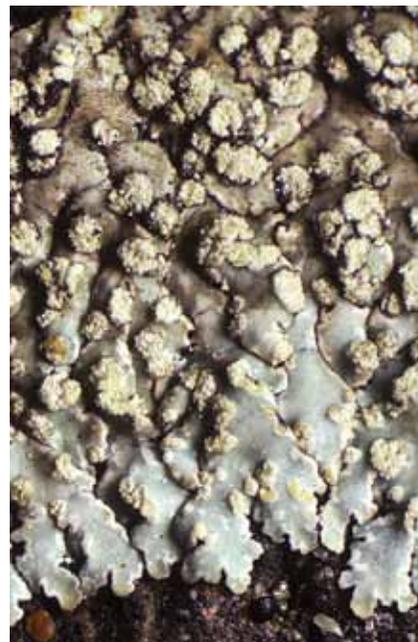


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In Australasia, the cosmopolitan *Pyxine subcinerea* colonizes bark, lignum (fenceposts), and coastal rock, mostly in northern New Zealand and both eastern and western Australia (New South Wales, Queensland, and Western Australia). Among its notable traits are glistening patches of whitish laminal pruina, a yellow to ochre medulla, marginal soralia spreading to the upper lamina, and medullary lichexanthone (UV+ citrine yellow).

1 mm 

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**Seven new species and a new record in the lichen genus *Pertusaria*
(Pertusariales, lichenized Ascomycota) from eastern Australia**

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Abstract

Seven new species, *Pertusaria gadgarrensis*, *P. glebulosa*, *P. hiatensis*, *P. lumbschii*, *P. quadraginta*, *P. salazinica* and *P. ternata* are described from Queensland, Australia. In addition, *Pertusaria violacea*, originally from Japan, is reported from Australia (New South Wales) for the first time.

Introduction

This paper continues our investigation of the lichen genus *Pertusaria* in Australia. The history of the genus and taxa recognized until 1997 were reported by Archer (1997), but subsequent publications (Archer & Elix 2009a, 2009b, 2013, 2016a, 2016b) have increased the number of taxa in Australia to 170. A study of additional specimens collected in Queensland has yielded seven new species that are described here.

In the present work, chemical constituents were identified by thin-layer chromatography (Elix 2014) and by comparison with authentic samples.

1. *Pertusaria gadgarrensis* A.W.Archer & Elix, sp. nov.
MycoBank No. **MB 819562**

Figs 1, 2

Similar to *Pertusaria depressa* (Fée) Mont. & Bosch, but differs in having smaller ascospores with rough inner walls.

Type: Queensland: Gadgarra State Forest, 15 km NE of Malanda, 17°18'S, 145°47'E, 680 m alt., on treelet stem, in *Araucaria cunninghamii* plantation in rainforest, *H. Streimann* 46587, 15.xii.1990 (holotype – CANB).

Thallus corticolous, pale olive-green; surface smooth and shiny, slightly cracked, lacking soralia and isidia. Apothecia verruciform, numerous, sometimes confluent, flattened-hemispherical, becoming concave above, 0.5–1.0 mm diam. Ostioles black, punctiform, conspicuous, sunken, 1 per verruca. Ascospores 4 per ascus, ellipsoid, hyaline, with rough inner walls, 70–80 × 36–40 µm.

Chemistry: 2'-*O*-methylperlatolic acid (major), stictic acid (major) and constictic acid (minor).

Etymology: The epithet *gadgarrensis* is derived from the type locality, Gadgarra State Forest.

Pertusaria gadgarrensis is characterised by the shiny, pale olive-green thallus surface, the punctiform black ostioles, ascospores with rough inner walls and the presence of 2'-*O*-methylperlatolic and stictic acids as major lichen compounds. Superficially, it resembles *P. depressa*, but is distinguished by having shorter ascospores, (100–120 µm long in *P. depressa*) and different chemistry. *Pertusaria depressa* contains the lichexanthone 2-chlorolichexanthone, 2-*O*-methylhyperlatolic acid and 2-*O*-methylsuperla-

toxic acid.

At present the new species is known only from the type locality in northern Queensland.

2. *Pertusaria glebulosa* A.W.Archer & Elix, sp. nov.
MycoBank No. **MB 819563**

Fig. 3

Similar to *Pertusaria isidiosa* A.W.Archer, but differs in having crowded, short stubby isidia, in containing 2-chlorolichexanthone and superlatolic acid and in lacking apothecia.

Type: Queensland: Forty Mile Scrub National Park, 53 km E of Mt. Surprise, 18°06'32"S, 144°49'35"E, 700 m alt., on dead tree in vine thicket with *Ficus* and *Brachychiton*, J.A. Elix 44584, 8.viii.2006 (holotype – CANB; isotype – BRI).

Thallus corticolous, white to off-white; surface smooth and matt, slightly cracked, isidiate; soralia absent. Isidia concolorous with the thallus, numerous, crowded, short, stubby to hemispherical, 0.05–0.15 mm diam. Apothecia and ascospores not seen.

Chemistry: lichexanthone (major), 2-chlorolichexanthone (minor) and superlatolic acid (major).

Etymology: The epithet *glebulosa* is from *glebula*, the diminutive of *gleba* (Latin, lump), a reference to the numerous, crowded, short, stubby isidia.

Pertusaria glebulosa is characterised by the white to off-white thallus that fluoresces bright yellow under long wavelength UV light (360 nm), the crowded, stubby isidia and the presence of lichexanthone, 2-chlorolichexanthone and superlatolic acid.

Superficially, the new species resembles *P. isidiosa* (Archer 1991), in that both species are isidiate and contain lichexanthone, but the isidia in *P. glebulosa* are crowded, short and stubby, whereas those of *P. isidiosa* are taller (to 0.4 mm) and become coralloid-branched. The two species also have different chemistry: *P. isidiosa* contains lichexanthone, 2'-*O*-methylperlatolic acid and stictic acid. The combination of lichexanthone and 2-chlorolichexanthone is uncommon in *Pertusaria*, and is known in only two other species, *P. depressa* and *P. atromaculata* A.W.Archer & Elix.

At present the new species is only known from the type locality.

SPECIMEN EXAMINED

Queensland. Type locality, on dead tree in vine thicket with *Ficus* and *Brachychiton*, J.A. Elix 44599, 8.viii.2006 (CANB).

3. *Pertusaria hiatensis* A.W.Archer & Elix, sp. nov.
MycoBank No. **MB 819564**

Fig. 4

Similar to *Pertusaria xanthodactylina* A.W. Archer & Elix, but differs in containing thiophanic acid rather than thiophaninic and stictic acids.

Type: Queensland: Tozers Gap, Iron Range National Park, 29 km SW of Cape Weymouth (17 km NW of Lockhart River Settlement), 12°44'S, 143°11'E, 120 m alt., on semi-shaded boulder under heath, in heathy *Eucalyptus* woodland on ridge, H. Streimann 56407, 12.x.1995 (holotype – CANB; isotype – B).

Thallus saxicolous, pale fawn; surface smooth, isidiate, lacking soralia. Isidia numerous, scattered, concolorous with the thallus, cylindrical with rounded tips or sometimes subconical and tapering to a point, 0.4–0.6 mm tall and 0.1 mm diam. Apothecia and ascospores not seen.

Chemistry: thiophanic acid (major).

Etymology: The epithet *hiatensis* is from the Latin *hiatus* (opening, gap) and *-ensis* (place of origin or growth), a reference to the type locality Tozers Gap.

Pertusaria hiatensis is characterized by the sterile, isidiate thallus containing thiophanic acid as the sole lichen compound present. It resembles the saxicolous *P. xanthodactylina* (Archer 1997), but that species contains thiophaninic and stictic acids. It can be distinguished from the chemically similar but corticolous *P. lumbschii* (*vide infra*) by the density and structure of the isidia. Whereas *P. hiatensis* is saxicolous with scattered, ± subconical isidia, *P. lumbschii* is corticolous and has crowded isidia with rounded tips. The new species is one of a number of sterile, isidiate, Australian *Pertusaria* species that can be differentiated by their chemistries.

4. *Pertusaria lumbschii* A.W.Archer & Elix, sp. nov.
MycoBank No. **MB 819565**

Fig. 5

Similar to *Pertusaria xanthodactylina* A.W.Archer & Elix, but differs in growing on bark and in containing thiophanic acid rather than thiophaninic and stictic acids.

Type: Queensland: Cook District, boat ramp, c. 1 km SE of Edmonton, SE of Cairns, 17°01'S, 145°48', 1 m alt., on mangrove, H.T. Lumbsch 11140f, 24.vii.1996 (holotype – CANB).

Thallus corticolous, off-white; surface smooth, lacking soralia, densely isidiate. Isidia concolorous with the thallus, inconspicuous, simple or sometimes branched, to 0.5 mm tall and 0.1 mm diam., with rounded tips. Apothecia and asci not seen.

Chemistry: thiophanic acid (major) and unknown (minor).

Etymology: The epithet honours the collector H. Thorsten Lumbsch, who has made many important contributions to the study of Australian lichens.

Pertusaria lumbschii is characterised by the sterile, isidiate thallus and the presence of thiophanic acid. Other Australian species with thiophanic acid include the fertile saxicolous *P. thula* A.W.Archer [with additional asemone and arthothelin] from northern Queensland (Archer 1991) and the isidiate *P. alectoronica* var. *thiophanica* Kantvilas, Elix & A.W.Archer [with additional alectoronic acid] from Tasmania (Archer & Elix 2009a) as well as *P. hiatensis* described above. The new species is one of a number of isidiate *Pertusaria* species from Australia that lack apothecia and are differentiated by their chemistry.

At present *P. lumbschii* is known only from the type specimen.

5. *Pertusaria quadraginta* A.W.Archer & Elix, sp. nov.
MycoBank No. **MB 819566**

Figs 6, 7

Similar to *Pertusaria pseudococcodes* Müll.Arg., but differs in having larger ascospores and in lacking conspicuous black ostioles.

Type: Queensland: Forty Mile Scrub National Park, 53 km E of Mount Surprise, 18°17'S, 144°49'E, 770 m alt., on shrub stem in *Brachychiton*, *Pleiogonium* and *Owenia*-dominated scrub on basalt flow, H. Streimann 46740, 17.xii.1990 (holotype – CANB).

Thallus corticolous, pale fawn; surface subtuberculate, lacking isidia and soralia. Apothecia numerous, conspicuous, rarely confluent, flattened-hemispherical, 0.6–1 mm diam. Ostioles inconspicuous, pale yellow-fawn, translucent, 1 per verruca, c.

0.1 mm diam. Ascospores 2 per ascus, hyaline, ellipsoid, with smooth inner walls, 120–150 × 35–40 µm.

Chemistry: 4,5-dichlorolichexanthone (minor), stictic acid (major), constictic acid (minor).

Etymology: The epithet *quadraginta* is derived from the Latin for *forty*, a reference to the type locality, the Forty Mile Scrub.

Pertusaria quadraginta is characterized by apothecia with inconspicuous, pale yellow-fawn ostioles, 2-spored asci and the presence of 4,5-dichlorolichexanthone and stictic acid. It is chemically similar to *P. pseudococcodes* from Sri Lanka (Müller 1884), which also has 2-spored asci, but the ascospores are shorter (85–110 µm long), and *P. quadraginta* lacks the conspicuous black ostioles of *P. pseudococcodes*.

The chemically similar species *P. consocians* Dibben from North America (Dibben 1980) has longer ascospores (91–148(–215) µm), whereas in *P. pertusa* (L.) Tuck. from Europe, Africa and Asia, the ascospores are even longer (145–230 µm) (Smith *et al.* 2009). Both species have black ostioles similar to those of *P. pseudococcodes*.

At present *P. quadraginta* is known only from the type specimen.

6. *Pertusaria salazinica* A.W.Archer & Elix, sp. nov.

Fig. 8

Mycobank No. MB 819567

Similar to *Pertusaria lacerans* Müll.Arg., but differs in containing salazinic and norstictic acids rather than picrolichenic acid.

Type: Queensland: Tully Falls National Park, 12.6 km S of Ravenshoe, 17°41'57"S, 145°31'24", 885 m alt., in montane rainforest, on rotting log, *J.A. Elix 44549*, 7.viii.2006 (holotype – CANB; isotype – BRI).

Thallus corticolous, pale fawn; surface smooth, shiny, somewhat cracked, lacking isidia and soralia. Apothecia numerous, conspicuous, immature, pustulate, disciform, 0.5–0.9 mm diam., lacking a well-defined epitecium. Asci and ascospores not seen.

Chemistry: salazinic acid (major), norstictic acid (major) and connorstictic acid (minor).

Etymology: The epithet *salazinica* is derived from salazinic acid, the major lichen compound present.

Pertusaria salazinica is characterized by the presence of numerous, immature, disciform apothecia, and the presence of salazinic and norstictic acids. Externally, it resembles *P. lacerans*, but that species contains picrolichenic acid. Its chemistry is identical to that of *P. celata* A.W.Archer & Elix from New Zealand (Archer & Elix 1994), but that species has verruciform apothecia and asci with eight biseriolate ascospores. Salazinic and norstictic acids also occur in the fertile, disciform *P. casta* Zahlbr. from South Africa (Zahlbruckner 1936), but they are accompanied by chlorinated norlichexanthones.

At present, the new species is known only from the type specimen.

7. *Pertusaria ternata* A.W.Archer & Elix, sp. nov.

Figs 9, 10

Mycobank No. MB 819568

Similar to *Pertusaria aberrans* Müll.Arg., but differs in having larger ascospores and in lacking sunken ostioles.

Type: Queensland: Rocky Creek, 4 km NE of Nambour, 29°36' S, 152°58' E, 40 m alt., on vine in disturbed rainforest on steep creek slopes, *J.A. Elix 35512*, 4.ix.1993 (holotype – CANB).

Thallus corticolous, pale fawn; surface subtuberculate and shiny, slightly cracked. Apothecia verruciform, scattered, concolorous with the thallus, sometimes confluent, flattened-hemispherical, not constricted at the base, 0.7–1.0(–1.5) mm diam. Ostioles black, punctiform, 1–2(–3) per verruca, *c.* 0.05 mm diam. Ascospores hyaline, elongate-ellipsoid, with smooth inner walls, 3(–4) per ascus, 100–120 × 30–40 µm.

Chemistry: thiophaninic acid (major) and stictic acid (minor).

Etymology: The epithet *ternata* is derived from the Latin *ternatus* (in threes), a reference to the three-spored asci usually present in the new species.

Pertusaria ternata is characterised by asci with 3(–4) ascospores and the presence of thiophaninic and stictic acids. This combination of lichen compounds is not uncommon in *Pertusaria*, but is usually found in species with 2 or 8 ascospores per ascus [such as *P. dispersa* Vain. (Africa), *P. subflavens* Müll.Arg. (Socotra), *P. subrugosa* Nyl. (Japan), *P. thiospoda* Knight (Australia) and *P. xanthothelia* Müll.Arg. (Africa), all with 2 ascospores per ascus, and *P. cinctula* Müll.Arg. (Africa), *P. leioplacella* Nyl. (New Caledonia), *P. texana* Müll.Arg. (USA), *P. xanthoplaca* Müll.Arg. (Australia) and *P. xanthothelia* Müll.Arg. (Africa), all with 8 ascospores per ascus.]

Only one other corticolous species contains thiophaninic and stictic acids with 3 or 4 ascospores per ascus, namely *P. aberrans* Müll.Arg., described from Victoria (Müller 1893, Fig. 11), but two chemically similar saxicolous species (with 4 ascospores per ascus) have been reported from Japan, *P. kashiwadani* Shibuichi and *P. boninensis* Shibuichi (Shibuichi, 1979), which differ from the new species in their substratum. The ascospores of *P. aberrans* are shorter than those of *P. ternata* (60–85 µm long). In addition, the ostioles in *P. aberrans* are conspicuous, sunken and disc-like, whereas the punctiform ostioles in *P. ternata* are inconspicuous.

At present *P. ternata* is known only from the type locality.

SPECIMEN EXAMINED

Queensland: • Type locality, on vine in disturbed rainforest on steep creek slopes, *J.A. Elix 35533*, 4.ix.1993 (CANB).

New record for Australia

Pertusaria violacea Oshio, *J. Sci. Hiroshima Univ. Ser. B, Div. 2 (Botany)* **12**, 92 (1968–69)

Fig. 12

Type: Japan, Pref. Tottori, Mt Daisen, 820 m, on the bark of *Cryptomeria japonica*, no. 6207; holotype: HIRO.

Pertusaria violacea is characterised by large [0.3–2(–3) mm diam.], white soralia with granulose soredia, the absence of apothecia and ascospores, and the presence of thamnolic acid. Oshio (*loc. cit.*) reported the thallus to react K+ yellow and then purple; Dibben, who examined a specimen sent to him by Oshio, also reported the presence of thamnolic acid (Dibben 1975). The species is distinguished from *P. leucosorodes* Nyl. by the granulose soredia and the absence of lichexanthone. The latter has farinose soredia and contains lichexanthone in addition to thamnolic acid. The two species can be differentiated by the presence (in *P. leucosorodes*) or absence (in *P. violacea*) of lichexanthone and hence their respective fluorescence under long-wavelength UV light (Fig. 13). Oshio subsequently recognised *P. violacea* as a later synonym of *P. variolina* Nyl. (Oshio 1977). Both species contain thamnolic acid, but *P. variolina* has fertile disciform apothecia containing a single ascospore, 100–140 µm long (Nylander 1890). In contrast, *P. violacea* is a sterile, sorediate species, and is here maintained as a separate species. *Pertusaria subviolacea* Q.Ren, described from China, is morphologically similar to *P. violacea*, but contains hypothamnolic and cryptothamnolic acids (Ren 2014).

SPECIMENS EXAMINED

Queensland: • Wide Bay district, State Forest, Kidaman Creek Road, c. 1 km N of Curramore Road junction, 26°41'S, 152°47'E, 500 m alt., on old fallen log in dryish *Eucalyptus* forest, P.C. Heyligers L359, 12.iii.1999 (CANB).

New South Wales: • Patonga, Patonga Creek, 33°53'S, 151°27'E, 1 m alt., on *Avicennia*, A.W. Archer P665 p.p., 2.xi.1993 (NSW).

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Fig. 1. *Pertusaria gadgarrensis* (holotype). Habit of thallus. Scale bar = 1 mm.



Fig. 2. *Pertusaria gadgarrensis* (holotype). Ascospores. Scale bar = 50 μ m.



Fig. 3. *Pertusaria glebulosa* (holotype). Habit of thallus. Scale bar = 1 mm.



Fig. 5. *Pertusaria lumbschii* (holotype). Habit of thallus. Scale bar = 1 mm.



Fig. 4. *Pertusaria hiatensis* (holotype). Habit of thallus. Scale bar = 1 mm.



Fig. 6. *Pertusaria quadraginta* (holotype). Habit of thallus. Scale bar = 1 mm.

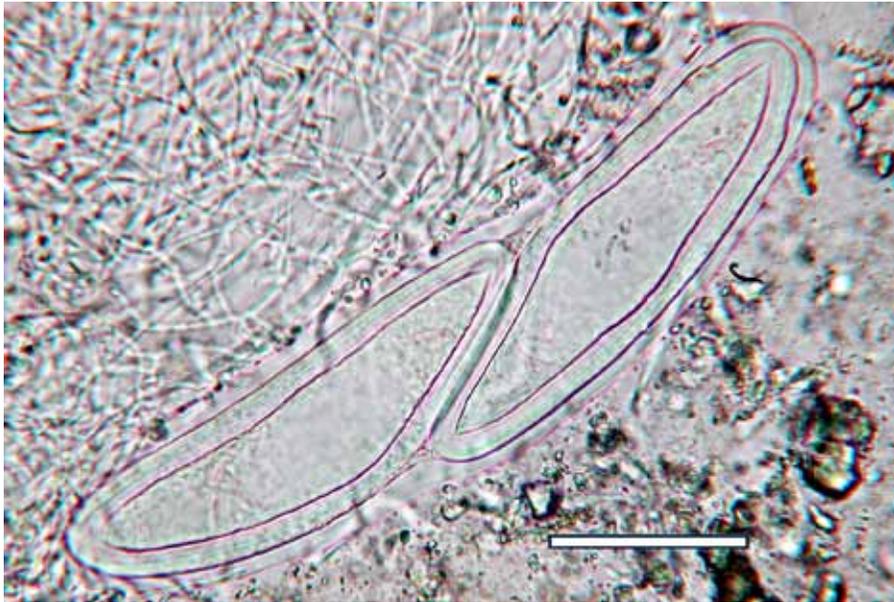


Fig. 7. *Pertusaria quadraginta* (holotype). Ascospores. Scale bar = 50 μ m.



Fig. 9. *Pertusaria ternata* (holotype). Habit of thallus. Scale bar = 1 mm.



Fig. 8. *Pertusaria salazinicata* (holotype). Habit of thallus. Scale bar = 1 mm.



Fig. 10. *Pertusaria ternata* (holotype). Ascospores. Scale bar = 50 μ m.



Fig. 11. *Pertusaria aberrans* (isotype). Habit of thallus. Scale bar = 1 mm.



Fig. 12. *Pertusaria violacea* (Heyligers L359, CANB). Habit of thallus. Scale bar = 1 mm.



Fig. 13. *Pertusaria violacea* and *P. leucosorodes* under long wavelength UV light. Scale bar = 1 cm.

Two new species and a new record of Acarosporaceae
(lichenized Ascomycota) from eastern Australia

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Abstract: *Sarcogyne canberrense* sp. nov. is described from limestone outcrops in *Eucalyptus* woodland in the Australian Capital Territory, and *S. tholifera* sp. nov. is reported from compacted, acidic soil in woodland in the southern Darling Downs, Queensland and on the central-western slopes of New South Wales. *Caeruleum heppii* (Nägeli ex Körb.) K.Knudsen & L.Arcadia, is recorded for the first time from Australia (A.C.T.). A key is provided to the 23 species and infraspecific taxa of Australian Acarosporaceae.

The lichen family Acarosporaceae Zahlbr. includes about 200 species in 10 genera, having appeared in the Carboniferous–early Permian but only diverged quite recently, in the upper Cretaceous (Prieto & Wedin 2013, Westberg *et al.* 2015). Found in most climatic regions, these lichens grow on exposed rocks and soil. They are especially diverse in temperate and arid habitats, and they are least common in the wet tropics. The thallus is crustose, squamulose or placodioid, mainly free-living, with lecanorine or lecideine ascomata and asci that usually produce 50–200 or more, simple ascospores.

Species of *Sarcogyne* Flot. have a crustose, often immersed and usually inconspicuous thallus, reddish brown to black apothecia with a lecideine exciple, a non-carbonized epihymenium and simple to sparingly branched paraphyses (Magnusson 1935, 1937; Clauzade & Roux 1985; Knudsen & Standley 2008; Fletcher & Hawksworth 2009). More than 40 accepted species inhabit calcareous and siliceous rocks and soil, mainly in temperate and semi-arid regions (especially in Europe, North Africa and North America), less commonly at subtropical, wet-tropical and subpolar latitudes.

