

The genus *Dendrothele* (Agaricales, Basidiomycota) in New Zealand

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Sixteen species of *Dendrothele* sensu lato are confirmed from New Zealand. Nine new taxa are described: *Dendrothele arachispora*, *D. aucklandica*, *D. australis*, *D. cymbiformis*, *D. leptostachys*, *D. magnenavicularis*, *D. navicularis*, *D. novae-zelandiae* and *D. subellipsoidea*. Ten species were previously reported, but only four are confirmed: *D. ampullospora* comb. nov., *D. biapiculata*, *D. incrustans* and *D. pulvinata*. Reports of *Dendrothele acerina*, *D. candida*, *D. commixta* and *D. nivosa* were not confirmed. Furthermore, *D. nivosa* sensu G. Cunningham and *D. corniculata* are not true dendrotheles, and *D. fasciculata* is accepted in *Epithele*. The new taxa, *D. ampullospora*, *D. biapiculata* and *D. pulvinata* are described and illustrated. A key to *Dendrothele* s.l. from New Zealand is provided.

Keywords: *Acanthophysium*; corticioid fungi; *Corticium corniculatum*; diversity; *Epithele fasciculata*; *Nia* clade; southern hemisphere

Introduction

Dendrothele Höhn. & Litsch. (1907) is a heterogeneous corticioid genus that includes species with discoid or crustose basidiomes that occur primarily on bark of living trees. Lemke (1964a, b) included 14 species in the first comprehensive study of *Dendrothele* (as *Aleurocorticium* P.A.Lemke). Subsequently, many new species have been described. In 2009, 41 accepted species of *Dendrothele* were listed in CortBase (Parmasto et al. 2004). New species *Dendrothele cornivesiculosa* P.Roberts and *Dendrothele gilbertsonii* Nakasone were described recently by Hjortstam et al. (2009) and Nakasone (2009), respectively. Molecular phylogenetic studies show that *Dendrothele griseocana* (Bres.) Bourdot & Galzin, the generic type of *Dendrothele*, is embedded in the *Agaricales* clade and closely related to *Lachnella* Fr. and *Cyphellopsis* Donk (Langer 2001; Bodensteiner et al. 2004; Binder et al. 2005). Earlier, Goranova (2003) demonstrated that *Dendrothele* is

polyphyletic with taxa distributed among 11 lineages in the hymenochaetoid, russuloid, corticioid and agaricoid clades. She concluded that convergences in morphological traits and habit occurred repeatedly, resulting in dendrotheloid fungi.

Dendrothele species from New Zealand were first studied by Cunningham (1954, 1963), who originally placed these taxa in *Acanthophysium* (Pilát) G.Cunn. or *Corticium* Pers. Of the 42 species of *Corticium* he studied, Cunningham (1954) included 3 species that were later transferred to *Dendrothele*: *C. commixtum* Höhn. & Litsch., *C. ampullosporum* G.Cunn. and *C. corniculatum* G.Cunn. In 1963, he elevated *Aleurodiscus* subg. *Acanthophysium* Pilát to generic status (Cunningham 1963). He included 15 species of *Acanthophysium* from New Zealand of which 6 were later moved into *Dendrothele* by various mycologists: *A. acerinum* (Pers.: Fr.) G.Cunn., *A. biapiculatum* G.Cunn., *A. candidum* (Schwein.: Fr.) G.Cunn., *A. fasciculatum*

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G.Cunn., *A.nivosum* (Berk. & M.A.Curtis) G.Cunn. and *A.pulvinatum* G.Cunn. Stalpers (1985) restudied many of Cunningham's *Corticium* species and proposed the transfer of *C.corniculatum* into *Dendrothele*. *Dendrothele incrustans* (P.A.Lemke) P.A.Lemke was recently reported from New Zealand based on two specimens originally identified as *C.commixtum* (Nakasone 2009).

In this article, 16 species of *Dendrothele* sensu lato from New Zealand are discussed. Nine new species are described and illustrated, and a new combination is proposed. In addition, three lesser known species, *Dendrothele ampullospora*, *Dendrothele biapiculata* and *Dendrothele pulvinata*, are described and illustrated. Previous reports of *D.acerina*, *D.candida*, *D.commixta* and *D.nivosa* were not confirmed. *Dendrothele fasciculata* is accepted in *Epithele* and *D.corniculata*, of uncertain relationship, is excluded from *Dendrothele* sensu stricto. A key to the 16 confirmed species of *Dendrothele* s.l. from New Zealand is provided.

Materials and methods

Thin, freehand sections from basidiomes were mounted in 2% aqueous potassium hydroxide (KOH) and 1% aqueous phloxine or Melzer's reagent (Kirk et al. 2008) and examined under an Olympus BH2 compound microscope. To facilitate microscopic observations, sections or mounts were sometimes treated with hydrochloric acid (37% diluted 1:1 in distilled water), followed by a KOH rinse, to dissolve the abundant crystals embedded in the context (Boidin et al. 1996). Line drawings were made with a camera lucida attachment. Cyanophily of basidiospore and hyphal walls was observed in 0.1% cotton blue in 60% lactic acid (Kotlaba & Pouzar 1964; Singer 1986). *Q* values were obtained from dividing average basidiospore length by width for at least 30 spores (Kirk et al. 2008). Basidiospores were often scarce, collapsed and adherent in specimens, thus

Q values based on fewer than 30 spores are approximate and flagged with an asterisk. Colour names are from Kornerup & Wanscher (1978), except for capitalized colour names, which are from Ridgway (1912). Unless otherwise indicated, all specimens are on deposit at PDD; herbarium abbreviations follow Thiers (continuously updated). Some specimens from Argentina were obtained from the herbarium at Centro de Investigación y Extensión Forestal Andino Patagónico (CIEFAP), Esquel, Chubut, Argentina.

Lemke (1964a, b) used the term 'catahymenium' to refer to the hymenial organization found in basidiomes of *Aleurodiscus* and *Dendrothele* (as *Aleurocorticium*); however, we do not believe this term was correctly applied. Catahymenium was coined by Lemke to replace what Donk (1957, p. 4; 1964, p. 210) called 'hyphidial hymenium.' The hyphidial hymenium begins as a layer of sterile hyphal elements, such as branched dendrohyphidia, that is developed before the basidia are initiated within or below this sterile tissue. As the basidium matures, it elongates through the sterile elements to produce and release basidiospores at or above the surface of the sterile layer. In *Dendrothele*, we observed that dendrohyphidia develop and grow in a thickening zone together with basidia and cystidia. In some species, the subhymenial layer that produces the hymenial elements is thick and not too dense so that it is easy to see that basidia, cystidia and dendrohyphidia arise at slightly different levels. In other species, this subhymenial layer is narrow, compact and dense so that hymenial elements appear to develop at nearly the same level. Dendrohyphidia, including the encrusted tips, often form a canopy over the basidia and cystidia so that only the apices of mature basidia, sterigmata and basidiospores are visible above the mass of crystals. This mimics what is observed in species with a catahymenium. We believe that the hymenial development in *Dendrothele* is best described as a thickening hymenium.

Results

Key to the species of *Dendrothele sensu lato* in New Zealand

- 1 Basidiomes with hyphal pegs 2
- 1 Basidiomes smooth to colliculose, hyphal pegs absent 3
- 2 Hyphal system dimitic, basidiospores ellipsoid, 14–16 × 9–11.5 μm *Epithele fasciculata*
- 2 Hyphal system monomitic, basidiospores narrowly navicular to subfusiform, (11.5–)14–17.5 × 4–5(–6) μm *D. cymbiformis*
- 3 Cystidia present 4
- 3 Cystidia absent 12
- 4 Cystidia ventricose–rostrate or broadly clavate, usually with an apical appendage . . 5
- 4 Cystidia variously shaped but always lacking an apical appendage 7
- 5 Basidiomes soft, rimose, readily detaching from substrate *D. australis*
- 5 Basidiomes firm, dense, securely attached to substrate 6
- 6 Basidiomes pulvinate, irregularly orbicular, basidiospores broadly ellipsoid to subglobose (8.7–)9.5–10(–10.7) × 8–9 μm *D. pulvinata*
- 6 Basidiomes beginning as linear colonies, basidiospores broadly cylindrical to ellipsoid, (13.2–)14–16 × (7.2–)8–9(–9.5) μm *D. leptostachys*
- 7 Basidiospores globose to subglobose, (14–)16–20(–22) × (13–)14–17(–20) μm *D. nivosa* sensu G.Cunn.
- 7 Basidiospores variously shaped but always less than 12 μm diam 8
- 8 Hyphae simple septate, basidia with 2 sterigmata *D. biapiculata*
- 8 Hyphae nodose septate, basidia with 4 sterigmata 9
- 9 Basidiospores navicular, (11–)14–18(–19) × 5.5–7.2(–8) μm *D. navicularis*
- 9 Basidiospores cylindrical, ellipsoid, subglobose or biapiculate 10
- 10 Basidiospores cylindrical to ellipsoid, often slightly tapered toward distal end, (13.5–)14–18(–19.5) × (8–)8.5–10(–11) μm *D. ampullospora*
- 10 Basidiospores ellipsoid to citriform, 9–12 × 6.5–10 μm 11
- 11 Basidiospores ellipsoid to nearly biapiculate, cystidia numerous *D. subellipsoidea*
- 11 Basidiospores citriform, distinctly biapiculate, cystidia scarce *D. novae-zelandiae*
- 12 Basidiospores citriform 13
- 12 Basidiospores variously shaped but never biapiculate 14
- 13 Hyphae nodose septate, basidia with 4 sterigmata *D. novae-zelandiae*
- 13 Hyphae simple septate, basidia with 2 sterigmata *D. biapiculata*
- 14 Basidiospores globose to subglobose, (14–)16–20(–22) × (13–)14–17(–20) μm *D. nivosa* sensu G.Cunn.
- 14 Basidiospores variously shaped but always less than 12 μm diam 15
- 15 Basidiospores globose, broadly ellipsoid or with a median constriction 16
- 15 Basidiospores cylindrical, navicular or fusiform 19
- 16 Basidiospores ellipsoid with a median constriction or suburniform, (14–)16–18 × (6.5–)7.5–8.5(–9.5) μm . *D. arachispora*
- 16 Basidiospores variously shaped but never with a median constriction 17
- 17 Basidiospores cylindrical to ellipsoid, often slightly tapered toward distal end, (13.5–)14–18(–19.5) × (8–)8.5–10(–11) μm *D. ampullospora*
- 17 Basidiospores globose to ellipsoid, less than 14 μm long 18
- 18 Basidiospores globose to broadly ellipsoid, 9–12(–13) × 8–10 μm, basidia urniform to suburniform, 35–60 × 9.5–13 μm *D. incrustans*
- 18 Basidiospores ellipsoid, (7–)8–11 × 5–6.5 μm, basidia cylindrical to ovoid, 15–30 × 6–10 μm *Corticium corniculatum*
- 19 Basidiospores cylindrical, subfusiform, or ellipsoid 20
- 19 Basidiospores navicular 21
- 20 Basidiospores cylindrical to subfusiform, (14–)16–19.5(–22) × (5–)6–7.5(–8.5) μm *D. aucklandica*

- 20 Basidiospores cylindrical to ellipsoid, often slightly tapered toward distal end, (13.5-)14-18(-19.5) × (8-)8.5-10(-11) μm
..... *D. ampullospora*
- 21 Basidiospores large, (17.3-)18-22(-24) × (5.5-)6-7(-7.8) μm.....
..... *D. magnenavicularis*
- 21 Basidiospores smaller, (11-)14-16(-19) × 5.5-7.2(-8) μm..... *D. navicularis*

Species descriptions

Dendrothele ampullospora (G.Cunn.) Nakasone & Burds., comb. nov. Figs. 1, 2, 4, 5
≡ *Corticium ampullosporum* G.Cunn., *Trans. Roy. Soc. New Zealand* 82: 306. 1954.

DESCRIPTION: Basidiomes resupinate, effuse, beginning as small, discrete, oblong or irregular colonies, confluent, up to 55 × 30 mm, adnate, thin to moderately thin, up to 500 μm thick, soft to subceraceous; hymenial surface smooth or irregular, subtuberculate, densely pruinose to matted felty, pale yellow (4A3), light yellow (4A4), greyish yellow (4B4), pale orange (5A3), light orange (5A4), or greyish orange [5B(3-4)]; cracks scarce; margin distinct, rapidly thinning out or abrupt, subfarinose or porulose, concolorous with hymenial surface. Hyphal system monomitic with clamped generative hyphae. Subiculum absent. Hymenium thickening, with a basal, partially agglutinated tissue of vertically arranged hyphae, degraded hymenial elements, collapsed basidiospores and abundant, embedded, coarse, hyaline crystals in large clusters especially next to substrate; hyphae 1.5-3.5 μm diam, clamped, moderately branched, irregular, walls hyaline, thin, smooth; and an upper, fertile layer composed of dendrohyphidia, cystidia and basidia. Dendrohyphidia abundant, more or less filiform, simple or sparsely branched at apex, 20-40 × 2-6 μm, clamped at base, walls hyaline, thin, smooth. Cystidia rare, inconspicuous, subfusiform or obclavate to clavate with an

obtuse apex, 22-45 × 8-11 μm, with a basal clamp, sometimes with resinous contents, walls hyaline, thin, smooth. Basidia suburniform, subclavate, clavate or cylindrical with slight constrictions, 28-55 × 11-17 μm, clamped at base, walls hyaline, thin, smooth, 4-sterigmate, sterigmata up to 15 × 4 μm. Basidiospores abundant, often collapsed, ellipsoid to cylindrical, often slightly tapered toward distal end, with a small, distinct apiculus, (13.5-)14-18(-19.5) × (8-)8.5-10(-11) μm, average of five specimens 14.5-17.1 × 9.1-9.4 μm, *Q* = 1.6-1.9, walls hyaline, slight thick to thick, smooth, cyanophilous, not reacting in Melzer's reagent. HABITAT AND DISTRIBUTION: On bark of *Metrosideros* Banks ex Gaertn., rarely on *Vitex* L., known only from New Zealand.

