

**Two new species of *Buellia sens. lat.* (Ascomycota, Physciaceae) from New Zealand with 1-septate ascospores**

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**Abstract**

*Buellia hypostictella* Elix & H.Mayrhofer and *B. malcolmii* Elix are described as new to science. In addition, *Baculifera macromera* Elix & Kantvilas, *Buellia halonia* (Ach.) Tuck. and *Rinodinella fertilis* (Körb.) Elix are reported for the first time from New Zealand.

In his revised second edition of the *Flora of New Zealand Lichens*, Galloway recorded a total of 16 species of *Buellia* (Galloway 2007). Two of those species have since been transferred to *Amandinea* (Elix *et al.* 2015). Among the remaining 14 taxa were three species of *Buellia* in the strict sense, now limited to those with *Callispora*-type ascospores, bacilliform or weakly clavate conidia and a hymenium interspersed with oil droplets (Bungartz *et al.* 2007), the balance representing unrelated taxa that are classified as *Buellia* in the broad sense. Subsequently, seven additional taxa of *Buellia s. lat.* were reported from New Zealand (Elix *et al.* 2015, Elix 2016a). In this paper, we describe two new species of *Buellia* in the broad sense, both with 1-septate ascospores.

**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 (H<sub>2</sub>SO<sub>4</sub>) 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 hypostictella*** Elix & H.Mayrhofer, sp. nov. Fig. 1  
Mycobank number: **MB 816608**

Similar to *Buellia leptina* J.Steiner, but differs in having a pruinose upper surface, larger ascospores, longer conidia and in containing calcium oxalate in the medulla.

*Type:* New Zealand, South Island, Nelson, Tata Beach, NE of Pohara, 40°49'S, 172°55'E, on coastal rocks, *H. Mayrhofer* 10784, 28.viii.1992 (GZU – holotype).

*Thallus* crustose, continuous, verrucose-ridged to rimose-areolate, to 40 mm wide and 1 mm thick; individual areoles-verrucae 0.5–1.2 mm wide, becoming elevated; upper surface white, grey-white or pale grey, dull, very uneven, becoming cracked, white-pruinose in depressions; prothallus not apparent; photobiont cells 7–15 µm wide; medulla white, containing calcium oxalate, (H<sub>2</sub>SO<sub>4</sub>), I–. *Apothecia* 0.4–1 mm wide, lecideine, separate and ±round to crowded and distorted by mutual pressure, broadly

adnate or rarely sessile; disc black, often white-pruinose, plane to convex; proper exciple thick, persistent, in section 30–50 µm thick, the outer part dark brown to deep olive-brown, K+ yellow solution, N+ violet-brown, paler brown within. *Hypothecium* 180–250 µm thick, brown to brown-black, K–, N+ violet-brown. *Epithymenium* 10–12 µm thick, dark brown to deep olive-brown, K–, N+ pale red-brown. *Hymenium* 75–95 µm thick, colourless, not interspersed; subhymenium 50–60 µm thick, pale reddish brown to brown, interspersed with oil droplets; paraphyses 1.5–2.0 µm wide, simple to sparsely branched, with apices 5–6 µm wide and with dark brown caps; *asci* of the *Bacidia*-type, 8-spored. *Ascospores* of the *Buellia*-type, 1-septate, brown, ellipsoid, 10–[12.4]–16 × 5–[6.5]–8 µm, rarely constricted at the septum; outer spore-wall smooth to finely ornamented. *Pycnidia* immersed, punctiform; conidia bacilliform, 5–9 × 1–1.5 µm.

*Chemistry:* Thallus K+ yellow, P–, UV–; containing hypostictic acid (major) hyposalazinic acid (minor).

*Etymology:* The specific epithet is derived from the unusual chemistry of the species.

**Notes**

In many respects the new species resembles *B. leptina*, known from coastal rocks in the Canary Islands (Giralt & van den Boom 2011). Both are characterized by the presence of hypostictic acid, a non-amyloid medulla, pruinose discs and similar apothecial anatomy, including similar reactions of the hypothecium and epithymenium. However, *B. hypostictella* differs in having a pruinose upper surface, a medulla that contains calcium oxalate, larger ascospores [9–11(–12) × (5–)6–6.5 µm in *B. leptina*] and longer conidia (3–4 × 1–1.2 µm in *B. leptina*). Superficially, *B. hypostictella* resembles *B. cranwelliae* Zahlbr., a common species on coastal rocks in New Zealand. However, the latter differs in having epruinose discs, longer ascospores, (10–)11–16(–18) µm long, shorter conidia (3–5 µm long), a N– epithymenium and in lacking lichen substances (Elix 2015). *Buellia hypostictella* also resembles the North American species *B. sheardii* Bungartz (Bungartz *et al.* 2007). Both have pruinose discs, bacilliform conidia and *Buellia*-type ascospores, and both occur on coastal siliceous rocks, but *B. sheardii* has smaller ascospores, 8–[10.2]–13.5 × 4–[4.8]–6 µm, and it contains atranorin and norstictic acid.