In this contribution, two new species of *Sarcogyne* are described from limestone in the Australian Capital Territory and from soil in southern Queensland and central-western New South Wales, and *Caeruleum heppii* (Nägeli ex Körb.) K.Knudsen & L.Arcadia is recorded for the first time from Australia (A.C.T.). Following Westberg *et al.* (2015) and Knudsen & Kocourková (2015), and incorporating the latest additions, the Australian lichen flora currently includes 12 species and an additional variety of *Acarospora*, eight species of *Sarcogyne* and one each of *Caeruleum* K.Knudsen & L.Arcadia and *Myriospora* Nägeli. A key is provided to the 23 taxa.

Methods

Observations and measurements of thallus and apothecium anatomy, asci, ascospores and conidia were made on hand-cut sections mounted in water and treated with 10% potassium hydroxide (K) and 50% nitric acid (N). Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K. Chemical constituents were identified by thin-layer chromatography (TLC) and high-performance liquid chromatography (HPLC, Elix 2014) and comparison with authentic samples.

New species

Sarcogyne canberrensis P.M.McCarthy & Elix, sp. nov.
Mycobank No. MB 818170

Figs 1A, 2

Characterized by a whitish to pale greenish grey, endolithic to subepilithic thallus, with or without a poorly defined cortex and lacking lichen substances. Apothecia adnate, 0.2–0.52 mm diam., with a black, deeply concave to plane disc, a paler, lecideine margin that is non-carbonized, prosoplectenchymatous and cupulate in section, a thin, pale hypothecium, a non-dispersed hymenium of mainly simple paraphyses, and asci containing c. 80–150 ascospores that are narrowly to broadly ellipsoid or subglobose and $4\text{--}8.5 \times 2.5\text{--}5 \mu\text{m}$.

Type: Australia, Australian Capital Territory, Cotter Caves, c. 20 km W of Canberra, 35°20'01"S, 148°56'28"E, alt. 580 m, on sheltered limestone outcrops in *Eucalyptus* woodland, P.M. McCarthy 4481, 4.v.2016 (holotype – CANB).

Thallus crustose, endolithic to subepilithic, effuse to ± determinate, continuous to quasi-areolate, 0.05–0.13 mm thick, forming colonies to c. 2 cm wide, heavily impregnated with rock fragments and crystals that commonly protrude; 'areoles' formed by minute fissures in the surface of the crumbling substratum in conjunction with the biological weathering action of the lichen. **Cortex** poorly defined, c. 8–12 μm thick, hyaline, of rounded, thick-walled cells 2–3 μm wide, or indistinct as a c. 5–10 μm thick necral layer, or not apparent. **Algal layer** discontinuous, 30–60 μm thick; cells green, chlorococcoid, globose, 7–10(–13) μm wide; interstitial mycobiont cells ± rounded, 2–5 μm wide. **Medulla** poorly defined; hyphae moniliform, 2.5–4 μm wide. **Prothallus** not apparent. **Apothecia** very numerous, lecideine, adnate, solitary, paired, in clusters of 3–5 or in irregular rows of up to 6, rounded or broadly ellipsoid, although the shape is commonly distorted due to mutual pressure, (0.2–)0.37(–0.52) mm diam. [$n = 75$], subtended by a continuous layer of algae which is broken only by rock fragments; disc deeply concave to plane, smooth, epruinose, dull greenish black to jet-black, the colour unchanged when wetted or becoming slightly paler and translucent; margin 30–50 μm thick, entire, smooth, persistent at maturity, usually slightly to considerably paler than the disc and pale to medium brown, occasionally concolorous, epruinose; some (mostly immature) apothecia with a pale, pseudothalline margin that is mostly amorphous necral material, with few or no algal cells. **Proper excipulum** non-carbonized, 35–60 μm thick in section, radiating-prosoplectenchymatous, the outer 15–30 μm medium to dark olive-brown, the hyphae tightly conglomerate, elongate, thick-walled, with cells 2–3 μm wide, the outermost cells ellipsoid to subglobose, 3–5 μm (these cells not enlarged when the excipulum has a hyaline, necral, extra-excipular coat); inner marginal zone hyaline to pale brown, 20–35 μm thick, with longer, thinner-walled, paler hyphae; excipulum base colourless, 10–15 μm thick, composed of long-celled, thin-walled, periclinal hyphae. **Hypothecium** hyaline to very pale brown, 10–35 μm thick, not or very sparingly interspersed with granules, K–, N–, I– (with or without pretreatment in K), of loose, short-celled, variously orientated hyphae 1.5–2 μm wide. **Hymenium** 70–95 μm thick, not interspersed with granules or oil droplets; hymenial gel I+ blue. **Epithymenium** dark reddish brown, 10–15(–20) μm thick, K–, N+ pale brown. **Paraphyses** rather tightly conglomerate in water, loosening a little in K (except near the apices), unbranched below, repeatedly branched in the epihymenium, long-celled, 2–2.5(–3) μm wide, some but not all apical cells thicker-walled, rounded, with diffuse or dark, capitate pigmentation and 3–4 μm wide; cell contents clear or minutely granulose. **Asci** narrowly to broadly clavate or clavate-cylindrical (immature asci often narrowly cylindrical), containing c. 80–150 ascospores, 62–105 \times 18–34 μm [$n = 25$], with an abrupt or more tapering stalk; apex rounded, with a thin to thick, uniformly but lightly amyloid tholus and an inconspicuous or distinct ocular chamber. **Ascospores** colourless, simple, narrowly to broadly ellipsoid

or subglobose, with rounded or, occasionally, somewhat pointed ends, lacking a perispore, usually uni- or biguttulate, the contents also commonly granular, (4–)6(–8.5) × (2.5–)4(–5) μm [*n* = 50]. *Pycnidia* solitary, sparse or patchily numerous, 60–100 μm diam., ± globose, almost completely immersed in the thallus, black above, with an ostiolate or more gaping opening, medium to dark brown below; conidiogenous layer simple or convoluted; conidiogenous hyphae simple, 8–10(–15) × *c.* 1 μm; conidia narrowly to broadly ellipsoid, hyaline, 0.8–2 × 0.5–1 μm.
Chemistry: Thallus K–, C–, KC–, PD–, UV–; no substances detected by TLC.

Etymology: The specific epithet refers to the discovery of this new lichen near Canberra, the national capital.

Remarks

Six species of *Sarcogyne* have been reported from Australia, *viz.* *S. clavus* (DC.) Kremp. and *S. hypophaea* (Nyl.) Arnold from the south-west of Western Australia, the rather common *S. regularis* Körb. from temperate latitudes, *S. iridana* P.M. McCarthy & Kantvilas from sandstone in central Australia, *S. meridionalis* P.M. McCarthy & Kantvilas from limestone, mainly in southern coastal and hinterland areas, and *S. sekikaica* P.M. McCarthy & Elix from montane rhyolite in the Central Tablelands of New South Wales (McCarthy & Kantvilas 2013, McCarthy & Elix 2014, McCarthy 2016). *Sarcogyne meridionalis*, the Australian species most similar to *S. canberrensis*, differs in having a more endolithic thallus, smaller, immersed and deeply concave apothecia with a dark brown to black proper margin, a thicker hypothecium [30–60(–80) μm] and asci containing 150–200 ascospores that are significantly smaller (3–6 × 1.5–2.5 μm) than those of *S. canberrensis* (McCarthy & Kantvilas 2013).

The new lichen is probably referable to the informal *Sarcogyne nivea* group comprising at least seven calcicolous species from the Northern Hemisphere. The group is characterized by a non-carbonized excipulum, a hyaline hypothecium and broadly ellipsoid to globose ascospores (Knudsen *et al.* 2009). While most members have discontinuously larger apothecia (usually with a much thicker hymenium) and/or significantly larger or smaller ascospores (Magnusson 1935, 1937; Knudsen *et al.* 2009), *S. polackiana* (Müll. Arg.) H. Magn., from Iran, has apothecia and ascospores of a similar size to *S. canberrensis*. However, the apothecia are basally constricted, with a thinner, paler and probably annular (rather than cupulate) excipulum, a much thicker and centrally obconical hypothecium and smaller asci (50–60 × 17–20 μm; Magnusson 1937).

Sarcogyne canberrensis is known only from the type locality, a shallow valley in *Eucalyptus* woodland in the Australian Capital Territory. Outcrops and boulders only metres up the side of the valley are bare, or support only a depauperate lichen flora, presumably since severe bushfires impacted the area in 2003. However, *S. canberrensis* is moderately abundant along a 20-metre-long series of small Silurian limestone outcrops, boulders and rubble among herbs and low shrubs on the valley floor. There, a diverse and well-established lichen community remains almost untouched by recent fires and includes *Caeruleum heppii* (Nägeli ex Körb.) K. Knudsen & L. Arcadia (see below), *Caloplaca* aff. *atroflava* (Turner) Mong., *C. mereschkowskiana* S. Y. Kondr. & Kärnefelt, *Candelariella aurella* (Hoffm.) Zahlbr., *Circinaria contorta* (Hoffm.) A. Nordin, S. Savič & Tibell, *Lecania turicensis* (Hepp) Müll. Arg. (a new record for the A.C.T.; P.M. McCarthy 4482, CANB), *Lecanora dispersa* (Pers.) Sommerf., *Sarcogyne meridionalis* P.M. McCarthy & Kantvilas (a new record for the A.C.T.; P.M. McCarthy 4486 (part), 4487, CANB), *S. regularis* Körb., *Verrucaria muralis* Ach. (a new record for the A.C.T.; P.M. McCarthy 4483, CANB) and *V. nigrescens* Pers.

ADDITIONAL SPECIMEN EXAMINED

AUSTRALIA: Australian Capital Territory: type locality, P.M. McCarthy 4486, 4.v.2016 (CANB).

Sarcogyne tholifera P.M. McCarthy & Elix, *sp. nov.*
Mycobank No. MB 818171

Figs 1B, 3

Characterized by the terricolous, mainly yellowish and minutely squamulose, ecorticate thallus containing rhizocarpic acid (major) and epanorin (minor). Apothecia semi-immersed to almost superficial and moderately to strongly convex or ± hemispherical, lecidine, 0.32–0.62 mm diam., with a dull greenish black, bilayered, cupulate excipulum, a shallow hypothecium, a deep hymenium 220–280 μm thick, an evenly pigmented epihymenium lacking melanized or carbonized accretions, sparingly branched and anastomosing paraphyses, and large asci containing hundreds of broadly ellipsoid to subglobose ascospores measuring 2–3.5 × 1.5–2.5 μm.

Type: Australia, Queensland, Darling Downs, Yelarbon State Forest, 10.5 km S of Inglewood, 28°30'23"S, 151°06'18"E, alt. 315 m, on compacted, acidic soil in *Eucalyptus-Callitris* woodland, J.A. Elix 43831, 8.v.2005 (holotype – CANB; isotypes – BRI, CANB).

Thallus terricolous, minutely squamulose (in places crustose and contiguous-areolate), forming colonies up to 5(–8) cm wide. *Squamules* rounded to oblong and moderately to strongly convex or almost subglobose, the largest often flatter, more irregular in shape or with minutely effigurate margins, mostly pale to medium greenish yellow, patchily medium greyish green, dull, smooth, epruinose, 0.1–0.4(–0.6) mm in maximum extent, scattered or, more commonly, closely aggregated and contiguous or not, but not overlapping, 50–120(–150) μm thick. *Cortex* and necral layer lacking on upper and lower surfaces; uppermost 5–8 μm of the thallus free of algae but otherwise undifferentiated. *Algal layer* continuous and dominating the thallus; cells green, ± globose, 4–8 μm wide; interstitial mycobiont cells ± rounded above, more hyphal below, 2–3(–4) μm wide. *Medulla* poorly defined, the deepest parts of the thallus a mixture of algal cells, loose hyphae, rhizohyphal initials and soil material. *Squamules* broadly anchored in the substratum by: 1) undifferentiated thalline hyphae; 2) simple or sparingly branched, hyaline rhizohyphae that are short-celled or moniliform, rather thick-walled and 4–7(–8) μm wide; 3) rudimentary rhizines formed of several intertwined, conglutinate rhizohyphae and up to 25 μm thick; anchoring structures can penetrate the soil to a depth of at least 0.5 mm. *Prothallus* not apparent. *Apothecia* sparse to numerous, scattered, developing within squamules, later largely immersed in the soil, at maturity semi-immersed to almost superficial and moderately to strongly convex or ± hemispherical, (0.32–)0.47(–0.62) mm diam. [*n* = 50]; margin curving upwards and inwards, dull greenish black, with a faint rim that delimits a usually plane, concolorous or slightly paler, smooth, epruinose disc one-third to half the diameter of the ascoma, its colour unchanging when wetted. *Thalline margin* absent. *Proper excipulum* cupulate, the rim curving inwards, 25–50 μm thick at the sides, tapering towards the apex and thickening towards the base (40–75 μm thick), bilayered; outer layer dark greenish brown, N+ orange-brown, 10–15 μm thick laterally, 25–50 μm thick at the base, composed of rounded, thick-walled cells 6–10 μm diam., grading to a hyaline to pale brown inner layer that is 15–35 μm thick at the sides and 20–25 μm thick basally, the innermost hyphae tightly packed, elongate, thin-walled, periclinal, 10–15 μm long and 1.5–2 μm wide. *Hypothecium* hyaline, 20–30 μm thick, not interspersed with granules or oil globules, K–, N–, I– (with or without pretreatment in K). *Hymenium* 220–280 μm thick, not interspersed with granules or oil globules, only the hymenial gel and ascus apices I+ blue. *Epihymenium* dark reddish brown to olive-brown, an evenly pigmented gel surrounding the uppermost 15–30 μm of the paraphyses, lacking melanized or carbonized accretions, K–, N–. *Paraphyses* rather tightly conglutinate in water, loosening a little in K, long-celled, 1.5–2(–2.5) μm wide, mostly simple or simple for most of their length, occasionally branched and anastomosing especially in basal or distal parts and in those paraphyses that are farthest from the excipulum; apical cells not swollen. *Asci* narrowly clavate, narrowly

obclavate or clavate-cylindrical, each containing several hundred ascospores, 140–230 × 20–30 μm [*n* = 15], with an abrupt or tapering stalk; apex rounded or subacute, with a thin, uniformly amyloid tholus; ocular chamber not apparent; ascoplasma non-amyloid. *Ascospores* colourless, simple, mostly broadly ellipsoid or subglobose, occasionally globose, lacking a perispore, the contents commonly guttulate, (2–)3(–3.5) × (1.5–)2(–2.5) μm [*n* = 50]. *Pycnidia* not seen.

Chemistry: Thallus K–, C–, KC–, PD–, UV–; rhizocarpic acid (major), epanorin (minor) by HPLC.

Etymology: The specific epithet refers to the shape of the ascomata, from the Latin *tholus* (a dome) and the suffix *-ifera* (-bearing).

Remarks

Sarcogyne tholifera is a very distinctive lichen, and while it is unlike any other species of *Sarcogyne*, it appears to exhibit attributes of both that genus and *Acarospora* A.Massal. Thus, the minutely squamulose, predominantly yellowish thallus has a secondary chemistry dominated by rhizocarpic acid and similar to that of yellow species of *Acarospora* (Knudsen 2008a), and while the squamules are ecorticate, the latter character is consistent with the broader circumscription of *Acarospora* that subsumes *Polysporina* Vězda (Kantvilas 1998, Knudsen 2008c, Westberg *et al.* 2015, Knudsen & Kocourková 2015). The ascomata are lecideine apothecia, as are those of *Polysporina*, but they lack all traces of carbonization in the epihymenium and exciple and melanized accretions in the smooth and evenly pigmented epihymenium. However, given the absence of a thalline margin, combined with an inrolled and melanized proper excipulum and a hamathecium of sparingly branched paraphyses, this new species is most appropriately assigned to *Sarcogyne* as it is currently recognized (K.Knudsen, pers. comm.).

The prominent apothecia of *S. tholifera*, and their distinctive excipulum, are very similar to those of the terricolous *Acarospora tasmaniensis* K.Knudsen & Kocourk. [syn: *Polysporina terricola* Kantvilas (1998); and see a photograph in McCarthy (2016)]. However, the Tasmanian lichen has a greyish, almost nondescript thallus that lacks lichen substances, the epihymenium has melanized accretions, and the paraphyses exhibit abundant anastomoses, their hyphal cells containing oil-filled vacuoles that can give them a moniliform appearance (Kantvilas 1998).

The new species is known from consolidated, acidic soil in two woodland localities in southern Queensland and central-western New South Wales.

ADDITIONAL SPECIMENS EXAMINED

AUSTRALIA: Queensland: Darling Downs: type locality, *J.A. Elix* 43835, 8.v.2005 (CANB). New South Wales: Central-Western Slopes: Goonoo State Forest, Ranters Creek, Cashels Dam Road, 33 km SE of Gilgandra, 31°58'25"S, 148°51'46"E, alt. 360 m, on compacted, acidic soil in *Eucalyptus-Callitris* woodland with a *Calytrix* and *Grevillea* understorey, *J.A. Elix* 37398, 12.x.2005 (CANB).

New record

Caeruleum heppii (Nägeli ex Körb.) K.Knudsen & L.Arcadia, *Opuscula Philolichenum* 11, 24 (2012)

Acarospora heppii Nägeli ex Körb., *Parerga Lichenologica* 61 (1865). Type: "Auf Kalkstein, Findlingen", *P. Hepp*, *Fletcher Europas* 57; *n.v.*

Thallus of scattered or contiguous, rounded to irregular areoles or squamules that are pale greyish brown, 0.4–0.8(–1) mm wide, to 0.2 mm thick, epruinose, ecorticate, sometimes reduced to a narrow thalline ring around individual apothecia, often almost translucent when wetted, K–, C–. *Apothecia* lecanorine, immersed, usually 1

per areole/squamule, 0.2–0.5 mm wide; disc concave to plane, smooth, pale to medium olive-brown or red-brown, frequently pale greyish blue-pruinose; proper margin concolorous with or a little darker than the disc, 20–40 μm thick; hypothecium hyaline, 10–15 μm thick; hymenium 80–110 μm thick, amyloid; epihymenium pale reddish brown or nondescript; paraphyses 0.5–1 μm wide, anastomosing; asci 70–100 × 10–15 μm, with a thick, I+ dark blue tholus, producing c. 200 ascospores; ascospores hyaline, simple, narrowly ellipsoid, 2.5–5 × 1.5–2.5 μm.

This often inconspicuous lichen is best-known from calcareous rocks in warm-temperate to boreal latitudes of Europe and North America (Clauzade & Roux 1985, Knudsen 2008b, Fletcher *et al.* 2009); it has also been documented from Ecuador (Knudsen 2012) and South Korea (Kondratyuk *et al.* 2013). Reported here for the first time from Australia, *C. heppii* grows on limestone in the Australian Capital Territory, in association with the newly described *Sarcogyne canberrensis*. See under that species for additional habitat and floristic information.

SPECIMENS EXAMINED

AUSTRALIA: Australian Capital Territory: Cotter Caves, c. 20 km W of Canberra, 35°20'01"S, 148°56'28"E, alt. 580 m, on sheltered limestone outcrops in *Eucalyptus* woodland, *P.M. McCarthy* 4484, 4485, 4.v.2016 (CANB).

Key to the Australian species of *Acarosporaceae*

- 1 Thallus squamulose-areolate, yellow-green; rhizocarpic acid present2
- 1: Thallus immersed to superficial and squamulose-areolate, shades of grey, brown, or orange-red to rust-red; rhizocarpic acid absent4
- 2 Thallus terricolous; apothecia lecideine, black [Qld, N.S.W., endemic].....*Sarcogyne tholifera* P.M.McCarthy & Elix
- 2: Thallus saxicolous; apothecia lecanorine, yellow to brown.....3
- 3 Areoles contiguous; margins sublobate [W.A., N.T., S.A., Qld, Vic, endemic]*Acarospora novae-hollandiae* H.Magn.
- 3: Areoles scattered or contiguous; margins never sublobate [syn: *A. negligens* H.Magn.; W.A., N.T., S.A., Qld, N.S.W., A.C.T., Vic., Tas.].....*Acarospora citrina* (Taylor) Zahlbr. ex Rech.
- 4 Thallus terricolous5
- 4: Thallus saxicolous8
- 5 Thallus crustose, effuse, free-living; apothecia lecideine, black; paraphyses anastomosing [syn: *Polysporina terricola* Kantvilas; Tas., endemic]*Acarospora tasmaniensis* K.Knudsen & Kocourk.
- 5: Thallus crustose-areolate or squamulose, lichenicolous on *Diploschistes* spp.; apothecia lecanorine; paraphyses simple.....6
- 6 Thallus C+ red; gyrophoric and 5-O-methylhiascic acids present [syn: *A. macrocarpa* H.Magn.; W.A., S.A., N.S.W., Vic., endemic]*Acarospora ferdinandii* Müll.Arg.
- 6: Thallus C–; gyrophoric and 5-O-methylhiascic acids absent7
- 7 Thallus K–; norstictic acid absent [W.A., S.A., N.S.W., Vic.].....*Acarospora nodulosa* (Dufour) Hue var. *nodulosa*
- 7: Thallus K+ yellow then red; norstictic acid present [Knudsen (2008a) considered this to be synonymous with var. *nodulosa*; S.A., N.S.W., Vic.]*Acarospora nodulosa* var. *reagens* (Zahlbr.) Clauzade & Cl.Roux

