

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

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Abstract

Buellia austera Elix & Kantvilas, *B. fallax* Elix & Kantvilas and *Endohyalina gillamsensis* Elix & Kantvilas are described as new to science. In addition, *Buellia cranwelliae* Zahlbr. is reported as new to Tasmania and Australia, and the new combination *Amandinea nebulosa* (Elix & Kantvilas) Elix & Kantvilas is made. A remarkable lichenicolous *Arthonia* infecting the apothecia of *B. austera* is also discussed.

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

The new species

1. *Buellia austera* Elix & Kantvilas, sp. nov.
Mycobank No. MB 817122

Fig. 1

Similar to *Buellia kimberleyana* Elix, but differs in having a poorly developed thallus, broader ascospores, 7–9.5 µm wide, and longer, bacilliform conidia, 8–10 µm long.

Type: Australia, Tasmania, Lovely Banks Road, 42°28'S, 147°15'E, 280 m alt., on sandstone outcrops in degraded *Eucalyptus tenuiramis* open bushland, *G. Kantvilas* 478/02, 18.ix.2002 (holotype – HO).

Thallus crustose, inconspicuous, pale dingy grey-brown to olive-brown, forming discontinuous patches to c. 100 mm wide and 0.1–0.2 mm thick, but often much thinner, effuse to ±absent and with only the apothecia apparent; prothallus absent; cortex c. 10 µm thick; medulla I–; photobiont cells 8–15 µm diam. *Apothecia* 0.1–0.5 mm wide, scattered, lecideine, broadly adnate to sessile; disc black, epruinose, plane to weakly convex; proper excipulum distinct and persistent, in section 25–40 µm thick, the outer zone dark brown to brown-black, K–, N+ orange-brown, the inner zone paler brown. *Epithemium* 8–12(–18) µm thick, dark brown to dark olive-brown, K–, N–. *Hypothecium* 20–80 µm thick, olive-brown to dark brown, K–. *Hymenium* (40–) 55–65 µm thick, colourless, not interspersed; paraphyses 1.5–2.0 µm wide, simple to branched, capitate, with apices 4–8 µm wide, dark brown; asci approximating the *Bacidia*-type, 8-spored. *Ascospores* at first of the *Physconia*-type, then of the *Buellia*-type, 1-septate, grey-green to brown, ellipsoid, 10–16 × 7–9.5 µm, not constricted at the septum; outer spore-wall smooth to faintly ornamented when old. *Pycnidia* immersed; conidia bacilliform, straight, 8–10 × 1 µm.

Chemistry. Thallus K+ red, P+ yellow or yellow-orange, best observed in squash preparations due to the thinness of the thallus; containing norstictic acid (major) and connorstictic acid (minor or trace).

Etymology: The epithet refers to the type locality, from the Latin *austerus* (harsh), a very dry, exposed habitat.

Remarks

Buellia austera is an inconspicuous species, often with little apparent thallus, and detectable mainly due to the numerous, small, sessile apothecia scattered over the surface of the rock. It is chemically identical to *Buellia kimberleyana* Elix, a widespread species on siliceous rocks in mainland Australia. However, *B. kimberleyana* differs in having a much better-developed, rimose-areolate thallus, often with a conspicuous, black, marginal prothallus, narrower ascospores, 4.5–6.5 µm wide, and short, bacilliform conidia, 4–6.5 × 0.7–1 µm (Elix 2009b). In overall thalline morphology, *B. austera* resembles *Amandinea nebulosa* (see below), but the latter differs by having asci approximating the *Lecanora*-type and in lacking norstictic acid.

The new species is known only from south-eastern Tasmania, where it occurs on dry, exposed outcrops of Triassic sandstone in rather degraded, *Eucalyptus tenuiramis*-dominated dry sclerophyll forest. That habitat tends to be rich in lichens, and associated species include several species of *Acarospora*, *Caloplaca* and *Xanthoparmelia*.

