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The Australasian *Pseudocyphellaria rubella* is widespread in New Zealand, and is known also from New South Wales, southern Victoria, and Tasmania in southeast Australia. Its most distinctive trait is a silky pubescent upper surface dotted with granular yellow soralia. Its thallus chemistry is a rich mixture of pulvinic acid, pulvinic dilactone, calycin, and 20 lupane triterpenoids.

5 mm 

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Strigula rhodinula comb. nov. (Strigulaceae,
Ascomycota) from Marlborough, New Zealand

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Abstract: *Strigula affinis* (A.Massal.) R.C.Harris was reported from limestone in Marlborough, New Zealand, by McCarthy (1993) based on material collected in 1934 by J. Scott Thompson and misplaced in *Porina*, as *P. rhodinula* Zahlbr., by Zahlbruckner (1941). However, the now widely accepted circumscription of the exclusively corticolous *S. affinis* (Roux & Sérusiaux, 2004) and a reassessment of Zahlbruckner's lichen necessitate the new combination *Strigula rhodinula* (Zahlbr.) P.M.McCarthy. The species is described and illustrated here.

Strigula rhodinula (Zahlbr.) P.M.McCarthy, comb. nov.
MycoBank No.: **MB815476**

Fig. 1

Basionym: *Porina rhodinula* Zahlbr., *Denkschr. Akad. Wiss. Wien math.-naturwiss. Kl.* 104: 254 (1941).

Type: New Zealand, South Island, Marlborough, Chalk Range, on limestone, *J.S. Thompson 1530*, iii.1934 (holotype – W; isotypes – CHR 374647! OTA 029090!). Note: The selection by Galloway (1985) of CHR 374647 as the lectotype was not appropriate because Zahlbruckner's description was based on the only known specimen, *J.S. Thompson 1530*. This typification error was perpetuated by McCarthy (1993) and Galloway (2007).

Thallus crustose, subepilithic, effuse to determinate, rimose to areolate, greenish white to grey-green or with a faint reddish tint, matt, smooth to minutely and irregularly uneven, partially scabrid-farinose, ecorticate, to 70 μm thick; areoles 0.2–0.6 mm wide, angular to rounded, slightly concave to plane. *Algae Trentepohlia*; the cells broadly ellipsoid to globose, 7–15 \times 7–10 μm ; interstitial hyphae 2–4 μm wide. *Prothallus* not apparent. *Perithecia* numerous, semi-immersed to 2/3 immersed, usually solitary, occasionally paired. *Perithecial apex* rather flattened to convex; ostiole inconspicuous or in a shallow depression. *Involucrellum* black in surface view, greenish black in thin section, extending to midway between the apex and the base of the excipulum, (0.29–) 0.33(–0.38) mm diam. ($n = 40$), 40–70 μm thick, K–. *Centrum* globose to depressed-ovate, 0.22–0.32 mm diam. *Excipulum* hyaline to dark brown, darkest towards the apex, 15–22 μm thick. *Paraphyses* simple to sparingly branched, not anastomosing, 1–1.5 μm thick. *Periphyses* absent. *Asci* fissitunicate, 8-spored, cylindrical to cylindro-clavate, 67–87 \times 10–14 μm ; lateral walls c. 1.5 μm thick; apical dome 3–5 μm thick, with a hemispherical to conical ocular chamber 2.5–3.5 μm wide and 1–2 μm tall; walls and apex IKI–; ascoplasma IKI+ red-brown. *Ascospores* hyaline, fusiform, oblong or elongate-clavate, (1–)3(–5)-septate, often with a 1–2 μm thick perispore, irregularly biseriate in the asci, frequently constricted at least at the primary septum, (15.5–) 20(–26.5) \times (4.5–)6(–8.5) μm ($n = 50$); contents finely to coarsely guttulate. *Conidiomata* semi-immersed to almost entirely immersed, black above, medium brown to black below, of two types: (1) 100–160 μm diam. and producing 3-septate, bacilliform macroconidia, 12–21 \times 2.5–3.5 μm , mostly with subglobose to acuminate, gelatinous appendages at the apices, growing obliquely from the tips of short, unbranched conidiophores; (2) 80–100 μm diam. and producing fusiform microconidia 2.5–3.5 \times 0.6–0.8 μm .

Remarks

Strigula rhodinula, known only from its type locality, is characterized by the rather robust, rimose to areolate thallus, moderately prominent perithecia with a blackish involucrellum of 0.29–0.38 mm diam. and comparatively large, mainly 3-septate ascospores. This lichen is correctly placed in *Strigula*, rather than *Porina*, due to its fissitunicate asci, each with a well-defined tholus and ocular chamber. Its erroneous inclusion in *S. affinis* can now be corrected, the latter having a paler, brownish involucrellum and smaller ascospores (15–22 × 4.5–6 μm; Harris 1995, Roux & Sérusiaux 2004). *Strigula affinis* is exclusively corticolous and is found mainly in central and southern Europe (McCarthy 2013).

Acknowledgements

I am grateful to the curators of CHR, OTA and W for the loan of type material.

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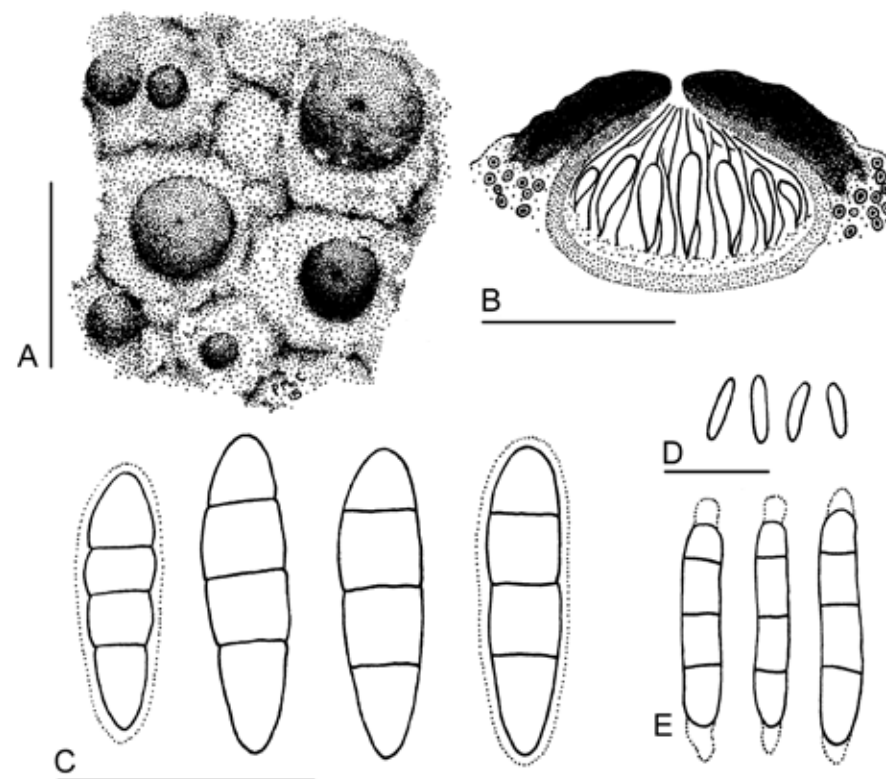


Figure 1. *Strigula rhodinula* (isotype – OTA). A, Thallus with perithecia and pycnidia. B, Section of perithecium and adjacent thallus (semi-schematic). C, Ascospores. D, Microconidia. E, Macroconidia. Scales: A = 0.5 mm; B = 0.2 mm; C = 20 μm; D, E = 5 μm.

A new species of *Mycobilimbia* s. lat. (Ascomycota, Lecideaceae) from the Northern Territory, Australia

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Abstract: An enigmatic, terricolous lichen collected in the seasonally wet tropics of the Northern Territory, Australia, is described as *Mycobilimbia territorialis* P.M. McCarthy & Elix, sp. nov. (Lecideaceae).

A highly distinctive and richly fertile crustose lichen collected from soil at an abandoned uranium mine site in the wet tropics of the Northern Territory, Australia, although somewhat anomalous in its anatomy, chemistry and tropical occurrence, exhibits particularly strong affinities to the mainly northern-temperate to boreal *Mycobilimbia* Rehm (Lecideaceae). The new species is described and illustrated, and its circumscription and relationships are discussed.

Mycobilimbia territorialis P.M. McCarthy & Elix, sp. nov. MycoBank No.: MB 815596

Figs 1, 2

Characterized by the pale grey-green, granular thallus containing argopsin and chlorococcoid algae, adnate to stipitate, biatorine apothecia, *Mycobilimbia*-type apothecial ontogeny, the usually massive, chondroid hypothecium, asci with a well-defined and strongly amyloid tholus, narrowly ellipsoid to oblong-fusiform or fusiform, 3-septate ascospores and bacilliform conidia.

Type: Australia, Northern Territory, Rum Jungle, 65 km S of Darwin, 12°59'26"S, 130°59'57"E, alt. 75 m, on soil bank in abandoned mine site, with scattered *Acacia* and *Calytrix*, J.A. Elix 38527, 6.viii.2005 (holotype – CANB).

Thallus superficial on soil, plant detritus and sandstone pebbles, likely to form extensive colonies, diffuse to continuous or sparingly rimose, with a few irregular areolae to 0.15 mm wide, dull pale greyish green, 40–100 μm thick, minutely granular (granules 30–80 μm wide), lacking soralia, ecorticate or with an indistinct, alga-free hyphal layer 8–15 μm thick. *Algal layer* continuous or not, 40–80 μm deep; cells chlorococcoid, bright green, globose or broadly ellipsoid, rather thick-walled, (7–)8–12(–15) μm wide; interstitial hyphae short- or long-celled, thin-walled, hyaline, 1.5–2.5(–3) μm wide. *Prothallus* absent. *Apothecia* numerous, biatorine, pale to medium reddish brown to darker olive-brown, at first commonly translucent-glossy, eventually dull, although somewhat paler and a little translucent when wetted, adnate, sessile to substipitate or turbinate, solitary, paired or in tight clusters of up to 8, often 2–4 discrete apothecia tightly fused to form a single, shallowly lobate, stipitate structure, the shape of individual apothecia frequently distorted by mutual pressure; solitary apothecia (0.30–)0.44(–0.64) mm wide [$n = 67$]; clustered apothecia (0.40–)0.68(–0.90) mm in maximum extent [$n = 43$], some clusters clearly formed by fusion of apothecia, others likely to have been derived from rupture and subsequent proliferation; disc smooth, epruinose, at first plane to slightly convex, becoming moderately to strongly convex or subglobose. *Proper margin* (20–)30–50 μm thick in surface view when immature, entire, concolorous with or much darker than the disc, smooth, glossy, soon becoming excluded, but sometimes visible as a thin dark brown ring when mature apothecia are wetted; in section the proper exciple is medium to dark greenish brown adjacent to the hymen-

ium, 25–50 μm thick, I–, consisting of 3–4 μm wide, parallel to radiating hyphae, the lumina thin (0.7–1.8 μm wide), but the hyphal structure remaining distinct (in marked contrast to the hypothecial tissue, see below); outermost cells of the excipular hyphae not enlarged; lower levels of the exciple (e.g. where it encloses the hypothecial stalk) anatomically identical but considerably paler than uppermost tissues. *Epithymenium* poorly defined, hyaline to pale diffuse brown or yellowish brown, c. 10–15 μm thick, K–, N–, I–. *Subhymenium* poorly defined, especially its transition to the upper levels of the hypothecium. *Hypothecium* with an upper layer that is pale to medium olive-brown, 40–60(–80) μm thick, not interspersed with granules or oil droplets, K–, N–, I–; lower levels 80–300 μm thick and forming the apothecial stalk, anatomically a compact, chondroid tissue of thick-walled, hyaline hyphae (yellowish *en masse*) 3–5 μm thick, K–, N–, I+ yellowish brown, in section the hyphal lumina appearing punctate or simple- to branched-serpentine, 0.8–1.5 μm wide. *Hymenium* 60–80(–100) μm thick, predominantly hyaline, not interspersed with granules or globules, K–, C–, N–; *paraphyses* tightly conglutinate, simple to sparingly branched and anastomosing, long-celled, apparently thin-walled, 1–1.5(–1.8) μm thick; apical cells hyaline, thin-walled, not swollen. *Asci* narrowly clavate or cylindroclavate, 58–74 \times 10–14 μm [$n = 20$], 8-spored; walls amyloid; ascus apex very difficult to observe in thin section, in Lugol's iodine (pretreated with K) with a thick amyloid tholus with or without narrow vertical bands of more deeply staining material on either side of a short conical ocular chamber to 2 μm tall and 0.7–1 μm wide. *Ascospores* colourless, irregularly biserial in the ascus, 3-septate, narrowly ellipsoid to oblong-fusiform or fusiform, usually straight, occasionally slightly curved, not constricted at the septa, (15–)18(–22) \times (4.5–)6(–7.5) μm [$n = 60$]; apices rounded to subacute; spore wall to 0.5 μm thick, lacking a perispore. *Pycnidia* uncommon, superficial, globose, black, glossy, c. 0.1 mm wide, resembling apothecial initials; conidiogenous cells mostly terminal (cf. conidiophore-type IV of Vobis 1980); conidia bacilliform, 3–5 \times 0.7–1 μm . *Chemistry*: Thallus K–, C–, PD–, UV–; argopsin (major) by TLC.

Etymology: The epithet *territoralis* refers to the type locality in the Northern Territory, Australia.

Remarks

The new species is characterized by the following combination of attributes: (1) a thin, pale grey-green, granular, terricolous thallus containing the β -orcinol depsidone argopsin; (2) rather thick-walled chlorococcoid algae; (3) moderately large, adnate to stipitate, biatorine apothecia that are solitary or clustered; (4) a convex to subglobose, reddish brown to olive-brown apothecial disc and a thin, uniformly hyphal proper exciple that becomes excluded as the apothecium matures; (5) a nondescript epithymenium, an amyloid hymenium, a comparatively dark subhymenium and a usually massive, chondroid hypothecium; (6) tightly conglutinate, simple to sparingly branched and anastomosing paraphyses with inconspicuous apical cells; (7) asci of an as yet unresolved type, but with a well-defined and strongly amyloid tholus; (8) narrowly ellipsoid to oblong-fusiform or fusiform, 3-septate ascospores; and (9) bacilliform conidia.

Mycobilimbia territorialis is reminiscent of some species of *Micarea* (Pilocarpaceae), but it contains chlorococcoid algae rather than smaller, micareoid algae (Coppins 1983, 2009). While the recently described *Brianaria* (Psoraceae) was segregated from *Micarea* largely because of its anomalous chlorococcoid photobiont, that genus also has dimorphic paraphyses and 0–1-septate ascospores (Ekman & Svensson 2014). The new species also exhibits strong similarities in apothecial morphology and anatomy with the almost exclusively northern-temperate to boreal genus *Biatora* (Ramalinaceae), especially the well-supported *Biatora rufidula*-group of corticolous species characterised by 3-septate ascospores and a proper exciple in which individual hyphae remain clearly visible (Printzen 1995, 2014; Printzen & Tonsberg 2000, 2004; Printzen &

Otte 2005; Printzen & Coppins 2009). Importantly, however, apothecial ontogeny in *Biatora* involves paraphyses and excipular hyphae forming together from the same gelatinized hyphae, and the first asci appearing among those same hyphae (Printzen 1995, 2014). By contrast, in *Mycobilimbia* and *M. territorialis*, those primordial hyphae become the developing exciple, while the asci and paraphyses form in the centre of the immature apothecium (Fig. 2; Printzen 1995: 40, Fig. 7).

Mycobilimbia, with fewer than 10 accepted species, shares many thalline and ascomatal traits with *Biatora*, but it is distinguished primarily by apothecial ontogeny (Hafellner 1989, Printzen 1995, Printzen *et al.* 2009). The mainly Arctic-alpine *M. tetramera* (De Not.) Vitik., Ahti, Kuusinen, Lommi & T. Ulvinen ex Hafellner & Türk is especially similar to *M. territorialis*, but it has a K+ purplish proper exciple and upper hymenium, and the thallus, like those of all known *Mycobilimbia* species, lacks secondary chemistry (Ekman 2004, Printzen *et al.* 2009). The newly described Australian species is assigned to *Mycobilimbia* due to its thalline and apothecial anatomy and ontogeny, and in spite of its anomalous secondary chemistry and unresolved ascus type. This placement will require a reassessment when ascus structure is finally elucidated and additional specimens become available for molecular analyses.

Recently, several species of *Mycobilimbia* have been described or reported from cool-temperate Australasia and southern South America (Kantvilas *et al.* 2005). Fryday *et al.* (2014) transferred *M. australis* Kantvilas & Messuti and several other taxa to the new genus *Bryobilimbia* (*incertae sedis*) mainly by virtue of their *Porpidia*-type asci and supported by molecular phylogenetic analyses. *Mycobilimbia meridionalis* Kantvilas, a Tasmanian endemic with a small-celled photobiont and 0–2-septate ascospores, was not included in *Bryobilimbia*, nor was *M. subbyssoides* Øvstedal, known only from Heard Island, an Australian subantarctic territory (Øvstedal & Gremmen 2008).

