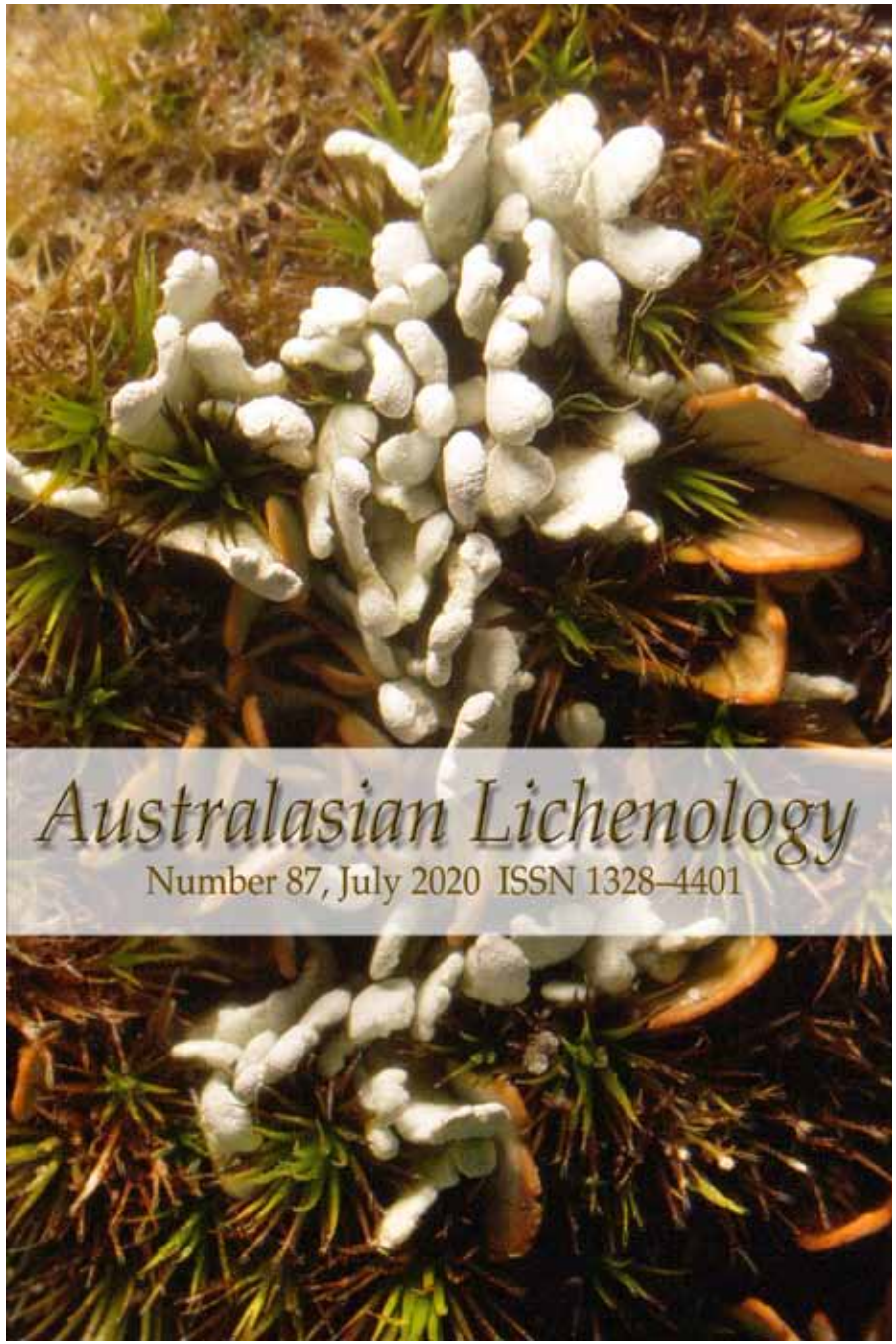

Australasian Lichenology
Number 87, July 2020 ISSN 1328–4401

The consistently sterile *Siphula decumbens* grows on moist inorganic or peaty soils from near sea level to high alpine elevations. Its irregularly branched thallus contains thamnolic acid, and often is dorsiventral, with one side more scabrid than the other (*see* left). Its morphology varies markedly with habitat. The species is widespread, recorded from Africa, Central and South America, Borneo, Papua New Guinea, Japan and China as well as Tasmania and New Zealand. The cover illustration shows it growing intermixed with *Parasiphula fragilis*.

5 mm

CONTENTS

Ten new species and two new records of buellioid lichens (Physciaceae, Ascomycota) from Australia and Norfolk Island

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Abstract

Amandinea pilbarensis Elix, *Baculifera confusa* Elix, *Buellia arida* Elix, *B. cravenii* Elix, *B. eldridgei* Elix, *B. kowenensis* Elix & P.M.McCarthy, *B. lordhowensis* Elix, *B. phillipensis* Elix, *Tetramelas flindersianus* Elix and *T. gariwerdensis* Elix are described as new to science. In addition, *Amandinea brugierae* (Vain.) Marbach and *Buellia hypostictella* Elix & H.Mayrhofer are reported for the first time from Australia.

Introduction

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

New species

1. Amandinea pilbarensis Elix, sp. nov. Fig. 1
MycoBank No. **MB834721**

Similar to *Amandinea polyxanthonica* (Elix) Elix, but differs in having smaller ascospores, 8–[*9.9*]–13 × 5–[*6.1*]–7 µm, and in containing medullary calcium oxalate and thiophanic acid.

Type: Australia, Western Australia, Pilbara Region, 27 km SW of DeGrey River, E of Port Headland, on siliceous rock, *A.C. Beauglehole 13962A*, 10.viii.1965 (holotype – MEL).

Thallus crustose, continuous, rimose-areolate, to 15 mm wide and 0.1 mm thick; individual areoles angular to irregular, 0.1–0.5 mm wide, becoming weakly radiate at the margin; upper surface white to pale cream, matt; prothallus not apparent; medulla white, containing calcium oxalate (H_2SO_4+), I–; photobiont cells 6–12 µm diam. *Apothecia* 0.1–0.4 mm wide, lecideine, immersed then broadly adnate, more rarely sessile and constricted at the base, dispersed, rounded; disc black, epruinose, plane or becoming convex with age; proper exciple thin, persistent, often with adhering, necrotic thalline fragments; in section outer zone dark brown, cupuliform, K–, N–, 20–30 µm thick; inner zone pale brown to colourless. *Epihymenium* 5–8 µm thick, brown, K–, N–. *Hypothecium* colourless to pale brown, 40–60 µm thick, K–. *Hymenium* 38–48 µm thick, colourless, not inspersed; subhymenium 10–15 µm thick, colourless, not inspersed. *Paraphyses* 1.2–1.5(–2) µm wide, sparsely branched, with apices 3–5 µm wide and brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores Buellia*-type when mature, pale brown to brown, ellipsoid, 8–[*9.9*]–13 × 5–[*6.1*]–7 µm, becoming constricted at the septum; outer spore-wall smooth. *Pycnidia* immersed; ostiole black. *Conidia* filiform, curved, 12–20 × 0.7 µm.
Chemistry: Thallus K–, P–, C+ orange, UV+ orange; containing thiophanic acid.

Etymology: The species is named after the type locality.

Remarks

Amandinea pilbarensis is characterized by the crustose, rimose-areolate, white to pale cream thallus, the immersed then broadly adnate apothecia, the non-amyloid medulla, a non-inspersed

hymenium, the 1-septate, *Buellia*-type ascospores, 8–13 × 5–7 µm, curved, filiform conidia, 12–20 µm long, and by the presence of calcium oxalate and thiophanic acid. Morphologically, it can resemble diminutive specimens of *A. polyxanthonica*, but that species lacks medullary calcium oxalate, has larger ascospores, 12–20 × 6–10 µm, longer conidia, 18–30 µm long, and it contains an extensive cohort of xanthones, usually with 3-*O*-methylthiophanic acid as the major substance (Elix 2009).

At present, *A. pilbarensis* is known only from the type collection. Associated species include *Australiaena streimannii* Matzer, H.Mayrhofer & Elix, *Buellia kimberleyana* Elix and *Caloplaca leptozona* (Nyl.) Zahlbr.

2. Baculifera confusa Elix, sp. nov. Fig. 2
MycoBank No. **MB834722**

Similar to *Baculifera xylophila* (Malme) Marbach, but differs in having a colourless to pale yellow-brown hypothecium, smaller ascospores, 11–17 × 6–8 µm, and shorter conidia, 5–6 µm long.

Type: Australia, South Australia, Murray Park Flora and Fauna Reserve, Murray Bridge, 35°07'S, 139°15'E, 30 m alt., on dead wood in remnant mallee scrub with *Callitris* and *Eucalyptus*, *J.A. Elix 36810*, 31.xii.2005 (holotype – CANB).

Thallus crustose, endophloedal and not apparent, or epiphloedal, to *c.* 15 mm wide, rimose or rimose-areolate, pale grey to dark brown, up to 100 µm thick, areoles 0.1–0.4 mm wide, esorediate; prothallus marginal, black when abutting other lichens or not apparent; medulla lacking calcium oxalate (H_2SO_4–), I–; photobiont cells 10–20 µm wide. *Apothecia* 0.2–0.8 mm wide, lecideine, scattered or crowded, adnate then sessile; disc black, epruinose, plane to markedly convex, sometimes becoming tuberculate; proper excipulum concolorous with the disc, thin, excluded in older, convex apothecia, in section 25–35 µm thick, dark brown, yellow-brown within, K+ yellow solution, N+ intense blue-black. *Epihymenium* 8–12 µm thick, dark olive-brown to dark brown, K+ yellow solution, N+ intense blue-black. *Hypothecium* 50–60 µm thick, colourless to very pale yellow-brown, K–. *Hymenium* 65–85 µm thick, colourless, not inspersed. *Paraphyses* 1–1.5 µm wide, simple to weakly branched, capitate, with apices brown, 3–4 µm wide. *Asci* approximating the *Bacidia*-type, 8-spored. *Ascospores* of the *Buellia*-type, 1–septate, olive-green to brown, ellipsoid, 11–[*14.4*]–17 × 6–[*6.8*]–8 µm, becoming constricted at the septum, curved or not, rounded at apices, with subapical wall-thickenings; outer spore-wall strongly ornamented. *Pycnidia* immersed. *Conidia* bacilliform, straight, 5–6 × 1 µm. *Chemistry*: Thallus K–, P–, C–, UV–; no lichen substances detected.

Etymology: The species name follows from its previous confusion with *Baculifera xylophila*.

Remarks
In several respects, the new species resembles the common and widely distributed *Baculifera xylophila*, in that both lack lichen substances, have epihymenia containing similar pigments (N+ grey-black or blue-black), and ascospores that exhibit subapical wall-thickenings during ontogeny. However, *B. xylophila* differs in having a dark brown to brown-black hypothecium, a thicker hymenium, 100–130 µm thick, larger ascospores, 12–[*17.6*]–22 × 6–[*8.9*]–11 µm, and longer conidia, 7–10 µm long (Marbach 2000; Elix & Kantvilas 2014). Moreover, the epihymenial pigments differ in the two species. *Baculifera xylophila* contains the *micromera*-green pigment, a greenish brown to greenish black substance that reacts N+ greyish black, K+ green, HCl+ intensifying bluish green (Bungartz *et al.* 2007), whereas the epihymenium of *B. confusa* contains dark olive-brown to dark brown pigment that reacts K+ chestnut or yellow-brown, forming a yellow solution, N+ intense blue-black, HCl+ intensifying purple-black.

At present the species is known from dead wood in inland areas of southern Western Australia, South Australia and New South Wales. Common associated lichens include *Amandinea extenuata* (Müll.Arg.) Marbach, *Austromelanelixia piliferella* (Essl.) Divakar, A.Crespo & Lumbsch, *Austroparmelina conlabrosa* (Hale) A.Crespo, Divakar & Elix, *A. pseudorelicina* (Jatta) A.Crespo, Divakar & Elix, *Buellia reagenella* Elix, *Flavoparmelia rutidota* (Hook.f. & Taylor) Hale, *Japewiella variabilis* Elix & P.M.McCarthy, *Physcia jackii* Moberg, *Ramboldia brunneocarpa* Kantvilas & Elix and *Usnea inermis* Motyka.

ADDITIONAL SPECIMENS EXAMINED
New South Wales. ● Goonoo State Forest, Ranters Creek, Cashels Dam Road, 33 km SE of Gilgandra, 31°58'25"S, 148°51'46"E, 360 m alt., on dead *Calytrix* twigs in *Eucalyptus-Callitris* woodland with *Calytrix* and *Grevillea* understorey, *J.A. Elix 37393*, 12.x.2005 (CANB). *Victoria*. ● Otway Plain, Ironbark Basin Reserve, Point Addis Road, Point Addis, 38°24'S, 144°15'E, on twig of *Acacia* in *Eucalyptus tricarpa–E. sideroxylon*-dominated forest, *K. Ralston 1011 pr. p.*, 21.iii.1999 (MEL).
Western Australia. ● Intersection of Marwick and Quairading roads, 9 km SE of York, 31°53'S, 116°51'E, on dead twigs in *Eucalyptus-Acacia* woodland, *R.J. Cranfield 23642/2*, 30.v.2009 (CANB). ● Quarrell Range, Moora–New Norcia road, 22 km by road S of Moora, 30°41'38"S, 116°12'20"E, 275 m alt., on dead *Acacia* in remnant *Eucalyptus-Acacia* woodland with basalt outcrops along dry creek, *J.A. Elix 37559*, 2.iv.2006 (CANB).

3. Buellia arida Elix, sp. nov. Fig. 3
MycoBank No. **MB834723**

Similar to *Buellia abstracta* (Nyl.) H.Olivier, but differs in having larger ascospores, 11–[*13.7*]–17 × 5–[*5.8*]–7 µm, and longer conidia, 4–6 µm long.

Type: Australia, Northern Territory, Henbury Station, Chandler Range, near Rockhole Bore, 24°30'55"S, 133°27'12"E, 434 m alt., on sandstone boulder near base of a steep rocky slope in open shrubland with *Acacia*, *Dodonaea* and *Eremophila*, *V. Stajsic 6636*, 22.v.2013 (holotype – MEL).

Thallus to 40 mm wide, endolithic and not apparent or epilithic, fragmentary and comprised of discontinuous corticate patches 0.2–0.5 mm wide at the base of apothecia or in rock crevices; upper surface off-white, matt; prothallus not apparent; photobiont cells 8–19 µm wide; medulla lacking calcium oxalate (H_2SO_4–), I–. *Apothecia* 0.2–1 mm wide, abundant, lecideine, roundish, scattered, broadly adnate then sessile; disc black, epruinose, plane to markedly convex; proper exciple thin, excluded in older, convex apothecia, in section 45–55 µm thick; outer part brown-black, K+ yellow and soon forming red, needle-like crystals, N+ orange-brown; inner part brown. *Epihymenium* 10–13 µm thick, dark olive-brown, N–. *Hypothecium* 100–150 µm thick, brown to deep red-brown. *Hymenium* 50–75 µm thick, colourless, not inspersed; subhymenium 30–45 µm thick, pale brown, not inspersed. *Paraphyses* 1–2 µm wide, sparingly branched, with apices 4–6 µm wide and brown caps. *Asci* 8-spored, *Bacidia*-type. *Ascospores Buellia*-type, 1-septate, pale brown then dark brown, ellipsoid, 11–[*13.7*]–17 × 5–[*5.8*]–7 µm, rarely constricted at the septum; outer wall finely ornamented. *Pycnidia* rare, punctiform, immersed; ostiole black. *Conidia* bacilliform, 4–6 × 0.7–1 µm.
Chemistry: Medulla K+ yellow then red, C–, PD+ orange, UV–; containing norstictic acid [major], connorstictic acid [trace].

Etymology: The species is named after its occurrence in arid habitats.

Remarks
The endolithic or poorly developed, very thin, discontinuous thallus resembles the cosmopolitan *B. abstracta*, as both species are dominated by abundant, broadly adnate to sessile apothecia. However, *B. abstracta* has significantly smaller ascospores, 10–[*11.7*]–14 × 3–[*4.6*]–6 µm, and shorter conidia, 2.5–4 µm long (Coppins *et al.* 2009, as *B. sequax*). *Buellia arida* could also be confused with the Australasian *B. northallina* Elix & Kantvilas. However, that species

has shorter, broader ascospores, 10–[*11.7*]–14 × 6–[*6.9*]–9 µm, and shorter conidia *c.* 3 µm long, and a subhymenium inspersed with oil droplets (Elix *et al*. 2017).

The new species is known from far-western New South Wales and southern parts of the Northern Territory. Common associated lichens include *Buellia dispersa* A.Massal., *B. spuria* var. *amblyogona* (Müll.Arg.) Elix, *Caloplaca australiensis* S.Y.Kondr., Kärnefelt & Filson, *Sarcogyne iridana* P.M.McCarthy & Kantvilas and *Xanthoparmelia cravenii* Elix & J.Johnst.

ADDITIONAL SPECIMENS EXAMINED
Northern Territory. ● 25 km SW of Alice Springs, 24°49'S, 133°47'E, on S-face of sandstone hill, *P.K. Latz 6380B*, 24.ii.1976 (MEL); ● East McDonnell Ranges, 1 km W of entrance to Ruby Gap National Park, 23°29'05"S, 134°57'46"E, 434 m alt., on rocky outcrop with SE aspect, *K. Ralston 2559*, 1.x.2002 (MEL).
New South Wales. ● South Western Plains, Manara Hills, Mount Manara Station, 66 km N of Ivanhoe, 32°28'S, 143°55'E, on rock face in exposed situation, *R.B. Filson 14576*, 10.xi.1972 (MEL).

4. Buellia cravenii Elix, sp. nov. Fig. 4
MycoBank No. **MB834724**

Similar to *Buellia psoromica* Elix, but differs in having a non-amyloid medulla, oil paraphyses in the hymenium, somewhat longer ascospores, 12–19 µm long, and shorter conidia, 5–7 µm long.

Type: Australia, Northern Territory, Macdonnell Range, 1 km N of Glen Helen Tourist Camp, 24°41′S, 132°41′E, 640 m alt., on sandstone rocks with a southerly aspect in mulga scrub, *J.A. Elix 11260 & L.A. Craven*, 16.ix.1983 (holotype – CANB).

Thallus crustose, to 35 mm wide and 0.6 mm thick, continuous, rimose-areolate; areoles 0.2–1 mm wide, irregular, angular; upper surface grey-white, matt, epruinose; prothallus absent; photobiont cells 8–20 µm wide; medulla white, lacking calcium oxalate (H_2SO_4–), I–. *Apothecia* 0.3–0.8 mm wide, abundant, lecideine, roundish, scattered, immersed then adnate or sessile; disc black, epruinose, more or less flat then markedly convex; proper exciple thick, black, excluded in convex apothecia, in section 60–75 µm thick; outer part dark olive-brown to deep aeruginose, K–, N+ purple-brown; inner part brown. *Epihymenium* 15–25 µm thick, deep aeruginose to aeruginose-black, K+ indigo, N+ purple. *Hypothecium* 150–250 µm thick, dark brown, K–, N+ orange-brown. *Hymenium* 75–100 µm thick, colourless, not inspersed, I+ blue; subhymenium 20–35 µm thick, pale brown. *Paraphyses* 1.8–2.5 µm wide, shortly septate, sparsely branched, with apices 4–5 µm wide and aeruginose caps; oil paraphyses 4–8 µm wide. *Asci Bacidia*-type, 8-spored. *Ascospores* initially *Physconia*-type then *Buellia*-type, 1-septate, pale then dark brown, ellipsoid, 12–[*14.3*]–19 × 5–[*7.3*]–9 µm, becoming constricted at the septum; outer wall finely ornamented. *Pycnidia* brown, punctiform, immersed. *Conidia* bacilliform, straight, 5–7 × 0.8–1 µm.
Chemistry: Medulla K+ yellow, P+ yellow, C−, UV−; containing psoromic acid [major], atranorin [minor].

Etymology: This species is named in honour of my co-collector, friend and colleague, the late Dr Lyn A. Craven.

Remarks
Buellia cravenii resembles *B. psoromica* in that both contain psoromic acid and atranorin, have an aeruginose, N+ purple-brown epihymenium and proper exciple, *Buellia*-type ascospores and bacilliform conidia. However, *B. psoromica* has an intensely amyloid medulla, a hymenium that lacks oil paraphyses, somewhat-shorter ascospores, 11–16 µm long, and larger conidia, 6–10 µm long. In addition, *B. psoromica* usually has a well-developed black prothallus that is apparent at the thallus margins and between adjacent areoles (Elix 2009). In several

respects the new species also resembles the common and widely distributed *Buellia aethalea* (Ach.) Th.Fr. in that both have initially immersed apothecia and aeruginose epihymenia. However, in *B. aethalea* the hypothecium varies from colourless to pale brown, the medulla reacts K+ yellow then red due to the presence of norstictic acid and the ascospores are much larger, 12–20 × 7–12 µm (Elix 2011).

This species is known from siliceous rocks in the arid inland areas of South Australia, the Northern Territory and Western Australia. Common associated lichens include *Buellia dispersa* A.Massal., *B. spuria* var. *amblyogona* (Müll.Arg.) Elix, *Caloplaca australiensis* S.Y.Kondr., Kärnefelt & Filson, *Sarcogyne iridana* P.M.McCarthy & Kantvilas and *Xanthoparmelia cravenii* Elix & J.Johnst.

ADDITIONAL SPECIMENS EXAMINED
South Australia. ● Flinders Ranges, Nooltana Creek, 12 km N of Hawker, 31°49'S, 138°23'E, 550 m alt., on rocks in chenopod shrubland, *J.A. Elix 17941 & L.H. Elix*, 29.x.1984 (CANB).
Western Australia. ● Karijini National Park, Hamersley Range, Dales Gorge, Circular Pool, [22°30'S, 118°24'E], on rock, *A.C. Beaglehole 13983*, 14.viii.1965 (MEL).