The apothecia of one of the specimens studied (*Kantvilas* 155/13) is infected by a remarkable species of *Arthonia*. In this specimen, the apothecia of the *Buellia* are frequently somewhat papillate and deformed, and the asci of the *Arthonia* are interspersed within the hymenium of the *Buellia*, rather like the case of *Arthonia intexta* Alm. infecting *Lecidella* species (Kantvilas & Wedin 2015). The *Arthonia* has clavate, eight-spored asci, 35–40 × 12–15 µm, with a well-developed tholus that is I- and KI- and lacks any amyloid ring-structure. The ascospores are ±soleiform, 1-septate, hyaline, 9–12 × 4–5 µm. Pycnidia with bacilliform conidia 5 × 1 µm were also observed with the hymenium of the *Buellia*, but whether they belong to the *Arthonia* or another organism is unclear. There are relatively few lichenicolous *Arthonia* species reported from *Buellia* (Lawrey & Diederich 2015). With respect to the dimensions of the asci, ascospores and conidia, the species studied comes close to *A. epimela* (Norm.) I.M.Lamb (Almquist 1880) as described from Scandinavia, although that species is reported from the thallus of *Amandinea punctata* (Ihlen & Wedin 2008).

SPECIMEN EXAMINED

Tasmania: • Harry Walker Tier, S of Letterbox Gully, 42°35'S 147°07'E, 320 m alt., on sandstone boulders and outcrops in dry sclerophyll woodland, *G. Kantvilas* 155/13, 30.v.2013 (HO).

2. *Buellia fallax* Elix & Kantvilas, sp. nov.
Mycobank No. MB 817123

Figs 2, 3

Similar to *Buellia procellarum* A.Massal., but differs in having smaller ascospores and a non-inspersed hymenium, and in containing hafellic acid.

Type: Australia, Tasmania, Woods Quoin, summit, 42°17'S, 147°06'E, 925 m alt., on vertical, relatively dry and sheltered dolerite rock faces, *G. Kantvilas* 58/13, 5.v.2013 (holotype – HO).

Thallus crustose, rimose-areolate, chinky to markedly bullate, matt, esorediate, white to whitish grey, epruinose, 1.5–5 cm wide and c. 1.5 mm thick; individual areoles

convex, contiguous, 0.5–2 mm wide, \pm subeffigurate at the margins; prothallus absent; cortex 10–15 μ m thick; photobiont cells 8–14 μ m wide; medulla white, containing calcium oxalate (H_2SO_4 +), I–. *Apothecia* 0.3–1.2 mm wide, lecideine, broadly adnate; disc black, epruinose, weakly concave at first, then \pm plane to weakly convex, often crowded and distorted by mutual pressure; proper excipulum distinct, persistent, black, in section 50–80 μ m thick, dark red-brown throughout. *Epithymenium* 10–20 μ m thick, dark brown to olive-brown, K–, N–. *Hypothecium* 25–35 μ m thick, dark brown. *Hymenium* 70–80 μ m thick, colourless, not inspersed; paraphyses 1.5–2.5 μ m wide, simple to weakly branched, capitate, with apices 5–6 μ m wide, dark brown. Asci of the *Bacidia*-type, 8-spored. *Ascospores* initially of the *Callispora*-type, then *Buellia*-type, 1-septate, olive-green to brown, ellipsoid, 15–22 \times 7–10 μ m, constricted at the septum, \pm slightly curved, often pointed at apices, with medial and weak subapical wall-thickenings; outer spore-wall smooth. *Pycnidia* immersed; conidia bacilliform, straight, 4–5.5 \times 1–1.2 μ m.

Chemistry: Thallus K+ yellow, P+ pale yellow, C–, UV–; atranorin (major), chloroatranorin (minor), hafelic acid (minor) and neopaludonic acid (trace).

Etymology: From the Latin *fallax* (deceptive), in reference to the cryptic habitat of the species, typically growing amongst other buellioid lichens.

