

## New and Interesting Agarics from Western Australia

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**Abstract.** – Four news species in *Russula*, *Lactarius*, *Inocybe* and *Hebeloma* are described from Western Australia. In addition, *Psilocybe merdaria* is described from Western Australia for the first time. Habitat and ecology are reported for each taxon.

### Introduction

A rather diverse agaric flora exists in Western Australia. HILTON (1982) has enumerated the taxa which have been recognized to date. Recent collections from Western Australia by both authors have confirmed that many unreported species are present. However, each new taxon must be thoroughly studied to ascertain if it has been previously described in the very scattered literature of the Southern Hemisphere agaric mycoflora. Cosmopolitan agarics, which are decomposers, are often the ubiquitous and well known species. There are also a number of species which have been introduced with the plantings of exotic forest trees and horticultural species of plants now well established in Australia. However, there are many species of *Eucalyptus* in the Myrtaceae, *Acacia* in the Mimosaceae, *Casuarina* in the Casuarinaceae, and others which are native ectomycorrhizal plants (WARCUP, 1980). We know very little about the Australian agarics which form ectomycorrhizae with indigenous plants. Our knowledge is even more limited in Western Australia where less mycological work has taken place. We must assume that relationships among taxa in ectomycorrhizal families and genera of fungi are similar to those described from the Northern Hemisphere (MILLER, 1982 a; b). All of these factors have made the job of accurately describing the mycoflora a very difficult one. The new species reported here represent elements of the native, ectomycorrhizal.

agaric flora. In addition, a widely dispersed decomposer is also reported.

Colors in quotation marks are from RIDGWAY (1912) while color designations by page and block (eg. p. 22, E-2) are from KORNERUP & WANSCHER (1967). Collections are at the University of Western Australia (UWA) or at Virginia Polytechnic Institute and State University (VPI).

### Enumeration of taxa

#### 1. *Lactarius eucalypti* MILLER & HILTON, sp. nov. – Pl. 1, figs. 1–4 b

Pileus 18–31 mm latus, cum late convexus tum planus, cum humidus tum paulum viscidus, rufus. Lamellae decurrentes, substantes, lamellis brevibus alternantes, eburneae. Stipes 30–60 mm longus, 4–5 mm latus, aequalis vel ad basim parum expansus, aridus, levis, rufus. Sapor mitis. Odor nullus. Sporae 6.5–9.5 × 6.8–8.5 µm, cum globosae tum subglobosae, reticulo parziale humilique (0.5 µm) instructae, amyloideae. Pleurocystidia cheilocystidiaque 35–45 × 7.5–9 µm, fusiformia, saepe apice rotundato instructa, tenuiter tunicata, hyalina in solutione Melzeri immersa, numerosa. Caulocystidia absentia. Cutis pilei ixomixocutis est hyphis hyalinis 3.4–6 (–8) µm composita. Typum legit R. HILTON & L. O. HILTON, UWA 2341, in silvis *Eucalypti marginatae* Sm. necnon *Eucalypti calophyllae* R. BR., Denmark, Church Rd., June 1979, Western Australia.

Pileus 18–31 mm broad, broadly convex, nearly plane to somewhat recurved in age, moist to slightly viscid in wet weather, smooth, even, brownish red (p. 8, C-8). – Context soft but firm, light brownish red, darker just beneath cuticle. – Latex white, unchanging. – Taste mild. – Smell not distinctive. – Lamellae decurrent, substant with alternating short lamellulae, cream color. – Stipe 30–60 mm long, 4–5 mm broad, equal or enlarged somewhat toward the base, dry, smooth, concolorous with the cap or somewhat lighter, base adorned with short, dark, stiff hairs.

