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. Fig. 1
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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 (H_2SO_4–), 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 inspersed, 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. Fig. 2
MycoBank number: **MB 814393**

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 (H_2SO_4–), 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 inspersed, 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. Fig. 3

MycoBank number: **MB 814394**

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 (H_2SO_4–), 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 inspersed 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 (H_2SO_4+), and non-constricted ascospores. Furthermore, it grows on a variety of siliceous rock substrata rather than limestone. *Buellia homophylia* (C.Knight) Zalhbr., 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. Fig. 4

MycoBank number: **MB 814395**

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 (H_2SO_4–), 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 inspersed; 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*-methylarthothelin (major), arthothelin (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 arthothelin (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. lygomma* 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. Fig. 5
MycoBank number: **MB 814396**

Similar to *Buellia leptocline* (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 (H_2SO_4–), 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 inspersed 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. leptocline* (Flot.) A.Massal., a species widespread in the Northern Hemisphere (Coppins *et al.* 2009). However, *B. leptocline* 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 (H_2SO_4+), 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. homophylia* (C.Knight) Zahlbr., *Lecidella stigmatea* (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 Kiandra 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. Fig. 6
MycoBank No. **MB 814397**

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, lecideine, 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 inspersed; 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 × 5–[*6.6*]–8, very rarely constricted at the septum; outer spore wall smooth. *Pycnidia* immersed; conidia bacilliform, straight, (5–)6–8(–10) × 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. Fig. 7
MycoBank number: **MB 814398**

Similar to *Buelliae 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, ±continuous; areoles contiguous or scattered, individual areoles 0.2–1.0 mm wide, irregular, ±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, lecideine, 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 inspersed; 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 × 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 × 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), *Milvinia*-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, *Poeltiaria 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 ruguloate, *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 Låktatjkka 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).

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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.

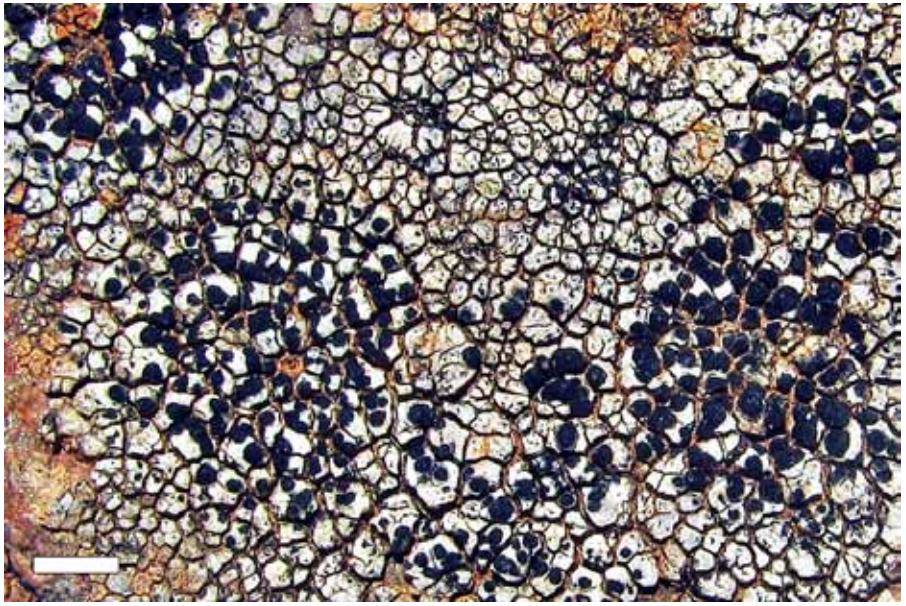

Figure 5. *Buellia maficola* (holotype in CANB). Scale = 2 mm.

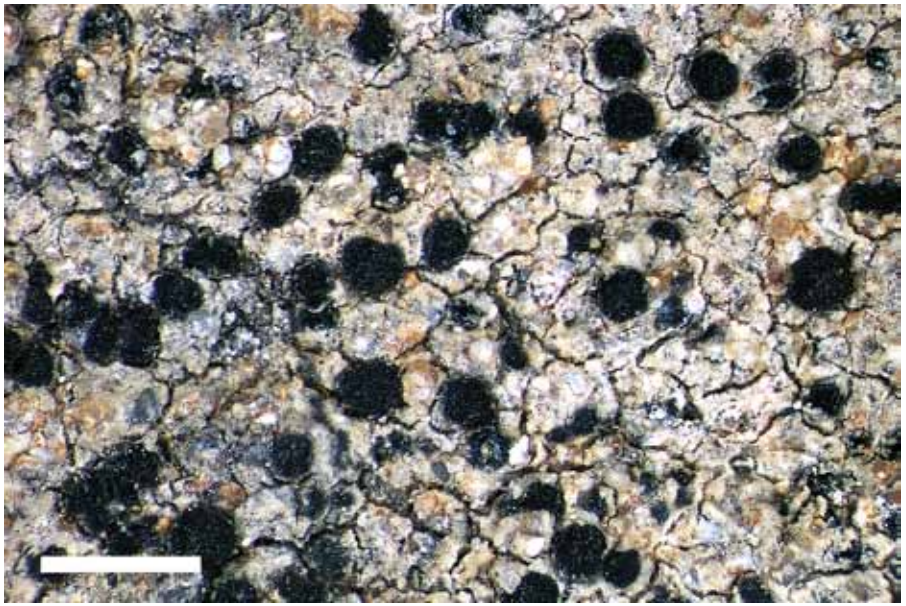

Figure 6. *Buellia mayrhoferae* (holotype in CANB). Scale = 1 mm.

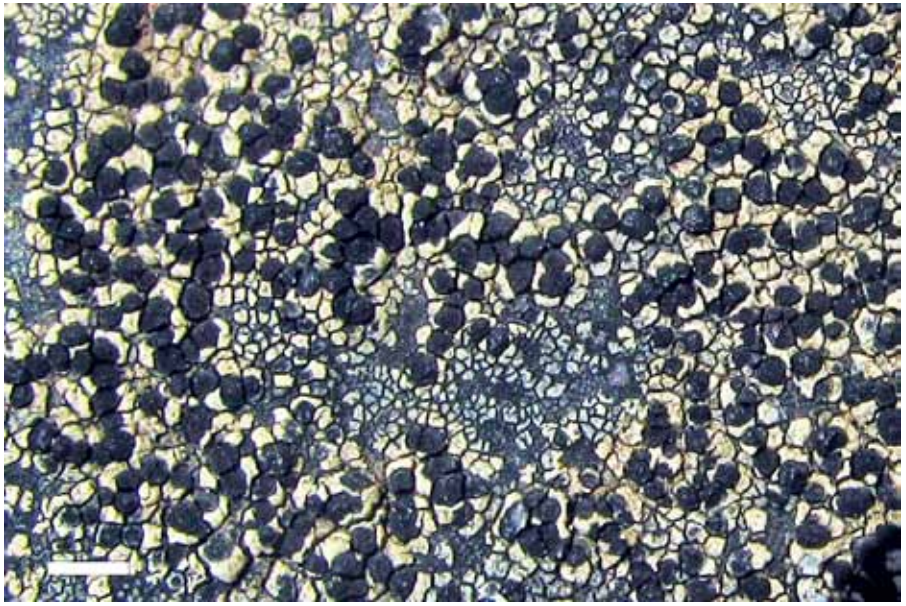

Figure 7. *Buellia pannarina* (holotype in CANB). Scale = 2 mm.