8 Apothecia lecanorine.....	9
8: Apothecia lecideine.....	16
9 Thallus on limestone.....	10
9: Thallus on siliceous rocks.....	12
10 Ascus tholus IKI+ blue; thallus thin, areolate or squamulose, or poorly developed and reduced to a rim around the 0.2–0.5 mm wide apothecia [syn: <i>A. heppii</i> Nägeli ex Körb.; A.C.T.].....	<i>Caeruleum heppii</i> (Nägeli ex Körb.) K.Knudsen & L.Arcadia
10: Ascus tholus IKI–; thallus usually well-developed to robust.....	11
11 Apothecial disc and margin densely blue-grey pruinose; areoles angular, margins wavy, ± evanescent [S.A., N.S.W.].....	<i>Acarospora glaucocarpa</i> (Ach.) Körb.
11: Apothecial disc epruinose; areoles grey-brown, robust, margins often white, densely pruinose [W.A., S.A., Vic.].....	<i>Acarospora cervina</i> A.Massal.
12 Thallus K+ yellow then red; norstictic acid present.....	13
12: Thallus K–; norstictic acid absent.....	14
13 Apothecia 1–2(–3) per areole; 0.1–0.15 mm diam. [Tas., endemic].....	<i>Acarospora tasmanica</i> Räsänen
13: Apothecia 3–7 per areole, 0.2–0.3 mm diam. [syn: <i>A. smaragdula</i> (Wahlenb.) A.Massal.; W.A., S.A., A.C.T.].....	<i>Myriospora smaragdula</i> (Wahlenb.) Nägeli ex Uloth
14. Thallus C+ red; gyrophoric acid present [syn: <i>A. fusciorufa</i> F.Wilson ex H.Magn.; N.S.W., Vic.].....	<i>Acarospora fuscata</i> (Nyl.) Arnold
14: Thallus C–; gyrophoric acid absent.....	15
15 Thallus deep orange-red to rust-red; disc black, 2–5 per areole, often gyrose [W.A., S.A.].....	<i>Acarospora sinopica</i> (Wahlenb.) Körb.
15: Thallus yellow-brown to brown or brownish black; disc concolorous with thallus, 1–3 per areole, not gyrose [N.S.W., A.C.T., Tas.].....	<i>Acarospora veronensis</i> A.Massal.
16 Apothecial disc umbonate to gyrose; excipulum carbonized; paraphyses anastomosing or not; usually on siliceous rocks [syn: <i>Polysporina simplex</i> (Davies) Vězda; W.A.].....	<i>Acarospora simplex</i> (Davies) Jatta
16: Apothecial disc ± smooth; excipulum carbonized or not.....	17
17 Excipulum carbonized.....	18
17: Excipulum not carbonized.....	19
18 Apothecia 0.4–1 mm diam.; margin entire; hypothecium colourless to pale brown [W.A.].....	<i>Sarcogyne hypophaea</i> (Nyl.) Arnold
18: Apothecia 1–3(–6) mm diam.; margin crenulate; hypothecium medium to dark brown [W.A.].....	<i>Sarcogyne clavus</i> (DC.) Kremp.
19 Thallus on calcareous rocks.....	20
19: Thallus on siliceous rocks.....	22
20 Apothecia 0.4–1.2 mm diam.; disc usually white- to blue-grey-pruinose, plane to convex [W.A., S.A., N.S.W., A.C.T., Vic., Tas.].....	<i>Sarcogyne regularis</i> Körb.
20: Apothecia 0.15–0.5 mm diam.; disc epruinose, deeply concave to plane.....	21

21 Apothecia immersed, often leaving pits in the substratum; ascospores 3–6 × 1.5–2.5 μm, c. 150–200 per ascus; hypothecium 30–80 μm thick [S.A., A.C.T., Tas., endemic].....
Sarcogyne meridionalis P.M.McCarthy & Kantvilas
 21: Apothecia mostly adnate; ascospores 4–8.5 × 2.5–5 μm, c. 80–150 per ascus; hypothecium 10–35 μm thick [A.C.T., endemic].....
Sarcogyne canberrensis P.M.McCarthy & Elix

22 Thallus whitish, lacking secondary metabolites; apothecia epruinose; ascospores 3–7 × 1.5–2.5 μm, c. 150–180 per ascus [N.T., endemic].....
Sarcogyne iridana P.M.McCarthy & Kantvilas
 22: Thallus greenish grey, containing sekikaic acid; apothecia pruinose or not; ascospores 6–9.5 × 3–5 μm, c. 40–60(–80) per ascus [N.S.W., endemic].....
Sarcogyne sekikaica P.M.McCarthy & Elix

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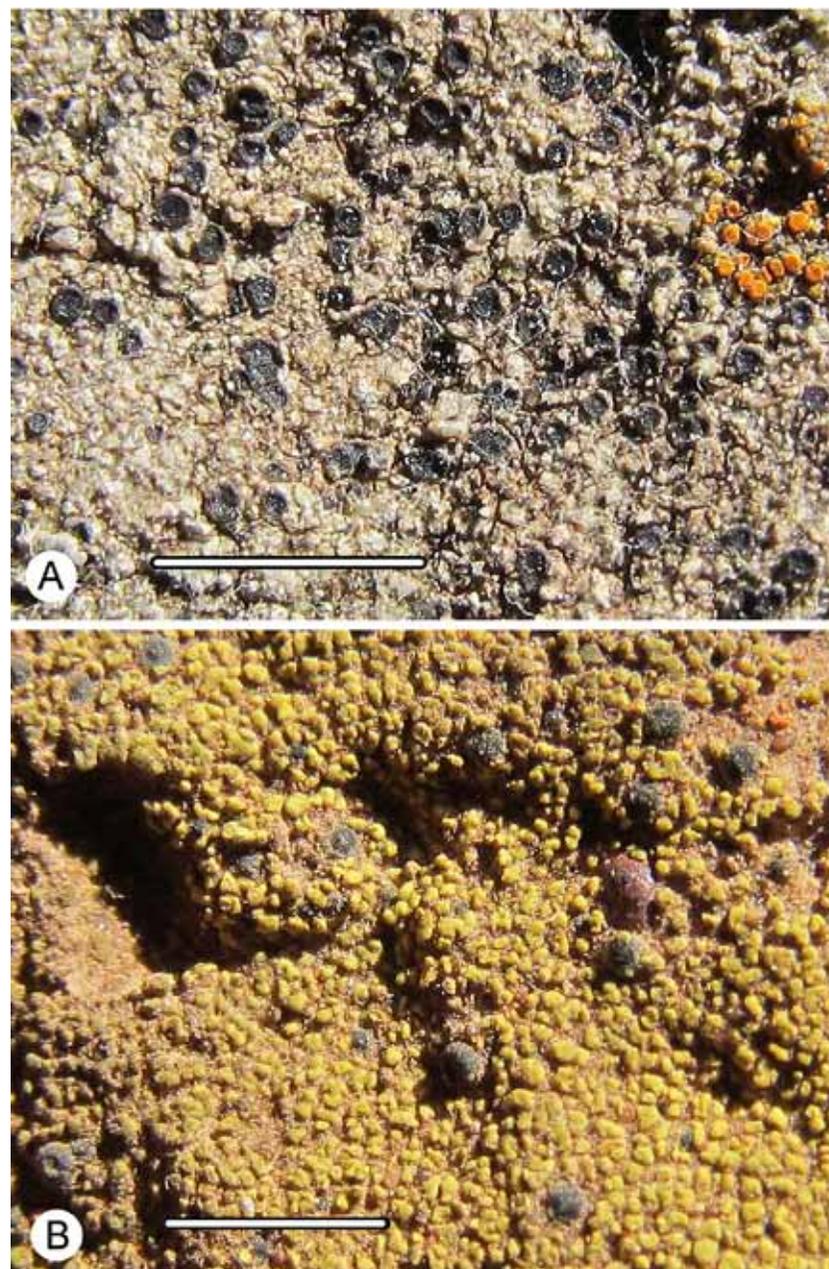


Figure 1. New species of *Sarcogyne*. A, *Sarcogyne canberrensis* (holotype); B, *Sarcogyne tholifera* (holotype). Scale bars = 2 mm.

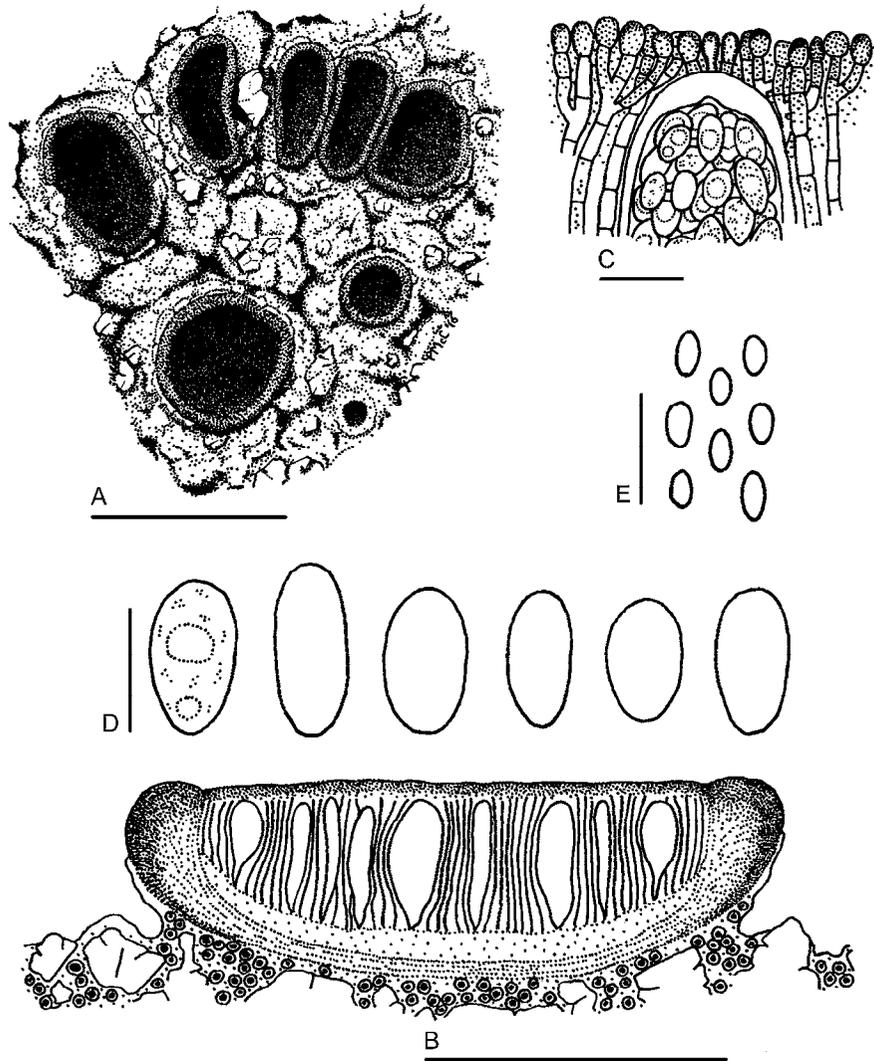


Figure 2. *Sarcogyne canberrensis* (holotype). A, Habit of thallus and apothecia; B, Sectioned apothecium and adjacent thallus (semi-schematic); C, Distal cells of paraphyses and an ascus apex; D, Ascospores; E, Conidia. Scale bars: A = 0.5 mm; B = 0.2 mm; C = 10 μ m; D, E = 5 μ m.

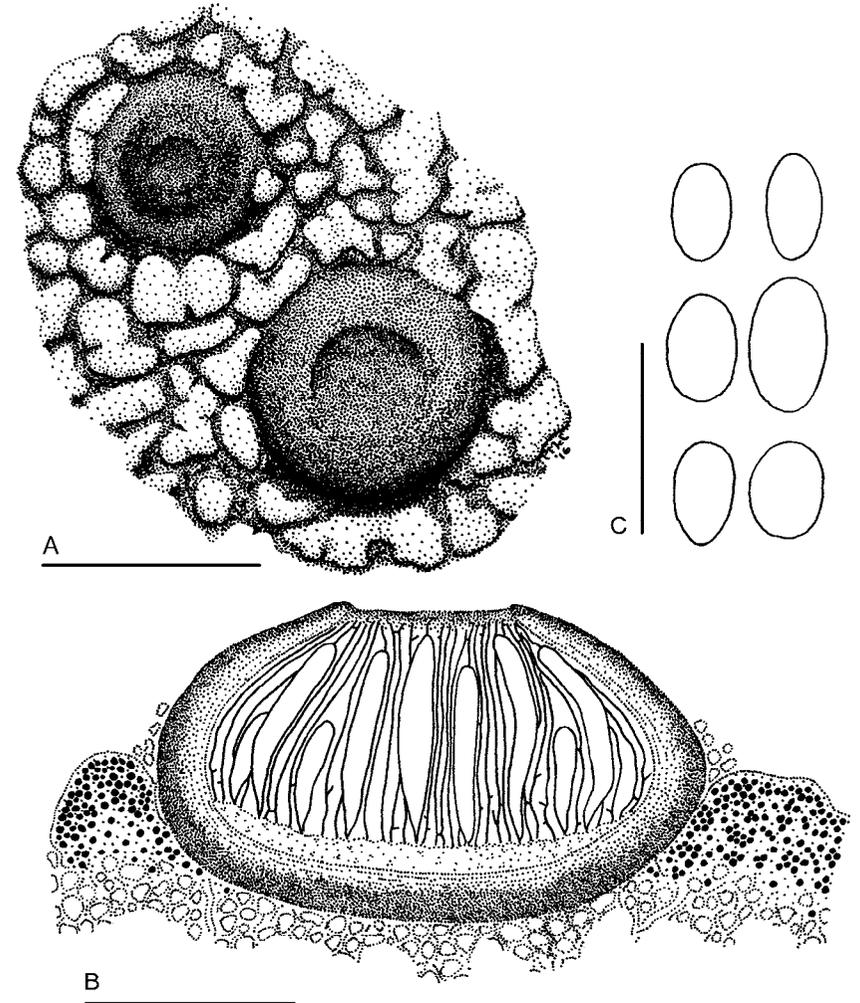


Figure 3. *Sarcogyne tholifera* (holotype). A, Habit of thallus and apothecia; B, Sectioned apothecium and adjacent thallus (semi-schematic); C, Ascospores. Scale bars: A = 0.5 mm; B = 0.2 mm; C = 10 μ m.

New species and a new record of buellioid lichens (Physciaceae, Ascomycota) from Australia

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Abstract

Amandinea prothallinata Elix & H.Mayrhofer, *Buellia canobolasensis* Elix & P.M.McCarthy and *B. weberi* Elix are described as new to science. The new combination *Amandinea prospersa* (Nyl.) Elix & H.Mayrhofer is made, and this species is reported for the first time from Australia. The differences between *A. prospersa* and *A. pelidna* (Ach.) Fryday & L.Arcadia are discussed

This paper continues our investigation of *Buellia*-like lichens in Australia, and follows from the first accounts of *Buellia* and related genera (Elix 2009, 2011) and our additions and revisions to *Amandinea* (Blaha *et al.* 2016; Elix & Kantvilas 2013a, 2016a; Mayrhofer *et al.* 2015), *Buellia sens. lat.* (Elix 2015b, 2016a; Elix & Kantvilas 2013b; Elix & Mayrhofer 2016), *Buellia sens. str.* (Elix & Kantvilas 2014a), *Baculifera* (Elix & Kantvilas 2014b), *Cratiria* (Elix 2014), *Monerolechia* (Elix 2015a) and other crustose Physciaceae (Elix 2016b; Elix & Kantvilas 2015, 2016b). In this paper, we deal with further new saxicolous species of *Amandinea* and *Buellia* in the broad sense. Methods are as described in previous papers cited above.

The new species

1. *Amandinea prothallinata* Elix & H.Mayrhofer, sp. nov. Figs 1–3
Mycobank No. **MB 818434**

Similar to *Amandinea punctata* (Hoffm.) Coppins & Scheid., but differs in having a prominent dark brown to black prothallus, longer conidia, and ascospores that often become constricted at the septum when mature.

Type: Australia, Norfolk Island, Duncombe Bay, 29°00'S, 167°55'30"E, 50 m alt., on top of flat boulder on cliffs with grasses and low shrubs, *H. Streimann* 34746, 9.xii.1984 (holotype – CANB).

Thallus crustose, continuous and membranaceous to rimose or rimose-areolate, to 45 mm wide and 0.1 mm thick; individual areoles irregular, angular, 0.2–0.5 mm wide; upper surface pale grey to grey-brown or dark grey, matt; prothallus prominent, dark brown to black, marginal, endolithic or epilithic, sometimes apparent between the areoles; medulla white, lacking calcium oxalate (H₂SO₄–), I–; photobiont cells 8–14 µm diam. *Apothecia* 0.1–0.6 mm wide, lecideine, immersed then broadly adnate or becoming sessile and constricted at the base, isolated or crowded, rounded; disc black, epruinose, weakly concave then plane, eventually convex; proper exciple prominent,

initially raised above the disc, excluded in older convex apothecia, in section the outer zone dark brown to brown-black, K–, N–, 35–50 µm thick, the inner zone paler brown. *Epithymenium* 8–13 µm thick, brown to dark brown, K–, N–. *Hypothecium* brown to dark brown, 80–170 µm thick, K–. *Hymenium* 50–70 µm thick, colourless; subhymenium 20–30 µm thick, pale brown, not interspersed with oil droplets; paraphyses 1–1.5 µm wide, sparsely branched, with apices 4–5 µm wide and with dark brown caps; asci of the *Bacidia*-type, 8-spored. *Ascospores* *Buellia*-type, brown, ellipsoid, 10–[13.1]–17 × 5–[7.1]–9 µm, ± constricted at the septum, sometimes bent; outer spore wall weakly ornamented. *Pycnidia* immersed, ostiole black; conidia filiform, curved, 13–30 × 0.7–1 µm.

Chemistry: Thallus K–, P–, C–, UV–; no lichen substances detected.

Etymology: This species is named for its very prominent dark brown to black prothallus.

Remarks

This new species is characterized by the crustose, rimose to rimose-areolate, pale grey to grey-brown or dark grey thallus, the prominent, marginal, dark brown to black prothallus, the immersed then broadly adnate to sessile apothecia, the non-amyloid medulla, the 1-septate, *Buellia*-type ascospores, curved, filiform conidia and the absence of lichen substances. Although *A. punctata* has similar sized, *Buellia*-type ascospores, they do not become constricted at the septum, and this species has shorter conidia, 14–20 µm long (Elix 2011, Scheidegger 2009, Bungartz *et al.* 2007). In addition, *A. punctata* usually lacks a prothallus, unlike *A. prothallinata* where the dark brown to black prothallus is always prominent. Morphologically, *A. prothallinata* can resemble *A. australasica* Blaha, H.Mayrhofer & Elix, but that species lacks a prominent prothallus and has smaller ascospores, 9–[11.4]–14 × 5–[6.1]–7 µm, which exhibit *Physconia*-type wall-thickenings in early ontogeny (Blaha *et al.* 2016).

Amandinea prothallinata is known from siliceous rocks in hinterland and coastal regions of eastern Australia (Queensland, New South Wales, the Australian Capital Territory, Victoria) and on Norfolk Island. Associated species include *Buellia halonia* (Ach.) Tuck., *B. spuria* var. *amblyogona* (Müll.Arg.) Elix, *B. stellulata* (Taylor) Mudd var. *stellulata*, *B. stellulata* var. *tasmanica* Elix & Kantvilas, *Caloplaca eos* S.Y.Kondr. & Kärnefelt, *C. gallowayi* S.Y.Kondr. *et al.*, *Halecania subsquamosa* (Müll.Arg.) van den Boom & H.Mayrhofer, *Pertusaria xanthoplaca* Müll.Arg., *Rinodina oxydata* (A.Massal.) A.Massal. and *Jackelxia ligulata* (Körb.) P.James.

SPECIMENS EXAMINED

Queensland: • Noosa Heads National Park, Devils Kitchen, 26°23'S, 153°06'E, 15 m alt., on rock on exposed headland, *J.A. Elix* 10388 *pr.p.*, 2.ix.1982 (CANB).

New South Wales: • Bare Bluff, 20 km N of Coffs Harbour, 30°09'S, 153°12'E, 4 m alt., on rocks along the foreshore, *J.A. Elix* 3534, 1.vii.1977 (CANB); • Merewether Bay, Newcastle, 32°56'31"S, 151°45'04"E, 0–30 m alt., on coastal sandstone rocks, *D. & H. Mayrhofer* 11002, 11197, 11199, *E. Hierzer, S. & R. Filson*, 22.vii.1992 (GZU).

Australian Capital Territory: • Molonglo Gorge Forest Park, 16 km SE of Canberra, 35°19'46"S, 149°14'59"E, 650 m alt., on sheltered quartzite rock face in dry *Eucalyptus-Callitris* woodland, *J.A. Elix* 46195, 18.vii.2016 (CANB, HO).

Victoria: • Wilsons Promontory, Mt Oberon, 39°02'29"S, 146°20'41"E, c. 540 m alt., on granite rocks, *D. & H. Mayrhofer* 11509 & *E. Hierzer*, 30.vii.1992 (GZU).

2. *Buellia canobolasensis* Elix & P.M.McCarthy, sp. nov. Fig. 4
Mycobank No. **MB 818435**

Similar to *Buellia abstracta* (Nyl.) H.Olivier, but differs in having broader ascospores, 5–[6.3]–8 µm wide, and longer conidia, 5–7 µm long.

Type: Australia. New South Wales, Mt Canobolas, summit area, 13 km SW of Orange, 33°20'40"S, 148°58'56"E, alt. 1390–1395 m, on volcanic rocks in area with scattered *Eucalyptus* and *Acacia*, P.M. McCarthy s.n., 5.iv.2016 (holotype – CANB; isotype – NSW).

Thallus to 50 mm wide, endolithic and not apparent or epilithic, very thin, discontinuous, effuse and ecorticate; upper surface pale grey-brown, matt; prothallus not apparent; photobiont cells 10–15 µm wide; medulla lacking calcium oxalate (H₂SO₄–), I–. *Apothecia* 0.05–0.15 mm wide, abundant, lecideine, roundish, scattered, broadly adnate; disc black, epruinose, weakly concave to plane; proper exciple prominent, swollen, persistent, in section 25–35 µm thick, outer part dark brown, K–, N–, inner part brown. *Epihymenium* 7–9 µm thick, dark brown, K–, N–. *Hypothecium* 75–90 µm thick, pale brown to dark brown, K–. *Hymenium* 65–75 µm thick, colourless, not interspersed; subhymenium 15–20 µm thick, pale brown, interspersed with oil droplets; paraphyses 1–2 µm wide, sparingly branched, with apices 4–5 µm wide and with brown caps; *asci* 8-spored, *Bacidia*-type. *Ascospores* *Buellia*-type, 1-septate, pale brown then dark brown, ellipsoid, 10–[12.4]–14 × 5–[6.3]–8 µm, not constricted at the septum, ± curved; outer wall finely ornamented. *Pycnidia* rare, punctiform, immersed, ostiole black; conidia bacilliform to ellipsoid, 5–7 × 2–3 µm.

Chemistry: Medulla K–, C–, PD–, UV–; no lichen substances detected.

Etymology: The species is named after the type locality.

Remarks

The endolithic or poorly developed, very thin, discontinuous, effuse thallus of this new species resembles *Buellia abstracta* from Europe and North America, in that both species are dominated by the minute, abundant, broadly adnate to sessile apothecia. However, *B. abstracta* has significantly narrower ascospores (3–[4.6]–6 µm wide) and shorter conidia (2–4 × 1–1.5 µm) (Coppins *et al.* 2009). *Buellia canobolasensis* also resembles some depauperate forms of *Amandinea punctata* (Hoffm.) Coppins & Scheid., but that species has larger, *Buellia*-type ascospores, 10–[13.5]–20 × 5–[7.5]–9 µm, and curved, filiform conidia (14–20 × 0.7–1 µm) (Elix 2011).

