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The foliicolous *Mazosia melanophthalma* is common throughout the tropics, and is known from both New Zealand and Australia. *Mazosia* was authored by the legendary Italian lichenologist Abramo Massalongo in 1854 (*A. Massal.*, 1824–1860). He based the name on the Greek word *mazos* (“breast”).

0.5 mm 

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**Four new species of buellioid lichens
(Caliciaceae, Ascomycota) from Australia**

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Abstract

Amandinea meridionalis Elix from the Flinders Ranges in South Australia, *A. wagoorooensis* Elix from Carnarvon National Park in central Queensland, *Buellia gaahnabulensis* Elix from Mt Canobolas in central New South Wales, and *B. purdieae* Elix from southern Northern Territory and northern South Australia, are described as new to science.

Introduction

This paper continues my investigation of *Buellia*-like lichens in Australia. For the more recent additions see Elix (2020) and Elix & Kantvilas (2020) and references cited therein. In this paper, I describe two new species of *Amandinea* and two new species of *Buellia* in the broad sense. Methods are as described in the previous papers cited above.

New species

1. *Amandinea meridionalis* Elix, sp. nov.
MycoBank No.: **MB 840959**

Fig. 1

Similar to *Amandinea montanensis* Elix & H. Mayrhofer, but differs in having shorter, straight, non-constricted *Buellia*-type ascospores, 9–14 µm long.

Type: Australia. South Australia, Flinders Ranges, Copley–Balcanooona road, 13 km E of Copley, 30°32'S, 138°31'E, 350 m alt., on rocks along ridge in chenopod shrubland, *J.A. Elix 18006* & *L.H. Elix pr.p.*, 30.x.1984 (holotype – CANB).

Thallus crustose, to 40 mm wide and 0.25 mm thick, rimose to rimose-areolate; individual areoles contiguous to dispersed, angular, irregular, 0.2–1 mm wide; upper surface pale grey, matt; prothallus not apparent; medulla white, lacking calcium oxalate (H₂SO₄-), I-; photobiont cells 6–18 µm diam. *Apothecia* 0.1–0.5 mm wide, lecideine, broadly adnate, dispersed, rounded; disc black, epruinose, plane to convex. *Excipulum* thin, persistent or excluded in convex apothecia; in section 25–50 µm thick, the outer zone dark brown, K-, N-, inner zone pale brown. *Epihymenium* 8–12 µm thick, dark brown to brown-black, K-, N+ paler brown. *Hypotheecium* deep red-brown, 50–70 µm thick, K-. *Hymenium* 50–60 µm thick, colourless, not interspersed; subhymenium 10–15 µm thick, colourless to pale brown, not interspersed. *Paraphyses* 1.2–1.5(-2) µm wide, sparsely branched, with apices 4–6.5 µm wide and dark brown caps. *Asci* *Bacidia*-type, 8-spored. *Ascospores* *Buellia*-type, brown, ellipsoid, 9–[11.7]–14 × 6–[6.7]–8 µm, straight, not constricted at the septum; outer spore-wall weakly ornamented. *Pycnidia* immersed; ostiole black. *Conidia* filiform, curved, 18–24 × 0.7 µm. *Chemistry:* Thallus K-, P-, C-, UV-; no lichen substances detected by TLC.

Etymology: The epithet *meridionalis* (L., southern), refers to the known Australian distribution of the new lichen.

Remarks

This species is characterized by the crustose, rimose-areolate, pale grey thallus, the broadly adnate, lecideine apothecia, the non-amyloid medulla, the 1-septate, *Buellia*-type ascospores, 9–14 × 6–8 µm, curved, filiform conidia, 18–24 µm long, and the absence of lichen substances. It is quite similar to *A. montanensis*, but that species has a thicker, often subsquamulose thallus

and longer, commonly curved, *Physconia*- then *Buellia*-type ascospores, 10–[13.8]–18 × 5–[7.5]–10 µm (Elix & Mayrhofer 2021).

Amandinea meridionalis is known from siliceous rocks in the Flinders Ranges in South Australia. Associated species include *Acarospora citrina* (Taylor) Zahlbr. ex Rech., *Buellia intergescens* Müll.Arg., *B. maficola* Elix, several *Caloplaca* species, *Circinaria contorta* (Hoffm.) A.Nordin and various *Xanthoparmelia* species.

ADDITIONAL SPECIMENS EXAMINED

South Australia. • Flinders Ranges district, Main Road, 2 km W of Orreroo, 32°44'S, 138°35'E, on siliceous rock, *W.H. Ewers 7064 pr.p.*, 7073 pr.p., 20.vi.1990 (CANB).

2. *Amandinea wagooroensis* Elix, sp. nov. Mycobank No.: MB 840960

Fig. 2

Similar to *Amandinea mountmeensis* Elix & H.Mayrhofer, but differs in having a squamulose to subsquamulose thallus with larger squamules, 1–3 mm wide, and a non-amyloid medulla that lacks calcium oxalate.

Type: Australia. Queensland, Wagooro Creek, Carnarvon National Park, 94 km NNW of Injune, 25°02'S, 148°14'E, 520 m alt., on shaded boulder in *Eucalyptus* forest with well-developed shrub understorey, *H. Streimann 52169*, 21.viii.1993 (holotype – CANB; isotype – B, not seen).

Thallus squamulose to subsquamulose, to 70 mm wide and 0.5 mm thick; individual squamules irregular, 1–3 mm wide, often lobulate along margins or on the surface, lobules 0.1–0.3 mm wide; upper surface pale brown, matt; prothallus not apparent; medulla white, lacking calcium oxalate (H₂SO₄-), I-; photobiont cells 6–17 µm wide. *Apothecia* 0.5–1.2 mm wide, lecideine, broadly adnate to sessile and constricted at the base, dispersed; disc black, epruinose, plane to convex, ± distorted. *Excipulum* thin, excluded in older convex apothecia, in section 25–35 µm thick; outer zone brown, K-, N-, inner zone pale brown. *Ephymenium* 12–20 µm thick, brown, K-, N-. *Hypothecium* 75–125 µm thick, brown to dark brown, adjoining a central stipe, K-. *Hymenium* 100–125 µm thick, colourless, not interspersed; subhymenium 20–30 µm thick, pale brown, not interspersed. *Paraphyses* 1.5–2 µm wide, sparsely branched, with apices 3.5–5 µm wide and brown caps. *Asci* of the *Bacidia*-type, with 8 or fewer (4) spores. *Ascospores* *Physconia*- then *Buellia*-type, brown, ellipsoid, 16–[19.5]–24 × 9–[10.9]–14 µm, often with acute apices, older spores constricted at the septum; outer spore-wall rugulate. *Pycnidia* immersed; ostiole brown. *Conidia* filiform, curved, 14–22 × 0.7–1 µm. *Chemistry*: Thallus K-, P-, C-, UV-; no lichen substances detected.

Etymology: The species is named after the type locality.

Remarks

This species is characterized by the squamulose to subsquamulose thallus, the squamules often becoming lobulate, a pale brown upper surface, the broadly adnate to sessile apothecia, the non-amyloid medulla which lacks calcium oxalate, a non-interspersed hymenium, the 1-septate, *Physconia*- then *Buellia*-type ascospores, curved, filiform conidia, 14–22 µm long, and the absence of lichen substances. Morphologically, it can resemble *A. mountmeensis* in that they both have similar-sized ascospores and conidia, but *A. mountmeensis* has a crustose to subsquamulose thallus composed in part of much smaller squamules, 0.1–0.4 mm wide, and an amyloid medulla that contains calcium oxalate (Elix & Mayrhofer 2020). The subsquamulose thallus of *A. wagooroensis* can resemble some free-living forms of *Monerolechia badia* (Fr.) Kalb, but that species has smaller ascospores, 10–15 × 6–8 µm, and bacilliform conidia, 3–5 µm long (Elix 2011).

At present *A. wagooroensis* is only known from the type collection. Associated species include *Dirinaria flava* (Müll.Arg.) C.W.Dodge, *Lecidella buelliastrum* (Nyl.) Knoph &

Rambold, *Ramboldia sanguinolenta* (Kremp.) Kalb, Lumbsch & Elix and *Xanthoparmelia incerta* (Kurok. & Filson) Elix & J.Johnst.

3. *Buellia gaahnabulensis* Elix, sp. nov. Mycobank No.: MB 840961

Fig. 3

Similar to *Buellia poimena* Elix & Kantvilas, but differs in having much smaller ascospores, 6–11 × 3–6 µm.

Type: Australia. New South Wales, Mt Canobolas, summit area, 13 km SW of Orange, 33°20'40"S, 148°58'56"E, 1390–1395 m alt., on volcanic rocks in area with scattered *Eucalyptus* and *Acacia*, *J.A. Elix 23458 pr.p.*, 6.xii.1989 (holotype – CANB).

Thallus crustose, to 25 mm wide and 0.5 mm thick, dark brown, chinky, areolate, the individual areoles irregular, angular, columnar, 0.4–1 mm wide; prothallus absent; medulla lacking calcium oxalate (H₂SO₄-), I- or I+ pale pink in part; photobiont cells 8–16 µm diam. *Apothecia* 0.1–0.5 mm wide, scattered, lecideine, immersed to broadly adnate; disc black, epruinose, weakly concave to plane. *Excipulum* distinct, elevated above the disc, persistent, in section 40–50 µm thick; outer zone dark brown to brown-black, K-, N+ orange-brown, inner zone paler brown. *Ephymenium* 8–12 µm thick, dark brown to brown-black, K-, N-. *Hypothecium* 45–55 µm thick, brown to dark brown, with a dark brown to brown-black central stipe, 140–150 µm thick, N+ intense red-brown. *Hymenium* 50–60 µm thick, colourless, not interspersed; subhymenium 10–15 µm thick, pale brown, not interspersed. *Paraphyses* 1.5–2 µm wide, simple to branched, with apices 5–6.5 µm wide and dark brown caps. *Asci* *Bacidia*-type, 8-spored. *Ascospores* *Buellia*-type, 1-septate, brown, broadly ellipsoid, 6–[8.6]–11 × 3–[4.6]–6 µm, becoming constricted at the septum; outer spore-wall smooth to faintly ornamented when old. *Pycnidia* rare, punctiform, immersed; ostiole black. *Conidia* bacilliform, 5–7 × 0.7–1 µm. *Chemistry*: Thallus K-, P-, C+ pink, UV-; containing gyrophoric acid.

Etymology: The species is named after the type locality, Gaahna-bula, the traditional name for Mount Canobolas. The name comes from two words in the local Wiradjuri language “gaahna” and “bula”. This means “two shoulders” which refers to the summits of Mount Canobolas itself, and the subsidiary peak, Young Man Canobolas.

Remarks

The new species is characterized by the thick, dark brown, chinky-areolate crustose thallus, the non-amyloid medulla, the immersed to adnate lecideine apothecia, small broadly ellipsoid ascospores, 6–11 × 3–6 µm, bacilliform conidia, 5–7 µm long, and the presence of gyrophoric acid. The Australasian *B. poimena* also contains gyrophoric acid, but differs in having much larger *Physconia*- then *Buellia*-type ascospores, 11–[15.1]–20 × 6–[8.4]–11 µm, and elongate-bacilliform conidia, 5–15 µm long (Elix & Kantvilas 2013).

At present the new species is known only from the type locality, where associated species include *Amandinea montanensis* Elix & H.Mayrhofer, *Buellia aethalea* (Ach.) Th.Fr., *B. canobolasensis* Elix & P.M.McCarthy, *Lecanora farinacea* Fée, *Lecidella sublaticida* (C.Knight) Hertel and various *Xanthoparmelia* species.

4. *Buellia purdieae* Elix, sp. nov. Mycobank No.: MB 840962

Fig. 4

Similar to *Buellia suttonensis* Elix & A.Knight, but differs in having longer ascospores, 11–16 µm long.

Type: Australia, Northern Territory, West McDonnell National Park, Heavitree Range, Larapinta Trail section 9, base of hill area, 23°40'05"S, 134°47'17"E, 769 m alt., on rock, *R.W. Purdie 1589A*, 24.vi.2019 (holotype – CANB).

Thallus to 20 mm wide, endolithic and not apparent or epilithic, fragmentary and comprised of discontinuous corticate patches 0.2–0.5 mm wide and 100–200 µm thick at the base of apothecia, or in rock crevices; upper surface off-white, matt; prothallus not apparent; photobiont cells 8–19 µm wide; medulla when present lacking calcium oxalate (H₂SO₄-), 1-. *Apothecia* 0.1–0.4 mm wide, abundant, lecideine, roundish, scattered, broadly adnate then sessile; disc black, epruinose, plane to markedly convex. *Excipulum* thin, excluded in older, convex apothecia, in section 25–40 µm thick; outer part brown-black, K-, N+ orange-brown, inner part brown. *Ephymenium* 10–13 µm thick, dark brown to olive-brown, N-. *Hypothecium* 80–150 µm thick, brown to dark brown. *Hymenium* 50–65 µm thick, colourless, not interspersed; subhymenium 15–20 µm thick, pale brown, not interspersed. *Paraphyses* 1–2 µm wide, sparingly branched, with apices 4–7 µm wide and brown caps. *Asci* 8-spored, *Bacidia*-type. *Ascospores* *Buellia*-type, 1-septate, pale brown then dark brown, ellipsoid, 11–[13.4]–16 × 5–[6.3]–9 µm, straight, rarely constricted at the septum; outer wall finely ornamented. *Pycnidia* rare, punctiform, superficial; ostiole black. *Conidia* bacilliform, 4–6 × 0.7–1 µm. *Chemistry*: Thallus K-, P-, C-, UV-; no lichen substances detected.

Etymology: The species is named after the botanist Dr Rosemary Purdie (Canberra), the collector of the type specimen.

Remarks

The endolithic or poorly developed, very thin, discontinuous thallus resembles the Australasian *B. suttonensis*, in that both species are dominated by abundant, broadly adnate to sessile apothecia, although the latter has shorter ascospores, 10–[11.6]–13 µm long (Elix & Knight 2017). Superficially, the species could also be confused with saxicolous specimens of *Amandinea punctata* (Hoffm.) Coppins & Schied., as they often have poorly developed thalli and similar-sized *Buellia*-type ascospores. However, in *A. punctata* the ascospores are commonly curved and the conidia are filiform, curved and 14–20 × 0.5–1 µm (Elix 2011).

The new species is known only from northern South Australia and southern parts of the Northern Territory, where it occurs on siliceous rocks in arid shrubland, in association with various *Caloplaca* and *Xanthoparmelia* species.

ADDITIONAL SPECIMENS EXAMINED

Northern Territory. ● Chandler Range, Henbury Station, near Rockhole Bore, 24°30'59"S, 133°27'08"E, 442 m alt., on rock overhang near base of steep rocky slope with a southerly aspect. *V. Stajsic 6646 pr.p.*, 22.v.2013 (CANB). *South Australia*. ● Flinders Ranges district, 2–3 km NW of Arkaroola Village, 30°18'S, 139°19'E, on siliceous rock, *W.H. Ewers 6969 pr.p.*, 9.iv.1990 (CANB); ● *loc. id.*, *W.H. Ewers 6975 pr.p.*, 18.vi.1990 (CANB).

Correction

Buellia ecclesensis Elix, *Australas. Lichenol.* **81**, 33 (2017)

Type: Australia, Victoria, Victorian Volcanic Plain region, Mount Eccles, on rim near dry crater, 38°04'S, 141°56'E, on basalt, *W.H. Ewers 11*, 11.x.1986 (CANB – holotype).

Remarks

In the description of this species, I stated that it was characterized by the presence of atranorin and 2'-*O*-methylperlatolic acid, but that is incorrect. The type specimen has now been shown to contain atranorin and 2,5,7-trichloro-3-*O*-methylnorlichexanthone, and exhibits medullary reactions K+ pale yellow, C+ orange, P+ pale yellow and UV+ pale orange. This species would appear to be closely related to *Buellia subarenaria* Müll.Arg., but the latter differs in lacking calcium oxalate in the medulla.

SPECIMENS EXAMINED

Victoria. ● Volcanic Plain region, Pomorie East Road, 2–4 km from main Warrnambool–Melbourne Hwy, 38°77'30"S, 143°21'E, *W.H. Ewers 1412*, 30.viii.1987 (CANB); ● Volcanic Plain region, Mount Eccles, near Natural Bridge, 38°04'S, 141°56'E, on basalt, *W.H. Ewers 38, 48, 49*, 11.x.1986 (CANB).

Acknowledgements

I thank Dr Christine Cargill and Ms Judith Curnow for their kind cooperation in providing access to key collections in CANB.

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Figure 1. *Amandinea meridionalis* (holotype in CANB). Scale = 1 mm.

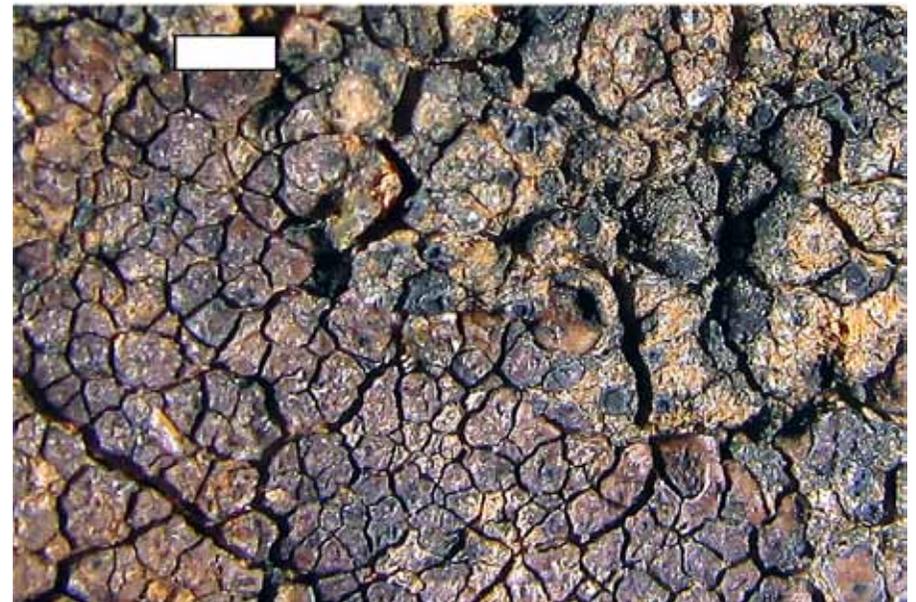


Figure 3. *Buellia gaahnabulensis* (holotype in CANB). Scale = 1 mm.

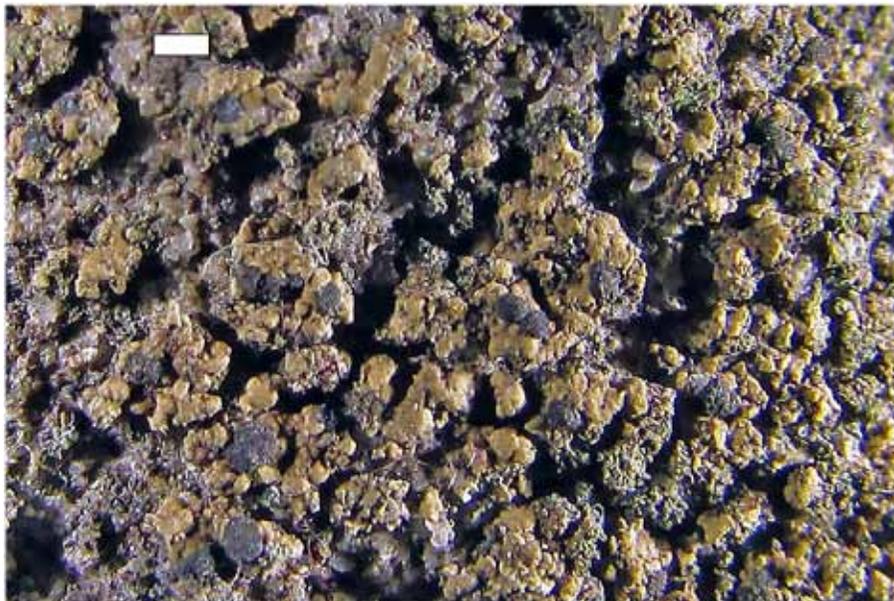


Figure 2. *Amandinea wagoorooensis* (holotype in CANB). Scale = 1 mm.



Figure 4. *Buellia purdieae* (holotype in CANB). Scale = 1 mm.

A new species of *Dictyomeridium* (lichenized Ascomycota, Trypetheliaceae) from Tasmania

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Abstract

Dictyomeridium tasmanicum sp. nov. (Trypetheliaceae) is described from the bark of coastal *Allocasuarina verticillata* in south-eastern Tasmania. The new lichen has a thin, UV⁻, epiphloeodal thallus, small but prominent, pleurothelioid ascomata with eccentric to lateral ostioles, and bisporous asci containing comparatively large, muriform-euseptate ascospores.

Introduction

The tropical and subtropical lichen genus *Dictyomeridium* Aptroot, M.P.Nelsen & Lücking was recently segregated from *Polymeridium* (Müll.Arg.) R.C.Harris as a phylogenetically and morphologically distinct lineage within the family Trypetheliaceae (Lücking *et al.* 2016). Comprising seven species, it is characterized by the combination of pleurothelioid ascomata with eccentric to lateral ostioles and muriform ascospores (Aptroot & Lücking 2016; Lücking *et al.* 2016; Hongsanan 2020). In Australia, two species are already known from Queensland (McCarthy 2020); in this contribution, the newly described *D. tasmanicum* is reported from coastal habitats in south-eastern Tasmania.

Dictyomeridium tasmanicum P.M.McCarthy & Kantvilas

Figs 2 & 3

Mycobank No.: **MB 840847**

Similar to *D. immersum* (Aptroot, A.A.Menezes & M.Cáceres) Aptroot, M.P.Nelsen & Lücking in that both species, uniquely in the genus, have 2-spored asci, but the new entity differs in having an off-white to pale silvery grey, UV⁻ thallus lacking a prothallus, and semi-immersed to almost superficial ascomata.

Type: Australia, Tasmania, near Triabunna, Spring Bay Mill, shoreline below Lispers Corner, 42°33'S, 147°56'E, 2 m alt., on bark of *Allocasuarina verticillata* along foreshore, *G. Kantvilas 429/19*, 20.xi.2019 (holotype – HO 599616).