TYPE SPECIMENS EXAMINED: NEW ZEALAND. Auckland, Piha, Whites Stream, *Metrosideros excelsa* Sol. ex Gaertn. (bark), Jan 1951, *J.M. Dingley*, PDD 11428 (holotype PDD; isotype BPI US0280246).

ADDITIONAL SPECIMENS EXAMINED: NEW ZEALAND. Auckland, Waitakere Ranges, on *M. robusta* A.Cunn., 7 Jul 1953, *J.M. Dingley*, PDD 11864; Waitakeres, Cascades, on *M. robusta* (bark), 3 Apr 1954, *S.D. Baker*, PDD 15458; Waipoua, on *M. robusta*, 21 Jan 1954, *J.M. Dingley*, PDD 14150 and 21 Jan 1955, *J.M. Dingley*, PDD 14146; Henderson, Mountain Road, on *M. robusta*, 20 Sep 1953, *J.M. Dingley*, PDD 12612; Huia, *M. robusta* (bark), 8 Jan 1955, *J.M. Dingley*, PDD 14088; Mt. Te Aroha, 1200 ft, on *Vitex lucens* Kirk (bark), 9 Sep 1954, *G.H. Cunningham*, PDD 13720.

Dendrothele ampullospora is characterized by smooth, light yellow to light orange basidiomes, inconspicuous cystidia, suburniform basidia, and large, cyanophilous, ellipsoid basidiospores that taper slightly toward the distal end. A thickening hymenium was observed in thicker basidiomes only, and there is significant variability in basidiospore shape and size. This species appears to be restricted to

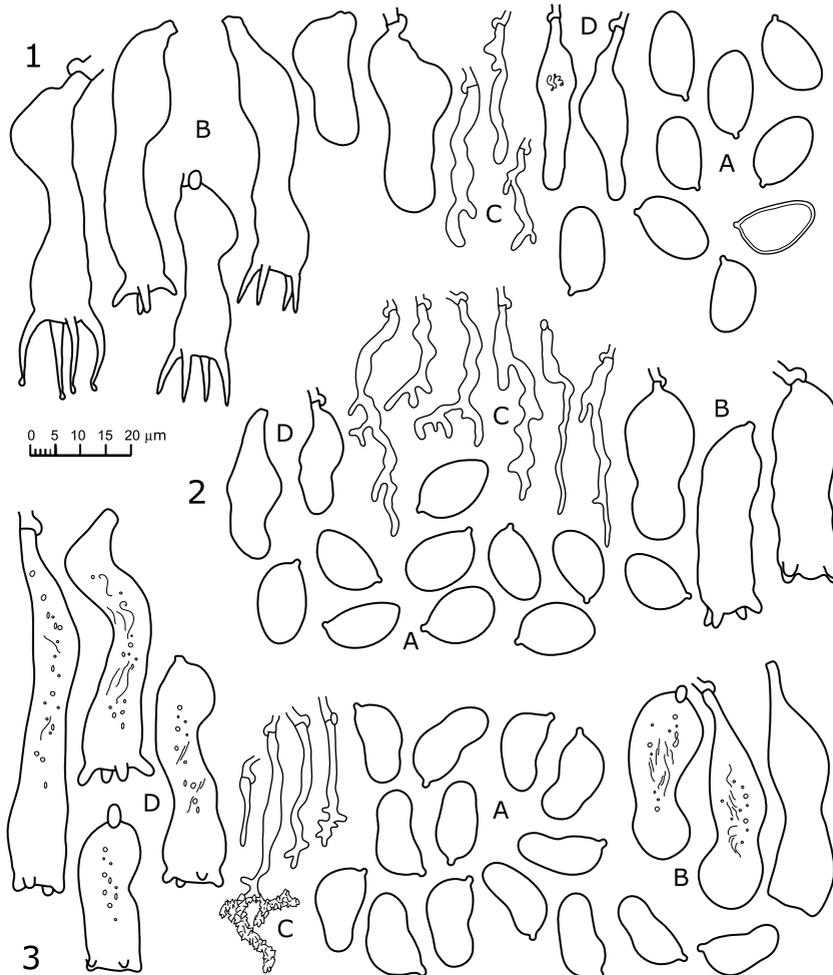
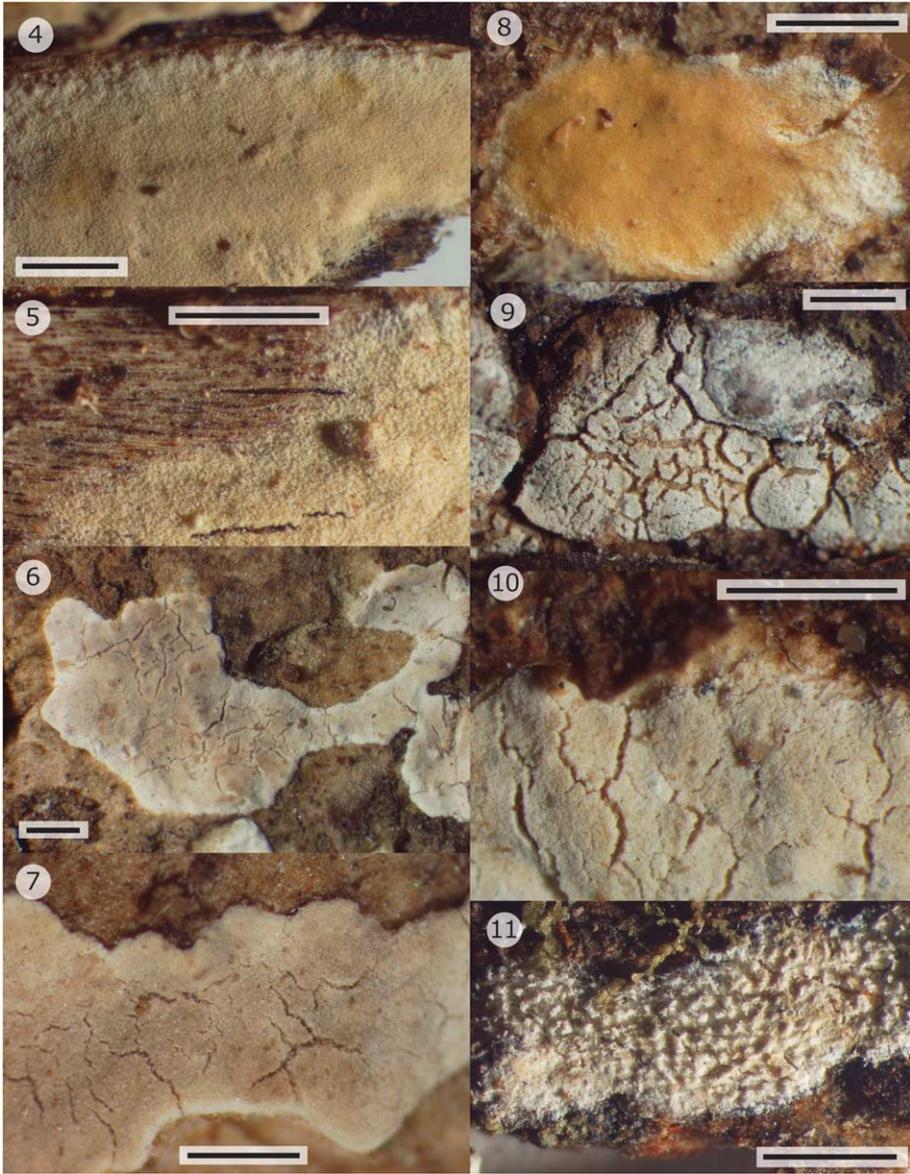


Figure 1–3. Line drawings of hymenial elements. **Figure 1.** *Dendrothele ampullospora* PDD 11428, holotype: **A**, basidiospores, **B**, mature and immature basidia, **C**, dendrohyphidia, **D**, cystidia. **Figure 2.** *Dendrothele ampullospora* PDD 11864: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, cystidia. **Figure 3.** *Dendrothele arachispora* PDD 15067, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, basidia from PDD 17005.

New Zealand, and its preferred substrate is bark of *Metrosideros*. *Dendrothele aucklandica* has a similar hymenial development but with subfusiform basidiospores and is found on *Kunzea ericoides* (A.Rich.) Joy Thomps.

Cunningham (1954, 1963) cited a number of specimens of *C. ampullosporum* but only those on *Metrosideros* and *Vitex* were correctly

identified. All 22 specimens named *C. ampullosporum* at PDD were examined for this study; only eight were identified as this species. The descriptions and illustrations of *C. ampullosporum* by Cunningham (1954, 1963) appear to refer to *D. aucklandica* (see below). The type of *C. ampullosporum* was described and illustrated by Stalpers (1985).



Figures 4–11. Close-up photographs of basidiome surfaces and margins. Bar = 1 mm. **Figure 4.** *Dendrothele ampullospora* PDD 11428, holotype. **Figure 5.** *Dendrothele ampullospora* PDD 11428, holotype. **Figure 6.** *Dendrothele arachispora* PDD 15066, isotype. **Figure 7.** *Dendrothele arachispora* PDD 15066, isotype. **Figure 8.** *Dendrothele aucklandica* PDD 12633, holotype. **Figure 9.** *Dendrothele australis* PDD 17044. **Figure 10.** *Dendrothele australis* PDD 16845, holotype. **Figure 11.** *Dendrothele cymbiformis* PDD 18193, holotype.

Dendrothele arachispora Nakasone & Burds., sp. nov. Figs. 3, 6, 7

MYCOBANK # MB518644

HOLOTYPE: New Zealand, Wellington, Lake Papaitonga, 50 ft, on bark of *Myrsine salicina* Heward, 26 Aug 1955, *G.H. Cunningham*, PDD 15067 (PDD, isotype PDD 15066).

DIAGNOSIS: *Differt Dendrothele pitrae basidiosporis grandioribus ellipsoideis indentatis vel suburniformibus, (14–)16–18 × (6.5–)7.5–8.5 (–9.5) μm.*

ETYMOLOGY: From *Arachis*, the generic name of peanut, and 'spora,' Latin for spore, refers to the shape of the basidiospores.

DESCRIPTION: Basidiomes resupinate, effuse, beginning as small, discrete, pulvinate, oblong or irregular colonies, confluent, up to 20 × 10 mm, adnate, thin to moderately thick, up to 300 μm thick, soft to moderately firm, subcretaceous to subceraceous; hymenial surface smooth, densely pruinose, yellowish white to yellowish grey [4(A–B)2], orange white (5A2), greyish orange [5(B–C)3], pale orange (5A3) or greyish orange to brownish orange [5(B–C)3], darkening to brownish orange (6C3) or greyish brown (6D3); fine, intricate cracks developing later in mature areas; margin attached, distinct, abrupt, slightly thinner and lighter in color than hymenial surface, off-white to pale cream. Hyphal system monomitic with clamped generative hyphae. Subiculum a partially agglutinated tissue obscured by abundant, embedded, small to medium-sized, hyaline crystals; subicular hyphae 1.5–3 μm diam, clamped, moderately branched, irregular, walls hyaline, thin, smooth. Hymenium thickening, up to 100 μm thick, composed of dendrohyphidia and basidia in a dense matrix of hyaline crystals. Dendrohyphidia numerous, hyphoid, unbranched or with short, knobby branches at apex, 23–40 × 2–3 μm, clamped at base, walls hyaline, thin, encased in a thin, crystalline sheath. Basidia suburniform, subclavate to clavate or broadly cylindrical with slight constrictions, 30–55(–70) × (9–)10–12 (–14) μm, clamped at base, often with oil-like contents, walls hyaline, thin, smooth,

4-sterigmate. Basidiospores scarce to abundant, often collapsed, adherent, ellipsoid with a slight median constriction (peanut-shape) or suburniform, with a small, distinct apiculus, (14–)16–18 × (6.5–)7.5–8.5(–9.5) μm, $Q = 2.1$, walls hyaline, thin to slightly thickened, smooth, weakly cyanophilous, not reacting in Melzer's reagent. HABITAT AND DISTRIBUTION: On bark of *Myrsine salicina* and *Myoporum laetum* G.Forst., known only from New Zealand.

ADDITIONAL SPECIMEN EXAMINED: NEW ZEALAND. Auckland, Piha, on *Myoporum laetum* (bark), 1 Apr 1956, *J.M. Dingley*, PDD 17005, as *Corticium ampullosorum*.