At present the new species is only known from the type locality. Commonly associated species include *Aspicilia caesiocinerea* (Nyl.) Arnold, *Buellia aethalea* (Ach.) Th.Fr., *B. maficola* Elix, *Gyalideopsis halocarpa* P.M.McCarthy & Elix, *Lecidea capensis* Zahlbr., *Ramboldia petraeoides* (Bab. & Mitt.) Kantvilas & Elix, *Rhizocarpon geographicum* (L.) DC., *R. reductum* Th.Fr., *Xanthoparmelia incerta* (Kurok. & Filson) Elix & J.Johnst. and *X. mougeotina* (Nyl.) D.J.Galloway.

3. *Buellia weberi* Elix, sp. nov.

MycoBank number: **MB 818436**

Fig. 5

Similar to *Buellia halonia* (Ach.) Tuck., but differs in having an amyloid medulla, immersed cryptolecanorine then lecideine apothecia and *Buellia*-type ascospores that become constricted at the septum when mature.

Type: Australia, Australian Capital Territory, Mount Ainslie, Canberra, 35°16'S, 149°10'E, 780 m alt., on volcanic boulder outcrops, W.A. Weber L-47221, 2.xi.1967 (CANB – holotype).

Thallus crustose, continuous, areolate, to 40 mm wide and 0.15 mm thick; individual areoles irregular, angular, 0.3–0.8 mm wide; upper surface pale yellow, dull, smooth; prothallus black, marginal or not apparent; photobiont cells 8–20 µm wide; medulla white, H₂SO₄–, I+ purple. *Apothecia* 0.2–0.4 mm wide, cryptolecanorine at first, eventually lecideine, separate to crowded and distorted, ± round, immersed or rarely

just adnate; disc black, yellow-white-pruinose, plane; initially with a thin, entire thalline margin that is excluded with age; proper margin thin, slightly elevated above the disc, persistent but often obscured by a necrotic thalline veil, in section 35–65 µm thick, the outer part brown-black to aeruginose-black, K–, N+ purple-brown, paler brown within. *Hypothecium* 150–250 µm thick, deep red-brown, K–, N–. *Epihymenium* 12–15 µm thick, dark brown to olive-brown, K–, N– or N+ pale purple-brown. *Hymenium* 55–65 µm thick, colourless, not interspersed with oil droplets; subhymenium 40–50 µm thick, pale reddish brown; paraphyses 1.5–2.0 µm wide, simple to sparsely branched, with apices 4.5–5.5 µm wide and with brown caps; *asci* of the *Bacidia*-type, 8-spored. *Ascospores* of the *Buellia*-type, 1-septate, brown, ellipsoid, 12–[14.5]–19 × 6–[7.2]–9 µm, becoming constricted at the septum and sometimes curved; outer spore-wall finely ornamented. *Pycnidia* immersed, ostioles pale brown; conidia 5–6.5 × 1 µm. *Chemistry:* Cortex K–, C+ yellow-orange, KC+ orange, P–, UV+ dull orange; containing arthothelin (major) and atranorin (minor).

Etymology: This species is named after the American cryptogamist, botanist and collector of the type specimen, Dr W.A. (Bill) Weber.

Remarks

The new species resembles some specimens of *B. halonia*, a widespread saxicolous species known from Australia, North America, South America and South Africa (Elix 2011). Both species are characterized by the presence of arthothelin or isoarthothelin and have similar-sized ascospores and a partially aeruginose epihymenium (N+ red-violet to purple-brown). Although *B. halonia* initially has immersed apothecia, they become broadly adnate to sessile when mature. In addition, *B. halonia* differs in having a non-amyloid medulla and *Physconia*-type ascospores, where the septum becomes distinctly thickened during spore ontogeny but the spores do not become constricted at the septum with age (Bungartz *et al.* 2007, Elix 2011). *Buellia malcolmii* Elix has similar, immersed, cryptolecanorine apothecia, *Buellia*-type ascospores and contains arthothelin, but it differs from *B. weberi* in having a granular upper surface, where elevated wrinkles or ridges become cracked, eroded and pustulate-sorediate in part, and larger ascospores, 13–[17.6]–21 × 6.5–[8.5]–11 µm (Elix & Mayrhofer 2016). *Buellia weberi* could also be confused with *B. caldesiana* Bagl., from southern Europe, as the two species exhibit similar morphology and identical chemistry. However, the immature ascospores of *B. caldesiana* are of the *Physconia*-type with distinct inner septal wall-thickenings (*Buellia*-type throughout ontogeny in *B. weberi*), and they do not become constricted at the septum at maturity (Giralt *et al.* 2009).

At present, the new species is known only from the type locality. Associated species include *Acarospora citrina* (Taylor) Zahlbr. ex Rech., *Buellia procellarum* A.Massal., *Lecanora farinacea* Fée, *Monerolechia badia* (Fr.) Kalb, *Rhizocarpon geographicum* (L.) DC., *Xanthoparmelia australasica* D.J.Galloway and *X. parviloba* (Essl.) O.Blanco *et al.*

New record and new combination

Amandinea prospersa (Nyl.) Elix & H.Mayrhofer, comb. nov.

Figs 6–8

MycoBank number: **MB 818437**

Basionym: *Lecidea prospersa* Nyl., *Flora* 63, 127 (1880); *Buellia prospersa* (Nyl.) Riddle, *Brookl. Bot. Gard. Mem.* 1, 114 (1918); *Rinodina prospersa* (Nyl.) Zahlbr., *Cat. Lich. Univ.* 7, 544 (1931)

Type: United States, Virgin Islands. Saint Thomas, *Dr Forel*, 1878 (H – lectotype, herb. NYL 9312! *vide* F.Bungartz, T.H.Nash III & B.D.Ryan, *Can. J. Bot.* 82, 544. 2004).

For further synonyms see Imshaug (1955).

This species was known previously from islands in the Caribbean Sea and coastal areas of south-western North America (Imshaug 1955, Bungartz *et al.* 2007). It is characterized by its continuous, rimose to rimose-areolate, pale yellow to yellow-

brown, crustose thallus that contains thuringione (\pm minor quantities of arthothelin), rarely delimited by a dark prothallus, its small, broadly adnate to sessile, lecideine apothecia, 0.2–0.5 mm wide, with *Orcularia*- then *Physconia*-type ascospores, 10–[13.5]–17 \times 5–[6.6]–8 μm , which become constricted at maturity and have a microrugulate outer spore wall, and curved, filiform conidia, 20–30 \times 0.7–1 μm . It closely resembles *A. pelidna* (Ach.) Fryday & L.Arcadia and, indeed, Bungartz *et al.* (2004, 2007) synonymized the two species. However, the mature ascospores of *A. pelidna* do not become constricted at the septum, whereas immature spores are often centrally dilated (compare Figs 7, 8) and, furthermore, this species lacks lichen substances. Despite only subtle differences in ascospore ontogeny, in practice the two species can readily be distinguished by the UV reaction of the upper surface (*A. prospersa* UV+ orange, *A. pelidna* UV–). Although both species occur on coastal, siliceous rocks, they have contrasting distributions, with *A. prospersa* restricted to tropical areas and *A. pelidna* the cool-temperate areas of northern Europe, southern Australia and New Zealand. A detailed description of *A. prospersa* is given in Imshaug (1955).

SPECIMENS EXAMINED

Australia. Queensland. • Port Douglas, NE of Cairns, SE end of Island Point, 16°28'S, 145°28'E, c. 20 m alt., on rock outcrops near the shore, *H. Mayrhofer* 11367 & *E. Hierzer*, 7.viii.1993 (GZU); • Trinity Beach, NE of Cairns, SE of Taylor Point, 16°47'S, 145°42'30"E, on coastal granite rocks, *H. Mayrhofer* 11834 & *E. Hierzer*, 7.viii.1993 (GZU).

Costa Rica. • Pacific coast, Prov. Puntarenas, S margin of Playa de Jacó, on coastal rock, *H. Mayrhofer* 10088 & *E. Hierzer*, 30.iii.1991 (GZU).

Acknowledgements

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



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

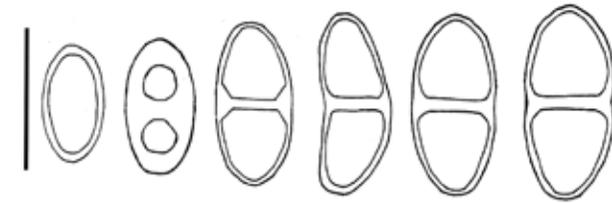


Figure 3. Ascospore ontogeny of *A. prothallinata*. Scale = 10 μ m.

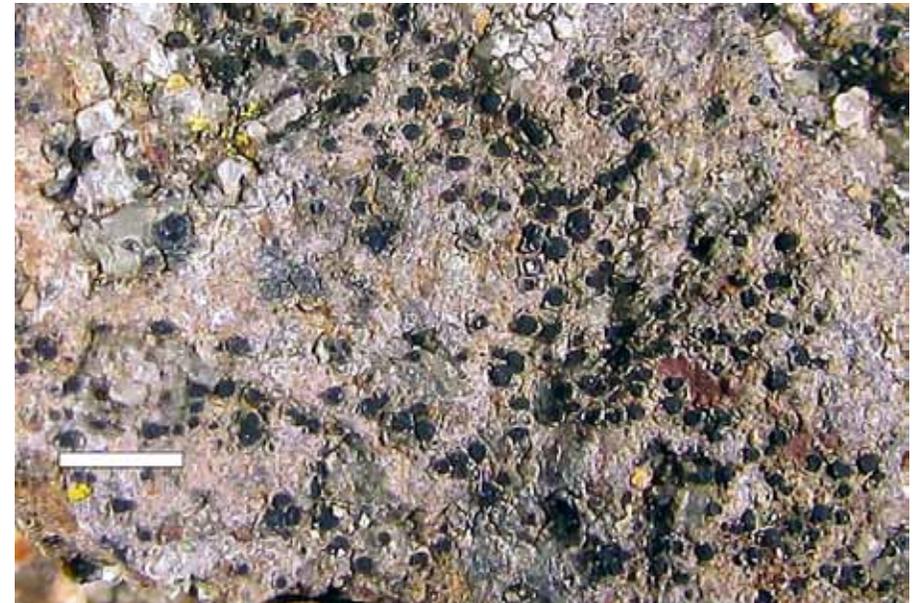


Figure 4. *Buellia canobolasensis* (holotype in CANB). Scale = 1 mm.



Figure 5. *Buellia weberi* (holotype in CANB). Scale = 1 mm.

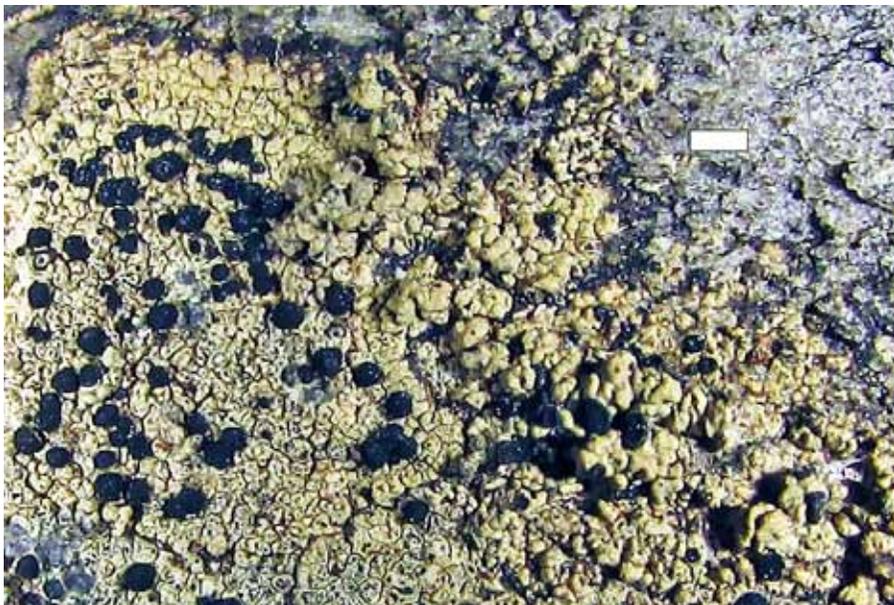


Figure 6. *Amandinea prospersa* (H. Mayrhofer 11367 & E. Hierzer in GZU). Scale = 1 mm.



Figure 7. Ascospore ontogeny of *A. prospersa*. Scale = 10 μ m.

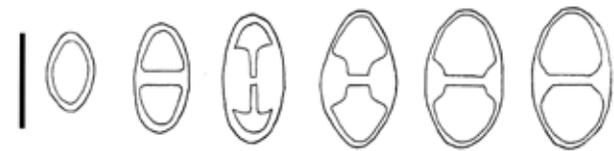


Figure 8. Ascospore ontogeny of *A. pelidna*. Scale = 10 μ m.

A new species of *Dimelaena* (Physciaceae, Ascomycota) from Victoria, Australia

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Abstract: *Dimelaena ewersii* Elix is described as new to science, and a revised key to *Dimelaena* in Australia is provided.

Dimelaena Norman is a cosmopolitan genus of ten species (Giralt *et al.* 2014), three of which were previously known from siliceous rocks in Australia (Elix 2011, Mayrhofer *et al.* 1996). It is generally characterized by placodioid thalli that are areolate in the centre and have radiate-plicate marginal lobes, but it also includes *D. lichenicola* K. Knudsen, Sheard, Kokourková & H. Mayrhofer, which has a reduced thallus lacking well-developed plicate margins (Knudsen *et al.* 2013), and a subsquamulose species, *D. subsquamulosa* Giralt, H. Mayrhofer, van den Boom & Elix (Giralt *et al.* 2014). *Dimelaena californica* (H. Magn.) Sheard, a second species with a reduced thallus, has recently been transferred to *Monerolechia* (Elix 2015). The genus *Dimelaena* also exhibits variable apothecial characters, in that it includes species with lecanorine or lecideine apothecia and with hyaline or brown hypothecia. Two of the three known Australian species, *D. australiensis* H. Mayrhofer & Sheard and *D. tenuis* (Müll. Arg.) H. Mayrhofer & Wippel, have placodioid thalli, colourless hypothecia and lecanorine apothecia, while the third, *D. elevata* Elix, Kalb & Wippel, has a placodioid thallus but lecideine apothecia with a dark brown hypothecium. In this paper I describe a new species containing psoromic acid, with lecanorine or cryptolecanorine apothecia and a colourless hypothecium. A revised key to *Dimelaena* in Australia is provided.

The new species

1. *Dimelaena ewersii* Elix, sp. nov.
Mycobank No. **MB 818382**

Fig. 1

Similar to *Dimelaena radiata* (Tuck.) Müll. Arg., but differs in having a colourless hypothecium, shorter conidia and a black, marginal prothallus.

Type: Australia, Victoria, base of Mt Arapiles, NW of Grampians, 36°45'S, 141°50'E, c. 300 m alt., on quartzite, *W.H. Ewers 424*, 26.xi.1986 (holotype – CANB).

Thallus crustose, forming small patches to 25 mm wide, epilithic, thin, placodioid, with radiate-plicate marginal lobes, 0.2–0.6 mm wide, cracked and areolate within; areoles irregular, angular, 0.3–0.5 mm wide. Upper surface grey-white to dark grey matt, uneven, verrucose; prothallus black, narrow, marginal; photobiont cells 8–13 µm wide. *Apothecia* 0.1–0.4 mm wide, lecanorine or cryptolecanorine, immersed then adnate, crowded, rounded or irregular through mutual pressure; disc dark brown to black, epruinose, weakly concave to plane or weakly convex; thalline exciple to 75 µm thick, concolorous with the thallus, poorly developed, often incomplete or excluded, the margin becoming lecideine, black and carbonaceous; proper excipulum obscure, persistent, narrow, in section 25–35 µm thick, with outer zone dark brown, K–, paler brown within. *Epithymenium* 8–10 µm thick, dark brown, K–, N–. *Hypothecium* 55–85 µm thick, colourless to very pale yellow, K–, N–. *Hymenium* 70–80 µm thick, colourless, not interspersed with oil droplets; paraphyses 1.5–1.8 µm wide, simple to sparsely branched, capitate, with brown apices 3–4 µm wide; asci of the *Bacidia*-type, 8-spored. *Ascospores* *Buellia*-type, 1-septate, brown, broadly ellipsoid, (6–)7–10(–13) × 5–6(–10) µm, not constricted at the septum, some non-septate spores present; outer spore wall

smooth. *Pycnidia* common, globose, immersed, black; conidia bacilliform, 3–4 × 1–1.3 µm. *Chemistry:* Thallus K+ yellow, C–, P+ yellow, UV–; containing psoromic acid.

Etymology: This species is named in honour of the collector of the type specimen, the late Australian biologist Dr William H. Ewers.

Remarks

The only other species of *Dimelaena* known to contain psoromic acid is chemotype IV of *D. radiata*, from western North America (Matzer *et al.* 1996, Mayrhofer & Sheard 2004). Morphologically, *D. radiata* and *D. ewersii* are very similar, but *D. radiata* has a brown to dark brown hypothecium and longer conidia (7–11 µm). In addition, *D. radiata* lacks a prothallus, and the mature ascospores become constricted at the septum (Rico *et al.* 2003). In Australia, this new species closely resembles *D. australiensis*, both having thin, crustose, grey-white to grey thalli that are placodioid, with radiate-plicate marginal lobes, small, lecanorine or cryptolecanorine, immersed then adnate apothecia, colourless hypothecia and small *Buellia*-type ascospores. However, while *D. australiensis* has longer conidia (4–6 µm) and somewhat shorter ascospores (7–10 µm), the two species differ most markedly in chemistry. Whereas *D. australiensis* contains 3,5-dichloro-2'-*O*-methylanziaic acid (major), 3,5-dichloro-2'-*O*-methylnorstenosporic acid (minor), and 3-chloro-2'-*O*-methylanziaic acid (minor) [with the thallus reacting K–, C+ red, P–, UV+ blue-white], *D. ewersii* contains only psoromic acid.

At present the species is known only from the type collection. Associated lichens include *Buellia homophyllia* (C. Knight) Zahlbr., *Caloplaca brownlieae* S.Y. Kondr., Elix & Kärnefelt, *Lecidea capensis* Zahlbr., *Rhizocarpon geographicum* (L.) DC. and numerous *Xanthoparmelia* species.

Key to *Dimelaena* in Australia

- 1 Apothecia lecideine; hypothecium brown; xanthones present *D. elevata*
1: Apothecia lecanorine or cryptolecanorine; hypothecium colourless or pale yellow; xanthones absent 2
- 2 Ascospores 7–10 µm long; 3,5-dichloro-2'-*O*-methylanziaic acid present
..... *D. australiensis*
2: Ascospores 9–14 µm long; gyrophoric or psoromic acids present 3
- 3 Thallus C+ red, K–, P–; gyrophoric ± 5-*O*-methylhiassic acids present *D. tenuis*
3: Thallus C–, K+ yellow, P+ yellow; psoromic acid present *D. ewersii*

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Mayrhofer, H; Sheard, JW; (2004): *Dimelaena* Norman in Nash III, TH; Gries, C; Bungartz, F (eds) *Lichen Flora of the Greater Sonoran Desert Region 2*, 93–97. Lichens Unlimited, Arizona State University, Tempe.

Mayrhofer, H; Matzer, M; Wippl, A; Elix, JA (1996): The genus *Dimelaena* (lichenized Ascomycetes, Physciaceae) in the Southern Hemisphere. *Mycotaxon* 58, 293–312.

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A new species and new records of buellioid lichens (Physciaceae, Ascomycota) from the Kermadec Islands

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Figure: 1. *Dimelaena ewersii* (holotype in CANB). Scale = 1 mm.

Abstract

Buellia insularicola Elix & de Lange, from the Kermadec Islands and Lord Howe Island, is described as new to science. *Amandinea conioops* (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer, *Buellia cranwelliae* Zahlbr. and *Rinodinella fertilis* (Körb.) Elix var. *fertilis* are new records for the Kermadec Islands

The Kermadec Islands are a remote, widely scattered archipelago of 19 subtropical islands, islets and rock stacks located in the southern Pacific Ocean. The islands lie between latitudes 29°S and 31°30' S and longitudes 177°W and 179°W (Sykes 1977), and are the most northerly part of the New Zealand Botanical Region (Allan 1961, de Lange & Rolfe 2010), located 800–1000 km north-east of the North Island of New Zealand. Geologically they are mostly andesitic volcanic islands, with a total land area of 33 square kilometres. An introduction to the geology, landforms, vegetation, climate and lichenological history of the island has been provided by de Lange & Galloway (2015). Two buellioid lichens have previously been reported from the Kermadec Islands, namely *Buellia stellulata* (Taylor) Mudd (Sykes 1977; Elix & McCarthy 1998; de Lange 2015a,b) and, provisionally *Amandinea subbadioatra* (C.Knight) Elix & Kantvilas (de Lange 2014). At least one further *Buellia* was reported at the generic level (de Lange 2014). In this paper, we describe a new species of *Buellia sens. lat.* as well as reporting three new records for the islands. The new species *B. insularicola* has also been found on Lord Howe Island, Australia.

Methods

Observations and measurements of thallus and apothecium anatomy, asci, ascospores and conidia were made on hand-cut sections mounted in water and treated with 10% potassium hydroxide (K) and 50% nitric acid (N). Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K. Medullary sections were treated with 10% sulfuric acid (H₂SO₄). Chemical constituents were identified by thin-layer chromatography (TLC) (Elix 2014) and comparison with authentic samples.

The new species

Buellia insularicola Elix & de Lange, sp. nov.
MycoBank No. MB 818420

Figs 1, 2

Similar to *Buellia fallax* Elix & Kantvilas, but differs in having smaller pseudolecanorine apothecia, *Buellia*-type ascospores and in lacking medullary hafelllic acid and calcium oxalate.

Type: New Zealand, Kermadec Islands, Southern Kermadec Islands Group, Cheeseman Island, near summit, 30°32'10"S, 178°34'03"E, 80 m alt., on weathered, hydrothermally altered andesite, P.J. de Lange K1256, 20.v.2011 (holotype – UNITEC 6949; isotype – CANB).

Thallus crustose, to 25 mm wide and 1 mm thick, epilithic, rimose-areolate to verrucose-areolate; upper surface off-white to grey-white, matt, cracked, often becoming granular; prothallus black, marginal or not apparent; photobiont cells 8–15 µm wide; medulla lacking calcium oxalate (H₂SO₄-), I-. *Apothecia* 0.1–0.5 mm wide, abundant, cryptolecanorine, biatorine or ultimately lecideine, roundish, scattered, immersed or rarely just adnate; disc dark brown to black, epruinose or white-pruinose, weakly concave to plane; proper exciple thin, persistent, often covered with a necrotic thalline veil, in section 25–35 µm thick, outer part dark olive-brown, K-, N+ orange-brown, inner part paler brown. *Epithymenium* 10–12 µm thick, cupular, olive-brown to dark brown, K-, N-. *Hypothecium* 25–40 µm thick, pale brown, K-. *Hymenium* 60–75 µm thick, colourless, not interspersed; subhymenium 10–20 µm thick, very pale brown, weakly interspersed; paraphyses 1.7–2.4 µm wide, sparingly branched, with apices 3–4.5 µm wide and pale brown caps. *Asci* (3–6)8-spored, *Bacidia*-type. *Ascospores* *Buellia*-type, 1-septate, pale then dark brown, ellipsoid, 14–[18.5]–23 × 6–[8.3]–10 µm, becoming constricted at septum and broadly fusiform with age, often curved, ± pointed, outer wall ornamented (rugulate). *Pycnidia* not seen. *Chemistry*: Thallus K+ yellow, P+ pale yellow, C-, UV-; atranorin (major).

