5). The hymenium of species of *Duportella* is largely composed of a dense palisade of organs which simulate setae. They differ from true setae in that they are terminal ends of skeletal hyphae which pass practically unchanged from the context.

(9) *Fascicles* (Text-fig. B, fig. 4). In three genera are present fascicles of hyphae which arise from the base of the context, pierce the hymenial layer and emerge unchanged for 50μ to 200μ . Hyphae of which they are composed are usually compacted, often cemented, and may enclose columns of crystals or be coated exteriorly with crystals. Fascicles are often so numerous that the surface of the hymenium appears as if covered with spines, so that species may be mistaken for members of the Hydnaceae. In *Mycobomia* and *Epithele* fascicles are of hyaline hyphae, in *Veluticeps* coloured. Similar organs are present in species of *Heterochaete*, one of the heterobasidiomycetes.

(10) *Conducting Vessels*. Present in several species of *Stereum*, these organs extend through the context to the surface of the hymenium. Modified skeletal hyphae, they contain a thick, granular solution which in fresh plants may exude upon the hymenial surface, when damaged, drops of yellow or red fluid. In sections they stain blue, and often exude their contents as long irregular amorphous filaments. Because of their contents they are also termed lactiferous ducts.

CLASSIFICATION OF THE THELEPHORACEAE

Thelephoraceae (Persoon) Saccardo, Sylloge Fungorum, 11, 115, 1895.

Thelephoreae Pers., Myc. Eur., 1, 109, 1822.

Thelephorei Fr., Hym. Eur., 629, 1874.

Hymenophore stipitate, sessile, or resupinate, annual, biennial or perennial, discrete and pileate or effused when resupinate. Context of hyaline or coloured hyphae, sometimes stratose; hyphal systems monomitic or dimitic, with or without clamp connections. Hymenial layer forming a continuous membrane over a surface which may be even, rugulose or papillate, seated upon the context and closely adherent to it, composed of a palisade of basidia and paraphyses alone or associated with various ancillary organs such as gloeocystidia, cystidia, setae, acanthophyses, dichophyses or asterophyses. Basidia simple, mostly subclavate, bearing usually 2-4 spores on apices of simple sterigmata. Spores one-celled, smooth or roughened, hyaline or coloured.

KEY TO GENERA

A. Sub-family MERULOIDEAE: Hymenophore pileate or resupinate, effused-reflexed or effused. Hymenial surface shallowly rugulose-porose or rugose; hyphal system monomitic or dimitic; basidial type meruloid. Spores smooth.

- | | | |
|------------------------------------|-----------|---------------------------------|
| *Context hyphae and spores hyaline | | 1. <i>Merulius</i> Pers. ex Fr. |
| Context hyphae and spores brown | | 2. <i>Serpula</i> Pers. ex Gray |

* *Merulius* was treated as a genus of the family Polyporaceae in a previous paper (P.D.D. Bulletin 83, 12 pp., 1950). Since the hymenial layer forms a continuous membrane over shallow rugose-porose or rugulose folds of the context, and is not limited to the inner walls of pores, it is better treated as a genus of the Thelephoraceae.

B. Sub-family CYPHELLOIDEAE: Hymenophore pileate; pilei either cylindrical and sessile, cupulate when sessile or attached by a narrow base, or obconic and pendulous from the vertex; hyphal system monomitic, generative hyphae hyaline or coloured, with clamp connections; hymenium composed of a palisade of basidia and paraphyses lining interior of pilei; basidial type clavate. Spores smooth, hyaline or coloured.

- a. Pilei crowded upon a subiculum composed of woven hyphae effused over the substratum 3. *Solenia* Pers.
- b. Pilei attached by a brief base, scattered, sessile upon or pendent from the substratum; subiculum absent 4. *Cyphella* Fr.

C. Sub-family THELEPHOROIDEAE: Hymenophore pileate when stipitate or sessile, or resupinate when effused and adnate with the substratum; hymenial surface even, granular, or pierced by fascicles of hyphae (in *Epithele* and *Veluticeps*); hyphal system monomitic or dimitic, generative hyphae with or without clamp connections; basidial type clavate.

I. Tribe CORTICEAE: Hymenophore resupinate (save in a few species of *Peniophora*), context hyphae commonly hyaline (brown in a few species), loosely woven or if compact the hyphae mainly vertically arranged; hymenial layer composed of basidia, paraphyses and sometimes in addition gloeocystidia (*Corticium*), dichophyses (*Vararia*), asterophyses (*Asterostroma*), cystidia (*Peniophora*), or fascicles of hyphae (*Epithele*, *Veluticeps*). Spores hyaline, smooth or verruculose.

- a. Palisade hymenium not developed, basidia and paraphyses arising in small clusters from lateral branches of repent context hyphae; hyphal system monomitic; septo-cystidia sometimes present 5. *Pellicularia* Cke.
- b. Palisade hymenium well developed, composed of basidia, paraphyses with in addition one or more types of ancillary organs; hyphal system monomitic or dimitic.
 - (a) Hymenophore resupinate; hymenial layer composed of basidia and paraphyses with in addition gloeocystidia in some species 6. *Corticium* Pers.
 - (b) Hymenophore resupinate; hymenial layer composed of basidia, paraphyses, dichophyses, and in some species gloeocystidia 7. *Vararia* Karst.
 - (c) Hymenophore resupinate; hymenial layer and context composed of basidia, paraphyses, asterophyses and gloeocystidia 8. *Asterostroma* Mass.
 - (d) Hymenophore commonly resupinate, in a few species pileate; hymenial layer composed of basidia, paraphyses, cystidia, and in some species gloeocystidia or septocystidia 9. *Peniophora* Cke.
 - (e) Hymenophore pileate; hymenial layer composed of basidia, paraphyses and projecting fascicles of hyaline hyphae 10. *Mycobonia* Pat.
 - (f) Hymenophore resupinate; hymenial layer composed of basidia, paraphyses and projecting fascicles of hyaline hyphae 11. *Epithele* Pat.
 - (g) Hymenophore pileate or resupinate; hymenial layer composed of basidia, paraphyses and projecting fascicles of coloured hyphae 12. *Veluticeps* Cke.

II. Tribe STEREEAE: Hymenophore pileate when stipitate or sessile, resupinate in a few species of *Aleurodiscus*; context hyphae usually hyaline, compact, parallel and radiating from the base; hymenial layer composed of basidia and paraphyses alone or associated with conducting vessels, gloeocystidia and/or acanthophyses. Spores hyaline, smooth or verruculose.