The new lichen grows on oligotrophic soil, sparse plant detritus and sandstone pebbles at the type locality, an abandoned uranium mine site in the wet tropics of the Northern Territory, Australia.

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Figure 1. *Mycobilimbia territorialis* (holotype in CANB). Scale = 2 mm

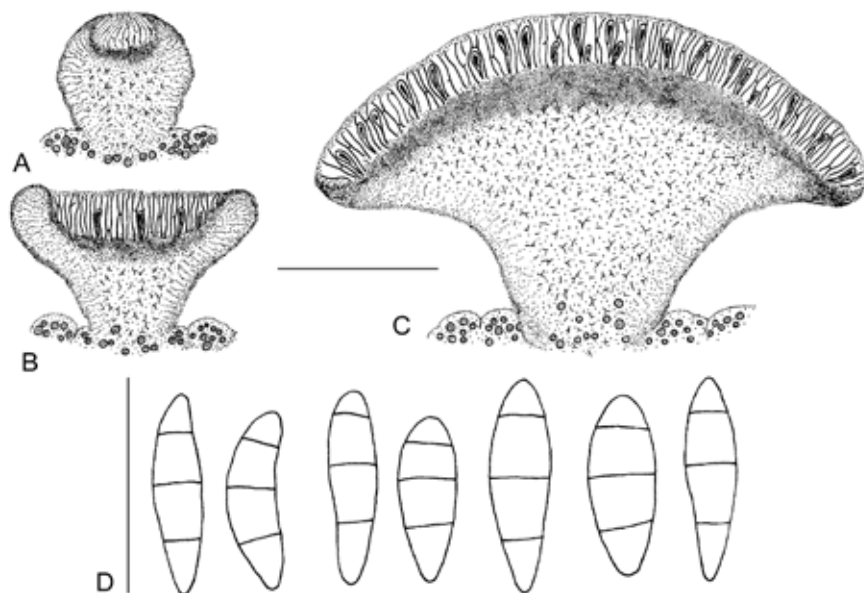


Figure 2. *Mycobilimbia territorialis* (holotype in CANB). A–C, Sectioned apothecia (semi-schematic) at 3 stages of development. D, Ascospores. Scales: A–C = 0.2 mm; D = 20 μ m.

**Two new corticolous species of *Amandinea*
(Ascomycota, Physciaceae) from New Zealand**

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Abstract: *Amandinea ornata* Ropin, H.Mayrhofer & Elix and *A. ropinii* H.Mayrhofer & Elix are reported as new to science. In addition, *Amandinea lignicola* var. *australis* Elix & Kantvilas and *A. pillagaensis* Elix & Kantvilas are reported for the first time from New Zealand. A key to the corticolous species of *Amandinea* in New Zealand is provided.

In his revised second edition of the *Flora of New Zealand Lichens*, Galloway recorded a total of seven species of *Amandinea* (Galloway, 2007), three of which occur on bark or wood. Since then one of those species has been transferred to the new genus *Orcularia* as *O. insperata* (Nyl) Kalb & Giralt (Kalb & Giralt 2011), and *Buellia porulosa* Nyl. has been transferred to *Amandinea* (Elix *et al.* 2015). In this paper, we describe two new corticolous species of *Amandinea*, and report two new records for New Zealand. *Amandinea ropinii* is also recorded for New South Wales.

Methods

Observations and measurements of photobiont cells, thallus and apothecium anatomy, asci and ascospores were made on hand-cut sections mounted in water and 10% KOH (K). Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K. Medullary sections were treated with 10% sulfuric acid (H_2SO_4), and apothecial sections with 50% nitric acid (N).

The new species

1. *Amandinea ornata* Ropin, H.Mayrhofer & Elix, sp. nov. Figs 1, 2
Mycobank number: MB 815808

Similar to *Amandinea subduplicata* (Vain.) Marbach, but differs in having initially lec-anorine apothecia, smaller ascospores, and an absence of atranorin.

Type: New Zealand, North Island, South Auckland, Stoney Point, Lake Tarawera, SE of Rotorua, 38°11'S, 176°24'E, on *Populus*, H. Mayrhofer 11974 & E. Hierzer, 18.viii.1992 (holotype – GZU; isotype – WELT).

Thallus crustose, continuous to rimose-areolate, to 10 mm wide and 0.05 mm thick; upper surface white, smooth, matt, becoming \pm wrinkled, ridged or slightly granular; prothallus not apparent; medulla white, lacking calcium oxalate (H_2SO_4 -), I-; photobiont cells 5–12 μ m diam. *Apothecia* 0.2–0.6 mm wide, initially immersed, erumpent, with an accessory thalline margin that is soon excluded, then biatorine or lecideine, broadly adnate or sessile, separate or in small groups; disc black, epruinose, weakly

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concave then plane or weakly convex; proper exciple thick, tumid at first, raised above the disc, thinner and indistinct in older convex apothecia, in section outer zone dark brown, 45–55 μm thick, K-, N-, inner zone pale brown. *Epihymenium* 10–12 μm thick, dark brown, K-, N-. *Hypothecium* pale brown to brown, 70–80 μm thick, K-. *Hymenium* 60–90 μm thick, colourless, not interspersed with oil droplets; paraphyses 1–1.5 μm wide, sparsely branched, with apices 4–5 μm wide and brown caps; asci of the *Lecanora*-type, 8-spored. *Ascospores* *Physconia*-type when immature, *Buellia*-type when mature, brown, ellipsoid, 14–[17.2]–21 \times 6–[7.7]–9 μm , older spores constricted at septum; outer spore-wall strongly ornamented. *Pycnidia* immersed, ostiole black; conidia filiform, curved, 20–30 \times 0.7–1 μm . Chemistry: Thallus K-, P-, C-, UV-; no lichen substances detected.

Etymology: This species is named for its prominently ornamented ascospore walls.

Remarks

The new species is characterized by the crustose, smooth to rimose-areolate, white thallus, the eruptent apothecia that are initially lecanorine, then biatorine but ultimately lecideine and adnate to sessile, the 1-septate, *Physconia*- then *Buellia*-type ascospores that become constricted at the septum and have strongly ornamented outer walls, and the absence of lichen substances. Morphologically, it closely resembles *A. subduplicata* (Marbach 2000, Giralt et al. 2015), but that species has somewhat longer ascospores, 15–[19.4]–24 μm , and contains atranorin.

Amandinea ornata is known from two localities in New Zealand, where it grows on the bark of introduced trees. Associated species include *Caloplaca cerinella* (Nyl.) Flagey, *Candelariella xanthostigma* (Pers.) Lettau, *Lecanora dispersa* (Pers.) Sommerf., *Hyperphyscia adglutinata* (Flörke) H. Mayrhofer & Poelt, *Lecanora flavopallida* Stirt., *Physcia adscendens* H. Olivier, *P. jackii* Moberg, *Ramalina celastri* (Spreng.) Krog & Swinscow, *Rinodina pyrina* (Ach.) Arnold, *Teloschistes velifer* F. Wilson, *Xanthoria incauata* (Stirt.) Zahlbr. and *X. parietina* (L.) Th. Fr.

SPECIMENS EXAMINED

North Island: • type locality, *H. Mayrhofer* 11977, 11982 & *E. Hierzer*, 13.viii.1992 (GZU). *South Island*: • Nelson, Golden Bay, E of Takaka, 40°51'30"S, 172°49'30"E, c. 20 m alt., on *Crataegus* sp., *H. Mayrhofer* 11975, 11981, 28.viii.1992 (GZU).

2. *Amandinea ropinii* H. Mayrhofer & Elix, sp. nov. Figs 3, 4
Mycobank number: **MB 815809**

Similar to *Amandinea stajscicii* Elix & Kantvilas, but differs in having lecanorine apothecia that become biatorine and ultimately lecideine, and different ascospore ontogeny.

Type: New Zealand, North Island, Wellington, Waser Bay, Mirimar Peninsula, E of Wellington, 41°19'S, 174°49'E, on *Coprosma repens*, *H. Mayrhofer* 12018, *D. Glennly*, *W. Nelson*, *B. Polly* & *C. West*, 22.viii.1992 (holotype – GZU, isotype – WELT).

Thallus crustose, continuous, membranaceous to rimose or rimose-areolate, to 10 mm wide and 0.05 mm thick; upper surface white, pale grey, olive or grey-brown, smooth, matt, becoming \pm verruculose or granular; prothallus not apparent; medulla white, lacking calcium oxalate (H_2SO_4 -), I-; photobiont cells 8–15 μm diam. *Apothecia* 0.2–0.5 mm wide, initially lecanorine, then biatorine and ultimately lecideine, with an accessory thalline margin that is soon excluded, broadly adnate or rarely sessile, separate or in small groups, sometimes crowded and distorted by mutual pressure; disc black, epruinose, weakly concave then plane or weakly convex; proper exciple thick and tumid at first, thinner with age, persistent, in section outer zone dark brown to brown-black, 25–50 μm thick, K-, N-, inner zone pale brown. *Epihymenium* 10–12 μm

thick, olive-brown to dark brown, K-, N-. *Hypothecium* pale brown to brown, 50–75 μm thick, K-. *Hymenium* 70–80 μm thick, colourless, not interspersed with oil droplets; paraphyses 1–1.5 μm wide, sparsely branched, with apices 5–8 μm wide and brown caps; asci of the *Bacidia*-type, 8-spored. *Ascospores* initially with lachrymiform locules, then *Physconia*-type, *Buellia*-type when mature, olive-brown to brown, ellipsoid, 10–[12.9]–17 \times 5–[6.1]–8 μm , older spores constricted at the septum; outer spore wall smooth. *Pycnidia* immersed, ostiole black; conidia filiform, weakly curved, 15–20 \times 0.7–1 μm . Chemistry: Thallus K-, P-, C-, UV-; no lichen substances detected.

Etymology: This species is named after Dr Klaus Ropin for his pioneering work on the corticolous species of *Amandinea* in New Zealand.

Remarks

This new species closely resembles *A. stajscicii* Elix & Kantvilas, from southern Australia and Norfolk Island (Elix & Kantvilas 2013), but differs in the development of its apothecia and ascospores. In *A. ropinii*, apothecia are initially pseudolecanorine (biatorine), but then become lecideine, where the thalline exciple, which is initially colorous with the thallus, is soon reduced or excluded. In contrast, in *A. stajscicii*, the apothecia are invariably broadly adnate and lecideine throughout all stages of development. At certain stages of their ontogeny, the ascospores of the two species are superficially similar. However, in early ontogeny the locules of the ascospores of *A. stajscicii* appear to have an elongate, almost inter-connecting canal, but that stage is never observed in *A. ropinii*, where the locules are initially lachrymiform or turbinate. The mature ascospores of both species soon become *Physconia*-type and ultimately *Buellia*-type.

Amandinea ropinii is common in temperate areas of New Zealand, where it grows on twigs or bark of shrubs and trees. It is also known from one locality in Australia. Associated species in New Zealand include *Caloplaca cerinella* (Nyl.) Flagey, *Candelariella xanthostigma* (Pers.) Lettau, *Lecanora dispersa* (Pers.) Sommerf., *Hyperphyscia adglutinata* (Flörke) H. Mayrhofer & Poelt, *Lecanora flavopallida* Stirt., *Physcia adscendens* H. Olivier, *P. jackii* Moberg, *Rinodina pyrina* (Ach.) Arnold, *Teloschistes velifer* F. Wilson, *Xanthoria incauata* (Stirt.) Zahlbr. and *X. parietina* (L.) Th. Fr.

SPECIMENS EXAMINED

AUSTRALIA: *New South Wales*: • Great Dividing Range, Jenolan Caves, SW of Katoomba, 33°50'S, 150°00'E, c. 800 m alt., on twigs, *M. & H. Mayrhofer* 5355, 30.ix.1981 (GZU).

NEW ZEALAND: *North Island*: • Hawkes Bay, 5 km NW of Mohaka River Bridge, 16 km NW of Te Pohue, 39°10'S, 176°37'E, c. 260 m alt., on *Populus* sp., *H. Mayrhofer* 11962 & *E. Hierzer*, 16.viii.1992 (GZU); • Wellington, Te Rewarewa Point, Hongoeka Bay, NW of Plimmerton, 41°04'S, 174°51'E, sea level, on driftwood, *H. Mayrhofer* 12013, *D. Glennly*, *W. Nelson*, *B. Polly* & *C. West*, 23.viii.1992 (GZU). *South Island*: • Nelson, Uruwhenua Reserve, N of Upper Takaka, c. 80 m alt., 40°59'S, 172°49'30"E, c. 80 m alt., on *Populus* sp., *H. Mayrhofer* 11950, 28.viii.1992 (GZU); *loc. id.*, on *Melicytus* sp., *H. Mayrhofer* 12016, 28.viii.1992 (GZU); • Nelson, Ataata Point, Cable Bay, NE of Nelson, 41°09'30"S, 173°24'E, c. 7 m alt., on twigs of shrub, *H. Mayrhofer* 11985, *N. & W. Malcolm* & *B. Polly*, 25.viii.1992 (GZU); • Canterbury, Canterbury Plains, Bankside Scientific Reserve, SE of Bankside, 41°09'30"S, 173°24'E, c. 70 m alt., on twigs, *H. Mayrhofer* 9016, *H. Hertel*, *C.D. Meurk* & *B.P.J. Molloy*, 14.i.1985 (GZU); • Canterbury, limestone outcrops, E of Coringa Station, NW of Motunau Beach, 43°02'S, 173°02'E, c. 150–200 m alt., on *Melicytus alpinus*, *H. Mayrhofer* 12017 & *C.D. Meurk*, 2.ix.1992 (GZU); • Otago, Tavora Reserve, near Goodwood, 45°31'54"S, 170°45'27"E, 3 m alt., on twigs of *Plagianthus divaricatus* at edge of saltmarsh, *A. Knight*, 7.vi.2014 (CANB, OTA).

New records

1. *Amandinea lignicola* var. *australis* Elix & Kantvilas, *Australasian Lichenology* 72, 7 (2013)

Amandinea lignicola var. *australis* is a very distinctive taxon that is common in southern Australia. It is typically distinguished by having a conspicuous, well-developed, pale grey to blue-grey or olive-brown, crustose to squamulose thallus with a smooth to often granular or sorediate upper surface. It is further characterized by having a non-inspersed hymenium, *Physconia*- then *Buellia*-type, 1-septate, ellipsoid ascospores, (11–)13–20 × (5–)6–8 μm, with a smooth to weakly ornamented outer wall, curved, filiform conidia (12–)18–26 × 0.5–1 μm, and by the absence of lichen substances. A detailed description is given in Elix & Kantvilas (2013).

SPECIMEN EXAMINED

North Island: • Wellington, Te Rewarewa Point, Hongoeka Bay, NW of Plimmerton, 41°04'S, 174°51'E, sea level, on driftwood, *H. Mayrhofer* 12013A, *D. Glenny*, *W. Nelson*, *B. Polly* & *C. West*, 23.viii.1992 (GZU).

2. *Amandinea pillagaensis* Elix & Kantvilas, *Australasian Lichenology* 72, 10 (2013)

This species was previously known from eastern Australia. It is characterized by the thin, crustose, white to pale grey thallus, the 4–8-spored asci, the 1-septate, ellipsoid then broadly fusiform, *Buellia*-type ascospores, 17–25 × 7–12 μm, often pointed at the apices, with ±pronounced apical wall thickenings (as in *Cratiria*), with a smooth outer wall, the inspersed hymenium, the curved filiform conidia, 25–38 × 0.4–0.6 μm, and by the absence of lichen substances, or rarely with traces of atranorin. A detailed description is given in Elix & Kantvilas (2013).

SPECIMEN EXAMINED

South Island: • Canterbury, Lewis Park National Park, Nina Valley walking track, on trunk of *Nothofagus solandri* in *Nothofagus* forest, *J. Johnston* 3471 & *R. Elder*, 8.xi.1989 (CANB).