Etymology: This species name is derived from the Latin (the island dweller), reflecting the distribution of the species.

Remarks

The new species belongs to *Buellia* in the broad sense (Elix 2011, Bungartz *et al.* 2007). Superficially, it resembles *B. fallax* in that both species are characterized by the crustose, areolate thalli, the commonly curved, *Buellia*-type ascospores that become broadly fusiform with age, and by the presence of atranorin. However, *B. fallax* differs in having broadly adnate to sessile, lecideine apothecia (0.3–1.2 mm wide), epruinose discs, a dark brown to brown-black hypothecium, ascospores that approximate the *Callispora*-type in early ontogeny and have a smooth outer wall at maturity and in containing additional hafellic acid and medullary calcium oxalate (Elix & Kantvilas 2016).

At present the new species is known from Lord Howe Island and Cheeseman Island in the southern Kermadec island group (de Lange 2015b). Field notes by the junior author described *B. insularicola* as being 'uncommon' on Cheeseman Island. Associated species include *Amandinea coniops* (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer, *Buellia cranwelliae* Zahlbr., various *Caloplaca* sp., *Heterodermia tremulans* (Müll. Arg.) Kurok., *Jackelixia ligulata* Körb.) S.Y.Kondr., Fedorenko, S.Stenroos, Kärnefelt & A.Thell, *Ramalina microspora* Kremp., *Rinodinella fertilis* (Körb.) Elix var. *fertilis* and *Trapelia glebulosa* (Sm.) J.R.Laundon.

SPECIMEN EXAMINED

Australia. *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 basalt rocks in lowland forest with dense shrub cover, *J.A. Elix* 42037, 5.ii.1995 (CANB).

New records

1. *Amandinea coniops* (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer, *Lichenologist* 25, 342 (1993)

In Australasia, *A. coniops* has been found in both islands of New Zealand, Norfolk Island and Tasmania (Elix & Kantvilas 2016a). It is also common elsewhere in the Southern Hemisphere, including Antarctica, South Georgia and other subantarctic islands (Øvstedal & Lewis Smith 2001). A detailed description is given in Elix & Kantvilas (2016a). It was first reported as a "*Buellia*" from Egeria Rock by de Lange (2014).

SPECIMENS EXAMINED

New Zealand. • Kermadec Islands, Southern Kermadec Islands Group, L'Esperance Rock, 31°26'01"S, 178°54'E, 70 m alt., on fissured, scoriaceous lava, *P.J. de Lange* K1180, 26.v.2011 (CANB, CHR, UNITEC); • Kermadec Islands, Kermadec Islands Nature Reserve, Northern Kermadec Islands Group, Egeria Rock, 29°15'S, 177°53'42"E, 18 m alt., on summit ridge of rock, *P.J. de Lange* K1197, 13.v.2013 (CANB, UNITEC).

2. *Buellia cranwelliae* Zahlbr., *Denkschr. Akad. Wiss. Wien math.-naturwiss. Kl.* 104, 375 (1941)

This species is now known to be widespread on coastal rocks in both islands of New Zealand (Galloway 2007, D.J. Blanchon pers. comm. 2016), but also occurs on Rangitira (South East Island) in the Chatham Islands group, Norfolk Island (Elix 2016), eastern Australia and Tasmania (Elix & Kantvilas 2016b). A detailed description is given in Elix (2016).

SPECIMENS EXAMINED

New Zealand. • Kermadec Islands, Kermadec Islands Nature Reserve, Northern Kermadec Islands Group, Egeria Rock, 29°15'S, 177°53'42"E, 18 m alt., on summit ridge of rock, *P.J. de Lange* K1195, 13.v.2013 (CANB, UNITEC); • Kermadec Islands, Kermadec Islands Nature Reserve, Northern Kermadec Islands Group, The Meyers, North Meyer, 40 m alt., on rock shore platform, *P.J. de Lange* K1213, 12.v.2013 (CANB, UNITEC).

3. *Rinodinella fertilis* (Körb.) Elix var. *fertilis*, *Australas. Lichenol.* 66, 46 (2010)

This species was previously known from South Africa, southern Australia, and the South Island, New Zealand (Elix 2011, Elix & Mayrhofer 2016). A detailed description is given in Elix (2011).

SPECIMEN EXAMINED

New Zealand. • Kermadec Islands, Southern Kermadec Islands Group, Cheeseman Island, near summit, 30°32'15"S, 178°34'00"E, 80 m alt., on xenoliths in hydrothermally altered andesite, *P.J. de Lange* K1261, 14.xi.2014 (CANB, UNITEC).

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Figure 1. *Buellia insularicola* (isotype in CANB). Scale = 1 mm.



Figure 2. Ascospore ontogeny of *B. insularicola*. Scale = 10 μ m.

New species and new records of buellioid lichens
(Physciaceae, Ascomycota) from New Zealand and Tasmania

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Abstract

Buellia akatorensis Elix & A.Knight, *B. hypopurpurea* Elix & A.Knight and *B. kantvilasii* Elix, Blanchon & A.Knight are described as new to science. *Baculifera micromera* (Vain.) Marbach and *Buellia stellulata* var. *tasmanica* Elix & Kantvilas are recorded for the first time from New Zealand.

This paper continues our investigation of *Buellia*-like lichens in New Zealand and Tasmania, and follows from the previous accounts of *Buellia* and related genera (Elix *et al.* 2015, Elix 2016, Elix & Mayrhofer 2016) and our additions and revisions to *Amandinea* (Blaha, Mayrhofer & Elix 2016, Mayrhofer *et al.* 2016). In this paper, we deal with a further three new saxicolous species of *Buellia* in the broad sense. Methods are as described in previous papers cited above.

The new species

1. *Buellia akatorensis* Elix & A.Knight, sp. nov. Figs 1, 2
Mycobank No. MB 818431

Similar to *Buellia procellarum* A.Massal., but differs in having smaller, commonly curved ascospores, 15–25 × 8–13 μm, white to pale grey-pruinose discs and in containing medullary norstictic acid rather than diploicin.

Type: New Zealand, South Island, Otago, Akatore Creek, 46°06'45"S, 170°11'30"E, alt. 1 m, on schistose rock 15 m seaward from coastal cliff, *A. Knight s.n.*, 26.xi.2015 (holotype – OTA 065319; isotype – CANB).

Thallus crustose, to 25 mm wide and 1.2 mm thick, epilithic, rimose-areolate, chinky, ± forming small rosettes, subeffigurate at the margins; upper surface off-white to pale grey, matt, cracked; prothallus not apparent or dark brown to black, marginal; photobiont cells 8–15 μm wide; medulla lacking calcium oxalate (H₂SO₄-), I-. *Apothecia* 0.4–1.2 mm wide, lecidine, roundish, scattered, initially immersed then broadly adnate to sessile; disc black, epruinose or often sparsely white- to pale grey-pruinose, weakly concave to convex; proper exciple thin, persistent, in section 25–60 μm thick, outer part dark brown to brown-black, K+ yellow then forming red, needle-like crystals, N-, inner part brown. *Epihymenium* 12–15 μm thick, dark brown, N-. *Hypothecium* 100–140 μm thick, dark brown to brown-black, K+ yellow then forming red, needle-like crystals, N+ orange-brown. *Hymenium* 100–120 μm thick, colourless,

with a few scattered oil droplets; subhymenium 50–75 μm thick, pale brown, interspersed with oil droplets; paraphyses 1.5–2 μm wide, sparingly branched, with apices 4–6 μm wide and dark brown caps; *asci* (4–6)8-spored, *Bacidia*-type. *Ascospores* *Callispora*- then *Buellia*-type, 1-septate, pale then dark brown, ellipsoid, 15–[21.3]–25 × 8–[10.8]–13 μm, becoming constricted at the septum and broadly fusiform with age, often curved; outer wall moderately to strongly ornamented. *Pycnidia* common, punctiform, immersed, ostiole black. *Conidia* bacilliform, 4–6 × 1–1.5 μm. *Chemistry*: Thallus K+ yellow then red, P+ yellow-orange, C-, UV-; atranorin (major), norstictic acid (major), connorstictic acid (minor or trace).

Etymology: The species is named after its type locality.

Remarks

The new species is characterized by the crustose, thick and chinky, rimose-areolate, off-white to pale grey thallus, the interspersed subhymenium, ± white to pale grey-pruinose discs, the often curved, *Callispora*- then *Buellia*-type ascospores that often become broadly fusiform with age and have an ornamented outer wall, and the presence of atranorin and norstictic acid. *Buellia akatorensis* is superficially similar to *B. procellarum*, a common saxicolous species in Australia (Elix 2009). However, the latter differs in having epruinose discs, a densely interspersed hymenium, larger, straight ascospores (22–40 × 10–18 μm) and in containing atranorin and diploicin. *Buellia fallax* Elix & Kantvilas, present in Tasmania and New Zealand (Elix & Kantvilas 2016) has similar but slightly smaller ascospores (15–22 × 7–10 μm) and has epruinose discs and a medulla that contains calcium oxalate (H₂SO₄+) and hafellic acid.

At present the new species is known from Otago in the South Island of New Zealand, where it occurs on siliceous rocks in coastal areas. Commonly associated species include *Amandinea nitrophila* (Zahlbr.) Elix, *A. pelidna* (Ach.) Fryday & L.Arcadia, *Caloplaca cribrosa* (Hue) Zahlbr., *C. gallowayi* S.Y.Kondr., Kärnefelt & Filson, *Halecania subsquamosa* (Müll.Arg.) van den Boom & H.Mayrhofer, *Lecanora subcoarctata* (C.Knight) Hertel, *Pertusaria graphica* C.Knight, *Rinodina blastidiata* Matzer & H.Mayrhofer and *Jackelia ligulata* (Körb.) S.Y.Kondr., Fedorenko, S.Stenroos, Kärnefelt & A.Thell.

SPECIMENS EXAMINED

Otago: • Type locality, on coastal schistose rock, *A. Knight s.n.*, 26.xi.2015 (CANB, OTA 065318 *pr.p.*); • Black Head, Dunedin, 44°55'11"S, 170°27'13"E, 2 m alt., on basalt boulder at base of cliff in splash zone, *A. Knight s.n.*, 28.xi.2015 (CANB, OTA 069081 *pr.p.*), (CANB, OTA 069084 *pr.p.*).

2. *Buellia hypopurpurea* Elix & A.Knight, sp. nov. Fig. 3
Mycobank No. MB 818432

Similar to *Buellia stellulata* (Taylor) Mudd var. *stellulata*, but differs in having an hypothecium and excipulum that effuse an intense purple solution in K and a non-aeruginose, N- epihymenium.

Type: New Zealand, South Island, Otago, Akatore Creek, 46°06'34"S, 170°11'03"E, alt. 2 m, on rocks beside estuary, c. 250 m from mouth, *A. Knight s.n.*, 26.xi.2015 (holotype – OTA 065320; isotype – CANB).

Thallus crustose, to 25 mm wide and 0.1 mm thick, epilithic, rimose-areolate, areoles irregular, 0.2–0.5 mm wide; upper surface off-white to pale brown, matt, cracked; prothallus prominent, black, marginal and between areoles; photobiont cells 8–17 μm wide; medulla lacking calcium oxalate (H₂SO₄-), I-. *Apothecia* 0.1–0.4 mm wide, lecidine, roundish, scattered, mainly immersed, rarely becoming adnate; disc black,

epruinose, concave; proper exciple prominent, persistent, raised above disc, in section 50–75 µm thick, outer part brown-black, K+ forming an intense purple solution, N+ orange-brown, inner part brown. *Epithymenium* c. 10 µm thick, brown, N-. *Hypothecium* 75–120 µm thick, brown to brown-black, K+ forming an intense purple solution. *Hymenium* 60–80 µm thick, colourless, not interspersed; subhymenium 20–30 µm thick, pale brown; paraphyses 1.5–2 µm wide, sparingly branched, with apices 3–4 µm wide and pale brown caps; *asci* 8-spored, *Bacidia*-type. *Ascospores* *Buellia*-type, 1-septate, pale then dark brown, ellipsoid, 10–[13.8]–17 × 6–[7.3]–9 µm, becoming constricted at the septum, outer wall weakly ornamented. *Pycnidia* not seen. *Chemistry*: Thallus K+ yellow, P+ yellow, C-, UV-; containing atranorin (major), rugulosin monoacetate (major), unknown yellow pigment (trace), ± 2'-*O*-methylperlatolic acid (minor).

Etymology: The epithet refers to the colour of the solution produced by treating the hypothecium and excipulum with K.

Remarks

This new species belongs to *Buellia* in the broad sense (Bungartz *et al.* 2007; Elix 2009) and is characterized by the thin, crustose, rimose-areolate, off-white to pale brown thallus, the prominent black prothallus, small, immersed apothecia, a dark brown to brown-black hypothecium and excipulum which give an intense purple solution in K, *Buellia*-type ascospores and the presence of atranorin and the anthraquinone rugulosin monoacetate. Morphologically, the new species closely resembles *Buellia stellulata* var. *stellulata*, but can be readily distinguished because the latter has a K-hypothecium and excipulum (Elix 2011).

At present, the new species is known from Otago in the South Island of New Zealand and Campbell Island, where it occurs on coastal siliceous rocks. Commonly associated species include *Amandinea nitrophila* (Zahlbr.) Elix, *A. pelidna* (Ach.) Fryday & L.Arcadia, *Caloplaca cribrata* (Hue) Zahlbr., *C. gallowayi* S.Y.Kondr., Kärnefelt & Filson, *Halecania subsquamosa* (Müll.Arg.) van den Boom & H.Mayrhofer, *Lecanora subcoarctata* (C.Knight) Hertel, *Pertusaria graphica* C.Knight, *Rinodina blastidiata* Matzer & H.Mayrhofer and *Jackelisia ligulata* (Körb.) S.Y.Kondr., Fedorenko, S.Stenroos, Kärnefelt & A.Thell.

SPECIMENS EXAMINED

• Otago, Tavora Reserve near Goodwood, 45°31'50"S, 170°45'36"E, 7 m alt., on rocks in splash zone, first rocky point at N end of sandy beach, *A. Knight s.n.*, 7.vi.2014 (CANB, OTA 065263 *pr.p.*); • Campbell Island, near Bull Rock, on ledges of molly-mawk rookery, 52°29'S, 169°13'E, *H.A. Imshaug* 47272, 19.i.1970 (MSC).

3. *Buellia kantvilasii* Elix, Blanchon & A.Knight, sp. nov.

Fig. 4

Mycobank No.: **MB 818433**

Similar to *Buellia albula* (Nyl.) Müll.Arg., but differs in having immersed apothecia, weakly concave to flat discs, interspersed subhymenium and siliceous rock substratum.

Type: Australia, Tasmania, Freycinet Peninsula, Sleepy Bay, 42°08'S, 148°19'E, sea level, on vertical, sheltered faces of coastal granite rocks, *G. Kantvilas* 136/84 & P. James, 2.ii.1984 (HO – holotype; CANB – isotype).

Thallus crustose, continuous, rimose to rimose-areolate, to 40 mm wide and 0.7 mm thick, becoming inflated and sublobate at the margins; upper surface white, grey-white or pale grey, shiny, becoming cracked, white-pruinose; prothallus not apparent; photobiont cells 7–15 µm wide; medulla white, containing calcium oxalate, (H₂SO₄), I-. *Apothecia* 0.3–0.6 mm wide, lecidine, separate and ± round to crowded and dis-

torted by mutual pressure, mainly immersed, rarely adnate; disc black, usually white-pruinose, weakly concave to plane; proper exciple prominent, persistent, elevated above disc, in section 25–40 µm thick, the outer part dark brown to deep olive-brown, K+ yellow solution forming orange-red, needle-like crystals, N+ purple-brown to weak red-brown, paler brown within. *Hypothecium* 80–120 µm thick, chestnut-brown to brown-black below, K+ forming orange-red, needle-like crystals. *Epithymenium* 10–12 µm thick, deep olive-brown, K-, N+ purple-brown to weak red-brown. *Hymenium* 60–95 µm thick, colourless, not interspersed; subhymenium 20–30 µm thick, pale brown, interspersed with oil droplets; paraphyses 1.5–2.0 µm wide, simple to sparsely branched, with apices 3.5–4 µm wide and brown caps; *asci* of the *Bacidia*-type, 8-spored. *Ascospores* of the *Buellia*-type, 1-septate, brown, ellipsoid, 10–[12.5]–15 × 5–[6.4]–8 µm, not constricted at the septum; outer spore wall smooth to finely ornamented. *Pycnidia* immersed, punctiform. *Conidia* bacilliform, 3–5 × 1–1.5 µm.

Chemistry: Thallus K+ yellow then red, C-, P+ orange-red, UV-; containing norstictic acid (major), connorstictic acid (minor).

Etymology: The species is named after our colleague, friend and collector of the type specimen, Dr Gintaras Kantvilas.

Remarks

In many respects this new species resembles *B. albula*, a very common lichen on calcareous rocks in New Zealand and Australia (Elix 2011). Both species are characterized by the presence of norstictic acid, a non-amyloid medulla, ±pruinose discs and similar ascospores, conidia, apothecial anatomy including similar reactions of the hypothecium and epithymenium. However, *B. albula* differs in having apothecia that are initially immersed but soon become broadly adnate to sessile, discs that become markedly convex, a deep, red-brown hypothecium and in growing exclusively on limestone or limestone-impregnated rocks. Superficially, *B. kantvilasii* resembles *B. hypostictella* Elix & H.Mayrhofer, a species that also occurs on siliceous coastal rocks in New Zealand. However, the latter has longer conidia (5–9 µm), and contains hypostictic acid (Elix & Mayrhofer 2016).

At present, this new species is known from coastal rocks in New Zealand and eastern Tasmania. In New Zealand associated species include *Amandinea coniois* (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer, *A. pelidna* (Ach.) Fryday & L.Arcadia, *Buellia cranwelliae* Zahlbr., *Caloplaca allanii* Zahlbr., *Pertusaria xanthoplaca* Müll.Arg., *Jackelisia ligulata* (Körb.) S.Y.Kondr., Fedorenko, S.Stenroos, Kärnefelt & A.Thell and *Xanthoparmelia* species.

SPECIMENS EXAMINED

New Zealand. • North Island, Great Barrier Island, Motu Kaikoura, Crawford Bay, 36°11'12"S, 175°19'41"E, 1 m alt., on coastal volcanic rocks, *D.J. Blanchon s.n.*, 12.xii.2008 (CANB, UNITEC); • North Island, West Auckland, Waitakere Ranges, Cowan Bay, 36°59'55"S, 174°28'36"E, 2 m alt., on basalt blocks in conglomerate on rocky bluff beside dune lake, *D.J. Blanchon s.n.*, 16.v.2013 (CANB, UNITEC); • North Island, West Auckland, Piha, Lion Rock, 36°57'11"S, 174°28'00"E, alt. 2 m, on fallen boulders on N side of rock, *D.J. Blanchon s.n.*, 16.vi.2013 (CANB, UNITEC); • North Island, Auckland, Motutaiko Island, Hauraki Gulf, 36°12'58"S, 175°17'23"E, 3 m alt., on volcanic conglomerate cliff, splash zone, *A. Knight s.n.*, 13.ii.2015 (CANB, OTA); • South Island, Canterbury, Banks Peninsula, Rapaki Bay SW of Lyttelton, 43°36'25"S, 172°40'55"E, 1–3 m alt., on coastal basalt rocks, *J. Blaha* 0110 *pr.p.*, 16.iii.2001 (GZU).

New records

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

This species was known previously from Australia (Elix & Kantvilas 2014), Central and South America, and southern and eastern Africa (Marbach 2000). It is characterized by a white to pale grey, crustose thallus containing atranorin (K+ yellow), a green to greenish black epihymenium [containing *micromera*-green pigment: K+ greenish, N+ purple-black or grey-black (Bungartz *et al.* 2007)], *Buellia*-type ascospores, 12–17 × 5–7 μm, with weak subapical wall-thickenings and a strongly ornamented outer wall, and bacilliform conidia, 4–5 × 1 μm. A detailed description is given in Marbach (2000). *Baculifera pseudomicromera* Marbach is rather similar, but differs in containing additional norstictic acid and in having ascospores with a weakly ornamented outer wall, while *B. macromera* Elix & Kantvilas has larger ascospores with a smooth outer wall and lacks the *micromera*-green pigment in the epihymenium (Elix & Kantvilas 2014).

SPECIMENS EXAMINED

New Zealand. • North Island, South Auckland, Domain Drive, Museum Reserve, Parnell, 36°51'43"S, 174°46'52"E, alt. 60 m, on fallen bark, *A. Knight s.n.*, 24.ii.2015 (CANB, OTA); 36°51'36"S, 174°46'45"E, alt. 60 m, on fallen oak branches, *A. Knight s.n.*, 24.ii.2015 (CANB, OTA).

2. *Buellia stellulata* var. *tasmanica* Elix & Kantvilas, *Australas. Lichenol.* 73, 32 (2013)

This taxon was previously known from Australia (New South Wales and Tasmania). Morphologically, it is identical to *Buellia stellulata* var. *stellulata*, but can be readily distinguished chemically, because the latter contains additional 2'-O-methylperlatolic acid (major) and confluent acid (minor). A detailed description is given in Elix & Kantvilas (2013).

SPECIMENS EXAMINED

New Zealand. • North Island, Auckland, Kawau Island, Bon Accord Harbour, Stockyard Bay, 36°25'01"S, 174°49'34"E, 2 m alt., on quartz vein in cliff, splash zone, *A. Knight*, 16.ii.2015 (CANB, OTA); • Antipodes Island, just S of Hut Cove, 49°40'30"S, 178°48'42"W, 45 m alt., on rock outcrops in tussock grassland, *R.C. Harris* 5813A, 19.i.1970 (MSC).

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Fig. 1. *Buellia akatorensis* (holotype in OTA). Scale = 1 mm.

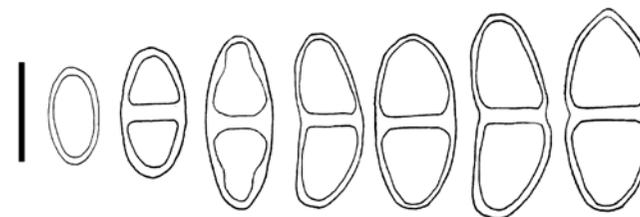


Fig. 2. Ascospore ontogeny of *B. akatorensis*. Scale = 10 μm.