- a. Hymenophore pileate, stipitate when urceolate, infundibuliform, flabelliform or spathulate, or

- sessile when appanate or effused-reflexed; hymenial layer composed of basidia and paraphyses alone or with conducting vessels, gloeocystidia or acanthophyses 13 *Stereum* Pers. ex Fr.
- b Hymenophore pileate or resupinate; when pileate pezizoid, discoid, or flabelliform, when resupinate effused and adnate; hymenial layer composed of basidia, paraphyses, acanthophyses and gloeocystidia 14. *Alcurodiscus* Rabh
- c. Hymenophore pileate when discoid or patelliform and attached by a narrow ventral base. hymenial surface often rugulose; hymenial layer composed of basidia and paraphyses with in addition gloeocystidia in some species 15. *Cytidia* Quel.
- III. Tribe THELEPHOREAE: Hymenophore pileate or resupinate; hyphal system monomitic or dimitic, hyphal walls coloured brown; hymenial layer composed of basidia and paraphyses and sometimes septocystidia. Spores coloured, smooth, verrucose or echinulate.
- a. Hymenophore pileate, stipitate or sessile and appanate or effused-reflexed; hyphal system monomitic with clamp connections; cystidia absent; spores verrucose or echinulate 16. *Thelephora* Ehrh ex Fr.
- b. Hymenophore resupinate and effused; hyphal system monomitic or dimitic, without clamp connections; septocystidia sometimes present; spores smooth 17 *Comophora* DC. ex Fr
- c Hymenophore resupinate and effused; hyphal system monomitic, with clamp connections, septocystidia sometimes present; spores echinulate or verrucose 18. *Tomentella* (Pers) Pat
- IV. Tribe HYMENOCHAETEAE: Hymenophore pileate or resupinate; hyphal system monomitic or dimitic, with or without clamp connections, hyphal walls coloured brown; hymenial layer composed of basidia, paraphyses and in addition brown aculeate setae or cylindrical pseudosetae, spores smooth and hyaline
- a. Hymenophore pileate or resupinate; hyphal system dimitic (save in *H. rhabarbarinum*). without clamp connections; brown aculeate or subulate setae forming a palisade in the hymenial layer and sometimes several layers in the context 19 *Hymenochaete* Lev
- b. Hymenophore resupinate, hyphal system dimitic, with clamp connections in generative hyphae, terminal ends of skeletal hyphae forming a palisade of pseudosetae in the hymenial layer, sometimes associated with gloeocystidia 20 *Dupoitella* Pat

B. Sub-family CYPHELLOIDEAE

1. *Solenia* Persoon, Mycologia Europea, 1, 334, 1822

Calyptella Quel., Ench. Fung., 16, 1886, pro parte.

Hymenophore composed of a felted resupinate subiculum upon or in which are crowded numerous annual pilei. Pilei cylindrical, tubular, cupulate, turbinate, pyriform or subglobose, sessile or briefly stipitate, naked or more usually covered with numerous erect hyaline or coloured hairs. Context with a monomitic hyphal system, generative hyphae hyaline or brown, branched, septate, with clamp connections. Hymenial layer composed of basidia and paraphyses forming a dense palisade lining inner walls of pilei. Basidial-type clavate, basidia simple,

subclavate, 2-4-spored. Spores globose, oblong, elliptical or subballantoid, smooth, hyaline or rarely coloured. Conidia present in some species.

TYPE SPECIES. *Solenia candida* Pers.

DISTRIBUTION. World-wide.

Though in microstructure close to *Cyphella*, the genus differs in that pilei are crowded upon or seated within a felted subiculum. This may persist through the life of the plant, or become tenuous and in part disappear with age. Five species have been collected in New Zealand and may be identified by the following key:—

KEY TO SPECIES

- | | |
|---|--------------------------------------|
| Pilei cylindrical, naked, white becoming honey-yellow, spores globose, 4.5–5.5 μ diameter | 1. <i>S. candida</i> Pers. |
| Pilei subglobose, turbinate, pyriform or pezizoid | |
| Pilei with a prominent stem more than twice as long as the receptacle, tan coloured, coated with yellow-brown crystal-coated hooked hairs; spores elliptic-oblong, ovate or obovate, 8–11 x 3–4.5 μ | 2. <i>S. stipitata</i> Fel. |
| Pilei sessile or practically so. | |
| Spores subglobose | |
| Pilei pezizoid, grey, crowded in a grey subiculum; clothed with hyaline hairs | 3. <i>S. poraeformis</i> (Pers.) Fr. |
| Pilei subglobose, cream or sulphur yellow, superficial upon a delicate yellowish subiculum; coated with yellow-brown cylindrical hairs | 4. <i>S. sulphurea</i> Sacc. & Ell. |
| Spores oblong, 7–9 x 5–6.5 μ ; pilei subglobose, white, black where exposed through tomentum, embedded in a dense white subiculum | 5. <i>S. hua</i> G. H. Cunn. |

1. *Solenia candida* Persoon, *Mycologia Europaea* 1, 334, 1822.

(Text-fig. C, fig. 1; Text-fig. D, fig. 2.)

Solenia fasciculata Pers., *Myc. Eur.*, 1, 335, 1822.

Cyphella fasciculata (Pers.) Berk. & Curt., *Jour. Acad. Sci. Phil.*, 3, 207, 1856.

Cyphella schneideri Berk. & Br., *Trans. Linn. Soc.*, II, 2, 220, 1887.

Calyptella candida (Pers.) Pat., *Essai Tax.*, 55, 1900.

Calyptella fasciculata (Pers.) Pat., l. c.

Subiculum annual, effused, to 10 cm. across, fragile, delicate, white. Pilei densely aggregated but not confluent, sometimes scattered, cylindrical or subclavate, sessile, waxy, brittle, apex narrow, 0.5–3 mm. long, 100–400 μ diameter, white becoming honey yellow when dry, surface naked or sometimes finely pruinose, margin inrolled and slightly thickened. Context white, 30–35 μ thick, of densely arranged parallel hyphae; generative hyphae to 3 μ diameter, wall 0.25 μ thick, hyaline, branched, septate. Hymenial layer to 30 μ deep, paraphyses subclavate. Basidia subclavate, 12–16 x 5–6 μ , 4-spored. Spores globose or subglobose, apiculate, 4.5–5.5 μ diameter, smooth, hyaline.

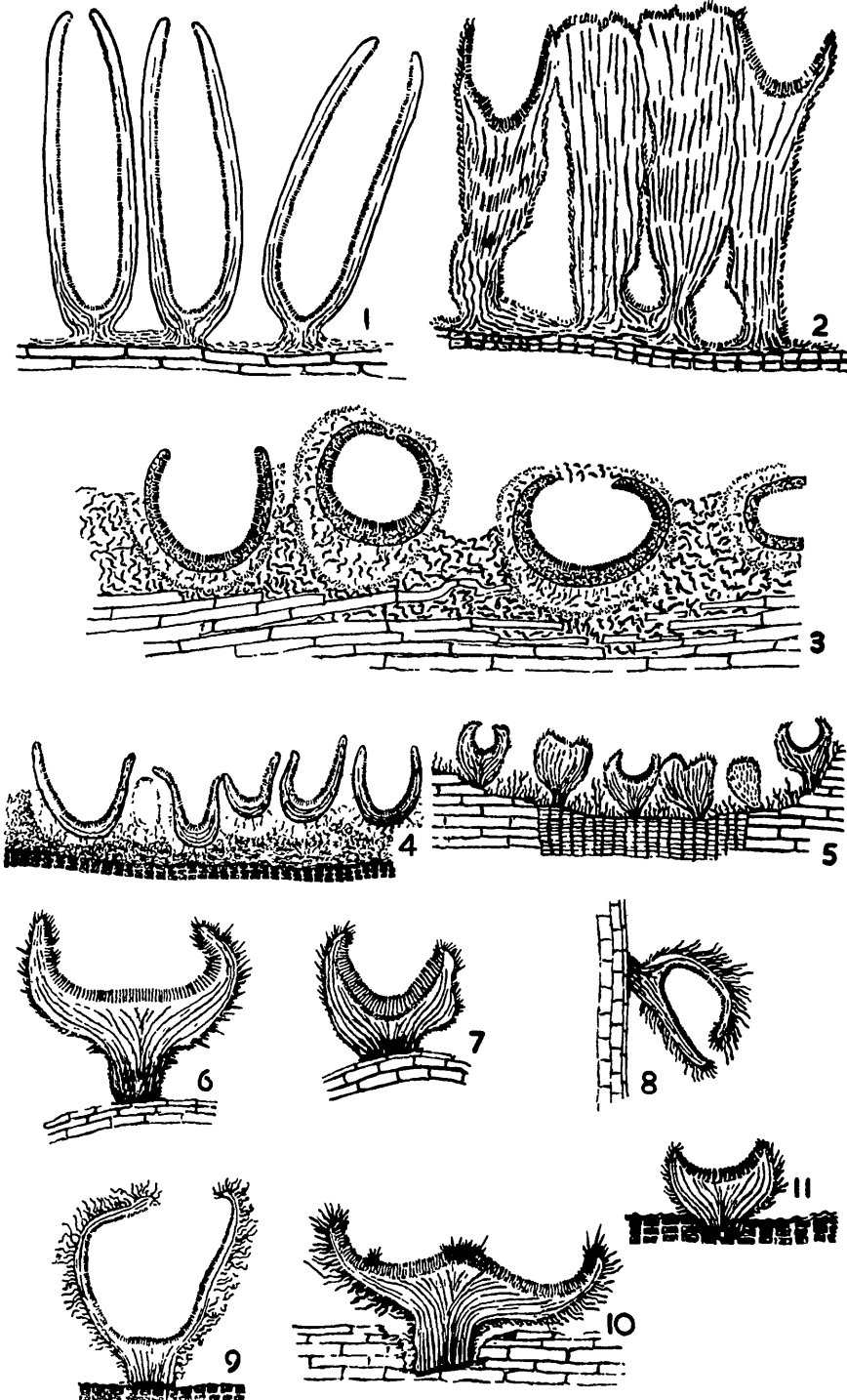
TYPE LOCALITY. Europe.