Key to the corticolous and lignicolous species of *Amandinea* in New Zealand

- 1: Thallus yellow; medulla C+ orange, UV+ orange, containing xanthonones 2
- 1: Thallus white, grey or brown; medulla C–, UV–, not containing xanthonones .. 3
- 2: Asci 16-spored; ascospores 9–12 × 4–5.5 μm **A. melaxanthella**
- 2: Asci 8-spored; ascospores 11–14 × 4.5–6 μm **A. diorista** var. **hypopelidna**
- 3: Ascospores without medial thickenings; spores 12–15 × 7–9 μm ... **A. punctata**
- 3: Ascospores with medial thickening during spore ontogeny, but often quickly reduced 4
- 4: Ascospores 14–25 μm long 5
- 4: Ascospores 10–16 μm long 7
- 5: Apothecia initially lecanorine, then biatorine and lecideine; ascospores 14–21 × 6–9 μm **A. ornata**
- 5: Apothecia lecideine throughout development 6
- 6: Ascospores 17–25 × 7–12 μm, with apical thickenings **A. pillagaensis**
- 6: Ascospores 14–20 × 6–8 μm, without thickenings **A. lignicola** var. **australis**

- 7: Apothecia initially lecanorine, then biatorine and finally lecideine; juvenile ascospore locules lachrymiform **A. ropinii**
- 7: Apothecia lecideine throughout development; juvenile ascospore locules spherical or clavate 8
- 8: Subhymenium inspersed; juvenile ascospore locules spherical **A. porulosa**
- 8: Subhymenium not inspersed; juvenile ascospore locules clavate **A. lignicola** var. **australis**

Acknowledgements

H.M. is indebted to H. Hertel (Munich), B.P.J. Molloy and C.D. Meurk (both Christchurch) for their company during a field trip in 1985, and to HM's wife Eleonore for her support during another trip in 1992, as well as to D. Glenny, W. Nelson, B. Polly and C. West (all Wellington), N. and W.M. Malcolm (Nelson) and C.D. Meurk (Christchurch) for their assistance in the field. H.M. acknowledges financial support from the Austrian Science Fund (FWF-projects P8500-BIO, P10514-BIO and P25237-B16).

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Figure 1. *Amandinea ornata* (holotype in GZU). Scale = 1 mm.

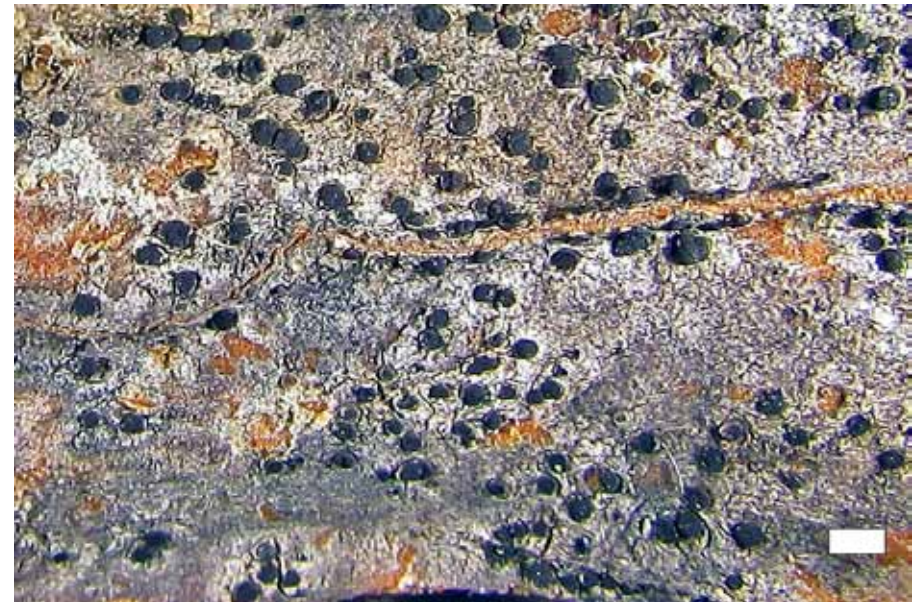


Figure 3. *Amandinea ropinii* (holotype in GZU). Scale = 1 mm.

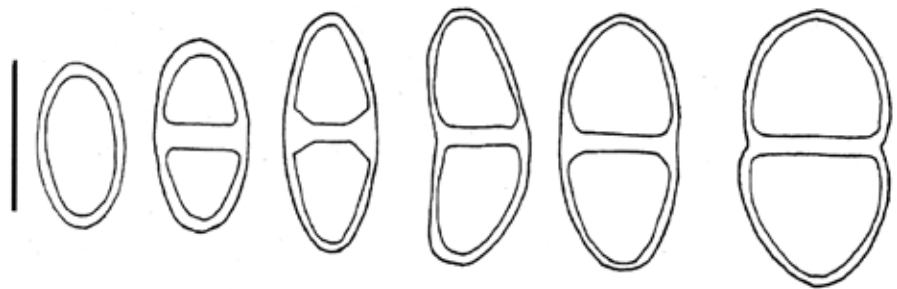


Figure 2. Ascospore ontogeny of *A. ornata*. Scale = 10 μ m.

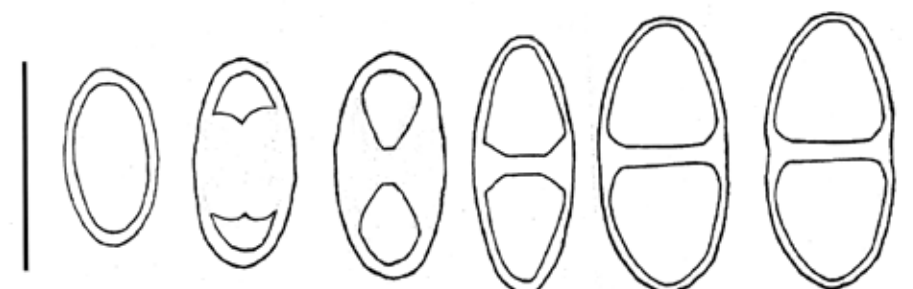


Figure 4. Ascospore ontogeny of *A. ropinii*. Scale = 10 μ m.

**Two new species of *Buellia sens. lat.* (Ascomycota, Physciaceae)
with pluriseptate ascospores from New Zealand**

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Abstract: *Buellia alectorialica* Elix and *B. billewersii* Elix are reported as new to science. The ascospores of both species have 3 (or occasionally more) septa.

In his revised second edition of the *Flora of New Zealand Lichens*, Galloway recorded a total of 16 species of *Buellia* (Galloway, 2007), although two of those species have since been transferred to *Amandinea* (Elix *et al.* 2015). Among the remaining 14 taxa are three species of *Buellia* in the strict sense, now limited to species with *Callispora*-type ascospores, bacilliform or weakly clavate conidia and a hymenium interspersed with oil droplets (Bungartz *et al.* 2007), with the remainder representing unrelated taxa that remain classified as *Buellia* in the broad sense. Since that time an additional five taxa of *Buellia s. lat.* have been recorded for New Zealand (Elix *et al.* 2015). In this paper, I describe two new species of *Buellia* in the broad sense, both with pluriseptate ascospores.

Methods

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

The new species

1. *Buellia alectorialica* Elix, sp. nov.
Mycobank number: **MB 814272**

Fig. 1

Similar to *Buellia bogongensis* Elix, but differs in having a thicker hymenium and in containing alectorialic rather than norstictic acid.

Type: New Zealand, South Island, Canterbury, Broken River, SE of Arthurs Pass, 43°08'S, 171°41'E, 1500 m alt., on rock high above the snow line, *W.H. Ewers 5734*, 4.xi.1989 (holotype – CANB).

Thallus crustose, to 50 mm wide and 0.1 mm thick, continuous, areolate, the areoles aggregated or delimited by a black prothallus; individual areoles irregular, angular, 0.2–0.7 mm wide; upper surface whitish or yellow-white, smooth; prothallus black, prominent, marginal and between adjacent areoles; medulla white, lacking calcium oxalate (H₂SO₄-), I+ intense blue; photobiont cells 8–14 μm diam. *Apothecia* 0.3–0.6 mm wide, lecidine, immersed in the thallus or among the areoles, isolated or crowded, round or distorted by mutual pressure; disc black, epruinose, weakly concave then plane, initially with a necrotic thalline veil; proper exciple thin, persistent, in section 40–55 μm thick, outer zone brown-black to greenish black, K-, N+ purple-brown, inner zone brown. *Epithymenium* 12–15 μm thick, aeruginose to greenish black, K+ blue-green, N+ purple. *Hypothecium* 75–150 μm thick, deep red-brown to brown-black, K-, N+ red-brown. *Hymenium* 120–140 μm thick, colourless, not interspersed, subhymenium 50–75 μm thick, colourless to pale brown; paraphyses 1.7–2 μm wide, moderately branched, capitate, with apices 3–4 μm wide, caps aeruginose; asci of the *Bacidia*-type, with 8 or fewer spores. *Ascospores* 3-septate or with an additional vertical

septum, brown, elongate-ellipsoid, 13–20(–27) × 6–9(–11) μm; outer spore wall weakly ornamented. *Pycnidia* not seen.

Chemistry: Thallus K+ yellow, P+ yellow, C+ red, UV-; containing atranorin (major), alectorialic acid (minor).

Etymology: The species is named for its characteristic chemistry.

Remarks

This new species is characterized by the crustose, areolate, whitish or yellow-white thallus, the immersed, often crowded apothecia, the 3-septate to submuriform ascospores, the greenish black epithymenium and outer excipulum (N+ purple) and the presence of atranorin and alectorialic acid. Morphologically it closely resembles the Australian *B. bogongensis*, but that species has a narrower hymenium, 75–100 μm thick, and contains atranorin plus norstictic and connorstictic acids (Elix 2011). Alectorialic acid is very uncommon in *Buellia s. lat.*, previously reported from only two corticolous species. The European *B. pulverea* Coppins & P.James produces only alectorialic acid (Coppins *et al.* 2009), while *B. rhizocarpica* Etayo, Giralt & Elix from Central America contains additional atranorin and epanorin, plus rhizocarpic and gyrophoric acids (Etayo *et al.* 2010). Both of those species have relatively small, 1-septate, *Buellia*-type ascospores.

Buellia alectorialica is known from siliceous rock in alpine regions of both the North and South Islands of New Zealand. Associated species include *Buellia aethalea* (Ach.) Th.Fr., *B. ocellata* (Flot.) Körb., *Lecanora farinacea* Fée, *Lecidella stigmatea* (Ach.) Hertel & Leuckert, *L. sublapicida* (C.Knight) Hertel, *Notoparmelia signifera* (Nyl.) A.Crespo, Ferencova & Divakar, *Rhizocarpon geographicum* (L.) DC., *Umbilicaria cylindrica* (L.) Delise ex Duby and *U. umbilicarioides* (B.Stein.) Krog & Swinscow.

SPECIMENS EXAMINED

North Island: • Wellington, Tongariro National Park, Mt Ruapehu, at ski lift, 39°17'S, 175°3'E, on rock above snowline, *W.H. Ewers 2611, 2615, 31.iii.1988* (CANB).

2. *Buellia billewersii* Elix, sp. nov.
Mycobank number: **MB 814273**

Fig. 2

Similar to *Buellia rubroraeagens* A.Nordin, but differs in having broader ascospores and a thicker hymenium.

Type: New Zealand, South Island, Canterbury, Tasman Glacier Road, Mt Cook, 43°36'S, 170°08'E, on bark, *W.H. Ewers 5223*, 10.xi.1989 (holotype – CANB).

Thallus crustose, up to 25 mm wide, 0.05 mm thick to evanescent, continuous or dispersed, membranaceous; upper surface white to whitish grey or grey, smooth; prothallus not apparent; medulla white, lacking calcium oxalate (H₂SO₄-), I-; photobiont cells 8–17 μm diam. *Apothecia* 0.3–1 mm wide, broadly adnate but soon sessile and constricted at base, often crowded but rarely confluent; disc black, epruinose, plane or rarely weakly convex; proper margin distinct, persistent, slightly higher than the disc, in section 35–55 μm thick, dark brown to brown-black in the outer part, K+ red in part but with no crystals, paler brown within. *Epithymenium* 12–15 μm thick, olive-brown to dark brown, K-, N-. *Hypothecium* 75–90 μm thick, brown to dark brown, K-. *Hymenium* 75–100 μm thick, colourless, not interspersed but with scattered oil drops. *Paraphyses* 1.5–2 μm thick, sparsely branched; apices 3–5 μm wide, with dark brown caps. Asci *Bacidia*-type, with 8 or fewer spores. *Ascospores* olive-brown to dark brown, 1–3-septate when immature, 3-septate at maturity, 17–26 × 8–11 μm, with apical and septal wall thickenings, sometimes curved; outer wall ornamented. *Pycnidia* black, immersed, c. 0.08 mm wide; conidia bacilliform, 4–6 × 0.7–1 μm.

Chemistry: Thallus K+ pale yellow, P+ pale yellow, C-, UV-; containing atranorin (major).

Etymology: The species is named after the late Australian biologist Dr William H. Ewers.

Remarks

Morphologically this new species is similar to *B. rubroreagens* A.Nordin, a tropical species from Brazil and the Caribbean. *Buellia rubroreagens* has ascospores similar to those of *B. billeviersii* and an excipulum and hypothecium that contain a yellow, K+ reddish pigment (Nordin 2000). Specimens of *B. rubroreagens* from the West Indies contain only atranorin, but differ in having a thinner hymenium, 70–80 µm thick, which lacks oil drops, and narrower ascospores, 6.5–8 µm wide, while specimens from Brazil contain additional norstictic acid. *Buellia triseptata* A.Nordin from Europe and north-western North America is also morphologically similar to *B. billeviersii*, but differs in having somewhat smaller ascospores, 14–22 × 5.5–8 µm, and a dark brown, K- excipulum. *Buellia triseptata* usually lacks lichen substances, but sometimes contains atranorin. It also differs in being lichenicolous in the early stages of its development (Nordin 2000).

The new species occurs on the twigs and branches of trees and shrubs in subalpine and alpine areas of the South Island of New Zealand. Associated species include *Haematomma alpinum* R.W.Rogers, *H. babingtonii* A.Massal. and *Xanthomendoza novozelandica* (Hillmann) Sochting, Kärnefelt & S.Kondr.

SPECIMENS EXAMINED

South Island: • Canterbury, Castle Hill, 43°44'S, 173°51'E, 760 m alt., on matagouri in open grassland, *J.A. Elix 8484*, 9.vi.1980 (CANB); • Type locality, on bark, *W.H. Ewers 5224*, 5232, 5235, 10.xi.1989 (CANB); • Canterbury, Mount Cook National Park, Tasman Glacier Valley road adjoining moraine, 43°40'S, 170°10'E, on deciduous shrub in stand of alpine scrub between creek and moraine, *J. Johnston 3529 pr.p.*, 9.vi.1980 (CANB).

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Fig. 1. *Buellia alectorialica* (holotype in CANB), scale = 1 mm.



Fig. 2. *Buellia billeviersii* (holotype in CANB), scale = 1 mm.

***Amandinea coniops* (Physciaceae, Ascomycota)
and its mimics in Tasmania and New Zealand**

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Abstract: The status of the widespread species *Amandinea coniops* (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer in Australasia is discussed and found to include an additional three taxa. *Amandinea austroconiops* Elix & Kantvilas and *A. destituta* Elix & Kantvilas are described as new to science, and the new combination *Amandinea subbadioatra* (C.Knight) Elix & Kantvilas is proposed.

Amandinea coniops (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer is a widespread species that has been reported from coastal rocks in Europe, Iceland, North America (Scheidegger 2009), Antarctica and subantarctic islands (Lamb 1968, Øvstedal & Lewis Smith 2001), Tasmania (Elix 2011, Elix & Kantvilas 2013), New Zealand (Elix *et al.* 2015) and Norfolk Island (Elix 2015). It is characterized by the pale grey-brown to brown, areolate to bullate or sublobate thallus, the broadly adnate to sessile apothecia up to 1 mm wide with epruinose discs, ascospores that are at first *Physconia*-type and then *Buellia*-type, 13–18 × 7–10 µm, which become constricted at the septum, filiform conidia, 15–30 × 0.8–1.0 µm, and by the absence of any lichen substances. A detailed re-examination of the Australasian material and comparisons with authentic *A. coniops* from the Northern Hemisphere has revealed that three additional species are involved; their circumscription is the subject of this paper.

Material and methods

The study is based on herbarium holdings, chiefly in the Tasmanian Herbarium (HO), the Australian National Herbarium (CANB) and the Herbarium GZU, Karl-Franzens-Universität Graz, Austria, and on recent collections and field observations by the authors. Hymenial and subhymenial inspersion and conidia were observed by mounting the apothecial or pycnidial tissue in a 0.5% solution of erythrosin B in dilute (10%) aqueous ammonium hydroxide and leaving for 2 minutes before placing the cover slip and examining under a compound microscope. Medullary amyloid reactions were observed in section by treatment with Lugol's Iodine (I) without pre-treatment with K. Dimensions of ascospores are based on 50 observations. The latter are presented in the format: 5th percentile–[average]–95th percentile. Chemical constituents were identified by thin-layer chromatography (Elix 2014) and comparison with authentic samples.

Key to *Amandinea coniops* and similar species in Australasia

- 1 Medulla I+ purple **A. austroconiops**
- 1: Medulla I- 2
- 2 Atranorin present **A. subbadioatra**
- 2: Atranorin absent 3
- 3 Subhymenium interspersed with oil droplets; ascospores 18–25 × 10–16 µm, coarsely rugulate **A. destituta**
- 3: Subhymenium not interspersed with oil droplets; ascospores 12–20 × 7–11 µm, minutely rugulate **A. coniops**

1. *Amandinea austroconiops* Elix & Kantvilas, sp. nov.
Mycobank number MB 815352

Figs 1, 2

Similar to *Amandinea coniops*, but differing in having an amyloid medulla, a subhymenium interspersed with oil droplets, and larger ascospores, 15–25 × 8–14 µm.