5. Buellia eldridgei Elix, sp. nov. Fig. 5
MycoBank No. **MB834725**

Similar to *Buellia dijiana* Trinkaus, but differs in having shorter ascospores, 11–16 µm long, a thinner hymenium, 65–75 µm thick, and in containing additional 6-*O*-methylarthothelin.

Type: Australia, Queensland, Andersen Paddock, Merigol Station, *c.* 40 km W of Charleville on the Quilpie road, 29°47'46"S, 148°49'19"E, on soil in open woodland on soft mulga sandplain with *Eucalyptus populnea* and *Acacia aneura*, *D. Eldridge CCS18 & T. Beutel*, 9.iv.2002 (holotype – CANB).

Thallus crustose, areolate to subsquamulose, to 10 mm wide; areoles crowded or dispersed, 0.4–1 mm wide, rounded, flat to weakly convex; upper surface pale yellow-brown, shiny; prothallus absent; medulla white, containing calcium oxalate (H_2SO_4+), I–; photobiont cells 7–14 µm diam. *Apothecia* 0.4–0.8 mm wide, lecideine, immersed to just adnate, 1 per areole, round; disc black, epruinose, weakly concave to flat; proper exciple persistent, thick and raised above disc at first, thinner with age and level with disc; in section outer zone dark brown, 25–30 µm thick, K–, N–; inner zone pale brown. *Epihymenium* 10–12 µm thick, brown, K–, N–. *Hypothecium* brown to dark brown, 150–175 µm thick, K–. *Hymenium* 65–75 µm thick, colourless, not inspersed; subhymenium, pale brown, 20–30 µm thick. *Paraphyses* 2–2.5 µm wide, sparsely branched, with apices 4–5 µm wide and brown caps. *Asci* of the *Bacidia*-type, (6–)8-spored. *Ascospores Buellia*-type, brown, ellipsoid, 11–[*13.3*]–16 × 6–[*7.4*]–9 µm; older spores constricted at the septum; outer spore-wall rugulate. *Pycnidia* not seen.
Chemistry: Medulla K–, P–, C+ orange, UV+ orange; containing 6-*O*-methylarthothelin (major), arthothelin (minor).

Etymology: This species is named after Prof. David Eldridge, the collector of the type specimen.

Remarks
Buellia eldridgei is characterized by the areolate to subsquamulose, pale yellow-brown terricolous thallus, the immersed to adnate, lecideine apothecia, the non-amyloid medulla containing calcium oxalate, a non-inspersed hymenium, the ellipsoid, 1-septate, *Buellia*-type ascospores, 11–16 × 6–9 µm, and by the presence of 6-*O*-methylarthothelin and arthothelin. *Buellia dijiana* has longer ascospores, 14–[*17.2*]–21 µm long, a thicker hymenium, 75–110 µm, and contains only arthothelin (Trinkaus *et al.* 2001).

Buellia eldridgei is known only from the type collection. Associated species were not recorded.

6. Buellia kowenensis Elix & P.M.McCarthy, sp. nov. Fig. 6
MycoBank number: **MB834726**

Similar to *Buellia halonia* (Ach.) Tuck., but differs in having smaller, persistently *Buellia*-type ascospores and in containing medullary calcium oxalate.

Type: Australia, Australian Capital Territory, Kowen Road, Kowen Forest, 11.7 km E of Canberra, 35°19'02"S, 149°15'07"E, 700 m alt., on sandstone rocks along old road bordering open *Eucalyptus* woodland, *J.A. Elix 46788*, 31.vii.2019 (CANB – holotype).

Thallus crustose, rimose-areolate, to 10 mm wide and 0.3 mm thick; individual areoles 0.1–0.7 mm wide; upper surface white to off-white, dull, appearing crystalline or maculate due to the incorporation of silica in the thallus, esorediate; prothallus not apparent; photobiont cells 8–14 µm wide; medulla white, containing calcium oxalate (H_2SO_4+), I−. *Apothecia* 0.1–0.4 mm wide, lecideine, separate, broadly adnate; disc black, epruinose, weakly concave to convex; proper exciple thin, initially elevated above the disc, excluded in older convex apothecia, in section 15–25 µm thick, the outer part dark brown, K–, paler within. *Hypothecium* 50−60 µm thick, deep red-brown, K−, N−. *Epihymenium* 10–12 µm thick, dark brown, K−, N−. *Hymenium* 50–60 µm thick, colourless, not inspersed with oil droplets; subhymenium 10−15 µm thick, pale brown. *Paraphyses* 1.5–2 µm wide, simple to sparsely branched, with apices 4−5 µm wide and brown caps. *Asci* of the *Bacidia*-type, with 8 spores. *Ascospores* of the *Buellia*-type, 1-septate, brown, ellipsoid, 9–[*10.9*]–13 × 5–[*5.2*]–7 µm, becoming constricted at the septum; outer spore wall microrugulate. *Pycnidia* punctiform, immersed; ostiole brown. *Conidia* bacilliform, 8–10 × 1 µm.
Chemistry: Cortex K–, C+ yellow, KC+ orange, P–, UV+ dull orange; containing isoarthothelin (major), 4,5-dichloronorlichexanthone (trace).

Etymology: The epithet is derived from the type locality.

Remarks
Chemically, *B. kowenensis* closely resembles *B. halonia*, a widespread saxicolous species known from Australia, North America, South America and South Africa (Elix 2011). Both are characterized by the presence of arthothelin or isoarthothelin, and both ultimately have *Buellia*-type ascospores. However, in *B. halonia* the ascospores are initially *Physconia*-type and are significantly larger, 12–[*15.0*]–18 × 7–[*8.2*]–10 µm. Furthermore, *B. halonia* contains isoarthothelin and roccellic acid as major substances, and it lacks medullary calcium oxalate, whereas *B. kowenensis* lacks roccellic acid and contains high concentrations of calcium oxalate. Morphologically, *B. kowenensis* could also be confused with the widespread Australasian *B. suttonensis* Elix & A.Knight, but the latter lacks lichen substances and medullary calcium oxalate (Elix & A.Knight 2017).

This species is known only from the type locality. Common 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.

7. Buellia lordhowensis Elix, sp. nov. Fig. 7
MycoBank No. **MB834727**

Similar to *Buellia lichexanthonica* Aptroot & Cáceres, but differs in having immersed apothecia and a well-developed, black prothallus.

Type: Australia, New South Wales, Lord Howe Island, Rocky Run Creek, 31°33'20"S, 159°05'33"E, 35 m alt., on basalt rocks in poor lowland forest beside broad rocky stream, *J.A. Elix 42499*, 10.ii.1995 (holotype – CANB).

Thallus crustose, rimose to rimose-areolate, to 55 mm wide; areoles crowded or dispersed, 0.2–0.8 mm wide, irregular, angular, flat; upper surface pale yellow-grey, dull; prothallus black, prominent, marginal and between areoles; medulla white, lacking calcium oxalate (H_2SO_4–), I–; photobiont cells 6–11 µm diam. *Apothecia* 0.1–0.25 mm wide, lecideine, immersed to level with the thallus, round; disc black, epruinose, flat; proper exciple persistent, thin, initially slightly raised above the disc, becoming level with age; in section outer zone aeruginose-black, 25–35 µm thick, K–, N+ purple-brown; inner zone brown. *Epihymenium* 8–10 µm thick, dark brown to aeruginose, K–, N+ purple-brown. *Hypothecium* brown to dark brown, 70–80 µm thick, K–. *Hymenium* 45–55 µm thick, colourless, not inspersed; subhymenium pale brown, 10–15 µm thick. *Paraphyses* 1.5–2 µm wide, sparsely branched, with apices 4–5 µm wide and aeruginose-brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores Buellia*-type, brown, ellipsoid, 9–[*10.8*]–13 × 5–[*5.8*]–8 µm, older spores constricted at the septum; outer spore-wall microrugulate. *Pycnidia* brown to black, immersed. *Conidia* straight, bacilliform, 6–9 × 0.7–1 µm.
Chemistry: Medulla K–, P–, C–, UV+ orange; containing 4,5-dichlorolichexanthone (major).

Etymology: The epithet is derived from the type locality.

Remarks
Buellia lordhowensis is characterized by the rimose to rimose-areolate, pale yellow-grey thallus, the prominent black prothallus, the immersed, lecideine apothecia, 0.1–0.25 mm wide, the non-amyloid medulla lacking calcium oxalate, a non-inspersed hymenium, the ellipsoid, 1-septate, *Buellia*-type ascospores, 9–13 × 5–8 µm, the bacilliform conidia, 6–9 × 0.7–1 µm, and the presence of 4,5-dichlorolichexanthone. *Buellia lichexanthonica*, from Brazil, has a similar thallus, ascospores and anatomy and identical chemistry, but it lacks a prothallus and has larger, sessile apothecia, 0.2–0.5 mm wide and up to 0.2 mm high (Aptroot *et al.* 2017). Superficially, *B. lordhowensis* is very similar to *B. stellulata* (Taylor) Mudd, but the latter differs chemically in containing atranorin, 2'-*O*-methylperlatolic acid, ± confluentic acid and ± roccellic acid.

Buellia lordhowensis is known only from the type collection. Associated species include *Buellia homophylia* (C.Knight) Zahlbr., *Megalaria cf. laureri* (Hepp ex Th.Fr.) Hafellner, *Parmotrema reticulatum* (Taylor) M.Choisy and *Xanthoparmelia thamnoides* (Kurok.) Hale.

8. Buellia phillipensis Elix, sp. nov. Fig. 8
MycoBank No. **MB834728**

Similar to *Buellia cranwelliae* Zahlbr., but differs in having cryptolecanorine apothecia and in lacking medullary calcium oxalate.

Type: Norfolk Island, Phillip Island, Upper Long Valley, 29°07'30"S, 167°57'E, 80 m alt., on rock outcrop in African olive-dominated valley, *H. Streimann 32259A*, 4.xii.1984 (holotype – CANB).

Thallus crustose, rimose-areolate, to 15 mm wide; areoles crowded, 0.3–1 mm wide, irregular, angular, flat; upper surface white, shiny; prothallus black, prominent, marginal; medulla white, lacking calcium oxalate (H_2SO_4–), I–; photobiont cells 10–16 µm diam. *Apothecia* 0.1–0.4 mm wide, initially immersed then level with the thallus, lecanorine then biatorine or lecideine, separate or in small groups; thalline margin ultimately excluded with age; disc black, epruinose, weakly concave then plane; proper exciple thin, persistent, black; in section outer zone aeruginose-black, 25–30 µm thick, cupulate, K–, N+ purple-brown; inner zone brown. *Epihymenium* 10–12 µm thick, dark brown to aeruginose, K–, N+ purple-brown. *Hypothecium* brown to deep brown, 50–86 µm thick, K–. *Hymenium* 50–60 µm thick, colourless, not inspersed; subhymenium pale brown, 10–15 µm thick. *Paraphyses* 1.5–2 µm wide, sparsely branched, with apices 3–4 µm wide and dark brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores Buellia*-type, brown, ellipsoid, 9–[*10.6*]–13 × 5–[*6.2*]–8 µm, not constricted at the

septum; outer spore-wall microrugulate. *Pycnidia* brown to black, immersed. *Conidia* straight, bacilliform, 4–5 × 0.7–1 µm.
Chemistry: Medulla K–, P–, C–, KC–, UV–; no lichen substances detected.

Etymology: The epithet is derived from the type locality.

Remarks
The species is characterized by the white, rimose-areolate, crustose thallus, the prominent black prothallus, the lecanorine then biatorine or lecideine apothecia, 0.1–0.4 mm wide, the non-amyloid medulla lacking calcium oxalate, a non-inspersed hymenium, the ellipsoid, 1-septate, *Buellia*-type ascospores, 9–13 × 5–8 µm, the bacilliform conidia, 4–5 × 0.7–1 µm, and the absence of lichen substances. *Buellia cranwelliae* has a similar thallus and ascospores anatomy, and also lacks lichen substances, but it has larger, sessile, lecideine apothecia, 0.4–0.8 mm wide, and a medulla that contains calcium oxalate (Elix 2016). Superficially *B. phillipensis* is very similar to *B. haywardii* Elix, A.Knight & H.Mayrhofer from New Zealand, but the latter has a brown, N– epihymenium and an amyloid medulla, and it contains norstictic acid (Elix & Mayrhofer 2016).

Buellia phillipensis is known only from the type collection. Associated species include *Diploschistes actinostomus* (Pers.) Zahlbr., *Lecidella enteroleucella* (Nyl.) Hertel, *L. granulosula* (Nyl.) Knoph & Leuckert, *Parmotrema tinctorum* (Despr. ex Nyl.) Hale, *Pertusaria xanthoplaca* Müll.Arg., *Rinodina luridata* (Körb.) H.Mayrhofer, Scheid. & Sheard and *R. oxydata* (A.Massal.) A.Massal.

9. Tetramelas flindersianus Elix, sp. nov. Figs 9, 10
MycoBank No.: **MB834729**

Similar to *Tetramelas filsonii* Elix, but differs in having a non-amyloid medulla, narrower ascospores and in containing only atranorin.

Type: Australia, Tasmania, Flinders Island, *c.* 5.8 km at 34° SE of West Point (on or within 2.6 m of the outcrop at Trig Point 881), 40°59’S, 144°39’E, on siliceous rock, *J. Whinray s.n.*, 29.i.1969 (holotype – MEL 2314982).

Thallus crustose, areolate, to 60 mm wide and 1 mm thick; areoles scattered or contiguous, irregular to angular, 1–2.5 mm wide, becoming aggregated and imbricate to form a secondary subsquamulose crust, in places lifting off the substratum; upper surface off-white to grey-white, dull, uneven, granular in part; prothallus not apparent; photobiont cells 8–23 µm wide; medulla white, lacking calcium oxalate (H_2SO_4–), I–. *Apothecia* 0.3–1 mm wide, lecideine, separate or in small groups (3 or 4), broadly adnate to sessile; disc black, epruinose, plane to weakly convex; proper exciple prominent, entire, persistent, shiny, in section 40–50 µm thick; outer part brown-black, K−, N−, paler brown within. *Hypothecium* 100−250 µm thick, brown to brown-black, forming a central plug. *Epihymenium* 10–15 µm thick, dark brown to dark olive-brown, K−, N−. *Hymenium* 65–90 µm thick, colourless, not inspersed; subhymenium 20−35 µm thick, pale brown. *Paraphyses* 1.5–2.0 µm wide, simple to sparsely branched, with apices 3–4 µm wide and dark brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores* initially of the *Callispora*- or *Physconia*-types, then of the *Buellia*-type, 1-septate, brown, ellipsoid to broadly fusiform or bottle-shaped, 13–[*15.9*]–20 × 5–[*6.4*]–7 µm, becoming constricted at the septum, often curved, sometimes with 1 or 2 endosepta; outer spore-wall microrugulate. *Pycnidia* immersed, punctiform. *Conidia* bacilliform, 5–7 × 0.7–1 µm.
Chemistry: Thallus K+ yellow, C–, P+ pale yellow, UV–; containing atranorin (major).

Etymology: The species is named after the type locality.

Remarks
The species is characterized by an areolate, off-white to grey-white thallus, the areoles

becoming aggregated and imbricate to form a secondary subsquamulose crust, by the presence of atranorin, the non-amyloid medulla, adnate to sessile, lecideine apothecia, 0.3–1 mm wide, a dark brown, N– epihymenium, *Callispora*- then *Buellia*-type ascospores, 13–20 × 5–7 µm, which become constricted at maturity, and bacilliform conidia, 5–7 × 0.7–1 µm. The ascospores and hymenium of *T. flindersianus* are most similar to those of *T. filsonii* from Antarctica (Elix 2019), with ascospores 12–17 × 6–10 µm, and a hymenium 70–80 µm high. However, *T. filsonii* has a suberect, pulvinate thallus and an amyloid medulla, and it contains 6-*O*-methylarthothelin and norstictic acid.

Tetramelas flindersianus is known from two localities on Flinders Island, Tasmania, and one in Victoria. It occurs on hard, siliceous rocks such as quartzite, associated with typical littoral species including *Buellia stellulata* (Taylor) Mudd var. *stellulata*, *Caloplaca cribrosa* (Hue) Zahlbr., *C. gallowayi* S.Y.Kondr. *et al.*, *Catillaria austrolittoralis* Kantvilas & v.d.Boom, *Lecanora subcoarctata* (C.Knight) Hertel, *Pertusaria xanthoplaca* Müll.Arg., *Rinodina blastidiata* Matzer & H.Mayrhofer and *Tylothallia verrucosa* (Müll.Arg.) Kantvilas.

ADDITIONAL SPECIMENS EXAMINED
Victoria. ● East Gippsland, Cape Conran Coastal Park, West Cape, 37°49’43”S, 148°43’43”E, 1–3 m alt., on granite rock along foreshore above the high tide mark, *J.A. Elix 42290A*, 30.x.2016 (CANB).
Tasmania.● Flinders Island, on the E side of Long Point (*c.* 118 m from the southern tip), 3 m alt., on quartzite rock, *J. Whinray 630 pr. p.*, 12.v.1970 (MEL).

10. Tetramelas gariwerdensis Elix, sp. nov. Fig. 11
MycoBank No.: **MB834730**

Similar to *Tetramelas darbishirei* (I.M.Lamb) Elix, but differs in having an areolate, crustose thallus rather than a suberect, pulvinate thallus.

Type: Australia, Victoria, Grampians National Park, Mt William, 37°17’33”S, 142°36’03”E, 1167 m alt., on stone, *W.H. Ewers 367*, 25.xi.1985 (holotype – CANB).

Thallus crustose, areolate, to 15 mm wide and 0.3 mm thick; areoles scattered or contiguous, round to irregular or angular, 0.3–1 mm wide; upper surface off-white to pale yellow, dull, uneven, epruinose; prothallus not apparent; photobiont cells 9–15 µm wide; medulla white, lacking calcium oxalate (H_2SO_4–), I+ pale purple. *Apothecia* 0.2–0.6 mm wide, lecideine, separate and ± round to crowded and distorted by mutual pressure, broadly adnate to sessile; disc black, epruinose, weakly concave to plane or convex, undulate with age; proper exciple prominent, elevated above the disc but excluded in older, convex apothecia, in section 25–35 µm thick, the outer part brown-black, K+ yellow solution, N−, paler brown within. *Hypothecium* 100−120 µm thick, brown to brown-black, K+ yellow solution. *Epihymenium* 10–15 µm thick, dark brown to dark olive-brown, K−, N−. *Hymenium* 55–70 µm thick, colourless, ± with scattered oil droplets; subhymenium 10−15 µm thick, pale brown. *Paraphyses* 1.5–2 µm wide, simple to sparsely branched, with apices 4–6 µm wide and dark brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores* initially of the *Callispora*- or *Physconia*-types, then of the *Buellia*-type, 1-septate, brown, ellipsoid to broadly fusiform, 15–[*19.4*]–25 × 7–[*8.2*]–12 µm, becoming constricted at the septum, often curved, sometimes with 1 or 2 endosepta when mature; outer spore wall microrugulate. *Pycnidia* immersed, punctiform. *Conidia* bacilliform, 4.5–6.5 × 1 µm.
Chemistry: Thallus K+ yellow, C+ pale orange, KC+ orange, P+ pale yellow, UV+ very pale orange; containing atranorin (major), 6-*O*-methylarthothelin (minor).

Etymology: The species is named after the type locality. Gariwerd (Grampians mountain range) is a special place for the traditional people of this area (the Djab Wurrung and the Jardwadjali), because of the dreaming stories and the abundance of food, water and shelter it provides.

Remarks
The ascospores and hymenium of *T. gariwardensis* are most similar to those of *T. darbishirei* from Antartica (Lamb 1968; Elix 2018), which has ascospores 15–[*18.8*]–23 × 7–[*8.6*]–10 µm and a hymenium 70–80 µm high. However, *T. darbishirei* differs in having a suberect, pulvinate thallus. It is also similar to *T. oreophilus* Elix & Kantvilas from Tasmania, but that species lacks atranorin and has shorter conidia (Elix & Kantvilas 2020).

The new species is known only from the Grampians in western Victoria. Associated species include *Circinaria caesiocinerea* (Nyl. ex Malbr.) A.Nordin, *Buellia aethalea* (Ach.) Th.Fr., *B. ocellata* (Flot.) Körb., *Lecidea lygomma* Nyl., *Ramboldia petraeoides* (Nyl. ex C.Bab. & Mitt.) Kantvilas & Elix, *Rhizocarpon geographicum* (L.) DC. and several *Xanthoparmelia* species.

New records

1. Amandinea brugierae (Vain.) Marbach, *Biblioth. Lichenol.* **74**, 55 (2000) Fig. 12
Buellia brugierae Vain., *Ann. Univ. Fenn. Aboënsis*, ser. A, **2**, 14 (1926)
Type: South Africa, near Durban, Natal, on bark of *Brugierae*, *P.A. van der Bijl 138*, 1921 (holotype – TUR).

Thallus crustose, continuous, to 25 mm wide; upper surface white to grey-white, dull, rarely becoming granular; prothallus black, marginal when abutting other lichens; medulla white, lacking calcium oxalate (H_2SO_4–), I–; photobiont cells 6–10 µm diam. *Apothecia* 0.1–0.8 mm wide, lecideine, broadly adnate to sessile and constricted at the base, isolated or crowded, rounded; disc black, epruinose, plane; proper exciple thin, slightly raised above the disc, persistent, in section the outer zone olive-brown to brown-black, K–, N+ orange-brown, 25–35 µm thick; inner zone pale brown. *Epihymenium* 8–10 µm thick, red-brown, K–, N–. *Hypothecium* brown-black, 125–150 µm thick, K–. *Hymenium* 60–70 µm thick, colourless, not inspersed; subhymenium 25–35 µm thick, colourless to pale brown, not inspersed. *Paraphyses* 2–2.5 µm wide, sparsely branched, with apices 3–4 µm wide and pale brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores Buellia*-type, brown, narrowly ellipsoid, 10–[*12.7*]–16 × 4–[*5.1*]–6.5 µm, ± curved, older spores constricted at the septum; outer spore wall moderately ornamented. *Pycnidia* not seen.
Chemistry: Thallus K+ yellow, P+ pale yellow, C–, UV–; containing atranorin. A detailed description and illustration are provided in Marbach (2000).