Remarks

The new species is characterized by the crustose, rimose-areolate, chinky to markedly bullate, white to whitish grey thallus, the *Callispora*- then *Buellia*-type ascospores with a smooth outer wall, and the presence of atranorin and hafelic acid. *Buellia fallax* is superficially similar to *B. procellarum* A.Massal., a common saxicolous species in Australia. However, *B. procellarum* differs in having an inspersed hymenium, larger ascospores (22–40 \times 10–18 μ m) with a moderately ornamented outer spore-wall and in containing atranorin and diploicin. *Cratiria subtropica* (Elix) Elix has spores similar in size to those of *B. fallax* and contains hafelic acid, but it differs in being corticolous, in having an inspersed hymenium and ascospores with a moderately ornamented outer spore-wall. Furthermore, *C. subtropica* can contain additional norstictic acid.

The first collections of this elusive but distinctive species were made by the intrepid collector Tony Moscal from Maatsuyker Island, a difficult-to-access craggy island off Tasmania's rugged south coast. Associated species, gleaned from the diaries of the Bratt Herbarium (where the specimens were kept), include several *Caloplaca* species, among them *C. cribrata* (Hue) Zahlbr., *Flavoparmelia haysonii* (C.W.Dodge) Hale, *Lecanora flotowiana* Spreng. and *Tylothallia verrucosa* (Müll.Arg.) Kantvilas. Since then the species has been collected a few more times from sheltered underhangs on large dolerite tors in dry sclerophyll forest in south-eastern Tasmania. That habitat tends to be rather species-poor for lichens, but other lichens present on the specimens include depauperate thalli of several *Caloplaca* species, *Usnea torulosa* (Müll.Arg.) Zahlbr. and *Buellia halonia* (Ach.) Tuck. It is also known from the South Island of New Zealand.

SPECIMENS EXAMINED

Tasmania: • Goat Gully (Manning's Property), 42°21'S, 147°40'E, 200 m alt., in sheltered underhangs on dolerite, *G. Kantvilas 188/13 pr.p.*, 18.viii.2013 (HO); • Maatsuyker Island, north point, 43°39'S, 146°17'E, 15 m alt., on exposed schist, *A. Moscal [Bratt Herb. no. 76/914]*, x.1976 (HO); • Maatsuyker Island, 43°39'S, 146°17'E, 15 m alt., on schist, *A. Moscal [Bratt Herb. no. 76/915]*, x.1976 (HO).

New Zealand: • South Island, Canterbury, Banks Peninsula, Taylors Mistake, SE of Christchurch, 43°35'S, 172°47'E, on coastal rocks, *H. Mayrhofer 10808*, 4.ix.1992 (GZU).

3. *Endohyalina gillamsensis* Elix & Kantvilas, sp. nov.
Mycobank No. MB 817124

Figs 4, 5

Similar to *Endohyalina kalbii* (Giralt & Matzer) Giralt, van den Boom & Elix, but differs in having a bright yellow-green thallus and larger ascospores, and in containing xantholepinone A.

Type: Australia, Tasmania, Gillams Beach, S of Ryans Point, Recherche Bay, 43°33'S 146°54'E, 2 m alt., on large shrubs of *Leptocophylla oxycedrus* along foreshore, *G. Kantvilas 355/14*, 4.ix.2014 (holotype – HO).

