

Three new species and five new records of corticolous and lichenicolous buellioid lichens (Caliciaceae, Ascomycota) from New Zealand's subantarctic islands

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Abstract

Buellia campbelliana Elix, *B. thelotremicola* Elix and *Gassicurtia jamesii* Elix are described as new to science. *Amandinea dudleyensis* Elix & Kantvilas, *A. extenuata* (Müll. Arg.) Marbach, *A. lignicola* var. *australis* Elix & Kantvilas, *Baculifera xylophila* (Malme) Marbach and *Orcularia insperata* (Nyl.) Kalb & Giralto are new records for New Zealand's subantarctic islands.

The Antipodes, Auckland, Campbell and Snares Islands and associated islets are located in the Southern Ocean between New Zealand and Antarctica. An introduction to the geology, landforms, vegetation and climate of these subantarctic islands has been provided by Elix (2017). Three corticolous and one lichenicolous species of buellioid lichens have previously been reported from the islands, namely *Amandinea adjuncta* (Th.Fr.) Hafellner, *A. diorista* var. *hypopelidna* (Stirt.) Marbach & Kalb and *A. porulosa* (Müll.Arg.) Elix (Fineran 1971; Galloway 2007). In this contribution, two new lichenicolous species, one corticolous species and five new records of corticolous/lignicolous buellioid lichens are described from these islands. Methods are as described in Elix (2017).

New species

1. *Buellia campbelliana* Elix, sp. nov.
Mycobank No. **MB 822569**

Figs 1, 2

Thallus yellow, lichenicolous on basal squamules of a *Cladonia* species, with broadly adnate apothecia, 0.3–0.4 mm wide, that become crowded and distorted, with epruinose discs, constricted, *Buellia*-type ascospores, 10–[13.4]–16 × 6–[7.2]–9 µm and containing usnic and 2-*O*-methylsekikaic acids.

Type: New Zealand, Campbell Island, summit of Mt Fizeau, 52°31'01"S, 169°07'59"E, alt. 1655 feet [497 m], on soil in shingle feldmark, *H.A. Imshaug 46790*, 10.i.1970 (holotype – MSC).

Thallus lichenicolous, bright yellow, developed on the dense mat of squamules of the grey-brown host (escyphiferous *Cladonia* sp.), seemingly taking the form of the host. *Apothecia* 0.3–0.4 mm wide, abundant, lecideine, roundish, crowded and deformed by mutual pressure, broadly adnate; disc black, epruinose, plane; proper exciple thin, persistent, in section 50–60 µm thick, outer part dark aeruginose to dark brown, K–, N+ violet-brown, inner part brown. *Epithymenium* 7–12 µm thick, deep-aeruginose, K+ blue-green, N+ red-violet. *Hypothecium* 150–250 µm thick, dark brown to brown-black, K–. *Hymenium* 60–80 µm thick, colourless, not interspersed; subhymenium ill-defined, c. 20–25 µm thick, pale reddish brown, not interspersed; paraphyses 1–1.5 µm wide, sparingly branched, with apices 4–5 µm wide and aeruginose caps. *Asci* 8-spored, *Bacidia*-type. *Ascospores* *Buellia*-type, 1-septate, pale then dark brown, ellipsoid, 10–[13.4]–16 × 6–[7.2]–9 µm, commonly constricted at the septum, not curved; outer wall smooth to microrugulate. *Pycnidia* not seen. *Chemistry*: Thallus K+ yellow, KC+ yellow, P+ yellow-orange, C–, UV–; containing usnic acid (minor), 2-*O*-methylsekikaic acid (major). The host lichen contains stictic acid (major), constictic acid (minor) and cryptostictic acid (trace).

Etymology: The species is named after the type locality.

Remarks

Buellia campbelliana is characterized by the small, crowded, adnate apothecia with epruinose discs, the bright yellow thallus containing usnic acid and the relatively small, constricted, 1-septate *Buellia*-type ascospores, 10–[13.4]–16 × 6–[7.2]–9 µm, with a smooth to microrugulate outer spore wall. The host species, an undetermined *Cladonia*, is clearly distinguished from the infecting species by its dull, grey-brown squamulose thallus, the absence of usnic acid and the presence of the stictic acid chemosyndrome. At present, usnic acid is known from only one other *Buellia* species, namely *B. soreidiata* Filson from Antarctica. The latter is very different from *B. campbelliana*, in being autonomous on rocks and producing numerous capitate soralia. 2-*O*-Methylsekikaic acid has not been detected previously in *Buellia sens. lat.* At present the new species is known from only the type collection.