Remarks
This species was previously known from South America, South Africa, Hawaii and Papua New Guinea (Marbach 2000). It is characterized by the crustose, white to grey-white, dull, rarely granular thallus, the broadly adnate to sessile, lecideine apothecia, the non-amyloid medulla, a non-inspersed hymenium, the narrowly ellipsoid, 1-septate, *Buellia*-type ascospores and the presence of atranorin. Chemically, it is identical to *Baculifera micromera* (Vain.) Marbach, but that species has a green to greenish black epihymenium [containing *micromera*-green pigment: K+ greenish, N+ purple-black or grey-black (Bungartz *et al.* 2007)], and larger ascospores [12–[*15.2*]–19 × 5–[*6.1*]–8 µm] with a strongly ornamented outer wall.

SPECIMEN EXAMINED
Queensland. ● Tully Falls National Park, Charmillin Creek, 10 km S of Ravenshoe, 17°41’09”S, 145°31’34”E, 960 m alt., on canopy branch in remnant montane rainforest, *J.A. Elix 44760*, 7.viii.2006 (CANB).

2. Buellia hypostictella Elix & H.Mayrhofer, *Australas. Lichenol.* **79**, 10 (2016)

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).
Buellia hypostictella, previously known from New Zealand, is characterized by a chinky, white-pruinose thallus containing hypostictic acid, a non-amyloid medulla that contains calcium oxalate, commonly pruinose discs, an aeruginose, N+ purple epihymenium and excipulum, a subhymenium inspersed with oil droplets, 1-septate, ellipsoid, *Buellia*-type ascospores, 10–16 × 5–8 µm and bacilliform conidia, 4–9 µm long. A detailed desciption and illustration are provided by Elix & Mayrhofer (2016).

SPECIMEN EXAMINED
South Australia. ● Port Elliot, S side of bay, on coastal granite, *R.B. Filson 15445*, 13.xi.1975 (MEL).

Acknowledgements
I thank the curators of MEL for their kind cooperation in providing a loan of numerous collections in their care, and Dr Chris Cargill and Ms Judith Curnow of CANB for their kind cooperation in providing me with ready access to key collections..

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Figure 1. *Amandinea pilbarensis* (holotype in MEL). Scale = 2 mm.

Figure 2. *Baculifera confusa* (holotype in CANB). Scale = 1 mm.

Figure 3. *Buellia arida* (holotype in MEL). Scale = 2 mm.

Figure 4. *Buellia cravenii* (holotype in CANB). Scale = 2 mm.

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

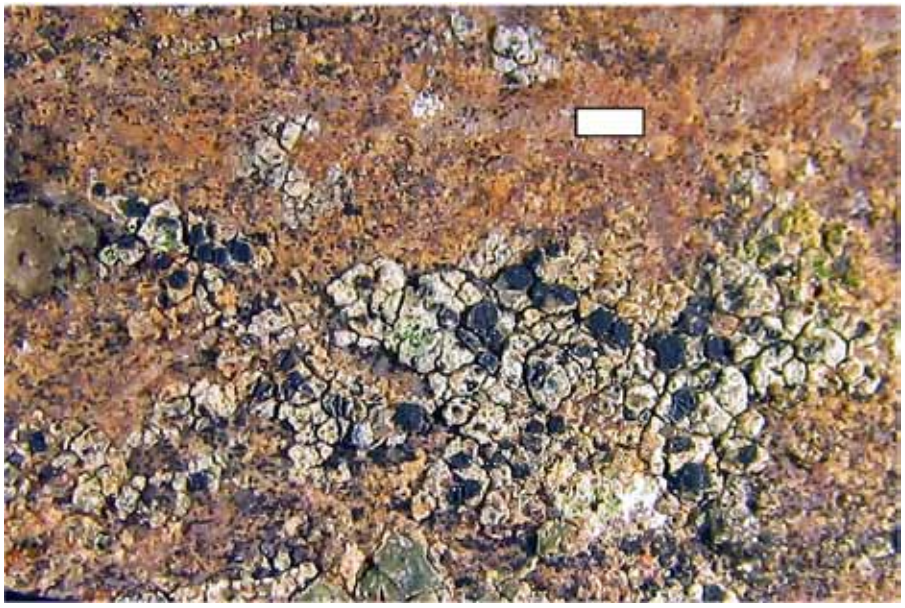

Figure 6. *Buellia kowenensis* (holotype in CANB). Scale = 1 mm.

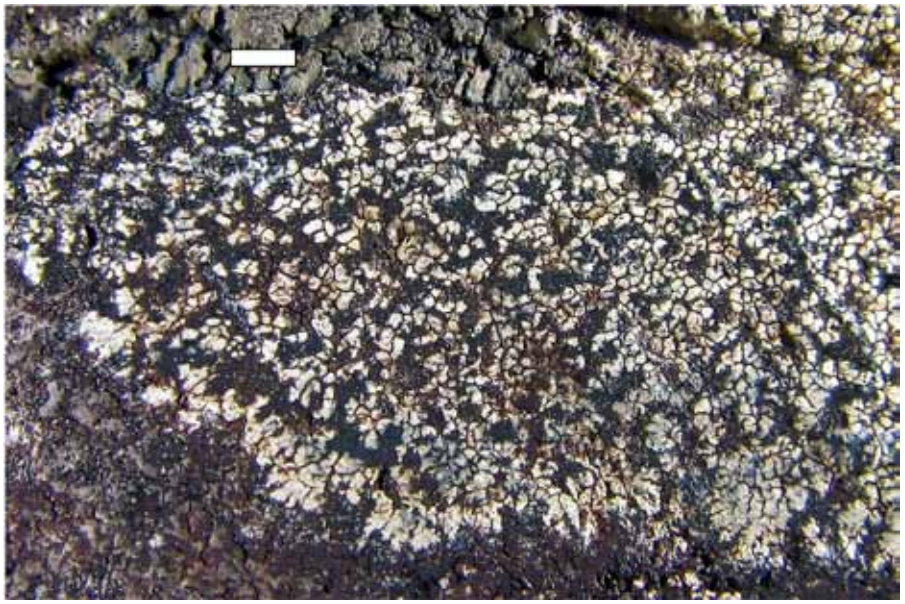

Figure 7. *Buellia lordhowensis* (holotype in CANB). Scale = 1 mm.

Figure 8. *Buellia phillipensis* (holotype in CANB). Scale = 1 mm.

Figure 9. *Tetramelas flindersianus* (holotype in MEL). Scale = 2 mm.

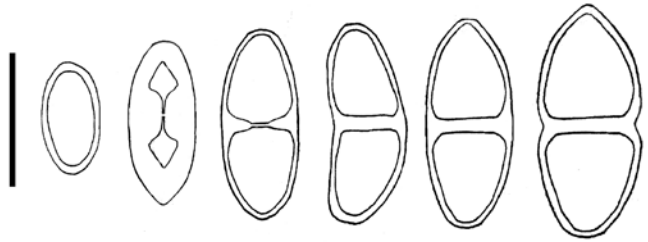

Figure 10. Ascospore ontogeny of *Tetramelas flindersianus*. Scale = 10 µm.

Figure 11. *Tetramelas gariwerdensis* (holotype in CANB). Scale = 1 mm.

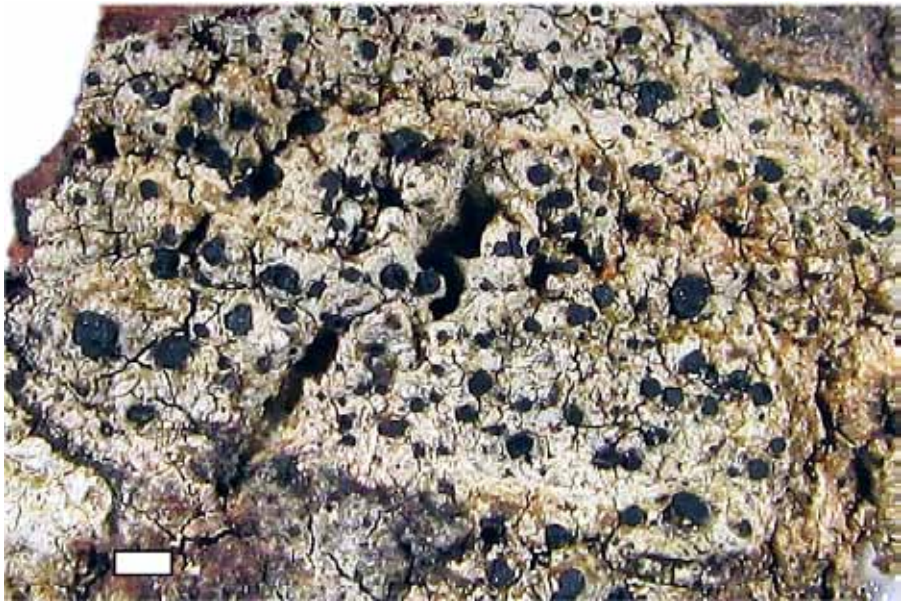

Figure 12. *Amandinea brugierae* (*Elix 44760* in CANB). Scale = 1 mm.

Three new species and a new record of buellioid lichens (Caliciaceae, Ascomycota) from Tasmania

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Abstract
Buellia acervicola Elix & Kantvilas, *B. paradisana* Elix & Kantvilas and *Tetramelas oreophilus* Elix & Kantvilas are described as new to science, and *Buellia macveanii* Elix is reported for the first time from Tasmania.

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 species of *Buellia* in the broad sense and one of *Tetramelas*. Methods are as described in the papers cited above.

New species

1. Buellia acervicola Elix & Kantvilas, sp. nov. Fig. 1
Mycobank No. **MB834658**

Similar to *Buellia epiaeruginosa* Elix, but differs in having an amyloid medulla, a paler brown hypothecium and smaller ascospores, 10–[*12.2*]–14 × 6–[*7.4*]–8 µm.

Type: Australia, Tasmania, Mt Rufus, 42°08′S, 146°06′E, 1415 m alt., on alpine dolerite rocks, *G. Kantvilas 508/14*, 27.xii.2014 (holotype – HO).

Thallus crustose, to 20 mm wide and 0.1 mm thick, areolate; areoles dispersed to contiguous, irregular, angular, 0.1–0.4 mm wide; upper surface dull grey to yellow-white, matt, epruinose; prothallus black, prominent at the periphery and between adjacent areoles; photobiont cells 5–15 µm wide; medulla white, lacking calcium oxalate (H_2SO_4–), I+ purple-blue. *Apothecia* 0.1–0.5 mm wide, abundant, at first aspicilioid then becoming lecideine at maturity, roundish, scattered, immersed; disc black, epruinose, weakly concave; proper exciple thin, black, persistent, ultimately elevated above the disc, in section 35–40 µm thick, outer part brown-black to partially aeruginose, K–, N+ purple-brown, inner part brown. *Epihymenium* 8–10 µm thick, dark brown to aeruginose-brown, N+ purple-brown. *Hypothecium* 50–70 µm thick, pale brown to brown, K–, N–. *Hymenium* 40–60 µm thick, colourless, not inspersed; subhymenium 10–15 µm thick, pale brown; paraphyses 1.8–2 µm wide, shortly septate, sparsely branched, with apices 4–5 µm wide and olive-brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores* of the *Buellia*-type, 1-septate, pale brown at first, then dark brown, ellipsoid, 10–[*12.2*]–14 × 6–[*7.4*]–8 µm, becoming constricted at the septum, outer wall finely ornamented. *Pycnidia* punctiform, immersed. Conidia elongate-bacilliform, straight, 8–11 × 1–1.5 µm.
Chemistry: Medulla K–, C–, P–, UV–; lichen substances absent.

Etymology: The specific epithet alludes to the habitat of the type specimen, on a rock cairn (*acervus*, meaning "heap") marking the mountain summit. The cairn is one of a series of more than 200 constructed on Tasmanian mountains by the surveyor James Sprent during the trigonometric survey of Tasmania, undertaken in the mid-19th Century.

Remarks
This new species resembles *B. epiaeruginosa*, in that both have immersed apothecia (at least initially), an aeruginose, N+ purple-brown epihymenium and excipulum, and bacilliform conidia, and they lack lichen substances. However, *B. epiaeruginosa* differs in having a non-amyloid medulla, a brown-black hypothecium and somewhat larger ascospores, 12–[*15.0*]–20 × 7–[*8.9*]–11 µm (Elix 2016). In some respects it also resembles the common and widely distributed *Buellia aethalea* (Ach.) Th.Fr. insofar as both have immersed apothecia with an aeruginose epihymenium. However, in *B. aethalea* the medulla reacts K+ yellow then red due to the presence of norstictic acid, and the ascospores are larger, 12–20 × 7–12 µm.

At present the new species is known from the type locality in Tasmania and the Grampian Mountains in Victoria. The habitat of the type specimen, a large dolerite cairn, is very richly colonized by crustose lichens and macrolichens. Other species present in the cairn include *Aspicilia cinerea* (L.) Körb., *Lecanora polytropa* (Ehrh.) Rabenh., *Rhizocarpon bicolor* Elix & P.M.McCarthy, *R. geographicum* (L.) DC. and *Rimularia albotessellata* Kantvilas.

ADDITIONAL SPECIMEN EXAMINED
Victoria. ● Grey Knob, Victoria Range, Grampians, on rock, *R. Filson 5255,* 14.ix.1963 (MEL).

2. Buellia paradisana Elix & Kantvilas, sp. nov. Fig. 2
Mycobank No. **MB834659**

Similar to *Amandinea lignicola* var. *australis* Elix & Kantvilas, but differs in having much smaller ascospores (8–13 × 3–5 µm) and bacilliform conidia, and in containing atranorin and placodiolic acid.

Type: Australia, Tasmania, Paradise, Wind Song Property, 42°21'S, 147°55'E, 30 m alt., on the lignin of an old standing eucalypt at the edge of dry sclerophyll forest, *G. Kantvilas 109/19*, 7.iv.2019 (holotype – HO).

Thallus crustose, areolate, dispersed, to 20 mm wide and 0.5 mm thick; individual areoles 0.1–0.2 mm wide; upper surface pale grey to grey-white or pale blue-grey, scurfy-granulose, eroded or with erumpent soralia; prothallus absent; medulla white, lacking calcium oxalate (H_2SO_4–), I–; photobiont cells 5–20 µm diam. *Apothecia* 0.1–0.5 mm wide, scattered or crowded, lecideine, broadly adnate to sessile; disc black, epruinose, plane to weakly convex; proper excipulum distinct, persistent, in section cupuliform, 25–65 µm thick, outer zone dark brown to brown-black, K–, N–, inner zone pale brownish. *Epihymenium* 8–12 µm thick, brown, K–, N–. *Hypothecium* 40–70 µm thick, pale brown, inspersed with oil droplets. *Hymenium* 50–65 µm thick, colourless, not inspersed; paraphyses 1.5–2 µm wide, simple to branched, capitate, with apices 4–5 µm wide, dark brown. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores* at first of the *Buellia*-type, 1-septate, pale brown to brown, ellipsoid, 8–[*9.9*]–13 × 3–[*4.3*]–5 µm, ± curved, becoming constricted at the septum; outer spore-wall smooth to minutely roughened. *Pycnidia* immersed, black; conidia bacilliform, 3.5–5.5 × 1 µm.
Chemistry: Thallus K+ yellow, P+ yellow, C–, UV–; containing atranorin (major), placodiolic acid (minor).

Etymology: This species is named after the type locality.

Remarks
Superficially *B. paradisana* resembles sorediate forms of *Amandinea lignicola* var. *australis*, in that both exhibit a pale grey to grey-white or pale blue-grey, scurfy-granulose, eroded to sorediate thallus with broadly adnate to sessile lecideine apothecia. However, the latter can be readily distinguished by its larger ascospores, 11–20 × 5–8 µm, curved, filiform conidia (18–26 × 0.5–1 µm) and by the absence of lichen substances (Elix & Kantvilas 2013). Several Northern Hemisphere species of *Buellia* sens. str. contain atranorin and placodiolic acid, namely *B. arborea* Coppins & Tønsberg, *B. leptoclinoides* (Nyl.) J.Steiner and *B. penichra*

(Tuck.) Hasse, but those three species have an inspersed hymenium, much larger ascospores and esorediate thalli (Bungartz *et al.* 2007; Coppins *et al.* 2009).

At present, the new species is known only from the type locality, a heavily degraded site that was formerly rough grazing ground but now supports scattered, mature eucalypts and copses of gorse (*Ulex europaeus*). The dominant lignicolous lichen in such situations is *Ramboldia stuartii* (Hampe) Kantvilas & Elix, with *Buellia schaereri* De Not. also present.

3. Tetramelas oreophilus Elix & Kantvilas, sp. nov. Figs 3, 4
MycoBank No.: **MB834660**

Similar to *Tetramelas allisoniae* Elix, H.Mayrhofer & Glenny, but differs in containing 6-*O*-methylarthothelin, in having smaller ascospores, 17–[*21.2*]–26 × 6–[*8.2*]–10 µm, a thinner hymenium (60–80 µm thick) and a greenish black epihymenium.

Type: Australia, Tasmania, Hartz Peak summit, 43°15'S, 146°46'E, 1250 m alt., on the sheltered eastern face of an alpine dolerite tor, *G. Kantvilas 500/14*, 14.xii.2014 (holotype – HO).

Thallus crustose, continuous, rimose-areolate, to 50 mm wide and 0.3 mm thick; areoles irregular, angular, 0.1–1 mm wide; upper surface pale yellow to pale yellow-green, dull, unevenly verrucose-lumpy, epruinose; prothallus black and marginal or not apparent; photobiont cells 7–14 µm wide; medulla white, lacking calcium oxalate, (H_2SO_4–), I+ intense purple. *Apothecia* 0.2–1 mm wide, lecideine, separate and ± round to crowded and distorted by mutual pressure, broadly adnate to sessile; disc black, epruinose, weakly concave to plane, becoming convex, undulate or tuberculate with age; excipulum prominent, elevated above the disc but excluded in older, convex apothecia, in section 40–50 µm thick, the outer part dark olive-brown to greenish black, K+ yellow solution, N−; paler brown within. *Hypothecium* 40−50 µm thick, brown to dark brown, subhypothecium brown-black, 120−250 µm thick, K+ yellow; subhymenium 15−20 µm thick, pale brown. *Epihymenium* 9–12 µm thick, dark brown to greenish black, K−, N−. *Hymenium* 60–80 µm thick, colourless, ± with scattered oil droplets; paraphyses 1.5–2.2 µm wide, simple to sparsely branched, with apices 4–6 µm wide and dark brown caps. Asci of the *Bacidia*-type, 8-spored. *Ascospores* initially of the *Callispora*- or *Physconia*-types, then of the *Buellia*-type, 1-septate, brown, ellipsoid to broadly fusiform, 17–[*21.2*]–26 × 6–[*8.2*]–10 µm, becoming constricted at the septum, often curved, sometimes with one or two endosepta when mature; outer spore-wall microrugulate. *Pycnidia* immersed, punctiform, conidia bacilliform, 3.5–5 × 1 µm.
Chemistry: Thallus K+ yellow, C+ pale orange, KC+ orange, P–, UV+ pale orange; containing 6-*O*-methylarthothelin (major) and atranorin (major, minor or absent).

Etymology: The specific epithet refers to the montane habitat of the new species (from the Greek *oreos*, pertaining to mountains).

Remarks
The new species has been confused previously with *T. allisoniae* from New Zealand (Elix & H.Mayrhofer 2017) and *T. subpedicellata* (Hue) Elix from Antarctica (Elix 2018), both of which have larger ascospores, a thicker hymenium and different chemistries. Thus *T. allisoniae* has ascospores measuring 19–[*23.1*]–30 × 7–[*10.3*]–13 µm, and a hymenium 110–130 µm thick, and contains arthothelin, whereas *T. subpedicellata* has ascospores of 18–[*24.2*]–33 × 9–[*10.8*]–13 µm, and a hymenium 80–100 µm thick, and contains atranorin (major) and 6-*O*-methylarthothelin (minor), as well as having a pulvinate growth form. Indeed, the dimensions of the ascospores and hymenium of *T. oreophilus* are most similar to those of *T. darbishirei* (I.M.Lamb) Elix from Antarctica (Lamb 1968; Elix 2018), which has ascospores of 15–[*18.8*]–23 × 7–[*8.6*]–10 µm and a hymenium 70–80 µm thick. However, *T. darbishirei* differs in having a suberect, pulvinate thallus and in containing atranorin (major) and 6-*O*-methylarthothelin (minor).

At present, the new species is known only from the type locality, where it grows in a highly sheltered overhang amongst large alpine boulders of dolerite where few other lichens are present. That habitat is rarely investigated, owing largely to the difficulty of collecting saxicolous lichens from such a very hard substratum in a confined space. It was discovered fortuitously as the collector sheltered from driving winds.

New record for Tasmania

Buellia macveanii Elix, *Australas. Lichenol.* **78**, 35 (2016)
This species was previously known from New South Wales, the Australian Capital Territory and the South Island of New Zealand (Elix 2016). Characterized by minute, aggregated, yellow to yellow-green areoles, separate or clustered, immersed apothecia, a prominent black prothallus, an amyloid medulla, *Physconia*- then *Buellia*-type, 1-septate, ascospores 11–18 × 6–10 µm, an aeruginose, N+ violet-red epihymenium and by the presence of 6-*O*-methylarthothelin. A detailed description and illustration are given in Elix (2016).