Sporae 6.5–9.5 × 6.8–8.5 µm, globose to subglobose, with low partial reticulations (0.5 µm), variable in width and amyloid in Melzer's solution. – Basidia 34–46 × 9–14 µm, clavate to swollen in center, thin-walled, hyaline, four-spored, apiculus 4–6 µm long. – Pleurocystidia and cheilocystidia 35–45 × 7.5–9 µm, fusiform, often with a small rounded tip, thin-walled, hyaline in KOH and Melzer's solution, frequent to numerous extending slightly above the hymenium. – Caulocystidia absent. – Cuticle of pileus an ixomixocutis of hyphae 3.4–6 (–8) µm diam., mostly equal, some slightly swollen, tightly interwoven, thickened walls, hyaline in KOH and Melzer's solution. Trama of pileus of heteromerous tissue composed of nests of large sphaerocysts 20–35 µm diam., surrounded by filamentous hyphae 3.4–7.6 µm diam., light yellowish in KOH and Melzer's solution. Trama of lamellae similar to pileus trama.

Habit and habitat. – Solitary on ground in mixed jarrah/marri (*Eucalyptus marginata*, *E. calophylla*) woodland, with karri (*E. diversicolor* F. MUELL.) often present. Fruiting in May and June.

Material examined. – WESTERN AUSTRALIA: HILTON, UWA 1719, Gleneagle, Canning Dam Turnoff, Shire of Armadale-Kelm-scott, 17 June 1973; R. HILTON & L. O. HILTON, UWA 2341, TYPE, Denmark, Church Rd., June 1979; HILTON, UWA 2354, Walpole, Shire of Denmark, June 6, 1980.

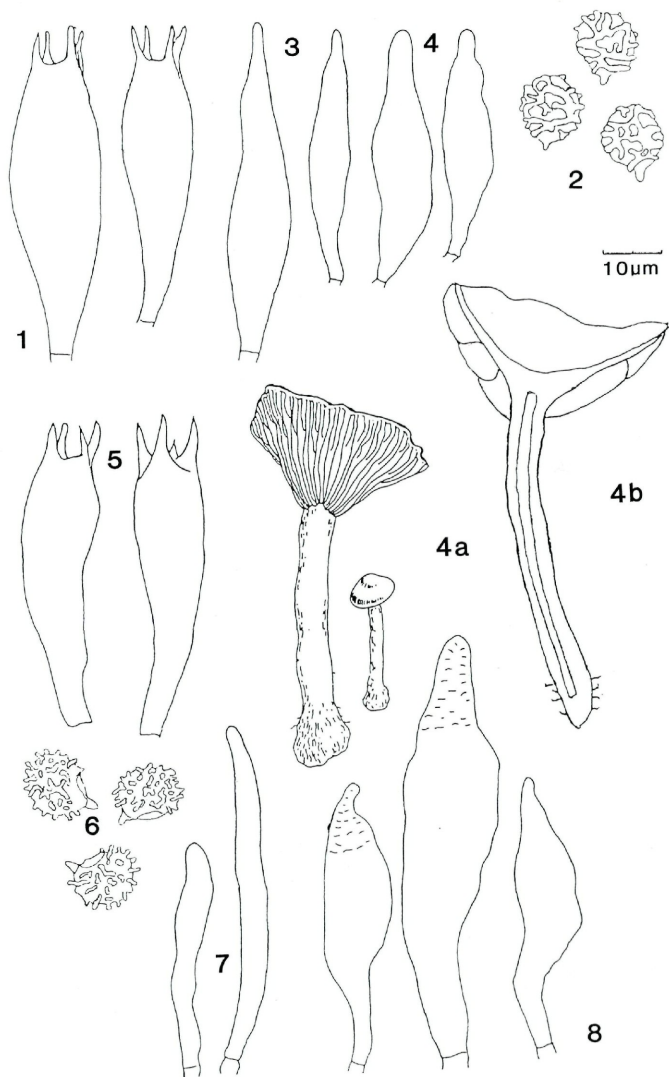
Observations. – This is the only species of *Lactarius* known from Western Australia. It is found in the Darling Range in small numbers where it fruits only in wet years. According to HESLER & SMITH (1979), *L. eucalypti* would be placed in the Subgenus *Russularia*, Section *Russularia*, but there is no comparable species in either the Subgenus or Section. It reminds one somewhat of *L. subdulcis* (FR.) S. F. GRAY but smaller, has globose spores, a mild taste, no pileocystidia, and most likely forms ectomycorrhizae with species of *Eucalyptus*.