Type: Australia, Tasmania, Lagoon Bay, Forestier Peninsula, 42°53'S, 147°58'E, 1 m alt., on littoral boulders and shingles, *G. Kantvilas* 318/09, 11.viii.2009 (holotype – HO; isotype – CANB).

Thallus crustose, to c. 50 mm wide and 0.1 mm thick, rimose-areolate; individual areoles irregular, angular, 0.1–0.5 mm wide; upper surface white to grey-white, matt, smooth; prothallus not apparent; medulla white, H₂SO₄ –, I+ purple; photobiont cells 8–16 µm wide. **Apothecia** 0.3–1 mm wide, lecideine, initially immersed but soon broadly adnate, rarely sessile and constricted at the base, dispersed or crowded, rounded or irregular through mutual pressure; disc black, epruinose, weakly concave to plane or weakly convex; proper exciple distinct, persistent, often slightly higher than the disc when young, thinner and level with the disc in older apothecia, in section 30–60 µm thick, with the outer zone dark brown to black-brown, K–, N+ red-brown, paler brown within. **Epithymenium** 12–18 µm thick, dark brown, K–, N–. **Hypothecium** brown to brown-black, 110–190 µm thick, K–, N+ red-brown. **Hymenium** 75–100 µm thick, colourless, not interspersed; subhymenium 30–50 µm thick, colourless to pale brown, interspersed with oil droplets; paraphyses 1.5–2 µm wide, simple to sparsely branched, with dark brown apices, 5–6.5 µm wide; asci of the *Bacidia*-type, with 8 or fewer ascospores. **Ascospores** of the *Physconia*-type initially, of the *Buellia*-type when mature, 1-septate, medium to dark brown, ellipsoid, 15–[19.6]–25 × 8–[11.2]–14 µm, sometimes curved, becoming constricted at the septum; outer spore wall strongly ornamented (rugulate). **Pycnidia** common, pyriform, immersed, black; conidia filiform, curved, (15–)20–27 × 0.7–1 µm.

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

Etymology: The epithet refers to the austral distribution of the new species, and its similarity to *Amandinea coniops*.

Remarks

Both *Amandinea austroconiops* and *A. coniops* are characterized by their relatively large, 1-septate ascospores that become constricted at the septum and have ornamented outer walls, and by their curved, filiform conidia. However, *A. coniops* differs in having somewhat smaller ascospores, 12–[16.5]–20 × 7–[8.5]–11 µm, a hymenium and hypothecium without oil droplets, a non-amyloid medulla and usually a much better-developed thallus that often becomes shortly lobed at the margins or where the areoles become aggregated and imbricate to form a bullate, warted, secondary sub-squamulose crust. In addition, the outer spore wall in *A. coniops* is more finely ornamented. Thus *A. austroconiops* more closely resembles *A. subbadioatra*, from which it differs chiefly by lacking atranorin and having smaller ascospores (see below).

Amandinea austroconiops has been recorded in Tasmania and the South Island of New Zealand. It occurs on siliceous rock, and ranges from coastal to montane elevations. Although unusual, such a wide ecological amplitude is displayed by other buellioid lichens we have studied, including *Buellia halonia* (Ach.) Tuck., *B. stellulata* (Taylor) Mudd var. *stellulata*, *Endohyalina arachniformis* Elix & Kantvilas and *Baculifera metaphragmioides* Elix & Kantvilas. Coastal collections from Tasmania are associated with typical littoral species such as *Buellia halonia* (Ach.) Tuck., *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 xanthoplaca* Müll.Arg., *Rinodina blastidiata* Matzer & H.Mayrhofer and *Xanthoria ligulata*

(Körb.) P.James. In montane areas, associated species include *Buellia aethalea* (Ach.) Th.Fr., *B. ocellata* (Flot.) Körb., *Lecanora farinacea* Fée, *Lecidella stigmatea* (Ach.) Hertel & Leuckert, *L. sublaticida* (C.Knight) Hertel, *Notoparmelia signifera* (Nyl.) A.Crespo, Ferencova & Divakar, *Rhizocarpon geographicum* (L.) DC., *Umbilicaria cylindrica* (L.) Delise ex Duby and *U. umbilicarioides* (B.Stein.) Krog & Swinscow.

SPECIMENS EXAMINED

TASMANIA: • Type locality, 3 m alt., on vertical dolerite rocks facing the sea, *G. Kantvilas* 310/09, 11.viii.2009 (CANB, HO); • Alum Cliffs, 42°58'S, 147°20'E, on mudstone rocks above the water-line, *G. Kantvilas* 165/97, 6.v.1997 (HO); • c. 3 km east of McDowall Hill, 41°54'S, 146°38'E, 1120 m alt., on dolerite boulder in alpine woodland, *G. Kantvilas* 105/00, 8.iii.2000 (HO); • Blowhole Point, Marion Bay, 42°45'S, 147°45'E, 2 m alt., on littoral dolerite outcrops, *G. Kantvilas* 342/12, 343/12, 5.viii.2012 (HO); Skullbone Plains, ridge SW of Kenneth lagoon, 42°03'S, 146°20'E, 980 m alt., on dolerite boulder in alpine heathland, *G. Kantvilas* 695/12, 12.xii.2012 (HO); • Cockle Bay Lagoon, 42°42'S, 147°56'E, 1 m alt., on dolerite cobbles on sea-shore, well beyond the splash zone, *G. Kantvilas* 737/12, 16.xii.2012 (HO).

NEW ZEALAND: *South Island*: • Canterbury, Mount Somers hut, NZMS 262 13:375733, 43°35'36"S, 171°19'E, c. 900 m, on rock, *W. Malcolm* 0379, 30.xii.1992 (CANB); • Nelson, Cable Bay, N face of Sentinel Hill, NZMS 260 O27:444054, 41°09'36"S, 173°24'36"E, 3 m alt., on rock, *W. Malcolm* 1918, 27.iv.1994 (CANB); • Canterbury, Banks Peninsula, Te Oka S of Little River, 43°48'18"S, 172°47'18"E, on basalt, *J. Blaha* 089, 090, 11.iii.2001 (GZU).

2. *Amandinea destituta* Elix & Kantvilas, sp. nov.
MycoBank number **MB 815353**

Figs 3, 4

Similar to *Amandinea coniops*, but differing in having larger ascospores, 18–25 × 10–16 μm, and a subhymenium interspersed with oil droplets; also similar to *Amandinea subbadioatra*, but with shorter ascospores and lacking atranorin.

Type: Australia, Tasmania, Raspins Beach near Sheas Creek, 42°33'S, 147°53'E, 2 m alt., on littoral sandstone boulders, *G. Kantvilas* 232/11, 11.viii.2011 (holotype – HO; isotype – CANB).

Thallus crustose, continuous, cracked and areolate, to 35 mm wide and 0.5 mm thick; individual areoles irregular, angular, 0.3–1.5 mm wide, becoming verrucose and bulate near the thallus margins; upper surface whitish grey to grey, matt, becoming eroded and granular with age; prothallus not apparent; medulla white, lacking calcium oxalate (H₂SO₄-), I-; photobiont cells 8–16 μm diam. *Apothecia* 0.4–1 mm wide, lecidine, broadly adnate to sessile and constricted at the base, dispersed or crowded, ±rounded; disc black, epruinose, weakly concave then plane; proper exciple thick, raised above the disc, persistent, in section 50–90 μm thick, outer zone brown-black, K-, N+ red-brown, inner zone brown. *Epithymenium* 10–12 μm thick, dark brown to brown-black, K-, N+ red-brown. *Hypothecium* dark brown to brown-black, 150–300 μm thick, K-, N+ deep red-brown. *Hymenium* 75–110 μm thick, colourless, not interspersed; subhymenium 60–70 μm thick, colourless to pale brown, interspersed with oil droplets; paraphyses 1–1.5 μm wide, sparsely branched, with apices dark brown, 4.5–6 μm wide; asci of the *Bacidia*-type, with 8 or fewer spores. *Ascospores* of the *Physconia*-type at first, of the *Buellia*-type when mature, brown, ellipsoid, 18–[21.8]–25 × 10–[12.8]–16 μm, sometimes curved, older spores constricted at the septum; outer spore wall strongly ornamented (rugulate). *Pycnidia* superficial, black, marginal; conidia filiform, curved, 15–23 × 0.7 μm.

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

Etymology: The species name refers to the absence of lichen substances, in contrast to the morphologically similar *A. subbadioatra*, which contains atranorin.

Remarks

This species is characterized by the crustose, rimose-areolate, whitish grey to grey thallus, the broadly adnate to sessile apothecia, the non-amyloid medulla, the 1-septate, *Buellia*-type ascospores, 18–25 × 10–16 μm, the curved, filiform conidia, 15–23 μm long, and the absence of lichen substances. *Amandinea subbadioatra* from New Zealand is morphologically very similar, but is distinguished by having longer ascospores and in containing copious amounts of atranorin (see below). Furthermore, *A. subbadioatra* occurs on montane rather than coastal rocks. *Amandinea destituta* is also very similar to *A. austroconiops* described above, but the latter has somewhat smaller ascospores, 15–[19.6]–25 × 8–[11.2]–14 μm and a strongly amyloid medulla. *Amandinea coniops* is also superficially similar to *A. destituta*, but differs in having a non-interspersed subhymenium and smaller ascospores.

Amandinea destituta is known from siliceous coastal rocks in Tasmania. Associated species include *A. austroconiops*, *Buellia halonia* (Ach.) Tuck., *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 xanthoplaca* Müll.Arg., *Rinodina blastidiata* Matzer & H.Mayrhofer and *Xanthoria ligulata* (Körb.) P.James.

SPECIMEN EXAMINED

TASMANIA: • Hibbs Pyramid, 42°36'S, 145°16'E, on littoral rocks, *A. Moscal* 6128a, 4.ii.1984 (HO).

3. *Amandinea subbadioatra* (C.Knight) Elix & Kantvilas, comb. nov. Figs 5, 6
MycoBank number **MB 815355**

Basionym: *Lecidea subbadioatra* C.Knight, *Trans. N.Z. Inst.* **8**, 317 (1876)
Buellia subbadioatra (C.Knight) Müll.Arg., *Bull. Soc. Roy. Bot. Belg.* **31**(2), 33 (1892).

Type: New Zealand: *sine loco*, Charles Knight (lectotype – BM *vide* D.J. Galloway, *Flora of New Zealand Lichens*, 53 [1985]; isolectotype – WELT!).

Thallus crustose, to 35 mm wide and 0.7 mm thick, continuous, rimose-areolate, becoming verrucose and lumpy with age and near the margins; individual verrucae irregular, 0.5–3.5 mm wide and thick; upper surface matt, esorediate, white to whitish grey, epruinose; prothallus black, marginal, apparent only when bordering other lichens; photobiont cells 8–14 μm wide; medulla white, lacking calcium oxalate (H₂SO₄-), I-. *Apothecia* 0.5–1.5 mm wide, lecidine, broadly adnate to sessile, separate or crowded and distorted by mutual pressure; disc black, epruinose, weakly concave at first, then ±plane to weakly convex or undulate, rarely tuberculate; proper exciple distinct, persistent, black, rarely excluded, in section 65–80 μm thick, dark brown, K-, N+ red-brown, brown within. *Epithymenium* 15–25 μm thick, dark brown, K-, N+ red-brown. *Hypothecium* 150–350 μm thick, dark brown to brown-black, K-, N+ deep red-brown (slow). *Hymenium* 115–130 μm thick, colourless; subhymenium 50–75 μm thick, colourless to brown, finely interspersed with oil droplets; paraphyses 1.5–2.5 μm wide, simple to weakly branched, with dark brown apices, 4–6 μm wide; asci of the *Bacidia*-type, with 8 or fewer spores. *Ascospores* of the *Callispora*- or *Physconia*-type in early ontogeny, then of the *Buellia*-type, 1-septate, olive-green to brown, ellipsoid then broadly fusiform with age, 20–[25]–32 × 10–[13]–16 μm, commonly curved, often pointed at the apices, constricted at the septum when older; outer spore wall finely to strongly ornamented. *Pycnidia* immersed; conidia filiform, curved, 18–31 × 0.7–1 μm.
Chemistry: Thallus K+ yellow, P+ pale yellow, C-, UV-; atranorin (major).

Remarks

The discovery of curved, filiform conidia, 18–31 × 0.7–1 µm, in both specimens examined confirms that this species should be accommodated in *Amandinea*.

SPECIMEN EXAMINED

NEW ZEALAND: *South Island*: • Otago, Mt. Maungatua, SW of Dunedin, c. 500 m W of summit, 45°54'S, 170°08'E, c. 850 m alt., on rock, *H. Mayrhofer 10468*, *H. Hertel & A.F. Mark*, 31.i.1985 (GZU).

4. *Amandinea conioops* (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer, *Lichenologist* 25, 342 (1993) Figs 7, 8

Thallus crustose, to c. 45 mm wide and 2 mm thick, bullate-areolate to sublobate; individual areoles irregular, angular, 0.5–2 mm wide, becoming aggregated and imbricate to form a secondary, bullate, warted or subsquamulose crust; lobes very short, highly imbricate and compacted, placodioid at the margins, 0.1–0.5 mm wide; upper surface grey-white to grey-brown or dark grey, matt, smooth; prothallus black but usually not apparent; medulla white, H₂SO₄–, I–; photobiont cells 10–16 µm wide. *Apothecia* 0.3–1 mm wide, lecideine, broadly adnate, dispersed or rarely crowded; disc black, epruinose, weakly plane to strongly convex; proper exciple distinct, initially slightly higher than the disc, excluded in older convex apothecia, in section 30–60 µm thick, with the outer zone dark brown, K–, paler brown within. *Ephymenium* 10–14 µm thick, dark brown, K–, N–. *Hypothecium* 30–50 µm thick, pale brown to brown, K–, N–. *Hymenium* 75–90 µm thick, colourless; subhymenium pale brown, not interspersed with oil droplets; paraphyses 1.5–1.7 µm wide, simple to sparsely branched, with the apices brown, 3.5–5 µm wide; asci of the *Bacidia*-type, 8-spored. *Ascospores* of the *Physconia*-type initially, of the *Buellia*-type when mature, 1-septate, brown, ellipsoid, 12–[16.5]–20 × 7–[8.5]–11 µm, straight, constricted at the septum; outer spore wall finely ornamented (microrugulate). *Pycnidia* common, pyriform, immersed, black; conidia filiform, curved, 20–30 × 0.7–1 µm.

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

Remarks

In Australasia, authentic *A. conioops* has been found in New Zealand, Norfolk Island and Tasmania. It is also common elsewhere in the Southern Hemisphere, including Antarctica and South Georgia and other subantarctic islands (Øvstedal & Lewis Smith 2001). This morphologically variable species (Lamb 1948) grows on siliceous coastal rocks.

SELECTED SPECIMENS EXAMINED

AUSTRALIA: *Tasmania*: • Hope Beach, Cape Direction end, 43°03'S, 147°25'E, on unstable mudstone rocks along the shore, *G. Kantvilas 174/01*, 12.ii.2001 (HO); *Norfolk Island*: • Rocky Point, Rocky Point Reserve, 29°03'S, 167°55'E, 40 m alt., on volcanic rocks along the cliff tops, *J.A. Elix 18533, 18534, 18536 pr.p., 18538 & H. Streimann*, 5.xii.1984 (CANB).

CANADA: • British Columbia, Queen Charlotte Islands, Graham Island, Tow Hill, 54°04'N, 131°47'W, 357 ft. alt., exposed face of cliff on slopes at summit, *I.M. Brodo 9926 & M.J. Shchepanek*, 16.vi.1967 (CANB).

NEW ZEALAND: *North Island*: • Coromandel Peninsula, NW of Colville, between Waiaro and Port Jackson, 36°30'55"S, 175°19'40"E, on coastal rocks, *J. Blaha 0193*, 16.iv.2001 (GZU). *South Island*: • Nelson, Golden Bay, Patons Rock NW of Takaka, 40°47'S, 172°43'E, on coastal rocks, *H. Mayrhofer 13144 & N. & B. Malcolm*, 25.viii.1992 (GZU); • Marlborough, NE of Kaikoura, Ohau Strea N of Ohau Point, 42°14'30"S, 173°50'E, on coastal rocks, *H. Mayrhofer 12191 & C.D. Meurk*, 31.viii.1992 (GZU); • Canterbury, Banks peninsula, Otanerito Bay, 43°50'14"S, 172°03'28"E, 0–3 m alt.,

on coastal basalt rocks, *J. Blaha 0107*, 14.iii.2001 (GZU); • Otago, S of Dunedin, St. Clair Beach, Second Beach Road, 45°54'47"S, 172°29'20"E, 15 m alt., on coastal basalt rocks, *J. Blaha 0117*, 22.iii.2001 (GZU); • Southland, E of Invercargill, Wai-kawa, Curio Bay, 46°39'41"S, 169°06'18"E, 1–3 m alt., on coastal sandstone rocks, *J. Blaha 0141*, 23.iii.2001 (GZU);

NORWAY: • Finnmark, Varager-Halbinsel: Insel Vadsöya vor Vadsö, an meeres-nahen Küstenfelsen oberhalb der Spritzwasserzone, 8 m, *K. Kalb & A. Schrögl*, 22.viii.1984 (Plantae Graecenses, Lich. 520 – CANB).

