

**Three new species of buellioid lichens (Caliciaceae, Ascomycota) from south-eastern Australia**

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**Abstract**

*Amandinea bittangabeensis* Elix & P.M.McCarthy, *A. hypohyalina* Elix & P.M.McCarthy and *Buellia quarryana* Elix & P.M.McCarthy are described as new to science.

**Introduction**

This paper continues our investigation of *Buellia*-like lichens in Australia. For the more recent additions, see Elix *et al.* (2017) and Elix & McCarthy (2018) and references cited therein. In this paper, we describe two new saxicolous species of *Amandinea* and one of *Buellia* in the broad sense. Methods are as described in the previous papers cited above.

**1. *Amandinea bittangabeensis*** Elix & P.M.McCarthy, sp. nov. Fig. 1  
Mycobank No. **MB 832303**

Similar to *Amandinea litoralis* (Zahlbr.) H.Mayrhofer & Elix, but differs in having a subhymenium that is densely interspersed with oil droplets, smaller apothecia, 0.1–0.4 mm wide, a cupular excipulum and a shallow hypothecium, 40–65 µm high.

*Type:* Australia, New South Wales, Ben Boyd National Park, Bittangabee Bay, 37°13'00"S, 150°01'04"E, 1–3 m alt., on coastal sandstone rocks in the spray zone, *J.A. Elix 46573*, 21.iii.2018 (holotype – CANB).

*Thallus* crustose, continuous, areolate to subsquamulose, to 30 mm wide and 1 mm thick; individual areoles rounded to irregular, 0.1–0.4 mm wide, sometimes becoming aggregated and imbricate to form a secondary warted or subsquamulose crust; upper surface grey-green to grey-brown or olive-brown, matt; prothallus not apparent; medulla white, lacking calcium oxalate (H<sub>2</sub>SO<sub>4</sub>-), I-; photobiont cells 5–14 µm diam. *Apothecia* 0.1–0.4 mm wide, lecideine, immersed then broadly adnate, more rarely sessile and constricted at the base, isolated or crowded, rounded, rarely becoming distorted by mutual pressure; disc black, epruinose, weakly concave then plane; proper excipulum thin, tumid at first, persistent, cupular in section, the outer zone brown-black, K-, N-, 25–35 µm thick; inner zone pale brown to colourless. *Epihymenium* 10–15 µm thick, brown to dark brown, K-, N-. *Hypothecium* brown-black, 40–65 µm thick, K-. *Hymenium* 60–80 µm thick, colourless, not interspersed; subhymenium 25–35 µm thick, colourless to pale brown, densely interspersed with oil droplets; paraphyses 1.2–1.5(-2) µm wide, sparsely branched, with apices 3–4 µm wide and brown caps. *Asci* of the *Bacidia*-type, with 8 spores. *Ascospores* *Physconia*-type when immature, *Buellia*-type when mature, brown, ellipsoid, 12–[13.8]–17 × 6–[6.5]–9 µm, ± curved; older spores constricted at the septum; outer spore-wall weakly ornamented. *Pycnidia* immersed; ostiole black. *Conidia* filiform, curved, 20–30 × 0.7–1 µm.

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

*Etymology:* The species is named after the type locality.

**Remarks**

The species is characterized by the crustose, areolate to subsquamulose, grey-green to grey-

brown or olive-brown thallus, the immersed then broadly adnate apothecia, the non-amyloid medulla, an interspersed subhymenium, the 1-septate, *Physconia*- then *Buellia*-type ascospores, 12–17 × 6–9 µm, curved, filiform conidia, 20–30 µm long, and the absence of lichen substances. Morphologically, it can resemble specimens of *A. litoralis*, but that species lacks an interspersed subhymenium and has an annular excipulum with a deep hypothecium, 120–200 µm high, which forms a stipe (Blaah *et al.* 2016). Subsquamulose specimens of *A. bittangabeensis* can resemble free-living forms of *Monerolechia badia* (Fr.) Kalb, but that species has shorter ascospores, 10–[11.8]–15 × 6–[6.5]–8 µm, bacilliform conidia, 3.0–5.0 × 1.0–1.5 µm, and it has a non-interspersed subhymenium (Elix 2011).

*Amandinea bittangabeensis* is known from siliceous rocks in coastal regions of eastern Australia (Queensland, New South Wales, Tasmania). Associated species include *Buellia halonia* (Ach.) Tuck., *B. spuria* var. *amblyogona* (Müll.Arg.) Elix, *B. stellulata* (Taylor) Mudd var. *stellulata*, *B. stellulata* var. *tasmanica* Elix & Kantvilas, *Caloplaca eos* S.Y.Kondr. & Kärnefelt, *C. gallowayi* S.Y.Kondr. *et al.*, *Halecania subsquamulosa* (Müll.Arg.) van den Boom & H.Mayrhofer, *Pertusaria xanthoplaca* Müll.Arg., *Rinodina oxydata* (A.Massal.) A.Massal. and *Jackelisia ligulata* (Körb.) S.Y.Kondr. & Kärnefelt.