In addition, no caulocystidia have been observed. CLELAND (1934–35) reported *Lactarius clarkei* CLEL., a large species (pileus 5–12.5 cm broad) without cystidia from New South Wales and *L. serifluus* (DC) FR. also from New South Wales. However, the latter species which is known from Europe, has white latex, a rancid taste, an unpleasant odor, and darker lamellae. CLELAND'S abbreviated description of the former reveals little, but his painting, Plate IV, depicts a somewhat similar taxon to ours which could be placed in the same Subgenus and Section.

2. *Russula clelandii* MILLER & HILTON, sp. nov. – Pl. 1, figs. 5–8; Pl. 2, figs. 9–9 b

Pileus 24–50 mm latus, late convexus tum planus; margo leniter striatus, ali-quantulum recurvus in senectute, aridus, glaber, planus, valde vinosopurpureus. Lamellae adnatae, clausae, lamellulis nullis nec ullo modo furcatae, cum abae tum cremae in senectute. Stipes 30–70 mm longus, 5–17 mm latus, aequalis, aridus, caespitibus parvis fibrillarum compositis in apice tectus, albus, rubro-tinctus. Contextus firmus, albus. Sporae  $7.5 \times 6-7 \mu\text{m}$ , ovoideae, verrucae plerumque discretiae, interdum nonnullae conjunctae, atropurpureae in solutione Melzerii, albae in deposito. Pleurocystidia cheilocystidiaque  $30-70 \times 7-15 \mu\text{m}$ , cum fusiformia tum ventricosa apice mucronato acutove. Pileocystidia  $40-50 \times 4.5-6.4 \mu\text{m}$ , anguste fusiformia, supra discum fasciculata, supra marginem infrequentia. Caulocystidia fusiformia aperte fasciculata in stipitis apice. Typum legit HILTON, UWA 2364, Denmark Water Supply Forest, Western Australia, June 1979.

Pileus 24–50 mm broad, broadly convex to plane or the margin recurved in age, dry, glabrous, even, minutely pubescent with a lens, deep purplish vinaceous, striate to faintly striate just at margin. –



Figs. 1-4b: *Lactarius eucalypti*: 1. basidia. - 2. basidiospores. - 3. pleurocystidia. - 4. cheilocystidia. - 4a. sporocarp  $\times 1$ . - 4b. Xsec  $\times 1$ . Figs. 5-8: *Russula clelandii*: 5. basidia. - 6. basidiospores. - 7. pileocystidia. - 8. cheilocystidia.