Dendrothele arachispora is characterized by small, discrete basidiomes and suburniform to peanut-shaped basidiospores. This species is particularly challenging to study because of the inconspicuous aggregates of collapsed basidiospores and abundant, embedded crystals. Basidiospores are numerous in the holotype but scarce in the isotype. The holotype was originally identified as *Acanthophysium acerinum*; the isotype is clearly from the same gathering. *Dendrothele pitrae* Gresl. & Rajchenb. from Argentina has basidiospores of similar shape but smaller, (11–)12–15(–16) × 5–5.5(–6) μm, with a tapered to nearly acute distal end (Greslebin & Rajchenberg 1998).

Dendrothele aucklandica Nakasone & Burds., sp. nov. Figs. 8, 12

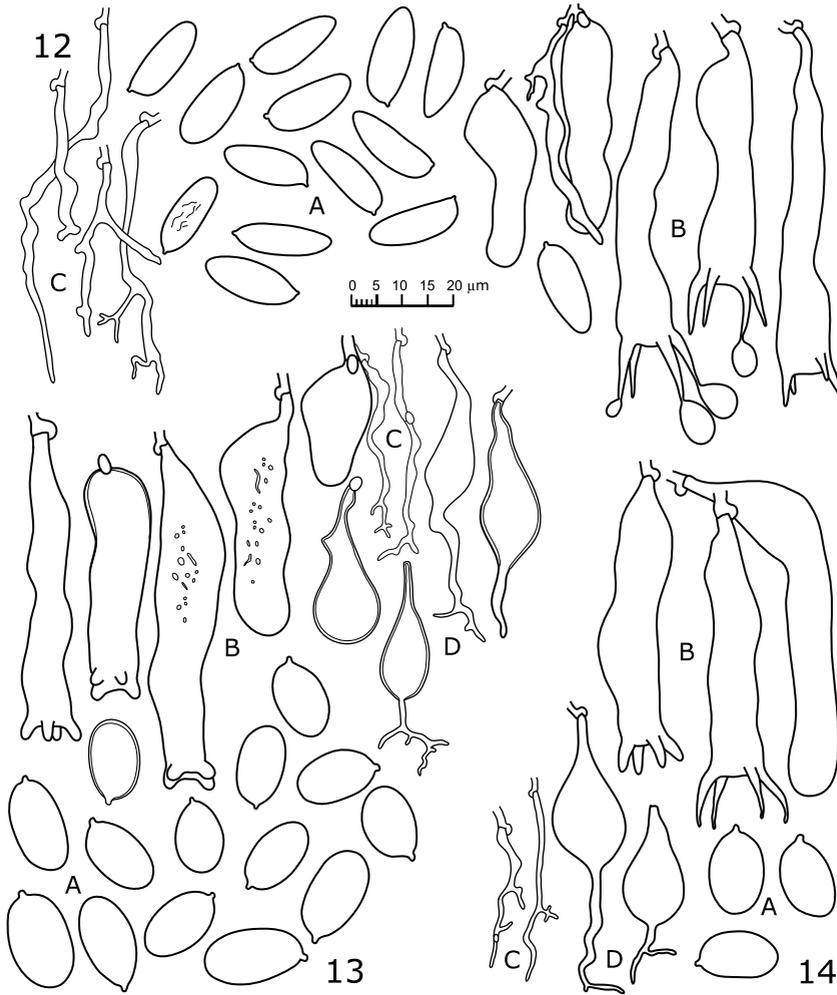
MYCOBANK # MB518645

HOLOTYPE: New Zealand, Auckland, Atkinson Park, Titirangi, on bark of *Leptospermum ericoides* A. Rich., 27 Jun 1953, *J.M. Dingley*, PDD 12633 (PDD).

DIAGNOSIS: *Differt Dendrothele speciebus basidiomatibus laevibus subceraceis rimis destitutis, hymeniis distincte incrassatis, et basidiosporis grandibus cylindricis vel fusiformibus cum parietibus incrassatulis cyanophilis, (14–)16–19.5(–22) × (5–)6–7.5(–8.5) μm.*

ETYMOLOGY: Named for Auckland District, the location of the type collection.

DESCRIPTION: Basidiomes resupinate, effuse, colonies small, linear to irregularly circular,



Figures 12–14. Line drawings of hymenial elements. **Figure 12.** *Dendrothele aucklandica* PDD 12633, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia. **Figure 13.** *Dendrothele australis* PDD 16845, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, cystidia. **Figure 14.** *Dendrothele australis* PDD 17044: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, cystidia.

coalescing, up to 65 × 15 mm, adnate, thin to moderately thick, up to 250 μm thick, firm, subceraceous; hymenial surface smooth, closely following contours of substrate, sometimes with a shiny surface, Cream–Buff, Cream Colour, pale yellow [4A(3–4)], pale orange (5A3), light orange (5A4), to greyish orange [5B(4–6)]; cracks lacking; margin distinct, adnate, abrupt, fimbriate to farinaceous or disappearing into a thin, nearly vernicose film.

Hyphal system monomitic with clamped generative hyphae. Subiculum absent. Hymenium thickening, composed of two parts: lower layer next to substrate a partially agglutinated tissue of vertically arranged hyphae, basidiospores, and embedded crystal clusters, up to 25 μm diam; hyphae 1.2–3 μm diam, clamped, moderately branched, irregular, short-celled, walls hyaline, thin to slightly thickened, smooth; and upper fertile layer of dendrohyphidia and

basidia. Dendrohyphidia hyphoid, simple to moderately branched at apex, sometimes with short, knobby branches, $30\text{--}70 \times 2\text{--}4 \mu\text{m}$, clamped at base, walls hyaline, thin, smooth. Basidia suburniform, clavate to broadly cylindrical, often with a short stalk, $40\text{--}72 \times 10\text{--}15 \mu\text{m}$, clamped at base, walls hyaline, thin, smooth, 4-sterigmate, sterigmata up to $15 \times 3 \mu\text{m}$. Basidiospores cylindrical to subfusiform, with a small, rounded apiculus, $(14\text{--})16\text{--}19.5(22) \times (5\text{--})6\text{--}7.5(8.5) \mu\text{m}$, average of four collections $16.8\text{--}18.5 \times 6.7\text{--}7.1$, $Q = 2.3\text{--}2.8$, walls hyaline, slightly thickened, smooth, cyanophilous, not reacting in Melzer's reagent.

HABITAT AND DISTRIBUTION: On bark of *Leptospermum ericoides* (= *Kunzea ericoides*), known only from New Zealand.

ADDITIONAL SPECIMENS EXAMINED (as *Corticium ampullosporum*): **NEW ZEALAND.** Auckland, Mt. Te Aroha, on *L. ericoides* (bark), 27 Aug 1956, G.H. Cunningham, PDD 17129 (PDD, BPI US0280245); Glen Esk Valley, Piha, on *L. ericoides* (bark), 12 May 1951, J.M. Dingley, PDD 11429; Rereatakahia Reserve, 300 ft, on *L. ericoides* (bark), 15 Oct 1956, G.H. Cunningham, PDD 16867; Little Barrier Island, on *L. ericoides* (bark), 9 Jun 1956, F.J. Newhook, PDD 16977.

The smooth, yellow to orange, subceraceous basidiomes on bark of *L. ericoides* and cylindrical to subfusiform basidiospores with thickened, cyanophilous walls distinguish *D. aucklandica* from other *Dendrothele* species. The thickening hymenium and general paucity of crystals in the basidiome are notable characters also. Specimens of *D. aucklandica* were originally identified as *Corticium ampullosporum* (Cunningham 1954, 1963), but this species has broader, ellipsoid basidiospores, cystidia, a matted felty or densely pruinose basidiome surface, and occurs on bark of *Metrosideros* and *Vitex*. The basidiospores of *C. ampullosporum* illustrated in Cunningham (1954, 1963) appear to be those of *D. aucklandica* instead.

Dendrothele australis Nakasone & Burds., sp. nov. Figs. 9, 10, 13, 14

MYCOBANK # MB518646

HOLOTYPE: New Zealand, Wellington, Lake Papaitonga, 50 ft, on bark of *Rubus australis* G.Forst., 11 May 1956, G.H. Cunningham, PDD 16845 (PDD).

DIAGNOSIS: *Species basidiomatibus parvis molibus subcretaceis profunde rimosis et facile separatis a congeneribus diversa habentibus cystidiis appendice apicali.*

ETYMOLOGY: From the Latin 'australis' meaning southern, refers to the southern hemisphere where this species occurs.

DESCRIPTION: Basidiomes resupinate, effuse, beginning as small, discrete, irregular colonies, confluent, up to $20 \times 15 \text{mm}$, adnate, thin to moderately thick, $100\text{--}350 \mu\text{m}$ thick, soft, subcretaceous, with numerous, deep cracks forming irregular polygons that readily detach from substrate; hymenial surface smooth, densely farinaceous, yellowish white [(3-4)A2], darkening to pale orange (5A3) or light brown (6D6); margin distinct, abrupt, adnate, concolorous with hymenium, occasionally finely farinaceous. Hyphal system monomitic with clamped generative hyphae. Subiculum absent. Hymenium thickening, composed of a dense, thick, basal layer of tangled, irregular, collapsed, vertically arranged hyphae, empty cystidia, collapsed basidiospores and abundant, small to medium-sized, hyaline crystals and an upper, narrow, fertile layer of dendrohyphidia, cystidia and basidia in a matrix of hyaline crystals. Dendrohyphidia numerous, hyphoid, sinuous, irregular, simple to finely branched apically, $25\text{--}40 \times 2\text{--}3.5 \mu\text{m}$, clamped at base, walls hyaline, thin, smooth. Cystidia numerous, enclosed, sphaeropedunculate to broadly clavate, $22\text{--}36 \times 8.5\text{--}16 \mu\text{m}$, often with a simple or sparsely branched, filamentous, apical appendage, $6\text{--}33 \times 1\text{--}3 \mu\text{m}$, clamped at base, walls hyaline, slightly thickened, smooth. Basidia suburniform, clavate, or subcylindrical, $43\text{--}65(95) \times 9\text{--}13 \mu\text{m}$, clamped at base, walls hyaline, thin, smooth, 4-sterigmate, sterigmata

up to $13 \times 3 \mu\text{m}$. Basidiospores scarce to abundant, often collapsed, ellipsoid to broadly cylindrical, with a small, distinct apiculus, $(13.5\text{--})15\text{--}16.5(\text{--}18.5) \times (7.2\text{--})8\text{--}11(\text{--}12) \mu\text{m}$, average of three collections $15.4\text{--}16.5 \times 8.5\text{--}10.2 \mu\text{m}$, $Q = 1.5\text{--}1.8$, walls hyaline, thin to slightly thickened, smooth, cyanophilous, not reacting in Melzer's reagent.

HABITAT AND DISTRIBUTION: On corticate branches of *Rubus australis*, known only from New Zealand.

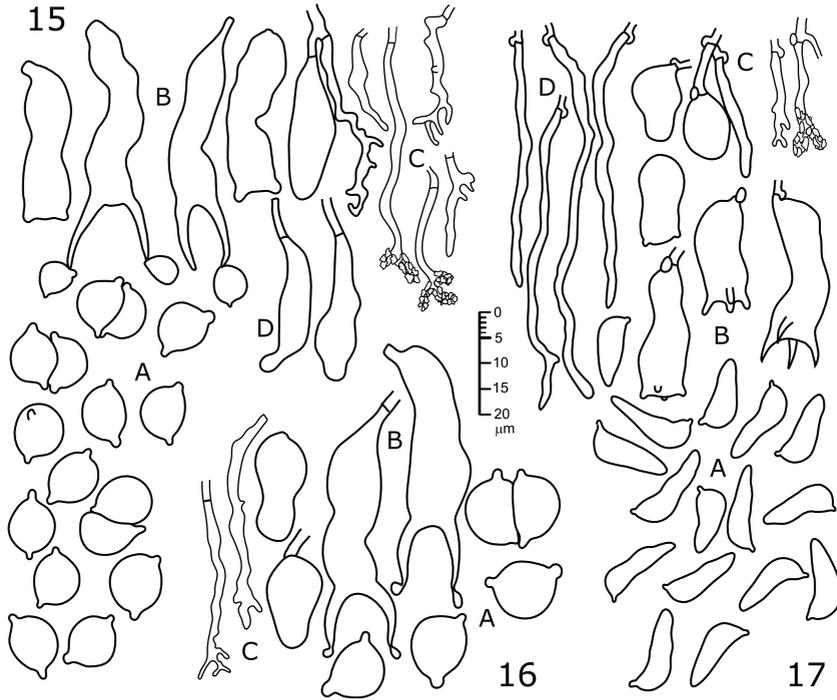
ADDITIONAL SPECIMENS EXAMINED (as *Acanthophysium acerinum*): **NEW ZEALAND.** Wellington, Ruahine Ranges, 3000 ft, on living stems of *Rubus australis* (bark), 10 Jan 1956, G.H. Cunningham, PDD 17024 (PDD, BPI US0285869); Lake Papaitonga, 50 ft, on *R. australis* (bark), 30 Aug 1956, G.H. Cunningham, PDD 17044 and PDD 17077, same location and substrate, 11 May 1956, G.H. Cunningham, PDD 16919.