Thallus lichenized, crustose, epiphloeodal, effuse, non-rimose, smooth to minutely uneven, off-white to pale silvery grey, to 25 mm wide, very thin, 20–40 µm thick, ecorticate, UV⁻. *Photobiont cells* sparse, trentepohlioid, 10–16 × 8–13 µm. *Prothallus* absent. *Ascomata* pleurothelioid, solitary, sparse, semi-immersed in the substratum to almost superficial, dull black and smooth above, not or only very slightly overgrown by the thallus, (0.25–)0.37(–0.45) mm wide [*n* = 20], with a broadly ellipsoid to pyriform outline in surface view; ostiole eccentric to lateral, *c.* 20–40 µm wide. *Ascomatal wall* greenish black in section, 25–50 µm thick above, 20–30 µm thick at the base, K⁻. *Hamathecium* hyaline, not interspersed with granules or oil droplets, of loosely anastomosing paraphysoids embedded in a gelatinous matrix (anastomoses most frequent towards the ostiole), KI⁻; paraphysoids long-celled, 0.5–0.7(–1) µm thick, not constricted at the septa. *Subhymenium* hyaline, not interspersed, 25–40 µm thick. *Asci* 2-spored, narrowly clavate to cylindroclavate, orientated vertically or tilted towards the ostiole, non-amyloid, 84–115 × 15–25 µm, initially with a thick tholus and, often, a long narrow ocular chamber that becomes excluded as the tholus contracts towards maturity. *Ascospores* colourless, narrowly ellipsoid, oblong-ellipsoid or oblong, contiguous-uniseriate or overlapping slightly, non-amyloid, the distal spore usually shorter and broader than the narrower and more

elongate proximal spore, muriform-euseptate, with 9–18 × 2–4 ± cuboidal or polygonal locules, usually distinctly constricted at the primary septum, (35–)50(–74) × (12–)15(–20) µm [*n* = 30], these measurements not including the perispore, which is smooth, hyaline and (2–)4–5(–7) µm thick (this last feature clearly visible only in ascospores outside the asci). *Pycnidia* not seen.

Etymology: The species epithet refers to the occurrence of the new lichen in Tasmania.

Remarks

The new species is one of only two members of *Dictyomeridium* with 2-spored asci. The other taxon, *D. immersum*, from western and north-eastern Brazil, has a pale pinkish white and UV⁺ yellow thallus surrounded by a brown prothalline line, together with deeply immersed ascomata with only the ostiole and periostiole region visible (Aptroot *et al.* 2013). Incidentally, all other species have 8-spored asci, including the two tropical Australian representatives, *D. amylosporium* (Vain.) Aptroot, M.P.Nelsen & Lücking and *D. proponens* (Nyl.) Aptroot, M.P.Nelsen & Lücking.

Dictyomeridium tasmanicum is currently known from coastal *Allocasuarina verticillata* (she-oak) woodland at two closely adjacent localities in south-eastern Tasmania. Coastal she-oak in Tasmania is usually a lichen-rich habitat with respect to biomass if not species richness. The tree produces very rough, furrowed bark on its older trunks, and is commonly covered in species of Parmeliaceae, notably *Austroparmelia pseudorelicina* (Jatta) A.Crespo, Divakar & Elix, *Flavoparmelia rutidota* (Hook.f. & Taylor) Hale, *Menegazzia subpertusa* P.James & D.J.Galloway and *Punctelia pseudocoralloidea* (Gyeln.) Elix & Kantvilas, whereas the smooth-barked younger limbs are typically rich in crustose lichens and festooned with *Usnea* species. In that respect, the type locality is very unusual, because at this site the she-oak trunks and branches are essentially bare (Fig. 1), no macrolichens at all are present, and crustose lichens are very rare, poorly developed and at most represented by tiny, very scattered thalli, mostly hidden in fissures of the bark. *Dictyomeridium tasmanicum* was found in such a habitat, but it was extremely uncommon and associated with equally uncommon, minute, scattered thalli of *Buellia dissa* (Stirt.) Zahlbr., *Enterographa divergens* (Müll.Arg.) Redinger and *Rinodina australiensis* Müll.Arg.

Indeed, the discovery of this highly inconspicuous new species was entirely fortuitous and due solely to a detailed flora survey being conducted at the site (the Third Tasmanian Museum and Art Gallery Expedition of Discovery; see Baker *et al.* 2019). The cause for this starkly depauperate local flora is unknown, but it may be due to the recent heavy industrialisation of the site when it served as one of the world's largest woodchip mills for more than four decades. There was also evidence of a loss of diversity in saxicolous lichen communities as well as some physical damage to lichen thalli.

ADDITIONAL SPECIMEN EXAMINED

Tasmania. ● near the type locality, Lispers Corner, 42°32'S, 147°56'E, 10 m alt., on bark of *Allocasuarina verticillata* in coastal woodland, *G. Kantvilas 17/21*, 10.i.2021 (HO 602363).

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Figure 1. *Allocasuarina verticillata*-dominated coastal woodland at Spring Bay, Tasmania. Note the unusual absence of epiphytes on the rough-barked trunks.



Figure 2. *Dictyomeridium tasmanicum* (holotype). Scales: 1 mm.

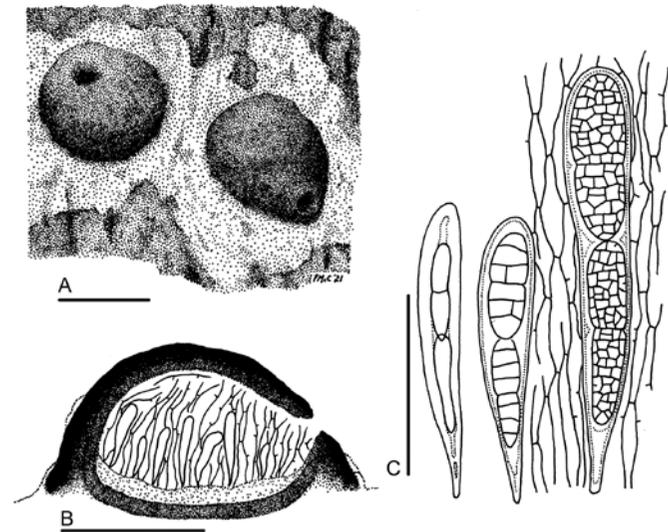


Figure 3. *Dictyomeridium tasmanicum* (holotype). A, Habit of thallus and two ascomata. B, Sectioned ascoma (semi-schematic). C, Two immature asci, a mature ascus and paraphysoids. Scales: A, B = 0.2 mm; C = 50 μ m.

A new species of *Leiorreuma* Eschw. (lichenized Ascomycota, Graphidaceae) from Christmas Island, Indian Ocean

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Abstract

Leiorreuma norsticticum sp. nov. (Graphidaceae) is described from the bark of a rainforest tree in Christmas Island, an Australian territory in the north-eastern Indian Ocean. The pale olive-green thallus contains norstictic acid, and the simple, adnate to sessile lirellae have a strikingly pruinose disc and a thin thalline margin. The proper excipulum is brown-black and thickest at the ascum base, and the heavily granule-inspersed hymenium contains simple paraphyses, 8-spored asci and brownish, 6-locular, non-amyloid ascospores, 19–28 × 5.5–9 µm.

Introduction

Leiorreuma Eschw. (Graphidaceae), a genus of at least 21 corticolous and mainly tropical species, is characterized by its pale corticate thallus, adnate to sessile lirellae with an open and often pruinose disc, a carbonized excipulum base that becomes thinner and divergent laterally, predominantly simple paraphyses in a heavily inspersed hymenium and pale brown, non-amyloid and mostly transversely loculate ascospores (Staiger 2002; Archer 2009). Four mainly pantropical and Palaeotropical species are known from eastern Australia (Archer 2009); in this paper a fifth is documented from the bark of a rainforest tree in the Australian territory of Christmas Island in the Indian Ocean.

***Leiorreuma norsticticum* P.M. McCarthy, sp. nov.**
Mycobank No.: **MB 840854**

Figs 1 & 2

Thallus corticolous, pale olive-green, continuous, corticate and containing norstictic acid, with unbranched, adnate to sessile lirellae 0.9–4.8 mm long and 0.40–0.64 mm wide, each with an open and persistently pruinose disc and a thin thalline margin. Proper excipulum brown-black and 50–120 µm thick at the base, ± concolorous, divergent and 25–40 µm thick laterally; hymenium 80–120 µm thick, heavily inspersed with granules and with simple paraphyses. Ascospores 8 per ascus, pale brown or pale greyish brown, 6-locular, non-amyloid, 19–28 × 5.5–9 µm.

Type: Australia. Christmas Island, Murray Road, 3.5 km NNE of ‘Central Area Workshop’, 10°27.26’S, 105°39.34’E, 210 m alt., on a centimetre-wide branch in moderately dense primary forest, *P.M. McCarthy 1611*, 26.vii.2000 (CANB — holotype).

Thallus crustose, epiphloeodal, pale olive-green, to 2 cm wide, 80–120 µm thick, smooth, dull to slightly glossy and with a waxy appearance, continuous or very sparingly cracked, corticate. *Cortex* hyaline to pale straw-yellow, 25–35 µm thick; cells very thick-walled, with rounded, polygonal, periclinally elongate or interconnecting stellate lumina. *Algae* trentepohlioid, occupying a layer 30–80 µm thick; cells ± ellipsoid, 6–13 µm in maximum extent; interstitial hyphae short-celled, 2–3 µm wide. *Medulla* with indistinct hyphae, 1–, dominated by small and large crystals of calcium oxalate, 10–40 µm wide (H₂SO₄⁺). *Prothallus* not apparent. *Apothecia* moderately numerous, lirelliform, scattered or contiguous, adnate to subsessile and then slightly constricted at the base, short and rounded to oblong or elongate, straight, curved, uncinuate or sinuous, not branched and with rounded, non-tapering ends, (0.9–)3.1(–4.8) mm long, (0.40–)0.51(–0.64) mm wide [*n* = 30]; disc open, slightly concave to plane or low-convex, smooth, not cracked or furrowed, thinly whitish to pale bluish grey-pruinose at all stages of development, or the pruina becoming eroded to expose the dark olive-brown or dull dark brown disc surface. *Thalline margin* dull whitish green, entire, divergent, not or only slightly prominent, or flush with the disc, 80–120(–150) µm thick; in thin section with dense

concentrations of plate-like or more irregular crystals of calcium oxalate (H₂SO₄⁺), these 30–80 µm in maximum extent; thalline cortex and algal layer fading distally. *Proper excipulum* brown-black at the ascum base, melanized rather than carbonized, (50–)80–100(–120) µm thick, 25–40 µm thick lateral to the hymenium and dark red-brown to brown-black; uppermost, basal excipular cells, i.e. those adjacent to the hypothecium, somewhat paler than those below, elongate, thick-walled, ± periclinally, 8–16 × 2–3.5 µm. *Epihymenium* usually obscured by the pruina layer which is 15–30(–50) µm thick; if treated with N or H₂SO₄ the pruina dissolves, exposing the brownish upper region of the hymenium. *Hymenium* 80–100(–120) µm thick, heavily inspersed with minute granules, I+ orange-brown, KI+ very pale lilac (soon fading); granules not dissolving in K, N or H₂SO₄. *Hypothecium* hyaline, 15–20(–25) µm thick, not inspersed with granules, with or without sparse, oily globules, I+ orange-brown, KI+ pale lilac to medium blue, this latter colour persisting; cells rounded, thin-walled, 2–3 µm wide, forming a compact paraplectenchyma. *Paraphyses* predominantly simple, strongly conglutinate in water, not separating in K or N, long-celled, not constricted at the septa, 1–1.8(–2.2) µm thick, heavily encrusted with granules that are 0.5–1.5 µm wide; apices neither swollen nor pigmented, with or without sparse branches. *Asci* narrowly to broadly clavate, 8-spored, 70–85 × 16–20 µm [*n* = 10], with a short, tapering stalk; apex broadly rounded and moderately thick; wall KI–. *Ascospores* pale brown or pale greyish brown and 6-locular at maturity, oblong-ellipsoid or cylindrical, straight, with rounded ends, I+ deep red-brown, KI–, (19–)24(–28) × (5.5–)7(–9) µm [*n* = 30]; epispore initially *c.* 2–3 µm thick, *c.* 0.5 µm thick or not apparent at maturity; locules lentiform or more irregular, the end locules often hemispherical; contents clear; post-mature ascospores darker, the locules collapsing, and almost appearing to have true septa. *Pycnidia* not seen.

Chemistry: Thallus containing norstictic acid (major, by TLC, but not producing needle-like crystals in K; Elix 2020).

Etymology: The epithet refers to the diagnostic occurrence of norstictic acid in the thallus.

Remarks

The new species is distinguished from others in the genus by the thallus containing only norstictic acid, lirellae with an unbranched, open disc, an excipulum base (50–)80–100(–120) µm thick, and 6-locular ascospores measuring 19–28 × 5.5–9 µm. Other taxa with 6-locular ascospores include *L. nornotaticum* (A.W.Archer & Elix) A.W.Archer, from north-eastern Australia and the Solomon Islands, with a thallus containing nornotatic acid and hypoprotocetraric acid and a carbonized excipulum base that is *c.* 250 µm thick (Archer 2009). *Leiorreuma taiwanense* M.Nakan., Kashiw. & K.H.Moon, from Taiwan, has a chemistry similar to that of *L. nornotaticum*, the lirellae have a black, canaliculate disc with tapering ends, a much thicker, carbonized proper excipulum, and shorter ascospores than in *L. norsticticum* (Moon *et al.* 2008). Finally, *L. nicobarensis* Pushpi Singh, Jagadeesh & Kr.P.Singh, from the Nicobar Islands, to the east of the Bay of Bengal, is certainly most similar to the newly described lichen in terms of morphology and ascum anatomy, but it has more prominent ascumata with a considerably thicker thalline margin, a thicker excipular base (100–180 µm), and it contains constictic and stictic acids as major substances in place of norstictic acid (Singh *et al.* 2017). Incidentally, the only other *Leiorreuma* known to contain norstictic acid, *L. explicans* (Fink) Lendemer from south-eastern U.S.A., has submuriform ascospores that are 24–31 × 9–12 µm (Lendemer & Knudsen 2008).

Leiorreuma norsticticum is known only from the type locality in Christmas Island. It occurs on a narrow tree branch in primary forest where it is associated with species of *Letrouitia*, *Physcia*, *Porina*, *Pyrenula* and other genera of Graphidaceae.

Acknowledgement

I am grateful to Jack Elix for his chemical analysis (TLC) of the type specimen.

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Figure 1. *Leiorreuma norsticticum* (holotype). Scale: 5 mm.

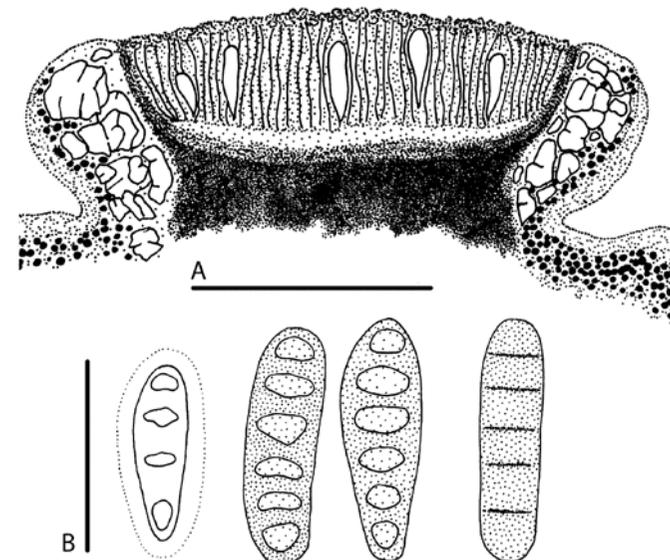


Figure 2. *Leiorreuma norsticticum* (holotype). A, Section of an ascoma (semi-schematic). B, Ascospores (left to right: immature, two mature, post-mature). Scales: A = 0.2 mm; B = 20 μ m.

**Three new species of buellioid lichens
(Caliciaceae, Ascomycota) from Cape Verde**

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Abstract

Amandinea santantaensis Elix & van den Boom, *Buellia rugulata* Elix & van den Boom and *Cratiria capeverdensis* Elix & van den Boom, from Cape Verde, are described as new to science.

Introduction

The Cape Verde archipelago is located in the North Atlantic Ocean, approximately 500 km W of Senegal. In 1976, Follmann and Mies began an investigation of the lichen flora of Cape Verde, culminating in the publication of a critical checklist of *c.* 300 taxa (Mies 1993). More recent papers reported additions to the flora as well as several new species (Giralt & van den Boom 2008; Llop & van den Boom 2009; Arup & van den Boom 2011; van den Boom 2012; Ertz & van den Boom 2012). The present study of buellioid lichens collected by the second author in 2006 revealed three new species: a saxicolous *Amandinea*, a saxicolous species of *Buellia sensu lato* and a lignicolous species of *Cratiria*. None of those species occurs in the Canary Islands, *c.* 1550 km to the north (Giralt & van den Boom 2011).

Material and methods

The study is based on specimens from the private herbarium of the second author; however, holotypes and many duplicates are deposited in CANB. Observations and measurements of photobiont cells, thallus and apothecial anatomy, asci, ascospores and pycnidia were made on hand-cut sections mounted in water and 10% KOH (K). Ascospore measurements were made in water at $\times 1000$ to an accuracy of 0.5 μm . Only free ascospores lying outside the asci were measured. Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K. Medullary sections were treated with 10% sulfuric acid (H_2SO_4), and apothecial sections with 50% nitric acid (N). Chemical constituents were identified by thin-layer chromatography (Elix 2020b) and comparison with authentic samples.

New species

1. *Amandinea santantaensis* Elix & van den Boom, sp. nov.
Mycobank No.: **MB 840877**

Fig. 1

Similar to *Amandinea prospersa* (Nyl.) Elix & H. Mayrhofer, but differs in having smaller *Buellia*-type ascospores, $9\text{--}13 \times 4\text{--}6.5 \mu\text{m}$.

Type: Republic of Cabo Verde (Cape Verde), Santo Antão, SW of Vila das Pombas, Figueiral de Paúl, NE part of valley, area of Lombo de Luzia, $17^\circ 07' 48''\text{N}$, $25^\circ 02' 42''\text{W}$, 180 m alt., on NW vertical wall among plantations with scattered mixed trees and acidic outcrops, *P. & B. van den Boom 36893*, 21.vii.2006 (holotype – CANB).

Thallus crustose, to 25 mm wide and 0.1 mm thick, continuous, rimose to rimose-areolate; areoles irregular, 0.2–1 mm wide, contiguous; upper surface pale yellow to pale yellow-brown, maculate, appearing eroded and pseudosorediate in places; prothallus marginal, yellow-white, \pm fimbriate or not apparent; medulla white, lacking calcium oxalate (H_2SO_4^-), I–; photobiont cells 5–15 μm wide. *Apothecia* 0.1–0.5 mm wide, abundant, lecidine, roundish, scattered,

broadly adnate then sessile; disc black, epruinose, weakly concave to weakly convex. *Excipulum* thick, persistent, concolorous or paler than the disc, initially raised above the disc, in section 17–30 μm thick; outer part brown-black, K–, N+ orange-brown, inner part brown. *Epihymenium* 7–10 μm thick, brown to dark brown, K–, N–. *Hypothecium* 50–100 μm thick, brown. *Hymenium* 50–60 μm thick, colourless, not interspersed; subhymenium 10–15 μm thick, pale brown, not interspersed. *Paraphyses* 1.5–2 μm wide, sparingly branched, with apices 4.5–5.5 μm wide and brown caps. *Asci* *Bacidia*-type, 8-spored. *Ascospores* *Buellia*-type, 1-septate, pale brown then dark brown, ellipsoid, $9\text{--}[11.7]\text{--}13 \times 4\text{--}[5.4]\text{--}6.5 \mu\text{m}$, straight, becoming constricted at the septum; ontogeny of type A; outer wall finely rugulate. *Pycnidia* rare, punctiform, immersed; ostiole black. *Conidia* curved, filiform, $22\text{--}32 \times 0.7 \mu\text{m}$. *Chemistry*: Thallus K–, P–, C–, UV+ orange; containing 4,5-dichlorolichexanthone (major).

Etymology: The species is named after the type locality.

Remarks

The species is characterized by its continuous, rimose to rimose-areolate, pale yellow to yellow-brown, crustose thallus that contains 4,5-dichlorolichexanthone, its broadly adnate to sessile, lecidine apothecia, 0.1–0.5 mm wide, with *Buellia*-type ascospores, $9\text{--}13 \times 4\text{--}6.5 \mu\text{m}$, which become constricted at maturity and have a microrugulate outer spore-wall, and curved, filiform conidia, $22\text{--}32 \times 0.7 \mu\text{m}$. It closely resembles *A. prospersa*, known from acidic rocks in islands in the Caribbean Sea, western North America and tropical Australia (Imshaug 1955; Bungartz *et al.* 2007; Elix *et al.* 2017). However, *A. prospersa* differs in having larger *Orcularia*- then *Physconia*-type ascospores, $10\text{--}[13.5]\text{--}17 \times 5\text{--}[6.6]\text{--}8 \mu\text{m}$, and usually contains thuringione (major) and arthothelin (minor or trace). *Amandinea pilbarensis* Elix from monsoon tropical Australia has similar-sized *Buellia*-type ascospores, but it differs in having a white to pale cream thallus, shorter conidia, 12–20 μm long, and in containing thiophanic acid (Elix 2020a).

At present, *A. santantaensis* is only known from the type collection. Associated lichens include *Caloplaca demissa* (Körb.) Arup & Grube and several *Peltula* species including *P. euploca* (Ach.) Poelt, *P. obscurans* (Nyl.) Gyeln., *P. omphaliza* (Nyl.) Wetmore, *P. patellata* (Bagl.) Swinscow & Krog and *P. rodriguesii* (Cromb.) Büdel.

2. *Buellia rugulata* Elix & van den Boom, sp. nov.
Mycobank No.: **MB 840878**

Fig. 2

Similar to *Buellia herveyensis* Elix, but differs in having larger ascospores, $15\text{--}29 \times 8\text{--}13 \mu\text{m}$, and in containing terpenes in addition to atranorin.