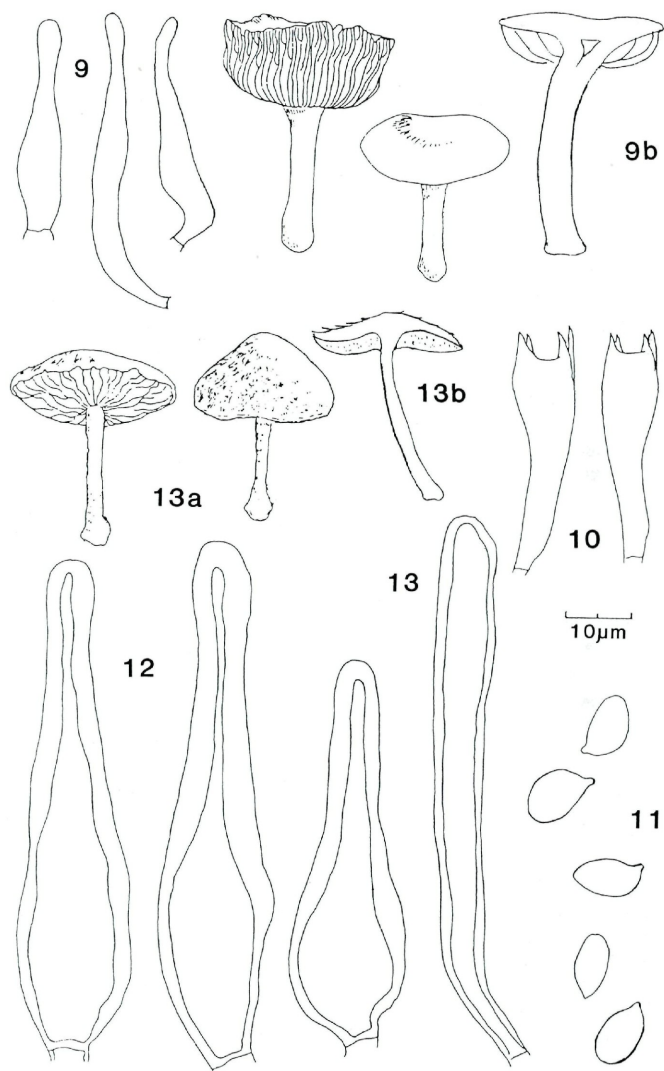
Lamellae adnate, close, with lamellulae, not forked, white at first remaining so or faintly tinted cream color in age. – Stipe 30–70 mm long, 5–17 mm broad, nearly equal or slightly enlarged just at the apex or base, dry, with small tufts of fibrils scattered over the apex, evenly colored deep red to the base or occasionally white just at the base, color located in minute clusters of caulocystidia (use lens) over a white ground color. – Context firm, white. – Taste and smell not recorded.

Spores  $7.5\text{--}8.5 \times 6\text{--}6.8 \mu\text{m}$ , ovoid, prominently apiculate, warts  $1 \mu\text{m}$  high, usually separate or occasionally several fused, deep purple-blue in Melzer's solution, white in deposit. – Basidia  $35\text{--}40 \times 7\text{--}10 \mu\text{m}$ , four-spored, broadly clavate, thin-walled, hyaline in KOH and Melzer's solution. – Pleurocystidia  $32\text{--}54 \times 7\text{--}10 \mu\text{m}$ , thinwalled, fusiform to ventricose, with a mucronate or acute apex, often very lightly encrusted, protruding conspicuously above basidia, hyaline in KOH and Melzer's solution, scattered to numerous. – Cheilocystidia similar but often larger and broader, up to  $70 \times 15 \mu\text{m}$ . – Caulocystidia in loose clusters or fascicles over stipe apex, narrowly fusiform to narrowly clavate-capitate,  $32\text{--}50 \times 5\text{--}8 \mu\text{m}$ , thin-walled, hyaline. – Suprapellis a mixocutis with hyphae  $1.7\text{--}5 \mu\text{m}$  diam., thinwalled, hyaline, simple septate, pileocystidia  $40\text{--}50 \times 4.5\text{--}6.4 \mu\text{m}$ , narrowly fusiform, thin-walled, scattered or in loose clusters over disc, rare over margin. Trama of pileus of interwoven connective hyphae  $1.5\text{--}8 \mu\text{m}$  broad, interspersed with clusters of sphaerocysts  $8.5\text{--}18 \mu\text{m}$  diam., hyaline in KOH and Melzer's solution. Trama of lamellae similar.

Habit and habitat. – Single to scattered on ground under mixed jarrah/karri (*Eucalyptus marginata*, *E. diversicolor*) woodland. Fruiting in June.

Material examined. – WESTERN AUSTRALIA: HILTON, UWA 2364, TYPE –VPI, Denmark Water Supply, June 1979.

Observations. – The stature and coloration of the fruiting bodies both fresh and dried are strikingly similar to *Russula mariae* PECK, a familiar fungus which the senior author has seen and studied in Virginia (BILLS & MILLER, 1984). In fact, it is very likely that it too will be in the Section *Heterophyllae* in the *Amoena*-group as delineated by MOSER (1978). However, the cheilo- and pleurocystidia are differently shaped and never lanceolate. Caulocystidia also occur in clusters but only at the apex of the stipe and the pileocystidia are also generally found over the disc where they are scattered or only in loose clusters but never in the discreet fascicles. Species of *Russula* are poorly represented in Australia, and it is probable that *R. clevelandii* forms ectomycorrhizae with species of *Eucalyptus*.



