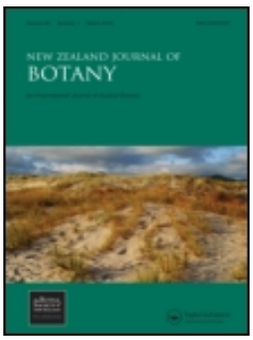

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The genus *Psilocybe* (Agaricales) in New Zealand

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Abstract Eight species of *Psilocybe* are reported from New Zealand: *P. argentina*, *P. aucklandii*, *P. coprophila*, *P. makarorae* sp. nov., *P. novae-zelandiae*, *P. semilanceata*, *P. subaeruginosa*, and *P. subcoprophila*. Of these, *P. aucklandii*, *P. makarorae*, *P. subaeruginosa*, and *P. semilanceata* stain blue-green with damage, a reaction characteristic of *Psilocybe* species with hallucinogenic properties. Descriptions and illustrations of all species are provided, with notes on their ecology and distribution, and a key for their identification.

Keywords fungi; Agaricales; *Psilocybe*; *P. makarorae* sp. nov.; New Zealand

INTRODUCTION

Eight *Psilocybe* species have been previously recorded from New Zealand: *P. coprophila* (Bull.: Fr.) P. Kumm. (Bell 1983), *P. novae-zelandiae* Guzmán & E. Horak (Guzmán & Horak 1978), *P. aucklandii* Guzmán et al. (Guzmán et al. 1991), 2 unnamed blueing species (Margot & Watling 1981; Guzmán et al. 1993), and *P. australiana* Guzmán & Watling, *P. eucalypta* Guzmán & Watling, and *P. semilanceata* (Fr.) P. Kumm. (Guzmán et al. 1993). From field collecting and collections deposited in the herbarium of Landcare Research, Auckland (PDD), two further species – *P. argentina* (Speg.) Singer and *P. subcoprophila* (Britzelm.) Sacc. – have been recognised, and the unnamed species of Margot & Watling (1981) is described as new. The names *P. australiana* and *P. eucalypta* are considered to be synonyms of *P. subaeruginosa* Cleland, following Chang & Mills (1992). Owing to the recent increase in illegal use of *Psilocybe* species as recreational drugs in New Zealand, a better understanding of the genus in this country has become important.

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METHODS

All descriptions are based on New Zealand material, and macroscopic features described from fresh material, unless otherwise stated. Microscopic features were measured and drawn from herbarium material rehydrated in 3% KOH, then placed in 100% lactic acid. Spore dimensions are expressed as (length) × (width in face view) × (width in side view). Distribution data are recorded as geographical areas within New Zealand as defined by Crosby et al. (1976). Herbarium abbreviations follow Holmgren et al. (1990).

KEY TO *PSILOCYBE* SPECIES KNOWN FROM NEW ZEALAND

1. On dung 2
   Not on dung 4
2. Spores always elliptic in face view, 15–22 µm long ..... ***P. subcoprophila***
   Spores often hexagonal or subhexagonal in face view, 10–18 µm long 3
3. Spore length 10–14.5 µm, average 12 µm ..... ***P. coprophila***
   Spore length 13–18 µm, average 15 µm ..... ***P. argentina***
4. Most spores more than 10 µm long 5
   Most spores less than 10 µm long 6

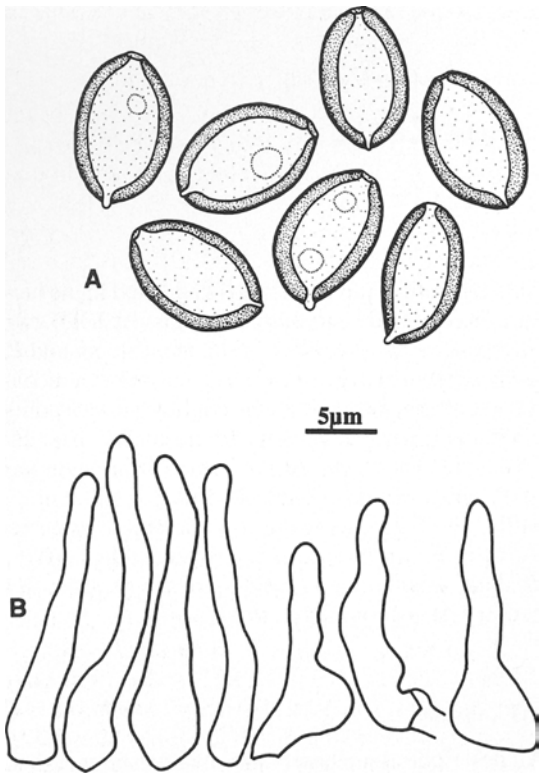

Fig. 1 *Psilocybe argentina* (PDD 58476): **A,** spores; **B,** cheilocystidia.

5. Pileus 12–50 mm diam., conic to convex with broad umbo; pleurocystidia present; cheilocystidia with simple neck 4–8 µm long; on buried wood in rough pasture and on bark mulches ..... ***P. subaeruginosa***
   Pileus 7–10 mm diam., conic to papillate with sharp umbo; pleurocystidia absent; cheilocystidia with flexuous, often bifurcate neck 8–12 µm long; on soil in high-altitude grasslands ..... ***P. semilanceata***
6. Pleurocystidia absent; not staining blue with damage ..... ***P. novae-zelandiae***
   Pleurocystidia present; staining blue with damage 7
7. Cheilocystidia with flexuous, often bifurcate neck, up to 12 µm long; spore wall about 0.5 µm thick ..... ***P. aucklandii***
   Cheilocystidia with simple neck, 3–5 µm long; spore wall about 0.8–1 µm thick ..... ***P. makarorae***

DESCRIPTIONS OF THE SPECIES

1. *Psilocybe argentina* (Spegazzini) Singer, *Beihefte zur nova hedwigia 29*: 241 (1969). (Fig. 1)