2. *Buellia thelotremicola* Elix, sp. nov.
Mycobank No. **MB 822570**

Fig. 3

Thallus and prothallus absent, lichenicolous on a *Thelotrema* species, with broadly adnate to sessile apothecia 0.05–0.1 mm wide, with epruinose discs, 3-septate ascospores, 8–[10.1]–13 × 4–[4.7]–5 µm and no lichen substances.

Type: New Zealand, Auckland Island, west arm of Musgrave Harbour, E of Fleming Plateau, on *Thelotrema* over dead mosses, *H.A. Imshaug 57066*, 28.xii.1972 (holotype – MSC).

Thallus lichenicolous, developed on the thallus of the host (*Thelotrema* sp.). *Apothecia* 0.05–0.1 mm wide, scattered or in groups, lecideine, round, emerging from the host thallus and soon broadly adnate to sessile; disc black, epruinose, weakly concave to plane; proper excipulum persistent, black, initially raised above level of the disc, in section 20–25 µm thick, outer part dark brown to brown-black, K–, N+ orange-brown, inner part brown. *Epithymenium* 7–10 µm thick, dark brown, K–, N–. *Hypothecium* 70–90 µm thick, dark brown, K–. *Hymenium* 35–50 µm thick, colourless, not interspersed; paraphyses 1.5–1.7 µm wide, simple to sparingly branched, with apices 3–4 µm wide and brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores* 3-septate or rarely 1-septate, brown, elongate-ellipsoid, 8–[10.1]–13 × 4–[4.7]–5 µm; outer spore-wall rugulate. *Pycnidia* not seen.

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

Etymology: The epithet is derived from the host genus.

Remarks

Buellia thelotremicola is a distinctive species characterized by its lichenicolous habit, the dark brown epithymenium and hypothecium, the small, 3-septate ascospores and the absence of lichen substances. Superficially, it resembles *Tetramelas pulverulentus* (Anzi) A. Nordin & Tibell, a lichenicolous species occurring on species of *Physconia*, *Physcia* and *Phaeophyscia* in the Northern Hemisphere (Nordin 2000; Nordin & Tibell 2005). However, *T. pulverulentus* has much larger ascospores, 15–25 × 6–9 µm.

At present the new species is known from only the type collection.

3. *Gassicurtia jamesii* Elix, sp. nov.
Mycobank No. **MB 822571**

Fig. 4

Similar to *Gassicurtia gallowayi* Elix & Kantvilas, but differs in having a soreidiate upper surface and in lacking a pigmented medulla.

Type: New Zealand, Auckland Islands, Enderby Island, Sandy Bay, 50°30'04"S, 166°16'55"E, on rata (*Metrosideros*) and *Myrsine*, *P.W. James 1318b*, 18.i.1963 (holotype – BM). *Thallus* crustose, ± continuous, to 35 mm wide and 0.1 mm thick, rimose-areolate to ver-

ruculose, individual areoles rounded, plane to weakly convex, 0.05–0.1 mm wide; upper surface grey-white to pale yellow or greenish yellow, sorediate, the soredia developing from erumpent verruculae or directly from the upper surface, sometimes spreading over the entire surface, soredia granular, granules 15–50 µm wide; prothallus usually black, marginal, to 0.5 mm wide, rarely absent; photobiont cells 6–16 µm wide; medulla white, H₂SO₄–, I–. *Apothecia* 0.2–1.2 mm wide, lecideine, scattered, round, immersed to broadly adnate or sessile, then basally constricted; disc black, epruinose or grey-white-pruinose, plane; proper excipulum persistent, glossy, black, in section 25–60 µm thick, mostly opaque dark brown to brown-black throughout, occasionally paler reddish brown in the inner part. *Hypothecium* 120–170 µm thick, dark brown to brown-black, K–. *Epithemium* 10–12 µm thick, brown, K–, N–. *Hymenium* 50–70 µm thick, colourless, not interspersed; subhymenium pale brown, 25–35 µm thick, colourless, interspersed with oil droplets or not; paraphyses 1.5–2.0 µm wide, simple to sparsely branched, capitate, with apices dark brown, 4.5–5.5 µm wide. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores* of the *Buellia*-type, 1-septate, olive-brown to brown, ellipsoid, 8–[13.6]–18 × 5–[6.4]–9 µm, becoming slightly constricted at the septum, when young with slight median wall thickenings and then of the *Physconia*-type; outer spore-wall smooth. *Pycnidia* immersed to subemergent; conidia fusiform, 4–7 × 1–1.5 µm. *Chemistry*: Cortex K–, KC–, C+ orange, P–, UV+ orange; containing thiophanic acid (major), arthothelin (major), 6-O-methylarthothelin (trace) and 4,5-dichloronorlichexanthone (trace).