Figs. 9–9b: *Russula clelandii*. – 9a. sporocarp  $\times 1/2$ . – 9b. Xsec  $\times 1/2$ . Figs. 10–13b: *Inocybe fibrillosibrunnea*. – 10. basidia. – 11. basidiospores. – 12. cheilocystidia. – 13. caulocystidia. – 13a. sporocarp  $\times 1$ . – 13b. Xsec  $\times 1$ .

3. *Inocybe fibrillosibrunnea* MILLER & HILTON, sp. nov. – Pl. 2, figs. 10–13 b

Pileus 14–21 mm latus, convexus-umbonatus, aridus, caespitibus fibrillosis implexis, cum fuscus tum brunneus. Lamellae adnatae, subdistantes, lamellulis longis alternantes, marginibus fimbriatis, brunneolae. Stipes 25–37 mm longus, 2.5–3.5 mm latus, apice basique aliquantum acutus, aridus, pubescens, brunneus. Sporae 9–11 × 4.2–6 µm, ellipticae vel ovatae, parietibus crassis, in deposito brunneae. Cheilocystidia et pleurocystidia 45–84 × 15–19 µm, obclavata, crassis parietibus, apice saepe incrustata, numerosa. Suprapellis trichoderma est, fibulis praesentibus. Typum legit DELL, UWA 2204, in silvis *Eucalypti marginatae* et *E. calophyllae*, Kalamunda, Western Australia, July 1977.

Pileus 14–21 mm broad, convex, convex-umbonate, brown to dark brown, „Verona Brown“ to „Snuff Brown“, dry, matted fibrillose tufts of light tipped fibrils over the disc somewhat recurved, irregularly raised over the margin. – Lamellae subdistant to distant, adnate, alternate with long lamellulae, minutely fimbriate, white margins, light brown, „Sayal Brown“. – Stipe 10–37 mm long, (1–)2.5–3.5 mm broad usually enlarging somewhat at the apex and base, dry, coarsely pubescent with tufts of minute fibrils over the base in age, concolorous with the pileus or somewhat lighter, „Sayal Brown“ to „Snuff Brown“. – Veil cortinose, scanty, light brown, soon disappears with no annular zone. – Odor not distinctive.

Spores 9–11 × 4.2–6 µm, inequilateral, nearly ovate, elliptical to amygdaliform or somewhat reniform in profile to narrowly ovate to ovate in face-view, slightly thick-walled, with an oval oil globule, brown in KOH and Melzer's solution, brown spore deposit. – Basidia clavate, four-spored, hyaline or light yellowish in KOH and Melzer's solution. – Cheilocystidia and pleurocystidia numerous, obclavate with long or short neck, 45–84 × 15–19 µm, thick-walled (1.7–2.5 µm), often with incrustated material at apex, yellow walls in KOH and Melzer's solution, usually conspicuously protruding above the hymenium. – Caulocystidia 45–95 × 5.5–8 µm, cylindrical, thick-walled, in fascicles, yellowish in KOH. – Suprapellis a trichoderm composed of coarse bundles of hyphae (4.2–)6.7–11 µm diam., thin-walled, reddish brown in KOH and Melzer's solution, some lightly incrustated, numerous clamp connections and numerous pileocystidia 60–80 × 7–9 µm, thickwalled with clamp connections. Trama of pileus of interwoven filamentous to somewhat swollen cells 3.4–15(–22) µm diam., thinwalled, numerous clamp connections, often incrustated. Trama of lamellae, interwoven hyphae 3.4–9(–15) µm diam., similar to pileus trama.

Habit and habitat. – In troops on ground in mixed jarrah/marri (*Eucalyptus marginata*, *E. calophylla*) woodland. Fruiting in July.