Pileus 10–25 mm diam., more or less subglobose, becoming convex to campanulate to somewhat flattened; slightly tacky; scattered veil remnants along edge of cap when young; dark orange-brown or reddish-brown, finely striate to margin, hygrophanous, drying to pale yellow. **Gills** broadly adnate to subdecurrent; pale greyish yellow-brown, with white fimbriate margin. **Stipe** 20–40(–70) × 1.5–2 mm, light yellow-brown, slightly darker to base. **Veil** cortinoid, poorly developed, visible only in very young caps. **Basidia** 27–35 × 8–11 µm, more or less cylindrical, tapering suddenly to small base, sometimes slightly constricted near centre, 4-spored, clamped. **Cheilocystidia** 20–30 × 5.5–7.5 µm, ventricose-rostrate, with long, flexuous, unbranching neck, hyaline, thin-walled. **Pleurocystidia** rare, ventricose, 27–36 × 8.5–10 µm. **Spores** (13–)14–16(–18) × 8.5–10(–11) × 7.5–9 µm, average 15.3 × 9.4 × 8.4 µm, in face view broad-elliptic to subhexagonal to subhexagonal, in side view elliptic; wall brown, smooth, 1–1.2 µm thick, with apical pore.

HABITAT: Dung of farm animals.

DISTRIBUTION: New Zealand: Waikato, Bay of Plenty, North Canterbury. Reported as widespread in Central and South America, as well as occurring in the southern United States and Europe (Guzmán 1983).

NOTES: A new record for the country, the New Zealand collections closely match the description of this species given by Guzmán (1983). Watling & Gregory (1987) considered the European collections cited by Guzmán to be better placed in a separate species, *P. merdicola* Huijsman.

SPECIMENS EXAMINED: New Zealand. WAIKATO: vic. Tuakau, Klondyke Hill, on sheep dung, *G. M. Taylor*, 3 Aug 1985, PDD 49587. BAY OF PLENTY: Rotorua, on sheep dung, *P. Broadhurst*, May 1987, PDD 45588. NORTH CANTERBURY: Mount Thomas Forest Park, Richardson Track picnic area, on sheep dung, *P. R. Johnston*, 15 Mar 1991, PDD 58476.

2. *Psilocybe aucklandii* Guzmán, C. C. King & Bandala, *Mycological research 95*: 507 (1991). (Fig. 2)

Pileus 15–55 mm diam., broad-conic, expanding to

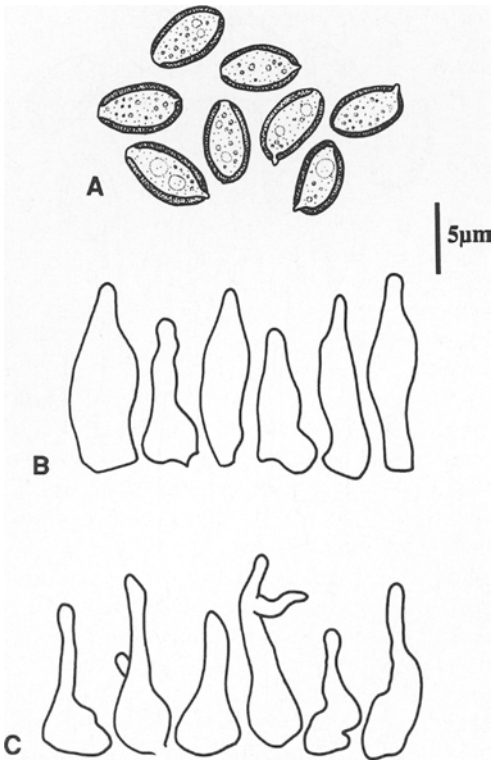

Fig. 2 *Psilocybe aucklandii* (PDD 58423): **A,** spores; **B,** pleurocystidia; **C,** cheilocystidia.

broadly umbonate to more or less flattened, with edges becoming slightly upturned and often splitting; dry; lacking veil remnants; dark brown to yellow-brown, striate to edge, hygrophanous, drying to pale yellow-brown to straw-coloured; staining greenish-blue with damage or age; flesh white. **Gills** adnate, greyish yellow-brown with conspicuous narrow pale margin. **Stipe** 35–100 × 1.5–5 mm, cylindric, finely pruinose toward top, silky-fibrillose toward base, whitish; staining greenish-blue with damage; flesh brownish. **Veil** cortinoid, poorly developed, disappearing as caps mature. **Basidia** 20–28 × 4.5–6 µm, cylindric, 4-spored, clamped. **Cheilocystidia** 15–32 × 4–8 µm, ventricose-rostrate, with long, tapering, flexuous and sometimes bifurcate neck up to 12 µm long, hyaline, thin-walled. **Pleurocystidia** 13–19 × 4.5–6 µm, scattered, similar in shape to cheilocystidia but with shorter neck, up to 4.5 µm long. **Spores** (6.5–)7–9.5 × 4–5.5 × 3.5–4.5 µm, average 8.1 × 4.9 × 4.3 µm, in face view ovate, in side view elliptic-ovate; wall brown, smooth, about 0.5 µm thick, with apical pore.

HABITAT: On soil and litter beneath *Leptospermum* and *Dacrydium,* and in pine plantations.

DISTRIBUTION: New Zealand: Auckland.

NOTES: This species has been found only in the Auckland region, where it appears to be quite common on soil and litter in native forest and in pine plantations. As noted by Guzmán et al. (1991), *P. aucklandii* is very similar to *P. zapotecorum* R. Heim emend. Guzmán, which is common in Mexico and known from South America. The two species are barely distinguishable microscopically, although comparison with published descriptions (Guzmán 1983) show that *P. aucklandii* may have slightly narrower pleurocystidia and slightly wider spores. Published illustrations of *P. zapotecorum* (Guzmán 1983) appear to show that *P. aucklandii* is a less robust species.