Type: Republic of Cabo Verde (Cape Verde), Santiago, W of São Domingos, N of Rui Vaz near village, $15^\circ 02' 18''\text{N}$, $23^\circ 35' 42''\text{W}$, 855 m alt., on NW exposed vertical rock on rocky mountain with some shrubs, *P. & B. van den Boom 36478*, 9.vii.2006 (holotype – CANB; isotype – herb. van den Boom).

Thallus crustose, to 30 mm wide and 0.4 mm thick, continuous, rimose-areolate; areoles irregular, 0.1–0.8 mm wide, contiguous; upper surface creamy white to pale brown or yellow-brown, smooth, maculate; prothallus marginal, black or not apparent; medulla white, lacking calcium oxalate (H_2SO_4^-), I–; photobiont cells 5–15 μm wide. *Apothecia* 0.2–1 mm wide, lecidine, roundish, scattered or rarely confluent, broadly adnate then sessile; disc black, epruinose, flat but soon convex. *Excipulum* initially thick, concolorous with the disc, excluded in convex apothecia, in section 80–100 μm thick, cupular; outer part brown-black to deep red-brown, K–, N–; inner part pale red-brown. *Epihymenium* 8–10 μm thick, red-brown to brown, K–, N–. *Hypothecium* 100–250 μm thick, red-brown to dark brown. *Hymenium* 75–100 μm thick, colourless, not interspersed; subhymenium 10–15 μm thick, pale brown, not interspersed. *Paraphyses* 1.5–2 μm wide, sparingly branched, with apices 3–5.5 μm wide and pale brown caps. *Asci* *Bacidia*-type, 8-spored. *Ascospores* *Buellia*-type, 1-septate, pale brown then dark

brown, ellipsoid, 15–[23.0]–29 × 8–[10.1]–13 µm, straight, becoming weakly constricted at the septum; outer wall markedly rugulate. *Pycnidia* common, punctiform, superficial, 50–150 µm wide; ostiole brown-black. *Conidia* elongate-bacilliform, straight, 7–14 × 0.7 µm. *Chemistry*: Thallus K+ yellow, KC–, P+ pale yellow, C–, UV–; containing atranorin (major), 7β-acetoxyhopane-22-ol (minor), hopane-7β,22-diol (major).

Etymology: The species is named after the markedly rugulate outer wall of the ascospores.

Remarks

The species is characterized by its continuous, rimose-areolate, creamy white, crustose thallus that contains atranorin, its broadly adnate to sessile, lecideine apothecia, 0.2–1 mm wide, with *Buellia*-type ascospores, 15–29 × 8–13 µm, which become constricted at maturity and have a very strongly rugulate outer spore-wall, and elongate-bacilliform conidia, 7–14 × 0.7 µm. It closely resembles *B. herveyensis*, known from siliceous rocks in tropical Australia, and *B. dimbulahensis* Elix, occurring on siliceous rocks in northern Australia and Indonesia (Elix 2015). All three species have similar thalli, relatively large ascospores, and elongate-bacilliform conidia, and occur on siliceous rocks in the tropics. *Buellia dimbulahensis* differs from the other two species in having somewhat shorter ascospores, 14–23 µm long, and in containing 4,5-dichlorolichexanthone. *Buellia herveyensis* differs from *B. rugulata* in having shorter conidia, 8–11 µm long, and in lacking the terpenes present in the latter.

At present this species is known from two collections from the island of Santiago. Associated lichens at the type locality include *Caloplaca scoriophila* (A.Massal.) Zahlbr., *Dirinaria appplanata* (Fée) D.D.Awasthi, *Lecanora sulphurella* Hepp, *Lichinella stipatula* Nyl., *Opegrapha subelevata* Nyl. and *Tephromela atra* (Huds.) Hafellner. At the second locality, *Buellia rugulata* is associated with several *Peltula* species, including *P. euploca* (Ach.) Poelt, *P. omphaliza* (Nyl.) Wetmore and *P. rodriguesii* (Cromb.) Büdel.

ADDITIONAL SPECIMEN EXAMINED

Republic of Cabo Verde (Cape Verde). ● Santiago, SE of Assomada, along road to Praia, between Picos and João Teves, 15°04'30"N, 23°37'24"W, 460 m alt., on W-exposed vertical outcrops on N-exposed slope, *P. & B. van den Boom 36561*, 13.vii.2006 (CANB).

3. *Cratiria capeverdensis* Elix & van den Boom, sp. nov. Fig. 3
Mycobank No.: **MB 840879**

Similar to *Cratiria dissimilis* (Nyl.) Marbach, but differs in having inflated, stunted isidia, longer ascospores, 14–24 µm long, and in containing arthothelin rather than norstictic acid.

Type: Republic of Cabo Verde (Cape Verde), Santiago, W of São Domingos, WNW of Rui Vaz, "Monte Tchopa", near telecommunication station, 15°02'12"N, 23°37'30"W, 1085 m alt., on exposed roots of *Eucalyptus* in hilly area with low exposed outcrops and mixed trees, *P. & B. van den Boom 36411*, 8.vii.2006 (holotype – CANB; isotype – herb. van den Boom).

Thallus crustose, to 12 mm wide and 0.15 mm thick, continuous, rimose-areolate, becoming isidiate; isidia simple to subcoralloid, inflated at apices, to 0.6 mm high and 0.2 mm wide; upper surface off-white to pale grey-brown, scurfy, matt; prothallus not apparent; medulla lacking calcium oxalate (H₂SO₄–), I–; photobiont cells 7–20 µm wide. *Apothecia* 0.1–0.5 mm wide, abundant, lecideine, roundish, scattered, broadly adnate then sessile; disc black, epruinose, weakly concave then plane to convex. *Excipulum* initially thick, concolorous with the disc, excluded in older, convex apothecia, in section 50–60 µm thick; outer part brown-black, K–, N+ orange-brown, inner part brown. *Epihymenium* 10–12 µm thick, dark brown, K–, N–. *Hypothecium* 60–100 µm thick, brown to dark brown, to 200 µm thick when adjoining central stipe. *Hymenium* 40–65 µm thick, colourless, not interspersed; subhymenium 10–15 µm thick, pale brown, not interspersed. *Paraphyses* 1–2 µm wide, sparingly branched, with apices 4–5.5 µm wide and brown caps. *Asci* *Bacidia*-type, 8-spored. *Ascospores* *Cratiria*- then

Buellia-type, 1-septate, pale then dark brown, ellipsoid, 14–[19.5]–24 × 5–[8.3]–11 µm, straight, becoming constricted at the septum, juvenile spores with weak apical wall thickenings; ontogeny of type A; outer wall smooth. *Pycnidia* rare, punctiform, immersed; ostiole black. *Conidia* bacilliform, 3–4 × 0.7–1 µm.

Chemistry: Thallus, K–, C+ pale orange, P–, UV+ orange; containing arthothelin.

Etymology: This species is named after the type locality.

Remarks

The species is characterized by an off-white to pale grey-brown, rimose-areolate thallus, simple to subcoralloid isidia with inflated apices, a non-inspersed hymenium, *Cratiria*- then *Buellia*-type ascospores, 14–24 × 5–11 µm, with weak apical wall-thickenings and a smooth outer spore-wall, short bacilliform conidia 3–4 µm long, and by the presence of arthothelin. There are two other known isidiate species of *Cratiria* from Asia and the Pacific, *C. dissimilis* and *C. exalbida* (Kremp.) Marbach (Marbach 2000). Both differ from *C. capeverdensis* in having smaller ascospores, 10–20 × 5–8 µm, and in containing atranorin and norstictic acid. *Cratiria jamesiana* Elix & H.Mayrhofer, a saxicolous species from Ascension Island, is somewhat similar in having a warted upper surface and containing arthothelin and thuringione, but it differs in having an interspersed hymenium, pruinose discs and shorter *Physconia*- then *Buellia*-type ascospores, 15–20 µm long (Elix & Mayrhofer 2020).

At present this species is only known from the type collection. Associated lichens include a *Collema* sp., a *Physcia* sp., *Rinodina polymorphaespora* Giralt & van den Boom and *Sculptolumina japonica* (Tuck.) Marbach. The latter is a new record for Cape Verde.

Acknowledgement

Special thanks are due to Bern van den Boom for her important fieldwork.

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Figure 1. *Amandinea santantaoensis* (holotype in CANB). Scale = 1 mm.



Figure 2. *Buellia rugulata* (holotype in CANB). Scale = 1 mm.



Figure 3. *Cratiria capeverdensis* (holotype in CANB). Scale = 1 mm.

A new saxicolous species of *Enterographa* (lichenized Ascomycota, Roccellaceae) from Lord Howe Island, Australia

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Abstract

Enterographa reticulata sp. nov. (Roccellaceae) is described from basalt in Lord Howe Island (New South Wales). In addition, *E. ophiolithica* Kantvilas, recently described from Tasmania, is reported for the first time from the south coast of New South Wales.

Introduction

Enterographa Fée sens. lat. (Roccellaceae) includes at least 60 mainly tropical and subtropical species that grow on bark, rock or leaves, or as parasites of other lichens (Sparrius 2004; Lücking 2008; Seavey & Seavey 2014; Cannon *et al.* 2021). Thirteen taxa are currently known from Australia and its oceanic island territories (Sparrius 2004; McCarthy & Elix 2016, 2018; Kantvilas 2021). In this contribution, *E. reticulata* is described as new from basalt in lowland forest in Lord Howe Island, while another saxicolous species, *E. ophiolithica* Kantvilas, is reported for the first time from New South Wales.

Methods

Observations and measurements of photobiont cells, thalline and ascomatal anatomy, asci, ascospores, and conidia were made on hand-cut sections mounted in water. Calcium oxalate was detected by treatment of thallus sections with a 10% aqueous solution of sulfuric acid; it forms colourless, needle-shaped crystals. Asci were observed in Lugol's Iodine (I), with and without pretreatment in K; the former procedure (KI) also yielded abundant crystals of norstictic acid originating from the sectioned excipulum. The specimen was analyzed for lichen substances by high-performance liquid chromatography (HPLC; Elix 2020).

New species

Enterographa reticulata P.M.McCarthy, sp. nov.
Mycobank No.: **MB 842303**

Figs 1, 2

Characterized by the rather thick cream-white thallus containing calcium oxalate but lacking lichen substances. Ascumata are dark greyish brown to blackish in surface view, almost punctiform and immersed in the thallus, not in pseudostromata; these coalesce as narrow, elongate and anastomosing lirellae. The cupulate excipulum contains norstictic acid, proximal parts of the hymenium and the pale brown hypothecium are interspersed with minute granules, and the narrowly clavate, 8-spored asci contain fascicles of 3(–5)-septate, elongate-fusiform ascospores measuring $32\text{--}45 \times 2.5\text{--}3.5 \mu\text{m}$.

Type: Australia, New South Wales, Lord Howe Island, Max Nicholls Track, $31^{\circ}31'08''\text{S}$, $159^{\circ}03'01''\text{E}$, 100 m alt., on basalt in lowland, subtropical forest on a broad ridge, *J.A. Elix 42399*, 9.ii.1995 (holotype – CANB).

Thallus crustose, epilithic, the type specimen a continuous colony at least 7.5 cm wide, richly but delicately rimose to obscurely areolate, smooth, cream-white, epruinose, $0.1\text{--}0.3(–0.5)$ mm thick. *Cortex* absent. *Algae Trentepohlia*; cells $8\text{--}18(–20) \times 8\text{--}15 \mu\text{m}$, not forming a distinct layer in the thallus; interstitial hyphae rather long-celled, $2\text{--}3(–4) \mu\text{m}$ wide. *Medulla* chalky white in section, containing abundant calcium oxalate (H_2SO_4^+), I–, KI– or patchily KI+ blue near ascumata. *Prothallus* thin, greyish brown, when separating adjacent thalli bounded on both sides by rows of pycnidia. *Ascumata* very numerous, immersed in the thallus, not in distinct pseudostromata, initially grey-brown to blackish (paler when wetted), plane,

rounded or ellipsoid in outline, dull to slightly glossy, the surface smooth or becoming faintly canaliculate in more elongate ascumata, epruinose, $70\text{--}100(–120) \mu\text{m}$ wide, coalescing to form lirelliform aggregations $0.4\text{--}3(–5)$ mm long [$n = 30$], the lirellae branching and anastomosing to form ascumatal reticula $5\text{--}10(–20)$ mm wide. *Proper excipulum* visible only in thin section, cupulate, with hyaline to pale brown apices, the vertical side-walls medium brown and $20\text{--}35 \mu\text{m}$ thick, the excipulum base dark brown and $30\text{--}50 \mu\text{m}$ thick. *Epihymenial layer* absent. *Hypothecium* pale brown, $30\text{--}40 \mu\text{m}$ thick, with granular inclusions. *Hymenium* $90\text{--}120 \mu\text{m}$ thick, not interspersed with granules or oil globules above; basal levels with or without granules; hymenial gel I+ dark bluish green, KI+ pale to medium blue. *Paraphysoids* strongly conglutinate in water, loosening in K, branched and anastomosing above, simple or sparingly branched below, long-celled, $0.8\text{--}1.2 \mu\text{m}$ wide; apical cells not swollen or up to $2.5(–3) \mu\text{m}$ thick, not pigmented. *Asci* narrowly clavate, 8-spored, $65\text{--}82 \times 12\text{--}15 \mu\text{m}$ [$n = 15$], with a non-amyloid wall and a narrow tholus ($2\text{--}3 \mu\text{m}$ thick) that lacks an ocular chamber but has a thin amyloid cap at maturity; ascoplasm and ascospores I+ dark orange-brown. *Ascospores* colourless, usually forming two overlapping fascicles in the ascus, 3(–5)-septate at maturity, elongate-fusiform, straight or slightly curved, not constricted at the septa, $(32\text{--})38(–45) \times (2.5\text{--})3(–3.5) \mu\text{m}$ [$n = 25$]; perispore to $0.5 \mu\text{m}$ thick around immature spores, not apparent at maturity; apices rounded or subacute; contents clear. *Pycnidia* very numerous, immersed in the thallus, plane and dark greyish brown above, hyaline below, $50\text{--}80 \mu\text{m}$ wide, solitary or forming loose clusters of $20\text{--}50(–100)$. *Conidia* hyaline, simple, filiform, usually curved or arcuate, $10\text{--}15(–18) \times c. 0.5 \mu\text{m}$.

Chemistry: No lichen substances detected in the thallus by HPLC (Elix 2020); norstictic acid produced in the proper excipulum (K+ crystals).

Etymology: The epithet *reticulata* refers to the net-like arrangement of the anastomosing lirellae.

Remarks

Enterographa reticulata is characterized by the thallus lacking lichen substances but with ascumata that contain norstictic acid, the latter initially \pm punctiform but developing into extensive, reticulate lirellae, as well as narrowly fusiform and predominantly 3-septate ascospores. Similar disjunct chemistry has been reported from several other *Enterographa* species, although none is saxicolous or exhibits comparable thallus and ascumatal morphology and anatomy (Seavey & Seavey 2014).

Comparison with other saxicolous Australian species of *Enterographa* further confirms the distinctiveness of the new lichen. Thus, *E. cretacea* P.M.McCarthy & Elix, from coastal rocks in south-eastern mainland Australia and Tasmania, has a thallus containing dehydroconstipatic acid (major) and 7-septate ascospores of $18\text{--}30 \times 4\text{--}5.5 \mu\text{m}$ (McCarthy & Elix 2016; Kantvilas 2021), while *E. ophiolithica* Kantvilas, previously a Tasmanian endemic (Kantvilas 2021, and see below), lacks thalline substances and ascumatal norstictic acid and produces ascospores that are 3(–)5–7(–8)-septate and $20\text{--}30 \times 4\text{--}6 \mu\text{m}$. Finally, *E. subgelatinosa* (Stirt.) Redinger, which occurs in similar habitats in northern New Zealand, Lord Howe Island, Tasmania and Western Australia, has a thallus containing gyrophoric and psoromic acids, and its mainly 6–7-septate ascospores are $18\text{--}30 \times 3.5\text{--}5 \mu\text{m}$ (Sparrius 2004; Kantvilas 2021).

This species is known only from the type locality in Lord Howe Island where it grows on sheltered basalt in lowland forest.

New record

Enterographa ophiolithica Kantvilas, *Muelleria* **40**, 36 (2021)

This species was previously known from a single locality on the west coast of Tasmania where it grows on serpentinite boulders and outcrops on the seashore at Trial Harbour (Kantvilas 2021).

SPECIMENS EXAMINED

New South Wales: • South Coast, Green Cape Peninsula, below lighthouse, 37°15'34"S, 150°02'52"E, c. 3 m alt., on hard, deeply shaded sandstone, *P.M. McCarthy 4762*, 21.iii.2018 (CANB); • South Coast, Jervis Bay, Vincentia, c. 1 km S of Plantation Point, 35°04'22"S, 150°41'41"E, c. 2–3 m alt., on sheltered sandstone, *P.M. McCarthy 4594 p.p.*, 23.v.2017 (CANB).

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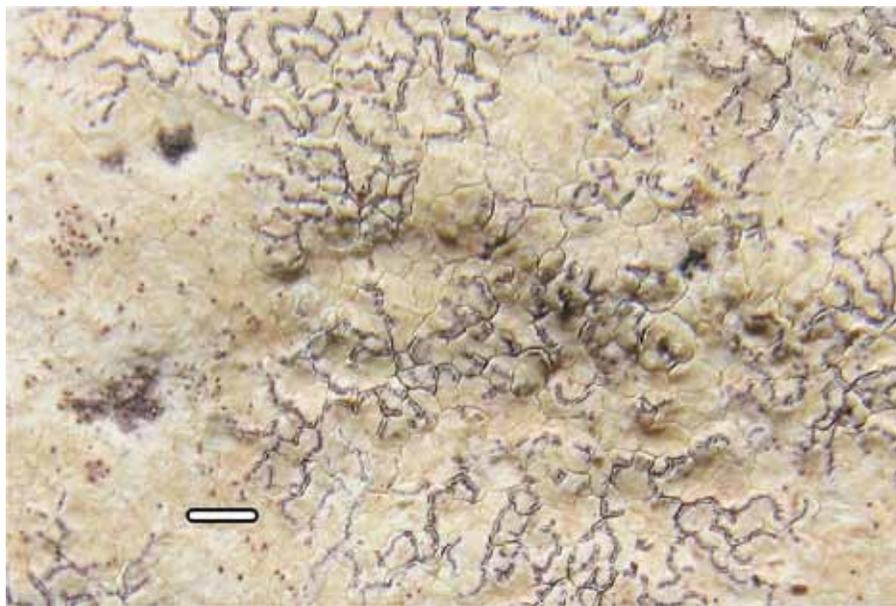


Figure 1. *Enterographa reticulata* (holotype). Scale = 1 mm.

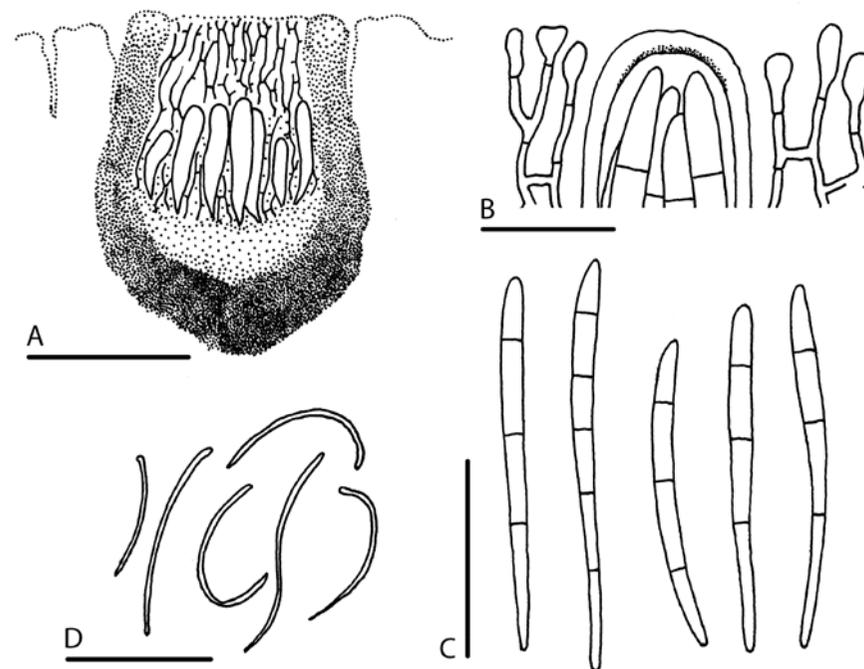


Figure 2. *Enterographa reticulata* (holotype). A, Vertical section through an ascoma (semi-schematic); B, Apices of an ascus and several paraphysoids; C, Ascospores; D, Conidia. Scales: A = 0.1 mm; B, D = 10 μ m; C = 20 μ m.

***Pannaria crispella* comb. nov. and *P. campbelliana* Hue,
two overlooked lichens from New Zealand**

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Abstract

Psoroma sphinctrinum var. *crispellum* has been considered a synonym of *Pannaria implexa*, but it is a distinct species, recombined here as *P. crispella*. It forms a thin, filmy thallus on tree trunks, and consists of rounded, confluent squamules surrounded by a distinct black prothallus. The apothecia are initially simple with a well-defined central thalline plug. However, the plug soon expands into a labyrinth-like structure with undulate margins, unlike those of any other Pannariaceae. The ascospores are long-tailed, as in *P. implexa*, but otherwise smooth, and the species contains argopsin, very rarely reported from the family except for the parmelielloid clade. *Pannaria campbelliana*, previously also considered to be a synonym of *P. implexa*, is shown here to represent a second well-founded species, characterized by thick, geotropically arranged squamules, a distinct fibrous prothallus, apothecia with a prominent simple thalline plug and short-ellipsoid spores lacking apiculate extensions.

Introduction

During field work in Egmont National Park, Taranaki, in 2016, a conspicuous, corticolous, squamulose Pannariaceae species was collected. It was common and formed large patches, occasionally more than 50 cm across, although possibly formed by several confluent thalli. The thalli were thin and firmly attached, and their apothecia were abundant and densely packed.