SWEDEN: • Bohuslän Prov., Stenkyrka par., Bäcekilen (Bäcke kile), 57°58'N, 11°40'E, on stones in the storm belt, among grass, *A.H. Magnusson 7500*, 24.vii.1923 (Lichenes Selecti Exsiccati Upsalienses no. 101 – CANB). Det. C. Scheidegger, 1991.

Acknowledgements

We would like to thank Jean Jarman (HO) for the photographs of *A. austroconioops* and *A. destituta*, and Dr H. Mayrhofer (GZU) and Dr W. Malcolm (Nelson) for providing key collections. The support of the Australian Biological Resources Study through the award of a Bush Blitz Applied Taxonomy Grant to GK is gratefully acknowledged.

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Figure 1. *Amandinea austroconiops* (holotype in HO). Scale = 2 mm.



Figure 3. *Amandinea destituta* (holotype in HO). Scale = 2 mm.



Figure 2. Ascospore ontogeny of *A. austroconiops*. Scale = 10 μ m.

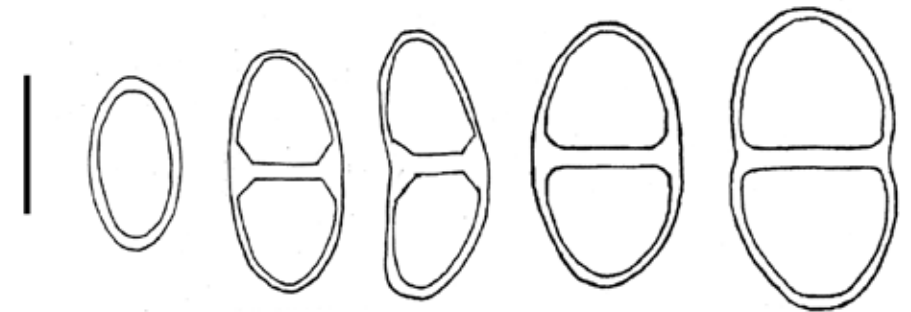


Figure 4. Ascospore ontogeny of *A. destituta*. Scale = 10 μ m.



Figure 5. *Amandinea subbadioatra* (Mayrhofer 10468 in GZU). Scale = 1 mm.



Figure 7. *Amandinea coniops* (Elix 18538 in CANB). Scale = 1 mm.

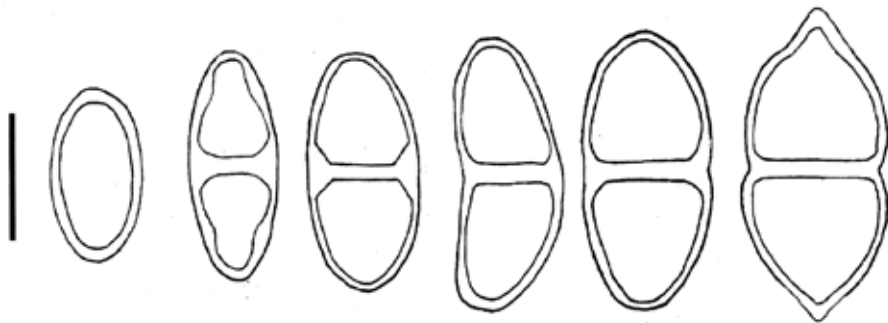


Figure 6. Ascospore ontogeny of *A. subbadioatra*. Scale = 10 μ m.

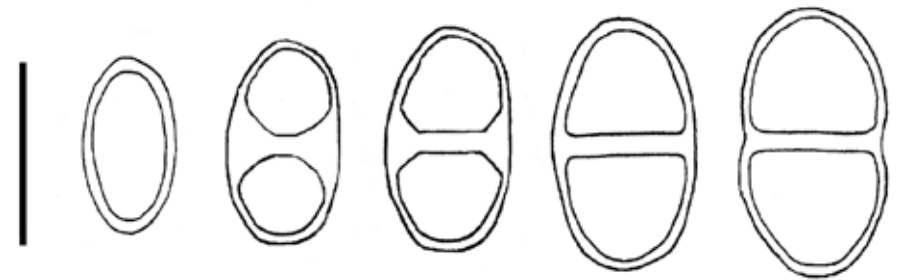


Figure 8. Ascospore ontogeny of *A. coniops*. Scale = 10 μ m.

Seven new species of *Buellia sens. lat.* (Ascomycota, Physciaceae) from southern mainland Australia

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Abstract: *Buellia epiaeruginosa* Elix, *B. ewersii* Elix, *B. fluviicygnorum* Elix, *B. macveanii* Elix, *B. maficola* Elix, *B. mayrhoferae* Elix & Kantvilas and *B. pannarina* Elix are reported as new to science. In addition, *Buellia molonglo* Grube & Elix has been shown to be a later synonym of *B. halonia* (Ach.) Tuck., and *Buellia jugorum* (Arnold) Arnold is recorded from Australia for the first time.

This paper is a continuation of the investigation of *Buellia*-like lichens in Australia, following on from the first accounts of *Buellia* and related genera (Elix 2009, 2011) and additions and revisions to *Amandinea* (Elix & Kantvilas 2013a), *Buellia sens. lat.* (Elix & Kantvilas 2013b, Elix 2015b), *Buellia sens. str.* (Elix & Kantvilas 2014a), *Baculifera* (Elix & Kantvilas 2014b), *Cratiria* (Elix 2014), *Monerolechia* (Elix 2015a) and other crustose Physciaceae (Elix & Kantvilas 2015). In this paper, I describe further new saxicolous species of *Buellia* in the broad sense from southern Australia.

The new species

1. *Buellia epiaeruginosa* Elix, sp. nov.
Mycobank number: MB 814392

Fig. 1

Similar to *Buellia aethalea* (Ach.) Th.Fr., but differs in lacking norstictic acid and in having a dark brown to brown-black hypothecium.

Type: Australia, Victoria, Alpine National Park, Mt McKay, 16 km SSE of Mount Beauty, 36°52'S, 147°14'E, alt. 1840 m, on exposed granite in alpine grassland, *J.A. Elix 40512* & *H. Streimann*, 18.ii.1994 (holotype – CANB).

Thallus crustose, to 50 mm wide and 0.2 mm thick, areolate; areoles separate or becoming contiguous, individual areoles angular and irregular to rounded, 0.1–0.5 mm wide, ±plane to weakly convex; upper surface pale to dark grey, matt, granular, epruinose, rarely slightly glossy and smooth; prothallus black, prominent at the periphery and between adjacent areoles; photobiont cells 8–16 µm wide; medulla white, 0.1–0.15 mm thick, lacking calcium oxalate (H₂SO₄–), I–. *Apothecia* 0.2–0.8 mm wide, abundant, lecideine, roundish, scattered, immersed at first then broadly adnate or very rarely sessile; disc black, epruinose, flat or convex with age, often becoming tuberculate; proper exciple thick, black, persistent, in section 30–60 µm thick, outer part brown-black to intensely blue-green, K–, N+ intense purple, inner part brown. *Epihymenium* 12–17 µm thick, olive-brown to intensely aeruginose, K+ blue, N+ violet. *Hypothecium* 170–210 µm thick, dark brown to brown-black, K–, N+ intense red-brown. *Hymenium* 100–130 µm thick, colourless, not interspersed, I+ blue; subhymenium 30–55 µm thick, colourless to pale greenish or pale brown; paraphyses 1.8–2.4 µm wide, short-septate, submoniliform, moderately branched, with apices 3–4 µm wide and dark greenish brown caps. *Asci* *Bacidia*-type, with 8 or fewer spores. *Ascospores* *Buellia*-type, 1-septate, pale then dark brown, ellipsoid, 12–[15.0]–20 × 7–[8.9]–11 µm, becoming constricted at the septum, outer wall finely ornamented. *Pycnidia* punctiform, immersed. Conidia elongate-bacilliform, straight, 6.5–10 × 0.8–1 µm. *Chemistry:* Medulla K–, C–, P–, UV–; lichen substances absent.

Etymology: The species is named for its intensely aeruginose epihymenium.

Remarks

In several respects, this new species closely resembles the common and widely distributed *Buellia aethalea*, in that both have initially immersed apothecia, intensely aeruginose epihymenia and proper exciples, and similar-sized ascospores. However, in *B. aethalea* the apothecia rarely become broadly adnate, and they are usually angular or comma-shaped (rather than rounded), the disc remains flat (not becoming convex and tuberculate), the bacilliform conidia are somewhat shorter (5–7.5 µm long), and the medulla reacts K+ yellow then red due to the presence of norstictic acid. In addition, the hypothecium of *B. aethalea* varies from colourless to pale brown, whereas in *B. epiaeruginosa* it is dark brown to brown-black.

At present this new species is known from alpine Victoria and Tasmania. Commonly associated species include *Amandinea isabellina* (Hue) Søchting & Øvstedal, *Circinaria caesiocinerea* (Nyl. ex Malbr.) A.Nordin, S.Savic & Tibell, *Buellia aethalea* (Ach.) Th.Fr., *B. bogongensis* Elix, *Lecidea lygommella* Elix, *Ramboldia petraeoides* (C.Bab. & Mitt.) Kantvilas & Elix, *Rhizocarpon geographicum* (L.) DC., *Xanthoparmelia mougeotina* (Nyl.) D.J.Galloway and several *Umbilicaria* species.

SPECIMENS EXAMINED

Victoria: • Dargo High Plains, Alpine National Park, 41 km NNW of Dargo, 37°06'S, 147°09'E, 1620 m alt., on exposed rock in swampy, subalpine grassland, *H. Streimann 53211*, 17.xii.1993 (CANB); • Lankey Plain, Dargo High Plains, Alpine National Park, 39 km NNW of Dargo, 37°07'S, 147°09'E, 1580 m alt., on exposed rocks beside road in subalpine grassland with scattered shrubs, *H. Streimann 53267 pr.p.*, 17.xii.1993 (B, CANB, H).

Tasmania: • Mt Rufus, 42°08'S, 146°06'E, 1415 m alt., on alpine dolerite rocks, *G. Kantvilas 506/14*, 27.xii.2014 (HO).

2. *Buellia ewersii* Elix, sp. nov.
Mycobank number: MB 814393

Fig. 2

Similar to *Buellia aethalea* (Ach.) Th.Fr., but differs in lacking norstictic acid and an aeruginose epihymenium.

Type: Australia, Victoria, Alpine National Park, Bogong High Plains, near Copes Hut, in valley opposite front door, 36°54'24"S, 147°17'33"E, alt. c. 1680 m, on exposed granite in alpine grassland, *W.H. Ewers 1762*, 8.xii.1987 (holotype – CANB).

Thallus crustose, to 50 mm wide and 1.5 mm thick, areolate, thin to thick and chinky; areoles separate or becoming contiguous, individual areoles angular and irregular, 0.5–2.5 mm wide, ±plane to undulate; upper surface whitish to pale or dark grey, matt or rarely slightly glossy; prothallus not apparent; photobiont cells 11–18 µm wide; medulla white, up to 1 mm thick, lacking calcium oxalate (H₂SO₄–), I–. *Apothecia* 0.4–1 mm wide, abundant, lecideine, roundish, scattered, immersed at first then broadly adnate; disc black, epruinose, flat or weakly convex with age; proper exciple thin, black, persistent or excluded in convex apothecia, in section 60–75 µm thick, outer part dark brown, K–, N–, inner part brown. *Epihymenium* 10–15 µm thick, olive-brown to dark brown, K–, N– or N+ greenish brown. *Hypothecium* 170–250 µm thick, brown to dark brown, K– or K+ intense yellow solution in part, N+ deep red-brown. *Hymenium* 55–80 µm thick, colourless, not interspersed, I+ blue; subhymenium 25–40 µm thick, colourless to pale brown; paraphyses 1–2 µm wide, sparingly branched, with apices 3–5 µm wide and dark brown caps. *Asci* with 8 or fewer spores, *Bacidia*-type. *Ascospores* *Physconia*- then *Buellia*-type, 1-septate, pale then dark brown, ellipsoid, 11–[14.1]–18 × 6.5–[7.5]–10 µm, rarely constricted at the septum, outer wall finely ornamented. *Pycnidia* common, punctiform, immersed, ostiole black. Conidia elongate-bacilliform, straight, (6.5–)8–13 × 0.9–1.2 µm.

Chemistry: Medulla K-, C-, PD-, UV-; lichen substances absent.

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

Remarks

In some respects this new species resembles the common and widely distributed *Buellia aethalea*, as well as *B. epiaeruginosa* described above. All three have initially immersed apothecia and similar-sized ascospores. However, *B. aethalea* is distinguished by the presence of norstictic acid and a colourless to pale brown hypothecium. Like *B. epiaeruginosa*, *B. ewersii* lacks lichen substances, but the proper exciple and epihymenium are dark brown to olive-brown, and react N- or N+ weak greenish brown, whereas they are intensely aeruginose (reacting N+ violet) in *B. epiaeruginosa*. *Buellia ewersii* also differs in having *Physconia*- then *Buellia*-type ascospores. It also has longer bacilliform conidia, and it lacks the prominent black prothallus of the other two species (see above).

At present the new species is known from alpine Victoria and the Australian Capital Territory. Commonly associated species include *Circinaria caesiocinerea* (Nyl. ex Malbr.) A.Nordin, S.Savic & Tibell, *Buellia aethalea* (Ach.) Th.Fr., *B. bogongensis* Elix, *Lecidea lygommella* Elix, *Ramboldia petraeoides* (C.Bab. & Mitt.) Kantvilas & Elix, *Rhizocarpon geographicum* (L.) DC., *Xanthoparmelia incerta* (Kurok. & Filson) Elix & J.Johnst., *X. mougeotina* (Nyl.) D.J. Galloway and several *Umbilicaria* species.

SPECIMENS EXAMINED

Australian Capital Territory: • Scabby Lake, Mt Scabby, Namadji National Park, 35°44'26"S, 148°51'54E, 1598 m alt., on sheltered granite, P.M. McCarthy 4254 pr.p., 12.xii.2013 (CANB).

Victoria: • Type locality, on exposed granite in alpine grassland, W.H. Ewers 1761, 8.xii.1987 (CANB).

3. *Buellia fluviicygnorum* Elix, sp. nov. Mycobank number: MB 814394

Fig. 3

Similar to *Buellia nashii* Bungartz, but differs in having an epruinose upper surface and apothecial discs, a medulla that lacks calcium oxalate and ascospores that become constricted at the septum.

Type: Australia, South Australia, 6 km N of Swan Reach along Murray River, 34°33'S, 139°34'E, on limestone rocks in open *Eucalyptus* woodland along river margin, J.A. Elix 26460, 13.ii.1992 (holotype – CANB).

Thallus crustose, to 6 cm wide and c. 0.5 mm thick, continuous, areolate; individual areoles angular, irregular, contiguous or separate, 0.4–1.0 mm wide, becoming rounded and sublobate-effigurate at the margins, to 2 mm wide; upper surface matt, smooth, esorediate, white to whitish grey, epruinose; prothallus not apparent; photobiont cells 10–20 µm wide; medulla white, lacking calcium oxalate (H₂SO₄-), I-. *Apothecia* 0.4–1 mm wide, lecideine, round or distorted by mutual pressure, immersed then broadly adnate; disc black, epruinose, weakly concave at first, then ±plane or becoming strongly convex; proper exciple thin, concolorous with disc, excluded in convex apothecia, in section 30–50 µm thick, strongly aeruginose, K-, N+ reddish violet, paler brown within. *Epihymenium* 8–12 µm thick, dark brown to olive-brown or aeruginose, K-, N+ reddish. *Hypothecium* 200–260 µm thick, deep red-brown, K+ orange-red crystals, N+ intense red. *Hymenium* 60–75 µm thick, colourless, not interspersed with oil droplets; paraphyses 1.5–2 µm wide, simple to weakly branched, capitate, with dark brown apices 4–5 µm wide. Asci of the *Bacidia*-type, 8-spored. *Ascospores* *Physconia*- then

Buellia-type, 1-septate, olive-green to brown, ellipsoid, 12–[13.7]–17 × 6–[7.2]–9 µm, older spores constricted at the septum, rounded at the apices, spore wall of uniform thickness; outer spore wall finely ornamented. *Pycnidia* immersed; conidia bacilliform, straight, 5–8 × 1–1.5 µm.

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

Etymology: The epithet refers to the type locality – from the Latin *fluvius cygnorum* (river of swans).