SPECIMENS EXAMINED: New Zealand. AUCKLAND: Woodhill State Forest, on ground in litter of mixed *Pinus*-native forest, *C. C. King*, Jun 1989, PDD 57236 (holotype); Waitakere Ranges, Sharps Bush, in litter under *Leptospermum* and *Dacrydium*, *P. R. Johnston*, 11 Jun 1982, PDD 43043; Waitakere Ranges, Atkinson Park, Titirangi Beach, on soil under *Leptospermum*, *G. M. Taylor*, 9 May 1979, PDD 49789; Waitakere Ranges, Piha Valley, Quarry Track, on litter, *B. P. Segedin 2219*, 4 Apr 1989, PDD 58423; Orere, on ground, *J. M. Dingley*, 23 May 1973, PDD 34593; Hunua Ranges, Mangatangi Valley, on rotten wood, *J. M. Dingley & S. Haydon*, 19 Jun 1974, PDD 34594.

3. *Psilocybe coprophila* (Bull.: Fr.) P. Kumm., Der Führer in die Pilzkunde, p.71 (1871). (Fig. 3)

Appearance of pileus, stipe, gills, veil, basidia, and cheilocystidia matching that of *P. argentina*, although cheilocystidia somewhat larger, 28–45 × 6.5–9.5 µm. **Spores** (10–)11–13.5(–14.5) × 7.5–9(–9.5) × 6.5–8 µm, average 12.3 × 8.5 × 7.5 µm, in face view hexagonal to subhexagonal, in side view elliptic; wall brown, smooth, 1–1.2 µm thick, with apical pore.

HABITAT: Dung of farm animals.

DISTRIBUTION: New Zealand: Bay of Plenty, Wanganui. Reported to be widespread in subtropical and temperate regions (Guzmán 1983; Guzmán et al. 1993).

NOTES: Bell (1983) provided additonal illustrations of New Zealand material.

SPECIMENS EXAMINED: New Zealand. BAY OF

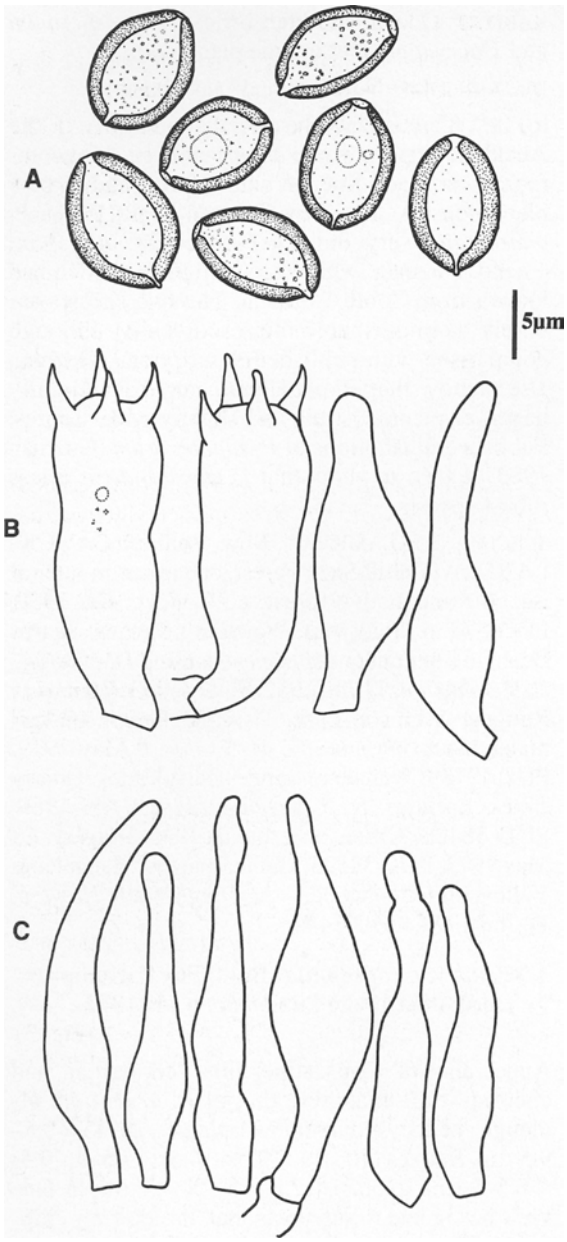

Fig. 3 *Psilocybe coprophila* (PDD 48412): **A,** spores; **B,** basidia; **C,** cheilocystidia.

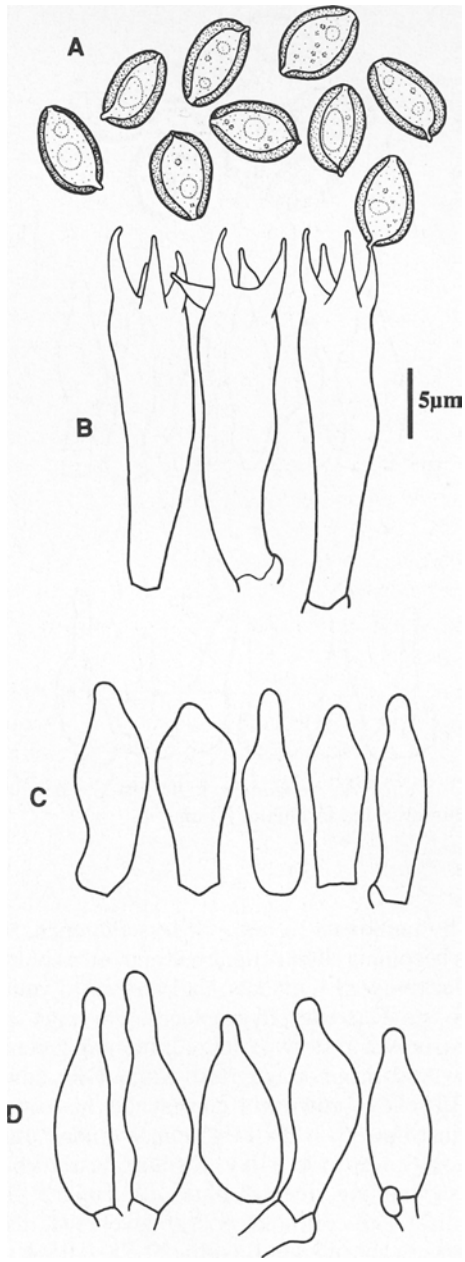

Fig. 4 *Psilocybe makarorae* (PDD 57396 – holotype): **A,** spores; **B,** basidia; **C,** pleurocystidia; **D,** cheilocystidia.