Dendrothele australis is characterized by small, discrete, rimose, soft, subcretaceous basidiomes, cystidia with an apical appendage, and large, broadly cylindrical basidiospores. Mature basidia and basidiospores were difficult to find in basidiomes of PDD 17044 and 17077 which are extensively cracked and over-mature. In addition to *D. australis*, there are three other *Dendrothele* species from New Zealand and Australia that develop vesiculose cystidia with an apical appendage: *D. pulvinata*, *D. cornivesiculosa* P. Roberts and *D. leptostachys*. *Dendrothele pulvinata* from New Zealand and *D. cornivesiculosa* from Australia (Hjortstam et al. 2009) differ from *D. australis* in producing smaller, ellipsoid to subglobose basidiospores. *Dendrothele leptostachys* has similar basidiospores to *D. australis* but differs in its denser, subceraceous basidiomes and agglutinated context. Moreover, basidia in *D. leptostachys* are more sinuous and the apical appendages on the cystidia are smaller and simpler compared with *D. australis*. In addition to morphological differences, these species differ in host preferences. With additional collecting, however, host specificity may not hold up.

Dendrothele biapiculata (G. Cunn.) P.A. Lemke, *Persoonia* 3: 366. 1965. Figs. 15, 16

≡ *Acanthophysium biapiculatum* G. Cunn., *New Zealand Dept. Sci. Industr. Res. Bull.* 145: 165. 1963.

DESCRIPTION: Basidiomes resupinate, effuse, beginning as small, irregular colonies, coalescing, up to $55 \times 8 \text{mm}$, adnate, thin, up to $220 \mu\text{m}$ thick, soft, subcretaceous to subceraceous; hymenial surface smooth, finely pruinose to farinaceous, yellowish white (4A2), pale yellow (4A3), greyish yellow (4B3) to orange white (5A2), thicker areas pale orange (5A3) to greyish orange (5B4); cracks absent; margin distinct, abrupt, adnate, concolorous. Hyphal system monomitic with simple-septate generative hyphae. Hymenium thickening, composed of a basal layer of dense, partially agglutinated tissue of mostly vertically arranged hyphae obscured by abundant, medium to fine, hyaline crystals; hyphae $1.5\text{--}2.5 \mu\text{m}$ diam, simple septate, frequently branched, irregular, short-celled, walls hyaline, thin, smooth; and an upper, fertile layer of dendrohyphidia, cystidia and basidia embedded in a matrix of fine, hyaline crystals. Dendrohyphidia abundant, more or less filiform with short branches at apex, $15\text{--}48 \times 1.5\text{--}4 \mu\text{m}$, simple septate at base, sometimes irregularly inflated or with lateral, knobby outgrowths along length, walls hyaline, thin, smooth or encrusted. Cystidia inconspicuous, rare, clavate to fusiform, apex obtuse, $25\text{--}30 \times 8\text{--}9 \mu\text{m}$, simple septate at base, walls hyaline, thin, smooth. Basidia suburniform at first, then suburniform to clavate with slight constrictions, $30\text{--}45 \times 8\text{--}12 \mu\text{m}$, simple septate at base, stalked or not, walls hyaline, thin, smooth, 2-(rarely 3-4) sterigmate, sterigmata up to $15 \times 3 \mu\text{m}$. Basidiospores often adhering in pairs, subglobose to broadly ellipsoid or D-shaped, biapiculate with a short peg at distal end and a smaller, distinct apiculus, $(9.5\text{--})10\text{--}12(\text{--}13) \times (8.5\text{--})9\text{--}11 \mu\text{m}$, average of isotype $10.5 \pm 0.6 \times 9.2 \pm 0.6$, $Q = 1.1$, contents cyanophilous, walls hyaline, thin to slightly thickened,



Figures 15–17. Line drawings of hymenial elements. **Figure 15.** *Dendrothele biapiculata* BPI US0285875, isotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, cystidia. **Figure 16.** *Dendrothele biapiculata* PDD 17457, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia. **Figure 17.** *Dendrothele cymbiformis* HHB 18193, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, hyphal elements from hyphal pegs.

smooth, cyanophilous, not reacting in Melzer's reagent.

HABITAT AND DISTRIBUTION: On bark of various angiosperms, reported from New Zealand, Argentina.

TYPE SPECIMENS EXAMINED: NEW ZEALAND. Nelson, Murchison, 170 m, on *Fuchsia excorticata* L.f. (bark and wood of branches), 28 Apr 1956, *S.D. and P.J. Brook*, PDD 17457 (holotype PDD, isotype BPI US0285875).

ADDITIONAL SPECIMEN EXAMINED: ARGENTINA. Tierra del Fuego, Departamento Ushuaia, Estancia Moat, on *Maytenus magellanica* Hook.f., 21 Mar 1998, *A. Greslebin* 1389 (CIEFAP).

Dendrothele biapiculata is characterized by simple-septate hyphae, dendrohyphidia, 2-sterigmate basidia and biapiculate, broadly ellipsoid basidiospores with cyanophilous walls.

Depending on the basidiospore orientation, it is not always possible to observe the distal peg, thus these basidiospores appear ellipsoid. Basidiospores of the holotype are slightly larger than the isotype. Additional descriptions and illustrations are available from Cunningham (1963, p. 165) and Greslebin (2002).

Dendrothele novae-zelandiae and *D. subellipsoidea*, new species described herein, have similar biapiculate basidiospores but develop 4-sterigmate basidia and clamped hyphae. *Dendrothele amygdalispora* Hjortstam has narrower, nearly biapiculate basidiospores, average size $10.5 \times 6.6 \mu\text{m}$ (Kotiranta & Saarenoksa 2000) and simple-septate hyphae, but its basidia are consistently 4-sterigmate. *Dendrothele citrisporella* Boidin & Duhem from France is the species most similar to *D. biapiculata* with respect to basidiospore shape and hyphal septa-

tion (Boidin et al. 1996). We examined three specimens of *D. citrisporella* from PC (0138175, 0138176, 0138177 holotype) and conclude that it is distinct from *D. biapiculata* because it lacks cystidia, has thinner basidiomes, up to 50 µm thick, smaller basidia that are always 2-sterigmate, 22–32 × 6–10 µm, and narrower basidiospores, 7–9 µm diam.

Dendrothele cymbiformis Nakasone & Burds., sp. nov. Figs. 11, 17

MYCOBANK # MB518647

HOLOTYPE: New Zealand, Campbell Island, Perseverance Harbour, track to Azimuth Mt., 52°32.740'S, 169°09.148'E, on bark at base of living *Dracophyllum scoparium* Hook.f., 15 Mar 2000, H.H. Burdsall, Jr, HHB18193 (PDD, isotype CFMR).

DIAGNOSIS: *Species clavis hypharum pusillis albis vel eburneis et basidiosporis anguste navicularibus a congeneribus diversa.*

ETYMOLOGY: From 'cymbiformis,' Latin for boat-shaped, refers to the shape of the basidiospores.

DESCRIPTION: Basidiomes resupinate, effuse, beginning as small circular or irregular colonies, coalescing, up to 7 × 3 mm, adnate, thin, up to 150 µm thick, soft, subcretaceous; hymenial surface furfuraceous to minutely odontoid from hyphal pegs, white to yellowish white (4A2); hyphal pegs a loose fascicle, more or less terete, 60–120 × 15–30 µm, 7–11 pegs per mm, fragile, apices fibrillose to penicillate; cracks scattered, deep; margin distinct, abrupt, with a white, fibrillose to arachnoid fringe. Hyphal system monomitic with clamped generative hyphae. Hyphal pegs a loose fascicle of hyphoid elements, these 45–75 × 2–3 µm, clamped at base, simple or occasionally branched, walls hyaline, thin, heavily encrusted. Subiculum an indistinct tissue of hyphae and abundant, embedded, coarse, hyaline crystals; subicular hyphae 1.5–2.2 µm diam, clamped, moderately branched, irregular, walls hyaline, thin to slightly thickened, smooth. Hymenium minimally thickened, composed of dendrohyphidia and basidia in a crystalline

matrix. Dendrohyphidia abundant, simple to sparsely branched, 19–23 × 2–2.5 µm, clamped at base, walls hyaline, thin, sometimes apices encased in a thin, crystalline sheath. Basidia suburniform, clavate, or cylindrical, slightly constricted, 17–30 × 7.5–10 µm, clamped at base, walls hyaline, thin, smooth, 4-sterigmate. Basidiospores often collapsed, adherent, narrowly navicular to subfusiform, pip-shaped in face view, with a small, distinct apiculus, (11.5–)14–17.5 × 4–5(–6) µm, average 15.1 ± 1.6 × 5.1 ± 0.5 µm, $Q = 3.0$, walls hyaline, thin, smooth, cyanophilous, not reacting in Melzer's reagent.

HABITAT AND DISTRIBUTION: On bark of living *Dracophyllum*, known only from New Zealand.

Dendrothele cymbiformis is characterized by tiny, white hyphal pegs, suburniform to clavate basidia, and narrowly navicular basidiospores. Basidiospores vary in size which may be related to spore maturity. *Dendrothele* species with navicular basidiospores, such as *D. magnenavicularis* and *D. navicularis*, lack hyphal pegs whereas those with hyphal pegs, such as *D. griseocana* and *D. americana* Nakasone, develop globose to ellipsoid basidiospores (Nakasone 2006).

Dendrothele incrustans (P.A.Lemke) P.A.Lemke, *Persoonia* 3: 366. 1965.

≡ *Aleurocorticium incrustans* P.A.Lemke, *Can. J. Botany* 42: 739. 1964

HABITAT AND DISTRIBUTION: On corticate twigs and branches of woody angiosperms and gymnosperms, reported from the United States of America, Canada, Guadeloupe, Argentina and New Zealand (Nakasone 2009).

SPECIMENS EXAMINED: NEW ZEALAND. Auckland, Rangitoto Island, on *Dodonaea viscosa* Jacq., July 1950, J.M. Dingley, PDD 10588, as *Corticium commixtum*. Campbell Island, Perseverance Harbour, Frilly Fern Gulch, 52°32.6'S, 169°09'E, on standing, dead *Dracophyllum scoparium* (bark), 7 Mar 2000, H.H. Burdsall, Jr., PDD 79277 (PDD, CFMR HHB 18008).

This species is distinguished by soft, subcretaceous to pruinose basidiomes, absence of cystidia, and globose to broadly ellipsoid basidiospores, $9\text{--}12\text{--}(13) \times 8\text{--}10\ \mu\text{m}$. For descriptions and illustrations of *D. incrustans* see Lemke (1964b), Boidin et al. (1996), Greslebin & Rajchenberg (1998) and Nakasone (2009). Nakasone (2009) identified as *D. incrustans* two specimens of *C. commixtum* collected by J.M. Dingley. On re-examination, PDD10588 was confirmed to be *D. incrustans*, but PDD11231, on corticate twigs of *Fuchsia excorticata*, was identified as *D. novae-zelandiae*.

Dendrothele leptostachys Nakasone & Burds., sp. nov. Figs. 18, 21, 22

MYCOBANK # MB518648

HOLOTYPE: New Zealand, Campbell Island, Perseverance Harbour, Shoal Point, $52^{\circ}33.138'\text{S}$, $169^{\circ}10.033'\text{E}$, on (bark of) standing, dead *Dracophyllum scoparium*, 10 Mar 2000, H.H. Burdsall, Jr., HHB18094 (PDD, isotype CFMR).

DIAGNOSIS: Differt *Dendrothele pulvinata* basidiosporis ellipsoideis grandioribus, $(13.2\text{--})14\text{--}16 \times (7.2\text{--})8\text{--}9\text{--}(9.5)\ \mu\text{m}$, differt *D. australi* basidiomatibus subceraceis, rimosis minime, affixis substrato firme.

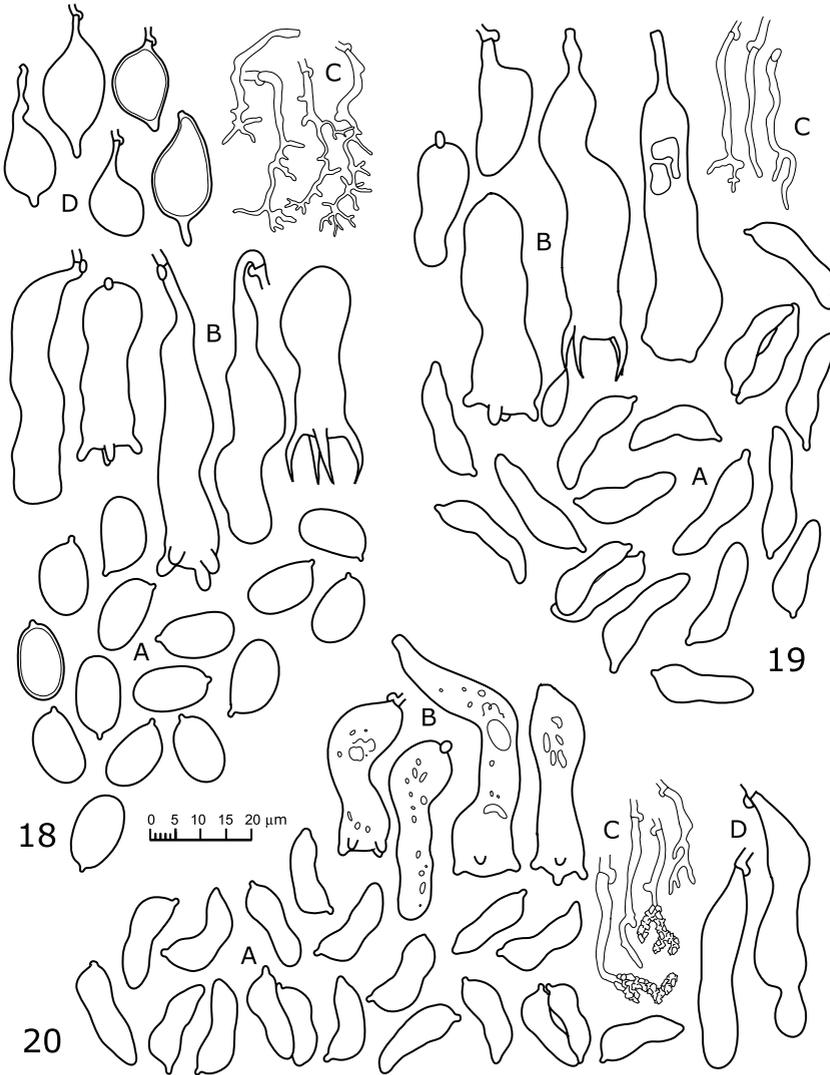
ETYMOLOGY: From the Greek 'lepto' meaning slender, thin and 'stachys' for spike, refers to the apical appendage on the cystidia.