Remarks

This new species is characterized by the crustose, areolate, white to whitish grey thallus that becomes sublobate and effigurate at the margins, the *Physconia*- then *Buellia*-type ascospores with an ornamented outer wall, and the presence of atranorin and norstictic acid. *Buellia fluviicygnorum* is superficially similar to the North American *B. nashii* Bungartz, in that both species have an aeruginose, N+ violet outer exciple, areolate to sublobate thalli and identical chemistry (Bungartz *et al.* 2007). However, *B. nashii* differs in having an upper surface that is coarsely or finely pruinose, a medulla containing calcium oxalate (H₂SO₄ +), and non-constricted ascospores. Furthermore, it grows on a variety of siliceous rock substrata rather than limestone. *Buellia homophyllia* (C.Knight) Zallhr., very common on siliceous rocks in southern Australia, has identical chemistry and similar-sized ascospores, but differs in having a crustose thallus (not sublobate and effigurate at the margins), an amyloid medulla, shorter conidia, 3–5 µm long, and alternative ascospore ontogeny (*Buellia*-type juvenile spores).

Buellia fluviicygnorum is presently known only from the type locality. Associated species include *Buellia albula* Müll.Arg., *Caloplaca kantvilasii* S. Kondr. & Kärnefelt, *C. mereschkowskiana* S.Y.Kondr. & Kärnefelt, *Diplotomma venustum* Körb., *Lecanora dispersa* (Pers.) Sommerf., *L. sphaerospora* Müll.Arg., *Rinodina bischoffii* (Hepp) A.Massal., *R. reagens* Matzer & H.Mayrhofer and *Placopyrenium trachyticum* (Haszl.) Breuss var. *trachyticum*, the last being a new record for South Australia.

4. *Buellia macveanii* Elix, sp. nov. Mycobank number: MB 814395

Fig. 4

Distinguished by the aggregated, yellow to yellow-green areoles delimited by a prominent black prothallus, separate or clustered apothecia, the *Physconia*- then *Buellia*-type, 1-septate, ascospores, 11–18 × 6–10 µm, the aeruginose, N+ violet-red epihymenium and the presence of 6-O-methylarthothelin.

Type: Australia, New South Wales, Snowy Mountains, Mt Kosciuszko, 36°28'S, 148°15'E, on quartz rock, D. McVean 67204, xi.1967 (holotype – CANB).

Thallus crustose, up to 40 mm wide and c. 0.2 mm thick, continuous, areolate, the areoles aggregated, contiguous or separate and delimited by a black prothallus, the individual areoles irregular, angular or rounded, 0.1–0.7 mm wide; upper surface smooth, yellow to pale yellow-green; prothallus black, prominent, marginal and between adjacent areoles; medulla white, lacking calcium oxalate (H₂SO₄-), I+ blue-violet; photobiont cells 8–14 µm diam. *Apothecia* 0.1–0.5 mm wide, lecideine, immersed, isolated or becoming clustered; disc black, epruinose, weakly concave then plane; proper exciple thin, persistent, reduced with age, in section 50–60 µm thick, the outer zone greenish black to black-brown, K-, N+ violet, the inner zone brown. *Epihymenium* 10–16 µm thick, greenish black to dark brown, K- or K+ deep blue-green, N+ purple. *Hypothecium* 100–150 µm thick, brown to brown-black, K-. *Hymenium* 60–100 µm thick, colourless, not interspersed; subhymenium 40–50 µm thick, colourless to pale brown or brown; paraphyses 1.5–2.5 µm wide, simple to sparingly branched, with

apices 3.5–5 µm wide and brown caps; asci of the *Bacidia*-type, 8-spored. *Ascospores* *Physconia*- then *Buellia*-type, 1-septate, brown to greenish grey or olive-green, broadly ellipsoid, 10–[13.8]–18 × 6–[7.8]–11 µm, initially with medial wall-thickenings, becoming constricted with age, apices rounded or often citriform; outer spore-wall ornamented. *Pycnidia* rare, immersed, conidia bacilliform, 3–6 × 1 µm. *Chemistry*: Thallus K–, C+ yellow-orange, P–, UV+ dull orange; containing 6-*O*-methyl-arthrothelin (major), arthrothelin (trace).

Etymology: The species is named in honour of the Scottish botanist and collector of the type specimen, the late Donald Neil McVean (1944–1996).

Remarks

The distinctive *Buellia macveanii* is characterized by the minute, aggregated, yellow to yellow-green areoles, the separate or clustered, immersed apothecia, a prominent black prothallus, an amyloid medulla, the *Physconia*- then *Buellia*-type, 1-septate ascospores, 10–18 × 6–11 µm, the aeruginose, N+ violet-red epihymenium and the presence of 6-*O*-methylarthothelin. The clustered yellow to yellow-green areoles resemble those of *B. ocellata* (Flot.) Körb., a species that also has a greenish black to brown-black, N+ red-violet proper excipulum and epihymenium and similar ascospores, but contains arthrothelin (Coppins *et al.* 2009). *Buellia ocellata* also differs in lacking clustered apothecia, in having a non-amyloid medulla, ascospores with rounded apices and a hypothecium that is green in its upper part.

At present this new species is known from the Australian Capital Territory, New South Wales and the South Island of New Zealand, where it occurs on rocks in alpine and subalpine heath. Associated species include *Circinaria caesiocinerea* (Nyl. ex Malbr.) A.Nordin, S.Savic & Tibell, *Buellia aethalea* (Ach.) Th.Fr., *B. bogongensis* Elix, *Lecanora polytropa* (Hoffm.) Rabenh., *Lecidea lapicida* (Ach.) Ach. var. *lapicida*, *L. lygoma* Nyl. ex Cromb., *Ramboldia petraeoides* (C.Bab. & Mitt.) Kantvilas & Elix, *Rhizocarpon geographicum* (L.) DC., *Xanthoparmelia mougeotina* (Nyl.) D.J. Galloway and several *Umbilicaria* species.

SPECIMENS 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 sheltered schist rock ledge on exposed summit, *J.A. Elix 19814* & *G. Rambold*, 27.i.1986 (CANB); *loc. id.*, *W.H. Ewers 4557 pr.p.*, 4624 *pr.p.*, 4666, 22.xi.1989 (CANB); • Brindabella Range, Mt Franklin, near Chalet, 38 km SW of Canberra, 35°30'S, 148°46'E, 1500 m alt., on schistose rock in open *Eucalyptus pauciflora* forest, *D. Verdon 3353 pr.p.*, 14.ii.1978 (CANB).

New Zealand: • South Island, Nelson, Mt Peel track, halfway between bush edge and Cobb Ridge, NZMS 260 M27:780068, 1340 m alt., on rock, *W. Malcolm 1679*, i.1994 (CANB).

5. *Buellia maficola* Elix, sp. nov.
Mycobank number: **MB 814396**

Fig. 5

Similar to *Buellia leptoclina* (Flot.) A.Massal., but differs in having a partially pigmented medulla and larger ascospores.

Type: Australia, New South Wales, Mount Canobolas State Conservation Area, W face of Mt Canobolas, 13 km SW of Orange, 33°20'17"S, 148°58'37"E, 1250 m alt., on weathered trachytic-rhyolite rocks in heath with scattered *Eucalyptus*, *J.A. Elix 45993*, 1.iv.2014 (holotype – CANB, isotype – NSW).

Thallus crustose, to 3.5 cm wide and c. 0.5 mm thick, rimose-areolate, chinky; individual areoles angular, irregular, contiguous or separate, 0.2–2.0 mm wide; upper surface

white to whitish grey, matt, esorediate, epruinose; prothallus white or not apparent; photobiont cells 8–13 µm wide; medulla white to orange-brown, lacking calcium oxalate (H₂SO₄–), white medulla I–, pigmented medulla I+ blue. *Apothecia* 0.2–0.8 mm wide, cryptolecanorine to lecideine, immersed to flush with the thallus or rarely broadly adnate; disc brown-black to black, epruinose, weakly concave at first, then ±plane; proper excipulum indistinct, persistent, concolorous with the disc, in section 35–50 µm thick, brown to brown-black, K–, N+ reddish. *Epihymenium* 10–12 µm thick, dark brown to olive-brown, K–, N–. *Hypothecium* 120–150 µm thick, dark reddish brown to brown-black, K–, N+ orange-brown. *Hymenium* 50–75 µm thick, colourless, not interspersed but with a few scattered oil droplets; paraphyses 1.5–2.4 µm wide, simple to weakly branched, capitate, with dark brown apices 4–5.5 µm wide. Asci of the *Bacidia*-type, 8-spored. *Ascospores* of the *Physconia*- then *Buellia*-type, 1-septate, olive-green to brown, ellipsoid, 14–[16.9]–23 × 7–[9.6]–12 µm, the older spores constricted at the septum, ±curved, rounded at the apices, spore wall of uniform thickness; outer spore wall finely to moderately ornamented. *Pycnidia* immersed; conidia bacilliform, straight, 4.5–7 × 1–1.5 µm.

Chemistry: Thallus K+ yellow, KC–, P–, C–, UV–; atranorin (major).

Etymology: The epithet refers to the substratum preference of this species – mafic volcanic rocks (basalt or rhyolite).

Remarks

This new species is characterized by the crustose, rimose-areolate, chinky, white to whitish grey thallus, the *Physconia*- then *Buellia*-type ascospores with an ornamented outer wall, and the presence of atranorin. *Buellia maficola* is superficially similar to *B. leptoclina* (Flot.) A.Massal., a species widespread in the Northern Hemisphere (Coppins *et al.* 2009). However, *B. leptoclina* differs in having sessile apothecia, a white, I+ blue medulla, shorter, *Physconia*-type ascospores (12–18 µm long), and an excipulum that effuses an orange solution with K. *Buellia cinnabarina* U.Grube also contains atranorin, but has a medulla containing calcium oxalate (H₂SO₄+), smaller ascospores, 13–19 × 6.5–8 µm, and a bright red subhypothecium that extends into the excipulum and effuses a yellow solution in K.

Buellia maficola is known from basic siliceous rocks in arid to subalpine areas of Queensland, New South Wales, South Australia, Lord Howe Island and Papua New Guinea. In subalpine areas associated species include *Buellia aethalea* (Ach.) Th.Fr., *B. ocellata* (Flot.) Körb., *B. homophyllia* (C.Knight) Zahlbr., *Lecidella stigmataea* (Ach.) Hertel & Leuckert, *L. sublapicida* (C.Knight) Hertel, *Notoparmelia signifera* (Nyl.) A.Crespo, Ferencova & Divakar, *Rhizocarpon geographicum* (L.) DC. and *Xanthoparmelia tasmanica* (Hook.f. & Taylor) Hale.

SPECIMENS EXAMINED

AUSTRALIA: New South Wales: • Mount Canobolas State Conservation Area, Mount Canobolas Summit Area, 13 km SW of Orange, 33°20'40"S, 148°58'56"E, 1380–1395 m alt., on trachytic-rhyolite rocks in heath with scattered *Eucalyptus* and *Acacia*, *J.A. Elix 46017*, 1.iv.2014 (CANB); • Type locality, *J. Johnston 2927*, 6.xii.1989 (CANB); *loc. id.*, *J.A. Elix 46001*, 1.iv.2014 (CANB, HO, NSW); • Mount Kosciuszko National Park, New Chums Hill, above old Kandra cemetery, 35°52'S, 148°30'E, 1460 m alt., on exposed basalt-slate rocks in subalpine grassland, *J.A. Elix 19140* & *H. Streimann pr.p.*, 10.iv.1985 (CANB); • Grey Range, Tibooburra to Cameron Corner road, 36 km NW of Tibooburra, 29°16'S, 141°41'E, 200 m alt., on exposed rocky outcrop, *H. Lepp 99020*, 2.v.1993 (CANB); • Along the Tibooburra to Cameron Corner road, 10 km W of Tibooburra, 29°27'S, 141°55'E, 200 m alt., on rocks in open area with scattered herbs and shrubs, *H. Lepp 99028*, 99032, 3.v.1993 (CANB).

South Australia: • Aroona, 31°17'S, 138°35'E, on ore samples, *G.C. Bratt 69/357*, 1969 (HO).

PAPUA NEW GUINEA: • Central Province, Hombrom Bluff, 25 km NE of Port Moresby, 9°24'S, 147°20'E, 650 m alt., on exposed conglomerate outcrop in *Eucalyptus*-dominated savannah woodland, *H. Streimann* 14981 & *E.K. Naoni*, 10.ii.1981 (CANB, H, LAE).

6. *Buellia mayrhoferae* Elix & Kantvilas, sp. nov.
Mycobank No. **MB 814397**

Fig. 6

Similar to *Buellia amandineaeformis* Elix & Kantvilas, but differs in lacking soredia and in having longer bacilliform conidia, 5–8 μm long.

Type: Australia, New South Wales, Central Coast, Newcastle, Bogey Hole, 33°08'S, 151°38'E, on waratah sandstone on coastal cliffs, *D. Mayrhofer* 11138, *H. Mayrhofer*, *E. Hierzer* & *R. Filson*, 22.vii.1992 (holotype – CANB, isotype – HO).

Thallus crustose, continuous to dispersed in patches 20–35 mm wide, rimose to areolate, individual areoles 0.1–0.5 mm wide and to 0.2 mm thick; upper surface pale tan to yellow-brown, matt, esorediate, epruinose; prothallus thin, marginal, black or not apparent; medulla white, lacking calcium oxalate (H_2SO_4^-), I–; photobiont cells 8–17 μm diam. *Apothecia* 0.1–0.5 mm wide, lecidine, scattered or crowded, immersed then broadly adnate, rarely sessile; disc black, epruinose, plane to weakly concave or weakly convex; proper exciple distinct, concolorous with the disc, persistent or excluded in older apothecia, in section 25–50 μm thick, outer zone opaque brown-black, K–, N+ orange-brown, inner zone paler brown. *Epihymenium* 12–15 μm thick, dark olive-brown to dark brown, K+ darker brown, N–. *Hypothecium* 50–100 μm thick, brown, K+ darker brown. *Hymenium* 60–90 μm thick, colourless, not interspersed; paraphyses 1.7–2.0 μm wide, simple to branched, with apices 3.5–5 μm wide and dark brown caps; asci of the *Bacidia*-type, with 8 or fewer spores. *Ascospores* briefly *Physconia*-type, then of the *Buellia*-type, 1-septate, olive-brown to brown, ellipsoid, 10–[12.9]–17 \times 5–[6.6]–8, very rarely centrally constricted at the septum; outer spore wall smooth. *Pycnidia* immersed; conidia bacilliform, straight, (5–)6–8(–10) \times 1 μm . *Chemistry:* Thallus K–, P–, C–, UV–; no lichen substances detected, or with traces of atranorin.

Etymology: This species is named in honour of the principal collector of the type specimen, Diana Mayrhofer.

Remarks

This new species is characterized by the thin, inconspicuous, pale tan to yellow-brown thallus, the numerous, scattered, small, broadly adnate apothecia, the 1-septate, *Buellia*-type ascospores, the elongate-bacilliform conidia and the lack of lichen substances or the presence of traces of atranorin. The apothecia, apothecial anatomy and chemistry of this species closely resemble those of *B. amandineaeformis* Elix & Kantvilas (Elix & Kantvilas 2013b). However, that species differs in having a granulose or sorediate thallus where the soredia develop at the eroded margins of the areoles, and, critically, by having short, bacilliform conidia, 3–4 μm long.

At present *B. mayrhoferae* is known only from the type collection. Associated species include several species of *Caloplaca*, *Paraporpidia leptocarpa* (C.Bab. & Mitt.) Rambold & Hertel and various *Xanthoparmelia* species.

7. *Buellia pannarina* Elix, sp. nov.
Mycobank number: **MB 814398**

Fig. 7

Similar to *Buellia arenaria* Müll.Arg., but differs in containing pannarin.

Type: Australia, Australian Capital Territory, Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, 1490 m alt., on sheltered schist rock ledge on exposed summit, *J.A. Elix* 19831 & *G. Rambold*, 27.i.1986 (holotype – CANB).

Thallus crustose, to 30 mm wide and 0.1 mm thick, areolate, \pm continuous; areoles contiguous or scattered, individual areoles 0.2–1.0 mm wide, irregular, \pm plane to weakly convex; upper surface whitish yellow, matt, smooth, esorediate, epruinose; prothallus prominent, marginal and between adjacent areoles, 0.5–1.0 mm wide at the periphery; photobiont cells 8–15 μm wide; medulla white, 0.5–0.9 mm thick, lacking calcium oxalate (H_2SO_4^-), I+ blue-violet. *Apothecia* 0.2–0.7 mm wide, abundant, lecidine, roundish or becoming distorted by mutual pressure, immersed at first then broadly adnate; disc black, epruinose, plane but becoming weakly convex with age; proper exciple thin, black, excluded in convex apothecia, in section 38–50 μm thick, with the outer part intensely aeruginose to greenish black, K–, N+ intense violet, the inner part brown. *Epihymenium* 12–16 μm thick, intensely blue-green, K–, N+ intense violet. *Hypothecium* 250–350 μm thick, dark brown to brown-black or blue-black, K+ yellow solution, N+ deep red-brown, red or violet in part. *Hymenium* 60–80 μm thick, colourless, not interspersed; subhymenium 25–50 μm thick, weakly aeruginose to pale brown or brown, K–, N+ orange-brown; paraphyses 1.7–2.0 μm wide, simple to weakly branched, septate, moniliform, the apices 3.5–5 μm wide, with aeruginose caps. *Asci* of the *Bacidia*-type, with 8 or fewer spores. *Ascospores* of the *Callispora*- then *Buellia*-type, 1-septate, brown to dark brown, broadly ellipsoid, 16–[22.2]–28 \times 8–[9.5]–12 μm , very rarely centrally constricted, often curved, the juvenile spores with weak medial and subapical wall-thickenings; the outer spore wall ornamented. *Pycnidia* dark brown, immersed; conidia cylindrical to weakly fusiform, straight, 5–6 \times 1–1.2 μm .