PLENTY: Rotorua, on sheep dung, *P. Broadhurst*, May 1987, PDD 45589. WANGANUI: Kai Iwi, Bushy Park Reserve, on horse dung, *P. R. Johnston & A. Bell*, 10 May 1987, PDD 48412.

4. *Psilocybe makarorae* P. R. Johnst. & P. K. Buchanan sp. nov. (Fig. 4)

Pileus 15–55 mm latus, e conico ad campanulato expansus et convexus, umbone acuto; siccus ad leviter viscosus; flavobrunneus ad aurantiobrunneus, ad marginem subtiliter striatum versus saepe

pallidiorem; foedatus viridi-caesius; carne alba. Lamellae adnexae, dilutae cinerascentes brunneae, margine concolora. Stipes 30–60 × 2–4 mm, cylindricus, sericeus, fibrillosus, albus, saepe basi brunneolae, foedatae viridi-caesius, basi rhizoideis albis; velo cortinoide. Basidia 25–31 × 7–8.5 µm, subclavata, tetraspora, fibulata. Cheilocystidia 18–26 × 6–9 µm, ventricoso-rostrata ad mucronata, hyalina, tenuiter tunicata, fibulata collo simplici, 3–5 µm longo. Pleurocystidia similibus cheilocystidiis sed angustiora, 4–8 µm lata, collo breviore, 2.5–4 µm longo. Sporae (6.5–)7.5–9.5(–10) × 5.5–6.5 × 4.5–5.5 µm, [mean] 8.7 × 6.0 × 5.3 µm, aspectu faciali ovato ad subrhombico, aspectu facie ellipsoido; pariete brunneo, laevi, ca. 0.8–1 µm lato, poro apicali. Hyphae cuticulae pilei filamentosae.

HOLOTYPE: New Zealand. OTAGO LAKES: Haast Pass, vic. Makarora, Blue Pools Track, on rotten *Nothofagus* wood, *P. R. Johnston, B. P. Segedin & R. H. Petersen*, 16 May 1990, PDD 57396.

ETYMOLOGY: named after the geographic locality of the type specimen.

Pileus 15–55 mm diam., conical to campanulate, expanding to convex with prominent, often more or less pointed umbo; dry to slightly tacky; yellow-brown to orange-brown, often paler towards the finely striate margin; staining greenish-blue with damage; flesh white. **Gills** adnexed, pale greyish-brown; margin concolorous. **Stipe** 30–60 × 2–4 mm, cylindrical, silky, innately fibrillose, white, often brownish at base, staining greenish-blue with damage, with white rhizoids at base; veil cortinoid, its remnants often visible on stipe, but never forming annulate ring. **Basidia** 25–31 × 7–8.5 µm, subclavate, tapering slightly to base, 4- spored, clamped. **Cheilocystidia** 18–26 × 6–9 µm, ventricose-rostrate to mucronate, with simple neck 3–5 µm long, hyaline, thin-walled, clamped. **Pleurocystidia** similar in shape to cheilocystidia, but narrower, 4–8 µm wide, and neck usually shorter, 2.5–4 µm. **Spores** (6.5–)7.5–9.5(–10.0) × 5.5–6.5 × 4.5–5.5 µm, average 8.7 × 6.0 × 5.3 µm, in face view ovate to subrhomboid, in side view elliptical; wall brown, smooth, about 0.8–1 µm thick, with apical pore. **Pileipellis** a cutis of long-celled, 2–3 µm diam., gelatinised hyphae. **Hypodermium** filamentous, of 4–6 µm diam. cells with pale brown walls. Clamps common. **Subhymenium** poorly developed, subcellular, of 2–4 µm diam. cells with very pale brown walls. **Hymenophoral trama** more or less regular, of short cylindric, 3–6 µm diam. cells with hyaline walls.

HABITAT: Fallen, rotting wood.

DISTRIBUTION: Known only from New Zealand: Bay of Plenty, Westland, Otago Lakes, Dunedin.

NOTES: Margot & Watling (1981) examined PDD 49788, and considered that it was similar to *P. caerulipes* (Peck) Sacc. *P. caerulipes*, belonging in section Semilanceatae of Guzmán (1983), is distinguished by its lack of pleurocystidia, different spore shape, and longer-necked cheilocystidia. Spore shape and the blueing reaction place *P. makarorae* in section Mexicanae of Guzmán (1983). The size of the caps, the presence of pleurocystidia, and the short-necked cheilocystidia distinguish *P. makarorae* from the six species accepted in this section by Guzmán.

ADDITIONAL SPECIMENS EXAMINED: New Zealand. BAY OF PLENTY: vic. Rotorua, Mt. Ngongotaha, on fallen wood, *Y. Doi*, 5 May 1987, PDD 58419. WESTLAND: Franz Josef Glacier moraine, on fallen twigs, *J. L. Austwick*, 27 May 1970, PDD 31361; Franz Josef Glacier, Peter's Pool Track, on litter, *G. M. Taylor*, 17 May 1969, PDD 49788. DUNEDIN: vic. Dunedin City, Woodside Glen picnic ground, on rotting wood, *G. M. Taylor*, 29 Apr 1967, PDD 49787.