DESCRIPTION: Basidiomes resupinate, effuse, beginning as small, linear colonies, confluent, up to $25 \times 8\ \text{mm}$, adnate, thin to moderately thick, $100\text{--}250\ \mu\text{m}$ thick, dense, firm, crustose, subcretaceous to subceraceous; hymenial surface smooth, yellowish white (4A2), pale yellow (4A3) to greyish yellow (4B3); cracks absent or scattered, shallow to deep; margin distinct, abrupt, adnate, with a narrow pulveraceous to fimbriate fringe, white to concolorous with hymenium. Hyphal system monomitic with clamped generative hyphae. Subiculum up to $20\ \mu\text{m}$ thick, a dense, compact, agglutinated tissue of hyphae arranged parallel to substrate with scattered, coarse, hyaline crystals; subicular hyphae irregular, $1\text{--}3\ \mu\text{m}$ diam, clamped,

moderately branched, walls hyaline, thin to slightly thickened, smooth. Hymenium well-developed, thickening, composed of two layers – a basal layer of agglutinated cystidia, collapsed basidiospores, and resinous material and a narrow, upper, fertile layer of dendrohyphidia, cystidia and basidia. Dendrohyphidia numerous, hyphoid, irregular, with short, delicate or knobby branches along length, $15\text{--}40 \times 1\text{--}2\ \mu\text{m}$, clamped at base, walls hyaline, thin, smooth. Cystidia abundant, embedded, ventricose to sphaeropedunculate, $15\text{--}25 \times 9\text{--}13\ \mu\text{m}$, clamped at base, usually with an apical papilla, small nub or filamentous appendage, $1\text{--}7 \times 1\text{--}2\ \mu\text{m}$, walls hyaline, slightly thickened, smooth. Basidia suburniform, clavate or subcylindrical, sometimes with a basal lobe, often medially constricted, sinuous, $30\text{--}60\text{--}(75) \times 9\text{--}14\ \mu\text{m}$, clamped at base, walls hyaline, thin, smooth, 4-sterigmate, sterigmata up to $16 \times 3\ \mu\text{m}$. Basidiospores scarce to abundant, often collapsed, adherent, narrowly ellipsoid to ellipsoid, adaxially flattened, with a small, rounded apiculus, $(13.2\text{--})14\text{--}16 \times (7.2\text{--})8\text{--}9\text{--}(9.5)\ \mu\text{m}$, average $14.6 \pm 0.9 \times 8.6 \pm 0.6\ \mu\text{m}$, $Q = 1.7$, walls hyaline, thin to slightly thickened, smooth, cyanophilous, not reacting in Melzer's reagent.

HABITAT AND DISTRIBUTION: On corticate branches of *Dracophyllum*, known only from New Zealand.

Dendrothele leptostachys is characterized by small, firm, subceraceous basidiomes with few crystals, abundant, embedded cystidia with a small apical appendage, and large, narrowly ellipsoid basidiospores. There are two other species of *Dendrothele* from New Zealand with similar cystidia – *D. australis* and *D. pulvinata*. Like *D. leptostachys*, *D. pulvinata* has a dense, subceraceous basidiome and a thickening hymenium with persistent, embedded cystidia bearing an apical appendage but with ellipsoid to subglobose basidiospores. *Dendrothele australis* has slightly larger basidiospores and a much softer, subcretaceous, rimose basidiome that readily detaches from the substrate (Figs. 9, 10) that contrasts with the subceraceous, minimally cracked, and firmly attached



Figures 18–20. Line drawings of hymenial elements. **Figure 18.** *Dendrothele leptostachys* HHB 18094, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, ventricose cystidia with an apical appendage. **Figure 19.** *Dendrothele magnenavicularis* PDD 17132, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia. **Figure 20.** *Dendrothele navicularis* PDD 15608, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, cystidia from PDD 15455.

basidiomes of *D. leptostachys* (Figs. 21, 22). In addition to substrate differences, *D. leptostachys* has more sinuous basidia, smaller and simpler apical appendages on the cystidia, and few crystalline materials in the context compared with *D. australis*.

Dendrothele cornivesiculosa, from western Australia, has dendrohyphidia that are similar to the cystidia described above and smaller, thin-walled basidiospores, $9\text{--}10.5 \times 6.5\text{--}7.5 \mu\text{m}$ (Hjortstam et al. 2009). Of the three north temperate species with appendage-bearing

cystidia, only *D. acerina* (Pers.: Fr.) P.A.Lemke has basidiospores that are similar in shape, but smaller, $10\text{--}12(-14) \times 7\text{--}8(-9)\mu\text{m}$, to those of *D. leptostachys* (Eriksson & Ryvarden 1975; Gorjón & Bernicchia 2010).

Dendrothele magnenavicularis Nakasone & Burds., sp. nov. Figs. 19, 23, 24
MYCOBANK # MB518649

HOLOTYPE: New Zealand, Wellington, Lake Papaitonga, 50 ft, on bark of *Melicytus ramiflorus* J.R.Forst. & G.Forst., 30 Aug 1956, G.H. Cunningham, PDD 17132 (PDD, isotype BPI US0285870).

DIAGNOSIS: *Differt Dendrothele cymbiformi basidiis et basidiosporis grandioribus et clavis hypharum destitutis, differt D.naviculari basidiosporis longioribus, (17.3–)18–22(–24) μm longis.*

ETYMOLOGY: From the Latin ‘magnus,’ meaning large and ‘navicularis,’ for boat-shaped, refers to the size and shape of the basidiospores.

DESCRIPTION: Basidiomes resupinate, effuse, small circular or irregular colonies, coalescing, up to 20×15 mm, adnate, moderately thick, up to $350\mu\text{m}$ thick, occasionally pulvinate, soft, fragile, pulveraceous to cretaceous; hymenial surface smooth to pulverulent, white to yellowish white (4A2); cracks scarce; margin distinct, abrupt, white. Hyphal system monomitic with clamped generative hyphae. Subiculum a loose tissue with abundant, embedded, coarse, hyaline crystals; subicular hyphae $1\text{--}2\mu\text{m}$ diam, clamped, frequently branched, irregular, walls hyaline, thin, smooth. Hymenium minimally thickened, composed of dendrohyphidia and basidia in a crystalline matrix. Dendrohyphidia abundant, hyphoid, simple to moderately branched, $25\text{--}35 \times 2\text{--}3\mu\text{m}$, clamped at base, walls hyaline, thin, smooth. Basidia suburniform, clavate or subcylindrical, sometimes stalked, $43\text{--}55 \times 9\text{--}14\mu\text{m}$, clamped at base, walls hyaline, thin, smooth, 4-sterigmate. Basidiospores scarce, collapsed, adherent, narrowly navicular, slightly constricted, often slightly curved, with a distinct apiculus, $(17.3\text{--})18\text{--}$

$22(-24) \times (5.5\text{--})6\text{--}7(-7.8)\mu\text{m}$, average $20.6 \pm 2.1 \times 6.5 \pm 0.7\mu\text{m}$, $Q = 3.2$, walls hyaline, thin, smooth, weakly cyanophilous, not reacting in Melzer’s reagent.

HABITAT AND DISTRIBUTION: On bark of *Melicytus*, known only from New Zealand.

Dendrothele magnenavicularis is characterized by small, irregular, soft, fragile basidiomes and long, narrowly navicular basidiospores. *Dendrothele cymbiformis* and *D. navicularis* have significantly shorter, navicular basidiospores.

Dendrothele navicularis Nakasone & Burds., sp. nov. Figs. 20, 25, 26

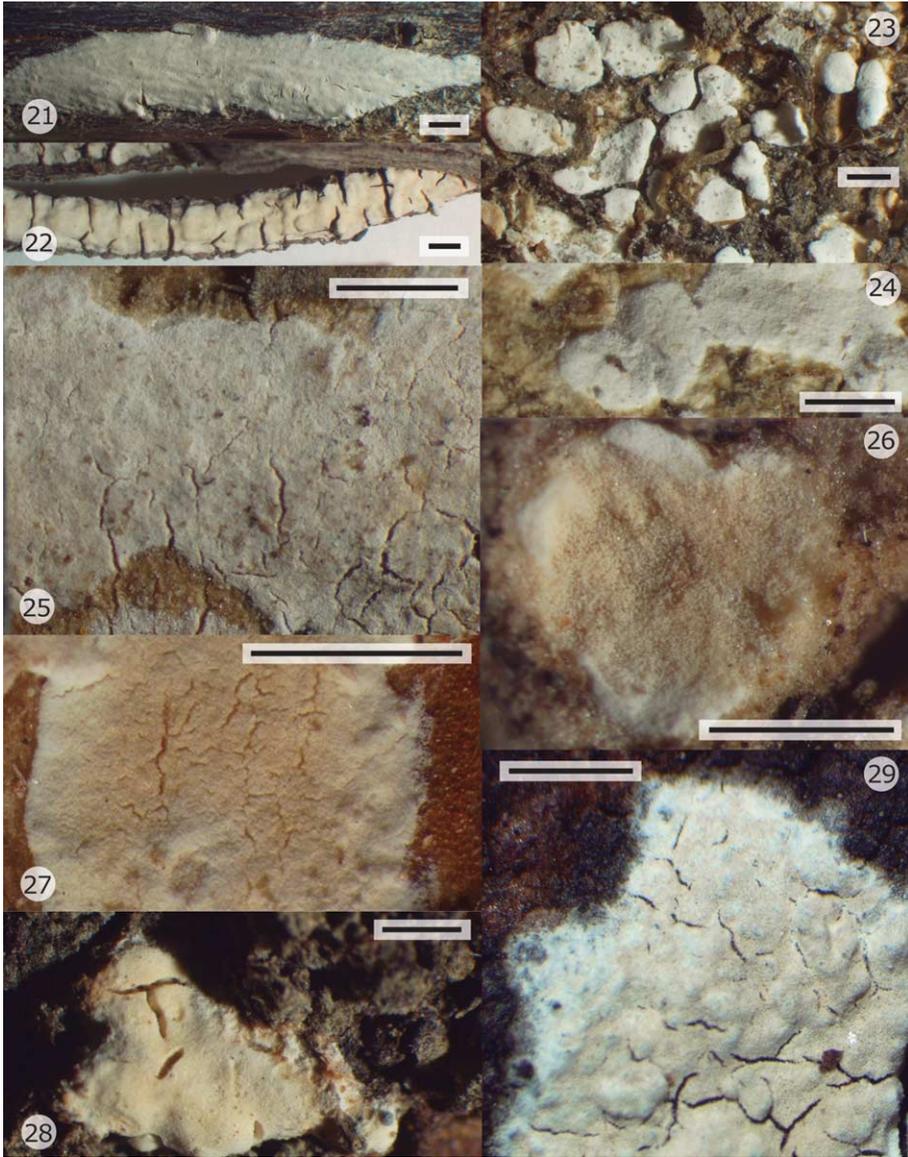
MYCOBANK # MB518650

HOLOTYPE: New Zealand, Auckland, Piha, Whekatahi Stream, on bark of *Brachyglottis repanda* J.R.Forst. & G.Forst., 10 Jul 1955, J.M. Dingley, PDD 15068 (PDD).

DIAGNOSIS: *Differt Dendrothele cymbiformi basidiosporis navicularibus latioribus, clavis hypharum destitutis, differt D.magnenaviculari basidiosporis navicularibus brevioribus.*

ETYMOLOGY: From ‘navicularis,’ Latin for boat-shaped, refers to the shape of the basidiospores.