DISTRIBUTION. Europe; North and South America, Australia, New Zealand.

HABITAT. Crowded on bark or decorticated decaying wood.

Aristotelia serrata (Forst.) Oliver. Auckland. Kaimai Range; July, 1950; J. M. Dingley.

Beilschmiedia tawa (A. Cunn.) Hook f & Benth. Auckland. Lake Rotoehu; May, 1952; G. H. C.



TEXT-FIG. C.—FIG. 1: Section through pilei of *Solenia candida*. FIG. 2: Section through pilei of *Solenia stipitata*. FIG. 3: Section through pilei of *Solenia huxi* showing locules in which pilei are embedded. FIG. 4 Section through pilei of *Solenia poriaeformis*. FIG. 5: Section through pilei of *Solenia sulphurea* showing delicate tortuous hyphae of subiculum. FIG. 6: Section through pileus of *Cyphella villosa*. FIG. 7. Section through pileus of *Cyphella alboviolascens*. FIG. 8: Section through pendent pileus of *Cyphella pseudopanax*. FIG. 9. Section through pileus of *Cyphella tongariro*. FIG. 10 Section through pileus of *Cyphella pyriforma*. FIG. 11: Section through pileus of *Cyphella turbmata*. All figures $\times 40$.
Original.

Brachyglottis repanda Forst. Auckland. Thames; October, 1950; J. M. Dingley.

Coprosma foetidissima Forst. Auckland. Whakapapa, Mt. Ruapehu, 3,500 feet; October, 1949; J. M. Dingley.

Dacrydium cupressinum Sol. Auckland. Lake Okataina, 1,100 feet; June, 1951; J. M. Dingley.

Eucalyptus globulus Lab. Auckland. Whakarewarewa; June, 1951; J. M. Dingley. Wellington. Waverley; December, 1946; E. E. Chamberlain.

Fuchsia excorticata L.f. Auckland. Lake Okataina, 1,100 feet; June, 1951; J. M. Dingley.

Meliclytus ramiflorus Forst. Auckland. Thames; October, 1950; J. M. Dingley.

Pinus radiata Don. Auckland. Oratia; November, 1948; D. W. McKenzie. Wellington. Weraroa; September, 1919; G. H. C.

Schefflera digitata Forst. Auckland. Waitakere Ranges; August, 1950; J. M. Dingley.

UNKNOWN HOSTS. Auckland. Oratia; November, 1948; D. W. McKenzie. Great King Island; January, 1952; E. E. Chamberlain.

Pilei are at first globose, soon becoming cylindrical, white changing to honey yellow when dry. At first delicately tomentose, as pilei mature they become naked and polished. They grew usually in dense clusters but do not become confluent; sometimes they are scattered when they attain a greater height and diameter. The subiculum is delicate, white and often difficult to see unless specimens are examined under the dissecting microscope. Spores vary in size and shape, largely because when first formed they are relatively thick-walled, but as they mature walls become thinner and spores slightly smaller. After examining specimens in Kew herbarium I am in agreement with Pilat (1924, p. 214) that *S. candida* and *S. fasciculata* are merely forms of the same species, for in microstructure they are identical.

2. *Solenia stipitata* Fuckel, Symbolae Mycologici, Nachtrag 1, 290, 1871.

(Text-fig. C, fig. 2; Text-fig. D, figs. 3, 4.)

Subiculum annual, effused, forming linear areas to 5×2 cm., fragile, ferruginous or chestnut-brown. Pilei crowded, sometimes confluent, turbinate, pyriform, urceolate or clavate, to 500μ diameter, often less, densely clothed with yellow-brown hairs 3μ diameter which are vertical with apices inturned or hooked, walls densely and finely crystal-coated; seated on a stem which may attain a length twice that of the pileus; margin inrolled, radiate-striate. Context brown, to 80μ thick, of radiately arranged hyphae; generative hyphae to 2.5μ diameter, wall 0.25μ thick, yellow-brown, sparsely septate, sparsely branched. Hymenial layer to 60μ deep, paraphyses subclavate. Basidia subclavate, $24-32 \times 6-7\mu$, 2-4-spored. Spores long-elliptical, ovate or obovate, apiculate, $8-11 \times 5-6.5\mu$, smooth, hyaline.

TYPE LOCALITY. Europe.

DISTRIBUTION. Europe; Australia; New Zealand.

HABITAT. Crowded on decorticated dead wood.

Eucalyptus globulus Lab. Auckland. Mt. Albert; October, 1948; D. W. McKenzie.

Nothopanax arboreum (Forst. f.) Seem. Taranaki. Mt. Egmont, 3,000 feet; March, 1951; J. M. Dingley.

Specific features are the crowded stipitate brown pilei with exteriors covered with brown crystal-coated hairs with inturned or hooked apices, obovate basidiospores and elliptical conidia. Sometimes a second pileus develops from the interior of an older one, specimens then being two or three times as long.

S. anomala, of which this has been considered a form by some European systematists, differs in the shorter stem, different hairs and narrower spores.

3. ***Solenia poriaeformis*** (Persoon) Fries, *Hymenomyces Europaei*, 597, 1874.
(Text-fig. C, fig. 4; Text-fig. D, fig. 7.)

Peziza poriaeformis Pers., ex DC., *Fl. Fr.*, 6, 26, 1815; Fries, *Syst. Myc.*, 2, 106, 1822.