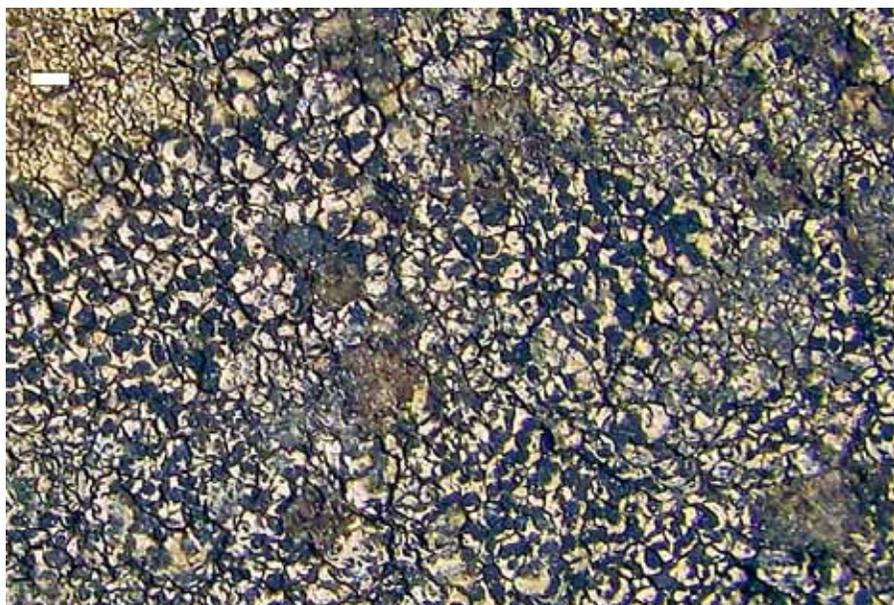


Fig. 3. *Buellia hypopurpurea* (holotype in OTA). Scale = 1 mm.



Fig. 4. *Buellia kantvilasii* (holotype in HO). Scale = 1 mm.

A new species of *Scytinium* (Ach.) Gray (lichenized Ascomycota, Collemataceae) from the Australian Capital Territory

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Abstract

Scytinium tenuilobum sp. nov. (Collemataceae) is described from small limestone outcrops in *Eucalyptus* woodland in the Australian Capital Territory. This diminutive lichen has exceptionally small thalli, short and narrow, pseudocorticate lobes, clustered *Nostoc* cells and persistently transversely septate ascospores.

The large, cosmopolitan genera *Collema* F.H.Wigg. and *Leptogium* (Ach.) Gray, which have dominated the cyanolichen family Collemataceae, were until recently characterized by the absence of a true cortex in the former, with *Leptogium* having eucorticate thalli (e.g. Degelius 1954, 1974; Clauzade & Roux 1985; Filson 1992; Verdon 1992; Galloway 2007; Jørgensen 2007; Gilbert & Jørgensen 2009; Gilbert & Jørgensen 2009). However, molecular studies by Otálora *et al.* (2013) confirmed the monophyly of ten morphological groups within or spanning *Collema* and *Leptogium*, the groups being defined not only by the presence or absence of a true cortex or pseudocortex, but also by growth form and the dimensions of lobes, as well as ascospore characteristics, other attributes of thallus anatomy and habitat preferences. As a consequence, *Collema* and *Leptogium* were recircumscribed, several old generic names were resurrected, and new genera were described (Otálora *et al.* 2013). One of the resurrected genera, the comparatively heterogeneous *Scytinium* (Ach.) Gray, has minute to medium-sized thalli that are crustose, squamulose or foliose, and occupy the full suite of potential substrata, mainly in temperate latitudes. A cortex or pseudocortex can be present or absent, apothecial anatomy is variable, and the ascospores are comparatively small and predominantly submuriform to muriform. As explained by Otálora *et al.* (2013), the genus includes species formerly placed in three sections of *Leptogium* (*Homodium*, *Collemodium* and *Leptogium*) and three species groups previously included in *Collema* (the *fragrans*, *callopismum* and *leptogioides* groups).

An undescribed species of Collemataceae, collected from limestone outcrops in *Eucalyptus* woodland in the Australian Capital Territory, is assigned here to *Scytinium* by virtue of its diminutive size, crust-like habit and minute, pseudocorticate lobes. While its ascospores are persistently transseptate, rather than submuriform or muriform, this difference cannot reasonably be considered an obstacle to its inclusion in *Scytinium*. Conversely, placement in the resurrected *Blennophora* Trevis., which includes foliose species with transversely septate ascospores, would be inappropriate given its larger thalli and more robust lobes that are invariably ecorticate and isidiate (Otálora *et al.* 2013). Similarly, species of *Enchylium* (Ach.) Gray (formerly the *Collema tenax* group) can have ascospores with one or more transverse septa (or submuriform in some species), but the thallus is also foliose, ecorticate and isidiate (Otálora *et al.* 2013).

Methods

Observations and measurements of thalline, apothecial and pycnidial anatomy, asci, paraphyses, ascospores and conidia were made on hand-cut sections mounted in water.

Scytinium tenuilobum P.M.McCarthy, sp. nov.

Mycobank No. MB 818622

Figs 1, 2

Characterized by the blackish, minutely and radially lobate, crust-like thallus that is pseudocorticate and non-isidiate and contains clusters of non-filamentous *Nostoc*

cells; apothecia adnate, 0.3–0.63 mm diam., with a thalline exciple 50–70(–100) μm thick (in section), a proper exciple 10–30 μm thick laterally and 12–18(–25) μm thick basally, narrowly clavate or clavate-cylindrical, (6–)8-spored asci measuring 90–112 \times 20–27 μm , and (1–)3(–5)-septate, narrowly ellipsoid to subfusiform or oblong ascospores of 20–35 \times 9–14 μm ; pycnidia globose, immersed in prominent thalline warts 0.1–0.2 mm diam., producing bacilliform conidia 2–4(–5) \times 0.5–1.2(–1.5) μm .

Type: Australia, Australian Capital Territory, Cotter Caves, c. 20 km W of Canberra, 35°20'01"S, 148°56'28"E, alt. 580 m, on sheltered limestone outcrops in *Eucalyptus* woodland, P.M. McCarthy 4490, 4.v.2016 (holotype – CANB).

Thallus epilithic, plane or uneven, rounded, angular or irregular in outline, minutely lobate, black when dry, greenish black and somewhat pulpy when fully hydrated, 0.2–0.7(–1) mm wide, 0.1–0.3(–0.4) mm thick, attenuated basally, contiguous or scattered, but dominating areas of the rock 1–3(–5) cm wide, attached to the substratum by means of hyaline, long-celled and moderately thick-walled hyphae 3–6(–8) μm wide. *Lobes* terete, abundant, radiating, lacking isidia, epruinose, sparingly branched and up to 0.1 mm long, smooth or faintly wrinkled and 30–50 μm thick when dry, smooth, 40–70 μm thick, tightly contiguous and slightly thicker apically when wet [interspersed with and subtended by a community of independent cyanobacteria, including *Gloeocapsa* sp., *Oscillatoria* sp. and pseudofilamentous species embedded in minute rock fragments and crystals]. *True cortex* absent; pseudocortex consisting of rounded, moderately thick-walled, dark cells 5–7(–10) μm wide, these being the apices of short, arcing branches from those hyphae at the core of each lobe, the pseudocortex subtending an amorphous, 2–3 μm thick sheath-like layer. *Photobiont* *Nostoc*, not forming distinct filaments, instead aggregated throughout in groups of 10–30 or more cells, (10–)15–20(–25) μm in maximum extent and enveloped by hyphae ("packets" *sensu* Degelius, 1954); cells pale greyish green, broadly ellipsoid to globose, 3–8 \times 2–7 μm ; interstitial mycobiont hyphae hyaline, long-celled, branched and anastomosing, 4–9 μm wide and periclinal in longitudinal sections of lobes, \pm rounded and appearing loosely parenchymatous in transverse sections. *Prothallus* absent.

Apothecia numerous, usually solitary and often 1 per thallus, or in small groups, round, adnate to subsessile, (0.3–)0.47(–0.63) mm diam. [$n = 50$]; disc concave to plane and glossy greenish black when immature, plane to moderately convex at maturity, smooth, epruinose, dull greenish black to black; margin 30–50 μm thick, often minutely and abundantly lobate when immature, persistent or becoming \pm excluded at maturity, concolorous with the disc. *Thalline exciple* 50–70(–100) μm thick in water sections, anatomically identical to the thallus lobes but with a 10–15(–20) μm thick, dark-pigmented outer zone. *Proper exciple* cupulate, pale yellowish brown and 12–18(–25) μm thick basally, of moderately elongate, periclinal, thick-walled cells 2–3 μm wide; laterally 10–30 μm thick and considerably darker towards the surface, the cells rounded to ellipsoid in section. *Hypothecium* hyaline to pale yellowish brown, 20–50 μm thick, not interspersed, K–, I– (with or without pretreatment in K), paraplectenchymatous, of rounded to angular, thick-walled cells 3–6 μm wide. *Hymenium* 120–160 μm thick, not interspersed with granules or oil droplets, I+ blue. *Epihymenium* medium olive-brown, 20–25(–30) μm thick. *Paraphyses* rather tightly conglutinate in water, loosening in K, unbranched, long-celled, 2.5–3.5(–4) μm wide; cell contents clear; apices neither swollen nor differentially pigmented. *Asci* narrowly clavate or clavate-cylindrical (immature and aborted asci often narrowly cylindrical), (6–)8-spored, 90–112 \times 20–27 μm ; apex rounded, with a thick, densely and uniformly amyloid tholus and an inconspicuous or distinct ocular chamber that can be rounded, truncate or even apparently inverted. *Ascospores* colourless, transversely (1–)3(–5)-septate, lacking longitudinal or diagonal septa, narrowly ellipsoid to subfusiform or oblong, irregularly biserial in the asci, or most spores clustered towards the distal end; end cells subacute or rounded and then occasionally slightly broader than the

median cells, constricted at the septa or not, thin-walled, lacking a perispore, (20–)27(–35) \times (9–)12(–14) μm [$n = 30$]; contents sparsely granulose and guttulate.

Pycnidia numerous, solitary, globose, immersed in convex, hemispherical or subglobose-attenuate, thalline warts 0.1–0.2 mm diam.; ostiole in a shallow depression; thalline wall 15–30 μm thick; pycnidial wall 12–20 μm thick, hyaline to pale yellowish brown, of slightly elongate, thick-walled, periclinal cells; conidiogenous layer not convoluted, of inwardly converging hyphae; conidiogenous hyphae 30–60 μm long, simple to richly branched and with abundant basal anastomoses, the cells isodiametric, barrel-shaped or slightly elongate, 2.5–4 μm wide, constricted at the septa or not. *Conidia* budding apically and subapically from conidiogenous hyphae, simple, hyaline, bacilliform, 2–4(–5) \times 0.5–1.2(–1.5) μm .

Etymology: The epithet *tenuilobum* refers to the narrow thallus lobes of the new species.

Remarks

Scytinium tenuilobum is an inconspicuous but highly distinctive member of the Collemataceae, being characterized by a suite of thalline and ascumal attributes, *viz.* minute, crust-like thalli with exceptionally short and narrow, radiating lobes that are pseudocorticate and contain clustered *Nostoc* cells, along with comparatively small apothecia that produce persistently trans-septate ascospores. The species that is probably most similar to the new lichen is the northern-temperate to boreal *Scytinium callospium* (A.Massal.) Otálora, P.M.Jørg. & Wedin (formerly *Collema callospium* A.Massal.). It also has minutely lobate, but essentially crustose thalli that are centrally attached to the limestone substratum, although the lobes are up to 0.3 mm long and wide. While the anatomy and dimensions of the apothecia are very similar to the Australian lichen, the ascospores are usually submuriform at maturity (rarely 3-septate) and 17–26 \times 9–11 μm (Degelius 1954; Clauzade & Roux 1985; Jørgensen 2007; Gilbert *et al.* 2009).

Enchylium coccophorum (Tuck.) Otálora, P.M.Jørg. & Wedin, a mainly northern temperate species that also occurs in Africa, southern Australia and New Zealand, has a small, crustose to squamulose thallus with lobes to 3 mm wide and plane at the margin, apothecia that are considerably larger than those of *S. tenuilobum* and smaller, trans-septate ascospores (Degelius 1954, 1974; Filson 1992; Jørgensen 2007; Gilbert *et al.* 2009). The more diminutive and often placoid *Pseudoleptogium diffractum* (Kremp. ex Körb.) Müll.Arg., from Europe and south-western U.S.A., has thallus lobes c. 1 mm long and 0.5 mm wide, and muriform ascospores (Jørgensen 2007; Gilbert & Jørgensen 2007), while the crustose-granular, northern-temperate to alpine *Scytinium aquale* (Arnold) Otálora, P.M.Jørg. & Wedin and *S. biatorinum* (Nyl.) Otálora, P.M.Jørg. & Wedin, both formerly included in *Leptogium*, have *Nostoc* cells in chains or clusters, respectively, as well as submuriform to muriform ascospores (Jørgensen 1994, 2007).

Scytinium tenuilobum is known only from the type locality, a shallow valley in *Eucalyptus* woodland in the Australian Capital Territory. Silurian limestone outcrops and boulders only metres up the side of the valley are bare, or support only a depauperate lichen flora, presumably since severe bushfires impacted the area in 2003. The new species is part of a diverse and well-established lichen community almost untouched by recent fires that includes *Caeruleum heppii* (Nägeli ex Körb.) K. Knudsen & L.Arcadia, *Caloplaca* aff. *atroflava* (Turner) Mong., *C. mereschowskiana* S.Y.Kondr. & Kärnefelt, *Candelariella aurella* (Hoffm.) Zahlbr., *Circinaria contorta* (Hoffm.) A.Nordin, S.Savic & Tibell, *Lecania turicensis* (Hepp) Müll.Arg., *Lecanora dispersa* (Pers.) Sommerf., *Sarcogyne canberrensis* P.M.McCarthy & Elix, *S. meridionalis* P.M.McCarthy & Kantvilas, *S. regularis* Körb., *Verrucaria muralis* Ach. and *V. nigrescens* Pers.

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Fig. 1. *Scytinium tenuilobum* (holotype). Scale bar = 1 mm.

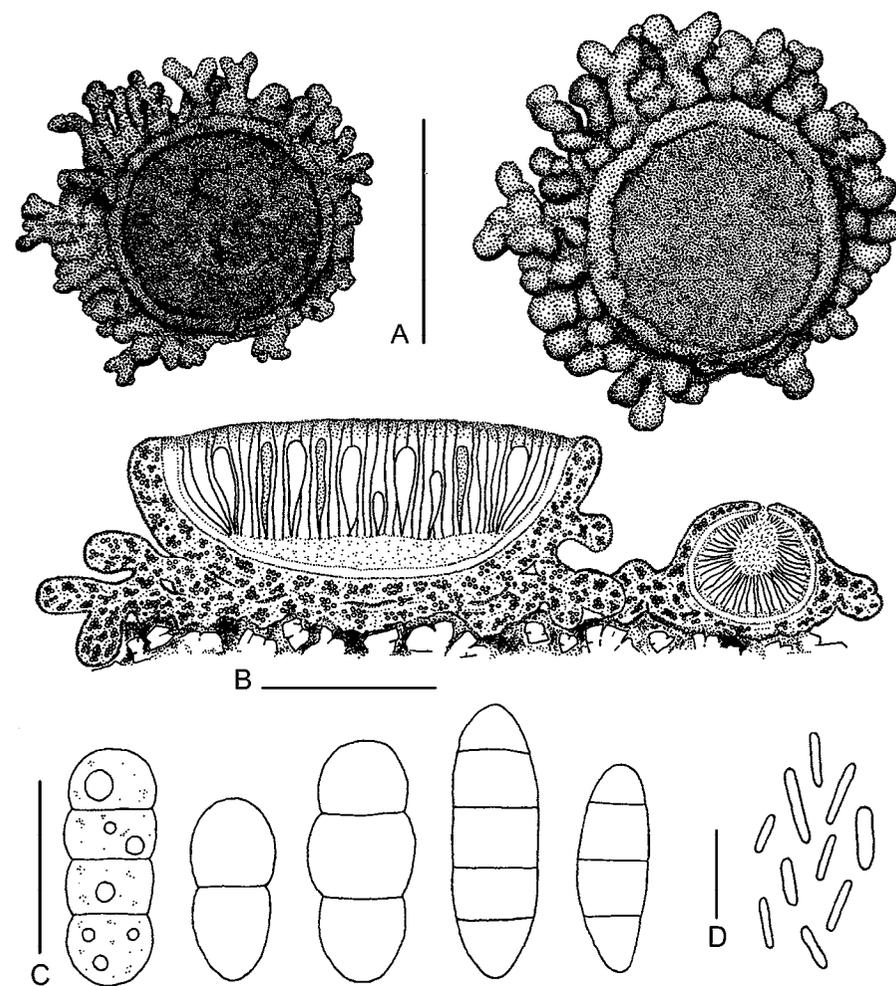


Fig. 2. *Scytinium tenuilobum* (holotype). A, Habit of an air-dried, fertile thallus (left), and the same thallus fully hydrated. B, Sectioned apothecium, pycnidium and adjacent lobes (semi-schematic); C, Ascospores; D, Conidia. Scale bars: A = 0.5 mm; B = 0.2 mm; C = 20 μ m; D = 5 μ m.

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Pertusaria endoxantha Vain.

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Abstract

Pertusaria endoxantha Vain. is reported for the first time from New Zealand.

Pertusaria endoxantha Vain. was first collected by G.F. Scott-Elliot in 1893–1894 from the Rwenzori mountain range of Uganda, then subsequently described by E.A. Vainio (Vainio 1898). Australian material was previously recorded as *P. norstictica* A.W.Archer, and was originally collected from Tasmania on *Acacia mearnsii* (Archer 1991). Other synonyms include *P. sanguinescens* Zahlbr., which was collected from *Eucalyptus* in Java, Indonesia (Zahlbruckner 1928), and *P. macrostomoides* C.W.Dodge and *P. prolifera* C.W.Dodge, from Africa (Dodge 1964).

Pertusaria endoxantha has also been reported from Papua New Guinea (Archer 2004) and northern Thailand (Jariangprasert 2005), but has not previously been recorded from New Zealand (Galloway 2007; de Lange *et al.* 2012). A lichen diversity study in the Auckland region of New Zealand (Fig. 1) found a single population of it on *Phyllocladus trichomanoides*.

Materials and methods

Specimens were examined with standard microscopic techniques. Chemical constituents were identified by thin-layer chromatography (Culberson 1972; White & James 1985).

***Pertusaria endoxantha* Vain., *Hedwigia* 37: 41 (1898)**

(Adapted from Archer (2004) (as *P. norstictica*)

Thallus off-white to pale olive-green, areolate and cracked, dull, sometimes patchy. Soredia and isidia absent. Apothecia numerous, verruciform, scattered, rarely confluent, flattened-hemispherical, concolorous with the thallus, 1–2 mm diam. Ostioles black, punctiform, but inconspicuous in a hyaline zone 0.2–0.3 mm diam., 1–2 per verruca. Ascospores 8 per ascus, regularly or irregularly uniseriate, elongate-ellipsoidal to subfusiform, with smooth inner walls, 82.5–100 µm long and 30–40 µm wide. Chemistry: K+ orange/red, C–, KC–; containing norstictic acid.

Remarks

The species is characterized by verruciform apothecia with inconspicuous black ostioles (Figs. 2, 3), asci with 8 uniseriate ascospores and by the presence of norstictic acid in the thallus.

Pertusaria endoxantha was collected as part of a three-year study of lichen diversity in the Auckland region. Although thirty-five similar sites have been surveyed so far, *P. endoxantha* has been found at only the Kakamatua Inlet site and on only one host, *Phyllocladus trichomanoides*, even though several other species of a similar size grow at the site, among them *Agathis australis*, *Kunzea robusta* and *Hakea sericea*.

Other lichen species found on the same trees include *Bactrospora arthonioides* Egea & Torrente, *Lepraria lobificans* Nyl., *Megalania pulverea* (Borrer) Hafellner & Schreiner, *Parmotrema reticulatum* (Taylor) M.Choisy, *Pertusaria psoromica* A.W.Archer & Elix, *Pyrenula occulta* (C.Knight) Müll.Arg. and *Thelotrema lepadinum* (Ach.) Ach.

SPECIMENS EXAMINED

North Island: • Kakamatua Inlet, Waitakere Ecological District, 37°0'9.97"S, 174°35'23.68"E, 51 m alt., on *Phyllocladus trichomanoides*, A. Marshall & D.J. Blanchon s.n., 12.vi.2014 (UNITEC); loc. id., on *P. trichomanoides*, A. Marshall & D.J. Blanchon, s.n., 15.x.2015 (UNITEC).

Acknowledgements

We thank Professor Jack Elix and Dr Alan Archer for confirmation of the identity of the original specimen.

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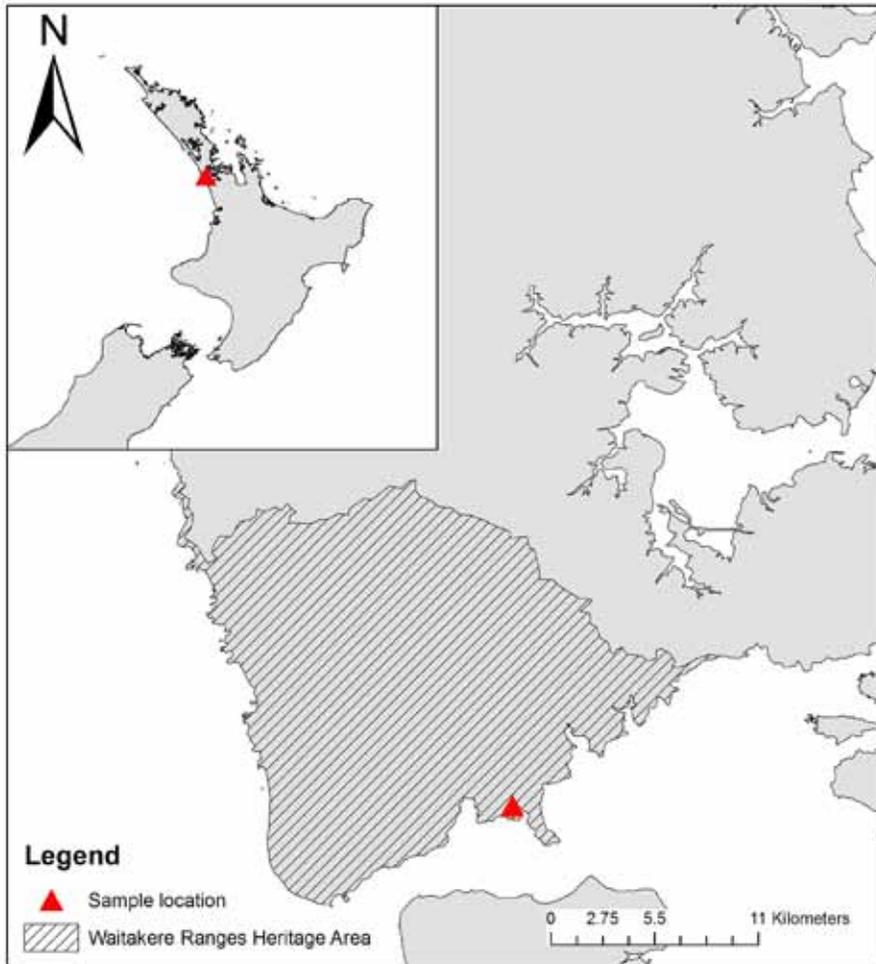


Fig. 1. *Pertusaria endoxantha* collection site.