During later herbarium studies, this distinctive lichen was identified as *Psoroma sphinctrinum* var. *crispellum* Nyl., described by Nylander in 1863 and based on a Colenso collection from New Zealand (*Colenso 4705*, BM). At the time, Nylander treated *Psoroma* as part of *Lecanora*, and in a later paper on the lichens of New Zealand's subantarctic Campbell Island (Nylander 1876), he stated that the lichen was a 'quasi' *Lecanora sphinctrina*, because its thallus was microphylline and the margins of its apothecia were crispate-contorted. Hence, he recombined it as *Lecanora pholidotoides* f. *crispella* (Nyl.) Nyl., citing only the *Colenso 4705* specimen. Later, he recognized it among Filhol's collections from Campbell Island, and included it in his list from that island as 'sur les écorces' ('on bark') (Nylander 1888). He stated its basionym, and added to the *Colenso 4705* specimen a collection by Knight.

Hue (1906) maintained the *Colenso 4705* collection as the only reference for the name *Psoroma sphinctrinum* var. *crispellum*, and noted that it had long-apiculate perispores. However, the specimen from Campbell Island collected by Filhol in 1874 and determined as the same taxon by Nylander (1876), was instead described by Hue (1906) as *Pannaria campbelliana* Hue, characterized by spherical to short-ellipsoid spores.

Those two taxa have been interpreted as *Psoroma implexum* Stirt. by later review studies (Galloway 1985, 2007; Jørgensen 2006). The latter species was recombined as *Pannaria implexa* (Stirt.) Passo, Calvelo & Stenroos by Passo *et al.* (2008), who also provided phylogenetic support. Later Passo & Calvelo (2011) revised their interpretation, and the material from South America was transferred to a new species, *Pannaria byssoidea* Passo & Calvelo. *Pannaria implexa* was redefined as a New Zealand endemic, with *Psoroma sphinctrinum* var. *crispellum*, *Pannaria campbelliana* and *Psoroma spectabile* Zahlbr. listed as synonyms.

The aim of the present study is to investigate whether *Psoroma sphinctrinum* var. *crispellum* represents a separate taxon which deserves recognition at species level. The newly recognized species will be compared with taxa previously regarded as synonyms, *Pannaria campbelliana* in particular.

Material and methods

This paper is based on material from the herbaria AK, BM, CHR, H, MAF, PC, TROM, TUR-V and WELT; *Pannaria crispella* was searched for in other herbaria, but unsuccessfully.

Ascospore structures were studied in water mounts and restricted to spores liberated from their asci. Detailed drawings of 23 ascospores from four samples of *P. crispella* and seven from the sample of *P. campbelliana* were made, and copies of the sketches were included with the specimens. Thin-layer chromatography of acetone extracts followed standardized procedures, and used solvents A and C (Orange *et al.* 2010). Nomenclature of ascospore structures follows Nordin (1997).

The species

***Pannaria crispella* (Nyl.) Elvebakk, comb. nov.**
Mycobank No.: **MB 842299**

Figs 1–5, 7

Type: New Zealand, (North Island, Manawatu-Wanganui Region) "on Podocarpus Cunningham. Forests, Ruahine", Oct. 27 [year not stated], *W. Colenso 4705*, (BM–lectotype!; WELT L1120–isolectotype!; H–isolectotype!). Basionym: *Psoroma sphinctrinum* var. *crispellum* Nyl., *Syn. Meth. Lich.* **2**, 25 (1863). ≡ *Lecanora pholidotoides* f. *crispella* (Nyl.) Nyl., *Compt. Rend. Hebd. Séanc. Acad. Paris, Sér. D*, **83**, 89 (1876).

Thallus squamulose, tripartite, corticolous, forming patches 10–60 cm wide; *hypothallus/prothallus* distinct, prothallus forming a peripheral border 2 mm wide, black, fine-textured. *Chlorobiont squamules* initially as 0.1 mm wide, scattered granules on the prothallus, soon expanding to 1 mm wide squamules with weakly incised, obtuse lobes, then coalescing centrally into an areolate and continuous crust, some lobes overlapping, strongly attached, 0.05–0.1 mm thick. *Upper surface* matt, pale greyish green when fresh and dry, salad-green when fresh and moist, young herbarium specimens immediately turning reddish brown after application of water, older herbarium specimens gradually becoming dark brown after long storage, glabrous except for a minute tomentum along margins, seen as pruinose when moist. *Cortex c.* 30 µm thick, upper part thin and sclerenchymatic, lower part pale and paraplectenchymatic, lumina mostly isodiametric, 5–10 µm, or weakly elongated, arranged perpendicularly to the upper surface, walls 2–3 µm thick, *Chlorobiont layer c.* 30 µm thick, below the cortex, of *Trebouxia* cells, globose, 5–10 µm diam., chloroplasts papillose. *Medulla* 20–30 µm thick, white; *lower cortex* absent. *Cyanobiont Nostoc*, in dark grey, placodioid cephalodia growing on the chlorobiont, 0.5–1 mm wide, forming densely adpressed, radiating lobules, c. 0.2 mm wide, common. *Nostoc* cells greyish green, irregularly subglobose to ellipsoid, 4–6 × 2–3 µm, organized within small glomeruli and without visible chain structures. *Apothecia* common, substipitate when juvenile and less than 0.5 mm wide, with smooth brown discs, but soon developing thalline structures consisting of a concave, central squamule, seen as a plug-like structure, mostly also accompanied on the disc by small secondary thalline granules. This develops further into an intricate, labyrinth-like, strongly convex apothecial structure 2–3 mm wide. *Thalline excipulum* 0.1–0.2 mm broad, crenulate, of small inrolled lobules, 0.1 mm wide, in older apothecia developing a strongly undulating, crispate pattern. *Epithecium* pale brown, c. 15 µm thick; *hymenium* pale, 100–120 µm, IKI+ blue; *hypothecium* brownish, 60–80 µm; algal layer discontinuous below the hypothecium, but forming extensions penetrating through the hymenium and forming thalline plugs. *Paraphyses* simple, septate, 1.5–2 µm wide, weakly swollen and fused apically in the epithecium. *Asci* clavate, c. 80 × 15 µm, with 8 spores. *Ascospores* regularly ellipsoid to weakly citriform or ovoid, 14–22 × 9–12 µm, perispores thin and even except for long-apiculate, apical extensions, 22–50 × 10–14 µm. *Pycnidia* not seen.

Chemistry: Argopsin detected by TLC.

Etymology: The species is named for its strongly crispate and undulate apothecial margins.

SPECIMENS EXAMINED

New Zealand. • *C. Knight* (TUR VAIN-12002b) (with no further information); *Taranaki Region*: • Taranaki/Egmont National Park, North Egmont, nature walk just S of the Visitor Centre, 39°16'15"S, 174°05'45"E, 960 m alt., on a trunk of *Podocarpus*, forming a 60-cm-long patch, *A. Elvebakk 16:151*, 28.ii.2016 (TROM); *Hawke's Bay Region*: • Hawke's Bay, near Napier, on rimu, *W. Colenso*, iv.1885 (WELT L1765); *Wellington*: • Wellington Land District, Tauwharenikau, *V.D. Zotov*, viii.194x (CHR 545611); *Marlborough Region*: • Queen Charlotte Sound, saddle 1 km S of Mount Furneaux, 41°06'S, 174°13'E, 580 m alt., on bark of *Podocarpus totara*, *A.E. Wright 1184*, 2.i.1992 (AK 205028); • *loc. id.*: *B.W. Hayward* (AK205390); *Canterbury Region*: • 700 m N of Arthur's Pass Village near bridge over McGrath Creek, 42°55'45"S, 171°33'29"E, 780 m alt., on light-exposed *Nothofagus solandri* trees near the road, *A. Elvebakk 16:236*, 1.iii.2016 (TROM); • 500 m S of Arthur's Pass, start of Bealey Valley Track, 42°54'53"S, 171°33'28"E, 870 m alt., forming a 20–30 cm wide patch on *Nothofagus solandri* in forest, *A. Elvebakk 16:190*, 28.ii.2016 (TROM); • Taranaki Region, Taranaki/Egmont National Park, nature walk just S of the Visitor Centre, 39°16'15"S, 174°05'45"E, 960 m alt., on a trunk of *Podocarpus*, forming a large patch, 26.ii.2016, • *loc. id.* *A. Elvebakk 16:149* (TROM); *A. Elvebakk 16:153* (TROM); • *loc. id.* *A. Elvebakk 16:154* (TROM); • *loc. id.* also over moss and filmy ferns, *A. Elvebakk 16:157a* (TROM); • North Egmont, c. 1 km along Veronica Loop Track, S of the Park Centre, 39°16'39"S, 174°05'14"E, 1150 m alt., *A. Elvebakk 16:120*, 24.ii. 2016 (TROM).

Pannaria campbelliana Hue, *Nouv. Arch. Mus. Nat. Hist. Sér. 4*, **8**, 271 (1906) Figs 6–7

Type: Expedition astronomique a l'Île Campbell, 1874, *M. Filhol* (H-NYL 30769—lectotype; *vide* Galloway 1985: 476); PC-HUE! – isolectotype, *vide* Galloway (2007: 1466); ≡ *Psoroma campbellianum* (Hue) Zahlbr., *Cat. Lich. Univ.* **3**, 267 (1925). For a description, see Hue (1906).

The isolectotype carries Nylander's handwriting, and Hue's personal species number "1136" has been written on the envelope; in contrast, he used "1133" for what is here recognized as *P. crispella*. The material (Figs 6A and B) consists of separate pieces of a squamulose thallus, possibly having measured 2–5 cm across. Squamules are entire to weakly divided, forming obtuse lobules, 0.2 mm thick, clearly scalariform, resting on a coarse black hypothallus continuing as a 2–3 mm wide, fibrose prothallus. No cephalodia were seen. Apothecia are common, 0.5–1.5 mm diam.; discs concave centrally with thalline plugs; excipulum 0.3 mm wide, crenate, of inrolled, obtuse lobes, 0.2 mm broad, on the isolectotype, mostly absent due to grazing by invertebrates. All apothecia have black necrotic spots centrally, and mature spores seen were very few. However, the ascospores are ellipsoid to ovoid and weakly citriform, 14–17 × 9–11 μm; perispores indistinctly verrucose when immature, otherwise with low verrucae and without apical extensions, 15–18 × 10–12 μm (Fig. 7). The lectotype contains pannarin by TLC (J.A. Elix pers. comm.).

Discussion and conclusions

While Pannariaceae cyanolichens are well understood in New Zealand, tripartite species within the genera *Pannaria* and *Psoroma* are difficult to identify due to many undescribed or misunderstood taxa. Those challenges need to be solved species by species, which is time-consuming. The squamulose species of *Pannaria* are among the most difficult. Three South American taxa were recently transferred to the new genera *Hispidopannaria* and *Phormopsora* (Elvebakk *et al.* 2020), in addition to the two species documented by Passo *et al.* (2008) and Passo & Calvelo (2011).

Here, it is shown that the present interpretation of *P. implexa* is too broad. *Pannaria crispella* is instead a distinct species, with a very thin (< 0.1 mm), filmy thallus, strange labyrinth-like apothecia, deserving the description 'apotheciis crispato-contortis contiguis' by Nylander (1863). Cephalodia have radiating, placodioid lobules, and perispores are long-apiculate with otherwise smooth walls. Perispores resemble those of *P. implexa*, but differ in

the lengths of the apiculi and the structure of the walls. *Pannaria crispella* contains argopsin, which is common in parmelielloid genera, such as *Erioderma*, e.g. Jørgensen (2001b), but rarely reported from other major clades within Pannariaceae. *Pannaria crenulata* P.M.Jørg. was reported to contain vicanicin and argopsin by Jørgensen (2001a:115; 2004: 239), and Ekman *et al.* (2014: 648) indicated in their key that *Fuscopannaria* and *Protopannaria* rarely contain argopsin. *Pannaria crispella* will probably turn out to be a widespread forest species in much of New Zealand. During my field work, it appeared to be common both in Taranaki and near Arthur's Pass. It is also very conspicuous, easily identified in the field, and is a New Zealand endemic. *Pannaria campbelliana* has been the subject of a limited study here, which, however, confirms Hue's claim (1906) that it is a distinct species. The thallus differs from that of *P. crispella*, and more closely resembles *P. implexa*. However, the squamules are clearly geotropically arranged, and the ascospores differ from both of those species in lacking apiculate extensions. The spores more closely resemble the South American *P. byssoidea* Passo & Calvelo, which also has a strongly developed, fibrose prothallus. However, the squamules of the latter are not geotropically arranged, its thallus has a thicker, almost pulvinate hypothallus/prothallus, and the species contains leprolomin (Passo & Calvelo 2011).

Many specimens collected on the Auckland and Campbell Islands by H. Imshaug and co-workers have been determined as *Psoroma campbellianum*. According to GBIF there are 43 specimens in MSC alone, and many have been distributed to other herbaria. Among those seen by me, only one (Auckland Island, mature *Metrosideros* forest on north side, near head of Musgrave Inlet, near sea level, *H.A. Imshaug 56536*, 28.ii.2016, (MAF L4559)) has been examined microscopically. Based on spore characters, it was determined as *P. implexa*. The status of *Pannaria campbelliana* in these islands remains unknown, except for the studied type material. Further herbarium specimens should be studied, as well as material from the southern part of South Island and Stewart Island, and fresh samples for a phylogeny would be particularly welcome. In any case, it remains clear that *P. campbelliana* should be recognized as a separate species rather than a synonym of *P. implexa*.

After the segregation of *Hispidopannaria* and *Phormopsora* from *Pannaria*, *Pannaria byssoidea* formed a well-supported sister group to the remaining foliose species of *Pannaria* represented in the phylogram by Elvebakk *et al.* (2020). The generic affiliations of an apparently heterogeneous assemblage of squamulose *Pannaria s.l.* species remain unresolved, and a future phylogenetic study is planned. However, type studies are also required to resolve species circumscriptions. *Psoroma pholidotoides* (Nyl.) Trevis. is a name that has mostly been erroneously used for specimens of *Xanthopsoroma contextum* (Stirt.) Elvebakk; see Elvebakk *et al.* (2010). However, the basionym of *Psoroma pholidotoides* is either conspecific with *Pannaria implexa*, in which case the former name would take priority, or it represents a neighbouring taxon. The latter interpretation is presently used also for *Psoroma caliginosum* Stirt., a topic under further study. The type of *Psoroma spectabile* Zahlbr. at W was on loan and not available during a visit there. However, the species was described by Zahlbruckner as having small squamules (< 1 mm wide), and apothecia that are large, lecanorine, rounded, undulate at maturity, and measuring up to 3.5 mm wide (Zahlbruckner 1941). He also stated that the spores had rounded apices and were evenly surrounded by perispores ("apicibus rotundatis, membrana mediocri et laevi cinctae"). That would exclude *P. spectabile* from being a synonym of *Pannaria implexa*, and related to *P. campbelliana* instead. If shown to be conspecific by future studies, the name *P. campbelliana* will take priority.

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Fig. 1. *Psoroma sphinctrinum* var. *crispellum*, lectotype.



Fig. 2. *Pannaria crispella* along a path in Egmont National Park. The specimen was sampled as *Elvebakk 16:151*.



Fig. 3. A moist specimen of *Pannaria crispella* in Egmont National Park, sampled as *Elvebakk 16:157A*. The associated species in the upper left corner is *Megalospora knightii* Sipman.



Fig. 4. *Pannaria crispella*, *Elvebakk 16:151*, photo: Julia Brekmo. Scale-bar = 1 cm.



Fig. 5. *Pannaria crispella*, Elvebakk 16:151, photo: Julia Brekmo. Scale-bar = 0.5 cm.



Fig. 6B. *Pannaria campbelliana*, isolectotype, photo: Mari Karlstad



Fig. 6A. *Pannaria campbelliana*, isolectotype. Scale bar = 1 cm.

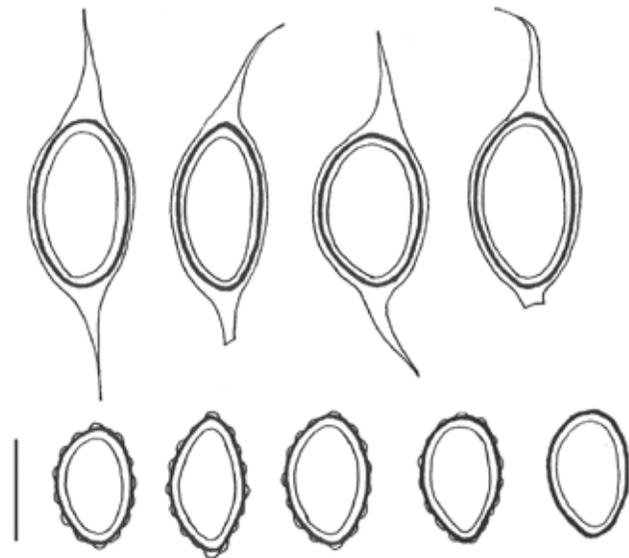


Fig. 7. Ascospores of *Pannaria crispella* (upper row) and *P. campbelliana*.

New species of *Megalaria* (lichenized Ascomycota, Ramalinaceae) from Queensland, Lord Howe Island and Norfolk Island, Australia

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Abstract

Four species of *Megalaria* Hafellner are described as new from tropical and subtropical Australia: *M. australiensis* from eastern Queensland and Lord Howe Island (corticolous and containing atranorin; excipulum bilayered, internally pale with variously orientated hyphae; epihymenium N+ maroon or blood-red; hymenium 70–100 µm thick; ascospores 12–23 × 4–7.5 µm); *M. crystallifera* from Lord Howe Island (corticolous and containing atranorin; excipulum internally pale, with tightly packed, radiating hyphae, the oblong to moniliform cells containing K-soluble crystals; epihymenium N+ purple; hymenium 55–90 µm thick; ascospores 10–17 × 4.5–7 µm); *M. norfolkensis* from Norfolk Island (corticolous and containing atranorin; excipulum bilayered, internally pale with variously orientated hyphae; epihymenium N+ deep maroon; hymenium 100–160 µm thick; ascospores 13–24 × 6–11 µm); and *M. stratosa* from north-eastern Queensland and Lord Howe Island (saxicolous and lacking lichen substances; excipulum multilayered, internally dense and very dark; epihymenium N+ violet or purple-violet; hymenium 60–100 µm thick; ascospores 9.5–18 × 4–7 µm).

Introduction

Megalaria Hafellner (Ramalinaceae) is an almost cosmopolitan genus of *c.* 45 mainly corticolous, crustose species. The thallus is often wide-spreading and robust, usually pale, smooth, granular or verruculose, occasionally isidiate, rarely sorediate, completely lacking lichen substances or with a very limited suite of depsides, depsidones and terpenoids, and it contains a unicellular green photobiont. Apothecia are comparatively large, usually sessile and mainly or completely black, lacking a thalline margin but with a usually thick and persistent, sometimes comparatively pale proper margin that is internally a cupulate proper excipulum, an amyloid hymenium with *Biatora*- or *Bacidia*-type asci or a variant of the *Lecanora*-type, simple, sparingly branched or somewhat anastomosing paraphyses, and small to moderately large, colourless, 1-septate ascospores (Hafellner 1984; Coppins 1992; Ekman & Tønberg 1996; Fryday 2004, 2007; Galloway 2007; Jagadeesh Ram *et al.* 2007; Kalb 2007; Fryday & Lendemer 2010; Fryday & Knight 2012; Lendemer *et al.* 2016; McMullin & Lendemer 2016; Su & Ren 2017; Wang *et al.* 2019; Aptroot *et al.* 2021; Cannon *et al.* 2021; Nimis & Martellos 2021).

Sixteen species of *Megalaria* are known from mainland Australia and its oceanic islands (McCarthy 2020). Recent contributions have included detailed accounts of the genus in Tasmania (Kantvilas 2008, 2016), as well as new taxa and new records from temperate, subtropical and wet-tropical localities (McCarthy & Elix 2016a, b; Elix & McCarthy 2018). In this paper four species are described as new from eastern Queensland and the Australian territories of Lord Howe Island and Norfolk Island in the south-western Pacific Ocean. All have a superficial, off-whitish to pale grey-green thallus that is sparingly rimose to areolate, smooth to minutely granulate or verruculose and lacks soralia and isidia, and all, apart from *M. stratosa* (the only saxicolous species), contain atranorin in major concentrations. The jet-black apothecia are sessile, usually persistently marginate, mostly 0.5–1(–1.4) mm in diameter, they have a deep red to medium or dark red-brown hypothecium (the colour usually intensifying in N), an indigo to blue-black epihymenium and comparatively small ascospores.

Methods

Observations and measurements of photobiont cells, thalline and apothecial anatomy, asci, ascospores, pycnidial anatomy and conidia were made on hand-cut sections mounted in water; apothecial sections were also treated with 10% potassium hydroxide (K) and 50% nitric acid (N). Calcium oxalate was detected by treatment of thallus fragments with a 10% aqueous solution of sulfuric acid (H₂SO₄); it forms colourless, needle-shaped crystals. Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K. Chemical constituents were identified by thin-layer chromatography (Elix 2020) and comparison with authentic samples.

The species

1. *Megalaria australiensis* P.M. McCarthy & Elix Mycobank No.: MB 841085

Figs 1, 5B, 6A

Characterized by an epiphloeodal thallus containing atranorin (major), uniformly black apothecia 0.33–0.98 mm wide, each with a pale, inner excipulum of loose and variously orientated hyphae, usually lacking crystals, and a thin outer layer of mainly blue-black, thick-walled, radiating hyphae, a blue-black epihymenium (N+ maroon or blood-red), a deep red to medium or deep red-brown or dark brown hypothecium (N+ intensifying or blood-red to crimson), asci that are 58–75 × 11–17 µm in a hymenium 70–100 µm thick, and rather elongate, 1-septate ascospores (12–23 × 4–7.5 µm).

Type: Australia, Queensland, Newell, 6 km NE of Mossman, 16°25'S, 145°24'E, 1 m alt., on *Bruguiera* stem in mangrove vegetation beside creek estuary, *H. Streimann 31064*, 6.vii.1984 (holotype – CANB).