DESCRIPTION: Basidiomes resupinate, effuse, oblong or irregular colonies becoming confluent, up to 25×10 mm, adnate, thin to moderately thin, $70\text{--}200\mu\text{m}$ thick, soft, subcretaceous; hymenial surface smooth, subfelty to densely farinaceous, nearly pulveraceous, Cream-Buffer, Warm Buffer, Cartridge Buffer, yellowish white (4A2), pale yellow (5A3), orange white (5A2), pale orange (5A3), or greyish orange (5B3); cracks fine, developed in mature areas; margin adnate, distinct, rapidly thinning out or abrupt, subfarinaceous or porulose, white to cream. Hyphal system monomitic with clamped generative hyphae. Subiculum a partially agglutinated tissue with abundant, embedded, coarse, hyaline crystals; subicular hyphae irregular, $2\text{--}3.5\mu\text{m}$ diam, clamped, moderately branched, walls hyaline, thin, smooth. Hymenium minimally thickened, composed of dendrohyphidia, cystidia and basidia in a crystalline matrix. Dendrohyphidia



Figures 21–29. Close-up photographs of basidiomes. Bar = 1 mm. **Figure 21.** *Dendrothele leptostachys* HHB 18904, holotype. **Figure 22.** *Dendrothele leptostachys* HHB 18904, holotype. **Figure 23.** *Dendrothele magnenavicularis* PDD 17132, holotype. **Figure 24.** *Dendrothele magnenavicularis* PDD 17132, holotype. **Figure 25.** *Dendrothele navicularis* PDD 11513. **Figure 26.** *Dendrothele navicularis* PDD 15608, holotype. **Figure 27.** *Dendrothele novae-zelandiae* PDD 11231. **Figure 28.** *Dendrothele pulvinata* PDD 17441, holotype. **Figure 29.** *Dendrothele subellipsoidea* PDD 90027, holotype.

abundant, simple to intricately branched, 15–35 × 1–4 μm, clamped at base, walls hyaline, thin, encrusted with a thin, crystalline sheath at apex. Cystidia rare, suburniform, pyriform or

narrowly clavate to cylindrical, 33–50 × 8–10 μm, clamped at base, walls hyaline, thin, smooth. Basidia suburniform to clavate, often stalked, 28–40(–55) × 9–14 μm, clamped at

base, often containing resinous materials, walls hyaline, thin, smooth, 4-sterigmate. Basidiospores scarce, often collapsed, adherent, irregularly subfusiform to navicular, triangular in dorsal view, often medially constricted, sometimes curved, with a small, distinct apiculus, (11–)14–18(–19) × 5.5–7.2(–8) μm, average of two collections 17.3–17.6 × 6.1–6.4 μm, $Q = 2.7–2.9$, walls hyaline, slight thick to thick, smooth, weakly cyanophilous, not reacting in Melzer's reagent.

HABITAT AND DISTRIBUTION: On bark of various angiosperms, known only from New Zealand. **ADDITIONAL SPECIMENS EXAMINED:** NEW ZEALAND. Auckland, Hick's Bay, 300 ft, on corticate branches of *B. repanda*, May 1952, G.H. Cunningham, PDD 11513, as *Corticium ampullosporum*; Cascades, Waitakere Range, on *B. repanda* (bark), 3 Apr 1954, S.D. Baker, PDD 15456, and on *Carpodetus serratus* J.R.Forst. & G.Forst. (bark), 3 Apr 1955, S.D. Baker, PDD 15455, both as *Acanthophysium acerinum*; Waiomu, Thames, on *B. repanda* (bark), 24 Aug 1954, J.M. Dingley, PDD 15457 (PDD, BPI US0285878), as *A. candidum*; Huia, on *Dysoxylum spectabile* Hook.f. (bark), 7 Mar 1953, J.M. Dingley, PDD 12443, as *Corticium commixtum*. Northlands, Waipoua Forest, on bark of living *Senecio kirkii* Hook.f. ex Kirk (= *Urostemon kirkii* (Hook.f. ex Kirk) B.Nord.), 20 Jan 1955, J.M. Dingley, PDD 14093, as *C. commixtum*. Otago, Catlin Forest Park, Cairn Road summit, on bark of living woody vine, 4 May 2004, H.H. Burdsall, Jr., HHB 19413 (CFMR).

Dendrothele navicularis is characterized by smooth, soft, subcretaceous, yellow to orange basidiomes and navicular basidiospores. Often collapsed and adherent, basidiospores are inconspicuous and vary in size probably due to spore maturity. Cystidia were rarely observed and resemble developing basidia. *Dendrothele cymbiformis*, which produces hyphal pegs, has narrower navicular basidiospores (4–6 μm diam) and smaller basidia whereas *D. magnenavicularis* has longer, navicular basidiospores, about 21 μm long on average, and larger

basidia. Moreover, these species with navicular basidiospores have different host preferences.

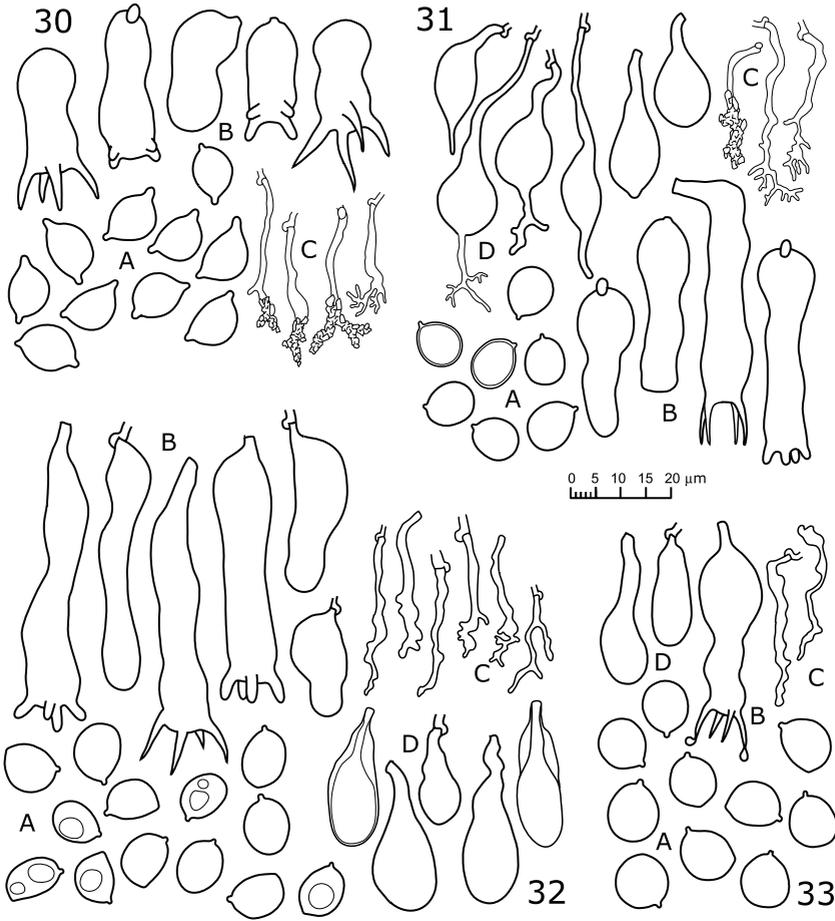
Dendrothele novae-zelandiae Nakasone & Burds., sp. nov. Figs. 27, 30

MYCOBANK # MB518651

HOLOTYPE: New Zealand, Otago, Catlin Forest Park, Cairn Road summit, 46°23.505'S, 169°27.567'E, on bark of living woody angiosperm, 4 May 2004, H.H. Burdsall, Jr., HHB 19421 (PDD, isotype CFMR).

DIAGNOSIS: *Differt Dendrothele biapiculata* hyphis *fibulatis* basidiis 4-sterigmatibus, *differt D. subellipsoidea* et *D. amygdalispora* basidiosporis *biapiculatis* *constanter*.

DESCRIPTION: Basidiomes resupinate, effuse, beginning as discrete, small, irregularly circular, oblong or linear colonies, confluent, up to 30 × 10 mm, adnate, thin, up to 350 μm thick, firm, cretaceous to subcretaceous; hymenial surface smooth, yellowish white [(3–4)A2], pale yellow [4A(3–4)], orange white or pale orange [5A(2–3)]; cracks scarce or numerous, then short, deep; margin distinct, abrupt or rapidly thinning out, white or concolorous with hymenial surface. Hyphal system monomitic with clamped generative hyphae. Subiculum absent. Hymenium thickening, composed of two layers: a thick, basal layer of agglutinated vertical hyphae and hymenial remnants obscured by abundant, embedded hyaline crystals; hyphae irregular, 1.5–3 μm diam, clamped, moderately to frequently branched, walls hyaline, thin, smooth or encrusted; and a thin, upper fertile layer of dendrohyphidia, cystidia and basidia. Dendrohyphidia abundant, filiform, simple or richly branched at apex, 20–35 × 1–3 μm, clamped at base, walls hyaline, thin, encrusted. Cystidia rare, clavate, 35–50 × 9–12 μm, clamped at base, walls hyaline, thin, smooth. Basidia scarce, suburniform to clavate, (20–)25–40 × 9–12(–15) μm, clamped at base, walls hyaline, thin, smooth; 4-sterigmate, sterigmata up to 14 × 3 μm. Basidiospores scarce, often adherent, collapsed, citriform with a prominent distal peg and apiculus, (9–)10–11(–12.5) × (6.5–)7–8.5



Figures 30–33. Line drawings of hymenial elements. **Figure 30.** *Dendrothele novae-zelandiae* HHB 19421, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia. **Figure 31.** *Dendrothele pulvinata* BPI US0285886, isotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, cystidia with apical appendage. **Figure 32.** *Dendrothele subellipsoidea* PDD 90027, holotype: **A**, basidiospores, **B**, basidia, **C**, dendrohyphidia, **D**, thin- and thick-walled, broadly clavate cystidia. **Figure 33.** *Dendrothele subellipsoidea* PDD 70444: **A**, basidiospores, **B**, basidium, **C**, dendrohyphidia, **D**, thin-walled, clavate cystidia.

(–10) μm , average of holotype $11 \pm 1.5 \times 8.1 \pm 0.7 \mu\text{m}$, $Q=1.4$, walls hyaline, thin, smooth, weakly to distinctly cyanophilous, not reacting in Melzer’s reagent.

HABITAT AND DISTRIBUTION: On bark and wood of *Fuchsia excorticata* L.f. and other angiosperms, known only from New Zealand.

ADDITIONAL SPECIMENS EXAMINED: NEW ZEALAND. Wellington, Featherston, on bark and wood of *Fuchsia excorticata*, 25 Nov 1951, J.M. Dingley, PDD 11231, as *Corticium*

commixtum; Blyth Track, Ohakune, on corticate branches of *F. excorticata*, 26 Jan 1954, S.D. Baker, PDD 12951, as *Corticium commixtum*; Pohangina Reserve, 300 ft, on bark of living stems of *F. excorticata*, 12 Jan 1954, G.H. Cunningham, PDD 14705, as *Corticium commixtum*; Mt. Tongariro, 2500 ft, on *F. excorticata*, 16 Jan 1955, G.H. Cunningham, PDD 14108, as *Corticium commixtum*. Auckland, Te Araroa, 650 ft, on bark of *F. excorticata*, 22 May 1952, G.H. Cunningham,

PDD 11508, as *Corticium commixtum*; Mamaku Forest, 1800 ft, on dead standing stems of *Coprosma australis* B.L.Rob., 11 Sep 1954, G.H. Cunningham, PDD 15460, as *Corticium commixtum*. Hawkes Bay, Peninsular wood, Norsewood, on *Fuchsia* twigs, no date, W. Colenso b288, PDD 39331, as *Corticium commixtum*. Otago, Catlin Forest, Catlin River Track, on bark of living shrub, 3 May 2004, H.H. Burdsall, Jr., HHB 19372 (CFMR).

Dendrothele novae-zelandiae is characterized by clamped generative hyphae, 4-sterigmate basidia, and citriform basidiospores. *Dendrothele biapiculata*, also from New Zealand on *Fuchsia*, has basidiospores of similar shape and size to *D. novae-zelandiae* but produces 2-sterigmate basidia and lacks clamp connections. Basidiospores of *D. subellipsoidea*, from New Zealand, and *D. amygdalispora*, from Europe, overlap in size to those of *D. novae-zelandiae* but are not distinctly biapiculate. In addition, cystidia are numerous and smaller in *D. subellipsoidea* but scarce and larger in *D. novae-zelandiae*.

Dendrothele pulvinata (G.Cunn.) P.A.Lemke, *Persoonia* 3: 367. 1965. Figs. 28, 31
≡ *Acanthophysium pulvinatum* G.Cunn., *New Zealand Dept. Sci. Industr. Res. Bull.* 145: 164. 1963.