Material examined. – WESTERN AUSTRALIA: DELL, UWA 2204, TYPE (part at VPI, part at UWA), Kalamunda, July 1977; MILLER 19431, Julimar State Forest, August 30, 1981 (VPI); MILLER 19432, Julimar State Forest (VPI).

Observations. – *Inocybe fibrillosibrunnea* has large reniform spores, a dark brown fibrillose pileus, is coarsely pubescent over the stipe apex and has large, thick-walled pleuro- and cheilocystidia. It is associated with Western Australian species of *Eucalyptus* with which it probably forms ectomycorrhizae. No comparable taxon is found among the four taxa of *Inocybe* described from South Australia by CLELAND (1934–35). It is similar to *I. australiensis* CLELAND & CHEEL as described and illustrated by HORAK (1980). However, this species has small spores ( $6.5\text{--}8 \times 4.5\text{--}5 \mu\text{m}$ ) which are shaped differently. No other taxon in *Inocybe* described by HORAK (1980) is comparable but the Western Australian species are not treated in his paper.

4. *Hebeloma aminophilum* HILTON & MILLER, sp. nov. – Pl. 3, figs. 14–16 e

Pileus (2–)3–9 cm latus, cum late convexus tum planus. rasilis. viscidus, cum cremeus juvenute tum brunneolus senectute. Lamellae late adnatae. confertae, aliquot ordinibus lamellarum instructae, cum ferrugineae tum senectute brunneae. Stipes 60–80 mm longus, 8–15 mm latus, aequalis sed basaliter tumida. aridus, candidus, glaber, senectute brunnescens sporis. velo nullo. Contextus cretaceus. Sporae  $8.2\text{--}10 \times 4.5\text{--}6 \mu\text{m}$ , ellipticae vel amygdaloideae, minute verrucosae, brunneae in deposito. Cheilocystidia  $40\text{--}52 \times 6\text{--}9 \mu\text{m}$ . fusiformia. parietibus tenuibus instructa, numerosa. Pileopellis est ixomixocutis hypharum  $2.5\text{--}5 \mu\text{m}$  diam. fibulis numerosis. Sarcophilum apud relicta putrescentia megaleiarum. cuniculorum, angium, animalium ceterorum vivens. Typum legit HILTON, UWA 2150. Kalamunda Shire, Pickering Brook. June 22. 1977.

Pileus (2–)3–9 cm broad, broadly convex to nearly plane, smooth, viscid, cream color at first to light brown in age. – Lamellae close, broadly adnate, several tiers of lamellulae, nearly flesh color to pinkish brown at first to rich brown in age. – Stipe 60–80 mm long, 8–15 mm broad, nearly equal but with a swollen base, dry, silky white, glabrous with no sign of a veil. – Context dull white.

Spores  $8.2\text{--}10 \times 4.5\text{--}6 \mu\text{m}$ , broadly elliptical to almond shaped in profile but somewhat constricted at apex, broadly elliptical in face view, thin-walled, minutely punctate, small apiculus. – Basidia 24–27  $\times$  5–6.5  $\mu\text{m}$ , clavate, hyaline, thin-walled, four-spored. – Pleurocystidia numerous, narrowly fusiform 30–41  $\times$  6–8  $\mu\text{m}$ , thin-walled, hyaline in KOH and Melzer's solution, protruding above the basidia. – Cheilocystidia numerous, narrow to broadly fusiform 40–52  $\times$  6–9  $\mu\text{m}$ , thin-walled, hyaline in KOH and Melzer's solution, protruding above the basidia. – Pileopellis



and ixomixocutis with a hyaline, gelatinous matrix of hyphae 2.5–5 µm diam., numerous clamp connections, light yellowish in KOH and Melzer's solution. Subcutis orange-red in Melzer's solution. Trama of pileus of densely interwoven, thin-walled, hyaline, refractive hyphae 3.4–7.6(–12) µm diam., numerous clamp connections, yellowish to hyaline in KOH and Melzer's solution in KOH and Melzer's solution. Trama of lamellae of parallel or nearly parallel hyphae, 3.4–8 µm diam., thin-walled, hyaline, clamp connections present.