SPECIMENS EXAMINED
Tasmania. ● Stacks Bluff, 41°38'S, 147°41'E, 1527 m alt., on rock, *J. Adams 72/1166,* 27.x.1972 (HO); ● Mt Mawson, 42°42'S, 146°35'E, 1200 m alt., on exposed dolerite, *G.C. Bratt 2944a & J.A. Cashin,* 4.xii.1965 (HO); ● track to Snowy South, on plateau above Lake Skinner, 42°56'S, 146°40'E, 1230 m alt., on alpine dolerite boulders, *G. Kantvilas 465/14,* 27.x.1972 (HO).

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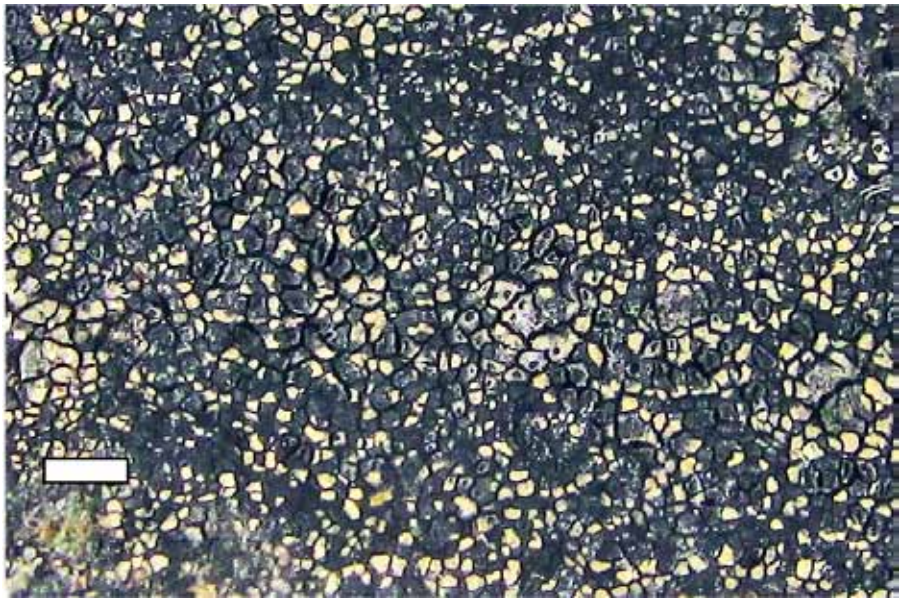

Figure 1. *Buellia acervicola* (holotype in HO). Scale = 2 mm.

Figure 2. *Buellia paradisana* (holotype in HO). Scale = 1 mm.

Figure 3. *Tetramelas oreophilus* (holotype in HO). Scale = 1 mm.

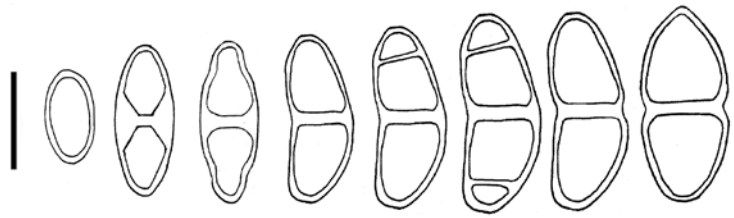

Figure 4. Ascospore ontogeny of *Tetramelas oreophilus*. Scale = 10 µm.

A new species of *Micarea* (Pilocarpaceae) from soil in New Zealand

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Abstract

Micarea rubiformis P.M.McCarthy & Elix sp. nov. (lichenized Ascomycota, Pilocarpaceae) is described from consolidated, siliceous soil in *Nothofagus* forest in southern New Zealand.

Introduction

The genus *Micarea* Fr. (Pilocarpaceae) is poorly understood in New Zealand and its offshore islands, with only nine species reliably reported (Coppins & Kantvilas 1990; Fryday 2004; Galloway 2007; Kantvilas & Coppins 2019). However, given that investigations carried out over many years have yielded 35 species in Tasmania (Kantvilas & Coppins 2019), the range of available substrata and habitats in New Zealand suggests that actual diversity is possibly in excess of 50 taxa. In this contribution, a new species, *M. rubiformis*, is described and illustrated from forest soil in the South Island.

Micarea rubiformis P.M.McCarthy & Elix, sp. nov. Figs 1 & 2
MycoBank No.: **MB834664**

Thallus terricolous, pale greyish green, continuous to rimose, 50–100 µm thick, containing 2'-*O*-methylsuperlatolic acid. Apothecia adnate to sessile, jet-black, immarginate, strongly convex to subglobose, 0.15–0.74 mm diam., markedly tuberculate; hypothecium deep red-brown (± Laurocerasi-brown), 80–210 µm thick; hymenium hyaline to pale yellowish, 48–70 µm thick, not inspersed. Asci 46–68 × 11–15 µm; ascospores 0(–1)-septate, mostly narrowly ellipsoid to oblong, 10–20 × 4.5–7 µm.

Type: New Zealand. South Island, Canterbury, track to Cass Saddle from Field Station, Sugarloaf Bush, 43°02'S, 171°47'E, *c.* 800 m alt., on consolidated, siliceous soil in *Nothofagus* forest, *J.A. Elix 26213*, 18.ii.1991 (holotype – CANB).

Thallus crustose, superficial on consolidated, siliceous soil, determinate and forming well-delimited colonies to *c.* 30 mm wide, smooth and continuous to granular-scurfy and rimose or densely and irregularly verruculose, uniformly pale greyish green, dull, 50–80(–100) µm thick, non-amyloid (I–), not containing calcium oxalate (H_2SO_4–), ecorticate; soredia and isidia absent. *Algae* dominating the thallus, not forming goniocysts; cells micareoid, greyish green, ± globose to broadly ellipsoidal, thin-walled, 4–6(–7) µm wide; interstitial hyphae 1.5–2.5 µm wide. *Medulla* poorly delimited; hyphae 2.5–3.5(–4) µm wide, short-celled, thin-walled. *Prothallus* not apparent. *Apothecia* very numerous, adnate to sessile, dull jet-black, rounded, ellipsoid or rounded-irregular (often due to mutual pressure among clustered apothecia), solitary or proliferating in groups of up to 20, and usually appearing tuberculate, (0.15–)0.42(–0.74) mm diam. [*n* = 80]; solitary apothecia up to 0.5 mm wide, but most structures greater than 0.35 mm wide are actually proliferating-tuberculate compound apothecia; occasional tuberculate clusters, 0.8–1.6 mm wide, usually the result of merging smaller clusters rather than apothecial proliferation; apothecia immarginate from very early in their development (even when less than 50 µm wide); disc dull, smooth, epruinose, moderately to strongly convex or subglobose. *Proper excipulum* not apparent at maturity, ± vestigial in very small, immature apothecia, red-brown, K+ paler, N–, C–. *Hypothecium* deep-red-brown [± Laurocerasi-brown of Meyer & Printzen (2000)], 80–160(–210) µm thick, paraplectenchymatous below, distally with short-celled, deeply pigmented, anticlinal hyphae 2.5–3.5 µm wide, not inspersed with granules or oil globules, K+ dark dirty brown, N–, C+ darker red-brown, with hints of brown-black. *Hymenium* hyaline to pale yellowish, with or without pale to medium red-brownish vertical streaks, 48–65(–70) µm thick, not inspersed, K+ paler, N–, C–; subhymenium not apparent. *Epihymenium* pale red-brown, or indistinct and not clearly delimited from the hymenium, K+ paler, N–, C–. *Paraphyses* uniform, tightly conglutinate in water, loosening only slightly in K, simple to sparingly furcate-branched towards the apices, long-celled, 1–1.5(–2) µm wide, not constricted at the septa; apices not pigmented, not or only very slightly swollen. *Asci* narrowly clavate to clavate-cylindrical, 46–68 × 11–15 µm [*n* = 15], 8-spored, *Byssoloma*-type, i.e. with an amyloid outer coat, the tholus well-developed, predominantly amyloid, with or usually without a minute, conical ocular chamber subtending a paler, apical cushion bounded by a more darkly amyloid tube structure. *Ascospores* colourless, 0(–1)-septate, narrowly ellipsoid to oblong, occasionally broadly ellipsoid or oblong-fusiform, the distal end commonly broader and more rounded than the proximal, usually straight, irregularly massed or overlapping-biseriate in the ascus, not constricted at the septum, (10–)14(–20) × (4.5–)5.5(–7) µm [*n* = 90], thin-walled, lacking a perispore; apices rounded; contents clear or finely granulose. *Pycnidia* not seen.
Chemistry: Thallus K–, P–, C–, UV–; containing 2'-*O*-methylsuperlatolic acid (major) by TLC (Elix 2014).

Etymology: The specific epithet, from the blackberry genus *Rubus* and *-formis* (having the shape of), alludes to the mature, tuberculate apothecial clusters that resemble blackberries.

Remarks

Micarea rubiformis is characterized by its pale and continuous to verruculose, terricolous thallus, with prominent, jet-black tuberculate apothecia that have a non-pigmented or pale yellowish hymenium (lacking Sedifolia-grey), a thick, dark hypothecium with ± Laurocerasi-brown, comparatively large 0(–1)-septate ascospores and, especially, by its thallus chemistry. In *Micarea*, the orcinol depside 2'-*O*-methylsuperlatolic acid is only known from *M. tubaeformis* Kantvilas & Coppins, a common epiphyte of Tasmanian rainforest (Kantvilas & Coppins 2019). However, the latter has large pycnidia that resemble the stalked ascomata of *Calicium* species, as well as a globose-areolate and cephalodiate thallus and ascospores that are 3–7-septate, filiform and 45–100 × 1–2 µm (Kantvilas & Coppins 2019). *Micarea melaenida* (Nyl.) Coppins, a terricolous species from Europe, South Africa and southern Australia (Tasmania and South Australia), has a rather similar thallus to *M. rubiformis*, along with blackish apothecia and a reddish brown to purple-brown hypothecium (Coppins 1983; Kantvilas & Coppins 2019). However, the apothecia are convex to hemispherical but not tuberculate, the epihymenium is dark purple-brown, the ascospores are predominantly 1-septate and noticeably narrower (3–5 µm wide), and the thallus lacks lichen substances.

The new species is known only from bare, consolidated, siliceous soil in *Nothofagus* forest in southern New Zealand. Associated species include various *Cladonia* spp., *Peltigera tereziana* Gyeln., *Pseudocyphellaria maculata* D.J.Galloway, *Trapeliopsis congregans* (Zahlbr.) Brako and *T. granulosa* (Hoffm.) Lumbsch.

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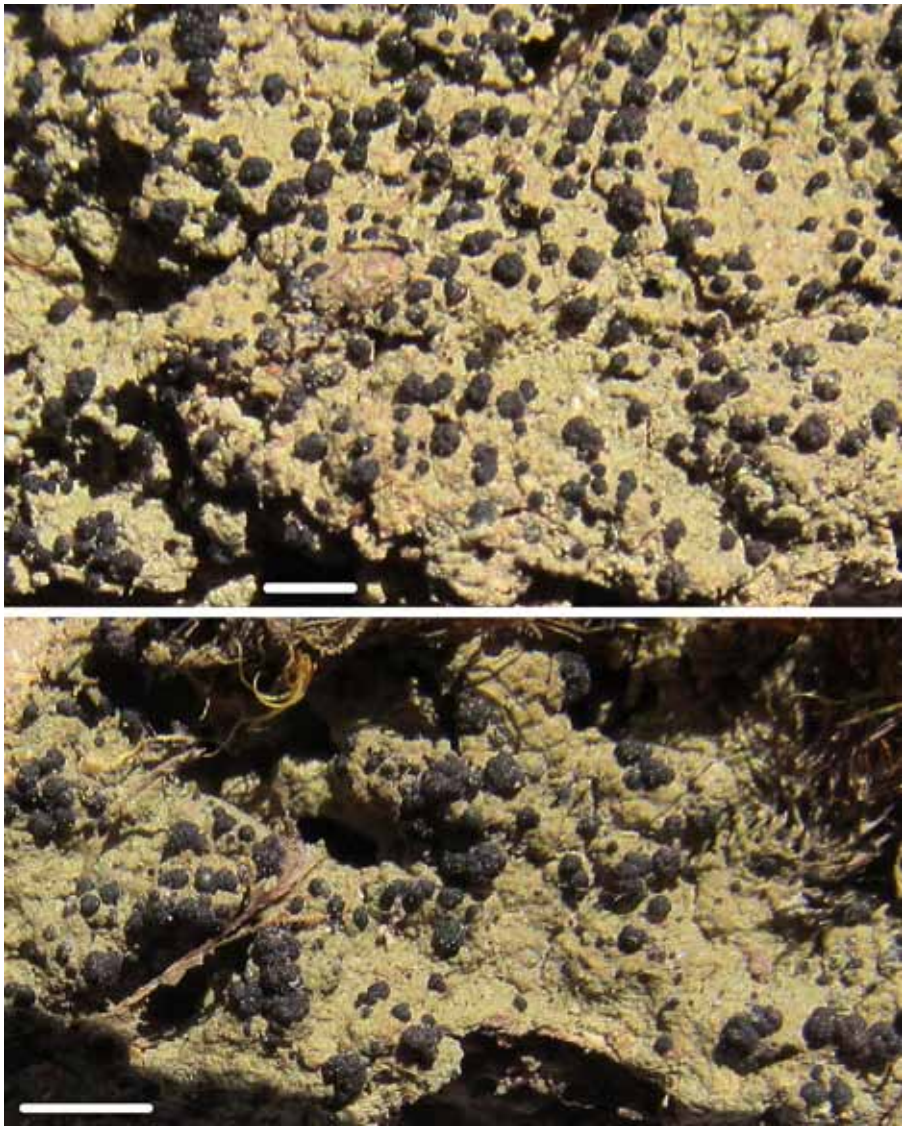

Figure 1. *Micarea rubiformis* (holotype). Scales: 2 mm.

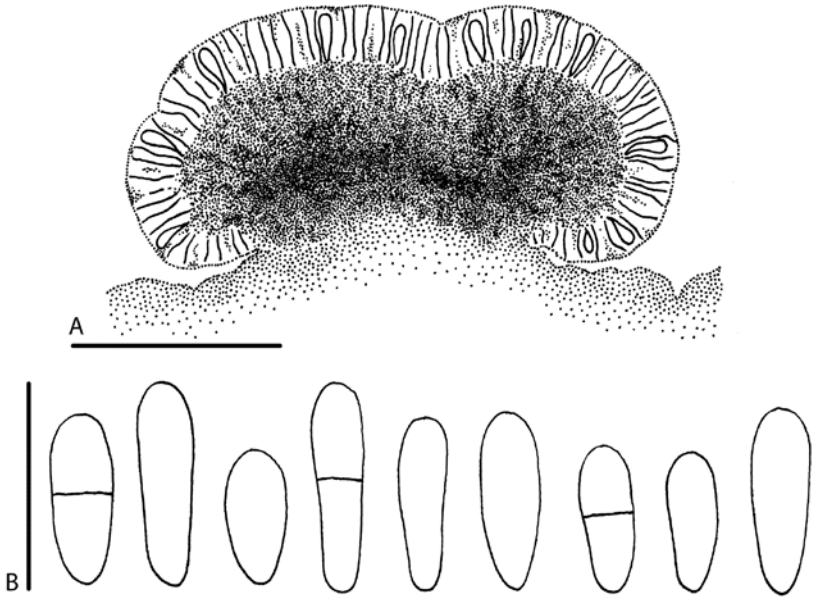

Figure 2. *Micarea rubiformis* (holotype). A, Vertical section of an apothecium (semi-schematic); B, Ascospores. Scales: A = 0.2 mm; B = 20 µm.

A new saxicolous species, a new combination and a new record of *Gyalidea* (lichenized Ascomycota, Asterothyriaceae) from Australia

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Abstract

Gyalidea nambourensis sp. nov. is described from siliceous rock in rainforest near Nambour, south-eastern Queensland. The new combination *Gyalidea halocarpa* (P.M.McCarthy & Elix) P.M.McCarthy is made for the calcicolous, Australian endemic *Gyalideopsis halocarpa*. *Gyalidea psammoica* (Nyl.) Lettau ex Vězda is reported for the first time from Australia (A.C.T. and N.S.W.), and a key is provided to the five species of *Gyalidea* known from the country.

Introduction

Gyalidea Lettau ex Vězda (Asterothyriaceae), a genus of 59 known species, occurs in most tropical and temperate regions. Thirty-two species are obligately saxicolous, mostly on acidic rocks, while most of the remainder are corticolous, apart from a few muscicolous and terricolous representatives. Thalli contain a chlorococcoid photobiont, they lack lichen substances, and the apothecia are mostly biatorine and urceolate, concave or plane, variously coloured (often quite pale) and commonly translucent when wetted. The often substantial proper exciple is a reticulum of radiating and anastomosing hyphae in a matrix dominated by their gelatinous hyphal walls, the hymenium is non-amyloid with mostly simple paraphyses and rather thin-walled asci containing hyaline ascospores that are either transversely septate (13 species) or submuriform to muriform (19 species; Vězda 1966; Clauzade & Roux 1985; Vězda *et al.* 1990; Vězda & Poelt, 1990, 1991; Harada & Vězda 1991, 1996, 1999; Galloway 2007; Gilbert *et al.* 2009; Harada 2016; Harada & Sakata 2016; Kondratyuk *et al.* 2016, 2019).

In this contribution, a new species of *Gyalidea* is reported from siliceous rock in rainforest in south-eastern Queensland, the combination *Gyalidea halocarpa* (P.M.McCarthy & Elix) P.M.McCarthy is proposed for the lichen previously named *Gyalideopsis halocarpa* P.M.McCarthy & Elix, and a second record of that species is documented. In addition, the terricolous *G. psammoica* (Nyl.) Lettau ex Vězda is reported from the Australian Capital Territory and the Southern Tablelands, New South Wales, and a key is provided to the five species known from Australia.

The species

1. Gyalidea halocarpa (P.M.McCarthy & Elix) P.M.McCarthy, comb. nov. Fig. 1
MycoBank No.: **MB834719**

Basionym: *Gyalideopsis halocarpa* P.M.McCarthy & Elix, *Telopea* **16**, 120 (2014) [MB809821]

The type specimen and an additional, recent collection of *Gyalideopsis halocarpa* (see below) have simple to sparingly branched and anastomosing paraphyses that differ markedly from and are sharply discontinuous with the hyphal reticulum and gelatinous matrix of the proper exciple (McCarthy & Elix 2014). By contrast, species of *Gyalideopsis* Vězda (Gomphillaceae) and its segregates have a hamathecium of anastomosing paraphysoids that are scarcely distinguishable from the adjacent excipular hyphae (Kalb & Vězda 1988; Lücking *et al.* 2005, 2006; Lücking 2008). For this reason, *Gyalideopsis halocarpa* is more appropriately included in *Gyalidea*, and that new combination is proposed here.

This species was initially described from an exposed, horizontal slab of mortar on the summit of Mount Canobolas (altitude 1392 m) in central-western New South Wales (McCarthy & Elix 2014). Following a very destructive bushfire in February 2018, there was concern that this apparently highly localized species might have been seriously impacted. However, a return visit to the summit area in October 2019 not only confirmed that the type population had survived the fire, it also revealed numerous other colonies on mortar in and around the summit carpark. Subsequently, the species was collected on concrete rubble in the Southern Tablelands of New South Wales. Clearly, *G. halocarpa*, with its thin, nondescript thallus and minute and more-or-less concolorous apothecia only 0.2–0.35 mm wide, has been overlooked in the past; it is probably common on natural and man-made, calcareous substrata throughout much of south-eastern Australia, and perhaps beyond.

ADDITIONAL SPECIMENS EXAMINED
New South Wales. ● Collector–Gundaroo road, 3 km WSW of Collector, 34°55’12”S, 149°24’19”E, 630 m alt., on calcareous concrete rubble on roadside in dry *Eucalyptus* woodland, *P.M. McCarthy 4913, 4914, 4916*, 27.xi.2019 (CANB).

2. Gyalidea nambourensis P.M.McCarthy, sp. nov. Figs 2 & 3
MycoBank No.: **MB834720**

Thallus epilithic, rimose, off-white to pale grey-green, thin. Apothecia biatorine, adnate to subsessile, medium to dark greenish brown or dull black, (0.28–)0.45(–0.67) mm diam.; disc becoming plane to moderately convex; margin usually persistent. Proper exciple laterally 70–100 µm thick, a radiating reticulum of narrow hyphae in a pale yellow-brown gelatinous matrix. Hypothecium hyaline to pale yellowish, 30–50 µm thick. Hymenium 75–100 µm thick, non-amyloid, with mostly simple paraphyses and thin-walled asci, 70–95 × 16–24 µm. Ascospores hyaline, submuriform, (4–)8 per ascus, 18–30 × 8–13 µm.

Type: Australia. Queensland, Blackall Range, Bold Knob, 18 km SSW of Nambour, 26°46’S, 150°54’E, 150 m alt., on siliceous rock in moist disturbed area of rainforest, *H. Streimann 9414*, 31.viii.1979 (holotype – CANB; ‘duplicates’ in B and M, *n.v.*).