Thallus crustose, bright yellow-green, epiphloeodal, continuous to rather dispersed-areolate, forming patches to c. 1.5 cm wide; individual areoles smooth to verruculose, 0.05–0.1 mm wide; prothallus generally indistinct, mainly marginal, dark grey; medulla I–; photobiont cells 7–16 μ m wide. *Apothecia* 0.2–0.9 mm wide, lecideine, broadly adnate or rarely sessile, scattered or crowded, rounded or irregular through mutual pressure; disc black, epruinose, plane then markedly convex; proper exciple thin and persistent or excluded in more convex apothecia, in section 25–50 μ m thick, with an outer dark brown to black-brown zone, K+ yellow solution, N+ intense red-brown, the inner zone paler brown. *Epithymenium* 10–17 μ m thick, dark olive-brown to olive-black, K–, N+ purple-brown. *Hypothecium* 50–100 μ m thick, red-brown, K–, N+ orange, densely inspersed with oil droplets. *Hymenium* 50–75 μ m thick, colourless, densely inspersed with oil droplets; paraphyses 1.4–1.7 μ m wide, simple to sparsely branched, with apices capitate, brown, 3–4.5 μ m wide; asci of the *Bacidia*-type, 8-spored. *Ascospores* at first of the *Serotina*-type, then of the *Pachysporaria*-type, *Dirinaria*-type or *Physconia*-type, and eventually *Cratiria*- or *Buellia*-type, 1-septate, pale olive-green to brown, (12–)14–17(–20) \times 8–10(–11) μ m, rarely weakly constricted at the septum, ultimately with apical wall-thickenings; outer spore-wall smooth. *Pycnidia* not seen.

Chemistry: Thallus K+ orange, C+ orange, P+ yellow, UV–; containing xantholepinone A (major).

Etymology: The specific epithet refers to the type locality.

Remarks

The new species is characterized by the yellow-green, smooth to verruculose, crustose thallus, lecideine apothecia with an inspersed hymenium and rather unusual ascospores, and by containing xantholepinone A. *Endohyalina kalbii* is similar in having juvenile *Dirinaria*-type ascospores and in lacking diploicin, a compound frequently found in the genus (it contains secalononic acid A as a major substance), but differs in that the mature ascospores are smaller (11–16 \times 5–8 μ m) and of *Pachysporaria*-type, and the thallus is brown rather than yellow (Giralt *et al.* 2009). Xantholepinone A also occurs in the saxicolous *E. arachniformis* Elix & Kantvilas, but that species contains additional diploicin, has a conspicuous, dark brown to black, marginal prothallus and ascospores of *Dirinaria*-type that grade into *Mischoblastia*- or *Physcia*-type. Initially, the juvenile ascospores of *E. gillamsensis* approximate the *Serotina*-type where they develop two globose-shaped lumina with an interconnecting canal, transitioning to *Pachysporaria*-, *Dirinaria*- or *Physconia*-type spores, and ultimately to *Cratiria*- or *Buellia*-type spores with definite apical wall-thickenings but obscure internal lumina. The younger ascospores of *E. gillamsensis* are very similar to those of *Sculptolumina serotina* (Malme) Marbach, but that species differs in having larger ascospores ([16–]18–22[–27] \times [8–]9–12[–14] μ m) and in containing lobaric acid and an unknown secalononic acid derivative (Marbach 2000).

At present *E. gillamsensis* is only known from the type locality, where it grows on the rather coarse, fibrous bark of unusually large individuals of the Epacridaceous shrub *Leptocophylla* in rather damp, shaded coastal scrub immediately above the high tide mark.

A new combination

Amandinea nebulosa (Elix & Kantvilas) Elix & Kantvilas, comb. nov.
MycoBank No. **MB 817875**

Basionym: *Buellia nebulosa* Elix & Kantvilas, *Australas. Lichenol.* **73**, 28 (2013).
Amandinea nebulosa is a very inconspicuous lichen, often with little apparent thallus and detectable mainly by the numerous, minute, sessile apothecia scattered over the surface of the rock. Older apothecia become markedly convex and seemingly imarginate. The new generic placement of this species follows the discovery of pycnidia and conidia in the isotype specimen (CANB). The pycnidia are minute, black and partially immersed, and the conidia are filiform and curved, $13\text{--}17 \times 0.7\text{--}1 \mu\text{m}$, consistent with the genus *Amandinea*. A detailed description is given in Elix & Kantvilas (2013b).