At present, this lichen is known from coastal rocks at two localities in New Zealand. Associated species include *Amandinea conioops* (Wahlenb.) M.Choisy ex Scheid. & H. Mayrhofer, *A. decedens* (Nyl.) Blaha, H.Mayrhofer & Elix, *A. pelidna* (Ach.) Fryday & L.Arcadia, *Buellia cranwelliae* Zahlbr., *Caloplaca circumlutosa* Zahlbr., *C. cribrata* (Hue) Zahlbr., *Pertusaria xanthoplaca* Müll.Arg. and *Xanthoria ligulata* (Körb) P.James & D.J.Galloway.

**SPECIMENS EXAMINED**

*New Zealand:* • North Island, South Auckland, Coromandel Peninsula, Fletchers Bay, N of Coromandel, N of Port Jackson, 36°28'35"S, 175°23'25"E, 0–3 m alt., on greywacke rocks, *J. Blaha* 0194, 0204, 17.iv.2001 (GZU).

**2. *Buellia malcolmii*** Elix, sp. nov. Fig. 2  
Mycobank number: **MB 816609**

Similar to *Buellia halonia* (Ach.) Tuck., but differs in having pustulate ridges on the upper surface, cryptolecanorine apothecia, *Buellia*-type ascospores and in lacking atranorin.

*Type:* New Zealand, South Island, Nelson, Mount Street hair-pin bend, NZMS 260 027:333921, 41°16'42"S, 173°16'36"E, 40 m alt., on rock, *W. Malcolm* 1961, 19.vi.1994 (CANB – holotype).

*Thallus* crustose, continuous, rimose-areolate to wrinkled-ridged in part, to 90 mm wide and 0.15 mm thick; individual areoles 0.2–0.5 mm wide, becoming elevated; upper surface pale yellowish white, dull, granular, in places elevated, wrinkled and ridged, the ridges becoming cracked, eroded and pustulate-sorediate; prothallus not apparent; photobiont cells 8–16  $\mu\text{m}$  wide; medulla white,  $\text{H}_2\text{SO}_4$ –, I–. *Apothecia* 0.1–0.4 mm wide, cryptolecanorine or eventually lecideine, separate to crowded and distorted,  $\pm$ round, immersed or rarely broadly adnate; disc black, epruinose or grey-white-pruinose, plane to rarely weakly convex; initially with a thin, entire thalline margin that is excluded with age; proper exciple poorly developed, thin, obscure, in section 25–30  $\mu\text{m}$  thick, the outer part pale brown, K–, colourless within. *Hypothecium* 125–150  $\mu\text{m}$  thick, deep red-brown, K–, N–. *Epithymenium* 8–10  $\mu\text{m}$  thick, brown to olive-brown, K–, N– or N+ pale red-violet. *Hymenium* 55–65  $\mu\text{m}$  thick, colourless, not interspersed with oil droplets; subhymenium 25–50  $\mu\text{m}$  thick, pale reddish brown; paraphyses 1.5–2.0  $\mu\text{m}$  wide, simple to sparsely branched, with apices to 3  $\mu\text{m}$  wide and with pale brown caps; *asci* of the *Bacidia*-type, with 8 or fewer spores. *Ascospores* of the *Buellia*-type, 1-septate, brown, ellipsoid, 13–[17.6]–21  $\times$  6.5–[8.5]–11  $\mu\text{m}$ , becoming constricted at the septum; outer spore-wall finely ornamented. *Pycnidia* not seen. *Chemistry*: Cortex K–, C+ yellow-orange, KC+ orange, P–, UV+ dull orange; containing arthothelin (major) 4,5-dichloronorlichexanthone (minor).

*Etymology*: This species is named after the New Zealand cryptogamist, botanical photographer and collector of the type specimen, Dr W.M. (Bill) Malcolm.

#### Notes

Morphologically, the new species resembles some specimens of *Buellia amandineaeformis* Elix & Kantvilas and *B. alutacea* Zahlbr., in that all three can have a pustulate-granular upper surface (at least in part) and *Buellia*-type ascospores, and also occur in New Zealand. However, *B. amandineaeformis* differs in having significantly smaller ascospores, 10–14  $\times$  5–8  $\mu\text{m}$ , a brown, N– epithymenium and in lacking lichen substances (Elix & Kantvilas 2013). *Buellia alutacea* has ascospores similar in size to those of *B. malcolmii*, but it has sessile, lecideine apothecia, a thallus composed of markedly convex, dispersed or contiguous areoles, and it contains atranorin and 2,5,7-trichloro-3-O-methylnorlichexanthone and isoarthothelin as the major xanthenes present (Elix 2011a). Chemically, *B. malcolmii* closely resembles *B. halonia*, a widespread saxicolous species known from Australia, New Zealand, North America, South America and South Africa (Elix 2011b). Both species are characterized by the presence of arthothelin or isoarthothelin and have similar sized ascospores and a partially aeruginose epithymenium (N+ red-violet). However, *B. malcolmii* has a granular upper surface, where elevated wrinkles or ridges become cracked, eroded and pustulate-sorediate in part (smooth and esorediate in *B. halonia*), immersed, cryptolecanorine apothecia (lecideine and broadly adnate in *B. halonia*) and *Buellia*-type ascospores (*Physconia*-type in *B. halonia*).