**SPECIMENS EXAMINED**

*Queensland:* ● North Stradbroke Island, Point Lookout, 27°26'S, 153°33'E, 30 m alt., on cliff faces on seashore, *J. Hafellner 15623*, 10.viii.1986 (GZU). *New South Wales:* ● Type locality, 1–3 m alt., on coastal sandstone rocks in the spray zone, *J.A. Elix 46586*, 21.iii.2018 (CANB); ● Ben Boyd National Park, Green Cape, adjacent to lighthouse, 37°13'00"S, 150°01'04"E, 10–15 m alt., on coastal sandstone rocks in the spray zone, *J.A. Elix 46574*, 21.iii.2018 (GZU). *Tasmania:* ● Crocodile Rock, Mt Wellington, 42°53'S, 147°15'E, 650 m alt., in an overhang on a sandstone bluff in open *Eucalyptus* forest, *G. Kantvilas 4/18*, 1.i.2018 (HO).

**2. *Amandinea hypohyalina*** Elix & P.M.McCarthy, sp. nov. Fig. 2  
Mycobank No. **MB 832304**

Similar to *Amandinea nebulosa* (Elix & Kantvilas) Elix & Kantvilas, but differs in having a colourless hypothecium, a subhymenium interspersed with granules, and somewhat smaller ascospores.

*Type:* Australia, Australian Capital Territory, Aranda, trail to Aranda Bushland, 4 km W of Canberra, 35°15'32"S, 149°04'53"E, 672 m alt., on sandstone rocks in dry *Eucalyptus* woodland, *J.A. Elix 46770*, 8.vii.2019 (holotype – CANB).

*Thallus* to 15 mm wide, endolithic and not apparent or epilithic, areolate, discontinuous; areoles irregular, angular to fleck-like, 0.1–0.4 mm wide, upper surface off-white, matt; prothallus effuse, dark grey or not apparent; photobiont cells 8–18 µm wide; medulla lacking calcium oxalate (H<sub>2</sub>SO<sub>4</sub>-), I-. *Apothecia* 0.05–0.4 mm wide, lecideine, roundish, scattered, broadly adnate then sessile; disc black, epruinose, plane to markedly convex; proper excipulum thin, excluded in older, convex apothecia, in section 15–20 µm thick; outer part brown to dark brown, K-, N-; inner part colourless. *Epihymenium* 10–12 µm thick, brown, N-. *Hypothecium* 40–50 µm thick, colourless. *Hymenium* 50–75 µm thick, colourless, not interspersed; subhymenium 10–12 µm thick, colourless, interspersed with granules; paraphyses 1–2 µm wide, sparingly branched, with apices 4–6 µm wide and brown caps. *Asci* 8-spored, *Bacidia*-type. *Ascospores* *Physconia*- then *Buellia*-type, 1-septate, pale brown then dark brown, ellipsoid, 9–[11.1]–13 × 5–[5.9]–8 µm, becoming constricted at the septum; outer wall smooth to finely ornamented. *Pycnidia* rare, punctiform, immersed; ostiole black. *Conidia* curved, filiform, 16–24 × 0.7–1 µm.

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

*Etymology:* The species is named after its colourless hypothecium.

## Remarks

The endolithic or poorly developed, very thin, discontinuous thallus resembles the endemic *A. nebulosa*, as both species are dominated by very small, broadly adnate to sessile apothecia. However, *A. nebulosa* has a dark brown hypothecium, a subhymenium that lacks granules and somewhat larger ascospores, 10–[11.6]–14 × 5–[6.4]–9 µm (Elix & Kantvilas 2013, as *Buellia nebulosa*). *Amandinea hypohyalina* could also be confused with the Australasian *Buellia suttonensis* Elix & A. Knight, but the latter differs in having a brown to dark brown hypothecium as well as bacilliform conidia (Elix & Knight 2017).

The new species is known from southern New South Wales and the Australian Capital Territory. Commonly associated lichens include *Buellia spuria* var. *amblyogona* (Müll.Arg.) Elix, *B. amandineaiformis* Elix & Kantvilas, *B. suttonensis*, *Lecidea sarcogynoides* Körb., *L. terrena* Nyl., *Trapelia concentrica* Elix & P.M. McCarthy and *Xanthoparmelia* sp.