Fig. 2. *Pertusaria endoxantha* habit on *Phyllocladus trichomanoides*.



Fig. 3. *Pertusaria endoxantha* verrucae.

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Abstract

Seven species: *Buellia malcolmii* Elix, *Caloplaca sideritis* (Tuck.) Zahlbr., *Graphis fournieri* Lizano & Lücking, *Ochrolechia apiculata* Verseghy, *Rinodina cana* (Arnold) Arnold, *Staurothele succedens* (Rehm ex Arnold) Arnold and *Toninia submexicana* B. de Lesd., are reported from Australia for the first time. New state, territory and oceanic island records are provided for 39 other taxa.

NEW RECORDS FOR AUSTRALIA

1. *Buellia malcolmii* Elix, in J.A.Elix & H.Mayrhofer, *Australas. Lichenol.* **79**, 11 (2016)
This species was recently described from the South Island of New Zealand. It is characterized by having a granular upper surface, where elevated wrinkles or ridges become cracked, eroded and pustulate-sorediate in part, immersed, cryptolecanorine apothecia, *Buellia*-type ascospores, 13–[17.6]–21 × 6.5–[8.5]–11 μm that become constricted at the septum and in containing arthothelin. A detailed description and illustration are given in Elix & Mayrhofer (2016).

SPECIMEN EXAMINED

Tasmania. • Shag Bay, 42°50'S, 147°20'E, 3 m alt., on mudstone outcrops along the sea-shore, *G. Kantvilas* 337/09, 22.viii.2009 (CANB, HO).

2. *Caloplaca sideritis* (Tuck.) Zahlbr., *Trav. Sous-Sect. Troitzkossawask-Khiaka, Sect. du Pays d'Amour Soc. Imp. Russe Geogr.* **12**, 92 (1911) Figs 1, 2

Thallus crustose, epilithic, areolate; areoles plane to convex or verrucose, 0.3–1(–1.3) mm wide, dull pale grey, K–; cortex 10–25 μm thick. Apothecia sessile, 0.3–0.8(–1) mm diam.; disc plane to moderately convex, medium orange, rusty orange or orange-brown, K+ dark red-violet; thalline margin entire and smooth to slightly flexuous, pale to medium grey, separated from the disc by a very thin, but distinct, dark grey to blackish ring (surface view); proper exciple 10–15 μm thick laterally, up to 100 μm thick and ± amorphous at the base, hyaline throughout except for the uppermost and outermost cells of the lateral exciple which are thick-walled and dark purple-grey (i.e. the dark ring in surface view); epihymenium golden-orange; hymenium 50–80 μm thick, interspersed with minute granules that are insoluble in K; paraphyses anastomosing and 1.5–2 μm thick, not containing oil bodies, more richly branched towards the apices (2–3 μm thick); hypothecium 50–70 μm thick, not interspersed; algae forming

a continuous layer beneath the hypothecium. Ascospores narrowly to broadly ellipsoid, 8–13 × 6.5–8 μm; septum (1.5–)2–4(–5) μm thick; apices thin-walled.

This species was previously known from North America, where it is widespread and common (Wetmore, 1996, 2007). It is characterized by the pale grey, areolate thallus, sessile apothecia with a dark orange disc, a grey thalline margin and a thin black ring of excipular tissue separating the two, as well as comparatively small ascospores. The Australian specimen is heavily overgrown by a black crust of coccoid and pseudofilamentous cyanobacteria (Fig. 1).

SPECIMEN EXAMINED

New South Wales. • Southern Tablelands, Tinderry Ra., Tinderry Rd, E of Michelago, 35°44'31"S, 149°15'52"E, 1140 m alt., on very exposed granite outcrops, *P.M. McCarthy* 4489, 7.ix.2016 (CANB).

3. *Graphis fournieri* Lizano & Lücking, in Lücking *et al.*, *Fieldiana, Bot.* **46**(1), 84 (2008) Fig. 3

Thallus crustose, epiphloeodal, continuous, smooth, dull, pale to medium waxy olive-green, corticate, K–; prothallus not apparent, or diffuse and whitish, or (when contiguous with other thalli) a thin, black line. Lirellae very numerous, simple to sparingly branched, mostly curved, sinuous or serpentine, superficial and commonly slightly constricted at the base, often contiguous or overlapping, 1–4(–5) mm long, 0.2–0.4 mm wide; thalline exciple absent; proper exciple carbonized laterally and basally, sulcate, with 2–4 parallel grooves on either side of the central slit; hymenium 120–160(–200) μm thick, not interspersed; paraphyses simple, although those closest to the exciple with some anastomoses. Ascospores (6–)8 per ascus, hyaline, ellipsoid, elongate-ellipsoid or subfusiform, straight or slightly curved, muriform, with 9–13 transverse septa, each transverse locule with (1–)2(–4) longitudinal divisions at maturity, 35–65 × 10–16(–20) μm, IKI+ violet-blue; perispore 2–5 μm thick.

Graphis fournieri is rather common on bark in the open, eucalypt woodland that dominates Magnetic Island, Queensland; it was not seen in the littoral vegetation or in the few rainforest pockets. It was previously known only from dry forest in Costa Rica. See Lücking *et al.* (2008) for a more detailed description.

SPECIMENS EXAMINED

Queensland. • Townsville, Magnetic Island, beside track from Horseshoe Bay to Radical Bay, 19°07'S, 146°53'E, c. 50 m alt., on bark in open eucalypt woodland, *P.M. McCarthy s.n.*, 27.viii.2014 (CANB); • Magnetic Island, Heritage Walk, beside road from Nelly Bay to Arcadia, 19°09'S, 146°52'E, c. 20 m alt., on bark in open eucalypt woodland, *P.M. McCarthy s.n.*, 14.viii.2014 (CANB).

4. *Ochrolechia apiculata* Verseghy, *Beih. Nova Hedwigia* **1**, 85 (1962) Fig. 4

Thallus crustose, saxicolous, to 150 mm wide and 0.2 mm thick, rimose-areolate to irregularly verrucose and warted, corrugated or rarely granulose; upper surface white, pinkish white or grey-white, usually pruinose, C+ red; prothallus marginal, white. Apothecia 1–3 mm wide, broadly adnate but soon sessile and constricted at the base; margins to 2 mm wide, white, smooth to wavy, warted or pustulate, white-pruinose, the cortex C+ red; disc shallowly concave to plane, scabrid, white-pruinose, C+ red. Hypothecium colourless to pale yellow-brown, 65–80 μm thick. Epihymenium brown to dark brown, 30–40 μm thick. Hymenium colourless, 140–200 μm thick, not interspersed, I+ blue. Ascii basally apiculate, with 8 or fewer spores (2, 3, 4 or 6). Ascospores broadly ellipsoidal to weakly pyriform, 50–[56.8]–65 × 32–[34.5]–40 μm. *Chemistry*: gyrophoric acid [major] and lecanoric acid [minor] in both the apothecia and thallus. Spot tests: Thallus C+ red; amphithecium cortex C+ red, medulla C+ red at least in part; disc C+ red.

Ochrolechia apiculata is rather common on coastal, siliceous rocks in southern New

South Wales, Victoria and Tasmania, and is characterized by its basally apiculate asci, medium-sized ascospores and chemistry. It was originally described from coastal rocks in the North Island of New Zealand, but it also occurs in similar situations in the South Island. Galloway (2007) synonymized this species with *O. tartarea* (L.) A.Massal. (Fletcher *et al.* 2009), but the latter does not occur in Australia or New Zealand.

SPECIMENS EXAMINED

New South Wales. • Lilli Pilli Beach, 35°46'S, 150°12'E, 2 m alt., on rocks along the foreshore, *J.A. Elix 1195*, 5.ix.1975 (CANB); • Jervis Bay, Stoney Creek, 34 km SE of Nowra, 35°10'S, 150°45'E, 2 m alt., on sandstone rocks in dry sclerophyll forest beside creek, *J.A. Elix 26409*, 8.xi.1990 (CANB); *loc. id.*, *J.A. Elix 26412*, 8.xi.1990 (B, CANB, NY); • cliffs just N of Barlings Beach, 35°49'49"S, 150°12'20"E, 2 m alt., on shale rocks along the foreshore, *J.A. Elix 46293*, 19.xi.2016 (CANB).

Victoria. • East Gippsland, Quarry Beach, 6 km S of Mallacoota, near airfield, 37°36'03"S, 149°43'41"E, c. 1 m alt., on siliceous rocks on the seashore, *J.A. Elix 46250*, 29.x.2016 (CANB).

Tasmania. • Remarkable Cave Beach, 4.5 km S of Port Arthur, 43°11'S, 147°52'E, 2 m alt., on rock, *F.E. Davies 1277*, *P. Ollerenshaw & R. Burns*, 26.i.1989 (CANB).

5. *Rinodina cana* (Arnold) Arnold, *Verh. Zool.-Bot. Ges. Wien* **30**, 125 (1880) Fig. 5
This species was previously known from Europe and North America (Sheard 2010). It is characterized by the continuous, cracked to areolate, pale grey to yellow-grey, crustose thallus that lacks secondary lichen substances and is often delimited by a dark prothallus, its small cryptolecanorine or lecideine apothecia with *Mischoblastia*- or *Milvinia*-type ascospores, 16–23 × 8.5–13 µm, which sometimes become rounded (*Pachysporaria*-type) when mature. It is distinguished from the very common *R. oxydata* (A.Massal.) A.Massal. by the absence of atranorin and the smaller ascospores. A detailed description is given in Sheard (2010).

SPECIMENS EXAMINED

Queensland. • Wanka Rd, 29 km S of Dalby along the Cecil Plains Rd, 27°26'51"S, 151°14'21"E, 340 m alt., on loose stones in grassland with remnant *Eucalyptus*, *J.A. Elix 39092*, 8.v.2005 (CANB).

Victoria. • Anakie Gorge, Picnic Area, near Geelong, 37°51'36"S, 144°15'43"E, on basalt, *W.H. Ewers 3259*, 23.ix.1988 (CANB); • Mt Korong, 13 km SE of Wedderburn, 36°28'S, 143°45'E, 220 m alt., on semi-exposed boulder in poor, disturbed *Eucalyptus* woodland with large granite outcrops, *H. Streimann 59100*, 6.xii.1996 (B, CANB).

6. *Staurothele succedens* (Rehm ex Arnold) Arnold, *Verh. Zool.-Bot. Ges. Wien* **30**, 149 (1880)

Fig. 6

Thallus a grey-brown to blackish, effuse to determinate, epilithic crust, continuous to irregularly areolate, or of goniocysts 50–100 µm wide, or almost subsquamulose, partly or largely overgrown by gloeocapsoid cyanobacteria; algae green, globose, 10–15 µm diam. Perithecia moderately numerous, 1/3-immersed in the thallus to almost superficial, not immersed in the substratum, mostly hemispherical, black, 0.3–0.62 mm diam., the surface usually irregularly uneven or radially grooved; involucrellum 80–110 µm thick, extending to exciple-base level; apex plane and whitish, with the massed periphyses visible, or blackish and moderately to deeply excavate; exciple 15–25 µm thick, inner half hyaline, outer half dark grey to black; periphyses 20–40 × 2–3 µm. Asci clavate, (6–)8-spored; ascospores hyaline to pale brown, muriform, narrowly to broadly ellipsoid, 29–44 × 17–26 µm; hymenial algae mostly globose, (3–)4–6(–7) µm diam., a minority elongate and 4–6(–9) × 2.5–5 µm.

Staurothele succedens is characterized by the dark, but sometimes rather nondescript, epilithic, calcicolous thallus, prominent and moderately large perithecia, 8-spored

asci and pale, muriform ascospores (Clauzade & Roux; Orange *et al.* 2009; Thüs & Schultz 2009; Orange 2013). However, while previous accounts of the species have invariably reported the hymenial algae to be elongate and in the range 3–11 × 1.5–4.5 µm, the Tasmanian specimen has predominantly globose algae. The taxonomic significance of the shape of hymenial algae remains uncertain (Thüs & Schultz 2009), and, at least until that is resolved, the Tasmanian lichen is most appropriately assigned to *S. succedens*. The species is already known from calcareous rocks, often in montane habitats, in the British Isles, Scandinavia, western, central and southern Europe and Turkey.

SPECIMEN EXAMINED

Tasmania. • South-west Natl Park, NE ridge of Mt Anne, at W rim of Annakananda Sinkhole, 42°55'57.2"S, 146°26'29.3"E, 1050 m alt., on sheltered, alpine limestone outcrops, *G. Kantvilas 111/16*, 5.ii.2016 (HO).

7. *Toninia submexicana* B. de Lesd., *Lich. Mexique* 25 (1914)

Fig. 7

Thallus epilithic, squamulose, dark grey-brown to dark olive-brown, forming extensive colonies; squamules rounded, slightly elongate, irregular or lobulate, imbricate, shallow-concave to moderately convex, dull to slightly glossy, epruinose, 0.5–1.5(–2) mm wide, with plane or slightly involute margins; groups of squamules forming areole-like aggregations 1.5–3(–5) mm wide; cortex 20–50 µm thick, with a distinct necral layer, not containing calcium oxalate. Apothecia lecideine, adnate, dull black, epruinose, initially plane and thinly marginate, becoming convex and the margin ± excluded, 0.3–1(–1.2) mm diam.; proper exciple cupulate, 50–70 µm thick, with a thin, dark grey, outer zone, hyaline to pale grey-brown within; epihymenium c. 10 µm thick, dark grey to grey-black or purple-black, K+ violet, N+ violet; hymenium 60–75 µm thick; hypothecium hyaline, 60–80 µm thick. Ascospores hyaline, bacilliform, (1–)3-septate, 17–33 × 2.5–3.5(–4) µm.

The species is known from south-western U.S.A., Central America, the Caribbean, Cape Verde Islands (off West Africa) and Turkey. See Timdal (1992, 2001) for more detailed descriptions.

SPECIMEN EXAMINED

Western Australia. • Kimberley, along road to Mount Joseph Yard, 25 km E of the Lennard River crossing, along the Gibb River Rd, 17°23'S, 125°00'E, 100 m alt., on exposed schistose rocks in *Triodia*-dominated grassland with scattered treelets and outcrops, *J.A. Elix 22276*, *H. Streimann & D.J. Galloway*, 17.v.1988 (CANB).

NEW STATE, TERRITORY AND OCEANIC ISLAND RECORDS

1. *Amandinea decedens* (Nyl.) Blaha, H.Mayrhofer & Elix, *Australas. Lichenol.* **79**, 46 (2016)
In Australia this species was previously known from Tasmania (McCarthy 2016). It also occurs in New Zealand and South Africa.

SPECIMENS EXAMINED

New South Wales. • South Coast, Pooles Beach, 3 km S of Mystery Bay, 36°18'46"S, 150°07'57"E, c. 1 m alt., on exposed shale outcrops along foreshore, *J.A. Elix 46294*, 18.xi.2016 (CANB).

Victoria. • East Gippsland, Quarry Beach, 6 km S of Mallacoota, near airfield, 37°36'03"S, 149°43'41"E, c. 1 m alt., on siliceous rocks on the seashore, *J.A. Elix 46249*, 46251, 29.x.2016 (CANB); • East Gippsland, Cape Conran Coastal Park, Banksia Bluff Camp, 37°48'03"S, 148°44'30"E, c. 1 m alt., on mica schist rocks on the seashore, *J.A. Elix 46266*, 46269, 46272, 46275, 30.x.2016 (CANB); • East Gippsland, Cape Conran Coastal Park, West Cape, 37°49'43"S, 148°43'43"E, c. 1 m alt., on granite rocks on the seashore, *J.A. Elix 5280*, 21.xi.1978 (CANB); • *loc. id.*, *D. Verdon 4254*, 20.xi.1978 (CANB).

2. Amandinea lignicola var. **australis** Elix & Kantvilas, *Australas. Lichenol.* **72**, 7 (2013)
In Australia, this species was previously known from South Australia, New South Wales, the Australian Capital Territory, Victoria and Tasmania (Elix & Kantvilas 2013).

SPECIMEN EXAMINED

Queensland. • Darling Downs, Nobby–Pittsworth road, 25 km NW of Nobby, 27°46'45"S, 151°41'53"E, 500 m alt., on dead wood in remnant *Eucalyptus* woodland, J.A. Elix 3965, 5.v.2005 (CANB).

3. Anisomeridium polypori (Ellis & Everh.) M.E.Barr, *Mem. New York Bot. Gard.* **79**, 76 (1996)

An almost cosmopolitan lichen, this is already known from Queensland and Tasmania (McCarthy 2016).

SPECIMEN EXAMINED

Victoria. • East Gippsland, Drummer Rainforest Walk, 10 km E of Cann River, 37°34'05"S, 149°16'26"E, alt. 80 m, on old wooden seat in warm-temperate forest, P.M.McCarthy 4568, 28.x.2016 (CANB).

4. Baculifera metaphragmioides Elix & Kantvilas, *Australas. Lichenol.* **75**, 31 (2014)

This endemic species was previously known from Western Australia and Tasmania (Elix & Kantvilas 2014).

SPECIMEN EXAMINED

Victoria. • Mitta Mitta River, at bottom of road from Bogong to Omeo, 11 km N of Anglers Rest, 62 km from Mount Beauty, 36°56'S, 147°27'E, on twigs, W.H. Ewers 2322, 9.xii.1987 (CANB).

5. Buellia aeruginosa A.Nordin, Owe-Larsson & Elix, *Mycotaxon* **71**, 400 (1999)

This endemic Australian species was previously known from South Australia, New South Wales and Tasmania (McCarthy 2016).

SPECIMEN EXAMINED

Victoria. • Phillip Island, Kitty Miller Bay, 38°30'30"S, 145°10'15"E, on rocky outcrop along rocky beach with small cliff, W.H. Ewers 5098 *pr.p.*, 30.i.1990 (CANB).

6. Buellia cranwelliae Zahlbr., *Denkschr. Akad. Wiss. Wien math.-naturwiss. Kl.* **104**, 375 (1941)

This Australasian species was previously known from New South Wales and Tasmania (Elix & Kantvilas 2016).

SPECIMEN EXAMINED

Victoria. • East Gippsland, Cape Conran Coastal Park, Banksia Bluff Camp, 37°48'03"S, 148°44'30"E, c. 1 m alt., on mica schist rocks on the seashore, J.A. Elix 46267, 30.x.2016 (CANB).

7. Buellia kimberleyana Elix, *Australas. Lichenol.* **65**, 11 (2009)

This endemic Australian species was previously known from Western Australia, the Northern Territory, South Australia, Queensland, New South Wales, Victoria and Norfolk Island (McCarthy 2016).

SPECIMENS EXAMINED

Australian Capital Territory. • Gudgenby Gorge, near Tharwa, 35°33'S, 149°04'30"E, on quartz, W.H. Ewers 4844, 4846A, 27.x.1989 (CANB).

8. Buellia spuria var. **amblyogona** (Müll.Arg.) Elix, *Australas. Lichenol.* **65**, 16 (2009)

This endemic taxon occurs in Western Australia, the Northern Territory, South Australia, Queensland, New South Wales, the Australian Capital Territory, Victoria, Lord Howe Island and Norfolk Island (McCarthy 2016).

SPECIMEN EXAMINED

Tasmania. • Bass Strait, Cape Barren Island, c. 1.8 km NW of summit of Home Hill, 40°21'40"S, 148°02'17"E, 32 m alt., on low granite bedrock outcrop, J.S. Whinray 4511A, 4512, 2.iv.2006 (CANB).

9. Buellia stellulata (Taylor) Mudd, *Man. Brit. Lich.*: 216 (1861) var. **stellulata**

In Australia this cosmopolitan species is known from Western Australia, South Australia, Queensland, New South Wales, Victoria, Lord Howe Island and Norfolk Island (McCarthy 2016).

SPECIMEN EXAMINED

Australian Capital Territory. • Gudgenby River Gorge, 27 km S of Canberra, 35°37'S, 149°05'E, on siliceous rocks in *Eucalyptus*-*Callitris*-dominated NW slope, H.T. Lumbsch 5627a *pr.p.*, 9.ix.1987 (HO).

10. Byssoloma adpersum Malcolm & Vězda, *Mycotaxon* **55**, 358 (1995)

This lichen is known from New Zealand, south-eastern New South Wales and southern Victoria (Malcolm & Vězda 1995).

SPECIMEN EXAMINED

Tasmania. • Bruny Island, Adventure Bay, Resolution Creek, 43°21'S, 147°19'E, on sandstone boulder on the seashore, G. Kantvilas 286/15, 2.ix.2015 (HO).

11. Coccotrema porinopsis (Nyl.) Imshaug ex Yoshim., *Misc. Bryol. Lichenol.* **6**, 135 (1974)

This species is known from Madagascar, Sri Lanka, Malesia, East Asia, New Caledonia and Chile and, in Australia, from New South Wales and Tasmania (McCarthy 2016).

SPECIMEN EXAMINED

Queensland. • Mt Bellenden Ker summit area, ridge-line N of telecommunications facility, 17°15'43"S, 145°51'17"E, 1500 m alt., on bark, G.Kantvilas 421/09, 20.x.2009 (BRI, HO, MSC).

12. Diploschistes hensseniae Lumbsch & Elix, *Pl. Syst. Evol.* **150**, 276 (1985)

In Australia this common terricolous species was previously known from Western Australia, South Australia, New South Wales and Victoria (McCarthy 2016).

SPECIMENS EXAMINED

Tasmania. • Bass Strait, Flinders Island, Marshall Bay, 39°57'39"S, 147°58'14"E, 8 m alt., on soil amongst *Leptospermum laevigatum*, J.S. Whinray 4903, 13.ix.2015 (CANB); • Bass Strait, Flinders Island, E side of Long Point, 40°06'S, 147°57'E, on soil over coastal mudstone, J.S. Whinray 4919, 13.ix.2015 (CANB).

13. Dirinaria applanata (Fée) D.D.Awasthi, *J. Indian Bot. Soc.* **49**: 135 (1970)

This common, pantropical to pantemperate species was previously known from Western Australia, the Northern Territory, Queensland, New South Wales, the Australian Capital Territory, Victoria, Lord Howe Island and Norfolk Island (McCarthy 2016).