Chemistry: Medulla K+ pale yellow, C–, PD+ orange; atranorin (minor), pannarin (major).

Etymology: The specific epithet refers to the chemistry of this species.

Remarks

Morphologically this new species resembles *B. arenaria*, both having initially immersed then broadly adnate apothecia, a N+ reddish or violet epihymenium, an I+ violet medulla and relatively large, *Callispora*- or *Physconia*-type ascospores, tending toward *Buellia*-type with a finely ornamented outer wall. However, *B. arenaria* can readily be distinguished chemically because it contains 2,5,7-trichloro-3-O-methylnorlichexanthone (major) and atranorin (minor) rather than pannarin (Elix 2011). *Buellia subarenaria* Müll.Arg. is also similar, and can contain pannarin as an accessory substance, but it has significantly shorter ascospores (13–17 μm long) and contains 2,5,7-trichloro-3-O-methylnorlichexanthone as a major metabolite. *Buellia pannarina* is chemically identical to *Rinodina murrayi* H.Mayrhofer, and could be confused with it. However, *R. murrayi* differs in having persistently lecanorine apothecia, a colourless hypothecium, a pale brown, N– epihymenium, and broader (10–13 μm wide), *Milvina*-type ascospores grading into *Physcia*-type.

At present this new saxicolous species is known from only the type locality, where it occurs on schist rocks at subalpine elevations. Commonly associated species include *Lecanora farinacea* Fée, *L. polytropa* (Ehrh.) Rabenh., *Paraporpidia leptocarpa* (C.Bab. & Mitt.) Rambold & Hertel, *Poeltaria coromandelica* (Zahlbr.) Rambold & Hertel, *Ramboldia petraeoides* (C.Bab. & Mitt.) Kantvilas & Elix, *Rhizocarpon geographicum* (L.) DC., *Stereocaulon caespitosum* Redinger, *Umbilicaria cylindrica* (L.) Delise ex Duby and *Xanthoparmelia stygiodes* (Nyl. ex Cromb.) O.Blanco, A.Crespo, Elix, D.Hawksw. & Lumbsch.

New synonymy

Buellia halonia (Ach.) Tuck., *Lich. California* 26 (1866)

Buellia molonglo U.Grube & Elix, in U.Grube, H.Mayrhofer & J.A.Elix, *Bibliotheca Lichenologica* 88: 164 (2004)

Previously *B. molonglo* was distinguished from *B. halonia* by the nature of the pigments in the lower medulla (both often contained eumitrin derivatives that reacted K⁺ dark yellow in *B. molonglo* but K⁺ deep purple in *B. halonia*). In addition, they had different distributions, *B. halonia* occurring on coastal rocks but *B. molonglo* in inland localities (Elix 2011). However, as more specimens became available it was discovered that those distinctions no longer held. Within even a single population, some specimens had no pigments in their lower medulla, whereas others had K⁺ deep purple or K⁺ yellow pigments.

SPECIMENS EXAMINED

AUSTRALIA: *Western Australia:* • Cape Naturaliste, Sugarloaf Rock, on granite outcrops, *W.A. Weber L-49930*, 10.v.1968 (HO).

South Australia: • Port Victoria, Yorke Peninsula, 35°30'S, 137°29'E, 2 m alt., on rocks along foreshore, *J.A. Elix 3741*, 30.viii.1977 (CANB); • Marble Range, 28 km SW of Cummins, 34°25'S, 135°30'E, 400 m alt., on quartz rocks on rocky ridge with scattered shrubs, *J.A. Elix 41783*, 22.ix.1994 (CANB); • Kangaroo Island, mouth of De Male River, 18 km SSE of Cape Borda, 35°43'S, 136°46'E, 20 m alt., on shaded boulder in dry sclerophyll forest, *H. Streimann 55064*, 30.ix.1994 (B, CANB).

New South Wales: • Warrumbungles National Park, Split Rock Track, 36 km W of Coonabarabran, 31°16'49"S, 148°58'42"E, 430 m alt., on sandstone in *Eucalyptus-Callitris* woodland, *J.A. Elix 45451*, 12.v.2005 (CANB); • Caloola Creek, 62 km NNE of Broken Hill, 31°30'S, 141°36'E, 275 m alt., on rocks beside creek with scattered small shrubs and *Eucalyptus*, *H. Streimann 6339*, 28.ix.1978 (CANB).

Australian Capital Territory: • Molonglo Gorge Reserve, 16 km SE of Canberra, A.C.T., 35°20'S, 149°15'E, 650 m alt., on rocks along river bank, *U. Trinkaus 993 & J.A. Elix*, 24.xi.1999 (CANB, holotype of *B. molonglo*); • Mount Ainslie, Canberra, c. 680 m alt., on boulders in dry sclerophyll woodland, *W.A. Weber L-47221*, 2.xi.1967 (CANB).

Victoria: • Mt Eccles National Park, Lake Surprise, 8 km SW of Macarthur, 38°04'S, 141°56'E, 160 m alt., on basalt rocks in dry sclerophyll forest, *J.A. Elix 25990*, 15.xii.1990 (CANB); • Stony Rises, Pomborneit East Road, 17 km ESE of Camperdown, 38°18'S, 143°20'E, 150 m alt., on basalt rocks in dry sclerophyll forest, *J.A. Elix 26032*, 16.xii.1990 (CANB); • Western Plains region, Port Fairy quarry (by sea), 38°22'S, 142°15'15"E, 100 m alt., on bluestone (basalt), *W.H. Ewers s.n.*, 29.iii.1986 (CANB).

Tasmania: • Harry Walker Tier, Cockatoo Gully Road, 6.5 km W of Dysart, 42°35'S, 147°09'E, 340 m alt., on moist sandstone rocks in *Eucalyptus* woodland, *J.A. Elix 40340 & G. Kantvilas*, 11.xii.1993 (CANB).

SOUTH AFRICA: • West Cape Province, Ysterfonteinpunt, 0–20 m alt., on maritime granite rocks, *F. Brusse 2862*, 29.iv.1981 (CANB).

UNITED STATES OF AMERICA: • California, Santa Barbara County, Santa Cruz Island, W end of island, on rim of shallow barranca of coastal bluffs, *W.A. Weber & C. Bratt* (Lichenes Exsiccati no. 680, distr. Univ. Colorado Museum).

A new record for Australia

Buellia jugorum (Arnold) Arnold, *Flora* 67, 588 (1884)

This species was previously known from alpine areas in Europe (Coppins *et al.* 2009). It is characterized by the contiguous to scattered, minute, yellow to yellow-green areoles, immersed to broadly sessile apothecia where the individual areoles often bear a single apothecium, an aeruginose, N⁺ red-violet epihymenium, minutely rugu-

late, *Buellia*-type ascospores, 11–16 × 6–8.5 μm, bacilliform conidia, 6–9 × 1 μm, and the presence of arthothelin (C⁺ orange, UV⁺ orange). When well-developed, the areolate margins of *B. jugorum* become slightly placodioid. *Buellia ocellata* (Flot.) Körb. also has a N⁺ red-violet epihymenium, *Buellia*-type ascospores and contains arthothelin, but it differs in having persistently immersed apothecia, yellow-grey areoles that are typically aggregated into small patches, 10–20 mm wide, and do not become placodioid at the margins, and in having shorter, bacilliform conidia, 4–6 × 1 μm.

SPECIMENS EXAMINED

AUSTRALIA: *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 ledge on exposed summit, *J.A. Elix 19826 pr.p. & G. Rambold*, 27.i.1986 (CANB); • *ibid.*, *W.H. Ewers 4571*, 4577 *pr.p.*, 4605 *pr.p.*, 22.xi.1989 (CANB); • Brindabella Range, summit of Mt Coree, 28 km W of Canberra, 35°18'28"S, 148°48'36"E, 1420 m alt., on exposed subalpine rhyolite rocks, *W.H. Ewers 4744 (part)*, 22.xi.1989 (CANB); • Mount Scabby, summit area, Namadji National Park, 35°45'08"S, 148°54'35"E, 1809 m alt., on granite rocks, *P.M. McCarthy 4295 pr.p.*, 9.xii.2013 (CANB); • Summit of Sentry Box Mountain, Namadji National Park, 35°49'34"S, 148°54'11"E, 1720 m alt., on sheltered granite rocks, *P.M. McCarthy 4113 pr.p.*, 4122 *pr.p.*, 4257 *pr.p.*, 4303 *pr.p.*, 12.xii.2013 (CANB); • below summit of Mt Bimberi, Namadji National Park, 35°39'27"S, 148°47'20"E, 1880–1900 m alt., on granite rocks, *P.M. McCarthy 4263 pr.p.*, 12.xii.2013 (CANB).

SWEDEN: • Torne Lappmark Prov., Jukkasjärvi par., Kärkevagge, 3 km S of Låktatjokka railway station, 68°24'N, 18°20'E, 800 m alt., on small pieces of schist on a small ridge in valley with big boulders, lower alpine belt, *R. Moberg 10076 & C. Scheidegger*, 25.viii.1992 (CANB, Lichenes Selecti Exsiccati Upsalienses, no.112).

Acknowledgements

I would like to thank Jean Jarman (HO) for the photograph of *B. mayrhoferae*, and Mr H. Lepp (CANB), Dr G. Kantvilas (HO), Dr W. Malcolm (Nelson) and Dr P.M. McCarthy (Canberra) for providing key collections.

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Figure 1. *Buellia epiaeruginosa* (Streimann 53211 in CANB). Scale = 1 mm.



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



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



Figure 4. *Buellia macveanii* (Ewers 4557 in CANB). Scale = 1 mm.

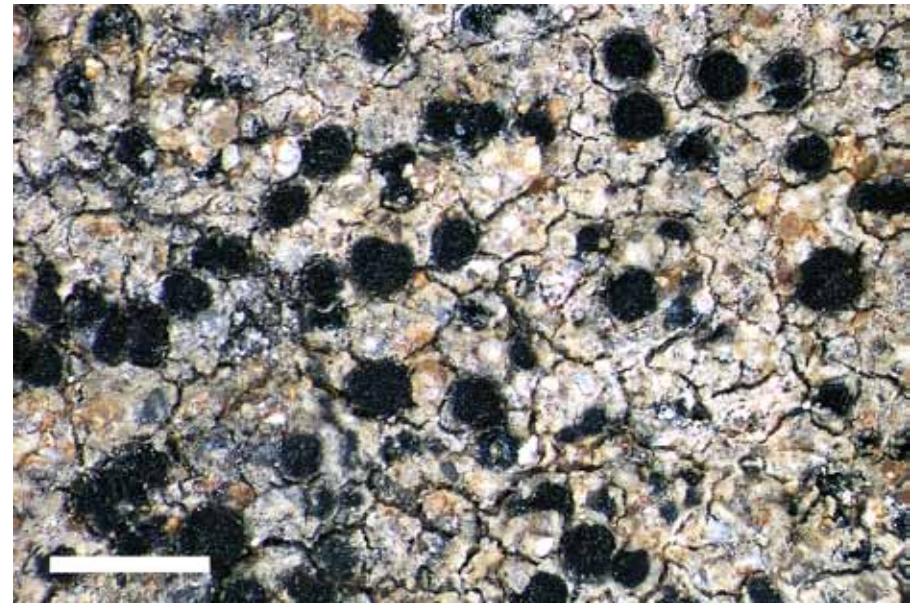


Figure 6. *Buellia mayrhoferae* (holotype in CANB). Scale = 1 mm.

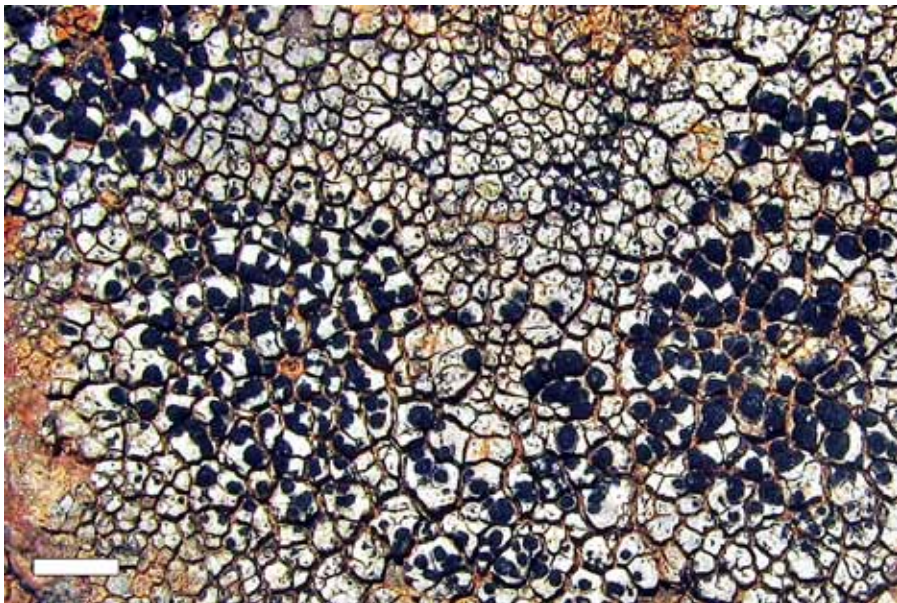


Figure 5. *Buellia maficola* (holotype in CANB). Scale = 2 mm.

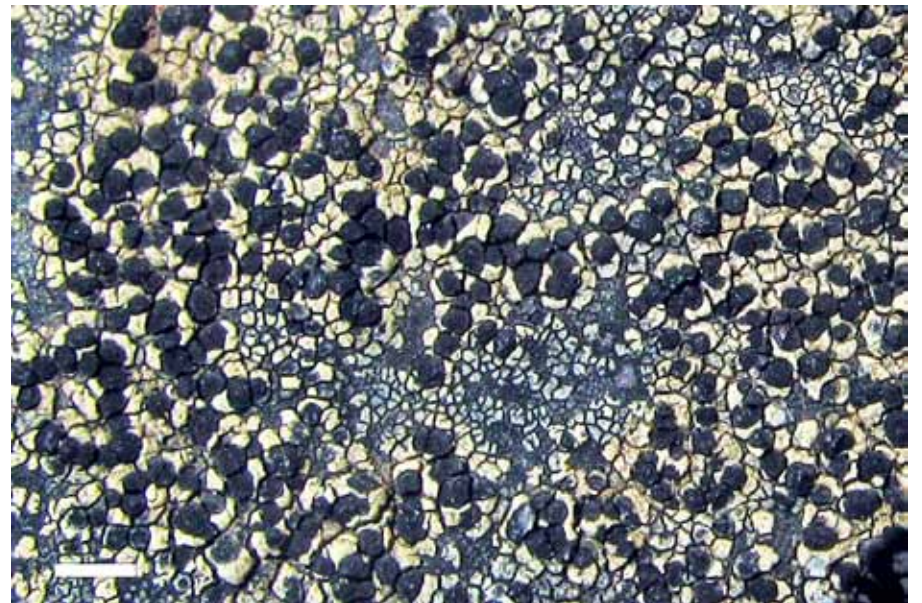


Figure 7. *Buellia pannarina* (holotype in CANB). Scale = 2 mm.

The biogeography of *Knightiella splachnirima*

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Abstract: A comprehensive, geo-referenced compilation of the known global distribution of *Knightiella splachnirima* is presented, based on herbarium records, literature, and personal observations in New Zealand and Australia (Tasmania and Victoria). *Knightiella splachnirima* probably is more widely distributed in New Zealand than current records show.

Introduction

Galloway (2000) transferred *Knightiella splachnirima* to *Icmadophila* Trevis., a change that has been widely accepted. However, a molecular-genetic reassessment of the phylogeny of the genus *Icmadophila* Trevis. (to be published elsewhere) showed that the species does not belong in *Icmadophila*. Hence, the previous name *Knightiella splachnirima* is correct, as argued earlier by Stenroos *et al.* (2002). The updated nomenclature is applied here as a prelude to a revision of the genus *Icmadophila*.

Knightiella splachnirima is endemic to south-eastern Australasia, defined here as the southern part of New Zealand, including its subantarctic off-shore islands, plus the Australian states of Tasmania and Victoria. Detailed biogeographic information on the species is difficult to compile, because it is scattered among various types of literature, a range of herbaria and ecological databases. This paper aims to provide a thorough compilation of the available information. The compilation is an essential part of my PhD study focusing on the species' reproductive ecology (Ludwig 2015), the contents of which will be published elsewhere.