5. *Psilocybe novae-zelandiae* Guzmán & E. Horak, *Sydowia 31*: 51 (1978). (Fig. 5)

(Macroscopic features of description based on Guzmán & Horak (1978: 51–53) and Guzmán (1983: 294–295); microscopic features from examination of type specimen.) **Pileus** 15–25 mm diam., hemispherical or convex, expanding to umbonate to more or less flattened; slightly tacky, glabrous; dark brown to fuscous, striate to edge, hygrophanous, drying to orange-brown. **Gills** broadly adnate, pale rust brown; edge concolorous. **Stipe** 30–40 × 2–3 mm, cylindrical, covered with whitish appressed fibrils, pale brown or concolorous with pileus. **Veil** cortinoid, remaining visible as fibrils on stipe in older fruit bodies, never forming an annulate ring. **Basidia** 21–30 × 6.5–8.5 µm, cylindrical, or sometimes slightly constricted near centre, 4-spored, clamped. **Cheilocystidia** 13–26 × 4.5–6 µm, more or less cylindrical, or with a poorly differentiated, broad, flexuous neck. **Pleurocystidia** absent. **Spores** (7.5–)9–10.5(–12.5) × 6–7 × 5–6 µm, average 9.5 × 6.3 × 5.8 µm, in face view subrhomboid, in side view elliptical; wall brown, smooth, <1 µm thick, with apical pore.

HABITAT: On soil and litter under *Nothofagus*.

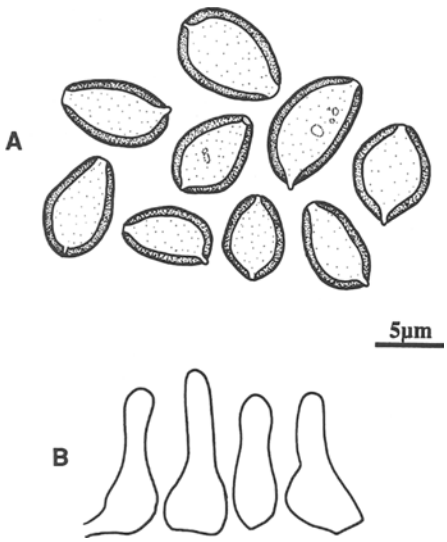

Fig. 5 *Psilocybe novae-zelandiae* (PDD 27132 – holotype): **A,** spores; **B,** cheilocystidia.

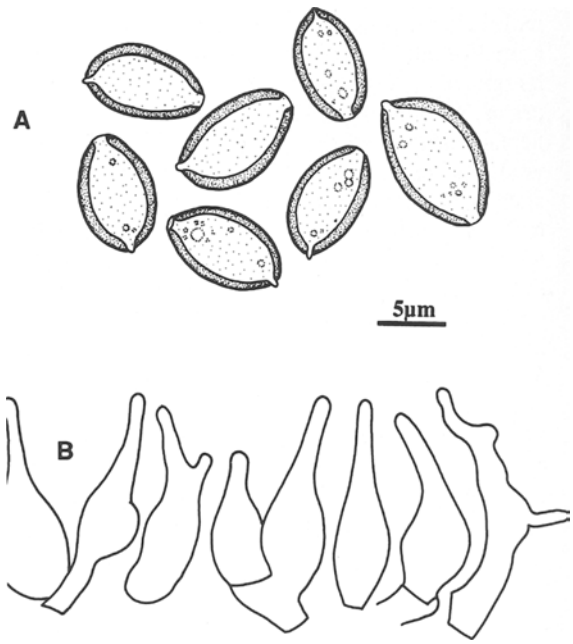

Fig. 6 *Psilocybe semilanceata* (PDD 46727): **A,** spores; **B,** cheilocystidia.

DISTRIBUTION: Known only from type collection, New Zealand: Mid Canterbury.

SPECIMEN EXAMINED: New Zealand. MID CANTERBURY: Mount Grey, Kowai Bush, on soil under *Nothofagus solandri* and *N. fusca*, *E. Horak*, 15 Sep 1967, PDD 27132 (Holotype).

6. *Psilocybe semilanceata* (Fr.) P. Kumm., Der Führer in die Pilzkunde, p.71 (1871). (Fig. 6)

(Macroscopic features of description based on Guzmán (1983), Watling & Gregory (1987), and dried material from New Zealand.) **Pileus** 7–10 mm diam., conical, papillate with sharp umbo; slightly tacky; light brown to medium brown, slightly striate to edge; some caps staining greenish-blue with damage. **Gills** with whitish margin, adnate to adnexed. **Stipe** 15–30 × 1–2 mm, cylindrical, medium yellow-brown, staining greenish-blue with damage. **Veil** cortinoid, poorly developed, visible only in young caps. **Basidia** 27–37 × 7.5–9.5 µm, cylindrical to subclavate, 4-spored, clamped. **Cheilocystidia** 17–30 × 5–7 µm, ventricose-rostrate with a flexuous, sometimes bifurcate neck, 8–12 µm long, hyaline, thin-walled. **Pleurocystidia** absent. **Spores** (11–)11.5–14(–15) × (6.5–)7–8(–9) × 6.5–7.5 mm, average 12.3 × 7.7 × 7.2 µm, in face view elliptical, rarely more or less ovate, in side view elliptical; wall brown, smooth, 0.8–1 µm thick, with apical pore.

HABITAT: High-altitude grasslands, reportedly locally common in the central South Island.

DISTRIBUTION: New Zealand: Mackenzie, Otago Lakes, Buller (Guzmán et al. 1993). Also reported from grasslands in Europe, North and South America, and Australia (Guzmán 1983).

SPECIMENS EXAMINED: New Zealand. MACKENZIE: vic. Mt Cook, Mar 1984, PDD 46727; vic. Mt Cook, Oct 1984, PDD 46717. OTAGO LAKES: vic. Queenstown, PDD 46970; vic. Queenstown, PDD 47828.

7. *Psilocybe subaeruginosa* Cleland, *Transactions and proceedings of the Royal Society of South Australia 51*: 305 (1927). (Fig. 7)

= *Psilocybe eucalypta* Guzmán & Watling, *Notes from the Royal Botanic Garden Edinburgh 36*: 204 (1978).
= *Psilocybe australiana* Guzmán & Watling, *Notes from the Royal Botanic Garden Edinburgh 36*: 206 (1978).