Thallus crustose, epilithic, effuse or forming determinate colonies to 2 or 3 cm wide, continuous to sparingly rimose, not areolate, sometimes peeling from thalline cracks, off-white to very pale greenish grey, dull or with a silvery tint, 40–80(–120) µm thick, smooth to minutely and irregularly rugulose or verruculose, ecorticate, non-amyloid (I–), not containing calcium oxalate (H_2SO_4–). *Algae* globose, chlorococcoid, 8–16 µm diam., rather thick-walled; interstitial hyphae short-celled, 1–2 µm thick. *Medulla* not delimited, much of the lower thallus packed with rock fragments and crystals. *Prothallus* not apparent. *Apothecia* moderately numerous, usually solitary and scattered, occasionally in proliferating clusters, adnate to subsessile and slightly constricted at the base, biatorine, (0.28–)0.45(–0.67) mm diam. [*n* = 87], rounded or somewhat irregular in outline, in section subtended by a continuous algal layer; disc at first shallowly concave or plane, later remaining plane or becoming slightly to moderately convex, smooth, epruinose, medium to dark greenish brown or dull black, the colour ± unchanged when wetted, but moist apothecia becoming rather translucent; margin concolorous with the disc, swollen and a little paler when wetted, *c.* 40–60 µm thick, entire to faintly undulate or irregularly crenulate, usually slightly prominent and persistent or becoming excluded in more convex, mature apothecia, without thallus remnants. *Proper exciple* annular, laterally 70–100 µm thick, 40–60(–80) µm thick at the base; anatomically a radiating reticulum of hyphae in a predominantly pale yellow-brown gelatinous matrix (i.e. the swollen hyphal walls), the upper, outer area of the exciple usually medium to dark brown, K–, N–, I–; hyphal lumina (1–)1.5(–2) µm wide. *Hypothecium* hyaline to pale yellowish, 30–50 µm thick, K–, N–, patchily KI+ pale violet (this colour takes up to 30 minutes to develop and is best seen in squash preparations); hyphae short-celled, rather thick-walled, periclinal, 3–5 µm long. *Hymenium* 75–100 µm thick, not inspersed with oil droplets, granules or crystals, non-amyloid, K–, N–. *Subhymenium* hyaline or very pale yellowish, 25–30 µm thick, K–, N–, KI–; hyphae variously orientated, 1–2 µm wide. *Epihymenium* 15–25 µm thick, a diffuse, pale to medium brown, extracellularly pigmented zone, K– or becoming darker, N– or becoming darker. *Paraphyses* rather conglutinate in water, loosening in KOH, mostly simple throughout their length, rarely with sparse branches and anastomoses, mainly distally, 0.7–1 (–1.2) µm thick, long-celled, not constricted at the septa; apices not or only very slightly swollen (to 1.5 µm

wide), not pigmented. *Asci* narrowly clavate or clavate-cylindrical, rarely more broadly clavate, (4–)8-spored, 70–95 × 16–24 µm [*n* = 25], with a gradually tapering stalk; wall and contents non-amyloid; ascoplasm KI+ orange-brown; apex rounded at maturity, with a thin tholus lacking an ocular chamber and apical apparatus; immature asci with a comparatively thicker tholus and, occasionally, a broad, rounded ocular chamber. *Ascospores* colourless, submuriform, with (3–)4–6(–7) transverse septa and (0–)1–3(–4) longitudinal or diagonal septa [6–10(–12) cells in optical section], the end cells rounded, oblong-ellipsoid to almost fusiform-ellipsoid, less commonly broadly ellipsoid or clavate to rather irregular in shape, straight or slightly bent, irregularly biseriate or overlapping-uniseriate in the ascus, thin-walled, usually lacking a perispore even when immature, (18–)25(–30) × (8–)10(–13) µm [*n* = 70]; cells contents usually clear, the external spore wall markedly constricted at the septa. *Pycnidia* not seen.
Chemistry: no substances detected by TLC (Elix 2014).

Etymology: The epithet *nambourensis* refers to the locality of the type specimen.

Remarks
The new species is characterized by its rather pale and nondescript thallus, uniformly brown to blackish and moderately large, subsessile apothecia, by the size and septation of its ascospores, along with a thick and annular proper exciple, a deep hymenium and a comparatively thick hypothecium.

Several taxa with submuriform or muriform ascospores are variously similar to *G. nambourensis* in apothecial morphology or other anatomical attributes, but all are readily distinguishable. Thus, *G. fritzei* (Stein) Vězda, from Europe, has persistently and deeply concave apothecial discs, each with a dark brown exciple, while the hymenium is up to 160 µm thick, and the fully muriform ascospores are 18–43 10–21 µm (Vězda 1966; Gilbert *et al*. 2009). *Gyalidea saxicola* (Groenh.) Hafellner & Vězda, from Indonesia, has rather similar brown-black apothecia, but the smaller ascospores (16–20 6–7 µm) are more sparingly septate, the outer excipulum is considerably darker in section and the hypothecium is thinner (Vězda & Poelt 1991). *Gyalidea luzonensis* (Kalb & Vězda) Aptroot & Lücking, from the Philippines and Papua New Guinea, also has smaller and less septate, submuriform ascospores (15–23 × 9–10 µm; Vězda & Poelt 1991; Aptroot & Lücking 2003), while the Japanese *G. pacifica* (H.Harada) Vězda has a thallus of goniocysts and smaller ascospores, 10–24 × 5–7 µm (Harada & Vězda 1996, 1999). Finally, the recently described *G poeltii* S.Y.Kondr., L.Lökös, J.P.Halda & Hur, from Korea, has a similarly thick but uniformly dark brown proper exciple, apothecia to 1 mm wide and halonate ascospores (Kondratyuk *et al*. 2019).

Gyalidea nambourensis is known only from the type locality in disturbed rainforest in south-eastern Queensland, Australia. Supposed duplicates of the holotype, sent in exchange from CANB to B and M, have not been examined.

3. Gyalidea psammoica (Nyl.) Lettau ex Vězda, *Folia Geobot. Phytotax. Praha* **1**, 329 (1966) Figs 4 & 5

Lecidea psammoica Nyl., *Flora* **51**, 343 (1868)

Thallus crustose, on friable soil, forming determinate colonies to *c.* 5 cm wide, richly rimose to obscurely areolate, dull, pale to medium greyish green, 60–80(–100) µm thick [to 100 (–150) µm thick beneath apothecia], heavily impregnated with soil material; areoles 0.2–0.6 (–0.8) mm wide, minutely and irregularly uneven, ecorticate, non-amyloid (I–), not containing calcium oxalate (H_2SO_4–). *Algae* globose, chlorococcoid, (8–)10–20(–23) µm diam.; interstitial hyphae 1–2 µm thick; medulla not delimited. *Prothallus* not apparent. *Apothecia* very numerous, usually solitary, occasionally in proliferating clusters or short rows, adnate to subsessile, biatorine, (0.23–)0.37(–0.55) mm diam. [*n* = 50], rounded or somewhat irregular or angular in outline (due to mutual pressure), in section subtended by a continuous algal layer to 100 µm thick; disc at first urceolate, becoming shallowly concave to plane, smooth, epruinose, dull greenish black to jet-black, the colour ± unchanged when wetted; margin concolorous with the disc or slightly to considerably paler, swollen and occasionally a little darker than the disc when wetted, 50–70(–80) µm thick, entire or irregularly fissured, slightly prominent and persistent to maturity, sometimes with sparse thallus remnants or with embedded soil particles. *Proper exciple* cupulate; laterally 35–55 µm thick, a radiating reticulum of hyphae in a hyaline to pale brown gelatinous matrix, the upper and outer 10–20(–25) µm of the lateral exciple medium to dark brown or brown-black, K–, N–, I–; outermost cells rounded, thick-walled, 4–6 µm wide; exciple base 8–12 µm thick, hyaline, of tightly arranged periclinal hyphae 1.5–2 µm wide. *Hypothecium* hyaline, 8–15(–20) µm thick, K–, N–; hyphae short-celled, variously orientated, 2–3 µm wide. *Hymenium* 55–72 µm thick, not inspersed with oil droplets or granules, non-amyloid, K–, N–. *Subhymenium* not distinguishable from the hypothecium. *Epihymenium* 10–20 µm thick, a diffuse, pale to medium brown pigmented zone, K– or becoming slightly darker, N– or becoming slightly darker. *Paraphyses* conglutinate in water, scarcely loosening in KOH, mostly simple throughout their length, with very sparse branches and even rarer anastomoses, 1–1.5(–2) µm thick, long-celled, not constricted at the septa; apices not or only very slightly swollen, not or very faintly and diffusely pigmented. *Asci* mostly narrowly clavate or clavate-cylindrical, 8-spored, 50–62 × 10–15 µm; wall non-amyloid, KI–; ascoplasm KI+ orange-brown; apex rounded, with a thin tholus lacking an ocular chamber and apical apparatus; immature asci with a thicker tholus and, occasionally, a broad, rounded ocular chamber. *Ascospores* colourless, submuriform, with (5–)6–8(–9) cells in optical section, the end cells rounded, narrowly to broadly ellipsoid to oblong-ellipsoid or broadly clavate to rather irregular in shape, irregularly biseriate or overlapping-uniseriate in the ascus, thin-walled, usually lacking a perispore even when immature, (10–)14.5(–18) × (6–)7.5(–9.5) µm [*n* = 25]; cell contents usually clear, the external spore wall markedly constricted at the septa. *Pycnidia* not seen.
Chemistry: no substances detected by TLC (Elix 2014).

Remarks
One of a handful of terricolous species in *Gyalidea*, *G. psammoica* was known with certainty only from Poland, where it was first collected from moist sandy soil (Vězda 1966). However, the diagnostic combination of a thin, grey-green thallus, medium-sized but thin, dark apothecia with a persistent margin and a concave to plane disc, as well as apothecial anatomy and exceptionally small, submuriform ascospores in the Australian material, confirms its identity, however unexpected that might seem. One anatomical anomaly: Vězda (1966) cited algal cells 6–12 µm wide, considerably smaller than those of the Australian specimens, *viz.* (8–)10–20(–23) µm.

SPECIMENS EXAMINED
Australian Capital Territory. ● start of Mount McDonald Summit Track, Cotter Avenue, 35°18’48”S, 148°56’50”E, 595 m alt., on friable, siliceous soil bank on roadside, *P.M. McCarthy 4919*, 12.ii.2020 (CANB); ● Cook, between Bindubi Street and the horse paddocks, *c.* 5 km W of Canberra, 35°16’08”S, 149°04’29”E, 630 m alt., on consolidated soil bank in dry *Eucalyptus* woodland, *P.M. McCarthy 4935*, 8.v.2020 (CANB).
New South Wales. ● Southern Tablelands, Murrumbateman–Gundaroo road, *c.* 2 km W of Sutton Rd intersection, *c.* 4 km SW of Gundaroo, 35°03’19”S, 149°14’08”E, 590 m alt., siliceous soil bank on roadside adjacent to pasture, *J.A. Elix 46956*, 17.iii.2020 (CANB); ● Southern Tablelands, Wallaroo District, Brooklands Road, *c.* 2 km W of Southwell Road, *c.* 7 km W of Hall, 35°09′49”S, 148°59′37”E, 605 m alt., on soil bank on roadside adjacent to pasture, *P.M. McCarthy 4932*, 23.iii.2020 (CANB).

Key to the Australian species of *Gyalidea*

1 Ascospores 3-septate, 15–24 × 5–6.5 µm; apothecia 0.8–1.2 mm diam., pinkish brown, with a paler proper margin ..... ***G. hyalinescens*** (Nyl.) Vězda
1: Ascospores submuriform to muriform; apothecia to 0.7 mm diam 2

2 Thallus growing on soil; ascospores 10–18 × 6–9.5 µm ..... ***G. psammoica***
2: Thallus growing on mortar or on rock; ascospores in the range 17–30 × 8–16 µm 3

3 Thallus calcicolous, growing on mortar; apothecia 0.15–0.35 mm diam., with a blackish disc; thallus remnants visible as a pale, discontinuous ring on the proper exciple..... ..... ***G. halocarpa***
3: Thallus silicolous; apothecial margin lacking thallus remnants; if the disc is blackish then the apothecia 0.28–0.67 mm diam 4

4 Apothecia pale yellow-brown; lateral exciple 40–60 µm thick; hymenium 65–75 µm thick; thallus rimose-areolate ..... ***G. henssenia*e** Hafellner, Poelt & Vězda
4: Apothecia medium to dark greenish brown or dull black; lateral exciple 70–100 µm thick; hymenium 75–100 µm thick; thallus continuous to sparingly rimose..... ***G. nambourensis***

Acknowledgement
Thanks to Jack Elix for his company and assistance in the field and for TLC.

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Figure 1. *Gyalidea halocarpa* (*P.M. McCarthy 4914*). Scales: 1 mm.

Figure 2. *Gyalidea nambourensis* (holotype). Scales: 1 mm.

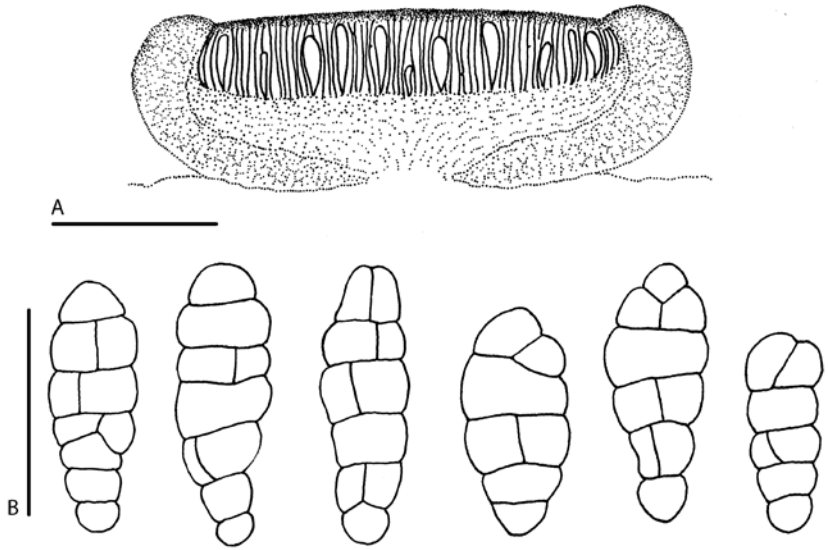

Figure 3. *Gyalidea nambourensis* (holotype). A, Section of apothecium (semi-schematic). B, Ascospores. Scales: A = 0.2 mm; B = 20 µm.

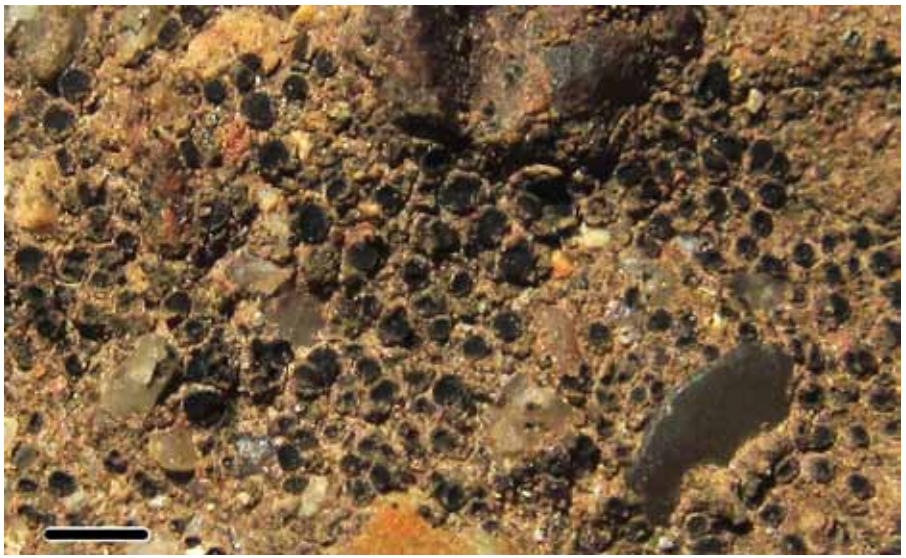

Figure 4. *Gyalidea psammoica* (*P.M. McCarthy 4919*). Scale: 1 mm.

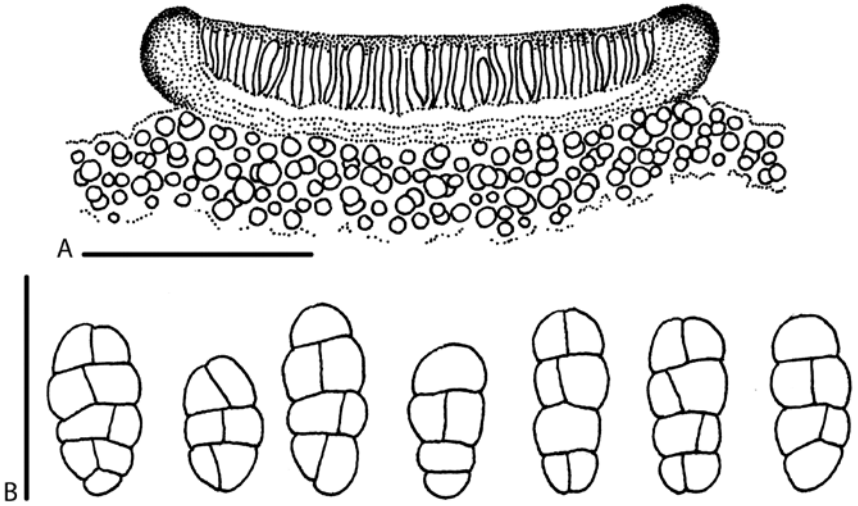

Figure 5. *Gyalidea psammoica* (*P.M. McCarthy 4919*). A, Section of apothecium and adjacent thallus (semi-schematic). B, Ascospores. Scales: A = 0.2 mm; B = 20 µm.

Three new species and a new record of *Trapelia* (lichenized Ascomycota, Trapeliaceae) from Australia

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Abstract

Trapelia occidentalis Elix, *T. rosettiformis* Elix & P.M.McCarthy and *T. terrestris* Elix & P.M.McCarthy (Trapeliaceae) are described as new from siliceous soil and rocks in southern Australia. *Trapelia placodioides* Coppins & P.James is reported from Australia for the first time, and an updated key to *Trapelia* in Australia is provided.

Introduction

This paper continues our investigation of *Trapelia* (lichenized Ascomycota, Trapeliaceae) species in Australia. For the more recent additions see Elix & McCarthy (2019, 2020) and references cited therein.

Eleven species of *Trapelia* have been reported from Australia (Elix & McCarthy 2019, 2020; McCarthy 2020), including the widespread, probably cosmopolitan *T. coarctata* (Sm.) M.Choisy and *T. involuta* (Taylor) Hertel, as well as the Australasian *T. macrospora* Fryday and eight Australian endemics, *viz. T. atrocarpa* Elix & P.M.McCarthy, *T. calvariana* Kantvilas & Lumbsch, *T. concentrica* Elix & P.M.McCarthy, *T. crystallifera* Kantvilas & Elix, *T. kosciuszkoensis* Elix, *T. lilacea* Kantvilas & Elix, *T. pruinosa* Elix & P.M.McCarthy and *T. thieleana* Kantvilas, Lumbsch & Elix. In this paper, three new species are described and illustrated, *viz. T. terrestris* and *T. rosettiformis* from siliceous rocks and soil in the Australian Capital Territory, New South Wales and Victoria and *T. occidentalis* from siliceous rocks in Western Australia. In addition, *Trapelia placodioides* Coppins & P.James is reported from Australia for the first time.

New species

1. Trapelia occidentalis Elix, sp. nov. Fig. 1
MycoBank No. **MB834759**

Similar to *Trapelia glebulosa* (Sm.) J.R.Laundon, but differs in having larger squamules, 0.3–1.5 mm wide, and immersed, cupuliform apothecia with pale discs.

Type: Australia, Western Australia, Porongurups National Park, slopes of Angwin Peak, 19 km ESE of Mount Barker, 34°40'S, 117°51'E, 360 m alt., on rocks in low, heathy, dry sclerophyll forest, *J.A. Elix 41321, H.T. Lumbsch & H. Streimann*, 16.ix.1994 (holotype – CANB).

Thallus to 50 mm wide and 0.1 mm thick, white or pale grey, squamulose; upper surface smooth, epruinose, lacking soredia; squamules, 0.3–1.5 mm wide, roundish to irregular, weakly concave to plane, discrete and dispersed, or contiguous and often linearly arranged; prothallus not apparent; medulla white, lacking calcium oxalate (H_2SO_4–), I–. *Photobiont* green, of the *Chlorella*-type, with individual cells irregularly roundish or rhomboid, 6–12 × 5–9 µm, solitary or in pairs, triads or tetrads. *Apothecia* rare, scattered, 0.1–0.4 mm wide, cupuliform, irregularly roundish, mainly immersed, rarely becoming adnate, with a persistent thalline rim; disc deeply concave to plane, pale brown to brown, epruinose. *Excipulum* in section cupular, dark brown, 15–30 µm thick at the sides, 100–110 µm thick at the base. *Hypothecium* 60–80 µm thick, pale brown, poorly differentiated from the hymenium. *Epihymenium* 20–25 µm thick, pale brown. *Hymenium* 120–140 µm thick, colourless, I+ blue,

not inspersed with granules or oil droplets. *Paraphyses* richly branched, particularly at the base and near the apices, slender, 1.5–2 µm thick, flexuose, tangled, separating readily in K; apices not markedly expanded. *Asci* 8-spored, of the *Trapelia*-type, with an amyloid wall and a prominent, non-amyloid tholus, elongate-clavate, 100–125 × 20–27 µm. *Ascospores* simple, non-halonate, thin-walled, often vacuolate, broadly ellipsoid, 14–[*19.5*]–22 × 8–[*11.7*]–13 µm. *Pycnidia* punctiform, brown, immersed in upper surface; conidia filiform, straight to curved, 13–22 × 0.7 µm.
Chemistry: Thallus K–, C+ red, KC+ red, P–, UV–; containing gyrophoric acid (major), lecanoric acid (trace or absent).

Etymology: The specific epithet *occidentalis* (L, of the west) refers to the occurrence of this species in Western Australia.

Remarks

Trapelia glebulosa from Europe and North America is chemically similar to *T. occidentalis*, but the squamules are smaller, 0.2–0.4(–0.7) mm wide, they are often arranged in small rosettes, and the mature apothecia are sessile with plane to convex discs (Orange 2018). The larger squamules of *T. occidentalis* can be dispersed, but they are often arranged in irregular lines. The new species could also be confused with the cosmopolitan *T. involuta*, with both species having similarly sized squamules with a smooth upper surface. However, *T. involuta* contains 5-*O*-methylhiascic acid as major secondary substance and has larger ascospores, 19–[*21.3*]–24.5 × 9–[*10.4*]–12.5 µm (Orange 2018).