DESCRIPTION: Basidiomes resupinate, effuse, beginning as small, pulvinate, irregularly orbicular colonies, coalescing, up to 15 × 6 mm, adnate, moderately thick to thick, 215–650 µm thick, firm, subcretaceous to ceraceous; hymenial surface smooth to rugulose, pale yellow (4A3), orange white (5A2) or pale orange (5A3); cracks few, short, deep in mature areas; margin adnate, distinct, abrupt, concolorous, sometimes with a thin, appressed, brown edge. Hyphal system monomitic with clamped generative hyphae. Subiculum not observed. Hymenium thickening, composed of two parts: a lower, dense, agglutinated, lacunose tissue, 100–450 µm thick, comprised primarily of a few hyphae agglutinated together, enclosing each cystidium to form a complex, multi-

layered, honeycomb-like tissue of numerous cavities, obscured by abundant, embedded, medium to fine, hyaline crystals often aggregated into larger clusters; hyphae irregular, 1.5–2 µm diam, clamped, frequently branched, walls hyaline, thin, smooth; and a well-developed, upper, fertile layer, 100–250 µm thick, composed of dendrohyphidia, cystidia and basidia embedded in a matrix of fine, hyaline crystals. Dendrohyphidia abundant, more or less filiform with short branches at apex, 25–35 × 1–2.5 µm, clamped at base, walls hyaline, thin, smooth or encrusted. Cystidia abundant, arising at multiple levels, clavate, ventricose or sphaeropedunculate, 22–45 × 8–11 µm, clamped at base, often with a hyphoid, simple or moderately branched apical appendage, 5–15 × 1–2 µm, walls hyaline, thin to slightly thickened, smooth. Basidia suburniform to cylindrical, sometimes stalked, 35–70 × 8–12 µm, clamped at base, walls hyaline, thin, smooth, 4-sterigmate, sterigmata up to 12 × 2 µm. Basidiospores scarce, subglobose to broadly ellipsoid, (8.7–)9.5–10(–10.7) × 8–9 µm, average of 13 spores 9.8 ± 0.4 × 8.5 ± 0.4, $Q = 1.2^*$, walls hyaline, slightly thickened, up to 0.5 µm thick, smooth, cyanophilous, not reacting in Melzer's reagent.

HABITAT AND DISTRIBUTION: On bark of *Beilschmiedia tawa* Kirk, known only from New Zealand.

TYPE SPECIMENS EXAMINED: NEW ZEALAND. Auckland, Lake Rotoehu, 1200 ft, on *Beilschmiedia tawa* (bark), 16 Oct 1956, G.H. Cunningham, PDD 17441 (holotype PDD, isotype BPI US0285886).

ADDITIONAL SPECIMEN EXAMINED: NEW ZEALAND. Wellington, Blyth Track, Ohakune, on bark, 26 Jan 1954, S.D. Baker, PDD 14703, as *Corticium commixtum*.

Dendrothele pulvinata is characterized by thick, dense, pulvinate basidiomes composed of overlapping layers of cystidia and subglobose to broadly ellipsoid basidiospores with slightly thickened, cyanophilous walls. The thickening hymenium with multiple layers of cystidia is unique in the genus. See Cunningham (1963,

p. 165) for a description and illustration of the embedded cystidia. He also describes and illustrates a subicular layer which we did not observe. The species was known only from the type collection, but recently, we uncovered another collection.

Dendrothele wojewodai Pouzar is most similar to *D. pulvinata*, with respect to basidiospore shape and size, but has a thinner, softer basidiome and occurs in Europe (Pouzar 2001; Gorjón & Bernicchia 2010). *Dendrothele acerina*, *D. alliacea* (Quél.) P.A.Lemke, *D. australis*, *D. leptostachys* and *D. cornivesiculosa* also develop ventricose cystidia with an apical appendage, but are easily distinguished from *D. pulvinata* by basidiome structure and basidiospore shape and size.

Dendrothele subellipsoidea Nakasone & Burds., sp. nov. Figs. 29, 32, 33

MYCOBANK # MB518652

HOLOTYPE: New Zealand, Mid-Canterbury, Craigieburn Forest, on (bark of) decaying logs, 15 Nov 1995, P.K. Buchanan, PKB8125-1, PDD 90027 (PDD).

DIAGNOSIS: *Species basidiomatibus laevibus vel tuberculatis, cystidiis vesiculatis et basidiosporis subglobois vel ellipsoideis fere biapiculatis a congeneribus diversa.*

ETYMOLOGY: From the Latin prefix 'sub-' meaning almost, approaching and 'ellipsoideus,' for ellipsoid, refers to the shape of the basidiospores.

DESCRIPTION: Basidiomes resupinate, effuse, beginning as small circular or irregular colonies, coalescing, up to 25 × 11 mm, adnate, moderately thin, up to 250 µm thick, soft, subcretaceous; hymenial surface smooth with scattered, small, rounded tubercles, white, yellowish white (4A2), orange white (5A2) to greyish orange (5B3); becoming extensively cracked with maturity; margin adnate, distinct, abrupt or rapidly thinning out with a narrow, white, fimbriate fringe. Hyphal system monomitic with clamped generative hyphae. Subiculum absent. Hymenium thickening, composed of dendrohyphidia, cystidia and basidia in a

dense crystalline matrix. Dendrohyphidia abundant, irregularly filiform with knobs and short branches throughout length, occasionally branched at apex, 15–30 × 1.5–3 µm, clamped at base, walls hyaline, thin, smooth. Cystidia embedded, broadly clavate, vesiculose, 24–35 × 8–12 µm, clamped at base, walls hyaline, slightly thickened, up to 2.5 µm at base, smooth, cyanophilous. Basidia suburniform to clavate, sinuous, 35–60(–72) × 8–12 µm, clamped at base, walls hyaline, thin, smooth, 4-sterigmate, sterigmata up to 12 × 3 µm. Basidiospores ellipsoid to broadly ellipsoid, with a distinct apiculus and often with a faint nub or peg near apex resulting in a biapiculate or citriform shape, (9.3–)10–11.5 × (6.5–)7–9(–10.5) µm, average of two specimens, 10.6–10.7 × 8–9.4 µm, $Q = 1.1–1.3$, walls hyaline, slightly thickened, smooth, cyanophilous, not reacting in Melzer's reagent.

HABITAT AND DISTRIBUTION: On corticate angiospermous twigs, stems and logs, known only from New Zealand.

ADDITIONAL SPECIMENS EXAMINED: NEW ZEALAND. Canterbury, Craigieburn Forest Park, Lyndon Saddle Track, 43°08'S, 171°43'E, on fallen log of *Nothofagus solandri* var. *cliffortioides* (Hook.f.) Poole (bark), 15 Nov 1995, P.K. Buchanan, R.B. Allen and P.W. Clinton, PDD 70444. Wellington, Lake Papaitonga, 50 ft, on *Clematis paniculata* J.F.Gmel. twigs (bark), 30 Aug 1930, G.H. Cunningham, PDD 17070, as *Acanthophysium candidum*. Auckland Islands, Enderby Island, Stella Creek, 50°30.018'S, 166°16.675'E, on suspended, dead *Dracophyllum longifolium* (J.R.Forst. & G.Forst.) R.Br. (bark), 12 Mar 2000, H.H. Burdsall, Jr., HHB 18296 (CFMR).

Dendrothele subellipsoidea is characterized by small, irregular basidiomes with smooth to rugulose fertile surfaces, broadly clavate cystidia without an apical appendage, and ellipsoid to broadly ellipsoid, nearly biapiculate, basidiospores. Thick-walled cystidia were only observed in the holotype specimen. Specimen PDD 70444 has primarily subglobose, rarely biapiculate, basidiospores. *Dendrothele*

biapiculata and *D. novae-zelandiae*, also from New Zealand, have distinctly biapiculate basidiospores. A north temperate species, *Dendrothele amygdalispora* has basidiospores of similar shape and size to *D. subellipsoidea* but lacks cystidia (Yurchenko & Kotiranta 2007).

Species of *Dendrothele* reported but not occurring in New Zealand

Dendrothele acerina (Pers.: Fr.) P.A.Lemke, *Persoonia* 3: 366. 1965.

≡ *Corticium acerinum* Pers., *Observ. Mycol.* 1: 37. 1796.

≡ *Acanthophysium acerinum* (Pers.: Fr.) G.Cunn., *New Zealand Dept. Sci. Industr. Res. Bull.* 145: 166. 1963.

Of the 10 specimens of *A. acerinum* cited by Cunningham (1963), none were identified as *D. acerina*. Four distinct, undescribed taxa were uncovered: *D. arachispora* (PDD 15066, 15067), *D. navicularis* (PDD 15455, 15456), *D. australis* (PDD 16845, 16919, 17024, 17044, 17077) and *D. magnenavicularis* (PDD 17132).

Dendrothele candida (Schwein.: Fr.) P.A.Lemke, *Persoonia* 3: 366. 1965.

≡ *Merisma candidum* Schwein., *Schriften Naturf. Ges. Leipzig* 1: 110. 1822.

≡ *Acanthophysium candidum* (Schwein.: Fr.) G.Cunn., *New Zealand Dept. Sci. Industr. Res. Bull.* 145: 166. 1963.

None of the four specimens of *A. candidum* cited by Cunningham (1963) was correctly identified. PDD 15457 on *Brachyglottis repanda* is *D. navicularis* and PDD 17070 on *Clematis-paniculata* is *D. subellipsoidea*. PDD 17040 on *Leptospermum scoparium* appears to be a mixed collection of *D. subellipsoidea* and a degraded, unidentifiable species, whereas PDD 14760 is *Dendrothele nivosa* sensu G.Cunn. An additional specimen, PDD 39357, Colenso b402, is tentatively named '*Dendrothele* sensu lato'. It was reported as *Aleurodiscus* sp. by Cunningham (1952), p. 282; 1954, p. 326) although filed as *Corticium laeve* at the herbarium at Kew.

Dendrothele commixta (Höhn. & Litsch.) J.Erikss. & Ryvardeen, *Cortic. N. Europe* 3: 355. 1975.

≡ *Corticium commixtum* Höhn. & Litsch., *Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Cl. Abt. 1* 116: 821. 1907.

Dendrothele commixta does not occur in New Zealand. There are 17 specimens of *Corticium commixtum* at PDD from New Zealand, including 15 cited by Cunningham (1954, 1963) who noted gross basidiome variability among the collections with respect to substrate. This observed variability is not surprising for seven different taxa were identified among the specimens cited by Cunningham: *D. incrustans* (PDD 10588) on *Dodonaea viscosa*, *Aleurodiscus* sp. (PDD 11855, 14704) on *Podocarpus* ssp., *Xenasma* sp. (PDD 11140, 11423) on *Coprosma foetidissima* J.R.Forst. & G.Forst., *Hyphodontia* sp. (PDD 14101) on *Melicytus ramosus*, *Intextomyces* sp. (PDD 15459) on *M. ramiflorus*, *D. navicularis* (PDD 14093) on *Senecio kirkii* and (PDD 12443) on *Dysoxylum spectabile*, *D. novae-zelandiae* (PDD 11231, 11508, 12951, 14108, 14705) on *Fuchsia excorticata* and (PDD 15460) on *Coprosma australis*. The remaining two collections of *C. commixtum* at PDD are *D. pulvinata* (PDD 14703), on bark of unknown host, and *D. novae-zelandiae* (PDD 39331, Colenso b288) on *M. ramiflorus*. This last collection was reported to be a sterile *Corticium* by Cunningham (1952).

Dendrothele nivosa sensu G.Cunn., as *Acanthophysium nivosum* (Berk. & M.A.Curtis ex Höhn. & Litsch.) G.Cunn., *New Zealand Dept. Sci. Industr. Res. Bull.* 145: 163. 1963, non *Dendrothele nivosa* (Berk. & M.A.Curtis ex Höhn. & Litsch.) P.A.Lemke, *Persoonia* 3: 367. 1965.

REPRESENTATIVE SPECIMENS EXAMINED: (as *Acanthophysium nivosum*): NEW ZEALAND. Auckland, Moumoukai Valley, Hunua Ranges, on *Libocedrus plumosa* (D.Don) Sarg., 1 Dec 1969, J.M. Dingley, PDD 28117. Wellington, Mt. Tongariro, 2500 ft, on *Podocarpus hallii* Kirk (bark), 14 Jan 1955, G.H.

Cunningham, PDD 14709 and PDD 14711. Otago, Mt. Cargill, Dunedin, on *P. hallii*, 30 Jan 1957, E.E. Chamberlain, PDD 17497. Nelson, Maitai Valley, on *P. totara* G.Benn. ex D.Don, 21 Apr 1956, S.D. Brook, PDD 17113. Hawkes Bay, Norsewood, on fallen tree, no date, W. Colenso b.46, PDD 66881.

Cunningham (1963) reported this species on various coniferous substrates, however, none of the ten specimens he cited is conspecific with *D. nivosa*. The basidiospores in the New Zealand specimens are large, smooth, globose to subglobose, (14–)16–20(–22) × (13–)14–17(–20) μm, whereas in *D. nivosa* they are finely echinulate, broadly ellipsoid, 18–22 × 14–16 μm. *Dendrothele nivosum* sensu G.Cunn. appears to be an undescribed taxon whose generic placement at this time is unknown and requires additional research.

Species excluded from *Dendrothele sensu stricto*

Corticium corniculatum G.Cunn., *Trans. Roy. Soc. New Zealand* 82: 317. 1954.

≡ *Dendrothele corniculata* (G.Cunn.) Stalpers, *New Zealand J. Bot.* 23: 304. 1985.

REPRESENTATIVE SPECIMENS EXAMINED: NEW ZEALAND. Auckland, Piha Valley, on *Leucopogon fasciculatus* A.Rich., 15 Aug 1953, J.M. Dingley, PDD 12428; Raglan, Mt. Karioi, on *Leptospermum scoparium* J.R.Forst. & G.Forst., Mar 1951, J.M. Dingley, PDD 11313. Northland, Western Hills, Whangarei, on decorticate *Leptospermum ericoides*, May 1949, J.M. Dingley, PDD 7400.