Thallus crustose, epiphloeodal, off-white to pale creamy grey or pale to medium greenish grey or pale greyish green, continuous to sparingly or richly rimose, less commonly areolate (the areoles 0.2–1 mm wide), dull, smooth or irregularly and minutely granulate or verruculose, (40–)90–150(–200) µm thick, not containing calcium oxalate (H₂SO₄–), I–; soredia and isidia absent. *Cortex* absent, but the thallus often with a hyaline, amorphous alga-free layer to 10–15 µm thick. *Algal layer* poorly delimited, to *c.* 100 µm thick; cells green, chlorococcoid, 6–11 (–13) µm diam.; interstitial hyphae short-celled, thin-walled, *c.* 2.5–3.5 µm wide. *Medulla* indistinct. *Prothallus* blackish and sharply defined, or diffuse, broad and bluish black, or not apparent. *Apothecia* usually very numerous, solitary, paired or forming clusters of 3–6 proliferating from a single apothecium, (0.33–)0.61(–0.98) mm wide [*n* = 238; clusters to 1.7 mm wide], becoming sessile; margin usually glossy black, entire, often flexuose, not very prominent, 50–90 µm thick, persistent to maturity but then thin, fissured or ragged, becoming excluded; disc at first slightly concave to plane, later undulate or weakly to moderately convex, dull jet-black, occasionally piebald or dark pinkish brown, smooth to minutely uneven, epruinose. *Proper excipulum* cupulate, 60–90(–120) µm thick laterally and at the base, of 2 well-defined layers (see Fig. 5B): i) inner layer adjacent to the hypothecium ± pale brownish grey, 40–70(–100) µm thick, of comparatively loose, variously orientated hyphae 2–3 µm wide, often with lacunae and scattered or clustered crystals to *c.* 20 µm wide (K–, N–, H₂SO₄–); ii), outer layer of radiating hyphae (prosoplectenchymatous), 20–30(–40) µm thick, the hyphae directed outwards laterally and downwards basally, tightly coherent, 1.5–2.5 µm wide, with a thick coat 5–8(–10) µm wide; in the lateral excipulum this layer uniformly blue-black, or with hints of red-brown, K+ deep purple-brown to reddish black in part, N+ maroon to deep maroon; in the basal excipulum with the outermost *c.* 10–15 µm hyaline to pale blue, the innermost half of this zone blue-black. *Hypothecium* 70–130(–150) µm thick, not interspersed with granules or oil globules, deep red to medium or deep red-brown or dark brown (darkest in the centre, paler towards the hymenium and the excipulum base), N+ intensifying or blood-red to crimson, K+ intensifying or maroon to red-black; hyphae variously orientated, 2.5–4 µm wide. *Hymenium* 70–100 µm thick, not interspersed, uniformly hyaline, or diffuse brownish

adjacent to the hypothecium, KI+ deep blue, N-, K-. *Epihymenium* usually well-delimited, medium grey-brown to blue-black, 10–20(–25) μm thick, N+ maroon or blood-red, K- or K+ bluish green. *Paraphyses* usually simple for most of their length, with sparse branches and anastomoses mainly in the epihymenium, tightly conglutinate in water, 1–1.5(–2) μm thick; apical cells usually swollen and rounded, 2–3(–4) μm wide, thick-walled, these and the subtending hyphal cell blue-black. *Asci* narrowly to broadly clavate or clavate-cylindrical, almost exclusively 8-spored, 58–75 \times 11–17 μm [$n = 25$]; tholus with a narrow, tube-like, moderately to deeply amyloid zone. *Ascospores* narrowly ellipsoid or oblong-ellipsoid to somewhat fusiform, hyaline, 1-septate, overlapping-uniseriate to irregularly biseriata in the ascus, not or only slightly constricted at the septum, straight or slightly bent, (12–)17(–23) \times (4–)5.5(–7.5) μm [$n = 388$; 179 ascospores (c. 46%) 17 μm long or longer; cf. *M. crystallifera* and *M. stratosa*, below]; apices rounded or subacute; wall smooth, 0.8–1.2 μm thick; epispore not apparent. *Pycnidia* not seen.

Chemistry: Thallus containing atranorin (major) by TLC.

Etymology: The epithet *australiensis* refers to this being an Australian species.

Remarks

The corticolous *M. australiensis* has ascospores that are longer than those of *M. crystallifera* and the saxicolous and TLC-negative *M. stratosa* (12–23 μm long vs 9.5–18 μm ; Fig. 6), the blue-black epihymenium reacts maroon or blood-red in N and the bilayered excipulum is pale with variously orientated hyphae internally but radiating-prosopectenchymatous and bluish black near the surface. While excipular anatomy is closer to that of *M. norfolkensis* than the multilayered *M. stratosa*, the more-or-less uniformly pigmented hypothecium of *M. australiensis* differs from that of the Norfolk Island species which is distinctly bilayered (darker below and paler above), while the ascospores are narrower ((4–)5.5(–7.5) μm vs (6–)8(–11) μm ; Fig. 6).

The similarly small-spored *M. laureri* (Th.Fr.) Hafellner, a predominantly temperate species across the Northern Hemisphere, has also been reported from tropical and temperate Australia (South Australia, Queensland, New South Wales and Tasmania; McCarthy 2020), although not always with unambiguous certainty (*vide* Kantvilas 2008). A corticolous species with little or no atranorin in its thallus, and an apothecial margin that is often paler than the blackish disc (Coppins 1992; Cannon *et al.* 2021; Nimis & Martellos 2021), apothecial sections have a dominant, pink or purple-pink pigment that intensifies pinkish in K and reacts N+ orange (Kantvilas 2008, 2019; Cannon *et al.* 2021; Nimis & Martellos 2021). The corticolous *M. hafellneriana* Kantvilas, another small-spored species known only from southern New South Wales, Victoria and Tasmania, is characterized by its granular thallus that lacks lichen substances and apothecial sections dominated by blue-green, N+ crimson pigments (Kantvilas 2016).

Two endemic species in New Zealand, *M. maculosa* (Stirt.) D.J.Galloway and *M. sublivens* (Nyl.) D.J.Galloway, also produce small 1-septate ascospores, but both have a pale hypothecium (Galloway 1985, 2007). The saxicolous *M. obhudens* (Nyl.) Fryday & Lendemer (syn. *M. imshaugii* Fryday), from Chile and Campbell Island, New Zealand, has a much thicker, areolate thallus lacking lichen substances, as well as a thicker hymenium and longer asci (Fryday 2004; Fryday & Lendemer 2010). Finally, *M. columbiana* (G.Merr.) S.Ekman, a rather common corticolous lichen on the west coast of North America, has small ascospores similar to those of *M. australiensis*, but also a red to red-black excipulum, a brown to red-brown epihymenium and a bright blue-green hypothecium (Noble 1980, as *Catillaria*; Ekman & Tønsberg 1996).

Megalaria australiensis grows on the twigs, branches and trunks of rainforest trees and those in strand and mangrove vegetation in the wet-tropics and subtropics of eastern Queensland; it is also known from a palm trunk in moist forest in Lord Howe Island in the south-western Pacific Ocean. Associated species include *Astrothelium meristosporum* (Mont. & Bosch.) Aptroot & Lücking, *Brigantaea tricolor* (Mont.) Trevis., *Coccocarpia palmicola* (Spreng.) Arv. & D.J.Galloway, *Heterodermia appendiculata* (Kurok.) Swinscow & Krog, *Lecanora dissoluta* Nyl., *Letrouitia domingensis* (Pers.) Hafellner & Bellem., *Parmeliella*

mariana (Fr.) P.M.Jørg. & D.J.Galloway, *Pyxine fallax* (Zahlbr.) Kalb, *Relicinopsis malacensis* (Nyl.) Elix & Verdon and *Trypethelium eluteriae* Spreng.

ADDITIONAL SPECIMENS EXAMINED

Queensland: ● Annan River, Grass Tree Pocket Road, 37 km S of Cooktown, 15°48'S, 145°14'E, 240 m alt., on tree trunk in monsoon forest on gentle ridge, *H. Streimann 46387*, 11.xii.1990 (CANB); ● Lookout over Barron Falls, Atherton Tableland, 16°50'S, 145°39'E, on bark in rainforest, *W.H. Ewers 8561*, 29.ix.1991 (CANB); ● Tinaroo Dam, 2 km past dam wall, Atherton Tableland, 17°10'S, 145°33'E, on twig in rainforest, *W.H. Ewers 8118*, 25.ix.1991 (CANB); ● Tully Gorge, 49 km NW of Tully, 17°45'20"S, 145°37'39"E, 145 m alt., on fallen tree trunk at margin of rainforest, *J.A. Elix 36967, 37004*, 28.vii.2006 (CANB); ● Garners Beach, 23 km NE of Tully, 17°49'S, 146°06'E, 1 m alt., on dead *Bruguiera* in strand vegetation, *H. Streimann 45502*, 1.xii.1990 (CANB); ● Stony Creek, Bowen State Forest, 25 km NNW of Yeppoon, 22°55'S, 150°39'E, 100 m alt., on shrub in remnant monsoon forest in head of gully, *J.A. Elix 34568*, 24.viii.1993 (CANB); ● Coochiemudlo Island, near Brisbane, 23°34'S, 153°20'E, 1–5 m alt., on bark in mixed mangrove vegetation, *C.H. Miller 128*, 30.viii.1984 (CANB).

New South Wales, Lord Howe Island: ● track to Goathouse Cave, at base of escarpment of Mt Lidgbird, 31°33'48"S, 159°05'11"E, 380 m alt., on base of palm in moist semi-tropical forest, *J.A. Elix 42085*, 7.ii.1995 (CANB).

2. *Megalaria crystallifera* P.M.McCarthy & Elix
Mycobank No.: **MB 841086**

Figs 2, 5C, 6B

Characterized by an epiphloeodal thallus containing atranorin (major), uniformly black apothecia 0.35–0.83 mm wide, each with a comparatively pale, inner excipulum of tightly packed, radiating hyphae with oblong to moniliform cells containing K-soluble crystals and 10–16 \times 5–10 μm , a blue-black epihymenium (N+ purple), a deep red to deep red-brown hypothecium (N+ intensifying or blood-red), asci that are 40–61 \times 10–16 μm in a hymenium 55–90 μm thick, and small, 1-septate ascospores (10–17 \times 4.5–7 μm).

Type: Australia, New South Wales, Lord Howe Island, track to Goathouse Cave, at base of escarpment of Mt Lidgbird, 31°33'48"S, 159°05'11"E, 380 m alt., on tree trunk in moist semi-tropical forest, *J.A. Elix 42077*, 7.ii.1995 (holotype – CANB).

Thallus crustose, epiphloeodal, greenish white to pale creamy grey, continuous to sparingly to richly and intricately rimose, or areolate (the areoles 0.3–0.8 mm wide), dull, smooth or irregularly and minutely uneven, (40–)60–100(–120) μm thick, with or without crystal-like inclusions of calcium oxalate (H_2SO_4^+ or H_2SO_4^-), I-; soredia and isidia absent. *Cortex* absent, but the thallus usually with an uppermost hyaline, amorphous alga-free layer to 20–35 μm thick. *Algal layer* poorly defined and discontinuous, to c. 70 μm thick; cells green, chlorococcoid, 6–12 μm diam.; interstitial hyphae short-celled, thin-walled, c. 2–3.5 μm wide. *Medulla* indistinct. *Prothallus* marginal, blackish and sharply defined, or patchy or not apparent. *Apothecia* usually very numerous, solitary, paired or forming clusters of 3 or 4 proliferating from a single apothecium, (0.35–)0.61(–0.83) mm wide [$n = 111$], becoming sessile; margin usually glossy black, entire, not very prominent, 40–70 μm thick, soon becoming excluded; disc plane to slightly convex, dull, jet-black, smooth to minutely uneven, epruinose. *Proper excipulum* cupulate, 55–100(–130) μm thick laterally and at the base, of 2 or 3 well-delimited layers (see Fig. 5C): i) inner layer appearing whitish in the cut surface of a vertically sectioned apothecium, \pm pale brownish grey in thin section, 40–90(–120) μm thick, lacking lacunae and large crystals, of tightly packed downwardly and outwardly radiating hyphae; cells 10–16 \times 5–10 μm , oblong or moniliform, thick-walled, packed with elongate crystals (1.5–2.5 μm long) most of which dissolve in K; ii) outer layer of radiating hyphae (prosopectenchymatous), 12–25 μm thick, the hyphae tightly coherent, with a thick coat 7–11 μm wide; in the lateral excipulum this layer uniformly blue-black, K+ indigo, N+

deep maroon; in the basal excipulum the hyphae with blue-black caps; iii) outermost, amorphous, hyaline layer 5–10 µm thick (not always present). *Hypothecium* 70–110(–130) µm thick, not interspersed with granules or oil globules, deep red to deep red-brown, with a sharply defined border with the excipulum base, N+ intensifying or blood-red, K+ intensifying or maroon. *Hymenium* 55–80 µm thick, not interspersed, uniformly hyaline or diffusely pale brownish adjacent to the hypothecium, KI+ deep blue, N–, K–. *Epihymenium* well-delimited and blue-black or patchily pigmented, 10–20(–25) µm thick, N+ purple, K– or K+ bluish green. *Paraphyses* usually simple for most of their length, with sparse branches and anastomoses mainly in the epihymenium, tightly conglutinate in water, 1–1.5(–2) µm thick; apices deeply pigmented, slightly swollen and often rounded, 1.5–2.5(–3) µm wide. *Asci* narrowly to broadly clavate, 8-spored, 40–61 × 10–16 µm [*n* = 25]; tholus with a narrow, tube-like, moderately to deeply amyloid zone. *Ascospores* narrowly ellipsoid or oblong-ellipsoid to somewhat fusiform, hyaline, 1-septate, overlapping-uniseriate to irregularly biseriolate or distally massed in the ascus, not or only slightly constricted at the septum, straight, curved or bent, (10–)14(–17) × (4.5–)5.5(–7) µm [*n* = 150; with 1 ascospore 17 µm long]; apices rounded or subacute; wall smooth, 0.8–1.2 µm thick; epispore not apparent. *Pycnidia* not seen. *Chemistry*: Thallus containing atranorin (major) by TLC.

Etymology: The epithet *crystallifera* refers to the K-soluble crystals of the massively impregnated excipulum.

Remarks

While the thallus of *M. crystallifera* contains abundant atranorin, and thus matches the three other corticolous species described here, its small ascospore dimensions, the thickness of the hymenium and the similarly pigmented and N-reactive epihymenium agree instead with the saxicolous *M. stratosa*. However, the excipulum is bilayered, not multilayered as in the latter taxon, with a comparatively pale, inner excipulum of radiating prosoplectenchymatous or moniliform hyphae, the cells containing massed K-soluble crystals, while in the basal outer excipulum the hyphal tips have distinctive, blue-black caps. Indeed, the faintly powdery appearance of the crystalliferous tissues of the excipulum is usually visible even on the cut surface of a vertically sectioned apothecium.

This lichen grows on the branches and trunks of trees in lowland, subtropical forest in Lord Howe Island in the south-western Pacific Ocean. Associated species include *Menegazzia lordhowensis* Elix, *Parmotrema crinitum* (Ach.) M.Choisy, *Parmotrema reticulatum* (Taylor) M.Choisy, *Phyllopsora foliata* (Stirt.) Zahlbr., *Phycia soredata* Nyl., *Porina eminentior* (Nyl.) P.M.McCarthy and *Pyrenula anomala* (Ach.) Vain.

ADDITIONAL SPECIMENS EXAMINED

New South Wales, Lord Howe Island: ● Intermediate Hill via track to North Hummock, 31°32'45"S, 159°04'55"E, 120 m alt., on *Cryptocarya* in poor lowland forest with dense shrub cover on steep slope, *J.A. Elix 42028*, 5.ii.1995 (CANB); ● track from Smoking Tree Ridge to Rocky Run, 31°33'35"S, 159°05'09"E, 170 m alt., on tree in lowland forest on moderate slope, *J.A. Elix 42433, 42444*, 10.ii.1995 (CANB).

3. *Megalaria norfolkensis* P.M.McCarthy & Elix
Mycobank No.: **MB 841087**

Figs 3, 5D, 6C

Characterized by an epiphloeodal thallus containing atranorin (major), uniformly black apothecia 0.45–1.48 mm wide, each with a comparatively pale, inner excipulum of loose and variously orientated hyphae, usually lacking crystals, and a thin outer layer of mainly blue-black, thick-walled, radiating hyphae, a blue-black epihymenium (N+ deep maroon), a bilayered hypothecium (pale to medium red-brown above, dark red-brown below; N+ intensifying), 4–8-spored asci (75–90 × 14–20 µm) in a hymenium 100–160 µm thick, and moderately large, 1-septate ascospores (13–24 × 6–11 µm).

Type: Australia, Norfolk Island, Mount Pitt National Park, track between Mt Pitt and Mt Bates, 29°00'05"S, 167°56'05"E, 270 m alt., on *Nestigia* in disturbed forest, *J.A. Elix 27391*, 15.vi.1992 (holotype – CANB).

Thallus crustose, epiphloeodal, whitish to pale greenish grey, continuous to sparingly rimose, not forming areoles, dull, mainly smooth but partly minutely and irregularly granulose-verruculose, 40–100 µm thick, not containing calcium oxalate (H₂SO₄–), I–; soredia and isidia absent. *Cortex* absent, but the thallus with a patchy, hyaline, amorphous alga-free layer 10–20 µm thick. *Algal layer* poorly delimited, 30–60 µm thick; cells green, chlorococcoid, 6–10 (–12) µm diam.; interstitial hyphae short-celled, thin-walled, *c.* 2.5–3.5 µm wide. *Medulla* indistinct. *Prothallus* blackish, discontinuous. *Apothecia* sparse, solitary, (0.45–)0.82(–1.48) mm wide [*n* = 45], becoming sessile; margin glossy black, entire to crenulate and often flexuous, not very prominent, 40–80 µm thick, usually persisting to maturity; disc plane to slightly convex, dull jet-black, smooth, epruinose. *Proper excipulum* cupulate, 50–90 µm thick laterally, 90–150 µm thick at the base, of 2 distinct layers (see Fig. 5D): i) inner layer adjacent to the hypothecium ± pale brownish grey, 70–110 µm thick, of comparatively loose, variously orientated hyphae 2–3 µm wide, often with lacunae and scattered or clustered crystals to *c.* 30 µm wide (these largely dissolving in N); ii), outer layer of radiating hyphae (prosoplectenchymatous), 25–35(–45) µm thick, the hyphae directed outwards laterally and downwards basally, tightly coherent, *c.* 1 µm wide, with a thick coat 4–6 µm wide; in the lateral excipulum this layer uniformly blue-black, K+ indigo, N+ violet; in the basal excipulum with the outermost *c.* 10–15 µm hyaline to pale blue, the innermost half of this zone blue-black. *Hypothecium* 100–150 µm thick, not interspersed with granules or oil globules, ± bilayered, pale to medium red-brown above, dark red-brown below, N+ intensifying, K+ deep maroon below. *Hymenium* 100–140(–160) µm thick, not interspersed, uniformly hyaline, KI+ deep blue, N–, K–. *Epihymenium* blue-black, 15–25 µm thick, N+ deep maroon, K– or K+ blue. *Paraphyses* simple for most of their length, with sparse branches and anastomoses mainly in the epihymenium, tightly conglutinate in water, 1–1.5 µm thick; apical cells deeply pigmented, swollen and often rounded, 2–4 µm wide. *Asci* narrowly to broadly clavate, 4-spored (with 4 others minute or aborted) or 8-spored, 75–90 × 14–20 µm [*n* = 10]; tholus with a narrow, tube-like, moderately to deeply amyloid zone. *Ascospores* narrowly to broadly ellipsoid, hyaline, 1-septate, overlapping-uniseriate to irregularly biseriolate in the ascus, not or only very slightly constricted at the septum, mostly straight, (13–)18(–24) × (6–)8(–11) µm [*n* = 130]; apices rounded or subacute; wall smooth, *c.* 1 µm thick; epispore not apparent. *Pycnidia* not seen.

Chemistry: Thallus containing atranorin (major) by TLC.

Etymology: The epithet refers to the occurrence of this species in Norfolk Island.

Remarks

Currently the rarest of the four newly described taxa, *M. norfolkensis* has an excipular anatomy almost identical to that of *M. australiensis* (Fig. 5), while its corticolous thallus also contains atranorin, and the epihymenium is N+ deep maroon. However, the hymenium is thicker (100–160 µm vs 70–100 µm), the ascospores are broader (6–11 µm wide vs 4–7.5 µm; Fig. 6), and the deep red to brown hypothecium is distinctly bilayered (darker below and paler above) rather than more-or-less uniformly pigmented as in *M. australiensis*. Apothecial pigmentation and reactions further distinguish *M. norfolkensis* from *M. laureri* and *M. hafellneriana* (see above), while the thinner and uniformly paler hypothecia of the small-spored corticolous New Zealand endemics *M. maculosa* and *M. sublivens* are also distinctive and diagnostic.

This lichen is known only from the type locality in Norfolk Island in the south-western Pacific Ocean, where it grows on a trunk of *Nestigia* in disturbed forest and in association with *Dirinaria applanata* (Fée) D.D.Awasthi, *Heterodermia subcomosa* (Nyl.) Elix, *Parmotrema reticulatum* (Taylor) M.Choisy, *Phyllopsora buettneri* (Müll.Arg.) Zahlbr., *Pyrenula cruenta* (Mont.) Vain., *Pyxine cocoes* (Sw.) Nyl. and *Ramalina stevensiae* Elix.

Characterized by an epilithic thallus lacking lichen substances, uniformly black apothecia 0.32–1.46 mm wide, each with a multilayered and comparatively dark excipulum lacking crystals, and with only the outermost hyphae radiating, with a blue-black epihymenium (N+ violet or purple-violet), a deep red or maroon to deep red-brown or brown-black hypothecium (N+ deep red, blood-red or crimson), asci that are 43–65 × 10–15 µm in a hymenium 60–80 (–100) µm thick, and small, 1-septate ascospores (9.5–18 × 4–7 µm).

Type: Australia, Queensland, 30 km SSE of Cooktown, Wallaby Creek, Home Rule Falls, 15°44'S, 145°18'E, 240 m alt., on semi-shaded, siliceous rock in gorge beside permanent creek, in *Tristaniopsis*-dominated forest, *H. Streimann* 57533, 23.x.1995 (holotype – CANB; according to the label, duplicate in B, *n.v.*).