Cyphella poriaeformis (DC.) Bourd. & Galz., *Hym. Fr.*, 163, 1928

Subiculum annual, effused, forming small arachnoid orbicular areas 1–2 cm. diameter, grey with white arachnoid margins, 100–150 μ thick, of loosely woven hyaline hyphae embedding masses of crystals. Pilei densely crowded, but seldom confluent, cupulate, sessile, 200–350 μ diameter, 150–300 μ deep, lower part embedded; exterior delicately tomentose, hairs hyaline; margin tomentose, grey, mostly inturned. Context white, 30–50 μ thick, of radiately arranged compact hyphae; generative hyphae to 3 μ diameter, wall 0.25 μ thick, branched, septate, finely crystal-coated. Hymenial layer to 25 μ deep, paraphyses subclavate. Basidia subclavate, 12–16 \times 5–7 μ , 2–4-spored. Spores subglobose or globose, apiculate, 5–7 \times 6 μ , smooth, hyaline.

TYPE LOCALITY. Europe.

DISTRIBUTION. Europe; North America; New Zealand.

HABITAT. Crowded on bark of rotting branches.

UNKNOWN HOSTS. Auckland. Manukau Harbour; February, 1931; M. Hodgkins. Titirangi. April, 1946; Myra Carter. Mountain Road, Henderson; May, 1948; J. M. Dingley.

Pilei are densely crowded in small groups immersed in a grey, subiculum resembling, as Burt observed (1924, p. 23), a cinereous crustaceous lichen bearing numerous small apothecia. They are seated in delicate rudimentary loculi in the subiculum, a condition well developed in *S. huia*.

4. ***Solenia sulphurea*** Saccardo & Ellis, *Michelia*, 2, 564, 1882.
(Text-fig. C, fig. 5; Text-fig. D, figs. 5, 6.)

Subiculum annual, delicate, arachnoid, yellow, effused, forming linear areas to 8 \times 1.5 cm. Pilei crowded but not confluent, subglobose or cupulate, 100–300 μ diameter, attached by a small, narrow base; exterior finely radiate-striate, tomentose with upright imbricate hairs which are tortuous, light yellow-brown, to 3 μ diameter, finely crystal-coated; margin strongly inturned, obscuring the hymenium, tomentose, lacerate. Context white, to 50 μ thick, of radiately arranged densely compacted hyphae; generative hyphae to 3 μ diameter, wall 0.25 μ thick, hyaline, sparsely branched, sparsely septate. Hymenial layer to 40 μ deep, paraphyses subclavate. Basidia subclavate, 16–24 \times 6–8 μ , 4-spored. Spores subglobose or globose, apiculate, 6–8 \times 5–6 μ , smooth, hyaline.

TYPE LOCALITY. New Jersey, U.S.A.

DISTRIBUTION. North America; Australia; New Zealand.

HABITAT. Crowded on bark of dead stems and branches.

Lupinus arboreus L. Taranaki. New Plymouth, sandhills; November, 1927; G. H. C.

Macropiper excelsum (Forst. f.) Miq. Auckland. Thames; June, 1950; J. M. Dingley.

Melicytus ramiflorus Forst. Auckland. Blue Lake, Rotorua; June, 1951; J. M. Dingley.

Rhopalostylis sapida (Sol.) Wendl. & Drude. Auckland. Waitakere Ranges; July, 1951; J. M. Dingley.

Specimens long retain their yellow colour, derived from the hairs on the surface of the pilei. The subiculum, though delicate, extends as an arachnoid film beyond the area occupied by the pilei, and under the microscope is seen to be composed of tufts of tortuous yellow hyphae arising from a few delicate parallel strands

*5. *Solenia huia* sp. nov.

(Text-fig. C, fig. 3; Text-fig. D, fig. 8.)

Subiculum coactum, album, in septa parva linearia acute definita 1–15 mm. longa effusum. Pilei in globis parvis (4–6) aut magnis (30–80) congregati, depresso globosi, sessiles, 250–600 μ diam., angusto nudo foramine in loculis in subiculo tarde hiscens; exteriore parte coacto albo tomento super nigrum glabrum parietem tecta. Contextus fuscus ad 70 μ crassus, hyphis dense textis compositus. Sporae oblongae, extremis rotundis, 7–9 \times 5–6.5 μ , leves, hyalinae.

Subiculum annual, felted, white, loosely attached, effused, forming small, sharply defined orbicular or linear areas 1–15 mm. long, to 160 μ thick. Pilei aggregated in groups of few (4–6) or many (30–80) in scattered areas, depressed-globose, sessile, 250–600 μ diameter, opening tardily by a narrow naked pore, seated within loculi in the substratum, each differentiated by a more densely woven zone and filled with loosely woven hyphae; exterior covered with felted white tomentum of hyaline woven crystal-coated hyphae which, when removed, exposes the almost black glabrous wall; margin naked, even, almost black. Context fuscous, to 70 μ thick, composed of densely woven almost pseudoparenchymatous hyphae; generative hyphae to 3 μ diameter, wall 0.25 μ thick, at first hyaline becoming fuscous near the periphery, branched, septate, finely crystal-coated. Hymenial layer to 40 μ deep, paraphyses subclavate. Basidia subclavate, 24–32 \times 6–7 μ , 4-spored. Spores oblong, with rounded ends, apiculate, 7–9 \times 5–6.5 μ , smooth, hyaline.

DISTRIBUTION. New Zealand.

HABITAT. Crowded on bark of dead stems.

Leptospermum scoparium Forst. Auckland. Huia, 100 feet; November, 1945; G. H. C.; type collection.

Pilei grow crowded in small groups on loosely attached portions of felted subiculum, and are depressed-globose and black where exposed. Each is embedded in a separate locule in the subiculum, defined by a densely woven wall and filled with loose hyphae. Primitive locules are present also in *S. poriaeformis*. Pilei open tardily by a narrow pore; their surfaces are long coated with dense white tomentum which, when rubbed away, exposes the glabrous black pileus wall.

* Latin descriptions of new species have been prepared by Miss Beryl Hooton, Librarian of the Plant Diseases Division.

2. *Cyphella* Fries, Systema Mycologicum, 2, 201, 1822.

Phaeocyphella Pat., Essai Tax., 57, 1900.

Pilei annual, solitary or in small groups, without a subiculum, pezizoid when sessile, or pendulous when obconic and attached by the vertex, naked or clothed with conspicuous hairs. Context with a monomitic hyphal system; generative hyphae hyaline, sometimes tinted in the exterior walls of the pilei, branched, septate, with clamp connections. Hymenial layer composed of basidia and paraphyses, lining interior walls of pilei. Basidial type clavate; basidia subclavate, 2-4-spored. Spores variously shaped, smooth or rough, hyaline or coloured.

TYPE SPECIES. *Cyphella lacera* (Pers.) Fr.

DISTRIBUTION. Probably world-wide.

Cyphella and *Solenia* are closely related, the latter differing mainly in pilei being crowded upon or within a felted or arachnoid subiculum. Species of the former may be confused with species of *Cytidia* but differ in the smaller, more cupulate or pezizoid pilei, usually smaller basidia and absence of gloeocystidia.

Plants may be pendulous and attached by a narrow vertex, or pezizoid, with flattened disc and erect or inturned margins. The context is formed from parallel hyphae radiating from the central base. Basidia are similar to those of *Solenia*, save in a few species where they are of similar size to several species of *Aleurodiscus*. Spores of most species are smooth and hyaline; but in *C. galeatea* (Schum.) Fr. they are finely verruculose, and in *C. densa* Berk. and *C. muscicola* Fr. they are brown. On this last feature Patouillard erected the genus *Phaeocyphella*. Burt (1914, p. 358) gave the type species as *C. digitalis* (A. & Sw.) Fr., which by modern interpretation is a species of *Cytidia*.

KEY TO SPECIES

Spores hyaline.

Exterior of pilei naked, without an evident tomentum

Growing on mosses.