Stalpers (1985) believed that *C. corniculatum* was similar to *D. commixta* so he made the transfer to *Dendrothele*. Although *C. corniculatum* does develop encrusted dendrohyphidia and basidiospores with slightly thickened walls, traits present in many *Dendrothele* species, the basidia are unusual. The cylindrical to clavate basidia are short, 15–30 × 6–10, with rather long sterigmata, up to 12 × 2 μm, but do not resemble the suburniform basidia typical of *Dendrothele*. In addition, the basidiomes are found on bark of dead branches. Therefore,

C. corniculatum is not accepted in *Dendrothele sensu stricto* but neither does it fit readily into any extant genus. For descriptions and illustrations of *C. corniculatum* see Cunningham (1954, 1963) and Stalpers (1985).

Epithele fasciculata (G.Cunn.) Boidin & Gilles, *Bull. Trimestrielle Soc. Mycol. France* 102: 302. 1986.

≡ *Acanthophysium fasciculatum* G.Cunn., *New Zealand Dept. Sci. Industr. Res. Bull.* 145: 167. 1963.

≡ *Dendrothele fasciculata* (G.Cunn.) P.A.Lemke, *Persoonia* 3: 366. 1965.

TYPE SPECIMEN EXAMINED: NEW ZEALAND. Wellington, Carterton, Carter's Beach, 150 ft on *Alectryon excelsus* Gaertn., 18 Dec 1952, G.H. Cunningham, PDD 17690 (holotype).

ADDITIONAL SPECIMENS EXAMINED: NEW ZEALAND. Wellington, Carterton, Carter's Beach, on *Melictytus ramiflorus*, 18 Dec 1952, G.H. Cunningham, PDD 17689; same location and date, on *Coprosma robusta* Raoul, 18 Dec 1952, G.H. Cunningham, PDD 17687; same location and date, on *Beilschmiedia tawa*, 18 Dec 1952, G.H. Cunningham, PDD 17688 (PDD, BPI US0285882).

This species is characterized by widely effuse basidiomes bearing hyphal pegs, a dimittic hyphal system with thick-walled skeletal hyphae, large basidia, and large, ellipsoid basidiospores. We agree with Boidin & Gilles (1986) that this species is correctly placed in *Epithele*. See Cunningham (1963) and Hjortstam & Ryvarden (2005) for descriptions.

Discussion

There are 13 species of *Dendrothele sensu stricto* from New Zealand. In this article, nine new species are described, of which three are represented solely by the type collection — *Dendrothele cymbiformis*, *D. leptostachys* and *D. magnenavicularis*. In addition, one new combination is proposed, *D. ampullospora*. Eleven species, except *D. incrustans* and *D. biapiculata*, are known only from New Zealand to date.

Some species are restricted to a specific host, but this may be a result of limited collecting. Navicular-shaped basidiospores, present in *D. cymbiformis*, *D. magnenavicularis* and *D. navicularis*, are described for the first time in *Dendrothele*. Corticioid species are well-studied in New Zealand because of the pioneering work of Cunningham (1963); however, our research shows that many more species await discovery. Because of the tendency for host specificity, we expect many of the *Dendrothele* species from New Zealand to be endemic or at least limited to the Australasian region, such as *D. biapiculata*. Endemics are not unusual for corticioid fungi from New Zealand (Buchanan 2001).

Dendrothele, as currently defined, does not represent a monophyletic genus. Molecular phylogenetic studies have demonstrated the polyphyletic nature of the genus (Goranova 2003). Although a few species have been transferred to other genera, defining and circumscribing *Dendrothele* sensu stricto requires more study. From our investigations, we determined that species such as *D. nivosa*, *D. candida* and *D. corniculata* are not true dendrotheles. These species differed in at least one important morphological feature – the basidia were not typically suburniform. Molecular phylogenetic analyses of the large subunit of the nuclear ribosomal RNA gene place *D. nivosa* and *D. candida* in the *Russulales* although they lack amyloid basidiospores (Goranova 2003).

Molecular phylogenetic studies place *Dendrothele* near *Lachnellaceae* Fr., sometimes called the *Nia* clade, which is closely related to *Schizophyllaceae* Qué. in the *Agaricales* (Bodensteiner et al. 2004; Binder et al. 2006; Matheny et al. 2006). Included in this clade are cyphellaceous genera, such as *Flagelloscypha* Donk, *Lachnella* Fr., *Mersimoides* Singer and *Woldmaria* W.B.Cooke, as well as species from marine habitats, such as *Nia vibrissa* R.T. Moore & Meyers, *Halocyphina villosa* Kohlm., *Calathella mangrovei* E.B.G.Jones & Agerer, and the anamorphic species *Peyronelina glomerulata* P.J.Fisher, J.Webster & D.F.Kane

(Yamaguchi et al. 2009). *Dendrothele*, a genus of corticioid fungi growing primarily on bark of living trees and shrubs, does not appear to have much in common with these cyphellaceous and marine species, but some species of *Flagelloscypha* and *Lachnella* have navicular-shaped basidiospores similar to those in *D. cymbiformis*, *D. magnenavicularis* and *D. navicularis* (Reid 1961; Agerer 1983; Piątek & Bujakiewicz 2004). Suburniform basidia, characteristic of *Dendrothele* species, are present in some species of *Flagelloscypha* (Agerer 1980) although clavate basidia are typical for most species in the *Lachnellaceae*.

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References

- Agerer R 1980. Contribution to neotropical cyphellaceous fungi – I. Three new species of *Flagelloscypha*. *Mycologia* 72: 908–914.
- Agerer R 1983. Typusstudien an cyphelloiden Pilzen IV. *Lachnella* Fr. s.l. *Mitteilungen der Botanischen Staatssammlung München* 19: 163–334.
- Binder M, Hibbett DS, Larsson K-H, Larsson E, Langer E, Langer G 2005. The phylogenetic distribution of resupinate forms across the major clades of mushroom-forming fungi (Homobasidiomycetes). *Systematics and Biodiversity* 3: 113–157.
- Binder M, Hibbett DS, Wang Z, Farnham WF 2006. Evolutionary relationships of *Mycaureola dilseae* (Agaricales), a basidiomycete pathogen of a subtidal rhodophyte. *American Journal of Botany* 93: 547–556.

- Bodensteiner P, Binder M, Moncalvo J-M, Agerer R, Hibbett DS 2004. Phylogenetic relationships of cyphelloid homobasidiomycetes. *Molecular Phylogenetics and Evolution* 33: 501–515.
- Boidin J, Gilles G 1986. Basidiomycètes Aphyllophorales de l'Île de la Réunion. IV. Les genres *Epithele* (Pat.) Pat. et *Pteridomyces* Jülich. *Bulletin Trimestriel de la Société Mycologique de France* 102: 299–304.
- Boidin J, Lanquetin P, Duhem B 1996. Contribution à la connaissance du genre *Dendrothele* (Basidiomycotina, Aphyllophorales). *Bulletin Trimestriel de la Société Mycologique de France* 112: 87–126.
- Buchanan PK 2001. Aphyllophorales in Australasia. *Australian Systematic Botany* 14: 417–437.
- Cunningham GH 1952 (1953). Revision of Australian and New Zealand species of Thelephoraceae and Hydnaceae in the herbarium of the Royal Botanic Gardens, Kew. *Proceedings of the Linnean Society of New South Wales* 77: 275–299.
- Cunningham GH 1954. Thelephoraceae of New Zealand Part III. The genus *Corticium*. *Transactions of the Royal Society of New Zealand* 82: 271–327.
- Cunningham GH 1963. The Thelephoraceae of Australia and New Zealand. New Zealand Department of Scientific and Industrial Research Bulletin 145: 1–359.
- Donk MA 1957. Notes on resupinate Hymenomycetes – IV. *Fungus* 27: 1–29.
- Donk MA 1964. A conspectus of the families of Aphyllophorales. *Persoonia* 3: 199–324.
- Eriksson J, Ryvarden L 1975. The Corticiaceae of North Europe. Volume 3. *Coronicium—Hyphoderma*. Oslo, Fungiflora.
- Gorjón SP, Bernicchia A 2010. The genus *Dendrothele* (Basidiomycota) in Italy, an update with notes on European species. *Nova Hedwigia* 90: 233–250.
- Goranova G 2003. Phylogenetic analyses of rDNA sequences indicate the corticioid genus *Dendrothele* is highly polyphyletic. Unpublished MA thesis, Clark University, Worcester.
- Greslebin AG 2002. Flora Criptogámica de Tierra del Fuego. Volume 11, Fascicle 4. Fungi, Basidiomycota, Aphyllophorales: Coniophoraceae, Corticiaceae, Gomphaceae, Hymenochaetaceae, Lachnocladiaceae, Stereaceae, Thelephoraceae, Tulasnellales: Tulasnellaceae. Buenos Aires, Consejo Nacional de Investigaciones Científicas y Técnicas de la República Argentina (CONICET).
- Greslebin A, Rajchenberg M 1998. Corticioid Aphyllophorales (Basidiomycotina) from the Patagonian Andes forests of Argentina. 3. The genus *Dendrothele*. *Mycotaxon* 67: 469–486.
- Hjortstam K, Ryvarden L 2005. Notes on the genus *Epithele* (Basidiomycotina, Aphyllophorales) from South America. *Synopsis Fungorum* 20: 23–32.
- Hjortstam K, Roberts PJ, Spooner BM 2009. Corticioid fungi from the Kimberly Region, Western Australia. *Kew Bulletin* 64: 353–368.
- Höhnelt F, Litschauer V 1907. Beiträge zur Kenntniss der Corticieen (II. Mitteilung). *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien, Mathematisch-naturwissenschaftliche Classe. Abteilung 1* 116: 739–840.
- Kirk PM, Cannon PF, Minter DW, Stalpers JA 2008. *Ainsworth & Bisby's dictionary of the fungi*. 10th edition. Wallingford, CAB International.
- Kornerup A, Wanscher JH 1978. *Methuen handbook of colour*. 3rd edition. London, Eyre Methuen.
- Kotiranta H, Saarenoksa R 2000. Corticioid fungi (Aphyllophorales, Basidiomycetes) in Finland. *Acta Botanica Fennica* 168: 1–55.
- Kotlaba F, Pouzar Z 1964. Preliminary results on the staining of spores and other structures of homobasidiomycetes in cotton blue and its importance for taxonomy. *Transactions of the British Mycological Society* 47: 653–654.
- Langer E 2001. Phylogeny of non-gilled and gilled basidiomycetes—DNA sequence inference, ultrastructure and comparative morphology. Unpublished Habilitationsschrift thesis, Univeristat Tübingen, Tübingen.
- Lemke PA 1964a. The genus *Aleurodiscus* (sensu stricto) in North America. *Canadian Journal of Botany* 42: 213–282.
- Lemke PA 1964b. The genus *Aleurodiscus* (sensu lato) in North America. *Canadian Journal of Botany* 42: 723–768.
- Matheny PB, Curtis JM, Hofstetter V, Aime MC, Moncalvo J-M, Ge Z-W, Yang Z-L, Slot JC, Ammirati JF, Baroni TJ, Bougher NL, Hughes KW, Lodge DJ, Kerrigan RW, Seidl MT, Aanen DK, DeNitis M, Daniele GM, Desjardin DE, Kropp BR, Norvell LL, Parker A, Vellinga EC, Vilgalys R, Hibbett DS 2006. Major clades of *Agaricales*: a multilocus phylogenetic overview. *Mycologia* 98: 982–995.
- Nakasone KK 2006. *Dendrothele griseocana* (Corticaceae) and related taxa with hyphal pegs. *Nova Hedwigia* 83: 99–108.
- Nakasone KK 2009. Morphological studies of *Dendrothele* species from North America. *North American Fungi* 4 (7): 1–15.

- Parmasto E, Nilsson RH, Larsson K-H 2004. Cortbase version 2. Extensive updates of a nomenclatural database for corticioid fungi (Hymenomycetes). *Phyloinformatics* 5: 1–7.
- Piątek M, Bujakiewicz A 2004. *Lachnella villosa* and *Woldmaria filicina*, two remarkable cyphelloid fungi from Poland. *Polish Botanical Journal* 49: 145–150.
- Pouzar Z 2001. Notes on the taxonomy and distribution of Aphyllophorales I. *Czech Mycology* 53: 121–131.
- Reid DA 1961. Fungi Venezuelani: V. The Cyphelloidaceae of Venezuela. *Kew Bulletin* 15: 261–275.
- Ridgway R 1912. Color standards and color nomenclature. Washington, DC, Author.
- Singer R 1986. The Agaricales in modern taxonomy. 4th edition. Koenigstein, Koeltz Scientific Books.
- Stalpers JA 1985. Type studies of the species of *Corticium* described by G. H. Cunningham. *New Zealand Journal of Botany* 23: 301–310.
- Thiers B [continuously updated]. Index Herbariorum: a global directory of public herbaria and associated staff. New York, Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/>
- Yamaguchi K, Degawa Y, Nakagiri A 2009. An aero-aquatic fungus, *Peyronelina glomerulata*, is shown to have teleomorphic affinities with cyphelloid basidiomycetes. *Mycoscience* 50: 156–164.
- Yurchenko EO, Kotiranta H 2007. Rare corticioid fungi (Basidiomycetes, Aphyllophorales) from northern Belarus. *Mycena* 7: 20–47.