Pileus 12–50 mm diam., broad-conic to convex with slightly inrolled edges when young, expanding to broadly umbonate, or sometimes with small, pointed umbo; slightly tacky; scattered whitish veil remnants

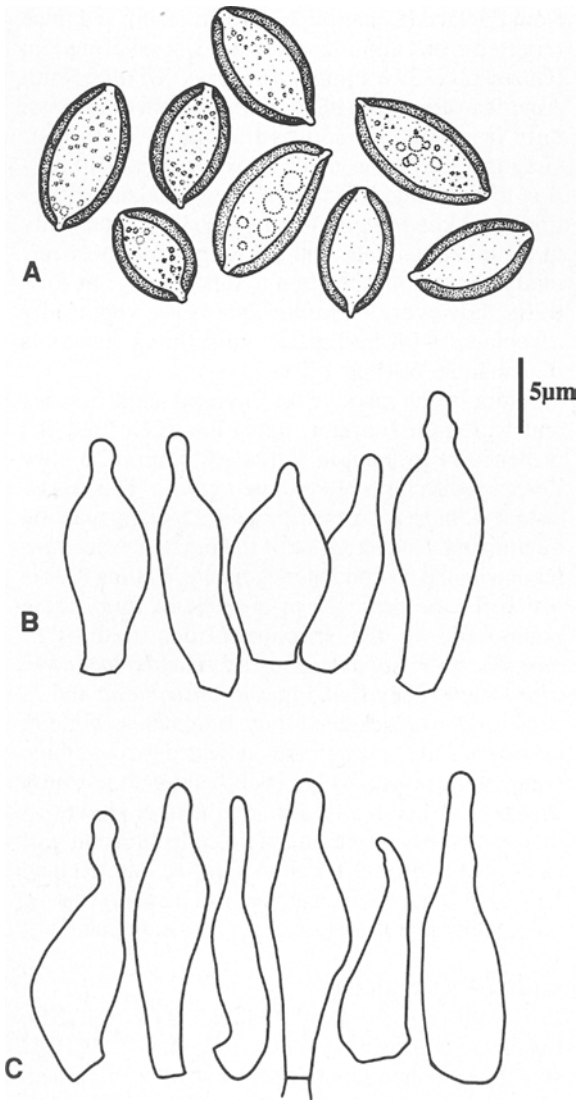

Fig. 7 *Psilocybe subaeruginosa* (PDD 57404): **A,** spores; **B,** pleurocystidia; **C,** cheilocystidia.

sometimes visible near edge of cap when young; yellow-brown to orange-brown, paler to the finely striate margin; hygrophanous, fading to pale orange-yellow; staining greenish-blue with damage or age; flesh white. **Gills** adnexed, pale yellow-brown to greyish yellow-brown, with narrow, pale margin. **Stipe** 25–70 × 2–3.5(–5) mm, more or less cylindrical, silky-fibrillose, whitish, often with white rhizoids at base, turning greenish-blue with damage; flesh brownish. **Veil** cortinoid, well developed, often remaining visible as fibrils on stipe in older fruit bodies, but never forming an annulate ring. **Basidia** 26–37 × 6.5–9.0 µm, more or less cylindrical, 4-spored, clamped. **Cheilocystidia** 21–36 × 6.5–10.0 µm, ventricose-rostrate to lageniform; apical neck simple to more or less mucronate, 4–8 µm long, hyaline, thin-walled. **Pleurocystidia** similar to cheilocystidia, but neck shorter, 2.5–5.0 µm long. **Spores** 9.5–13.5(–16.0) × 6.0–8.0(–9.0) × 5.5–7.0 µm, average 11.1 × 6.8 × 6.3 µm (see notes below), in face view elliptical to ovate, in side view elliptical; wall brown, smooth, 1–1.2 µm thick, with apical pore.

HABITAT: In New Zealand on small pieces of buried wood on rough, coastal farmland, especially on sandy soil, and in gardens, especially on mulches of *Pinus radiata* bark.

DISTRIBUTION: New Zealand: Auckland, Waikato, Bay of Plenty, Taranaki, Wanganui, Nelson, Buller, Southland. Australia: Tasmania, Victoria, New South Wales, South Australia (Chang & Mills 1992).

NOTES: Morphologically the New Zealand collections match Cleland's Australian collections of *P. subaeruginosa*, as well as collections from Australia cited by Guzmán & Watling (1978) as *P. australiana* and *P. eucalypta*. The two last-named species, originally described from Australia (Guzmán & Watling 1978), have since been recorded from New Zealand (Guzmán et al. 1993). Chang & Mills (1992) placed *P. australiana*, *P. eucalypta*, and *P. tasmaniana* Guzmán & Watling in synonymy with *P. subaeruginosa*, reporting overlapping microscopic characters for the four species. We accept their use of the name *P. subaeruginosa*, while removing *P. tasmaniana* from the synonymy because of its characteristic, sometimes branched cheilocystidia and coprophilous habit. A PDD collection (PDD 46240, deposited as '*P. tasmaniana*, on soil') was cited by Chang & Mills (1992) to question the reported coprophilous habit of *P. tasmaniana*. This specimen, which had been only tentatively referred to *P. tasmaniana* when accessioned is here redetermined as *P. subaeruginosa*. Authentic records of *P. tasmaniana* are not known from New Zealand.

Guzmán (1983) and Guzmán et al. (1993) held a different concept of *P. subaeruginosa*, and did not support synonymy of any species mentioned above. Guzmán (1983) placed *P. subaeruginosa* in *Psilocybe* section Subaeruginosae, characterised in part by chocolate brown cheilocystidia and pleurocystidia, and *P. australiana* and *P. eucalypta* in section Cyanescens, distinguished from section Subaeruginosae by hyaline pleurocystidia and cheilocystidia. Guzmán's disposition of *P. subaeruginosa*

was based on his examination of a single collection (AD – Cleland 13251) from among Cleland's syntype collections, and two additional fresh collections. In our examination of five syntype collections (AD 5598, 5599, 5600, 5602, 5603 – lectotype), no coloured cystidia were seen. This supports the observations of Chang & Mills (1992). We assume that Cleland 13251, described by Guzmán (1983), contained a different species from that represented by other syntype collections.