Spores pyriform or oval, $7-9 \times 5-6\mu$.. 1. *C. muscigena* (Pers.) Fr.

Growing on bark or wood.

Spores elliptic-fusiform, $12-13 \times 4-5\mu$.. 2. *C. hebe* G. H. Cunn.

Spores obovate or elliptical, $8-9.5 \times 5-6\mu$.. 3. *C. totara* G. H. Cunn.

Exterior of pilei coated with white tomentum hairs covered with fine crystals.

Tomentum hairs thin-walled, with bluntly rounded apices

Paraphyses subclavate.

Spores ovate or oval, $10-12 \times 7-9\mu$.. 4. *C. villosa* (Pers.) Karst.

Spores triangular, with rounded angles,
or pyriform, $12-17 \times 9-11\mu$

5. *C. alboviolascens* (A. & Sw.) Karst.

Paraphyses filiform.

Spores pyriform or flask-shaped, $15-20 \times$
 $9-11\mu$

6. *C. pyriforma* G. H. Cunn.

Spores turbinate, $14-16 \times 10-12\mu$

7. *C. turbinata* G. H. Cunn.

Tomentum hairs thick-walled and tortuous, tapering to long, acuminate, sometimes spirally coiled apices.

Spores fusiform-elliptical; tomentum
hyphae apically spirally coiled

8. *C. tongarivo* G. H. Cunn.

Spores broadly fusiform or lemon-shaped;
tomentum hyphae not coiled

9. *C. pseudopanax* G. H. Cunn.

Spores brown, elliptical, $7-9.5 \times 5-6\mu$; hyphae
of tomentum brown and thin-walled

10. *C. densa* Berk.

1. *Cyphella muscigena* (Persoon) Fries, *Systema Mycologicum*, 2, 202, 1822.

(Text-fig. D, fig. 19.)

Thelephora muscigena Pers., *Syn. Meth. Fung.*, 572, 1801; ex Fries, *Syst. Myc.*, 1, 524, 1821.*Arrhenia muscigena* (Pers.) Quel., *Fl. Myc. Fr.*, 33, 1888.

Pilei annual, scattered, waxy, fragile, 0.2–3 mm. diameter, campanulate, often irregular, attached by or pendent from a brief stem-like base, arising from a white mycelial disc; exterior white, drying white or pallid tan, naked or at first sometimes delicately tomentose with hyphal ends of context hyphae; margin acute, plane or flaring, often deeply lacerated. Context white, to 100 μ thick, base to 300 μ , of radiately arranged densely compacted hyphae; generative hyphae to 8 μ diameter, commonly about 5 μ , wall 0.25 μ thick, branched, septate, hyaline. Hymenial layer to 40 μ deep, paraphyses subclavate. Basidia subclavate, 16–24 \times 5–6 μ , 2–4-spored. Spores pyriform or oval with acuminate base, apiculate, 7–9 \times 5–6 μ , smooth, hyaline.

TYPE LOCALITY. Europe.

DISTRIBUTION. Europe; North America; Australia; New Zealand.

HABITAT. Scattered on leaves and stems of mosses.

UNKNOWN HOST. Wellington. Silverstream; July, 1948; L. B. Moore.

The collection agrees with European specimens seen in Kew herbarium. It was kindly contributed by Dr. G. B. Cone. The species may be identified by the moss habitat, fragile almost naked pilei, context hyphae of large diameter but thin walls, and hyaline pyriform spores. *C. muscicola* Fr., a second European species growing upon mosses, may be separated readily by the brown spores.

2. *Cyphella hebe* sp. nov

(Text-fig. D, fig. 9.)

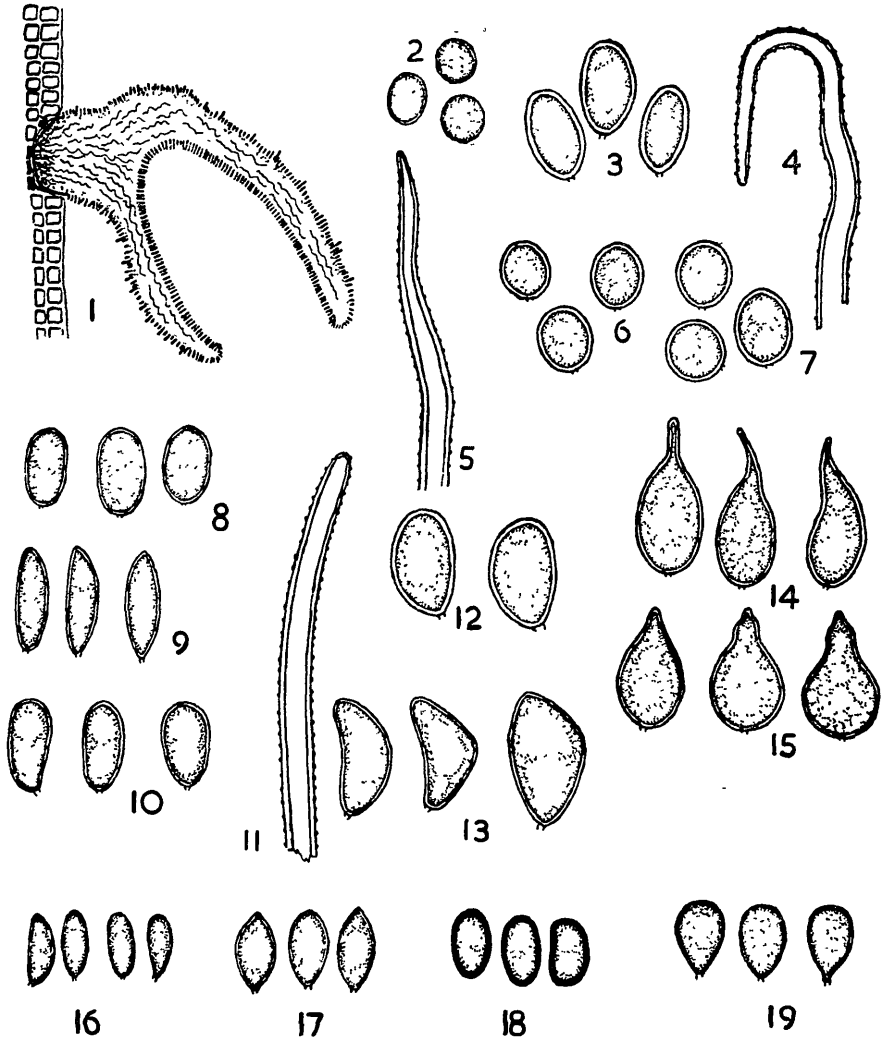
Pilei sparsi, membranacei, cupulati, 1–2.5 mm. diam.; exteriore parte brunneobadia, alutacea vel ferruginea, in radiis tenuiter striata, nuda; margine acuto paulo inflecto, toto aut uno vel duobus profundis incis. Contextus albus ad 80 μ crassus, hyphis sclerotiidibus ad 5 μ diam. in radiis ordinatis, pariete 2 μ crasso. Paraphyses subclavati. Sporae elliptice, fusiformes aliquot suballantoides, terminis obtuse acuminatis, apiculatae, 12–13 \times 4–5 μ , leves, hyalinae.