Etymology: This lichen is named in honour of the collector of the type specimen, the late Peter W. James.

Remarks

Morphologically, the new species resembles *Gassicurtia gallowayi* Elix & Kantvilas, a corticolous lichen known from Tasmania and Stewart Island, New Zealand (Elix & Kantvilas 2015). Both species are characterized by grey-white to pale yellow or greenish yellow, granular-verruculose thalli and ascospores that are relatively large for the genus *Gassicurtia*. However, *G. gallowayi* has an esorediate upper surface and a medulla with patchy dull purple-brown pigment (*G. jamesii* lacks pigments). Superficially, *G. jamesii* could be confused with *Amandinea efflorescens* var. *pseudohypopelida* Marbach in that both have a sorediate upper surface and contain xanthenes (Marbach 2000). However, the latter differs in having curved, filiform conidia, 16–31 × 0.7–1 µm, and in containing thuringione and arthothelin as major xanthenes. This is the first reported observation of conidia in the latter taxon.

SPECIMENS EXAMINED

New Zealand. *Auckland Island.* ● Cove of 1874 German Expedition, on bark of *Metrosideros* in large peat tussocks *H.A. Imshaug 56734*, 23.xii.1972 (MSC); ● Sealers Creek Cove, mouth of Laurie Harbour, on bark of *Metrosideros* in mature *Metrosideros* forest, *H.A. Imshaug 57687*, 9.i.1973 (MSC).

Amandinea efflorescens var. *pseudohypopelida* Marbach

Guyana. ● East Demerara District. Along western dyke at mouth of Mahaica River, 6°41'–43'N, 57°55'W, sea level, on trunk of *Cocos nucifera* in cultivated coastal area, *H. Sipman & A. Aptroot 19509*, 5.iii.1985 (CANB).

New records from Antipodes and Campbell Islands

1. *Amandinea dudleyensis* Elix & Kantvilas, *Australas. Lichenol.* **72**, 6 (2013)

This species was previously known from Kangaroo Island, South Australia (Elix & Kantvilas 2013). It is characterized by its crustose, white to pale grey, weakly rimose-areolate to verruculose thallus, broadly adnate to rarely sessile, lecideine apothecia, 0.2–0.7 mm wide, relatively large, 1-septate *Orcularia*- then *Physconia*-type ascospores, 18–[21.9]–28 × 8–[10.7]–14 µm, which become weakly constricted at the septum, by the curved, filiform conidia, 20–30 × 0.7–1 µm, the finely interspersed hymenium and the lack of lichen substances. Older

ascospores develop a markedly rugulate outer spore wall. A detailed description and illustrations are given in Elix & Kantvilas (2013).

SPECIMENS EXAMINED

New Zealand. *Auckland Islands.* ● Adams Island, Magnetic Station, SW of Camp Cove, Carnley Harbour, on branch of *Metrosideros* in *Metrosideros* forest, *H.A. Imshaug 57423*, *57425*, 5.i.1973 (MSC); ● Auckland Island, cove E of Tagua Bay, W of Mt D'Urville, on twigs of *Metrosideros* in *Metrosideros* forest along shore, *H.A. Imshaug 57408 57411*, 4.i.1973 (MSC); ● Rose Island, central part of island, on twigs in dead *Metrosideros* forest, *H.A. Imshaug 56415*, 14.xii.1972 (MSC). *Campbell Island.* ● Northwest Beach, Northwest Bay, on twigs of *Dracophyllum* in *Dracophyllum* scrub, *H.A. Imshaug 46639*, *46646*, *46648*, 7.i.1970 (MSC).