Habit and habitat. – Invariably in clusters from the vicinity of decaying animal matter. Very often interspersed with primordia at the base (HILTON, 1978). Assumed to be sarcophilous, the holotype was found on the ground and consisted of at least 100 sporophores growing amongst bones of a large kangaroo, the carcass of which had apparently been dumped some months previously. Found in mixed jarrah/marri (*Eucalyptus marginata*, *E. calophylla*) woodland in May and June.

Material examined. – WESTERN AUSTRALIA: HILTON, UWA 2013, Kalamunda Shire, Kalamunda, June 1, 1975; HILTON, UWA 2030, Mundaring Shire, Chidlow Road, June 13, 1975; HILTON, UWA 2111, Manjimup Shire, Quininup, May 21, 1976; HILTON, UWA 2150 TYPE (UWA), Kalamunda Shire, Pickering Brook, June 22, 1977.

Observations. – Several sarcophilous *Hebelomas* have been reported from Japan by SAGARA (1976, 1978) but they all differ from *H. aminophilum* as indicated below. *Hebeloma spoliatum* (FR.) GILLET has larger spores and no pleurocystidia and *H. radicosum* (BULL.: FR.) RICKEN also differs by its lack of pleurocystidia and its radicating stipe, shown in DAHNCKE (1979). *Hebeloma vinosophyllum* HONGO is also clearly different with larger spores and smaller cystidia, although like *H. aminophilum* it has both pleuro- and cheilocystidia. *Hebeloma sarcophyllum* PECK, described by KAUFFMAN (1918), has spores of similar size but lacks the pleurocystidia so commonly encountered in *H. aminophilum*. The specific epithet '*sarcophyllum*', refers to the fleshiness of the gill, not to any ecological preference.

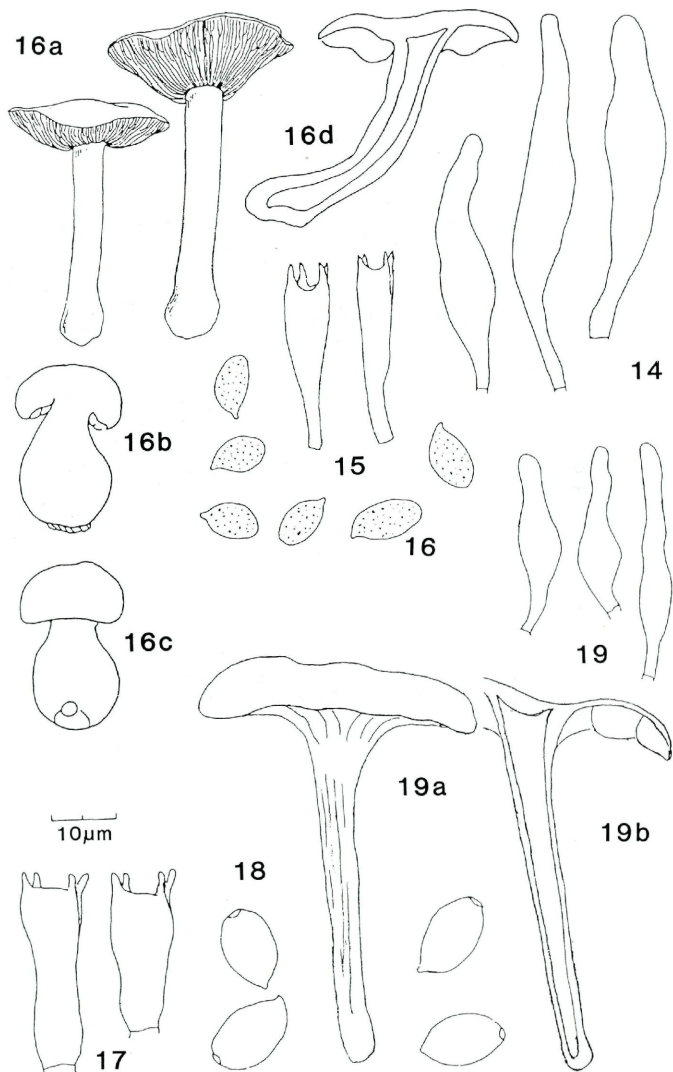
##### 5. *Psilocybe merdaria* (FR.) RICKEN Pl. 3, figs. 17–19 b

Blätterpilze, p. 251 (1915).