Pilei annual, scattered, membranous, tough, cupulate, 1–2.5 mm. diameter, attached by a narrow base; exterior bay-brown, tan, or ferruginous, concolorous, finely radiate-striate, often splitting on the posterior side, not tomentose though sometimes with a few scattered hairs; margin acute, slightly turned, entire or with one or two deep incisions; hymenial surface concave, even, pallid cream. Context white, save at the periphery, where a few hyphae are tinted, to 80 μ thick, base to 350 μ , of radiately arranged densely packed sclerotiid hyphae; generative hyphae to 5 μ diameter, wall to 2 μ thick, branched, septate, hyaline. Hymenial layer to 40 μ deep, paraphyses subclavate. Basidia subclavate, 35–42 \times 10–12 μ , 4-spored. Spores elliptic-fusiform, a few suballantoid, bluntly acuminate at ends, 12–13 \times 4–5 μ , smooth, hyaline.

DISTRIBUTION. New Zealand.

HABITAT. Solitary on bark of dead twigs.

Hebe salicifolia (Forst. f.) Ckn. & Allan. Taranaki. Mt. Egmont, 4,000 feet; April, 1946; J. M. Dingley; type collection.



TEXT-FIG D—FIG 1. Section through pendent pileus of *Cyphella densa*. FIG 2. Spores of *Solema candida*. FIG 3. Spores of *Solema stipitata*. FIG 4. Tomentum hair from pileus of *Solema stipitata*. FIG 5. Tomentum hair from pileus of *Solema sulphurea*. FIG 6. Spores of *Solema sulphurea*. FIG 7. Spores of *Solema poraeformis*. FIG 8. Spores of *Solema hura*. FIG 9. Spores of *Cyphella hebe*. FIG 10. Spores of *Cyphella totara*. FIG 11. Tomentum hair from pileus of *Cyphella villosa*. FIG 12. Spores of *Cyphella villosa*. FIG 13. Spores of *Cyphella alboviolascens*. FIG 14. Spores of *Cyphella pyriforma*. FIG 15. Spores of *Cyphella tubinata*. FIG 16. Spores of *Cyphella tongarua*. FIG 17. Spores of *Cyphella pseudopanax*. FIG 18. Spores of *Cyphella densa*. FIG 19. Spores of *Cyphella muscigena*. Figure 1 $\times 40$, others $\times 1000$. Original.

C. hebe and *C. totara* show a general resemblance to one another in shape and colour of the naked pilei. In microfeatures they differ in context structure, and shape of the spores. *C. densa* also possesses pilei with similar colour; but they are of different shape, much smaller, often caespitose at the base, tomentose, and the spores are brown.

3. *Cyphella totara* sp. nov.

(Text-fig. D, fig. 10.)

Pilei sparsi, membranacei, penduli et vertice angusto adjuncti vel conice cupulati ubi in basi lata sedent, 2-3 mm. longi, 1-3 mm. lati; exteriori parte

hinnulea vel alutacea, in radiis tenuiter striata, nuda; margine acuto, inflecto vel plano, toto vel paulo lacerato Contextus albus, 150–250 μ crassus, hyphis sclerotiidibus ad 5 μ diam. in radiis ordinatis, pariete 1 μ crasso. Paraphyses subclavati. Sporae obovatae vel ellipticae, apiculatae, 8–9.5 \times 5–6 μ , leves, hyalinae.

Pilei annual, scattered, membranous, tough, 2–3 mm. long, 1–3 mm. broad, pendulous when attached by a narrow vertex, or conical-cupulate when seated upon a somewhat broad base; exterior surface fawn or tan, darker peripherally, finely radiate-striate, or wrinkled, naked; margin acute, inturned or plane, entire or slightly lacerate; hymenial surface even, concave, bay-brown. Context white (brown in some old specimens), 150–250 μ thick, to 500 μ at the base, of radiately arranged sclerotiid compact hyphae; generative hyphae to 5 μ diameter, wall 1 μ thick, hyaline, branched, septate, tortuous. Hymenial layer to 70 μ deep, paraphyses subclavate. Basidia clavate, 40–56 \times 7–9 μ , 2–4-spored Spores obovate or elliptical, apiculate, 8–9.5 \times 5–6 μ , smooth, hyaline.

DISTRIBUTION. New Zealand.

HABITAT. Scattered on bark of living and dead branches.

Podocarpus hallii Kirk Auckland Mt Tongariro, 2,500 feet; March, 1952; G. H. C. Titirangi; February, 1951; J. M. Dingley. Wellington. Mt. Hector; Tararua Ranges, 2,700 feet; January, 1931; E. E. Chamberlain.

Podocarpus totara Don. Auckland. Oratia, Waitakere Ranges, 600 feet; January, 1932; M. Hodgkins Swanson; November, 1945; J. M. Dingley. Titirangi; February, 1951; J. M. Dingley. Canterbury. Peel Forest, 1,800 feet; January, 1928; G. H. C.; type collection. Otago. Lower Pike River, Hollyford Valley; January, 1950; J. M. Dingley.

The species is common on two endemic species of *Podocarpus*, called totara by the Maori, hence its specific name. It is often present on bark of living trunks or branches, though as frequent on dead branches. Close to *C. hebe*, it may be separated by the usually much larger size of pilei, thicker context with different hyphae, and differently shaped shorter spores. In Kew herbarium is filed one collection, ex totara bark, Buller Valley, Westland, T. Kirk, No. 236. It was placed by Cooke under the cover of *C. cupulaeformis* Berk. & Rav., a species which differs in possessing markedly angular, distorted, and irregular spores.

4. ***Cyphella villosa*** (Persoon) Karsten, Bidrag till kannedom af Finlands Natur och Folk, 325, 1876.

(Text-fig. C, fig 6; Text-fig. D, figs. 11, 12.)

Peziza villosa Peis., Syn Meth. Fung., 655, 1801, ex Fries, Syst. Myc., 2, 104, 1822.

Pilei annual, scattered or more often crowded in small groups, membranous, 0.2–1 mm. diameter, attached by a brief stem-like base, at first subglobose, becoming pezizoid; exterior white, covered with a dense tomentum of white hairs which are 4–6 μ diameter, wall 0.5–1 μ thick, aseptate, unbranched, apex rounded, sometimes inflated at or below the tip, densely and finely crystal-coated, crystals sometimes disappearing with age; margin inturned, fimbriate; hymenial surface concave, white becoming cream Context white, to 75 μ thick, to 300 μ at the base, of radiately arranged parallel hyphae tinted in the walls of a few outer layers; generative hyphae to 4 μ diameter, wall 0.25 μ thick, hyaline, branched, septate. Hymenial layer to 60 μ deep, paraphyses subclavate. Basidia subclavate, 35–60 \times 8–12 μ , 2–4-spored Spores ovate with bluntly acuminate bases, or oval, apiculate, 10–12 \times 7–9 μ , smooth, hyaline.

TYPE LOCALITY. Europe.

DISTRIBUTION. Europe; North America; New Zealand.

HABITAT. Scattered or crowded on bark or dead twigs.

Citrus limonum Osb. Auckland. Henderson; May, 1949; M. Dye.

Lupinus arboreus L. Auckland. Whatipu; June, 1946; J. M. Dingley.

Separated from other species with thin-walled hyaline encrusted tomentum by the oval or ovate spores of moderate size.

5. *Cyphella alboviolascens* (Albertini & Schweinitz) Karsten, Bidrag till kannedom af Finlands Natur och Folk, 133, 1882.

(Text-fig. C, fig. 7; Text-fig. D, fig. 13.)

Peziza alboviolascens Alb. & Schw., ex Fries, Syst. Myc., 2, 96, 1822.

Cyphella curreyi Berk. & Br., Ann. Mag. Nat. Hist., III, 7, 379, 1861.