## SPECIMENS EXAMINED

*Australian Capital Territory*: ● Woodstock Nature Reserve, Shepherds Lookout Walk, 20 km WNW of Canberra, 35°14'34"S, 148°58'38"E, 555 m alt., on porphyry pebbles in open *Eucalyptus-Callitris* woodland, *J.A. Elix 46678*, 17.viii.2018 (CANB); ● Kowen Rd, Kowen Forest, 11.7 km E of Canberra, 35°19'02"S, 149°15'07"E, 700 m alt., on sandstone rocks in open *Eucalyptus* woodland, *J.A. Elix 46780*, 9.i.2019 (CANB). *New South Wales*: ● Collector-Gundaroo road, 3 km WSW of Collector, 34°55'12"S, 149°24'19"E, 630 m alt., on roadside rocks in dry *Eucalyptus* woodland, *P.M. McCarthy 4862*, 22.v.2019 (CANB); ● Gooloogong-Grenfell road, 5 km N of Grenfell, 33°51'16"S, 148°10'37"E, 385 m alt., on consolidated clay in *Eucalyptus-Callitris* woodland, *J.A. Elix 46831*, 2.x.2019 (CANB, HO, NSW).

**3. *Buellia quarryana*** Elix & P.M. McCarthy, sp. nov. Fig. 3  
Mycobank No. **MB 832305**

Similar to *Buellia ferax* Müll.Arg., but differs in having smaller apothecia, 0.1–0.5 mm wide, and smaller ascospores, 9–12 × 5–7 µm.

*Type*: Australia, Victoria, East Gippsland, Quarry Beach, 6 km SW of Mallacoota, near airfield, 37°36'03"S, 149°43'41"E, 1–3 m alt., on siliceous rocks along the seashore, *J.A. Elix 46271* & *P.M. McCarthy*, 30.x.2016 (holotype – CANB).

*Thallus* crustose, forming extended patches to 30 mm wide, endolithic and not apparent or epilithic, very thin and membranaceous, forming a thin grey-white film over the substratum; prothallus absent; medulla white, very thin, containing calcium oxalate (H<sub>2</sub>SO<sub>4</sub>+), I–, K+ red-orange in patches; photobiont cells 10–19 µm wide. *Apothecia* 0.1–0.5 mm wide, lecidine, broadly adnate to sessile, scattered or crowded, rounded or often irregularly shaped; disc black, epruinose, weakly concave to plane or weakly convex; proper excipulum distinct, thick, persistent, in section 25–40 µm thick, with an outer zone brown-black to green-black, K+ yellow soon forming red, needle-like crystals or K–, paler red-brown within. *Epithymenium* 10–12 µm thick, dark brown to greenish black, N– or N+ dark brown. *Hypothecium* 75–100 µm thick, dark brown to brown-black. *Hymenium* 50–60 µm thick, colourless, not interspersed with oil droplets or granules; subhymenium 20–30 µm thick, pale brown to brown, not interspersed; paraphyses 1.2–1.5 µm wide, simple to moderately branched, capitate; apices 4–6 µm wide, with dark brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores* of the *Buellia*-type, 1-septate, pale olive-green to brown, ellipsoid, 9–[10.5]–12 × 5–[5.7]–7 µm, becoming constricted at the septum; outer spore wall microrugulate. *Pycnidia* immersed; ostiole black. *Conidia* bacilliform to ellipsoid, 4–6 × 1–2 µm.

*Chemistry*: Excipulum K+ yellow then red, C–, PD+ orange, UV–; containing norstictic acid (major), connorstictic acid (trace) by TLC.

*Etymology*: The species is named after the type locality.

## Remarks

The new species is characterized by the numerous minute, black, broadly adnate to sessile apothecia, by the endolithic thallus, the *Buellia*-type ascospores, 9–12 × 5–7 µm, the non-interspersed hymenium and subhymenium, the bacilliform to ellipsoid conidia, 4–6 × 1–2 µm, and by the presence of norstictic acid. In many respects, it closely resembles *Buellia ferax*, in that both contain norstictic acid, have rudimentary or endolithic thalli and *Buellia*-type ascospores. However, the latter has larger ascospores, 10–[12.6]–15 × 5–[6.2]–8 µm, and larger apothecia, to 1.2 mm wide (Elix & McCarthy 2018). Morphologically, *B. quarryana* resembles poorly developed specimens of *B. austroabstracta* Elix & Kantvilas, but the latter lacks lichen substances (Elix et al. 2017).