Thallus crustose, epilithic, off-white to pale grey, pale greenish grey or pale to medium yellowish grey, continuous to sparingly or richly rimose, or areolate (areoles 0.2–1(–1.5) mm wide), dull, smooth or irregularly and minutely granulose or verruculose, (50–)100–250(–500) µm thick, not containing calcium oxalate (H₂SO₄–), I–; soredia and isidia absent. *Cortex* 10–15(–25) µm thick, of poorly defined periclinal hyphae 2–2.5 µm wide or thick-walled paraplectenchymatous cells, or apparently ecorticate, but the thallus often with only a hyaline, amorphous alga-free layer to 10–15(–20) µm thick. *Algal layer* poorly delimited or forming a continuous layer to 70–120(–180) µm thick; cells green, chlorococcoid, (5–)6–12(–14) µm diam.; interstitial hyphae short-celled, thin-walled, *c.* 2–2.5 µm wide. *Medulla* indistinct, the lower levels of the thallus dominated by substratum material. *Prothallus* dark grey to blackish and sharply defined between adjacent thalli, or not apparent. *Apothecia* usually numerous, solitary, paired or forming clusters proliferating from a single apothecium, (0.32–)0.75(–1.46) mm wide [*n* = 310], becoming sessile; margin usually glossy black, entire or minutely uneven and fissured or crenulate, often flexuous, prominent or not, 50–80(–100) µm thick, persistent to maturity or becoming excluded; disc at first slightly concave to plane, later undulate or moderately convex, dull greyish black to jet-black, smooth, epruinose. *Proper excipulum* cupulate, 55–90(–130) µm thick laterally, 90–150(–180) µm thick at the base, predominantly blue-black, N+ deep violet, K+ paler blue-black or greyish black infused purple, of 3 or 4 well-delimited layers (see Fig. 5A): i) innermost layer adjacent to the hypothecium dense and very dark, 50–80 µm thick, ± parenchymatous; ii), this subtended by a looser, anatomically similar and slightly paler zone (50–80(–100) µm thick) often with minute lacunae and small scattered crystals (K–, N–, H₂SO₄–); iii) a radiating hyphal layer 10–25 µm thick, the hyphae directed outwards laterally and downwards basally, tightly coherent, *c.* 2–3 µm wide, with a thick coat 6–10 µm wide; iv) outermost, amorphous, hyaline layer 5–10(–15) µm thick (not always present). *Hypothecium* 50–80(–120) µm thick, not interspersed with granules or oil globules, red or maroon to deep red-brown or brown-black, N+ deep red, blood-red or crimson, K– or K+ purple or maroon. *Hymenium* 60–80(–100) µm thick, not interspersed, uniformly hyaline or patchily brownish and reduced in post-mature apothecia, KI+ deep blue, N–, K–. *Epihymenium* usually well-delimited, indigo to blue-black, 8–15(–20) µm thick, N+ violet or purple-violet, K–. *Paraphyses* simple to sparingly branched, with sparse anastomoses, tightly conglutinate in water, 1–1.5(–1.8) µm thick; apices deeply pigmented, slightly to strongly swollen and rounded (2.5–3.5(–4) µm). *Asci* narrowly to broadly clavate or clavate-cylindrical, (4–)8-spored, 43–65 × 10–15 µm [*n* = 25]; tholus penetrated almost to the apex by a broad apical cushion that is bordered by a narrow, moderately to deeply amyloid zone; ocular chamber low-convex to hemispherical. *Ascospores* narrowly to broadly ellipsoid or oblong-ellipsoid to somewhat fusiform, hyaline, 1-septate, overlapping-uniseriate to irregularly biseriolate in the ascus, not or only slightly constricted at the septum, straight or slightly bent, occasionally ± fabiform, (9.5–)14.5(–18) × (4–)5(–7) µm [*n* = 366; 10 ascospores (*c.* 3%) 17 µm long or longer]; apices rounded or subacute; wall smooth, 0.8–1.2 µm thick; epispore not apparent. *Pycnidia* absent, or present and numerous (seen in two of the eight specimens

examined), semi-immersed to almost completely immersed in the thallus, 50–90 µm wide, obpyriform to subglobose; apex dark brown to blackish and 15–25 µm thick, hyaline below; conidiophores simple, 15–25 µm long and *c.* 0.8 µm wide. *Conidia* narrowly ellipsoid or fusiform to bacilliform, 2–3(–3.5) × 0.5–0.8 µm.
Chemistry: No substances detected by TLC.

Etymology: The epithet *stratosata* (layered) refers to the anatomy of the excipulum in thin section.

Remarks

Megalaria stratosata, the only exclusively saxicolous lichen among the new species, has a thallus that lacks lichen substances, comparatively short and narrow ascospores, and the epihymenium reacts violet or purple-violet in N. Most distinctively, it has a multilayered excipulum, with or without a hyaline, amorphous external layer (Fig. 5). Like two of the three other new taxa (but not *M. norfolkensis*), it has a thin hymenium less than 100 µm deep. Another small-spored saxicolous species, *M. oblundens* (Nyl.) Fryday & Lendemer (syn. *M. imshaugii* Fryday), from Chile and Campbell Island, New Zealand, has an anatomically far less intricate excipulum, a thicker hymenium, a thin, dark blue hypothecium and asci 80–85 µm long (Fryday 2004).

This lichen grows on various siliceous rock types in rainforest and scrub and in lowland, subtropical forest in north-eastern Queensland and Lord Howe Island in the south-western Pacific Ocean. Associated species include *Buellia dimbulahensis* Elix, *Cratiria vioaxanthina* (Elix) Kalb & Elix, *Dirinara flava* (Mull. Arg.) C.W. Dodge, *Letrouitia bifera* (Nyl.) Hafellner, *Parmotrema crinitum* (Ach.) M. Choisy, *Pyxine pungens* Zahlbr., *Pyxine subcinerea* Stirt. and *Xanthoparmelia amplexula* (Stirt.) Elix & J. Johnst.

ADDITIONAL SPECIMENS EXAMINED

Queensland: ● type locality, *H. Streimann* 57532, 57536, 57538, 23.x.1995 (CANB; according to the labels, duplicates in B, *n.v.*); ● 32 km SSE of Cooktown, Slaty Creek, Home Rule, 15°45'S, 145°17'E, 230 m alt., on semi-exposed, siliceous rock, in forest on moderate slope, *H. Streimann* 64530, 29.viii.1999 (CANB; according to the label, duplicate in B, *n.v.*); ● 18 km NNE of Proserpine, Charleys Creek, 20°15'S, 148°38'E, 50 m alt., on basalt in poor, scrubby forest on rocky hillside, *J.A. Elix* 21004 & *H. Streimann*, 30.vi.1986 (CANB).
New South Wales, Lord Howe Island: ● Max Nicholls Track, 31°31'08"S, 159°03'03"E, 50 m alt., on basalt in dry, lowland forest, *J.A. Elix* 32730, 20.vi.1992 (CANB); ● Goathouse Cave, at base of escarpment of Mt Lidgbird, 31°33'50"S, 159°05'15"E, 420 m alt., on semi-shaded basalt rockface in moist forest, *H. Streimann* 55842, 7.ii.1995 (CANB; according to the label, duplicate in B, *n.v.*); ● Boat Harbour, 31°33'40"S, 159°05'50"E, 3 m alt., on basalt rocks along foreshore in disturbed lowland vegetation with palms, *J.A. Elix* 42474, 10.ii.1995 (CANB; according to the label, duplicates in B, H, NY, *n.v.*).

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Figure 1. *Megalaria australiensis* (holotype in CANB). Scale = 1 mm.



Figure 2. *Megalaria crystallifera* (holotype in CANB). Scales = 2 mm.



Figure 3. *Megalaria norfolkensis* (holotype in CANB). Scale = 2 mm.

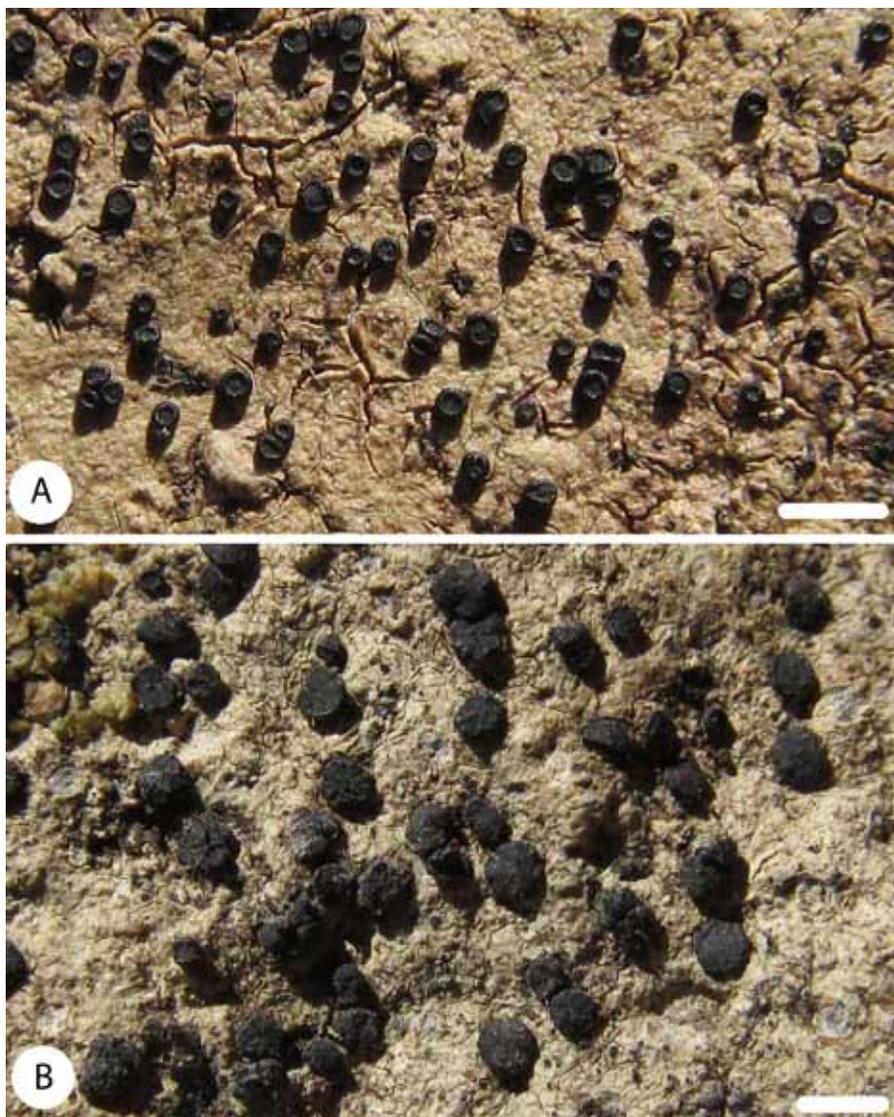


Figure 4. *Megalaria stratosa*. A, *H. Streimann* 57533 (holotype in CANB); B, *H. Streimann* 55842 (CANB). Scales = 2 mm.

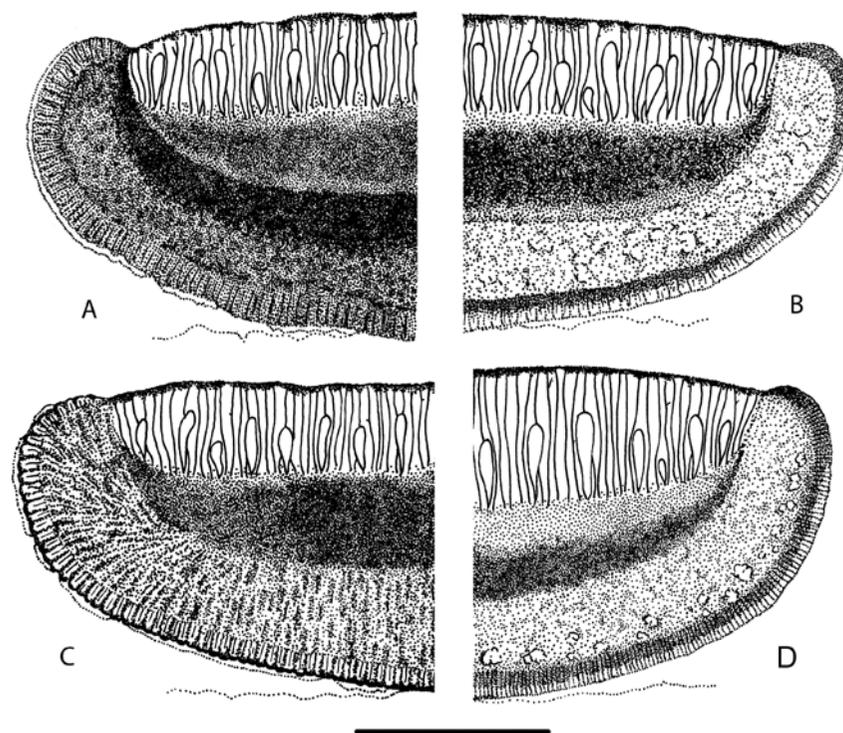


Figure 5. Sectioned apothecia of the new *Megalaria* species. (semi-schematic). A, *M. stratosa*; B, *M. australiensis*; C, *M. crystallifera*; D, *M. norfolkensis*. Scale = 0.2 mm.

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Abstract

Three species are reported from Antarctica: *A. gremmenii* Øvstedal sp. nov., *A. narssaquensis* (Lynge) Thomson, which is new to the Southern Hemisphere, and *Oxneriaria virginea* (Hue) S.Y.Kondr. & L.Lökös, which is already known from the region.

Introduction

Few species of *Aspicilia* A.Massal. and *Oxneriaria* S.Y.Kondr. & L.Lökös have been reported from Antarctica, viz. *O. virginea* (Hue) S.Y.Kondr. & L.Lökös (Halici *et al.* 2018, as *Aspicilia virginea*) and *Aspicilia* cf. *aquatica* Körb. (Øvstedal & Lewis Smith 2001). In addition, two other entities, presumed to represent *Aspicilia*, were recognized but not named by Øvstedal & Lewis Smith (2001, 2004). Neighbouring regions also have few species; for example Argentina has six species (Calvelo & Liberatore 2002), the Falkland Islands one (Fryday *et al.* 2021) and New Zealand seven (Galloway 2007). By contrast, the vast and well-studied landmasses of the Northern Hemisphere support substantial floras, with 97 species known from North America (Esslinger 2019), 40 from Svalbard (Øvstedal *et al.* 2009) and 104 from Russia (Urbanavichus 2010).

Aspicilia has recently been divided into four segregate genera: *Aspicilia* s. str., *Circinaria* Link and *Sagedia* Ach., both resurrected on the basis of molecular evidence (Nordin *et al.* 2011), and the newly described and mainly molecular-based *Oxneriaria* S.Y.Kondr. & L. Lökös (Moniri *et al.* 2019). Since the material examined here is too old for molecular analyses, the present species, apart from *O. virginea*, cannot be placed in that system.

Material and methods

All material is deposited in AAS. The specimens were investigated using a Zeiss Stemo 2000C microscope and a Zeiss Axiolab compound microscope. Microscopic details were obtained by examining hand-cut sections. The sections were mounted in dilute lactophenol cotton blue or water. Measurements were made on sections mounted in 10% KOH. Chemical constituents were identified by thin-layer chromatography (Elix 2014).

The species

***Aspicilia gremmenii* Øvstedal sp. nov.**
Mycobank No.: **MB 842490**

Fig. 1

Thallus of small rosettes, lead grey, with radiating lobes at the margin. Apothecia urceolate, to 0.4 mm in diam. Ascospores 16–20 × 12–17 µm. Paraphyses not moniliform. No chemical products.

Type: Antarctica, Signy Island, Moraine Valley, 60°43'S, 45°37'W, on exposed moraine boulders. *T.N. Hooker 639*, 1.ii.1974, (holotype—AAS).

Thallus as small rosettes, up to 9 mm wide, subeffigurate, lead grey, partly with a yellowish tinge. Inner part of thallus weakly rimose, in centre with elevated, adpressed fertile areolae 0.4–0.7 mm wide. Radiating at the margin, closely adpressed, minute lobes, darkened at end. No prothallus. Cortex pseudoparenchymatous, 25–35 µm high, the uppermost cells brownish. Photobiont trebouxoid, c. 10 µm in diam. Medulla with numerous colourless oxalate crystals. Apothecia urceolate, round to irregular, 1–4 per areolae, 0.1–0.4 mm in diam. Thalline margin not seen. Proper margin thin, 20–30 µm in upper part, narrowing

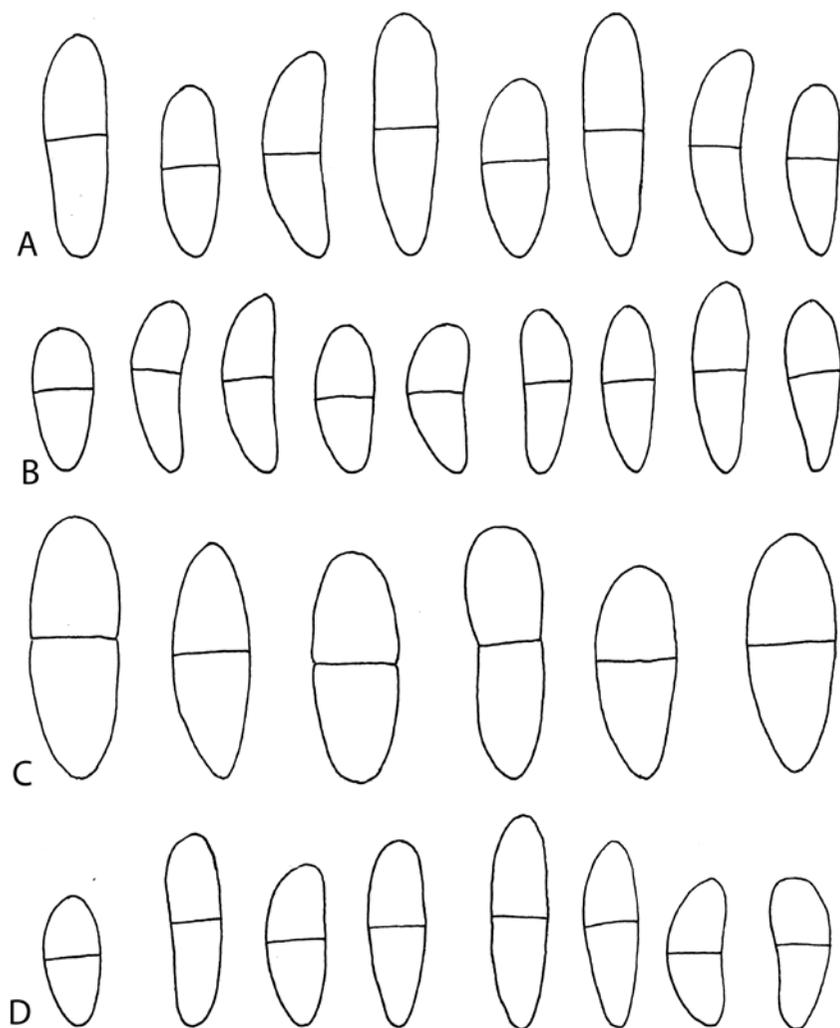


Figure 6. Ascospores of the new *Megalaria* species. A, *M. australiensis*; B, *M. crystallifera*; C, *M. norfolkensis*; D, *M. stratosa*. Scale = 20 µm.

further down, cells thick-walled. Disc black, rarely with whitish pruina. *Epithecium* brown, intensifying in K, N-. *Hymenium* 100–120 µm high, no oil droplets. *Hypothecium* colourless, composed of a pseudoparenchymatous tissue, 70–80 µm high. *Paraphyses* branched, c. 2.5 µm broad, not moniliform, cells in the uppermost part enlarged to 3–4 µm diam, tips brownish. Asci of *Aspicilia*-type, clavate, c. 55 × 30 µm. *Ascospores* hyaline, 8 in asci, broadly ellipsoid, 16–20 × 12–17 µm. *Pycnidia* not seen. *Chemistry*: TLC negative.

Etymology: Named in honour of N.J.M. Gremmen (1948–2019), a Dutch botanist who collected many lichens in the Antarctic and sub-Antarctic.

Remarks

This species was mistakenly reported as *Aspicilia* cf. *aquatica* by Øvstedal & Lewis Smith (2001). That species is grey to bluish grey, rimose-areolate, without radiating marginal lobes and with ascospores 22–24 µm long (Øvstedal *et al.* 2009). Externally the new species is similar to the boreal to Arctic *A. sublapponica* (Zahlbr.) Oxner which, however, contains substictic acid and has smaller ascospores and moniliform paraphyses (Øvstedal *et al.* 2009), while *Oxneriaria dendroplaca* (H.Magn.) S.Y.Kondr. & L.Lökös, from northern Europe and northern Russia, contains substictic acid and has smaller ascospores (Nordin *et al.* 2011). *Aspicilia mendozae* Räsänen, from Argentina, is somewhat similar, but has less-defined marginal lobes and much smaller ascospores (Räsänen 1941). The recently described *A. malviniae* Fryday & T.B.Wheeler (Fryday *et al.* 2021) from the Falkland Islands is effuse and areolate, and contains hypostictic acid. The ecology of *Aspicilia gremmenii*, occurring as it does on dry moraine boulders, is also distinctive.

ADDITIONAL SPECIMEN EXAMINED

Antarctica: ● South Orkney Islands, Signy Island, Cummings Cove, exposed moraine boulder facing west, alt. 200 ft, *T.N. Hooker 289*, 28.x.1973 (AAS).

Aspicilia narssaquensis (Lyngé) J.W.Thomson, *Bryologist* **90**, 163 (1987) Fig. 2

Thallus dimorphic; basal thallus 25–30 mm wide, effuse, pinkish, with no prothallus. Areolae raised in the inner part. *Apothecia* 1–5 per areole, 0.2–0.7 mm diam., flush with margin. Disc regular to irregular, slightly convex and sometimes pruinose, dark brown-blackish, up to 0.7 mm diam. Thalline margin prominent, up to 75 µm wide, pseudoparenchymatous, with numerous trebouxoid algae c. 10 µm diam. *Proper margin* thin, colourless, pseudoparenchymatous, c. 15 µm wide. *Hymenium* 100–110 µm high; *epithecium* pale brown. *Paraphyses* submoniliform, with brown apices. *Ascospores* 8 per ascus, 13–16 × 11–12 µm. *Pycnidia* not seen. *Chemistry*: containing substictic acid (TLC).

SPECIMEN EXAMINED

Antarctica: ● Antarctic Peninsula, James Ross Island, E side Lachman Craigs, dry boulders, alt. 20–30 m, *R.I. Lewis Smith 7363*, 31.i.1989 (AAS).

Remarks

Aspicilia narssaquensis is characterized by the dimorphic thallus and the presence of substictic acid. Reported as *Aspicilia* sp. in Øvstedal & Lewis Smith (2004). Distribution: Svalbard, North America, Greenland, China (Hou *et al.* 2014), Antarctica.