New record for Australia

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

This species was previously known from New Zealand (Galloway 2007) and Norfolk Island (Elix 2016). It is characterized by a white crustose thallus that is \pm sublobate or placodioid at the margins, a white medulla containing calcium oxalate (H_2SO_4^+), 8-spored asci, a dark brown, N+ greenish-black excipulum, 1-septate, olive-brown to brown, ellipsoid ascospores initially of the *Physconia*-type, then of the *Buellia*-type, $(10\text{--})11\text{--}16(\text{--}18) \times 5\text{--}8(\text{--}10) \mu\text{m}$, that are rarely weakly constricted at the septum and have a smooth outer wall, and the straight, bacilliform conidia, $3\text{--}5 \times 1\text{--}1.2 \mu\text{m}$. The thallus lacks lichen substances. A detailed description is given in Elix (2016).

SPECIMENS EXAMINED

New South Wales: • Glasshouse Rocks, 2 km S of Narooma, $36^\circ 13' 39''\text{S}$, $150^\circ 08' 25''\text{E}$, 1–5 m alt., on coastal shale rocks in the splash zone, *J.A. Elix 46105, 46112, 46115*, 9.ii.2016 (CANB); • Camel Rock, 5 km N of Bermagui, $36^\circ 22' 41''\text{S}$, $150^\circ 04' 37''\text{E}$, 1–5 m alt., on coastal rocks in the splash zone, *J.A. Elix 46118, 46122*, 10.ii.2016 (CANB); • Keating Rocks, c. 1.5 km N of Bermagui, $36^\circ 24' 54''\text{S}$, $150^\circ 03' 55''\text{E}$, 1–5 m alt., on coastal slate rocks in the splash zone, *J.A. Elix 46143*, 10.ii.2016 (CANB).

Tasmania: • Between mouths of Italian and Lagoon Rivers, Dago Plains vicinity, $41^\circ 30'\text{S}$, $144^\circ 49'\text{E}$, 5 m alt., on coastal rocks, *G. Kantvilas 120/15, 129/15*, 30.i.2015 (HO).

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Figure 1. *Buellia austera* (holotype in HO). Scale bar = 1 mm.



Figure 2. *Buellia fallax* (holotype in HO). Scale bar = 1 mm.

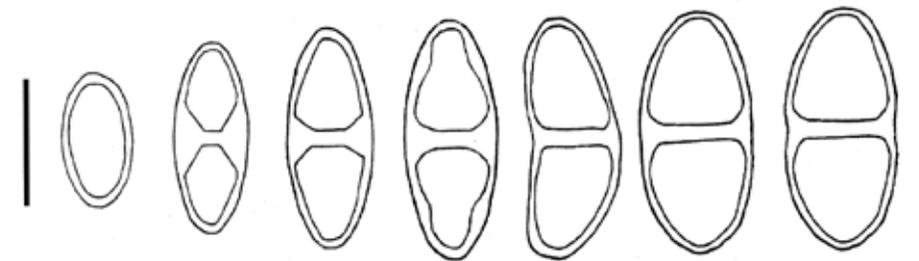


Figure 3. Ascospore ontogeny of *B. fallax*. Scale bar = 10 μ m.

Five new saxicolous species of *Amandinea* (Ascomycota, Physciaceae) from New Zealand and southern Australia

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Abstract

Amandinea australasica Blaha, H.Mayrhofer & Elix, *A. brunneola* Elix & H.Mayrhofer, *A. julianeae* H.Mayrhofer & Elix, *A. variabilis* Elix, Blaha & H.Mayrhofer and *A. vitellina* Blaha, H.Mayrhofer & Elix are described as new to science. *Amandinea julianeae* has been found in New Zealand and Norfolk Island, but the other four new species also occur in southern Australia. The new combinations *Amandinea decedens* (Nyl.) Blaha, H.Mayrhofer & Elix, *A. litoralis* (Zahlbr.) Elix & H.Mayrhofer and *A. otagensis* (Zahlbr.) Blaha, H.Mayrhofer & Elix are made. *Amandinea litoralis*, together with the previously poorly understood *A. fuscostratula* (Zahlbr.) Elix and *A. nitrophila* (Zahlbr.) Elix, are re-circumscribed, and a key to the saxicolous species of *Amandinea* in New Zealand is provided.

