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Abstract

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

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

The new species

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

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

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

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

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

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

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

Remarks

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

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

SPECIMENS EXAMINED

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

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

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

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

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

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

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

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

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

Etymology: The species is named after the type locality.

Remarks

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

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

3. *Buellia weberi* Elix, sp. nov.
MycoBank number: **MB 818436**

Fig. 5

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

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

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

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

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

Remarks

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

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

New record and new combination

***Amandinea prospersa* (Nyl.) Elix & H.Mayrhofer, comb. nov.**
MycoBank number: **MB 818437**

Figs 6–8

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

Type: United States, Virgin Islands. Saint Thomas, *Dr Forel*, 1878 (H – lectotype, herb. NYL 9312! *vide* F.Bungartz, T.H.Nash III & B.D.Ryan, *Can. J. Bot.* 82, 544. 2004). For further synonyms see Imshaug (1955).

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

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

SPECIMENS EXAMINED

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

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

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



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



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



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



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

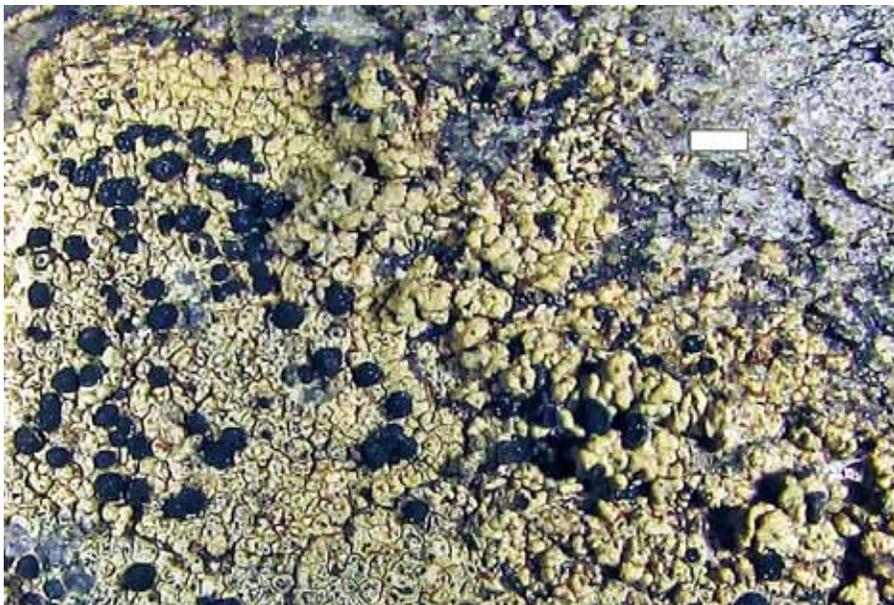


Figure 6. *Amandinea prospersa* (H. Mayrhofer 11367 & E. Hierzer in GZU). Scale = 1 mm.



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

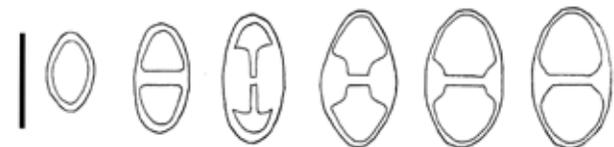


Figure 8. Ascospore ontogeny of *A. pelidna*. Scale = 10 μ m.