At present, the new species is known from two localities in the South Island of New Zealand. Associated species include *Buellia aethalea* (Ach.) Th.Fr., *B. ocellata* (Flot.) Körb., *Lecanora farinacea* Fée, *Rhizocarpon geographicum* (L.) DC. and *Xanthoparmelia australasica* D.J.Galloway.

#### ADDITIONAL SPECIMEN EXAMINED

*New Zealand*: • South Island, Marlborough, St. Arnaud, outside Travers-Sabine Lodge, 41°48'09"S, 172°50'47"E, 636 m alt., on pebbles, A. Knight *pr.*, 11.i.2015 (CANB, OTA).

#### New records for New Zealand

##### 1. *Baculifera macromera* Elix & Kantvilas, *Australas. Lichenol.* 75, 30 (2014)

This species was previously known from Tasmania. It is characterized by the thin, white to pale grey or greenish grey thallus containing atranorin, the non-interspersed hymenium, 4–8-spored asci and the 1-septate, ellipsoid to broadly fusiform ascospores, (12–)16–30  $\times$  (5–)7–12  $\mu\text{m}$ ,  $\pm$ constricted at the central septum and developing pointed apices, with moderate subapical wall-thickenings and a smooth outer spore-wall. Rarely, the older spores become 3-septate. The species has straight, bacilliform conidia, 5–6  $\times$  1  $\mu\text{m}$ . A detailed description is given in Elix & Kantvilas (2014).

#### SPECIMEN EXAMINED

*New Zealand*: • South Island, Otago, Rock and Pillar Range, 45°25'05"S, 170°05'08"E, alt. 1219 m, on dead stems and twigs of subalpine *Hebe*, A. Knight, 6.xii.2014 (CANB, OTA).

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

This species was previously known from Australia, South Africa and North and South America, where it occurs on siliceous rocks in coastal and hinterland regions (Elix 2011b, 2016b). It is characterized by the continuous to rimose-areolate, pale yellow-grey to yellow-green crustose thallus, often a red-pigmented lower medulla, immersed to broadly adnate or sessile apothecia,  $\pm$ yellow-grey-pruinose discs, usually an aeruginose, N+ red-violet epithymenium, *Physconia*- then *Buellia*-type ascospores, 11–19  $\times$  6–9  $\mu\text{m}$ , bacilliform conidia, 5–7  $\times$  1  $\mu\text{m}$  and the presence of arthothelin (C+ orange, UV+ orange) and often atranorin. A detailed description is given in Elix (2011b).

#### SPECIMENS EXAMINED

*New Zealand*: • North Island, Wellington, Te Rewarewa Point, Hongoeka Bay, NW of Plimmerton, 41°04'S, 174°51'E, on coastal rocks, H. Mayrhofer 12288, D. Glenny, W. Nelson, B. Polly & C. West, 23.viii.1992 (GZU); • South Island, Nelson, Boulder Bank, near oxidation ponds, NZMS 260 O27:370003, 41°12.3'S, 173°19.3'E, alt. 2 m, on exposed rounded cobbles on lee side of bank, W. Malcolm 3318, 10.x.2015 (CANB) [growing together with *Buellia stellulata*].

##### 3. *Rinodinella fertilis* (Körb.) Elix var. *fertilis*, *Australas. Lichenol.* 66, 46 (2010)

This species was previously known from South Africa and southern Australia, where it occurs on siliceous rocks in coastal and hinterland regions (Elix 2011b). It is characterized by the continuous to cracked and areolate, off-white to pale fawn, crustose thallus, immersed to broadly adnate or sessile, lecideine apothecia with epruinose discs, usually a partly aeruginose, N+ violet-brown epithymenium, *Rinodinella*-type ascospores, 10–15  $\times$  5–8  $\mu\text{m}$ , bacilliform to narrowly ellipsoid conidia, 3–4.5  $\times$  1–1.5  $\mu\text{m}$  and the presence of norstictic and connorstictic acids. A detailed description is given in Elix (2011b).

#### SPECIMEN EXAMINED

*New Zealand*: • South Island, Nelson, Golden Bay, Tata Beach, NE of Pohara, 40°49'S, 172°55'E, on coastal rocks, H. Mayrhofer 10774, 28.viii.1992 (GZU).

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Figure 1. *Buellia hypostictella* (holotype in GZU). Scale = 1 mm



Figure 2. *Buellia malcolmii* (holotype in CANB). Scale = 1 mm