Material and methods

To discover where specimens of *K. splachnirima* are currently held worldwide, searches were launched of several databases, including the New Zealand and Australian virtual herbaria, the Australian National Herbarium Specimen Information Register, the Global Biodiversity Information Facility, and the Consortium of North American Lichen Herbaria. Keywords for those searches were the currently accepted name and synonyms, including *Theleidea corrugata*, *Knightiella splachnirima* and *Icmadophila splachnirima*. Detailed specimen information has kindly been supplied by numerous herbaria (see Acknowledgements section). Additional localities and records were searched for in Dodge (1948), Dodge & Rudolph (1955), Martin (1960), Galloway (1968a+b, 1985, 2000, 2004, 2007), Fineran (1969), Bratt (1976a+b+c), Galloway & Elix (1980), Kantvilas & Seppelt (1992), Johnston (2001) and Hay *et al.* (2004). Because Otago Regional Herbarium (OTA) specimen data were not yet data-based, collection data were obtained from the herbarium packets themselves. The identities of all specimens lodged in New Zealand herbaria were verified. In addition, *K. splachnirima* was searched for in the field in New Zealand between 2010 and 2014.

A distribution map was generated with the package maps and the Pacific-centric map template "world2Hires" of freeware R 2.10.1. The geographic coordinates plotted in the map were either provided as geo-referenced public herbarium records, or manually inferred using Google Earth and topographical maps of New Zealand downloaded from either <http://www.topomap.co.nz/> or <http://www.linz.govt.nz/topography/topo-maps/index.aspx>. The coordinates of NZ herbarium specimens in NZTM or other formats were converted to the World Geodetic System 1984 (WGS84) format using the website <http://apps.linz.govt.nz/coordinate-conversion/>.

Results

All the records are compiled in Figure 1 as a global distribution map of *K. splachnirima*. The full dataset, in table form, can be downloaded as an Online Appendix

from the Dryad Data Repository (<http://datadryad.org/>). The link is <http://dx.doi.org/10.5061/dryad.43b8h/>. That dataset plus the remainder of the thesis will also be available for download, after publication, at the Otago University Research Archive <http://ourarchive.otago.ac.nz/>.

Tasmania stands out as the centre of distribution and abundance, with more than 70 sites spread over almost the entire island. In contrast, *K. splachnirima* is known from only four sites in Victoria, but they are widely scattered and include the northernmost and westernmost records in Australia. No confirmed record exists from Macquarie Island (Kantvilas & Seppelt 1992), but Dodge (1948:78) identified a poorly developed thallus as a species of *Theleidea*.

The species' known distribution is highly disjunct in New Zealand as well. It is centred around Stewart Island and the far South of the South Island, but more recently the species has been found in the north of the West Coast of the South Island. It is also known from subantarctic Auckland and Campbell Island, the latter being its southern limit. The easternmost collections were recently gathered from the Chatham Islands. Currently, no records exist for the North Island, Antipodes Island or Snares Island.

I have discovered several new localities in New Zealand, including the Blue Mountains summit plateau wetlands, Ajax Hill in the Catlins region, Bald Hill in the Longwood Range, the Heaphy Track between Karamea and Golden Bay, and Oban on Stewart Island. I have also collected specimens from three localities (Denniston Plateau near Westport, Takitimu Mts near Te Anau, and Rakeahua Flat on Stewart Island) that are reported in the literature (Galloway (1968a, 2007) but are not linked to any voucher specimens. In addition, I have collected further specimens from the Croesus Track in the Paparoa Range near Greymouth, a site that was discovered by Barbara Polly in 1999 but was not cited by Galloway (2007).

I could not find the species in the Black Swamp and Mt Maungatua sites in Otago, even though Black Swamp bog is only about 300 m diameter, and D.J. Galloway showed me the exact site on Mt Maungatua where he collected the species in 1966. Also, I could not find the species in the Awarua wetlands near Invercargill, but I visited the wetlands only briefly, and thus searched only a tiny fraction of that vast area. Unfortunately, draining of the Awarua plain by local farmers has encouraged the growth of manuka, which now forms a low forest cover over huge areas that during the 1960s were open bog (pers. comm., D.J. Galloway).

Discussion

After several years of searching for *K. splachnirima*, I am convinced that our understanding of its distribution is still incomplete, and probably will continue to be, because not only are few collectors out searching for it, but also it grows in wet and muddy sites that collectors typically avoid. I predict the discovery of many new localities along the South Island's West Coast, and the species is almost certainly present in the bogs of the Te Anau-Manapouri area (Southland), e.g. Kepler Mire just east of the Te Anau-Manapouri Aerodrome, and Dome Mire 13 km NNE of Te Anau (see Burrows & Dobson 1972). Possibly it also occurs at higher elevations on Banks Peninsula near Christchurch, even though I twice searched for it there without success. The vast boggy tussock grasslands on Antipodes Island appear suitable for the species as well, and it is likely to grow on Snares Island, if only because Stewart Island is nearby.

It should also be searched for in bogs and undisturbed subalpine areas of the North Island, e.g. Tararua and Ruahine Ranges or the Urewera National Park. Still another promising North Island site is the Kopuatai Peat Dome c. 30 km South of Thames (37°25'S, 175°34'E), an extensive lowland peat bog covering c. 10,000 hectares (Clarkson & Peters 2010, 2012). Other potential sites can be found by searching for suitable habitat in vegetation maps of New Zealand (Newsome 1987).

Although I suspect that *K. splachnirima* is much more widespread in New Zealand than current records show, I would argue that the species' current conservation status

of “Nationally Vulnerable” should not be relaxed (de Lange *et al.* 2012), because the species’ primary peat bog habitat continues to be threatened, especially in the lowlands.

In Australia, probably the species is more widespread in Victoria than records show. It should be searched for in the Australian Alps, which might well extend its range into New South Wales. King, Flinders and Cape Barren Islands, the major islands in Bass Strait north of Tasmania, could also have suitable habitats for it, although their highest points are below the elevations where it typically occurs. Clearly Tasmania is the species’ stronghold, and will be very important for its survival in a warming global climate.

Knightiella splachnirima might also occur on Macquarie Island. The island’s peaty soils and tussock grasslands are ideal habitats for it, and are already home to several other lichen species known to associate with it (Kantvilas & Seppelt 1992). Hence collectors visiting Macquarie Island should specifically search for it.

The disappearance of *K. splachnirima* from sites where it was collected in the past suggests that conservationists should assess its abundance every five or ten years. The distribution map of *K. splachnirima* presented here will be an essential reference for that task. Also in the future, the distribution data can be used to model the species’ macro-habit and potential distribution by superimposing Newsome’s (1987) vegetation cover maps and meteorological data from NIWA (National Institute of Water and Atmospheric Research) National Climate Database (<http://cliflo.niwa.co.nz>). Similar studies have been done on overseas lichens, among them the *Lecanora varia* group (McCune & Printzen 2011) and *Erioderma mollissimum* (Cameron *et al.* 2011).

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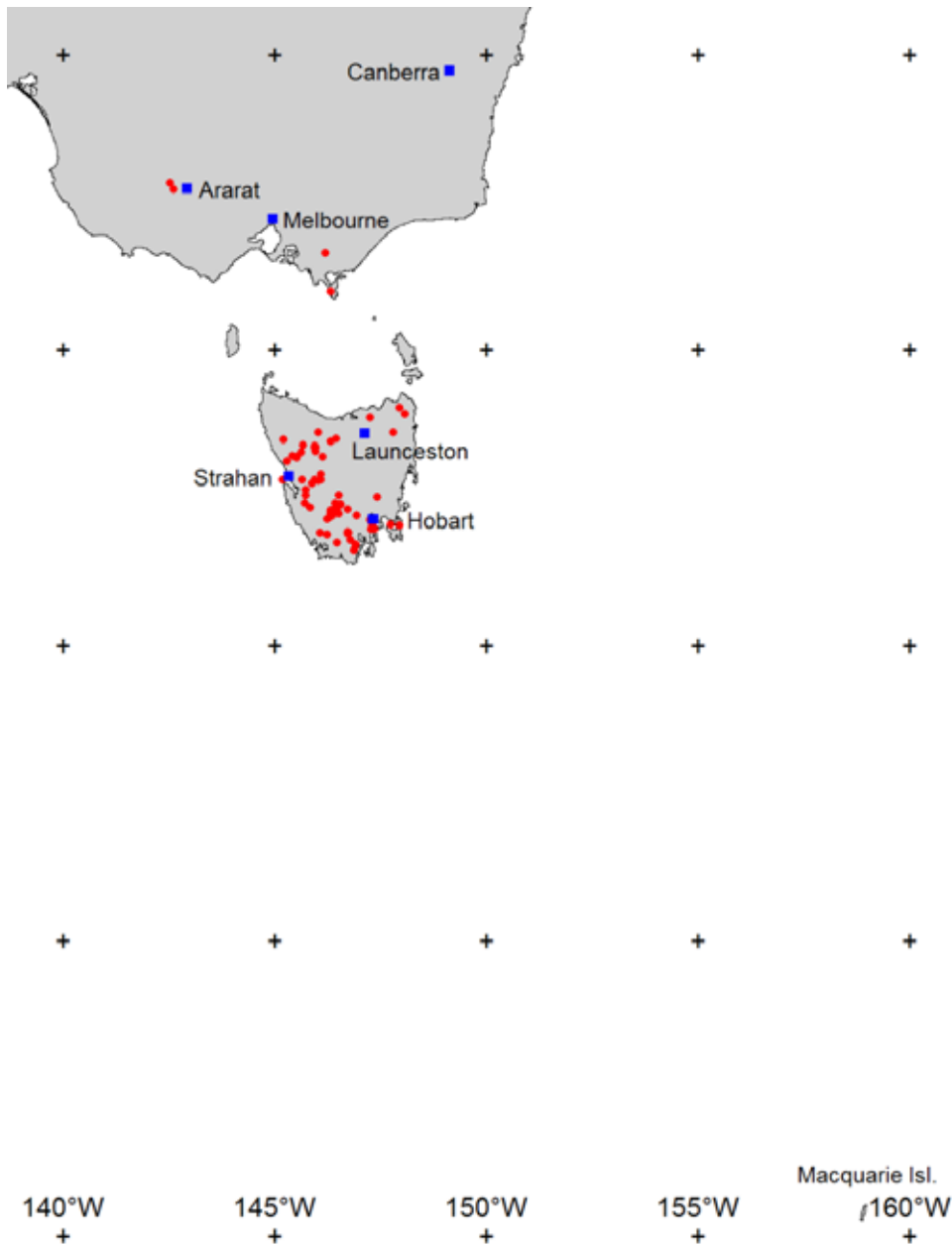
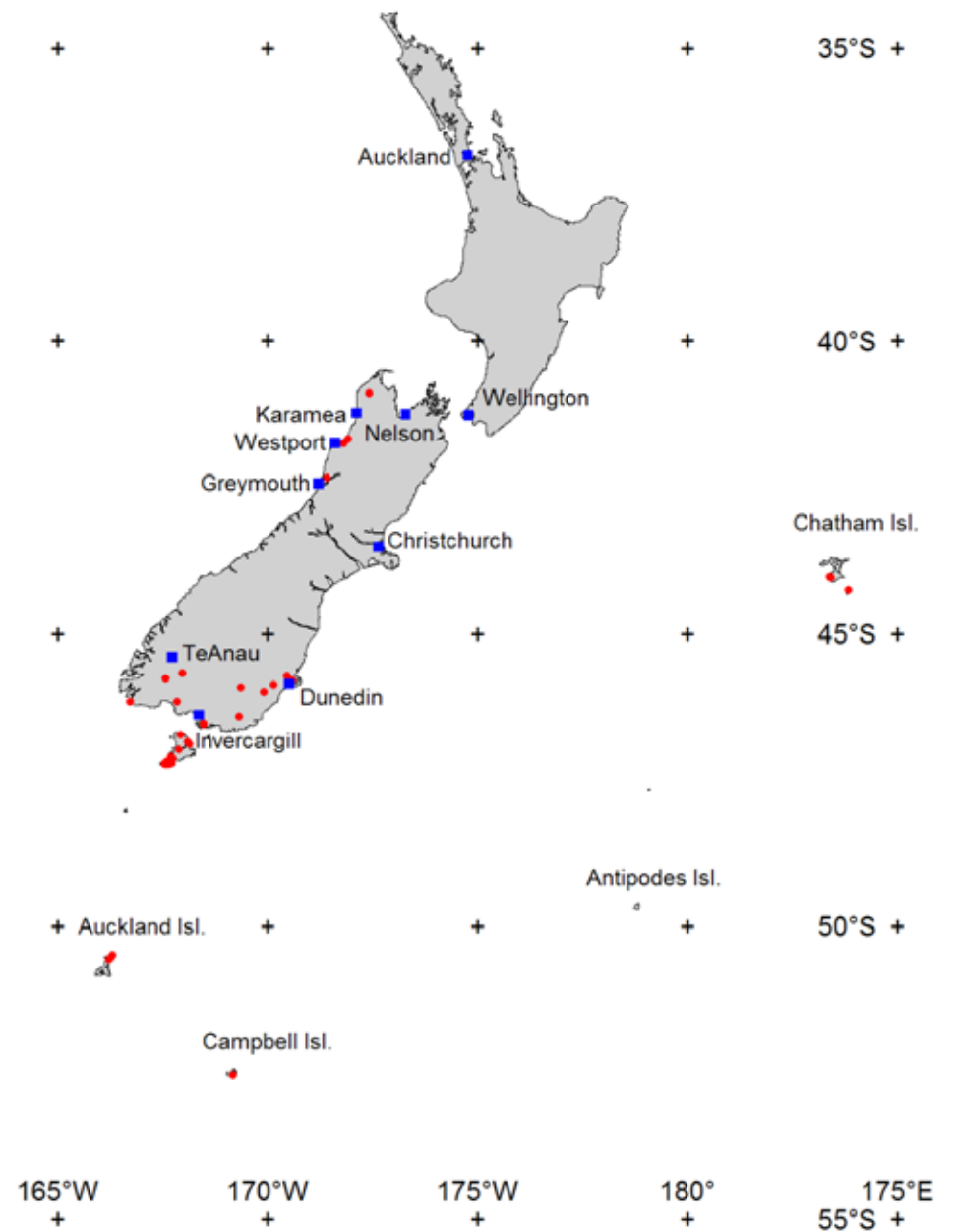


Figure 1. Dot map showing the known global distribution of *Knightiella splachnirima* in south-east Australia (Victoria and Tasmania) and New Zealand. The red dots are



known localities of the species, whereas the blue squares are cities or towns. The + symbols represent intersections of every 5th meridian and parallel.

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Ascomycota — Syllabus of Plant Families



Ascomycota, Part 1/2, *Syllabus of Plant Families*. Wolfgang Frey (editor). 2016. 322 pp., 16 colour plates, 8 figures, hardcover, 25 x 17 cm. 119 euros. www.borntraeger-cramer.com/9783443010898.

Ascomycota Part 1/2 *Syllabus of Plant Families* treats the worldwide morphological and molecular diversity of the fungal phylum Ascomycota, including lichenized forms, distributed from arctic tundra to tropical rainforests and semi-deserts, and freshwater and marine ecosystems. The volume is an updated synthesis of classical anatomical-morphological characters with modern molecular data, incorporating numerous new discoveries made during the past decade. It provides detailed descriptions of all families and genera of the Ascomycota.

Images — *Lichenes Australasici Exsiccati*

Images from *Lichenes Australasici Exsiccati* and of other characteristic Australasian lichens. Felix Schumm & John A. Elix. 2014. Norderstedt. Books on Demand GmbH, in two volumes. 1327 pages, with numerous colour figures, references and an index to species, hardcover, 21 x 15 cm. 135 euros per volume, Kindle US\$119.50 per volume.

The book includes photographs of typical Australasian lichen specimens issued and distributed as *Exsiccati* by J.A. Elix from 1982 to 1994 as well as additional species from Schumm's private herbarium. About 280 species are illustrated, almost half of them Parmeliaceae, and among them 44 species of *Xanthoparmelia*.

The aim was to make the lichens known to a wider audience than could be reached by the specimens alone. The images include not only high-quality photographs of the specimens, but also selected stained and unstained ascospore sections, spores and HPTLC plates. Each species has a brief description taken from the published volumes of the *Flora of Australia* plus specimen numbers, label details and explanations of the spots on the HPTLC plates. Because it illustrates less than 10% of the Australian lichen flora, the book is not intended for primary identification, but rather as a pictorial aid to supplement the lichen volumes of the *Flora of Australia*. In his 2015 review of the book (*Lichenologist* **47**, 349), D.J. Hill wrote "For anyone working on the Australian lichen flora and for anyone interested in lichen diversity, this book has much to offer", adding that "details of Felix Schumm's other books and...images can be found on his website www.fschumm.de".

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Drawings should be inked originals, and photographs should be sharp and clear (prints will do but negatives or transparencies are preferred). Drawings and photographs can be air-mailed or else scanned at 600 dpi and then e-mailed as TIFF (.tif) or highest-quality JPEG (.jpg) files.

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