*Buellia quarryana* is a coastal species known from southern New South Wales and Victoria where it is associated with typical littoral species including *Buellia aeruginosa* A. Nordin, Owe-Larsson & Elix, *B. stellulata* (Taylor) Mudd var. *stellulata*, *Catillaria australittoralis* Kantvilas & van den Boom, *Jackelixia ligulata* (Körb.) S.Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt & A. Thell, *Pertusaria melanospora* var. *sorediata* Elix & A.W. Archer, *Rinodina blastidiata* Matzer & H. Mayrhofer, *Rinodinella fertilis* (Körb.) Elix, *Tylothallia verrucosa* (Müll.Arg.) Kantvilas and *Xanthoparmelia australasica* D.J. Galloway.

## SPECIMENS EXAMINED

*New South Wales*: ● South Coast, Gerringong, Warrai Beach near Penguin Head, Culburra, 34°55'59"S, 150°46'46"E, 1–3 m alt., on S-facing sandstone rocks along the foreshore, *J.A. Elix 46380*, 18.iv.2017 (CANB); ● 1 km S of Plantation Point, Vincentia, Jervis Bay, 35°04'22"S, 150°41'41"E, 1–3 m alt., on sandstone rocks along the foreshore, *J.A. Elix 46409*, 23.v.2017 (CANB).

## Acknowledgements

We thank Helmut Mayrhofer and Walter Obermayer (GZU), Gintaras Kantvilas (HO), and the curators of CANB for their kind cooperation in providing loans of key collections.

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

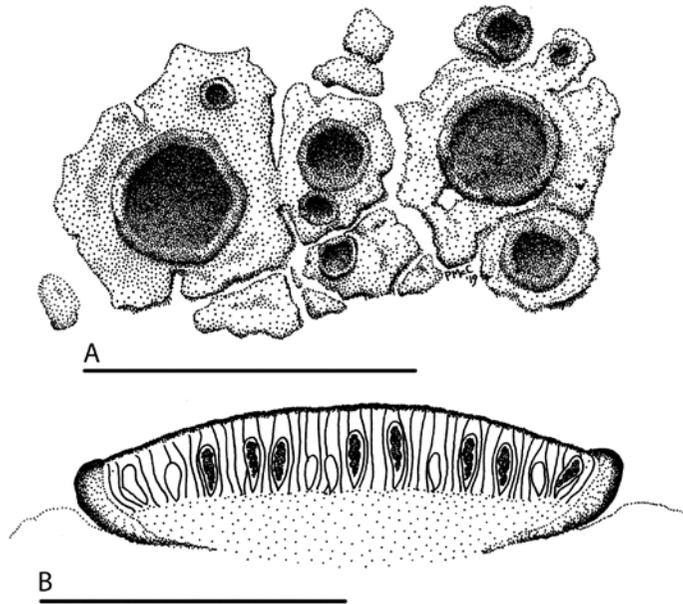


Figure 2. *Amandinea hypohyalina* (A = McCarthy 4862 in CANB; B = Elix 46678 in CANB). Scales: A = 0.5 mm, B = 0.2 mm.

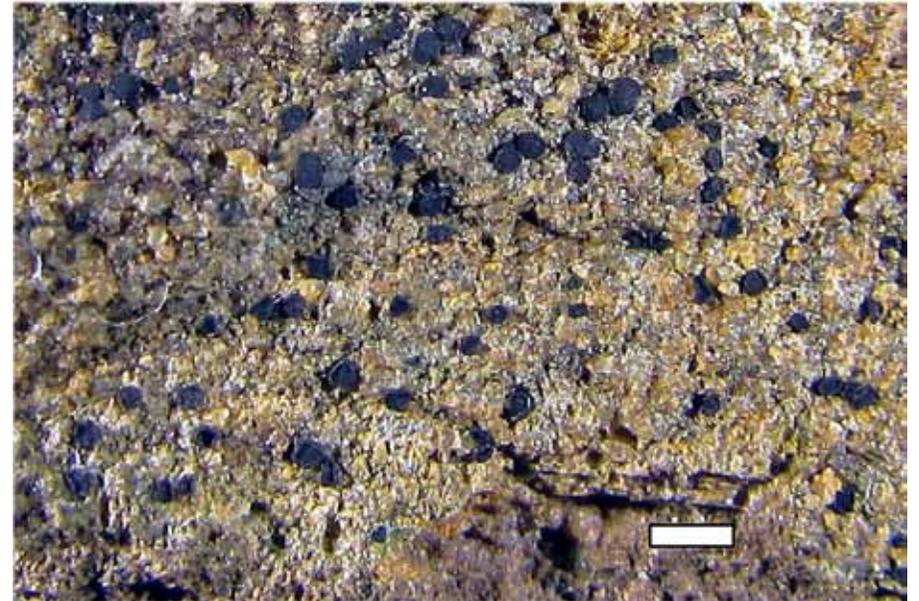


Figure 3. *Buellia quarryana* (holotype in CANB). Scale = 1 mm.