Pilei annual, scattered or gregarious, membranous, 0.25–1.25 mm. diameter, attached by a brief stem-like base, at first subglobose and with the apex closed with tomentum, becoming discoid or pezizoid; exterior white, covered with a dense tomentum of white hairs which curve over the hymenium and fringe the substratum, hairs 4–6 μ diameter, wall 0.5–1 μ thick, tapering to a long, acuminate apex, finely crystal-coated; margin inturned, fimbriate; hymenial surface concave, cream or pallid buff. Context white, to 80 μ thick, to 230 μ at the base, of radiately arranged parallel hyphae; generative hyphae 3–4 μ diameter, wall 0.25 μ thick, hyaline, tinted in a few outer layers, branched, septate. Hymenial layer to 80 μ deep, paraphyses subclavate. Basidia subclavate, 50–80 \times 11–14 μ , 2–4-spored. Spores irregular, obovate, pyriform, lemon-shaped or triangular, with rounded angles, apiculate, 12–17 \times 9–11 μ , smooth, hyaline.

TYPE LOCALITY. Europe.

DISTRIBUTION. Europe; North America; New Zealand.

HABITAT. Scattered or crowded on bark of dead twigs.

Cyphomandra betacea Sandt. Auckland. Remuera; February, 1946; J. M. Dingley. Mt. Eden; May, 1952; G. H. C.

Though close to *C. villosa*, the species may be separated by the larger basidia and characteristic almost triangular spores with rounded angles and oblique apiculus. Though in the original description the hymenial surface was said to be violaceous, in these specimens and collections seen at Kew it is cream or buff.

6. *Cyphella pyriforma* sp. nov.

(Text-fig. C, fig. 10; Text-fig. D, fig. 14.)

Pilei sparsi, membranacei, primo subglobosi, deinde pezizoides, 0.2–1 mm. diam.; exteriore parte alba, tomento denso pilorum brevium in hymenium curvatorum, subtiliter crystallis illinatorum, tecta, 5–6 μ diam., pariete 1 μ crasso; margine inflecto, fimbriato. Contextus albus ad 100 μ crassus, hyphis ad 4 μ diam. in radiis ordinatis, pariete 0.25 μ crasso. Paraphyses filiformes et apice acuminato. Sporae pyriformes, ampullaceae vel lacrimiformes, basi rotunda, apice longo-acuminato, apiculatae, 15–20 \times 9–11 μ , leves, hyalinae.

Pilei annual, scattered, membranous, brittle, 0.2–1 mm. diameter, attached by a brief narrow base, at first subglobose becoming pezizoid; exterior white, covered with dense tomentum of fine hairs curved over the hymenium, 5–6 μ diameter, wall 1 μ thick, finely crystal coated with occasional inflated areas at or near the

apex; margin inturned, fimbriate; hymenial surface concave, white becoming cream. Context white, to 100μ thick, to 250μ at the base, of radiately arranged compact parallel hyphae, outer few layers tinted; generative hyphae to 4μ diameter, wall 0.25μ thick, branched, septate. Hymenial layer to 60μ deep, paraphyses filiform, numerous, apically acuminate. Basidia subclavate, $40-50 \times 10-12\mu$, 2-4-spored. Spores pyriform, flask-shaped, or tear-shaped, base rounded, apex long-acuminate, $15-20 \times 9-11\mu$, smooth, hyaline.

DISTRIBUTION. New Zealand.

HABITAT. Scattered on bark of dead twigs.

Hebe salicifolia (Forst. f.) Ckn. & Allan. Taranaki. Mt. Egmont, 3,500 feet; April, 1946; J. M. Dingley; type collection.

Pilei resemble those of *C. villosa* and *C. alboviolascens*; but the species differs appreciably in the peculiar spores, which either resemble flasks with long necks or are tear-shaped with the broad base attached to the sterigmata. Both *C. pyriforma* and *C. turbinata* possess filiform paraphyses, whereas in the others described they are subclavate. In the sectional drawing (Text-fig. C, fig. 10) tufts of hairs are shown growing from the hymenial surface, a condition seen also in pilei of *C. villosa* and *C. alboviolascens*.

7. *Cyphella turbinata* sp. nov.

(Text-fig. C, fig. 11; Text-fig. D, fig. 15.)

Pilei sparsi, cerosi, primo subglobosi, deinde urceolati vel discoides, 0.1-0.5 mm diam.; exteriore parte sordide alba, tomento tenui tecta, pilis $4-6\mu$ diam., subtiliter crystallis illinatis, pariete 0.5μ crasso; margine inflecto, fimbriato. Contextus albus ad 80μ crassus, hyphis ad 6μ diam., in radiis ordinatis, pariete 0.25μ crasso. Paraphyses filiformes, apicibus acuminatis. Sporae turbinatae, apiculatae, $14-16 \times 10-12\mu$, leves, hyalinae.

Pilei annual, scattered, membranous, waxy, fragile, 0.1-0.5 mm. diameter, attached by a brief stem-like base, at first subglobose becoming urceolate or discoid; exterior dingy white, covered with a scanty tomentum, hairs $4-6\mu$ diameter, wall 0.5μ thick, hyaline, finely crystal coated; margin inturned, fimbriate; hymenial surface slightly concave, white or cream. Context white, to 80μ thick, to 250μ at the base, of radiately arranged mainly parallel hyphae; generative hyphae $5-6\mu$ diameter, wall 0.25μ thick, branched, septate, hyaline. Hymenial layer to 80μ deep, paraphyses filiform, somewhat scanty, apices acuminate. Basidia clavate, some almost capitate, $60-80 \times 16-20\mu$, 4-spored. Spores turbinate, $14-16 \times 10-12\mu$, smooth, hyaline.

DISTRIBUTION. New Zealand.

HABITAT. Scattered on bark of dead twigs.

Olearia paniculata (Forst. f.) Cheesm. Otago Invercargill; October, 1950; W. Faithful; type collection.

Separated from *C. villosa* by the small size of the pilei, rather scanty tomentum, large, almost capitate basidia and turbinate spores. The latter show a general resemblance to those of *C. pyriforma*, differing in shape and smaller size.

8. *Cyphella tongariro* sp. nov.

(Text-fig. C, fig. 9; Text-fig. D, fig. 16.)

Pilei sparsi, cerosi, cupulati, 0.5-0.75 mm diam.; exteriore parte alba, tomento hyphis tortuosis, aseptatis, ramosis, ad 5μ diam., parietibus crassis, crystallis

crassis deciduis illinatis, lumine paente obliterato, apicibus nudis in spiris longis fastigatis; margine inflecto, lacerato in maturitate. Contextus albus, ad 50μ crassus, hyphis ad 3.5μ diam., in radiis ordinatis, pariete 0.25μ crasso. Paraphyses subclavati. Sporae fusiformes, ellipticae, apice rotundo, basi acuta et apiculata, $7-8 \times 3-3.5\mu$, leves, hyalinae.

Pilei annual, scattered, waxy, brittle, cupulate, $0.5-0.75$ mm. diameter, attached by a narrow base; exterior white, tomentum composed of tortuous aseptate thick-walled branched hyphae, 5μ diameter, with lumen almost obliterated, coated with coarse deciduous crystals, terminating in long, gradually tapering spirally coiled naked apices; margins inturned, lacerate when old; hymenial surface concave, buff or honey-coloured. Context white, to 50μ thick, to 300μ at the base, of parallel radiately arranged hyphae; generative hyphae to 3.5μ diameter, wall 0.25μ thick, sparsely branched, septate. Hymenial layer to 40μ deep, paraphyses subclavate. Basidia subclavate, $16-20 \times 5-6\mu$, 4-spored. Spores fusiform-elliptical, apex rounded, base pointed and apiculate, $7-8 \times 3-3.5\mu$, smooth, hyaline.