At present, this species is known from siliceous rocks in dry *Eucalyptus* woodland in the south-west of Western Australia. Common associated lichens include numerous *Xanthoparmelia* species, *Buellia homophylia* (C.Knight) Zahlbr., *Diploicia canescens* (Dicks.) A.Massal. subsp. *canescens*, *Heterodermia reagens* (Kurok.) Elix, *Hypotrachyna revoluta* (Flörke) Hale, *Rhizocarpon geographicum* (L.) DC., *R. reductum* Th.Fr. and *Rinodina thiomela* (Nyl.) Müll.Arg.

ADDITIONAL SPECIMEN EXAMINED
Western Australia. ● Type locality, *H.T. Lumbsch 10819f, J.A. Elix & H. Streimann*, 16.ix.1994 (CANB).

2. Trapelia rosettiformis Elix & P.M.McCarthy, sp. nov. Fig. 2
MycoBank No. **MB834760**

Similar to *Trapelia involuta*, but differs in having smaller ascospores, 11–19 × 6–10 µm, and squamules that often expand to form fan-shaped to round, sometimes subumbilicate rosettes up to 2.5 mm wide.

Type: Australia, New South Wales, Collector–Gundaroo road, 3 km WSW of Collector, 34°55'12"S, 149°24'19"E, 630 m alt., on roadside shale rocks in dry *Eucalyptus* woodland, *J.A. Elix 46746 & P.M. McCarthy*, 22.v.2019 (holotype – CANB; isotype – HO).

Thallus to 30 mm wide and 1 mm thick, pale grey, glaucous grey or dark grey, squamulose; upper surface mainly epruinose but sometimes with a narrow, submarginal pruinose zone, not sorediate; squamules 0.5–1 mm wide, roundish to irregular, weakly concave to plane, often expanding to form small, fan-shaped to round, sometimes subumbilicate rosettes up to 2.5 mm wide, the rosettes with dissected, commonly elevated margins, sometimes becoming crowded and bullate; medulla white, lacking calcium oxalate (H_2SO_4–), I–. *Photobiont* green, of the *Chlorella*-type, with individual cells irregularly roundish or rhomboid, 6–10 × 5–8 µm, solitary or in pairs, triads or tetrads. *Apothecia* rare, 0.4–0.6 mm wide, irregularly roundish, at first immersed in elevated papillae, then superficial, adnate; proper margin very thin, brownish, sometimes with a poorly developed, rather ragged, discontinuous thalline rim; disc plane to weakly convex, corrugate, dark brown to brown-black, epruinose. *Excipulum* in section cupular, dark brown at the sides, paler brown within, K+ yellow-brown solution, 20–30 µm

thick at the sides and base. *Hypothecium* 100–150 µm thick, colourless to pale brown, poorly differentiated from the hymenium. *Epihymenium* 15–20 µm thick, pale brown to brown. *Hymenium* 150–180 µm thick, colourless, I+ blue, not inspersed with granules or oil droplets. *Paraphyses* richly branched, particularly at the base and near the apices, slender, 1.5–2 µm thick, flexuose, tangled, separating readily in K; apices not markedly expanded. *Asci* 8-spored, of the *Trapelia*-type, with an amyloid wall and a prominent, non-amyloid tholus, elongate-clavate, 70–110 × 20–25 µm. *Ascospores* simple, non-halonate, thin-walled, often vacuolate, ellipsoid, 11–[*14.1*]–19 × 6–[7.5]–10 µm. *Pycnidia* punctiform, black, immersed in upper surface; conidia filiform, straight to weakly curved, 11–21 × 0.7 µm.
Chemistry: Thallus K–, C+ red, KC+ red, P–, UV–; containing 5-*O*-methylhiascic acid (major), gyrophoric acid (minor).

Etymology: This species is named after the growth form of the thallus.

Remarks
Trapelia rosettiformis is somewhat similar to the widespread *T. involuta*, both species having an esorediate, effigurate-squamulose thallus and identical chemistry. There are, however, marked differences between the two taxa. In *T. rosettiformis*, the squamules are better developed, relatively large and crenulate-lobate throughout, forming distinct rosettes up to 2.5 mm wide with elevated and/or fan-shaped margins. In contrast, the squamules of *T. involuta* are only 0.2–0.6 mm wide, they become crowded and weakly convex, and the ascospores are significantly larger, 19–[*21.3*]–24.5 × 9–[*10.4*]–12.5 µm (Orange 2018). *Trapelia rosettiformis* appears to be most closely related to the rather widespread, Australian endemic *T. pruinosa*, with both species having an esorediate, squamulose thallus, with often separate, well-developed, crenulate-lobate squamules. However, *T. pruinosa* has a pruinose, crystalline to mealy upper surface, somewhat larger ascospores, 13–[*16.6*]–20 × 7–[*9.1*]–12 µm, and it contains calcium oxalate (Elix & McCarthy 2020).

At present, this species is known from siliceous rocks and consolidated soil in *Eucalyptus* woodland in the Australian Capital Territory, southern New South Wales and Victoria. Common associated lichens on rock include various *Xanthoparmelia* species, *Buellia amandineiformis* Elix & Kantvilas, *B. suttonensis* Elix & A.Knight, *Candelariella vitellina* (Hoffm.) Müll.Arg., *Diploschistes euganeus* (A.Massal.) J.Steiner, *Lecanora pseudistera* Nyl., *Lecidea terrena* Nyl., *Pertusaria lophocarpa* Körb., *Rhizocarpon geographicum* (L.) DC. and *R. reductum* Th.Fr.

ADDITIONAL SPECIMENS EXAMINED
New South Wales. ● Mt Ulandra, 30 km ENE of Junee, 34°49’S, 147°55’E, 700 m alt., on granite rocks in *Callitris*-dominated dry sclerophyll forest, *J.A. Elix 23169*, 16.xi.1989 (CANB); ● Shingle Ridge, 5 km N of Molong, along road to Yeoval, 33°04’22”S, 148°49’45”E, 595 m alt., on sandstone rock in remnant *Eucalyptus* woodland, *J.A. Elix 38562, 38563 pr. p.*, 13.x.2005 (CANB); ● Killarney State Forest, 16.6 km N of Narrabri, 30°13’19”S, 149°50’47”E, 270 m alt., on pebbles in *Eucalyptus*-*Callitris* woodland, *J.A. Elix 45352*, 11.v.2005 (CANB); ● type locality, on roadside shale rocks in dry *Eucalyptus* woodland, *J.A. Elix 46890, 46891*, 27.xi.2019 (CANB); ● Merungie Gap Road, 20 km WSW of Rankins Springs, 33°52’S, 146°02’E, 260 m alt., on shaded boulder in *Eucalyptus*-*Acacia*-dominated ridge, *H. Streimann 44847*, 12.vi.1990 (CANB); ● Wamboin Road, 500 m S of junction with Macs Reef Road, 35°12’18”S, 149°20’46”E, 685 m alt., on consolidated soil in dry *Eucalyptus* woodland, *J.A. Elix 46764*, 15.v.2019 (CANB); ● Warraderry Range, Gooloogong–Grenfell road, 38 km N of Grenfell, 33°38’42”S, 148°22’15”E, 330 m alt., on sandstone in *Eucalyptus*-*Callitris* woodland, *J.A. Elix 46844*, 2.x.2019 (CANB).
Australian Capital Territory. ● Booroomba Rocks, 30 km SSE of Canberra, 35°32’S, 149°00’E, 1240 m alt., on exposed northerly rock face with scattered *Leptospermum*, *H. Streimann 9049*, 11.vii.1979 (CANB).
Victoria. ● Lake Nillahcootie foreshore, 32 km S of Benalla, 36°51’20”S, 146°00’26”E, 280 m alt., on consolidated soil in open parkland, *J.A. Elix 36510*, 5.v.2006 (CANB, HO, MEL); ● Chiltern-Mount Pilot National Park, 2 km N of Chiltern, 36°07’47”S, 146°36’42”E, 200 m alt., on soil at base of *Eucalyptus*, *J.A. Elix 36947*, 5.v.2006 (CANB); ● *loc. id.*, on sandstone rocks in open *Eucalyptus* woodland, *J.A. Elix 36956 pr. p.*, 5.v.2006 (CANB); ● Three Sisters, Three Sisters Track, 23 km NNE of Cann River, 37°23’S, 149°06’E, 920 m alt., on sandstone rocks in dry *Eucalyptus* forest, *J.A. Elix 19546 & H. Streimann*, 27.ix.1985 (CANB); ● Argus Gap Road, 27 km NNW of Bairnsdale, 37°36’S, 147°32’E, 430 m alt., on old termite mound in regenerating wet sclerophyll forest, *H. Streimann 50301*, 31.x.1992 (CANB).

3. Trapelia terrestris Elix & P.M.McCarthy, sp. nov. Fig. 3
MycoBank No. **MB834761**

Similar to *Trapelia coarctata*, but differs in having sessile apothecia with rough, coarsely granular discs and somewhat larger ascospores, 14–30 × 8–15 µm.

Type: Australia, Australian Capital Territory, Canberra Nature Park, Aranda Bushland, Powerline Track, *c*. 4 km W of Canberra, 35°16’00”S, 149°04’54”E, 650 m alt., on soil bank in dry *Eucalyptus* woodland, *J.A. Elix 46819*, 14.viii.2019 (CANB – holotype).

Thallus micro-areolate, whitish grey to glaucous grey or grey-green, not sorediate; areoles dispersed to contiguous, 0.05–0.2 mm wide, roundish, plane to convex; medulla white, lacking calcium oxalate (H_2SO_4–), I–. *Photobiont* green, of the *Chlorella*-type, with individual cells irregularly roundish or rhomboid, 6–12 × 5–8 µm, solitary or in pairs, triads or tetrads. *Apothecia* common, 0.3–1.5 mm wide, irregularly roundish, sessile, at first appearing as a slightly paler convex mound, then splitting at the apex, the disc soon becoming superficial and sometimes with ragged, thalline margins at first but usually excluded with age, medium brown to dark brown or brown-black, coarsely granular, rough, epruinose; proper margin thick, brownish, usually lacking a thalline rim at maturity. *Excipulum* in section cupular, brown at the sides, pale brown to colourless within, unchanged in K, 70–80 µm thick at the sides, 100–120 µm thick at the base. *Hypothecium* 80–120 µm thick, hyaline to pale yellow, poorly differentiated from the hymenium. *Epihymenium* pale brown, 20–25 µm thick. *Hymenium* 100–150 µm thick, colourless, I+ blue, not inspersed with granules or oil droplets. *Paraphyses* richly branched, particularly at the base and near the apices, slender, 1–2.5 µm thick, flexuose, tangled, separating readily in K; apices not markedly expanded. *Asci* 8-spored, of the *Trapelia*-type, with an amyloid wall and a prominent, non-amyloid tholus, elongate-clavate, often with a long tapering stalk, 75–100 × 20–27 µm. *Ascospores* simple, non-halonate, thin-walled, often vacuolate, ellipsoid to ovate, 14–[*19.6*]–26(–30) × 8–[*11.3*]–13(–15) µm. *Pycnidia* punctiform, brown, immersed in areoles; conidia filiform, curved, 20–25 × 0.7 µm.
Chemistry: Thallus K–, C+ red, KC+ red, P–, UV–; containing gyrophoric acid (major), 5-*O*-methylhiascic acid (trace or absent).

Etymology: The specific epithet is based on the preferred soil substratum of this species.

Remarks
The new species is characterized by the conspicuous apothecia with brown to brown-black epruinose discs that lack a thalline rim, the nondescript, areolate thallus with a smooth surface, the relatively large, ovate to ellipsoid ascospores and the presence of gyrophoric acid. *Trapelia terrestris* is similar to the cosmopolitan *T. coarctata*, both species having a rather poorly developed thallus that contains gyrophoric acid but lacks calcium oxalate. There are, however, clear differences between the two taxa; in *T. terrestris*, the thallus is micro-areolate (coherent and cracked in *T. coarctata*), the apothecia are larger (only up to 0.6 mm wide in *T. coarctata*), the apothecial discs are coarsely roughened and granular (slightly roughened in *T. coarctata*), and the ascospores of *T. coarctata* are smaller, 14–21 × 7.5–10.5 µm (Orange 2018). The two species also exhibit different substratum preferences, *T. coarctata* being common on moist stones in disturbed and forested areas, whereas *T. terrestris* prefers consolidated soil banks.

This species is a common, early colonizer of consolidated soil in dry *Eucalyptus* woodland in the Australian Capital Territory, New South Wales and Victoria, and rarely occurs on siliceous rocks in similar areas. Common associated lichens on soil include several *Caloplaca*

species, *Cladia aggregata* (Sw.) Nyl. *sens. lat.*, *Buellia suttonensis* Elix & A.Knight, *Diploschistes thunbergianus* (A.Massal.) Lumbsch & Vězda, *Lecidea terrena* Nyl., *Trapelia pruinosa* and *T. involuta* (Taylor) Hertel.

ADDITIONAL SPECIMENS EXAMINED
New South Wales. ● Weddin State Forest, 25 km WSW of Grenfell, 34°01'S, 148°01'E, on boggy soil in *Callitris* woodland, *J.A. Elix 4756*, 14.vii.1978 (CANB); ● Mountain Creek, Jimberoo State Forest, 14 km NNE of Rankins Springs, 33°43'S, 146°20'E, 280 m alt., on consolidated soil in *Eucalyptus*- and *Callitris*-dominated flats, *J.A. Elix 25315 pr. p.*, 13.vi.1990 (CANB); ● Wamboin Road, 500 m S of junction with Macs Reef Road, 10.5 km NW of Bungendore, 35°12'18"S, 149°20'46"E. 685 m alt., on consolidated soil in dry *Eucalyptus* woodland, *J.A. Elix 46765*, 15.v.2019 (CANB).
Australian Capital Territory. ● Kowen Road, Kowen Forest, 17 km E of Canberra, 35°19'02"S, 149°15'07"E, 700 m alt., on soil bank bordering open *Eucalyptus* woodland, *J.A. Elix 46797*, 31.vii.2019 (CANB); ● trail to Aranda Bushland, 35°15'32"S, 149°04'53"E, 672 m alt., on soil bank in dry *Eucalyptus* woodland, *J.A. Elix 46801, 46802, 46805*, 9.viii.2019 (CANB); ● Type locality, on consolidated soil in open *Eucalyptus* woodland, *J.A. Elix 46811, 46812, 46813, 468115, 46817 & P.M. McCarthy 4882*, 14.viii.2019 (CANB); ● *loc. id.*, on sandstone pebble in open *Eucalyptus* woodland, *J.A. Elix 46826*, 14.viii.2019 (CANB); ● Latham, 11 km NW of Capital Hill, Canberra, 35°14'S,149°02'E, 550 m alt., on consolidated soil in grassy area with small trees, *H. Streimann 44977*, 18.vii.1990 (CANB).
Victoria. ● Tallarook, 37°06'S, 145°06'E, on soil in dry sclerophyll forest, *J.A. Elix 4884*, 29.vii.1978 (CANB).

New record

Trapelia placodioides Coppins & P.James, *Lichenologist* **16**, 257 (1984)
This species was previously known from Europe, North America, the Falkland Islands and New Zealand (Orange 2018). It is characterized by the pale, pinkish grey, cracked, wide-spreading thallus with farinose soredia. Soralia develop at the margins of secondary areoles or at the margin of cracks in the thallus. The species contains gyrophoric acid (major). A detailed description and illustrations are given in Orange (2018).

SPECIMENS EXAMINED
Western Australia. ● The Cascades, 4 km S of Pemberton, 34°29'S, 116°02'E, 180 m alt., on granite rocks in disturbed wet sclerophyll forest, *J.A. Elix 41091, H.T. Lumbsch & H. Streimann*, 13.ix.1994 (CANB).
South Australia. ● Kangaroo Island, Western River Conservation Park, Waterfall Creek, 30 km ENE of Cape Borda, 35°42'S, 136°54'E, 140 m alt., on semi-exposed rock face in dry sclerophyll forest, *H. Streimann 54951*, 28.ix.1994 (CANB).
New South Wales. ● Woomargama State Forest, 19 km S of Holbrook, 35°54'S, 147°19'E, 580 m alt., on granite rocks in dry sclerophyll forest, *J.A. Elix 23066, 23085*, 15.ix.1989 (CANB); ● Grove Creek Falls, 45 km SSE of Blayney, 33°56'S, 149°22'E, 550 m alt., on volcanic rocks in dry sclerophyll forest, *J.A. Elix 25560*, 12.ix.1990 (CANB); ● Moonbi Range, 9 km NE of Tamworth, 28°30'S, 152°45'E, 450 m alt., on granite rock in dry sclerophyll forest, *H. Streimann 9814*, 12.i.1980 (CANB).
Victoria. ● Kooyoora State Park, 16 km W of Inglewood, 37°51'S, 144°22'E, on semi-exposed boulder in *Eucalyptus* woodland, *H. Streimann 59145*, 7.xii.1996 (CANB).
Germany. ● Schleswig-Holstein. Closed down part of the shunting yard of Meimersdorf, *c*. 4 km S of city of Kiel (54°20'N, 10°08'E), on brick fragments lying on the ground, *P. Jacobsen 6143*, 14.iv.1989 (CANB, [H.Hertel, *Lecideaceae Exsiccatae* No. 260]).
U.S.A. ● Pennsylvania, Wyoming County. State Game Lands No. 57, Henry Lott Road, *c*. 2 miles SW of Kasson Brook, Forkston Township, 41°26'45"N, 76°08'45"W, 490–610 m alt., on sandstone outcrops in mature *Acer-Betula-Fagus* forest, *J.C. Lendemer 13670*, 21.vii.2008 (CANB).

Key to *Trapelia* in Australia

1 Soralia present 2
1: Soralia absent 3

2 Thallus squamulose or subsquamulose ..... **T. pruinosa**[1]
2: Thallus crustose, coherent, continuous ..... **T. placodioides**

3 Thallus squamulose or subsquamulose 4
3: Thallus crustose; surface continuous, rimose or areolate 8

4 Upper surface smooth or minutely rugose 5
4: Upper surface pruinose, scabrid, mealy or coarsely crystalline 6

5 Apothecia sessile; 5-*O*-methylhiascic acid (major) ..... **T. involuta**[2]
5: Apothecia mainly immersed; gyrophoric acid (major) ..... **T. occidentalis**

6 Ascospores 9–16 × 4–8 µm; gyrophoric acid (major) ..... **T. crystallifera**
6: Ascospores 11–20 × 6–12 µm; 5-*O*-methylhiascic acid (major) 7

7 Squamules expanding to form small rosettes to 2.5 mm wide; margins elevated, dissected; ± with submarginal or marginal pruina; squamules lacking calcium oxalate [H_2SO_4–] ..... **T. rosettiformis**
7: Squamules not forming rosettes; margins adnate to substratum; pruina concentrated in shallow depression in the centre of squamules; squamules containing calcium oxalate [H_2SO_4+] ..... **T. pruinosa**

8 Ascospores 17–34 × 12–20 µm; apothecia persistently immersed; alpine 9
8: Ascospores 9–30 × 4–15 µm; apothecia immersed at first, then adnate to sessile 10

9 Ascospores 25–34 µm long; hypothecium 150–180 µm thick; gyrophoric acid (major); Tasmania ..... **T. macrospora**
9: Ascospores 17–30 µm long; hypothecium 70–100 µm thick; 5-*O*-methylhiascic acid (major); N.S.W. ..... **T. kosciuszkoensis**

10 Thallus surface scabrid, mealy, coarsely crystalline; disc pruinose at least in part ..... **T. concentrica**
10: Thallus surface smooth to rugulose, not crystalline; disc epruinose 11

11 Thallus thicker at margins; 5-*O*-methylhiascic acid (major) 12
11: Thallus thinner at margins or of poorly developed areoles; gyrophoric acid (major) 13

12 Ascospores 16–23 × 9–15 µm; conidia 10–17 µm long; containing additional 5-methoxylecanoric acid ..... **T. lilacea**
12: Ascospores 11–18 × 5–10 µm; conidia 16–30 µm long; lacking 5-methoxylecanoric acid ..... **T. calvariana**

13 Thallus micro-areolate; ascospores 15–30 µm long 14
13: Thallus crustose, forming extensive patches; ascospores 14–21 µm long 15

14 Thallus containing calcium oxalate [H_2SO_4+]; disc usually black, with a well-developed white thalline rim ..... **T. atrocarpa**
14: Thallus lacking calcium oxalate [H_2SO_4–]; disc brown; thalline rim fragmentary or absent ..... **T. terrestris**

15 Upper surface often yellow-pigmented; 5-*O*-acetylhiascic acid present ..... **T. thieleana**
15: Upper surface greenish grey; 5-*O*-acetylhiascic absent ..... **T. coarctata**

[1] in older, highly pruinose specimens, the pruina often becomes eroded, and such specimens can appear sorediate.
[2] Australian collections of this species have somewhat smaller ascospores than their European counterparts, and possibly represent a separate taxon.

Acknowledgements
We thank Dr Chris Cargill and Ms Judith Curnow of CANB for their kind cooperation in providing us with ready access to key collections.

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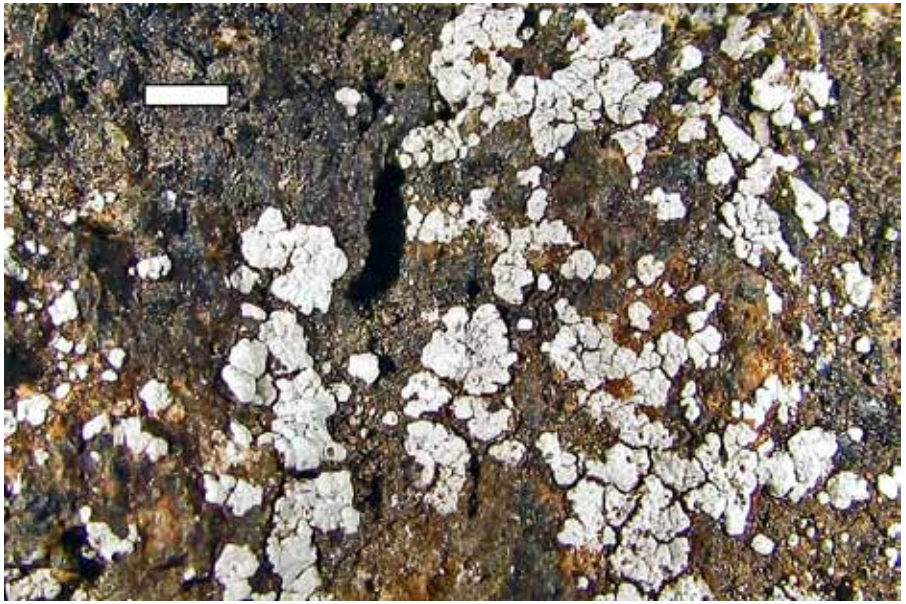

Figure 1. *Trapelia occidentalis* (holotype in CANB). Scale = 2 mm.