= *Stropharia merdaria* (FR.) QUÉL.

Champ. Jura Vosges I: 142 (1872).

Pileus 1–4.5 cm broad, convex, broadly convex to nearly plane, often undulating in age, glabrous, moist but not viscid, light yellow brown, veil remains on margin of young cap. – Context firm, pale white. – Smell and taste not distinctive. – Lamellae broadly



Figs. 14-16e: *Hebeloma aminophilum*: 14. cheilocystidia. - 15. basidia. - 16. basidiospores. - 16a. sporocarp  $\times 1$ . - 16b. button, Xsec  $\times 1$ . - 16c. button  $\times 1$ . - 16d. Xsec  $\times 1/2$ . - 16e. sporocarp  $\times 1/2$ . Figs. 17-19b: *Psilocybe merdaria*: 17. basidia. - 18. basidiospores. - 19. cheilocystidia. - 19a. sporocarp  $\times 1$ . - 19b. Xsec  $\times 1$ .

adnate with a short decurrent tooth, subdistant, broad at maturity with a repeating pattern of two short lamellulae with a longer one in the center, light gray at first but soon purple brown from the maturing spores. – Stipe 18–45 mm long, 2–4 mm broad, equal or slightly enlarged at the base and apex, often flexuous, glabrous, dry, light cream color darkening slightly in age, with a fine white pubescence over the base. The very fine, scanty remains of a floccose annular zone near the apex is seen on young specimens but no evidence remain in age or with dried specimens. Context dull white, firm with a hollow center.

Spores 11–12 × 6–8 μm, elliptical, thick-walled, with a large germ pore and an open-pored hilum, deep purple brown in deposit. – Basidia 18–30 × 9–11 μm, clavate to ovoid with an abrupt narrow base, thin-walled, four-spored. – Cheilocystidia 45–70 × 7–11 μm, narrowly clavate, fusiform to ventricose-rostrate and often with a protracted narrow neck, thin-walled, hyaline in KOH and Melzer's solution. – Pleurocystidia found occasionally near gill edge, otherwise absent. – Cuticle of hyphae 1–3 μm diam., forming an ixomixocutis, thinwalled, incrustations on walls light yellowish brown in KOH giving the entire cutis a yellow brown color. Trama of pileus of interwoven, hyaline hyphae 3–6 μm in diam., loosely interwoven near cutis, changing to a cellular layer (nearly a *textura angularis*) of elements 7–20 μm diam. with common walls near the lamellulae. Trama of the lamellae irregular with a cellular subhymenium, hyaline in KOH and Melzer's solution.

Habit and habitat. – Abundant in caespitose clusters over the surface of bauxite settling ponds to which chicken dung has been added in Kwiana, Western Australia. Fruiting occurs in June.

Material examined. – WESTERN AUSTRALIE: TACEY, UWA 2027, (part at VPI, part at UWA), Kwiana.

Observations. – The purple brown spores with an apical germ pore along with the ixomixocutis place this taxon in the Strophariaceae. As in other species of *Psilocybe*, there are no chryso-cystidia and no fusiform cheilocystidia. The large spores, persistent annulus and the lack of blue staining are typical of *P. merdaria*. The spore size is variously reported by GUZMAN (1983) as 11–13 × 7–8(–9) μm; by MOSER (1978) as 10–13 × 6.5–8.5 μm; PHILLIPS (1981) as 10–16 × 8–9 μm and STAMETS (1978) as 12–17 × 7–8 μm. Although this seems contradictory at first glance, FARR, MILLER & FARR (1977) have documented non-overlapping spore ranges in *Pholiota* (also in the Strophariaceae) among mating compatible populations. The progeny or F generation exhibited an intermediate spore size.

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