Oxneriaria virginea (Hue) S.Y.Kondr. & L.Lökös, *Acta Botanica Hungarica* **59**, 358 (2017)

Thallus areolate, up to 30 mm wide; areolae elongate at the periphery, yellowish white. *Prothallus* absent. *Apothecia* urceolate, 1–3 per areole, 0.2–0.4 mm wide, black, not pruinose.

Thalline margin not present, but a raised grey rim surrounds each apothecium. *Proper margin* pale brown, entire, c. 30 µm wide, pseudoparenchymatous. *Hymenium* 100–120 µm high; *epithecium* pale brown. *Paraphyses* not moniliform, c. 1 µm wide. *Ascospores* 8 per ascus, ellipsoid, 17–19 × 9–11 µm. *Pycnidia* not seen. *Chemistry*: TLC negative.

SPECIMEN EXAMINED

Antarctica: ● Antarctic Peninsula, James Ross Island, north-eastern part, on stones at margin of melt stream, alt. 50 m., *R.I. Lewis Smith 7605 B*, i.1989 (AAS).

Remarks

This species was first reported from the Antarctic by Halici *et al.* (2018), who determined it using nrITS markers. It was reported as *Aspicilia* sp. A in Øvstedal & Lewis Smith (2001). It also occurs in Fennoscandia and Arctic Canada (Nordin *et al.* 2011).

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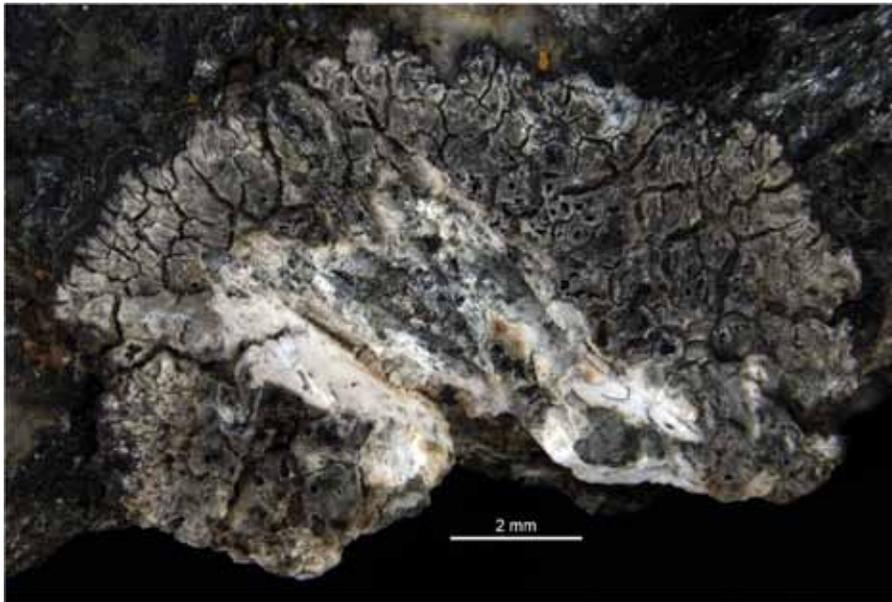


Figure 1. *Aspicilia gremmenii* (holotype in AAS).



Figure 2. *Aspicilia narssaquensis* (R.I. Lewis Smith 7363, AAS).

Additional lichen records from Australia 88

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Abstract: *Lepra variolina* (Nyl.) Q.Ren and *Pseudopyrenula papuana* Aptroot are reported for the first time from Australia. New State, Territory and oceanic island records are provided for 60 other species.

New records for Australia

Lepra variolina (Nyl.) Q.Ren, *Mycosystema* **38**(11), 1858 (2019)

Pertusaria variolina Nyl., *Lich. Japon.* 56 (1890).

Pertusaria violacea Oshio, *J. Sci. Hiroshima Univ.*, Ser. B, Div. 2, **12**(1), 92 (1968); *Lepra violacea* (Oshio) I.Schmitt, B.P.Hodk. & Lumbsch, in Wei *et al.*, *PloS ONE* **12**(7): e0180284, 10 (2017).

This species was previously known from Japan and China (Ren 2014). It is characterized by a sterile, grey, thin, white to grey-white sorediate thallus with rounded convex soralia and the presence of thamnolic acid (Figure 1).

SPECIMENS EXAMINED

Victoria: • Arte River, 30 km NE of Orbost, 37°35'S, 148°46'E, 300 m alt., on forest tree in wet sclerophyll forest, *J.A. Elix 24211*, 14.ii.1990 (CANB); • Cabbage Tree Creek Flora reserve, 17 km ESE of Orbost, 37°44'S, 148°39'E, 30 m alt., on forest tree in *Acmena*-dominated creek flats, *J.A. Elix 24249*, 14.ii.1990 (CANB).

Pseudopyrenula papuana Aptroot, in Aptroot *et al.*, *Biblioth. Lichenol.* **64**, 148 (1997)

Previously known only from Madang Province in Papua New Guinea (Aptroot *et al.* 1997; Aptroot & Lücking 2016), this species has a nondescript, crustose thallus without an obvious photobiont. Perithecia are very prominent, conico-hemispherical, 0.7–1.4 mm wide and dull black except for the slightly glossy, short-apiculate periostiole (Figure 2). The perithecial wall is hard, carbonized and up to 170 µm thick, pseudoparaphyses are tightly conglutinate, anastomosing and 0.5–1 µm wide, and the narrowly cylindrical asci are 140–180 × 12–16 µm, with 4–8 uniseriate ascospores. The latter are astrothelioid, oblong to fusiform, 4-locular, hyaline, and in the one possibly significant departure from the anatomy of the type specimen, the ascospores are 25–36(–40) × 9–13 µm ($n = 60$; vs 25–29 × 7–9 µm, *vide* Aptroot *et al.* 1997).

SPECIMENS EXAMINED

Christmas Island: • c. 750 m SW of Hanitch Hill, 10°27.20'S, 105°39.30'E, alt. 280 m, on bark in moderately dense primary forest, *P.M. McCarthy 1463*, 28.vii.2000 (CANB); • North-South Baseline Road, c. 1 km S of airport terminal building, 10°27.64'S, 105°41.24'E, alt. 230 m, on bark in moderately dense primary forest, *P.M. McCarthy 1375*, 31.vii.2000 (CANB).

New State, Territory and oceanic island records

Amandinea conglomerata Elix & Kantvilas, *Australas. Lichenol.* **72**, 4 (2013)

This endemic species was previously known from New South Wales and Tasmania (Elix & Kantvilas 2013).

SPECIMEN EXAMINED

Western Australia: ● Salmon Holes, Torndirrup National Park, S of Albany, on coastal granite rocks, *D., M. & H. Mayrhofer 8400 pr. p.*, 23.viii.1988 (GZU).

Amandinea devilliersiana Elix & Kantvilas, *Australas. Lichenol.* **72**, 5 (2013)

This endemic species was previously known from South Australia and Tasmania (Elix & Kantvilas 2013).

SPECIMEN EXAMINED

Western Australia: ● Boxer Island, Recherche Archipelago, on coastal rocks, *J.H. Willis s.n. pr. p.*, 9.xi.1950 (MEL).

Amandinea dudleyensis Kantvilas & Elix, *in* Elix & Kantvilas, *Australas. Lichenol.* **72**, 6 (2013)

This species was previously known only from South Australia (Elix & Kantvilas 2013).

SPECIMEN EXAMINED

Victoria: ● 10 km from Nelson on road to Princess Margaret Rose Caves, 36°00'S, 141°01'E, on twigs, *W.H. Ewers 6270*, 9.iii.1990 (CANB).

Amandinea extenuata (Müll.Arg.) Marbach, *Biblioth. Lichenol.* **74**, 71 (2000)

In Australia, this species was previously known from South Australia and New South Wales (Marbach 2000; McCarthy 2020a).

SPECIMENS EXAMINED

Western Australia: ● Pingelly Caravan Park, 154 km SE of Perth, 32°33'S, 117°05'E, 280 m alt., on *Acacia* sp., *P.C. Jobson 2364 pr. p.*, 11.x.1993 (MEL).

Victoria: ● beside Lake Crosby, Pink Lakes State Park, 52 km W of Ouyen, 35°03'S, 141°44'E, 40 m alt., on dead wood in saltbush scrub, *J.A. Curnow 1436 pr. p. & H. Lepp.*, 13.iii.1987 (CANB); ● Talgarno, Wandvale Property, 36°04'S, 147°10'E, on wood, *W.H. Ewers 5887*, 18.iv.1990 (CANB).

Amandinea lignicola var. **australis** Elix & Kantvilas, *Australas. Lichenol.* **72**, 7 (2013)

In Australia, this species was previously known from Queensland, South Australia, New South Wales, the Australian Capital Territory, Victoria, Tasmania and Western Australia (Elix & Kantvilas 2013).

SPECIMEN EXAMINED

Northern Territory: ● Penny Springs area, George Gill Range, on wood, *A.C. Beauglehole 26876*, 14.vii.1968 (MEL).

Anthracothecium macrosporum (Hepp) Müll.Arg., *Linnaea* **63**, 44 (1880)

This pantropical, corticolous lichen is already known in Australia from the Northern Territory and north-eastern Queensland (Aptroot 2009).

SPECIMEN EXAMINED

Christmas Island: ● c. 750 m SW of Hanitch Hill, 10°27.20'S, 105°39.30'E, alt. 280 m, on bark in moderately dense primary forest, *P.M. McCarthy 1461 pr. p.*, 28.vii.2000 (CANB).

Arthonia fusca (A.Massal.) Hepp, *Flecht. Europ.* 534 (1860)

Arthonia lapidicola auct. non (Taylor) Branth & Rostr. (1869)

First reported as *A. lapidicola* from a soft shale cliff on the South Coast of New South Wales (McCarthy & Elix 2017a), it was subsequently collected in the Southern Tablelands near Canberra. Importantly, however, Cannon *et al.* (2020) have determined that *A. lapidicola* is applicable to a species of the genus *Bryostigma* Poelt & Döbberler (Arthoniaceae), and that *A. fusca* is appropriate for this previously misapplied name.

SPECIMEN EXAMINED

New South Wales: ● Southern Tablelands, Murrumbateman–Gunderoo road, c. 2 km E of Nanima Road, 35°01'06"S, 149°06'54"E, 622 m alt., on exposed, consolidated, siliceous soil beside road, *P.M. McCarthy 4927*, 17.iii.2020 (CANB).

Aspicilia cinerea (L.) Körb., *Syst. Lich. German.* 164 (1855)

In Australia, this species was previously known from New South Wales and the Australian Capital Territory (McCarthy 2020a).

SPECIMENS EXAMINED

Victoria: ● Bogong High Plains, near Copes Hut, 36°54'S, 147°17'E, on rock, *W.H. Ewers 1761A*, 8.xii.1987 (CANB); ● Bogong High Plains, Mt Nelse Track, 36°52'S, 147°19'E, on granite, *W.H. Ewers 2083*, 9.xii.1987 (CANB).

Baculifera micromera (Vain.) Marbach, *Biblioth. Lichenol.* **74**, 134 (2000)

This cosmopolitan species was known previously from East and South Africa, Central and South America, New Zealand and, in Australia, from Queensland and New South Wales (Marbach 2000; McCarthy 2020a).

SPECIMENS EXAMINED

Victoria: ● Yarrowee River Reserve, Yarrowee Parade, Ballarat, 37°34'50"S, 143°50'45"E, 430 m alt., on twigs of *Acer pseudoplatanus*, *V. Stajsic 1792*, 13.xi.1997 (MEL).

Tasmania: ● Cape Contrariety, 43°01'S, 147°31'E, 50 m alt., on dead *Allocasuarina verticillata*, *G. Kantvilas 184/98 pr. p.*, 25.ix.1998 (HO); ● Babel Island, Furneaux Group, Bass Strait, 440 m alt., on dead shrub, *J.S. Whinray s.n.*, 26.i.1967 (MEL).

Christmas Island: ● Settlement, c. 500 m S of Rocky Point, 10°25'05"S, 105°40'30"E, 30 m alt., on dead wood among sparse regrowth, *H. Lepp 70054 pr. p.*, 23.vii.2000 (CANB).

Bogoriella obovata (Stirt.) Aptroot & Lücking, *Lichenologist* **48**, 913 (2016)

This eastern Palaeotropical lichen is already known from Queensland (Aptroot & Lücking 2016).

SPECIMEN EXAMINED

New South Wales: ● Lord Howe Island, Boat Harbour, 31°33'40"S, 159°05'50"E, 10 m alt., on twigs and narrow branches in moist, subtropical forest, *P.M. McCarthy s.n.*, 10.ii.1995 (CANB).

Buellia abstracta (Nyl.) H.Olivier, *Bull. Acad. Internat. Géogr. Bot.* **12**, 176 (1903)

This cosmopolitan species was known previously from Europe, North and South America, New Zealand and, in Australia, from New South Wales and Tasmania (Elix & McCarthy 2018).

SPECIMENS EXAMINED

Australian Capital Territory: ● Kowen Road, Kowen Forest, 11.7 km E of Canberra, 35°19'02"S, 149°15'07"E, 700 m alt., on pebbles embedded in soil bank in open *Eucalyptus* woodland, *J.A. Elix 46809*, *P.M. McCarthy 4863*, 31.vii.2019 (CANB).

Buellia cravenii Elix, *Australas. Lichenol.* **87**, 6 (2020)

This Australian endemic was previously known from Western Australia, Northern Territory and South Australia (Elix 2020).

SPECIMEN EXAMINED

New South Wales: ● 5 km E of Silverton on Broken Hill Road, 31°53'S, 141°16'E, on rock, *W.H. Ewers 1127 pr. p.*, 23.iv.1987 (CANB).

Buellia dijiana Trinkaus, in Trinkaus *et al.*, *Lichenologist* **33**, 52 (2001)
This Australian endemic was previously known from Western Australia, South Australia and New South Wales (Trinkaus *et al.* 2001).

SPECIMEN EXAMINED

Victoria: ● 10 km from Nelson on road to Princess Margaret Rose Caves, 38°00'S, 141°01'E, on old limestone river terrace at roadside, *W.H. Ewers 6272*, 9.v.1990 (CANB).

Buellia dimbulahensis Elix, *Australas. Lichenol.* **77**, 43 (2015)

This species was previously known from Northern Territory and Queensland (Elix 2015a).

SPECIMEN EXAMINED

Christmas Island: ● Settlement, c. 500 m S of Rocky Point, 10°25'05"S, 105°40'30"E, 30 m alt., on limestone boulder among sparse regrowth, *H. Lepp 70048*, 23.vii.2000 (CANB).

Buellia epiaeruginosa Elix, *Australas. Lichenol.* **78**, 32 (2016)

This Australasian species was previously known from Victoria, Tasmania and New Zealand (Elix 2016).

SPECIMENS EXAMINED

Australian Capital Territory: ● Namadgi National Park, Brindabella Range, summit of Mt Ginini, 52 km WSW of Canberra, 35°31'47"S, 148°46'22"E, 1762 m alt., on loose stones in subalpine *Eucalyptus* woodland, *J.A. Elix 47094, 47099, 47100*, 2.iii.2021 (CANB).

Buellia ferax Müll.Arg., *Bull. Soc. Roy. Bot. Belg.* **31**, 33 (1892)

In Australia this Australasian species was previously known from New South Wales (Elix & McCarthy 2018).

SPECIMENS EXAMINED

Western Australia: ● Ringbolt Bay, Cape Leeuwin, S of Augusta, Leeuwin-Naturaliste National Park, on coastal granite rocks, *D., M. & H. Mayrhofer 8386, 8388*, 21.viii.1988 (GZU); ● Salmon Holes, Torndirrup National Park, S of Albany, on coastal granite rocks, *D., M. & H. Mayrhofer 8399 pr. p., 8403*, 23.viii.1988 (GZU).

Buellia griseovirens (Turner & Borrer ex Sm.) Almborn, *Bot. Not.* **1952**, 247 (1952)

This cosmopolitan, corticolous species was known previously from Europe, North America, Asia, Africa, New Zealand and, in Australia, from Tasmania (Elix 2011).

SPECIMENS EXAMINED

Victoria: ● Grampians, near Elephants Hide, Halls Gap, 37°08'S, 142°30'E, on bark, *W.H. Ewers s.n.*, 29.vii.1986 (CANB); ● Grampians, Reids Lookout, 37°09'S, 142°26'E, on twigs, *W.H. Ewers 479*, 24.xi.1986 (CANB).

Buellia halonioides Elix, in Elix *et al.*, *Australas. Lichenol.* **81**, 34 (2017)

This Australasian species was previously known from South Australia, New South Wales and Tasmania, as well as New Zealand (Elix *et al.* 2017).

SPECIMEN EXAMINED

Victoria: ● Murray Mallee, The Cliffs, Lake Hindmarsh, 35°58'S, 141°52'E, on soil, *R.B. Filson 16836*, 2.xii.1980 (MEL).

Buellia hypostictella Elix & H.Mayrhofer, *Australas. Lichenol.* **79**, 10 (2016)

This Australasian species was previously known from South Australia and New Zealand (Elix 2020).

SPECIMEN EXAMINED

New South Wales: ● SE cliff face at N end of Mackenzies Beach, between Malua Bay and Rosedale, 35°48'12"S, 150°13'42"E, on rock, *S. Gibson MB6*, 1976 (CANB).

Buellia maficola Elix, *Australas. Lichenol.* **78**, 36 (2016)

This Australasian species was previously known from New South Wales and South Australia, as well as New Zealand (Elix 2016).

SPECIMEN EXAMINED

Northern Territory: ● Kata Tjuta (Mt Olga), Mt Bruce, northern-most dome, 25°18'S, 130°43'E, 700 m alt., on conglomerate rock in SE declivities, *J.H. Willis s.n.*, 10.ix.1963 (MEL 11239 *pr. p.*).

Buellia neohalonia Elix & H.Mayrhofer, *Australas. Lichenol.* **86**, 64 (2020)

This endemic species was previously known from Victoria (Elix & Mayrhofer 2020).

SPECIMEN EXAMINED

Tasmania: ● Cape Barren Island, The Corner, 40°23'10"S, 148°01'13"E, on coastal granite, *J.S. Whinray s.n.*, 17.v.1969 (MEL).

Buellia suttonensis Elix & A.Knight, *Australas. Lichenol.* **81**, 87 (2017)

This Australasian species was previously known from New South Wales, the Australian Capital Territory, Victoria and Tasmania, as well as New Zealand (Elix & Knight 2017).

SPECIMENS EXAMINED

South Australia: ● Inman Valley, road near Strangways Falls, 35°36'S, 138°28'E, on rock, *R.B. Filson 4915A*, 16.vi.1963 (MEL).

Queensland: ● road to Mount Mee State Forest, N of Dayboro, 40°23'10"S, 148°01'13"E, on rock, *H. Mayrhofer & R. Rogers s.n.*, 8.x.1981 (CANB).

Candelariella antennaria Räsänen, *Anales Soc. Ci. Argent.* **78**, 137 (1939)

This widespread species was known previously from North and South America, Asia and South Australia (McCarthy 2020a).

SPECIMEN EXAMINED

Victoria: ● beside Lake Crosby, Pink Lakes State Park, 52 km W of Ouyen, 35°03'S, 141°44'E, 40 m alt., on dead wood in saltbush scrub, *J.A. Curnow 1436 pr. p. & H. Lepp.*, 13.iii.1987 (CANB).

Catillaria nigroclavata (Nyl.) J.Steiner, *Sitzungsber. Kaiserl. Akad. Wiss. Math.-naturw. Kl.* **107**, 157 (1898)

Recently reported for the first time from Australia (Kangaroo Island, South Australia; Kantvilas 2019).

SPECIMEN EXAMINED

Queensland: ● Bauhinia Downs–Duarina road, 34 km SW of Duaringa, 23°59'S, 149°31'E, 150 m alt., on *Callitris* trunk in *Eucalyptus-Callitris*-dominated woodland, *J.A.Elix 34950*, 29.viii.1993 (CANB).

Clauzadea immersa (Hoffm.) Hafellner & Bellem., in Hafellner, *Beih. Nova Hedwigia* **79**, 322 (1984)

This cosmopolitan species was known previously from Europe, North America, Macaronesia, Africa, Asia, as well as South Australia (Elix 2012).

SPECIMEN EXAMINED

Tasmania: ● Bass Strait, Deal Island, Kents Group, 210 m E of head of East Cove, on limestone, *J.S. Whinray s.n.*, 9.xii.1971 (MEL).

Diorygma hieroglyphicum (Pers.) Staiger & Kalb, in Kalb *et al.*, *Symb. Bot. Upsal.* **34**(1), 151 (2004)

This predominantly Palaeotropical lichen has a distribution that includes eastern Queensland, north-eastern New South Wales and Norfolk Island (Archer 2009).

SPECIMENS EXAMINED

Christmas Island: ● Murray Rd, 3.3 km NNE of Central Area Workshop, 10°27.36'S, 105°39.24'E, alt. 220 m, on bark in moderately dense primary forest, *P.M. McCarthy 1460*, 26.vii.2000 (CANB); ● Murray Rd, near entrance to National Park, 10°27.10'S, 105°39.45'E, alt. 200 m, on bark in dense primary forest, *P.M. McCarthy 1484*, 26.vii.2000 (CANB); ● 1.7 km ESE of Jacks Hill, 10°29.00'S, 105°40.83'E, alt. 240 m, on bark in moderately dense primary forest, *P.M. McCarthy 1474*, 27.vii.2000 (CANB).

Enterographa pallidella (Nyl.) Redinger, *Feddes Repert.* **43**, 61 (1938)

This eastern Palaeotropical and Pacific species was previously known in Australia from north-eastern Queensland (Sparrius 2004).

SPECIMEN EXAMINED

Christmas Island: ● near Golf Course, 10°25.97'S, 105°42.20'E, alt. 40 m, on bark in moderately dense primary forest, *P.M. McCarthy 1483 pr. p.*, 25.vii.2000 (CANB).

Graphis dracaenae Vain., *Cat. Welwitsch Afr. Pl.* **2**(2), 439 (1901)

Known, in Australia, from eastern Queensland, New South Wales, Victoria and Tasmania (Archer 2009), this species also occurs in Angola, Papua New Guinea and Costa Rica.