Figure 2. *Trapelia rosettiformis* (holotype in CANB). Scale = 1 mm.

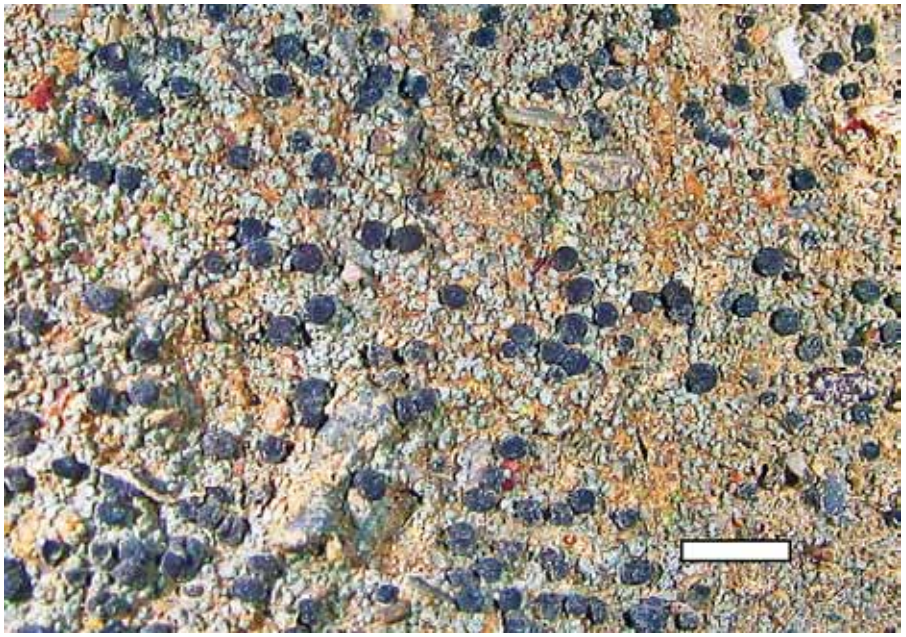

Figure 3. *Trapelia terrestris* (holotype in CANB). Scale = 2 mm.

A new species of the lichenicolous genus *Phaeospora* Hepp ex Stein (Verrucariales) from Australia

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Abstract

A pyrenocarpous microfungus, collected from consolidated soil in *Eucalyptus*-dominated woodland in the Australian Capital Territory, proved to be a species of the lichenicolous genus *Phaeospora* Hepp ex Stein (Verrucariales), probably parasitic on the endemic *Sarcogyne terrulenta* P.M.McCarthy & Elix (Acarosporaceae). *Phaeospora australiensis* P.M.McCarthy & Elix has minute, semi-immersed to almost superficial perithecia lacking an involucrellum and paraphyses, but with a uniformly brown-black excipulum, simple periphyses, an amyloid hymenium, (4–)8-spored fissitunicate asci, and 3-septate ascospores that are medium grey or medium brown or brownish grey, lack a perispore, and measure 12–22 × 4.5–8 µm.

Introduction

The lichenicolous fungal genus *Phaeospora* Hepp ex Stein is most diverse in temperate and higher latitudes of both hemispheres. It is characterized by simple, perithecioid ascomata with fissitunicate, (4–)8-spored asci, periphyses but no paraphyses, and brown 3(–7)-septate ascospores. Fourteen species are known to be parasitic on various Parmeliaceae, as well as on species of *Aspicilia*, *Catolechia*, *Diplotomma*, *Evernia*, *Lecania*, *Lecanora*, *Micarea*, *Myriolecis*, *Pannaria*, *Peltigera*, *Placopsis*, *Protoblastenia*, *Pseudocyphellaria*, *Rhizocarpon*, *Squamarina* and *Verrucaria* (Hawksworth 1980, 1983, 2003; Clauzade *et al.* 1989; Alstrup & Hawksworth 1990; Øvstedal & Hawksworth 1986; Horáková & Alstrup 1994; Alstrup & Olech 1996; Alstrup & Hansen 2001; Galloway 2007; van den Boom & Etayo 2014; Zhurbenko 2014; Diederich *et al.* 2018; and others). Two additional taxa were described as new from *Acarospora* and *Rinodina* in the South Shetland Islands by Alstrup *et al.* (2018); however, the names lacked registration numbers and they are, therefore, invalid. Previously unknown in Australia (McCarthy 2015), the genus is represented in New Zealand by *P. perrugosaria* (Lindsay) R.Sant., which occurs on the apothecia of *Placopsis perrugosa* (Nyl.) Nyl. (Galloway 2007).

In this contribution, *Phaeospora australiensis* P.M.McCarthy & Elix sp. nov. is described from a community of terricolous lichens in the Australian Capital Territory. While the identity of the host lichen is not known with complete certainty, it is probably the endemic, crustose species *Sarcogyne terrulenta* P.M.McCarthy & Elix (Acarosporaceae).

Methods

Observations and measurements of ascomatal anatomy, asci and ascospores were made on hand-cut sections mounted in water and dilute KOH (K). Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K.

Phaeospora australiensis P.M.McCarthy & Elix, sp. nov. Fig. 1
MycoBank No.: **MB835578**

Lichenicolous on an immersed, terricolous host, probably depauperate thalli of *Sarcogyne terrulenta* P.M.McCarthy & Elix, with black, semi-immersed to almost superficial, simple perithecia, 0.11–0.25 mm diam., each with a brown-black excipulum, unbranched periphyses (*c.* 10–18 × 2–3 µm) but without paraphyses. Hymenial gel KI+ medium blue. Asci (4–)8-spored, 51–62 × 10–15 µm. Ascospores 3-septate, medium grey or medium brown or brownish grey, narrowly ellipsoid to oblong-fusiform or oblong, thin-walled and lacking a perispore at maturity, 12–22 × 4.5–8 µm.

Type: Australia. Australian Capital Territory, *c.* 5 km W of Canberra, Cook, between Bindubi Street and the horse paddocks, 35°16'08"S, 149°04'29"E, 630 m alt., probably lichenicolous on *Sarcogyne terrulenta* on a consolidated soil bank in dry *Eucalyptus* woodland, *J.A. Elix 46984*, 25.iii.2020 (holotype – CANB).

Vegetative hyphae indistinct, hyaline. *Ascomata* perithecia, moderately numerous, solitary, scattered, semi-immersed and hemispherical to almost superficial and subglobose, (0.11–)0.17(–0.25) mm diam. [*n* = 50], jet-black, the surface smooth and dull to glossy; apex rounded or slightly flattened; ostiole central, inconspicuous or in a shallow depression *c.* 20 µm wide. *Involucrellum* absent. *Excipulum* uniformly dark brown to brown-black, 30–35 µm thick at the apex, 15–25 µm thick at the sides and base, K–; lateral and basal excipulum 5–8 cell layers thick in thin section, the cells rather thick-walled, narrowly to broadly ellipsoid, or oblong-ellipsoid to fusiform, 5–8 × 2–4(–5) µm. *Subhymenium* hyaline, 10–15 µm thick. *Paraphyses* absent. *Periphyses* unbranched, *c.* 10–18 × 2–3 µm. *Centrum* obpyriform to ± globose; hymenial gel I+ orange-brown, KI+ medium blue. *Asci* (4–)8-spored, fissitunicate, narrowly to broadly clavate, clavate-cylindrical or somewhat obclavate, 51–62 × 10–15 µm [*n* = 10], when immature the wall markedly thickened at the apex (I–, KI–) and with a narrow ocular chamber, at maturity the tholus reduced, with a thin, KI+ dark blue cap and the ocular chamber absent. *Ascospores* irregularly biseriate or ± massed in the ascus, 3-septate, narrowly ellipsoid to oblong-fusiform or oblong, usually straight, occasionally slightly curved, rarely sigmoidal, not to slightly or deeply constricted at the septa, initially hyaline, later pale grey, eventually medium grey or medium brown or brownish grey, transverse septa often markedly darker than the external spore wall, commonly the 2 end cells slightly to distinctly paler than the 2 inner locules, (12–)17.5(–22) × (4.5–)6.5(–8) µm [*n* = 137]; apices rounded or subacute; spore wall very thin, usually lacking a perispore (this occasionally visible and very thin in immature ascospores); spore contents clear, not granulose, most locules with a single large vacuole. *Pycnidia* absent.

Etymology: The epithet *australiensis* refers to known distribution of this species.

Remarks

The new species can be distinguished from most known taxa of *Phaeospora* by the combination of its perithecial dimensions, ascospore size and septation, the amyloid reaction of the hymenium, the absence of a perispore and the presumed host species. It is probably closest to the type species of the genus, *P. rimosicola* (Leighton ex Mudd) Hepp., a parasite of saxicolous *Aspicilia*, *Diplotomma* and *Rhizocarpon* from Iceland and from northern Europe to Central Asia, the latter having brown vegetative hyphae, smaller perithecia with a much thinner excipulum and shorter periphyses, and ascospores with a conspicuous perispore (Hawksworth 1983; Clauzade *et al.* 1989).

Although the identity of the host lichen of *Phaeospora australiensis* is not known with complete certainty, it is probably the endemic *Sarcogyne terrulenta*, the most abundant terricolous species on comparatively firm and well-drained clay soil at the type locality. Associated species include *Acarospora tasmaniensis* K.Knudsen & Kocourk., *Cladia aggregata* (Sw.) Nyl., a sparse *Cladonia* sp. (squamules only), *Diploschistes* sp., *Gyalidea psammoica* (Nyl.) Lettau ex Vězda, *Lecidea terrena* Nyl., *Micarea almbornii* Coppins, *M. humilis* P.M.McCarthy & Elix and *Trapelia terrestris* Elix & P.M.McCarthy. The parasite-host interaction is not apparent on the usually robust, fertile colonies of the *Sarcogyne* which are pale greyish brown or pale to medium sandy brown and rimose or quasi-areolate (McCarthy & Elix 2020). Rather, and assuming the relationship is an exclusive one, it occurs primarily on sterile areas of endosubstratal thalli, where the host is most effuse and nondescript and where the immersed algae form sparse or rather dense clumps, but not a distinct layer. Cells are chlorococcoid, globose or broadly ellipsoid, thin-walled and (5–)6–11(–12) µm wide, while

the interstitial, mycobiont hyphae (or possibly the vegetative hyphae of the parasite) are hyaline, thin-walled, long-celled and 1.5–2.5 µm wide. *Acarospora tasmaniensis* is a noteworthy record here. Formerly *Polysporina terricola* Kantvilas and endemic to Tasmania (Kantvilas 1998), this is among the first records of the species from mainland Australia (see below).

The type collection of *Phaeospora australiensis* consists of approximately 100 perithecia on about 25 square centimetres of soil crust, and the only indication of a recognizable lichen is a single apothecium of *Lecidea terrena*. A second visit to that locality yielded two small clusters of perithecia adjacent to, or possibly on *Sarcogyne* colonies. In the absence of an unambiguous association between the presumed parasite and host lichen, an alternative, but admittedly slim possibility, is that this is a lichenized or at least partially lichenized species of *Phaeospora*.

ADDITIONAL SPECIMEN EXAMINED
Australian Capital Territory. ● *c.* 5 km W of Canberra, Cook, between Bindubi Street and the horse paddocks, 35°16'08"S, 149°04'29"E, 630 m alt., probably lichenicolous on *Sarcogyne terrulenta* inhabiting a consolidated soil bank in dry *Eucalyptus* woodland, *P.M. McCarthy 4936*, 8.v.2020 (CANB).

Acarospora tasmaniensis K.Knudsen & Kocourk., *Opusc. Philolich.* **21**, 147 (2015)
Polysporina terricola Kantvilas, *Lichenologist* **30**, 552 (1998)

SPECIMENS EXAMINED
Australian Capital Territory. ● *c.* 5 km W of Canberra, Cook, between Bindubi Street and the horse paddocks, 35°16'08"S, 149°04'29"E, 630 m alt., on a consolidated soil bank in dry *Eucalyptus* woodland, *P.M. McCarthy 4937*, 8.v.2020 (CANB).
New South Wales. ● Southern Tablelands, adjacent to Kings Highway, 12 km E of Bungendore, 35°15'01"S, 149°34'29"E, 865 m alt., on consolidated soil in open *Eucalyptus* woodland, *J.A. Elix 46920*, 20.ii.2020 (CANB).

Acknowledgement
We are grateful to Dr Claude Roux (Mirabeau, France) for advice.

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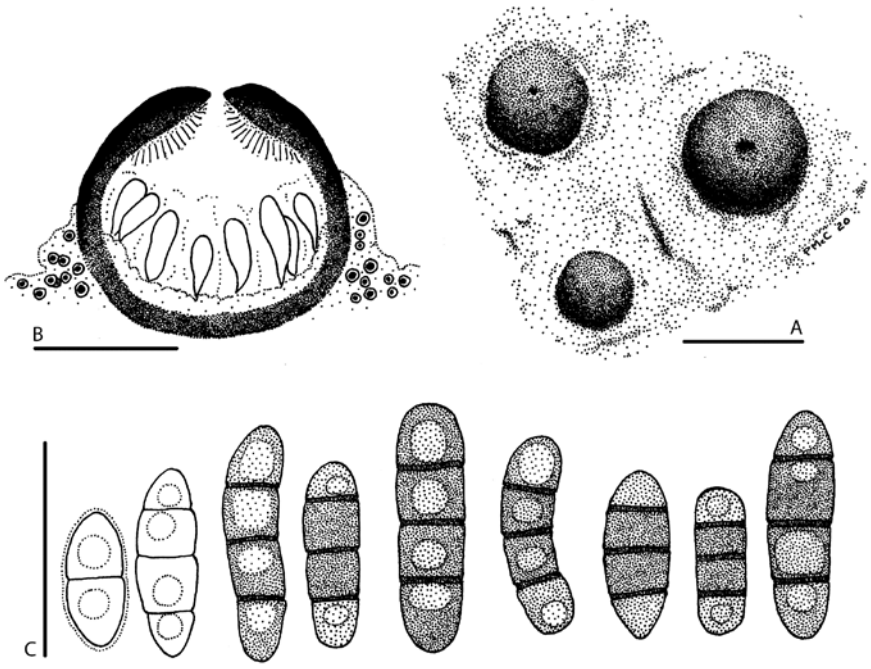

Figure 1. *Phaeospora australiensis* (holotype). A, Perithecia; B, Section of a perithecium and adjacent host thallus (semi-schematic). C, Ascospores (two hyaline ascospores on the left are immature). Scales: A = 0.2 mm; B = 0.1 mm; C = 20 µm.

Gibbosporina revisited: new records from Fiji, Indonesia, New Caledonia, Papua New Guinea and Queensland, with one species from the Solomon Islands transferred to *Pannaria*

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Abstract

More than 40 Australasian collections of the genus *Gibbosporina* have been studied and found to confirm the concepts of the six species previously known from Australia and Papua New Guinea. Perispore morphology is the character most useful for identification. *Gibbosporina nitida* appears to be the most common species in the area. *Gibbosporina elixii* and *G. leptospora* were previously thought to be very rare, known from only two localities each, but they are reported here from several new localities. *Gibbosporina thamnifera* was previously known from only the Eungella National Park in Queensland and from one locality in Papua New Guinea, but is now known from further localities. New Caledonia is now known to have three species, *G. leptospora* newly reported. Fiji also has three species, *G. leptospora*, *G. nitida* and *G. sphaerospora* newly reported here, and *G. sphaerospora* is also reported as new to Papua New Guinea. *Gibbosporina phyllidiata*, previously known from only the sterile holotype specimen from the Solomon Islands, is now shown to contain pannarin, and is therefore much better accommodated in *Pannaria* under its new name *P. melanesica.*

Introduction

The genus *Gibbosporina*, described by Elvebakk *et al.* (2016), ranges from western parts of the Indian Ocean (Réunion and Mauritius) to the Central Pacific (Samoa), and includes 13 known species, all large and foliose. *Gibbosporina* belongs to a major tropical clade within Pannariaceae, as shown by the phylograms provided by Elvebakk *et al.* (2016) and Weerakoon *et al.* (2018). It was also found as a strongly deviating *Pannaria* in the phylogram of Magain & Sérusiaux (2014), prior to the description of the new genus. However, it is tripartite and is dominated by the chlorobiont, and has a gross morphology much more similar to austral tripartite *Pannaria* species than to its phylogenetic relatives such as *Physma*, *Leightoniella* and *Lepidocollema*.

The 2016 study by Elvebakk *et al.* was based on the examination of 119 specimens of *Gibbosporina*. That might sound like a reasonably large sample of a conspicuous genus of lichens, and seven of the new species were also described with good molecular support. However, given the high number of newly described lichens represented by this material, one would certainly expect important gaps of knowledge in addition to the possibility of misidentification. Based on superficial impressions, most species appear broadly similar, in addition to being modified by local habitat conditions.

The principal centre of species diversity of *Gibbosporina* is Queensland in Australia, with six species, and with *G. elixii* Elvebakk, Hong & P.M.Jørg. as the only endemic taxon. However, if Queensland is treated together with neighbouring Papua New Guinea, *G. leptospora* Elvebakk and *G. thamnophora* Elvebakk & P.M.Jørg. can be added as endemic species. Our understanding of these six species has so far been based on 24 specimens from Australia and four from Papua New Guinea.

Further studies are required, particularly as this genus is probably common in suitable habitats in many parts of its range. There are also many additional specimens in CANB, apart from those documented by Elvebakk *et al.* (2016). This is also true of B, which has many duplicates of collections housed at CANB, in addition to numerous samples collected in Papua New Guinea by the second author. This contribution is based primarily on the collections in B, while some *Gibbosporina* samples from BM were also investigated, leading to the taxonomic revision of a previously described species. The aim of the present study is to determine whether the new *Gibbosporina* specimens match existing species concepts.

Material and methods

The material studied included 40 samples deposited at B, in addition to duplicates of CANB and H specimens already published, as well as four samples deposited at BM. The samples were studied applying the same methods as used by Elvebakk *et al.* (2016), including extensive sketch drawings of all fertile specimens, including *c.* 280 spores.

New name

Pannaria melanesica Elvebakk**,** nom. nov.
MycoBank number: **MB 836353**

Basionym: *Gibbosporina phyllidiata* Elvebakk, *Lichenologist* **48**, 37 (2016). Type: Solomon Islands, Guadalcanal Island, Mt Popomansiu, on ridge SE of Sutakiki River (Vunuvalukama), *c.* 4400 ft, [on bark in] montane rainforest, *D. Jackson Hill 9729*, 9.xi.1965 (BM 000731914 **—** holotype!).
Following its description, a second TLC analysis was performed on the holotype of *Gibbosporina phyllidiata* Elvebakk, the only species in the genus with specialized vegetative propagules and without known apothecia. Surprisingly, whereas all other *Gibbosporina* species are TLC negative, this specimen was found to contain pannarin. No foliose and tripartite *Pannaria* species reach tropical or subtropical areas, except for *P. lobulifera* Elvebakk from New Caledonia (Elvebakk 2007) and *P. papuana* (Aptroot & Diederich) P.M.Jørg. & Sipman (Jørgensen & Sipman 2006) from Papua New Guinea. The former contains vicanicin, while the latter is a brittle species with a single-layered cortex and without TLC-detectable compounds. Both species represent different complexes in *Pannaria* and are very different from *P. melanesica*. Pannarin occurs in many species of *Pannaria*, and for a sterile species like *G. phyllidiata*, chemistry is decisive. Its initial and erroneous status as TLC-negative, combined with its distribution, explains why this species was originally described as a *Gibbosporina*. However, now that it is known to contain pannarin, it is much better accommodated in *Pannaria*, certainly pending future discoveries of fertile and/or fresh material. A new name is required, since *P. phyllidiata* Elvebakk already exists for a different species (Lumbsch *et al.* 2011).

Etymology: the epithet reflects the known distribution of the species in Melanesia.

New records

1. Gibbosporina acuminata Elvebakk
This species is known from tropical forests in Australia (Queensland) and the Philippines.

SPECIMENS EXAMINED
Australia. *Queensland*: ● Crediton State Forest, 20 km SSW of Finch Hatton, 21°19’S, 148°33’E, rainforest dominated by *Syzygium* and *Argyrodendron trifoliatum*, on canopy of *Argyrodendron*, *J.A. Elix 21050*, 1.vii.1986 (B 60 0119628, CANB, H); ● Tully Falls Road, 18 km SE of Ravenshoe, alt. 760 m, 17°46’S, 145°33’E, rainforest on flats, on roadside shrub, *H. Streimann 29140*, 23.vi.1984 (B 60 0069980, CANB).

2. Gibbosporina elixii Elvebakk, Hong & P.M.Jørg.
This rare species is known from only two Queensland localities. Its concept is confirmed by the three specimens added. However, it maintains its position as a Queensland endemic, In two of the specimens, pycnidia were observed for the first time. They were small (0.1 mm wide), black and conspicuously glossy.