In his revised second edition of the *Flora of New Zealand*, Galloway reported seven species of *Amandinea* (Galloway, 2007), four of which occur on rock. Since that time, *Amandinea fuscostratula* (Zahlbr.) Elix and *A. nitrophila* (Zahlbr.) Elix, previously listed under *Buellia*, have been added (Elix *et al.* 2015) and a new species, *A. austroconiops* Elix & Kantvilas, described (Elix & Kantvilas 2016). In this paper, we describe five new saxicolous species of *Amandinea*, all of which occur in New Zealand. Four of those species also occur in Tasmania, three in mainland Australia and two in Norfolk Island.

Methods

Observations and measurements of photobiont cells, thallus and apothecium anatomy, asci, ascospores and conidia 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 pre-treatment 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 species

1. *Amandinea australasica* Blaha, H.Mayrhofer & Elix, sp. nov. MycoBank No. **MB 816942**

Figs 1, 2

Similar to *Amandinea punctata* (Hoffm.) Coppins & Scheid., but differs in having a better-developed thallus, longer conidia and smaller ascospores that exhibit weak medial wall-thickenings in early ontogeny (*Physconia*-type), and become constricted at the septum when mature.

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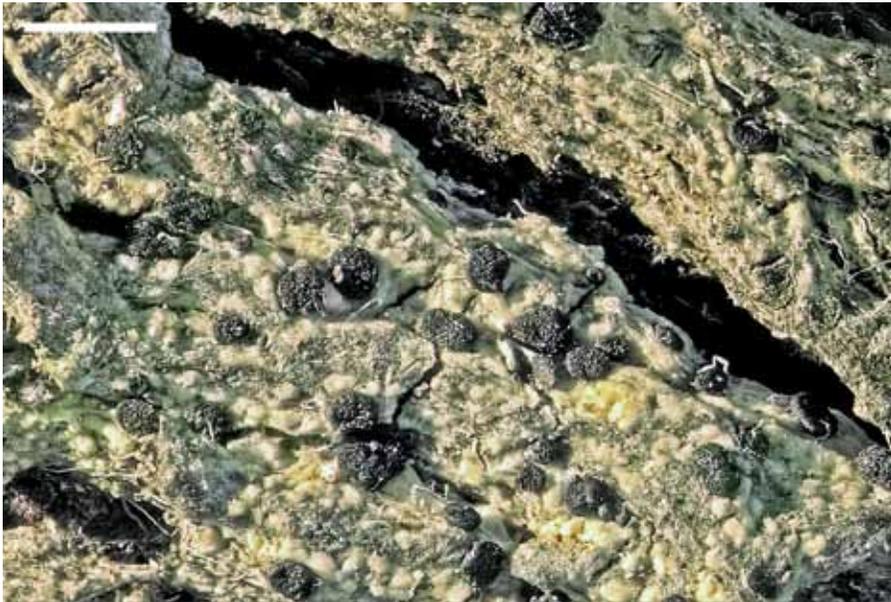


Figure 4. *Endohyalina gillamsensis* (holotype in HO). Scale bar = 1 mm.

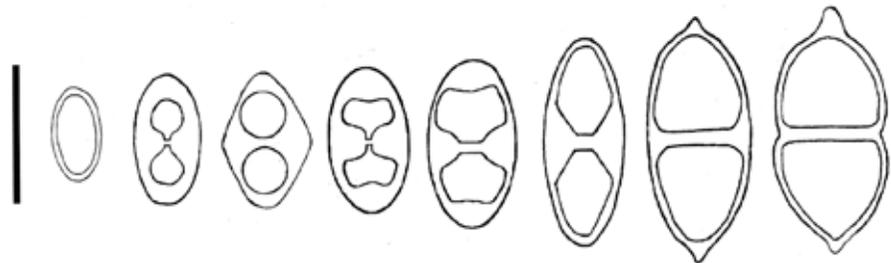


Figure 5. Ascospore ontogeny of *E. gillamsensis*. Scale bar = 10 µm.