SPECIMENS EXAMINED

South Australia. • Eyre Peninsula, Marble Range, 28 km SW of Cummins, 34°25'S, 135°30'E, 400 m alt., on quartz rock on rocky ridge with scattered shrubs, *J.A. Elix* 41760, 22.ix.1994 (CANB).

Tasmania. • Sleepy Bay Road, c. 2 km W of coast, 42°08'S, 148°18'E, 20 m alt., on granite overhang in coastal heathland, *G. Kantvilas* 157/84 & *P.W. James*, 2.ii.1984 (BM, HO).

14. Enterographa cretacea P.M. McCarthy & Elix, *Telopea* **19**, 138 (2016)

This species was described recently from shaded, siliceous rocks on a seashore in southern New South Wales (McCarthy & Elix 2016).

SPECIMEN EXAMINED

Victoria. • East Gippsland, Quarry Beach, 6 km S of Mallacoota, near airfield, 37°36'03"S, 149°43'41"E, c. 1 m alt., on sheltered siliceous rocks on the seashore, *P.M. McCarthy* 4490, 29.x.2016 (CANB).

15. Gassicurtia victoriana Elix & Kantvilas, *Australas. Lichenol.* **76**, 19 (2015)

This endemic taxon was previously known from Victoria (Elix & Kantvilas 2015).

SPECIMEN EXAMINED

Queensland. • Atherton Tableland, Koomboloomba Dam, near weir, 17°50'25"S, 145°35'45"E, 700 m alt., on bark of tree, *W.H. Ewers* 7951 *pr.p.*, 23.ix.1991 (CANB).

16. Megalaria hafellneriana Kantvilas, *Herzogia* **29**, 424 (2016)

This lichen was described very recently from Tasmania and alpine Victoria (Kantvilas 2016).

SPECIMENS EXAMINED

New South Wales. • Southern Tablelands, Rutherford Creek, 17 km SE of Nimmitabel, 36°36'S, 149°26'E, 850 m alt., on trunk of rainforest tree, *J.A. Elix* 24228, 14.ii.1990 (CANB); • Southern Tablelands, Pinkwood Creek, Hanging Mountain Forest Reserve, 25 km SW of Moruya, 36°00'S, 149°52'E, 380 m alt., on *Prostanthera* in *Eucryphia moorei*-dominated creek banks with *Tristaniopsis*, *J.A. Elix* 25442, 20.vi.1990 (CANB); • Southern Tablelands, Monga State Forest, Forest River Road, 5 km S of Monga, 35°38'S, 149°55'E, 665 m alt., on *Lomatia* in temperate rainforest with *Eucryphia*, *J.A. Elix* 30222, 19.ix.1993 (CANB).

17. Megalospora gompholoma (Müll.Arg.) Sipman subsp. **fuscolineata** Sipman, *Biblioth. Lichenol.* **18**, 103 (1983)

This lichen is known from Victoria, Tasmania and northern New Zealand (Sipman 1983; Kantvilas 1994).

SPECIMENS 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 dead log in moist, subtropical forest, *J.A. Elix* 42145, 7.ii.1995 (CANB); • *loc. id.*, on tree trunk, *J.A. Elix* 42080, 7.ii.1995 (CANB); • *loc. id.*, on buttress root, *J.A. Elix* 42095, 7.ii.1995 (CANB).

18. Mycoblustus dissimulans (Nyl.) Zahlbr., *Cat. Lich. Univ.* **4**, 3 (1926)

This species is known from southern South America, Juan Fernandez Islands, Falkland Islands, New Zealand and Tasmania (Kantvilas 2009).

SPECIMEN EXAMINED

New South Wales. • Lord Howe Island, Mt Gower, summit area, 31°35'12"S, 159°04'38"E, 820 m alt., on shaded treelet (*Leptospermum* sp.) branches in low vege-

tation dominated by *Metrosideros nervulosa*, *Zygogynum howeanum*, *Dysoxylum pachyphyllum*, *Dracophyllum*, tree ferns and palms, *H. Streimann* 56112, 11.ii.1995 (CANB).

19. Pertusaria melanospora var. **sorediata** Elix & A.W. Archer, *Australas. Lichenol.* **73**, 8 (2013)

This taxon was previously known from South Australia, New South Wales, the Australian Capital Territory, Tasmania and New Zealand (Elix & Archer 2013).

SPECIMENS EXAMINED

Victoria. • East Gippsland, Cape Conran Coastal Park, Banksia Bluff Camp, 37°48'03"S, 148°44'30"E, c. 1 m alt., on mica schist rocks on the seashore, *J.A. Elix* 46270, 46275, 30.x.2016 (CANB); • Cape Conran Coastal Park, West Cape, 37°49'43"S, 148°43'43"E, c. 1 m alt., on granite rocks on the seashore, *J.A. Elix* 46283, 30.x.2016 (CANB).

20. Porina corrugata Müll.Arg., *Bull. Herb. Boissier* **1**, 63 (1893)

This lichen is known from southern South Australia, coastal Victoria and Tasmania (McCarthy 2016). It also occurs in South Africa and New Zealand.

SPECIMENS EXAMINED

New South Wales. • South Coast, Keating Rocks, N of Bermagui, 36°24'54"S, 150°03'55"E, c. 1 m alt., on slate outcrops on the beach, *P.M. McCarthy* 4488, 10.ii.2016 (CANB); • South Coast, Pooles Beach, 3 km S of Mystery Bay, 36°18'46"S, 150°07'57"E, c. 1 m alt., on sheltered shale outcrops on the beach, *P.M. McCarthy* 4536, 18.xi.2016 (CANB).

21. Porina guentheri (Flot.) Zahlbr., *Cat. Lich. Univ.* **1**, 384 (1922)

The range of this subcosmopolitan species includes the south-west of Western Australia, Queensland, New South Wales, Tasmania and Macquarie Island (McCarthy 2016).

SPECIMENS EXAMINED

Victoria. • East Gippsland, Cape Conran Coastal Park, West Cape, 37°49'43"S, 148°43'43"E, c. 1 m alt., on sheltered granite on the seashore, *P.M. McCarthy* 4493, 4521 *pr. p.*, 30.x.2016 (CANB).

22. Porina whinrayi P.M. McCarthy, *Lichenologist* **22**, 195 (1990)

This lichen was previously known only from Tasmania where it is rather common on siliceous, seashore rocks (McCarthy 2016).

SPECIMEN EXAMINED

New South Wales. • South Coast, Mystery Bay, Lamont Young Drive, 36°18'07"S, 150°07'59"E, c. 1 m alt., on sheltered, sandstone outcrop on the beach, *P.M. McCarthy* 4529, 18.xi.2016 (CANB).

23. Porpidia soredizodes (Lamy) Knoph, Hertel & Rambold, *in* Rambold, *Biblioth. Lichenol.* **34**, 291 (1989)

This lichen occurs in northern and central Europe, Turkey, North America and China, and in Australia in New South Wales and Victoria (Rambold 1989).

SPECIMENS EXAMINED

Tasmania. • Dundas, at Dundas Rivulet, 41°53'S, 145°25'E, 220 m alt., on siliceous rocks subject to seasonal inundation, *G. Kantvilas* 87/06, 6.ii.2006 (HO); • Rapid River, downstream of bridge on Savage River Pipeline Road, 41°16'S, 145°20'E, 440 m alt., on siliceous rocks subject to seasonal inundation, *G. Kantvilas* 231/15, 31.i.2015 (HO); • Rapid River, near bridge on Tarkine Drive, 41°09'S, 145°06'E, 70 m alt., on siliceous

rocks subject to seasonal inundation, *G. Kantvilas* 370/16, 26.x.2016 (HO).

24. *Ramboldia brunneocarpa* Kantvilas & Elix, *Bryologist* 97, 297 (1994)

This Australian endemic was previously known from Western Australia, New South Wales, Victoria and Tasmania (McCarthy 2016).

SPECIMEN EXAMINED

Australian Capital Territory. • Piccadilly Circus, on hill, 10 km from Canberra, 35°22'S, 148°48'E, on twig, *W.H. Ewers* 4220, 24.ix.1989 (CANB).

25. *Ramboldia farinosa* Kalb, *Biblioth. Lichenol.* 88, 318 (2004)

This Australian endemic was previously known from New South Wales (McCarthy 2016).

SPECIMENS EXAMINED

Australian Capital Territory. • Brindabella Road, 4 km Canberra side of Piccadilly Circus, 35°20'S, 148°49'50"E, on bark, *W.H. Ewers* 4170, 4172, 24.ix.1989 (CANB).

26. *Rhizocarpon adarensis* (Darb.) I.M.Lamb, *Lilloa* 14, 221 (1948)

This species is known from Antarctica and southern Argentina, and in Australia from the Australian Capital Territory (McCarthy & Elix 2014).

SPECIMEN EXAMINED

Victoria. • Grampians, Mt William, 37°18'S, 142°36'E, on rock, *W.H. Ewers* 359 *pr.p.*, 25.xi.1986 (CANB).

27. *Rhizocarpon distinctum* Th.Fr., *Lichenogr. Scand.* 2, 625 (1874)

This species is known from the Australian Capital Territory, southern New South Wales and Victoria (McCarthy & Elix 2014). It also occurs in western and south-eastern Europe, Arctic Eurasia, Greenland, North America, New Zealand, southern South America and Antarctica.

SPECIMENS EXAMINED

Tasmania. • Bothwell–Steppes road, c. 8 km N of Hermitage turnoff, 42°12'S, 146°54'E, 480 m alt., on mudstone, *G.C. Bratt & M.H. Bratt* 73/573, 16.vi.1973 (HO 41190); • Muddy Plains Road, 42°27'S, 147°12'E, 343 m alt., on dolerite boulders in a degraded paddock, *G. Kantvilas* 142/16, 29.vi.2016 (HO 583429).

28. *Rhizocarpon intersitum* Arnold, *Verh. Zool.-Bot. Ges. Wien* 27, 554 (1877)

This species is known from the Australian Capital Territory, southern New South Wales, Victoria and Western Australia (McCarthy & Elix 2014). It also occurs in south-western and north-eastern U.S.A., Scotland, Scandinavia and Central Europe.

SPECIMEN EXAMINED

Tasmania. • South-west Natl Park, NE ridge of Mt Anne, 42°55'57.3"S, 146°26'25.6"E, 1090 m alt., on quartzitic rock outcrops in alpine heathland, *G. Kantvilas* 90/16, 5.ii.2016 (HO 583100).

29. *Rhizocarpon lavatum* (Fr.) Haszl., *Magyar Biro. Zuz.-Flor.* 206 (1884)

This species is known from the British Isles, continental Europe, Scandinavia, Svalbard, the Ukraine, North America, North Africa, East Asia, New Zealand, subantarctic islands, Antarctica and in Australia from New South Wales (McCarthy & Elix, 2014).

SPECIMENS EXAMINED

Tasmania. • Central Highlands, Skullbone Plains, 42°02'S, 146°19'E, 1000 m alt., on

siliceous boulders in open heathland, *G. Kantvilas* 136/12, 29.ii.2012 (HO 564811).

Macquarie Island. • Mt Elder, summit, 54°32'10"S, 158°56'05"E, on rock in wind tundra, *R. Hnatiuk* ANU11838, 22.i.1972 (CANB).

30. *Rhizocarpon superficiale* (Schaer.) Vain., *Acta Soc. Fauna Fl. Fenn.* 53, 319 (1922)

This species is known from Europe, Arctic Eurasia, Central and East Asia, the Himalayan region, East Africa, southern Africa, North and South America, Antarctica and New Zealand, and in Australia from Western Australia, New South Wales and Victoria (McCarthy & Elix, 2014).

SPECIMEN EXAMINED

Australian Capital Territory. • Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, 1490 m alt., on schist rock, *E. Stocker* 23, 15.ii.2001 (CANB).

31. *Rhizocarpon vigilans* P.M. McCarthy & Elix, *Telopea* 16, 205 (2014)

This Australian endemic was previously known from the Australian Capital Territory (McCarthy & Elix 2014).

SPECIMENS EXAMINED

Victoria. • Mt William, Grampians, 37°18'S, 142°36'E, on rock, *W.H. Ewers* 375 *pr.p.*, 25.xi.1986 (CANB).

Western Australia. • Trail to Toolbrunup Peak, Stirling Ranges, Stirling Ranges National Park, 40 km SW of Borden, 34°23'S, 118°03'E, 740 m alt., on volcanic rocks in dry sclerophyll forest with pockets of denser shrub vegetation, *J.A. Elix* 41497 *pr.p.*, 17.ix.1994 (CANB).

32. *Rinodina confragosula* (Nyl.) Müll.Arg., *Rev. Mycol. (Toulouse)* 9, 79 (1887)

This species was previously known from New Caledonia, New Zealand and South Africa, and in Australia from all States and Territories (Kaschik 2006).

SPECIMEN EXAMINED

New South Wales. • Lord Howe Island, slope between Little Island and The Cross, 31°34'20"S, 159°04'30"E, 30 m alt., on basalt rocks in *Ficus*-dominated steep slope, *J.A. Elix* 33006, 24.vi.1992 (CANB).

33. *Rinodina occulta* (Körb.) Sheard, *Lichenologist* 3, 349 (1967)

This species was previously known from Europe, and in Australia from Western Australia, the Australian Capital Territory, New South Wales, Victoria and Tasmania (Kaschik 2006).

SPECIMEN EXAMINED

New South Wales. • Lord Howe Island, junction of tracks to Mutton Bird Point and Intermediate Hill, 31°33'20"S, 159°03'33"E, 35 m alt., on basalt rocks in lowland forest beside broad, rocky stream, *J.A. Elix* 32756A, 21.vi.1992 (CANB).

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

This species is known from Central America, West Africa, South Africa and Indonesia, and in Australia from Queensland and Victoria (Kaschik 2006).

SPECIMEN EXAMINED

Tasmania. • Bass Strait, Furneaux Group, Cape Barren Island, c. 1.7 km from summit of Big Hill, 40°22'18"S, 148°04'55"E, 74 m alt., on granite, *J.S. Whinray* 4718, 26.vii.2008 (CANB).

35. *Solenopsora vulturiensis* A.Massal., *Lotos* 6, 75 (1856)

This species is known from Europe and Macaronesia, and in Australia from the south-west of Western Australia and southern New South Wales (McCarthy 2016).

SPECIMEN EXAMINED

Victoria. • East Gippsland, Quarry Beach, 6 km S of Mallacoota, near airfield, 37°36'03"S, 149°43'41"E, c. 1 m alt., on sheltered siliceous rocks on the seashore, *P.M. McCarthy 4491*, 29.x.2016 (CANB).

36. *Thelenella tasmanica* H.Mayrhofer & P.M.McCarthy, *Muelleria* 7, 338 (1991)

This endemic lichen is known from seashore rocks in southern New South Wales and Tasmania (McCarthy 2016). It is especially common and abundant on islands in Bass Strait.

SPECIMENS EXAMINED

Victoria. • East Gippsland, Cape Conran Coastal Park, Banksia Bluff Camp, 37°48'03"S, 148°44'30"E, c. 1 m alt., on sheltered mica schist on the seashore, *P.M. McCarthy 4492*, 30.x.2016 (CANB); • Cape Conran Coastal Park, West Cape, 37°49'43"S, 148°43'43"E, c. 1 m alt., on sheltered granite on the seashore, *P.M. McCarthy 4494*, 30.x.2016 (CANB).

37. *Trapeliopsis granulosa* (Hoffm.) H.T.Lumbsch, in Hertel, *Lecideaceae Exsiccatae* 5, [99] (1983)

A cosmopolitan lichen, the current range of this species includes New South Wales, the Australian Capital Territory, Victoria and Tasmania (McCarthy 2016).

SPECIMEN EXAMINED

Queensland. • D'Aguilar Range, Lepidozamia Track, 27°17'39"S, 152°44'19"E, 755 m alt., disturbed clay soil along a roadside in wet forest, *G. Kantvilas 462/14*, 13.xi.2014 (BRI, HO).

38. *Verrucaria microsporoides* Nyl., *Bull. Soc. Bot. France* 8, 759 (1861)

This intertidal species is known with certainty from north-western Europe and New Zealand, and in Australia from Victoria and Tasmania (McCarthy 2012).

SPECIMENS EXAMINED

New South Wales. • South Coast, Pooles Beach, 3 km S of Mystery Bay, 36°18'46"S, 150°07'57"E, on intertidal, siliceous rocks, *P.M. McCarthy 4554*, 18.xi.2016 (CANB); • South Coast, Barlings Beach, Rosedale, 35°49'49"S, 150°12'20"E, on intertidal, siliceous rocks with *Lichina confinis*, *P.M. McCarthy 4545*, 19.xi.2016 (CANB).

39. *Verrucaria praetermissa* (Trevis.) Anzi, *Comment. Soc. Crittog. Ital.* 2(1), 24 (1864)

This freshwater aquatic species is known from Europe, North America, China (Hong Kong), New Guinea, New Zealand, and the South Pacific Ocean (including Lord Howe Island), and in Australia from eastern Queensland and New South Wales (McCarthy 2012).

SPECIMEN EXAMINED

Tasmania. • Rapid River, downstream of bridge on Savage River Pipeline Road, 41°16'S, 145°20'E, 440 m alt., on semi-inundated boulders in river in rainforest, *G. Kantvilas 236/15*, 31.i.2015 (HO 579152).

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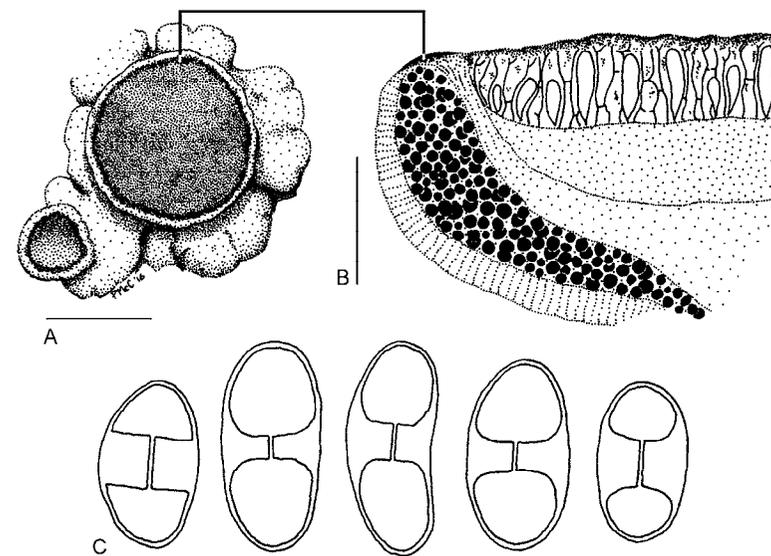


Fig. 2. *Caloplaca sideritis*. A, Part of a fertile thallus. B, Sectioned apothecium (semi-schematic); C, Ascospores. Scale bars: A = 0.5 mm; B = 0.1 mm; C = 10 μ m.

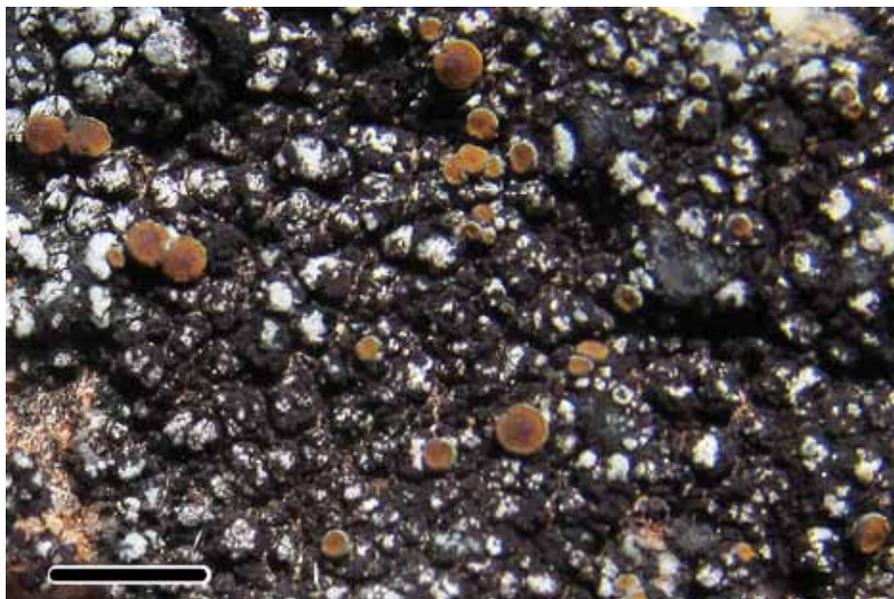


Fig. 1. *Caloplaca sideritis*. Scale bar = 5 mm.



Fig. 3. *Graphis fournieri*. Scale bar = 2 mm.



Fig. 4. *Ochrolechia apiculata*. Scale bar = 2 mm.



Fig. 5. *Rinodina cana*. Scale bar = 1 mm.

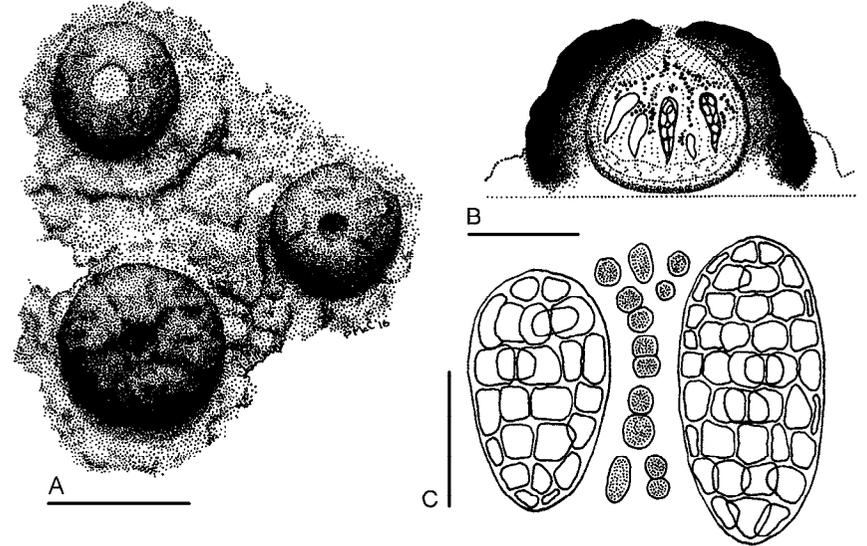


Fig. 6. *Staurothele succedens*. A, Part of a fertile thallus. B, Sectioned perithecium (semi-schematic); C, Ascospores and hyemial algae. Scale bars: A = 0.5 mm; B = 0.2 mm; C = 20 μ m.



Fig. 7. *Toninia submexicana*. Scale bar = 5 mm.

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