2. *Amandinea extenuata* (Müll.Arg.) Marbach, *Biblioth. Lichenol.* **74**, 71 (2000)

This species was previously known from Australia, South Africa, South America and Fiji (Marbach 2000; Giralt *et al.* 2015). It is characterized by the crustose, thin, warty to verrucose-areolate, pale grey to grey-brown thallus, the broadly adnate to sessile apothecia, 0.3–0.5 mm wide, the 1-septate, *Physconia*-type ascospores with weak inner septal wall-thickenings (when young), becoming *Buellia*-type, 11–16 × 5.5–7.5 µm, with microrugulate outer spore-walls, curved, filiform conidia, 15–30 µm long, and the absence of lichen substances. A detailed description is given in Marbach (2000).

SPECIMEN EXAMINED

New Zealand. *Antipodes Island.* ● c. 0.4 km S of Hut Cove, alt. 46 m, on twigs of shrub in tussock grassland, *R.C. Harris 5773B*, 16.ii.1970 (MSC).

3. *Amandinea lignicola* var. *australis* Elix & Kantvilas, *Australas. Lichenol.* **72**, 7 (2013)

This taxon was previously known from Australia and the North Island of New Zealand (Elix & Kantvilas 2013; Mayrhofer *et al.* 2016). It is distinguished by having a typically conspicuous, well-developed, whitish to pale grey or olive-brown, crustose to squamulose thallus with a smooth to often granular or sorediate upper surface. It is further characterized by having a non-interspersed hymenium, *Physconia*- then *Buellia*-type, 1-septate, ellipsoid ascospores, (11–)13–20 × (5–)6–8 µm, with a smooth to weakly ornamented outer wall, curved, filiform conidia (12–)18–26 0.7–1 µm, and by the absence of lichen substances. A detailed description is given in Elix & Kantvilas (2013).

SPECIMEN EXAMINED

New Zealand. *Campbell Island.* ● Road to old Tucker Cove Station, on wood in disturbed area, *R.C. Harris 4478*, 23.xii.1969 (MSC).

4. *Baculifera xylophila* (Malme) Marbach, *Biblioth. Lichenol.* **74**, 148 (2000)

This species was known previously from South America and Hawai'i (Marbach 2000) and Australia (Elix & Kantvilas 2014). It is characterized by a white to grey, crustose thallus lacking lichen substances (K–), epruinose apothecia, a dark brown, olive-brown to dark olive-green epithemium (containing *micromera*-green pigment), a non-interspersed hymenium, *Buellia*-type ascospores, 12–22 × 6–9 µm, with weak to moderate subapical wall-thickenings and a smooth or weakly ornamented outer spore-wall, and bacilliform conidia 8–12 × 1 µm. A detailed description is given in Marbach (2000).

SPECIMENS EXAMINED

New Zealand. *Campbell Island.* ● N side of Perserverance Harbour, 0.8 km N of Beeman Station, on twigs of *Dracophyllum* in *Dracophyllum* scrub, *R.C. Harris 5696*, *5730*, *5740*, 22.i.1970 (MSC).

5. *Orcularia insperata* (Nyl.) Kalb & Giralto, *Phytotaxa* 38, 56 (2011)

This species was previously known from Africa, Australia, South America and the South Island of New Zealand (Galloway 2007; Kalb & Giralto 2011). It is characterized by the grey, ochre-grey to white-grey thallus, apothecia with an initial thalline margin that is excluded with age, *Orcularia*-type ascospores, 12–22 × 6–10 µm, curved, filiform conidia 12–20 × 0.7–1 µm, and the absence of lichen substances. A detailed description is given in Galloway (2007, as *Amandinea insperata*).

SPECIMENS EXAMINED

New Zealand. *Campbell Island.* • Camp Cove, limestone ledges, on twigs of shrub, *H.A. Imshaug 46056*, 23.xii.1969 (MSC); • Head of Camp Cove, on bark of spruce tree in disturbed area, *H.A. Imshaug 46813*, 11.i.1970 (MSC).