Cleland 13251 was one of several syntypes cited by Cleland (1927), and although cited by Guzmán (1983) as 'Type', was not formally lectotypified. Cleland 13251 cannot now be located at AD, and Chang & Mills (1992) designated the syntype collection Cleland 13256 (AD 5603) as lectotype; this is accepted by us.

It is interesting to note that Young (1989) reported *Copelandia cyanescens* (Berk. & Broome) Singer as common in eastern Australia. It is distinct from *Psilocybe subaeruginosa* in macroscopic appearance, cuticle structure, and by the possession of brown metuloids. However, it does exhibit the blueing reaction typical of *P. subaeruginosa*, and it may be that Cleland 13251 comprised a mixed collection, hence the brown cystidia reported by Guzmán (1983).

Guzmán (1983) distinguished *P. eucalypta* from *P. australiana* by small differences in spore size and cystidial size and shape. Our measurements of spore length of specimens cited as these species by Guzmán (1983) more or less match those given by Guzmán. We found that average spore sizes from four collections of *P. australiana* varied from 11.9 to 12.8 µm, and those from five collections of *P. eucalypta* varied from 10.9 to 12.1 µm. Our examination of the pleurocystidia showed that they varied both between and within collections of each of the species in terms of both size and shape over the range considered charcateristic for each species by Guzmán (1983), and did not appear to be useful to distinguish these species. The New Zealand collections vary in spore length over the entire range found in *P. australiana* and *P. eucalypta*. For individual collections the shortest average length was 10.5 µm, while the longest was 12.8 µm. We consider the New Zealand collections to represent a single species, as variation in spore size formed a continuous series, and did not correlate with differences in any other character.

P. subaeruginosa, in the sense that we accept it, is morphologically very similar to *P. cyanescens*, and may represent the same species. Originally described from England (Dennis & Wakefield 1946), and since reported from other parts of the United Kingdom (Guzmán 1983; Watling & Gregory 1987) and North America (Guzmán 1983), *P. cyanescens* is known only from human-modified habitats. Watling & Gregory (1987) considered it to be a recent introduction to the United Kingdom. New Zealand collections of *P. subaeruginosa* have also been found only in disturbed habitats, and the fungus is almost certainly a recent introduction to this country. In Australia, however, *P. subaeruginosa* is reportedly associated with indigenous rain forest remnants (Guzmán & Watling 1978).

Work by the Institute for Environmental Science and Research (unpubl. data) has identified the presence of psilocybin and/or psilocin in 28 New Zealand collections of *P. subaeruginosa*. This is consistent with the species displaying a blueing reaction on bruising, characteristic of *Psilocybe* species containing indole compounds. Margot & Watling (1981) tested for the presence or absence of four indole compounds in the specimens identified as *P. australiana*, *P. subaeruginosa*, *P. eucalypta*, and *P. cyanescens*. They found that *P. australiana* and *P. subaeruginosa* lacked all four compounds, while *P. eucalypta* and *P. cyanescens* contained two and three compounds respectively. Their results do not fully support the taxonomy accepted above. However, their study was based on single collections only of each of the three Australian species, and Cleland 13251 (the collection examined by Guzmán) was the only collection of *P. subaeruginosa* examined.

SPECIMENS EXAMINED:

P. subaeruginosa. New Zealand. AUCKLAND: Epsom, in potting mix, *S. Davison*, May 1980, PDD 40401; Auckland Domain, on leaf litter in garden, *P. K. Buchanan*, 25 Jun 1989, PDD 57404; Mt. Albert, bark mulch in garden, *P. G. Broadhurst*, 7 Jun 1989, PDD 55207. WAIKATO: Otorohanga, bark mulch in garden, *P. R. Johnston, G. M. Taylor & T. Hongo*, 9 May 1987, PDD 45554; Te Kuiti, on litter in *Pinus radiata* plantation, *M. Muir*, 17 Aug 1988, PDD 54315. BAY OF PLENTY: Mt. Maunganui Golf Course, 26 May 1988, PDD 54517. TARANAKI: Bell Block, on litter in coastal farmland, *M. Valentine*, 16 Jun 1984, PDD 46185; New Plymouth, Balsem Park, on litter under *Pinus*, *P. R. Johnston, E. H. C. McKenzie, G. M. Taylor & P. French*, 14 May 1987, PDD 48409; New Plymouth, Riversdale Rd, on small pieces of buried wood in rough paddock, *P. R. Johnston, E. H. C. McKenzie, G. M. Taylor & P. French*, 14 May 1987, PDD

48411; New Plymouth, Balance Rd, on small pieces of buried wood in rough paddock, *P. R. Johnston, E. H. C. McKenzie, G. M. Taylor & P. French*, 14 May 1987, PDD 48410; on soil, Sep 1984, PDD 46240. WANGANUI: Marton, Lake Alice Hospital, *M. P. O'Connell*, 7 Aug 1988, PDD 54528. NELSON: Karamea, on small pieces of buried wood in coastal paddocks, *P. R. Johnston & E. M. Gibellini*, 26 May 1989, PDD 58418. BULLER: Greymouth, on litter under *Lupinus* on coastal dunes, *P. R. Johnston*, 1 May 1985, PDD 46894. SOUTHLAND: Tuatapere, bark mulch in garden, *P. R. Johnston & B. P. Segedin*, 22 May 1990 PDD 57700.

Australia. SOUTH AUSTRALIA: Morialta, *J. B. Cleland*, 3 Jun 1933, AD 5606; National Park, Belair Recreation Park, *J. B. Cleland*, 19 May 1925, AD 5603 (lectotype); ibid., 6 Aug 1921, AD 5602. NEW SOUTH WALES: Fitzroy Falls, *J. B. Cleland*, 8 Jun 1919, AD 5599; Royal National Park, *J. B. Cleland*, 24 May 1919, AD 5598. VICTORIA: Craigie, *E. J. Semmens*, Jun 1917, AD 5600.