DISTRIBUTION. New Zealand.

HABITAT. Scattered on bark of dead twigs

Phyllocladus trichomanoides Don. Auckland. Mt. Tongariro, 2,500 feet; March, 1952; G. H. C.; type collection.

In general appearance *C. tongariro* and *C. pseudopanax* resemble one another, but may be separated by the different spores and tomentum. Hairs of *C. tongariro* are branched, thick-walled, long-acuminate and terminate in whip-like coiled tendrils. The basal part is coated with coarse crystals, the apical naked. Both also show a general resemblance to *C. villosa*, differing mainly in the markedly distinct tomentum and different spores

9. *Cyphella pseudopanax* sp. nov.

(Text-fig. C, fig. 8; Text-fig. D, fig. 17.)

Pilei sparsi, cerosi, cupulati vel penduli, $0.2-0.5$ mm. diam.; exterior parte alba, tomento hyphis longis, sine ramis, aseptatis, tortuosis ad 3μ diam., apicibus longo-acuminatis gradatim fastigatis, crystallis illinatis; margine inflecto, lacerato in maturitate. Contextus albus, ad 40μ crassus, hyphis ad 2.5μ diam., in radiis ordinatis. Paraphyses subclavati. Sporae late fusiformes vel citriformes, apiculatae, $6-9 \times 4.5-5.5\mu$, leves, hyalinae.

Pilei annual, scattered, waxy, fragile, $0.2-0.5$ mm diameter, attached by a narrow base, cupulate or as often pendent; exterior white, drying cream, tomentum of long, unbranched aseptate hyphae, tortuous, 3μ diameter, finely crystal coated, tapering gradually to long-acuminate apices; margin inturned, lacerate when old; hymenial surface concave, even, pallid buff or cream. Context white, to 40μ thick, base to 250μ , of parallel hyphae radiately arranged; generative hyphae to 2.5μ diameter, wall 0.25μ thick, sparsely branched, septate. Hymenial layer to 35μ deep, paraphyses subclavate. Basidia subclavate, $12-16 \times 7-8\mu$, 4-spored. Spores broadly fusiform or lemon-shaped, apiculate, $6-9 \times 4.5-5.5\mu$, smooth, hyaline.

DISTRIBUTION. New Zealand.

HABITAT. Scattered on bark of dead stems.

Pseudopanax crassifolium (Sol.) Koch. Taranaki. Mt. Egmont, 2,700 feet; February, 1952. G. H. C.; type collection.

Tomentum hairs are long, unbranched, thin-walled and taper gradually to acuminate finely crystal-coated apices, the main stem being covered with coarse crystals.

10. *Cyphella densa* Berkeley, *Flora Novae-Zelandiae*, 2, 184, 1855.

(Text-fig. D, figs. 1, 18.)

Pilei annual, brittle, waxy, arranged in small, dense groups, 0.5–1 × 0.5 mm. diameter, pendulous, attached by a narrow stem-like vertex, sometimes with the inferior wall partly suppressed, exterior tan, bay-brown or ferruginous, tomentum brown, of tortuous unbranched aseptate hyphae to 4 μ diameter, wall 0.25 μ thick, naked, apices rounded; margin acute, entire, inturned; hymenial surface even, concave, ferruginous. Context tinted brown, to 100 μ thick, base to 350 μ , of radiately arranged hyphae; generative hyphae to 3 μ diameter, wall 0.25 μ thick, hyaline, branched, septate. Hymenial layer to 30 μ deep, paraphyses subclavate. Basidia subclavate, 18–24 × 5–6 μ , 4-spored. Spores elliptical or sometimes pip-shaped, seldom apiculate, 7–9.5 × 5–6 μ , smooth, clear brown.

TYPE LOCALITY. Hawke's Bay, New Zealand.

DISTRIBUTION. New Zealand.

HABITAT. Crowded often caespitose on bark of dead trunks.

Corynocarpus laevigata Forst. Hawke's Bay. Cape Kidnappers; W. Colenso; type collection in Kew herbarium, No. 2169.

Meryta sinclairii (Hook f.) Seem. Auckland. South-West Island, Three Kings; January, 1952, E. E. Chamberlain.

Rhoplostylis sapida (Sol.) Wendl. & Drude. Auckland. Oratia, Waitakere Ranges, 1,000 feet; July, 1951; J. M. Dingley.

Collections listed match the type seen in Kew herbarium. The species may be recognized readily by the small crowded pendent tomentose brown pilei, and brown spores.

EXCLUDED SPECIES OF *CYPHELLA*

cookei, *Cyphella* Sacc. & Syd. = *C. filicicola* Cke.

cupulaeformis, *Cyphella* Berk. & Rav. A collection in Kew herbarium, placed under this cover by Cooke, is of *C. totara*. It was collected in Buller Valley, Westland, by T. Kirk, No. 236.

discoidea, *Cyphella* Cke., *Grevillea*, 12, 85, 1884. The type in Kew herbarium consists of several orbicular white bodies 2–3 mm. diameter attached to once living leaves of *Hypochoeris radicata* L. collected at Napier by W. Colenso, No. b.30. Examination showed them to be empty egg-cases of a spider, loosely attached to the leaf hairs. On the type sheet is a sketch by Cooke and a note describing basidia and spores—“Basidiis brevibus, sporis globosis, laevibus 4 μ .” Neither basidium nor spore exists, the bodies being composed solely of loosely woven spider threads 1 μ diameter.

filicicola, *Cyphella* Cke., *Grevillea*, 14, 129, 1886.

pteridophila, *Cyphella* Cke., in herb. Kew; Sacc. in *Syll. Fung.*, 6, 683, 1886.

cookei, *Cyphella* Sacc. & Syd., *Syll. Fung.*, 14, 231, 1899.

Type specimens collected at Napier by W. Colenso, No. b.80, consist of numerous scattered cylindrical empty egg-cases of some moth or butterfly, loosely attached to fronds of *Hymenophyllum demissum* Swartz. Other collections on the same host, from the same locality and collector (Nos. b.965 and b.1245) are filed under the type cover at Kew. Specimens given by Colenso to Dr. Th. Rolph and by the latter to Baron F. v. Mueller were forwarded to Kew by Mueller from Melbourne, hence Cooke's reference to the presence of the species in Australia.

Because the combination *C. filicicola* was preoccupied Cooke changed the name in Kew herbarium to *C. pteridophila*, under which it was compiled by Saccardo in *Sylloge Fungorum*, together with New Zealand and Australian localities. As the latter also was preoccupied Saccardo and Sydow finally changed the name to *C. cookei*. Though Cooke described spores as being "elliptical, hyaline, $12 \times 4\mu$ " no spores exist, the egg-cases being waxy amorphous bodies without determinate structure.

zealandica, *Cyphella* Cke. & Phillips, ex Cke., *Grevillea*, 8, 57, 1879.

The type collection, ex Winton, Otago, Dr. S. Berggren, No. 230, is in Kew herbarium. Examination showed it to be an *Aleurodiscus* which will be published in this series as *A. zealandicus* (Cke. & Phil.) G. H. Cunn. A later synonym is *Aleurodiscus ochraceo-flavus* Lloyd, *Myc. Notes*, 70, 1228, 1923.

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