Key to the corticolous, lignicolous and lichenicolous species of buellioid lichens in New Zealand's subantarctic islands

- 1 Thallus corticolous or lignicolous..... 2
1: Thallus lichenicolous 9
- 2 Upper surface yellow or yellow-grey; thallus C+ orange; xanthonenes present..... 3
2: Upper surface grey to grey-brown; lichen substances absent 4
- 3 Upper surface sorediate; ascospores 5–9 µm wide; thiophanic acid present
..... **Gassicurtia jamesii**
3: Upper surface smooth to weakly verruculose; ascospores 4.5–5.5 µm wide;
thuringione present..... **Amandinea diorista** var. **hypopelidna**
- 4 Ascospores persistently *Orcularia*-type, or initially *Orcularia*-type then *Physconia*-
type 5
4: Ascospores initially *Physconia*-type then *Buellia*-type 6
- 5 Ascospores *Orcularia*-type then *Physconia*-type, 18–28 × 8–14 µm.....
..... **Amandinea dudleyensis**
5: Ascospores persistently *Orcularia*-type, 12–22 × 6–10 µm **Orcularia insperata**
- 6 Epithemium green to greenish black, K+ greenish, N+ purple-black or grey-black;
conidia bacilliform, straight, 5–9 µm long..... **Baculifera xylophila**
6: Epithemium brown, K–, N–; conidia curved, filiform, 16–30 µm long..... 7
- 7 Thallus on wood; ascospores 13–20 µm long... **Amandinea lignicola** var. **australis**
7: Thallus on bark or wood; ascospores 11–16 µm long..... 8
- 8 Subhymenium inspersed; locules of juvenile ascospores spherical.....
..... **Amandinea porulosa**
8: Subhymenium not inspersed; locules of juvenile ascospores clavate.....
..... **Amandinea extenuata**
- 9 Ascospores 3-septate; on *Thelotrema* sp..... **Buellia thelotremicola**
9: Ascospores 1-septate; on *Caloplaca* or *Cladonia* sp. 10
- 10 On *Caloplaca* sp.; thallus absent; ascospores 14–18 µm long
..... **Amandinea adjuncta**
10: On *Cladonia* sp.; thallus bright yellow; ascospores 10–16 µm long
..... **Buellia campbelliana**

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Figure 1. *Buellia campbelliana* (holotype). Scale bar = 1 mm.

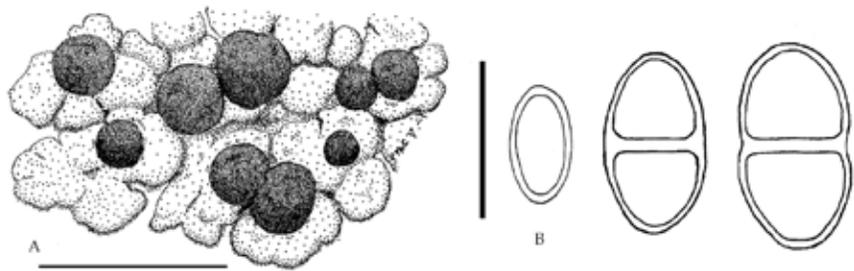


Figure 2. *Buellia campbelliana*. A. Apothecia on host thallus. B. Ascospore ontogeny. Scale bars: A = 1 mm; B = 10 μ m.

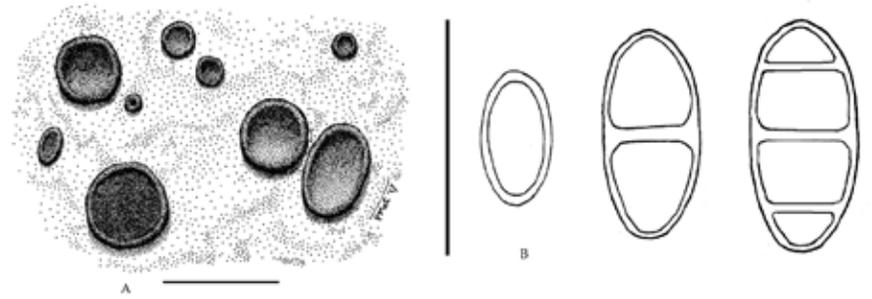


Figure 3. *Buellia thelotremicola* (holotype). A. Apothecia. B. Ascospore ontogeny. Scale bars: A = 0.2 mm; B = 10 μ m.



Figure 4. *Gassicurtia jamesii* (holotype). Scale bar = 1 mm.