As *P. australiana*. Australia. NEW SOUTH WALES: Blue Mountains, Mt. Wilson, *R. Watling 10888*, 16 Apr 1974, E. AUSTRALIAN CAPITAL TERRITORY: Tidbinbilla Reserve, on roadside, *R. Watling 10577*, 26 Apr 1974, E; Tidbinbilla Reserve, Lyre Bird Trail, amongst leaves, *R. Watling 10549*, 26 Apr 1974, E; Blue Range Block, near Cotter Dam, edge of plantation, *R. Watling 10617*, 25 Apr 1974, E (holotype).

As *P. eucalypta*. Australia. NEW SOUTH WALES: Mt. Wilson, rain forest remnant, *R. Watling 10856*, 16 Apr 1974, E; near Queanbeyan, Talagarda Forest Reserve, *R. Watling 10631*, 23 Apr 1974, E. AUSTRALIAN CAPITAL TERRITORY: Tidbinbilla Nature Reserve, *R. Watling 10656*, 26 Apr 1974, E (holotype).

P. cyanescens. United Kingdom. Camly Bank, Orchard road, on remains of *Syringa*, *R. Watling 11361*, 2 Nov 1975, E; FLINTSHIRE: Point of Air, in sand dunes amongst *Brachythecium albicans* and grass litter, *B. Ing*, 4 Nov 1978, E; EDINBURGH: Royal Botanic Garden, herbaceous border amongst twigs, *R. Watling 5349*, E; Royal Botanic Garden, herbaceous border, *R. Watling 5354*, 8 Nov 1967, E; LANCASHIRE: Euxton, Washington Hall, *M. J. Lewis*, 30 Oct 1981, E; GUERNSEY: south end of island, cliff walk, in grass below coastal shrubs, *R. Watling 20929*, 20 Oct 1988, E.

United States. CALIFORNIA: San Francisco Co., San Francisco, Fleishacker Zoo, under *Eucalyptus*, *C. Calhoun 187*, 14 Nov 1974, SFSU; San Francisco Co., San Francisco, Golden Gate Park, in soil in mixed woods, *H. D. Thiers 26886*, 9 Nov 1970, SFSU; San Francisco Co., San Francisco State University, on wood chips in flower bed, *H. D. Thiers 40217*, 9 Oct 1979, SFSU; Marin County, Audubon Canyon Ranch, Volunteer Canyon, Native Plant Garden, on woody litter and wood chips, *C. Calhoun 81–2816*, 6 Dec 1981, SFSU; ibid., *C. Calhoun 81–2603*, 19 Nov 1981, SFSU.

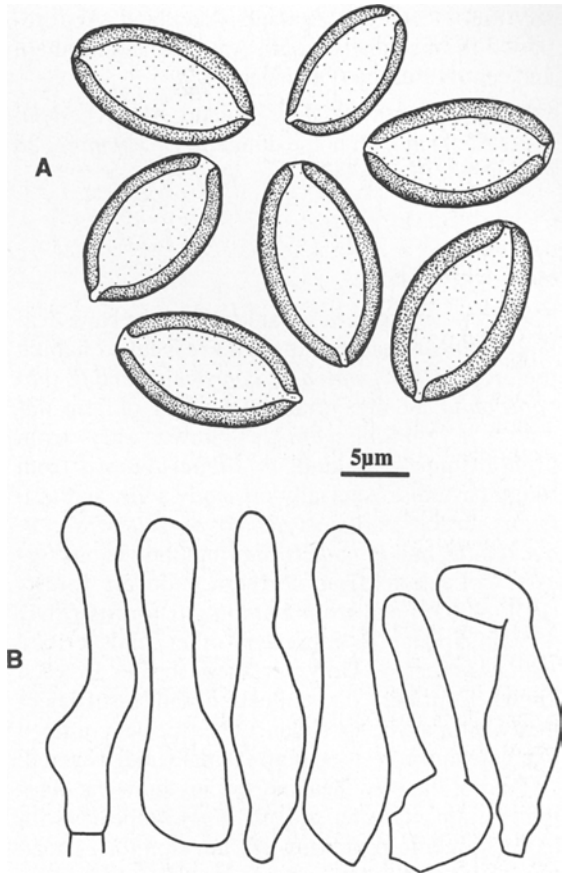

Fig. 8 *Psilocybe subcoprophila* (PDD 57479): **A,** spores; **B,** cheilocystidia.

8. *Psilocybe subcoprophila* (Britzelm.) Sacc., *Sylloge fungorum 11*: 72 (1895). (Fig. 8)

Appearance of pileus, stipe, gills, veil, basidia, and cheilocystidia matching *P. argentina*. **Spores** (15–)17–20.5(–22) × (9–)9.5–10.5(–11) × 9–10.5 µm, average 17.9 × 10.1 × 9.8 µm, elliptical in both face and side views; wall brown, smooth, 1–1.5 µm thick, with apical pore.

HABITAT: Dung of farm animals.

DISTRIBUTION: New Zealand: Auckland. Also reported from southern South America and northern and central Europe (Guzmán 1983).

SPECIMEN EXAMINED: New Zealand. AUCKLAND: West Auckland, on horse dung, *M. A. Manning*, 28 May 1990, PDD 57479.

DISCUSSION

The *Psilocybe* species so far known from New Zealand form distinct groups with respect to habitat preference. *P. argentina*, *P. coprophila*, and *P. subcoprophila* are all confined to the dung of farm animals; *P. semilanceata* is known only from high-altitude grassland; *P. subaeruginosa* from rough pastures, especially on sandy soils, and also from garden mulches; *P. novae-zelandiae*, *P. aucklandii*, and *P. makarorae* from indigenous forests. Collections from northern podocarp forests (PDD 43058) and from *Nothofagus* forests (PDD 45577) appear to represent other undescribed *Psilocybe* species. However, these species are each known from only one collection with insufficient material for a type specimen. Other species confined to indigenous forests no doubt remain undiscovered.

Four of the New Zealand species show the blueing reaction characteristic of *Psilocybe* species with hallucinogenic properties, *P. aucklandii*, *P. subaeruginosa*, *P. semilanceata*, and *P. makarorae*. Analyses performed by the Institute of Environmental Health and Forensic Science have shown that all four contain both psilocin and psilocybin (unpubl. data).

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