SPECIMENS EXAMINED

Christmas Island: ● Murray Rd, 3.3 km NNE of Central Area Workshop, 10°21.36'S, 105°39.24'E, alt. 220 m, on fallen canopy branch in moderately dense primary forest, *P.M. McCarthy 1506*, 26.vii.2000 (CANB).
New South Wales: ● Lord Howe Island, track to Boat Harbour, 31°33'40"S, 159°05'50"E, 10 m alt., on stems of *Pandanus* at margin of subtropical forest, *P.M. McCarthy s.n.*, 10.ii.1995 (CANB).

Graphis insulana (Müll.Arg.) Lücking & Sipman, in Lücking *et al.*, *Fieldiana (Bot.)* **46**, 84 (2008)

This is a rare corticolous species in north-eastern Queensland, as well as Fiji and Costa Rica (Archer 2009).

SPECIMEN EXAMINED

Christmas Island: ● c. 750 m SW of Hanitch Hill, 10°27.20'S, 105°39.30'E, alt. 280 m, on bark in moderately dense primary forest, *P.M. McCarthy 1461 pr. p.*, 28.vii.2000 (CANB).

Graphis tenella Ach., *Syn. Meth. Lich.* 81 (1814)

This rare, pantropical and southern-temperate, corticolous species is already known, in Australia, from southern New South Wales (Archer 2009).

SPECIMEN EXAMINED

Christmas Island: ● near Golf Course, 10°25.97'S, 105°42.20'E, alt. 40 m, on bark in moderately dense primary forest, *P.M. McCarthy 1483 pr. p.*, 25.vii.2000 (CANB).

Hemithecium aphanes (Mont. & Bosch) M.Nakan. & Kashiw., *Bull. Natl. Sci. Mus. Tokyo*, Ser. B, **29**(2), 88 (2003)

This eastern Palaeotropical lichen is already known from Queensland and north-eastern New South Wales (Archer 2009).

SPECIMEN EXAMINED

Christmas Island: ● c. 750 m SW of Hanitch Hill, 10°27.20'S, 105°39.30'E, alt. 280 m, on bark in moderately dense primary forest, *P.M. McCarthy 1461 pr. p.*, 28.vii.2000 (CANB).

Hemithecium implicatum (Fée) Staiger, *Biblioth. Lichenol.* **85**, 287 (2002)

This lichen is very rare in mainland Australia, being known only from the Mitchell Plateau in northern Western Australia (Archer 2009). It also occurs in Brazil, Mexico, southern U.S.A., the Caribbean, China and Vietnam.

SPECIMEN EXAMINED

Christmas Island: ● c. 700 m N of Grants Well, 10°28.52'S, 105°39.14'E, alt. 260 m, on bark in moderately dense primary forest, *P.M. McCarthy 1457 pr. p.*, 28.vii.2000 (CANB).

Ingvariella bispora (Bagl.) Guderley & Lumbsch, in Guderley *et al.*, *Nova Hedwigia* **64**, 152 (1997)

In Australia, this cosmopolitan species was previously known from Western Australia, South Australia, New South Wales and Victoria (Mangold *et al.* 2009).

SPECIMEN EXAMINED

Northern Territory: ● Alice Springs area, Gosses Bluff, meteorite crater, 23°49'01"S, 132°18'48"E, on sandstone, *H.T. Lumbsch 5493c & T. Henshell*, 25.viii.1987 (CANB).

Lecanora helva Stizenb., *Ber. Tätigk. St. Gallischen Naturwiss. Ges.* **1888–89**, 218 (1890)

In Australia this pantropical species was previously known from Western Australia, Northern Territory, South Australia, Queensland, New South Wales, Lord Howe Island and Norfolk Island (Lumbsch & Elix 2004).

SPECIMENS EXAMINED

Christmas Island: ● Settlement, c. 500 m S of Rocky Point, 10°25'05"S, 105°40'30"E, 30 m alt., on dead wood among sparse regrowth, *H. Lepp 70054 pr. p.*, 23.vii.2000 (CANB); ● track to Greta Beach, 150 m S of Ross Hill Gardens pump-house, 10°29.29'S, 105°40.66'E, alt. 80 m, on bark in moderately dense primary forest, *P.M. McCarthy 1448 pr. p.*, 2.viii.2000 (CANB).

Lecanora polytropha (Ehrh.) Rabenh., *Deutschl. Krypt.-Fl.* **2**, 37 (1845)

In Australia, this cosmopolitan species was previously known from New South Wales, Victoria and Tasmania (Lumbsch & Elix 2004).

SPECIMEN EXAMINED

Australian Capital Territory: ● Namadgi National Park, Brindabella Range, summit of Mt Ginini, 52 km WSW of Canberra, 35°31'47"S, 148°46'22"E, 1762 m alt., on loose stones in subalpine *Eucalyptus* woodland, *J.A. Elix 47107*, 2.iii.2021 (CANB).

Lecidea atrobrunnea (Ram. ex Lam. & DC.) Schaer., *Lich. Helv. Spic.* **3**, 134 (1828)

In Australia, this cosmopolitan species was previously known from New South Wales and Victoria (Rambold 1989).

SPECIMEN EXAMINED

Australian Capital Territory: ● Kowen Road, Kowen Forest, 11.7 km E of Canberra, 35°19'02"S, 149°15'07"E, 700 m alt., on sandstone in open *Eucalyptus* woodland, *J.A. Elix 46793*, 31.vii.2019 (CANB).

Lepra albopunctata (A.W.Archer & Elix) A.W.Archer & Elix, *Australas. Lichenol.* **82**, 131 (2018)

This endemic species was previously known from Queensland (Archer & Elix 2009, as *Pertusaria*).

SPECIMENS EXAMINED

New South Wales: ● Long Beach, 3 km E of Batemans Bay, 35°42'S, 150°14'E, 6 m alt., on tree in remnant rainforest, *J.A. Elix 2942*, 19.iii.1977 (CANB).

Norfolk Island: ● Mount Pitt National Park, track to Mt Bates, 29°00'40"S, 167°56'20"E, 280 m alt., on *Nestigia* in subtropical forest, *J.A. Elix 27467*, 15.vi.1992 (CANB); ● Mount Pitt National Park, West Palm Glen Track, 29°01'06"S, 167°56'33"E, 140 m alt., on dead *Cyathea* stump in subtropical forest, *J.A. Elix 29092*, 16.vi.1992 (CANB).

Lepra erythrella (Müll.Arg.) I.Schmitt, B.P.Hodk. & Lumbsch, in Wei *et al.*, *PLoS ONE* **12**(7), 8/14 (2017)

This endemic species was previously known from Queensland, New South Wales, Victoria and Tasmania (Archer 2004, as *Pertusaria*).

SPECIMEN EXAMINED

Norfolk Island: ● Mount Pitt National Park, West Palm Glen Track, 29°01'06"S, 167°56'33"E, 140 m alt., on dead *Cyathea* stump in subtropical forest, *J.A. Elix 29061 pr. p.*, 16.vi.1992 (CANB).

Lepra neotriconica (Elix & A.W.Archer) A.W.Archer & Elix, *Australas. Lichenol.* **82**, 132 (2018)

This endemic species was previously known from New South Wales and Victoria (Elix & Archer 2007, as *Pertusaria*).

SPECIMEN EXAMINED

Queensland: ● Fraser Island, Kingfisher–Eurong road, near Eurong, 25°29'S, 153°06'E, 60 m alt., on *Syncarpia hillii* in forest, *H. Streimann 64089*, 17.viii.1999 (CANB).

Monerolechia glomerulans (Müll.Arg.) Elix, *Telopea* **18**, 94 (2015)

This endemic species was previously known from Western Australia and South Australia (Elix 2015b).

SPECIMEN EXAMINED

Victoria: ● Sunset Country, Mt Henschke, 26 km S of Karawinna, 34°35'S, 141°42'E, on rock, *R.B. Filson 14720*, 16.xi.1971 (MEL).

Monerolechia norstictica Elix, *Telopea* **18**, 92 (2015)

This endemic species was previously known from Western Australia, Northern Territory and Queensland (Elix 2015b).

SPECIMENS EXAMINED

New South Wales: ● Evans, S of Blayney, c. 1 km S of intersection to Abercrombie Caves, on granite, *D. & H. Mayrhofer 11183*, 25.vii.1992 (GZU).

Victoria: ● Hanging Rock, 7 km NE of Woodend, 37°20'S, 144°36'E, on rock, *M. & H. Mayrhofer 3070, 3074*, 20.viii.1981 (GZU).

Normandina pulchella (Borrer) Nyl., *Ann. Sci. Nat., Bot.*, sér. 1, **4**, 382 (1861)

This almost cosmopolitan lichen has a distribution in Australia that includes Western Australia, South Australia, Queensland, New South Wales, the Australian Capital Territory, Victoria and Tasmania (McCarthy 2020a).

SPECIMEN EXAMINED

New South Wales: ● Lord Howe Island, track to Goat House Cave, at base of Mt Lidgbird escarpment, 31°33'48"S, 159°05'11"E, 380 m alt., on saxicolous bryophytes in moist, subtropical forest, *P.M. McCarthy 1176*, 7.ii.1995 (CANB).

Orcularia elixii Kalb & Giralt, *Phytotaxa* **38**, 56 (2011)

In Australia this species was previously known from New South Wales (Kalb & Giralt 2011).

SPECIMENS EXAMINED

Queensland: ● Main Range, Baldy Mountain State Forest, Atherton–Herberton road, 6 km NE of Herberton, 17°20'S, 145°26'E, 900 m alt., on wood, *H. Mayrhofer 13451 & E. Hierzer*, 9.viii.1993 (GZU).

Victoria: ● Black Rock, 37°58'S, 145°01'E, on wood, *R.A. Bastow s.n.*, 26.xii.1899 (MEL); ● Warrnambool Institute of Advanced Education Campus, 38°21'30"S, 142°32'30"E, 40 m alt., on wood, *W.H. Ewers 2459 pr. p.*, 7.iii.1988 (CANB); ● Levi Point Reserve, 5 km W of Warrnambool, 38°23'S, 142°28'E, on wood, *W.H. Ewers 7226 & J.A. Elix*, 16.xii.1990 (CANB). *Tasmania*: ● Bass Strait, Deal Island, Kents Group, Lighthouse Gully, on *Leptospermum scoparium*, *J.S. Whinray s.n.*, 11.xii.1971 (MEL).

Pertusaria pseudococcodes Müll.Arg., *Flora* **67**, 287 (1884)

This species occurs in India, Sri Lanka, Papua New Guinea, Vanuatu and in the Northern Territory and Queensland (Archer 2004).

SPECIMEN EXAMINED

New South Wales: ● Urunga, 23 km SW of Coffs Harbour, 30°19'S, 153°01'E, sea level, on *Casuarina* in strand vegetation, *H. Streimann 63777*, 16.vi.1999 (CANB).

Pertusaria subrigida Müll.Arg., *Bull. Herb. Boissier* **3**, 636 (1895)

In Australia, this pantropical-subtropical species occurs in Queensland, New South Wales and Lord Howe Island (Archer 2004).

SPECIMEN EXAMINED

Western Australia: ● Tinkers Flat Road, 5 km W of Heartlea, 34°05'32"S, 116°21'57"E, 320 m alt., on *Eucalyptus* in *E. marginata* forest, *J.A. Elix 43970*, 9.iv.2006 (CANB).

Placidiopsis parva P.M.McCarthy, *Australas. Lichenol.* **85**, 12 (2019)

This endemic, silicolous lichen was previously known only from the Australian Capital Territory (McCarthy 2019).

SPECIMENS EXAMINED

New South Wales: ● Southern Tablelands, Collector–Gundaroo road, 3 km WSW of Collector, 34°55'12"S, 149°24'19"E, 630 m alt., on sandstone pebbles embedded in consolidated, siliceous soil in dry *Eucalyptus* woodland, *P.M. McCarthy 4917, 4918*, 27.xi.2019 (CANB); ● Southern Tablelands, beside Queanbeyan–Captains Flat road, c. 5 km SE of Queanbeyan, Cuumbeun NR, Scabbing Flat Trail, 35°21'17"S, 149°16'20"E, 775 m alt., on pebbles embedded in consolidated, siliceous soil in dry *Eucalyptus* woodland, *P.M. McCarthy s.n.*, 2.vi.2020 (CANB).

Pyrenula nitidula (Bres.) R.C.Harris, *Bryologist* **64**, 164 (1997)

This more-or-less pantropical lichen is already known, in Australia, from north-eastern Queensland, Lord Howe Island and Norfolk Island (Aptroot 2009).

SPECIMEN EXAMINED

Christmas Island: ● c. 700 m N of Grants Well, 10°28.52'S, 105°39.14'E, alt. 260 m, on bark in moderately dense primary forest, *P.M. McCarthy 1457*, 28.vii.2000 (CANB).

Pyrenula quassiaecola Fée, *Essai Crypt. Écorc.*, Suppl.: 79 (1837)

This pantropical to warm-temperate species is already known from eastern Queensland, north-eastern New South Wales, Lord Howe Island and Norfolk Island (Aptroot 2009).

SPECIMEN EXAMINED

Christmas Island: ● c. 750 m SW of Hanitch Hill, 10°27.20'S, 105°39.30'E, alt. 280 m, on bark in moderately dense primary forest, *P.M. McCarthy 1464*, 28.vii.2000 (CANB).

Rinodina moziana (Nyl.) Zahlbr., *Cat. Lich. Univ.* 7, 544 (1931) var. **moziana**

In Australia, this cosmopolitan taxon is known from Western Australia, Northern Territory, Queensland, New South Wales, Norfolk Island, Victoria and Tasmania (Elix 2011).

SPECIMENS EXAMINED

Australian Capital Territory: ● Shepherds Lookout Walk, Woodstock Nature Reserve, 20 km WNW of Canberra, 35°14'34"S, 148°58'38"E, 555 m alt., on porphyry pebbles in open *Eucalyptus-Callitris* woodland, *J.A. Elix 46782*, 5.xii.2018 (CANB); ● Kowen Road, Kowen Forest, 11.7 km E of Canberra, 35°19'02"S, 149°15'07"E, 700 m alt., on sandstone rocks in open *Eucalyptus* woodland, *J.A. Elix 46707*, 9.i.2019 (CANB); *P.M. McCarthy 4862*, 31.vii.2019 (CANB).

Rinodina pyrina (Ach.) Arnold, *Flora* 64, 196 (1881)

In Australia, this cosmopolitan species is known from South Australia, the Australian Capital Territory and Tasmania (Mayrhofer *et al.* 1999).

SPECIMEN EXAMINED

Victoria: ● Talgarno, Wandvale property, 36°04'S, 147°10'E, on bark, *W.H. Ewers 5881*, 18.iv.1990 (CANB).

Rinodina substellulata Müll.Arg., *Proc. Roy. Soc. Edinburgh* 11, 461 (1882)

In Australia, this cosmopolitan species is known from Queensland, Victoria and Tasmania (Elix 2011).

SPECIMEN EXAMINED

New South Wales: ● below Waihou Trig Station, 25 km NW of Coff's Harbour, 30°06'S, 153°02'E, 340 m alt., on sandstone outcrop, *D. Verdon 3797A pr. p.*, 12.x.1978 (CANB).

Rinodina tenniswoodiorum Elix & Kantvilas, *in Elix et al., Australas. Lichenol.* 84, 11 (2019)

This endemic Australian lichen was previously known from Tasmania (Elix *et al.* 2019).

SPECIMEN EXAMINED

Victoria: ● Wilsons Promontory, Mt Oberon, 530 m alt., *D. & H. Mayrhofer 11555 & E. Hierzer*, 30.vii.1992 (GZU).

Sarcogyne canberrensis P.M.McCarthy & Elix, *Australas. Lichenol.* 80, 17 (2017)

This endemic, calcicolous lichen was previously known from New South Wales and the Australian Capital Territory (McCarthy & Elix 2017b).

SPECIMEN EXAMINED

South Australia: ● Murray Basin district, Taylorville, NW of Waikerie, 87 km from Renmark, 34°06'S, 139°57'E, on large limestone pebble, *W.H. Ewers 7135 pr. p.*, 20.vi.1990 (CANB).

Sarcogyne hypophaea (Nyl.) Arnold, *Flora* 53, 475 (1870)

This siliceous rock-inhabiting lichen is widespread in much of Eurasia and North America, less common in the Southern Hemisphere. In Australia it was previously known from Western Australia and South Australia (McCarthy 2020a).

SPECIMEN EXAMINED

New South Wales: ● Bungonia Lookdown, Bungonia Creek, 28 km ESE of Goulburn, 34°48'S, 150°00'E, 130 m alt., on siliceous pebble on the ground in moist shady area of sparse *Eucalyptus* woodland, *H. Streimann 6164*, 14.ix.1978 (CANB).

Toniniopsis aromatica (Sm.) Kistenich, Timdal, Bendiksby & S.Ekman, *Taxon* 67(5), 897 (2018)

Very common throughout much of the Northern Hemisphere, but much less so below the Equator. In Australia this lichen is already known from South Australia, Queensland and Victoria (Timdal 1992).

SPECIMENS EXAMINED

Norfolk Island: ● Point Hunter, Emily Bay, 29°04'S, 167°58'E, 3 m alt., on calcareous sandstone on the foreshore, *J.A. Elix 18540, 18544 & H. Streimann*, 5.xii.1984 (CANB).

Trapelia atrocarpa Elix & P.M.McCarthy, *Australas. Lichenol.* 86, 102 (2020)

This endemic species was previously known from New South Wales and the Australian Capital Territory (Elix & McCarthy 2020).

SPECIMENS EXAMINED

South Australia: ● Marino Rocks, headland of St. Vincents Gulf, just S of Brighton, on hard packed earth, *W.A. Weber & D. McVean L-47158*, 17.xi.1967 (CANB).

Norfolk Island: ● Selwyn Pine Road, 29°01'18"S, 167°56'41"E, 55 m alt., on semi-exposed road bank on olive and guava-infested roadside, *H. Streimann 53717*, 14.iv.1994 (CANB).

Trapelia calvariana Kantvilas & Lumbsch, *Austral. Syst. Bot.* 27, 397 (2015)

This endemic species was previously known only from Tasmania (Kantvilas *et al.* 2014).

SPECIMEN EXAMINED

Australian Capital Territory: ● Namadgi National Park, Brindabella Range, summit of Mt Ginini, 52 km WSW of Canberra, 35°31'47"S, 148°46'22"E, 1762 m alt., on loose stones in subalpine *Eucalyptus* woodland, *J.A. Elix 47102*, 2.iii.2021 (CANB).

Trapelia pruinosa Elix & P.M.McCarthy, *Australas. Lichenol.* 86, 105 (2020)

This endemic species was previously known from Queensland, New South Wales, the Australian Capital Territory and Victoria (Elix & McCarthy 2020).

SPECIMENS EXAMINED

Western Australia: ● Stirling Ranges, slopes of Bluff Knoll, 34°22'S, 118°15'E, 500 m alt., on termite mound in mixed *Eucalyptus* scrub, *J.A. Elix 10658 & L.H. Elix*, 25.x.1982 (CANB).

New South Wales: ● Lord Howe Island, Mt Eliza, 31°30'52"S, 159°02'20"E, 130 m alt., on exposed boulder in steeply SE-sloping grasslands, *H. Streimann 55793*, 6.ii.1995 (CANB).

Verrucaria kowenensis P.M.McCarthy, *Australas. Lichenol.* 86, 3 (2020)

Previously known only from the Australian Capital Territory (McCarthy 2020b), the thallus of the newly reported specimen is comparatively thin, continuous and scarcely rimose, lacking the subsquamulose areolae of the type collection.

SPECIMEN EXAMINED

New South Wales: ● Central Tablelands, Gillindich Nature Reserve, 10 km N of Binda, 34°12'59"S, 149°20'09"E, 830 m alt., on consolidated, siliceous soil in open *Eucalyptus* woodland, *J.A. Elix 46865*, 30.ix.2019 (CANB).

Xanthoparmelia millerae Elix, *in Elix & Kantvilas, Mycotaxon* 73, 448 (1999)

This endemic species was previously known from New South Wales (Elix & Kantvilas 1999).

SPECIMEN EXAMINED

South Australia: ● Mt Oliphant Monument, Arkaroola, 30°17'S, 139°19'E, on rock, *W.H. Ewers 7034*, 19.vi.1990 (CANB).

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Figure 1. *Lepra variolina* (J.A. Elix 24211). Scale = 2 mm.

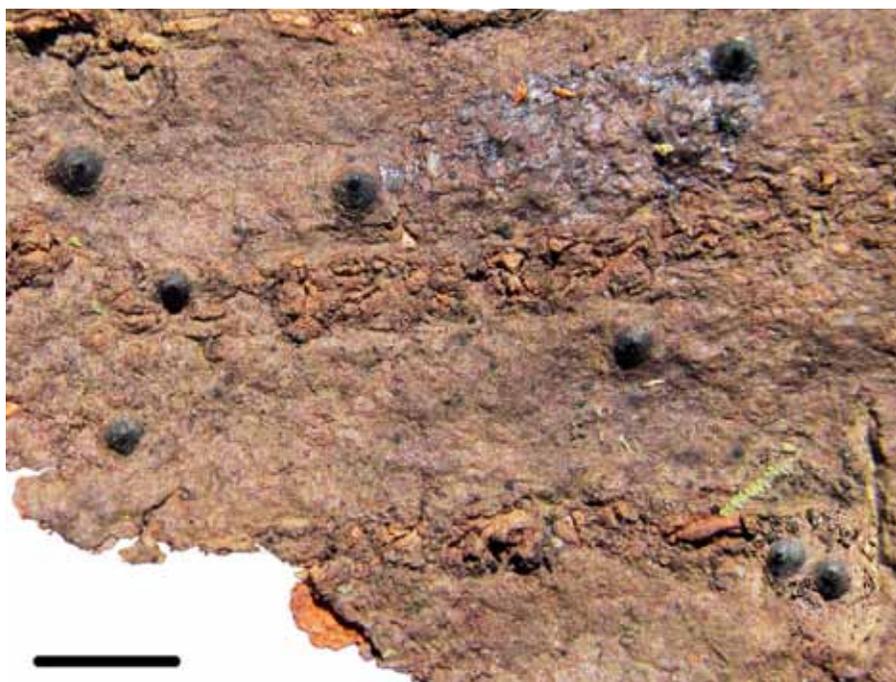


Figure 2. *Pseudopyrenula papuana* (P.M. McCarthy 1463). Scale = 5 mm.

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