SPECIMENS EXAMINED
Australia. *Queensland*: ● Cardwell Range, 24 km WNW of Cardwell, alt. 750 m, 18°12'S, 145°48'E, rainforest on broad ridge, in tree crown, *H. Streimann 28578*, 20.vi.1984 (B 60 0119639, CANB); ● Mount Windsor Tableland, 39 km NW of Mossman, alt. 1080 m, 16°16'S, 145°04'E, in rainforest beside small stream, on sapling, *J.A. Elix 16506*, 26.vi.1984 (B 60 0119630, B 60 0119631, CANB); ● Cooroo Logging Area, 16 km WNW of Innisfail, alt. 100 m, 17°31'S, 145°53'E, in coastal rainforest on felled tree, *J.A. Elix & H. Streimann 16653*, 28.vi.1984 (B 60 0119629, CANB, cf., sterile, no pycnidia seen).

3. Gibbosporina leptospora Elvebakk
This lichen, previously known from only two locations, is now shown to be much more widespread. It is reported here as new to Fiji and New Caledonia. The collection from New Caledonia was previously reported as *Psoroma araneosum* Church.Bab. (now in *Pannaria*) by Smith (1922).

SPECIMENS EXAMINED
Australia. *Queensland*: ● The Boulders, 6 km W of Babinda, alt. 80 m, 17°21'S, 145°53'E, remnant rainforest surrounding stream, on tree trunk, *H. Streimann 45682*, 3.xii.1990 (B 60 0088006, CANB); ● Barron State Forest, Herberton Range, 11 km SSW of Atherton, alt. 1050 m, 17°22'S, 145°36'E, rainforest, logged in the past, on tree trunk, *H. Streimann 27314*, 2.iii.1983 (B 60 0131528, CANB); ● Moses Creek, Rossville–Bloomfield River road, 35 km SSE of Cooktown, alt. 240 m, 15°47'S, 145°17'E, lowland rainforest on flats beside creek, on shaded upper tree trunk, *H. Streimann 57369*, 21.x.1995 (B 60 0119643, CANB); ● Rex Creek, Mossman Gorge, Daintree River National Park, 6 km W of Mossman, alt. 80 m, 16°28'S, 145°19'E, lowland rainforest with *Tristania* near stream, on tree trunk, *H. Streimann 45880*, 5.xii.1990 (B 60 0087993, CANB).
Fiji. *Viti Levu*: ● Nasori Highlands, Nadi–Sigatoka road, 13 km E of Vanturu Dam turnoff, in regrowth forest along roadside on trees, *J.A. Elix 15204*, 26.viii.1983 (B 60 0119637, CANB).
Papua New Guinea. *Milne Bay*: ● Woodlark Island, Mt Kabati–Kulumadau road, 5 km E of Kulumadau, alt. 100 m, 09°04'S, 152°47'E, lowland forest disturbed by roading, on *Endospermum* tree, *R. Kumei 92*, 11.x.1984 (B 60 0063194, CANB); ● Woodlark Island, Kaurai logging area, 9 km N of Kulumadau, alt. 100 m, 09°01'S, 152°43'E, forest dominated by *Syzygium*, *Endospermum*, *Calophyllum*, *Dysoxylum* and *Pometia*, on *Syzygium* branches, *R. Kumei 58*, 8.x.1984 (B 60 0079184, CANB). *Morobe*: ● Herzog Mountains, 15 km WNW of Lae, alt. 760 m, 06°45'S, 146°51'E, on *Castanopsis*- and Dipterocarpaceae-dominated ridge, on large tree trunk, *H. Streimann & T. Umba 10990*, 13.i.1981 (B 60 0113111, CANB).
New Caledonia. ● Mont Humboldt, on soil in moist gully forest, alt. 1000 ft, *Compton 1086*, v.1914, (BM 000760144).

4. Gibbosporina nitida Elvebakk, Hong & P.M.Jørg.
By far the most common species in the material under study, with 19 new collections identified and reported here. Previously, it was known from two localities in Papua New Guinea. Now it is known from 12 more collections there, although five are from the same area. It is characterized by highly glossy lobes, distinctly bullate perispores and proper spores (Nordin 1997) that range from globose and subglobose to short-ellipsoid. Some sterile specimens were determined based on the presence of dark, verrucose, marginal pycnidia. The species is reported here as new to Fiji.

SPECIMENS EXAMINED
Australia. *Queensland*: ● Crediton State Forest, 20 km SSW of Finch Hatton, alt. 840 m, 21°19'S, 148°33'E, tropical forest dominated by *Argyrodendron trifoliatum* and *Syzygium*, crown of *Argyrodendron*, *H. Streimann 37668*, 1.vii.1986 (B 60 0060963, CANB, NY); ● Ravenshoe State Forest, Tully Falls Road, 18 km SE of Ravenshoe, alt. 760 m, 17°46'S, 145°33'E, along rainforest margin on *Schefflera*, *J.A. Elix 16153*, 23.vi.1984 (B 60 0119626, CANB); ● Cooroo Logging Area, 16 km WNW of Innisfail, alt. 100 m, 17°31'S, 145°53'E, in coastal rainforest on felled tree, *J.A. Elix & H. Streimann 16668A*, 28.vi.1984 (B 60 0119627, CANB).
Fiji. *Viti Levu*: ● Nasori Highlands, Nadi–Sigatoka road, 3 km W of Vanturu Dam turnoff, in regrowth forest along roadside, on *Dacridium* in thicket, *J.A. Elix 15264*, 27.viii.1983 (B 60 0119635, B 60 0119636, CANB).
Papua New Guinea. *Central*: ● Owen Stanley Range, Kagi village, along Kokoda Trail towards Gap, alt. 1700 m, 09°08'S, 147°40'E, *Lithocarpus* forest on mountain ridge, *H. Sipman 38602*, 20–21.x.1995 (B 60 0185956, UPNG). *Eastern Highlands*: ● Waiopa, Aiyura–Omaura road, 13 km SE of Kainantu, alt. 1450 m, 06°22'S, 145°58'E, in remnant *Castanopsis* forest on *Cerbera floribunda*, *J.A. Elix 12406*, 8.xii.1982 (B 60 0119633, CANB); ● Wopeia, Aiyura–Omara road, 10 km SE of Aiyura, alt. 1550 m, 06°20'S, 145°55'E, pure *Castanopsis* forest on a broad ridge, on trunk of medium-sized *Cerbera floribunda*, *H. Streimann 18324*, 10.iv.1982 (B 60 0063171, CANB). *Madang*: ● S side of Ramu valley, Bundi village, along road to Bundi Gap, alt. 1500 m, 05°44,9'S, 145°14.1'E, epiphytes in disturbed forest on steep slope, *H. Sipman 39372*, 9.xi.1995 (B 60 0185958). *Morobe*: ● Araulu Logging Area, 26 km SE of Wau, alt. 1900 m, 07°28'S, 146°48'E, *Podocarpus*, *Phyllocladus*- and Fagaceae-dominated ridge forest, on large, shaded tree trunk, *H. Streimann 13583*, 29.i.1981 (B 60 0119647, CANB); ● Upper Nawata Banda, 9 km S of Bulolo, alt. 1400 m, 07°17'S, 146°38'E, *Castanopsis acuminatissima*-dominated forest on ridge, on *Sloanea* trunk, *H. Streimann 24904*, 3.x.1982 (B 60 0063193, CANB); ● Upper Watut River, 13 km SSW of Bulolo, alt. 1750 m, 07°17'S, 146°36'E, *Castanopsis-Ternstroemia britteniana*-dominated ridge, on treelet stem, *H. Streimann 23081*, 22.viii.1982 (B 60 0119646, CANB). *New Britain*: ● Geleo-Lasilai logging area at Laliti Mountain, Nakanai Mountains, 40 km SE of Hoskins, alt. 200 m, 05°42'S, 150°41'E, lowland forest on pumice on gentle slope dominated by Meliaceae, *Pometia* and *Garcinia*, in *Pometia* crown, *H. Streimann 40961*, 21.ii.1989 (B 60 0119641, CANB); ● *loc. id.*, *H. Streimann 40967*, 21.ii.1989 (B 60 0087992, CANB); ● *loc. id.*. *H. Streimann 40968*, 21.ii.1989 (B 60 0087995, CANB, NY, TU); ● *loc. id.*. *H. Streimann 40974*, 21.ii.1989 (B 60 0087994, CANB); ● *loc. id.*. *H. Streimann 41280*, 21.ii.1989 (B 60 0087991, CANB); ● Ibana Logging Area, slopes of Mt Ulawun (The Father), 10 km SSE of Ulamona Mission, alt. 250 m, 05°06'S, 151°17'E, lowland forest on volcanic ash, dominated by *Pometia*, *Calophyllum* and *Homalium*, on upper trunk of large tree (*Homalum foetidum*), *H. Streimann 41409*, 23.ii.1989 (B 60 0087990, CANB, KRAM). *Southern Highlands*: ● Piribu Sawmill, Tari–Komo road, 3 km SW of Tari, alt. 1650 m, 05°52'S, 142°56'E, in *Castanopsis* forest on dead tree, *J.A. Elix 13198*, 15.xii.1982 (B 60 0119632, CANB).
Philippines. *Leyte, Leyte Prov.*: ● Weg vom Gipfel des Mt Agipo nach Kadwa-An, alt. 780 m, *c.* 10°48'N, 124°47'E, *F. Schumm & U. Schwarz 7785*, 18.viii.2000 (B 60 0116418).

5. Gibbosporina sphaerospora Elvebakk & P.M.Jørg.
Nine specimens were determined as *G. sphaerospora*, which is reported as new to Fiji and Papua New Guinea. If present, the ascospores were very characteristic, with globose or subglobose proper spores (Nordin 1997) with thin and weakly gibbose perispores. The Fijian sample had some more gibbae than most other specimens of *G. sphaerospora*. Sterile specimens were determined by the presence of very conspicuous and large pycnidia. Some of the specimens proved to be a little more glossy compared to the description given by Elvebakk *et al.* (2016).

SPECIMENS EXAMINED
Fiji. *Viti Levu*: ● Mba (formerly Thole North), hills east of Nandala Creek, about 3 miles south of Nandarivatu, alt. 850–970 m, dense forest, 9–25 Sept. 1947, *A.C. Smith 6243* (BM).
Indonesia. *West Java*: ● Cibodas, Botanical Garden, alt. *c.* 1300 m, on tree trunks in garden. *H. Sipman & Zainal 30080*, 8.v.1991 (B 60 0083576).
Papua New Guinea. *Central*: ● K.B. Sawmill, Ehu Creek, 12 km SW of Sogeri, alt. 750 m, 09°28'S, 147°31'E, *Castanopsis*- and *Hopea*-dominated ridge, on a vine in the crown of a large *Castanopsis*, *H. Streimann & E.K. Naoni 16626*, 16.ii.1981 (B 60 0119652, CANB). *Morobe*: ● Aseki–Menyamya road, 6 km NE of Aseki, alt. 1950 m, 07°19'S, 146°09'E, in

disturbed montane forest on dead wood, *J.A. Elix & M. Toia 12142*, 5.xii.1982 (B 60 0119634, CANB); ● Araulu Logging Area, 26 km SE of Wau, alt. 1900 m, 07°28'S, 146°48'E, *Podocarpus*-, *Phyllocladus*- and Fagaceae-dominated ridge, on treelet trunk, *H. Streimann 13613*, 29.i.1981 (B 60 0119648, CANB). *Northern*: ● Owen Stanley Range, Myola, near guesthouse, along Iora River, alt. 2100 m, 09°09'S, 147°46'E, in primary montane forest in valley, *H. Sipman 38179*, 14.x.1995 (B 60 0185957, UPNG); ● Owen Stanley Range, Myola, *c.* 0.5 km along trail from guesthouse to Naduri, alt. 2100 m, 09°09'S, 147°46'E, in primary montane forest, *H. Sipman 38391*, 17.x.1995 (B 60 0185955, UPNG). *Southern Highlands*: ● Tari–Komo road, 6 km N of Komo, alt. 1480 m, 06°01'S, 142°51'E, in lower montane forest on tree, *J.A. Elix 13267*, 16.xii.1982 (B 60 0119638, CANB).
Philippines. *Luzon, Prov. Sorsogon*: ● Irosin, alt. 1500 ft, on the large limbs of a *Dipterocarpus*. *A.D.E. Elmer 15104*, xi.1915 (B 60 0060351).

6. Gibbosporina thamnophora Elvebakk & P.M.Jørg.
This species is now added from two new Australian localities. It was previously known from only Eungella National Park, as documented by collections deposited in Swedish herbaria. With its small-fruticose cephalodia, it was previously confused with the much more southern *Pannaria durietzii* (P.James & Henssen) Elvebakk & D.J.Galloway.

SPECIMENS EXAMINED
Australia. *Queensland*: ● Crediton State Forest, 20 km SSW of Finch Hatton, alt. 840 m, 21°19'S, 148°33'E, in rainforest dominated by *Syzygium* and *Argyrodendron trifoliatum*, on canopy of *Argyrodendron*, *J.A. Elix 21039*, 1.vii.1986 (B 60 0113110, CANB); ● Mount Windsor Tableland, 38 km NW of Mossman, alt. 1140 m, 16°17'S, 145°04'E, in rainforest with *Agathis robusta* along steep slope, on *Syzygium*, *J.A. Elix & H. Streimann 16516*, 26.vi.1984 (B 60 0113108, CANB).
Papua New Guinea. *Morobe*: ● Herzog Mountains, 15 km WSW of Lae, alt. 760 m, 06°45'S, 146°51'E, on *Castanopsis*- and Dipterocarpaceae-dominated ridge, on trunk of small *Myristica*, *H. Streimann & T. Umba 10965*, 13.i.1981 (B 60 0116419); ● Herzog Mountains, 15 km WNW of Lae, alt. 760 m, 06°45'S, 146°51'E, on *Castanopsis*- and Dipterocarpaceae-dominated ridge, large tree trunk, *H. Streimann & T. Umba 10990*, 13.i.1981 (B 60 0113111, CANB, among *Gibbosporina leptospora*).

Conclusions
The diversity patterns within *Gibbosporina*, with vicariant species in eastern or western parts of the Palaeotropics, has been upheld. All the collections could be assigned to the six species already known from Queensland, and the present study confirms existing species concepts. Two previously rare taxa, *G. elixii* and *G. leptospora*, are now recorded from additional localities, and *G. thamnophora* has its distribution in Queensland extended. *Gibbosporina nitida* appears to be the most common species in the area, whereas three species are recorded as new to Fiji, one to New Caledonia and one to Papua New Guinea. Co-occurrence of several species in one island was discussed by Elvebakk *et al.* (2016), and that is now confirmed by three species each known from Fiji and New Caledonia.

Detailed studies (with a substantial number of measurements) of the highly distinctive perispore morphology facilitates the recognition and separation of species. Individual spores of *G. sphaerospora* and *G. nitida* can overlap somewhat, but overall they conform to the patterns of perispore described by Elvebakk *et al.* (2016). As well, proper spores (Nordin 1997) have distinctive shapes ranging from globose to subglobose and short-ellipsoid in *G. sphaerospora*, to short-ellipsoid in *G. nitida*, intermediate-ellipsoid in *G. acuminata* and long-ellipsoid in *G. elixii*.

Pycnidia were used in a few cases to determine sterile samples. They are comparatively large and conspicuous in *G. sphaerospora*, moderately large and brown in *G. nitida,* sometimes with nodulose shapes, whereas they are newly described here as being small (0.1 × 0.1 mm), black and conspicuously glossy in *G. elixii*.

In regard to non-spore traits, glossy lobes are characteristic of most of the specimens, even some samples of *G. sphaerospora*, which appears more glossy than reported by Elvebakk *et al.* (2016).

Pannaria melanesica has uncertain affiliations within *Pannaria*, but it might be most closely related to an as yet undescribed, pannarin-containing species from Queensland and New Caledonia.

Acknowledgement
G. Weerakoon, at the Natural History Museum in London (BM), kindly helped in making specimens available for study.

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A new corticolous species of *Lasioloma* (lichenized Ascomycota, Pilocarpaceae) from north-eastern Queensland

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Abstract
Lasioloma corticola P.M.McCarthy is described from the bark of *Casuarina* in a montane rainforest margin in north-eastern Queensland, Australia. It is characterized by having conidia with 4 or 5 branches diverging from a single point, the branches (5–)7–9(–11)-septate and 25–60 × 1.5–2.5 µm.

Introduction

Species of the genus *Lasioloma* R.Sant. (Pilocarpaceae) have a corticolous or foliicolous thallus with an often pilose or woolly prothallus, a chlorococcoid primary photobiont, with or without cephalodia containing cyanobacteria, sessile biatorine apothecia with a paraplectenchymatous exciple, branched and anastomosing paraphyses in an amyloid hymenium, *Byssoloma*-type asci, and transversely septate to muriform ascospores. The conidiomata are campylidia, sessile and hood-like, while the particularly diagnostic conidia have 3–5 filiform branches originating from a single point, each branch being transversely septate. Nine species are currently accepted; three are corticolous and predominantly Neotropical, while six others are foliicolous and mainly Palaeotropical to pantropical (Santesson, 1952; Aptroot *et al.* 1997; Santesson & Lücking, 1999; Lücking & Sérusiaux, 2001; Breuss 2002; Lücking 2008; van den Boom *et al.* 2018). Four foliicolous taxa are known from tropical Queensland, *viz.* the pantropical *L. arachnoideum* (Kremp.) R.Sant. (also in Christmas Island, Indian Ocean) and the Palaeotropical *L. phycophilum* (Vain.) R.Sant., *L. phycophorum* (Vain.) R.Sant. and *L. trichophorum* (Vain.) R.Sant. In this paper, a new species is described from *Casuarina* bark in north-eastern Queensland.

Lasioloma corticola P.M.McCarthy, sp. nov. Figs 1 & 2
MycoBank No.: **MB834656**

Thallus crustose, corticolous, very thin, off-white to very pale greyish green; prothallus not apparent. Apothecia lacking. Campylidia ± erect to tilted and hood-like at maturity, (0.48–)0.95(–1.45) mm wide, to 1.1 mm tall; outer convex surface medium to dark grey; inner concave surface dull black. Conidia with 4 or 5 branches radiating from a single point; branches filiform and ± straight, or arcuate and often recurved, (5–)7–9(–11)-septate, 25–60 × 1.5–2.5 µm.

Type: Australia. Queensland, Atherton Tableland, Mt Baldy, 4 km SW of Atherton, 17°17'S, 145°27'E, 1080 m alt., on bark of *Casuarina* along the margin of regrowth rainforest, *J.A. Elix 16326 & H.Streimann*, 25.vi.1984 (holotype – CANB).

Thallus crustose, epiphloeodal, effuse to determinate, continuous to sparingly rimose, smooth to faintly rugulose or minutely and inconspicuously verruculose, dull to slightly glossy, off-white with a greenish tint to very pale greyish green, 30–70 µm thick, ecorticate, but with a discontinuous, hyaline necral layer 5–10 µm thick, non-amyloid (I–), not containing calcium oxalate (H_2SO_4–); cephalodia and isidia absent. *Algae* dominating the thallus, green, chlorococcoid, 7–12 µm wide; interstitial hyphae 2.5–4 µm wide. *Medulla* whitish or nondescript. *Prothallus* not apparent. *Apothecia* lacking. *Campylidia* moderately numerous, initially flattened and folded, then erect or tilted at *c.* 45° towards the substratum, concavo-convex and hood-like when mature, finally collapsed, tattered and perforated; mature campylidia (0.48–)0.95(–1.45) mm wide [*n* = 42], to 1.1 mm tall, tapering towards a bluntly pointed apex, pulpy and gelatinous when saturated with water; outer convex surface smooth, medium to dark grey (darker above, paler below); inner concave surface dull black. Sectioned campylidium externally hyaline and prosoplectenchymatous, 20–30 µm thick at the apex when dry, *c.* 50 µm thick when saturated, this external zone 30–70 µm thick at the base when dry, *c.* 100 µm thick when saturated. *Conidiogenous layer* greyish black in thin section, paraplectenchymatous, 10–20 µm thick; conidiophores rounded to somewhat angular, thick-walled, 4–6(–7) µm wide and dark grey-brown, or more elongate and 5–8 × 2–3 µm. *Conidia* concentrated towards the inner base of the hood-like campylidium, hyaline, with 4 or 5 branches radiating from a single point, the structure appearing to remain intact after release from the campylidium (i.e. not fragmenting); branches filiform and ± straight, or arcuate and often recurved, (5–)7–9(–11)-septate, (25–)41(–60) × 1.5–2.5 µm [*n* = 35], not constricted at the septa; ends rounded, but attached to the conidiophore by the free end of one of the branches which appears truncate once detached, the remaining 3 or 4 branches forming a tight fascicle while the conidium remains attached, diverging only after it is released.
Chemistry: no substances detected by TLC (Elix 2014).

Etymology: The specific epithet refers to the new species growing on bark.

Remarks

Even in the absence of ascomata, the new species is readily characterized by the size and septation of its 4- or 5-pronged conidia, i.e. the branches being (5–)7–9(–11)-septate and 25–60 × 1.5–2.5 µm. By contrast, another sterile corticolous species, *L. appendiculatum* Breuss from Costa Rica, has much shorter, 4-branched conidia, each with 2–4 septa and with two branches having distinctly cylindrical appendices *c.* 5 µm long (Breuss 2002). The corticolous *L. pauciseptatum* v.d.Boom, from Suriname, has a blue-black prothallus and pale blue-tinged campylidia to 0.8 mm wide, while the conidial branches are 1–6-septate and 45–55 × 2–2.5 µm (van den Boom *et al.* 2018). Finally, although the corticolous *L. stephanellum* (Nyl.) Lücking & Sérus., from the Neotropics and West Africa, lacks campylidia, it can be distinguished from the Australian lichen by having a yellowish thallus, a pale yellow medulla and a distinctive, whitish, arachnoid prothallus (Lücking & Sérusiaux 2001).

Lasioloma corticola is known only from the bark of *Casuarina* sp. in montane rainforest in north-eastern Queensland.

Acknowledgement

I am grateful to Jack Elix for carrying out TLC of the holotype.

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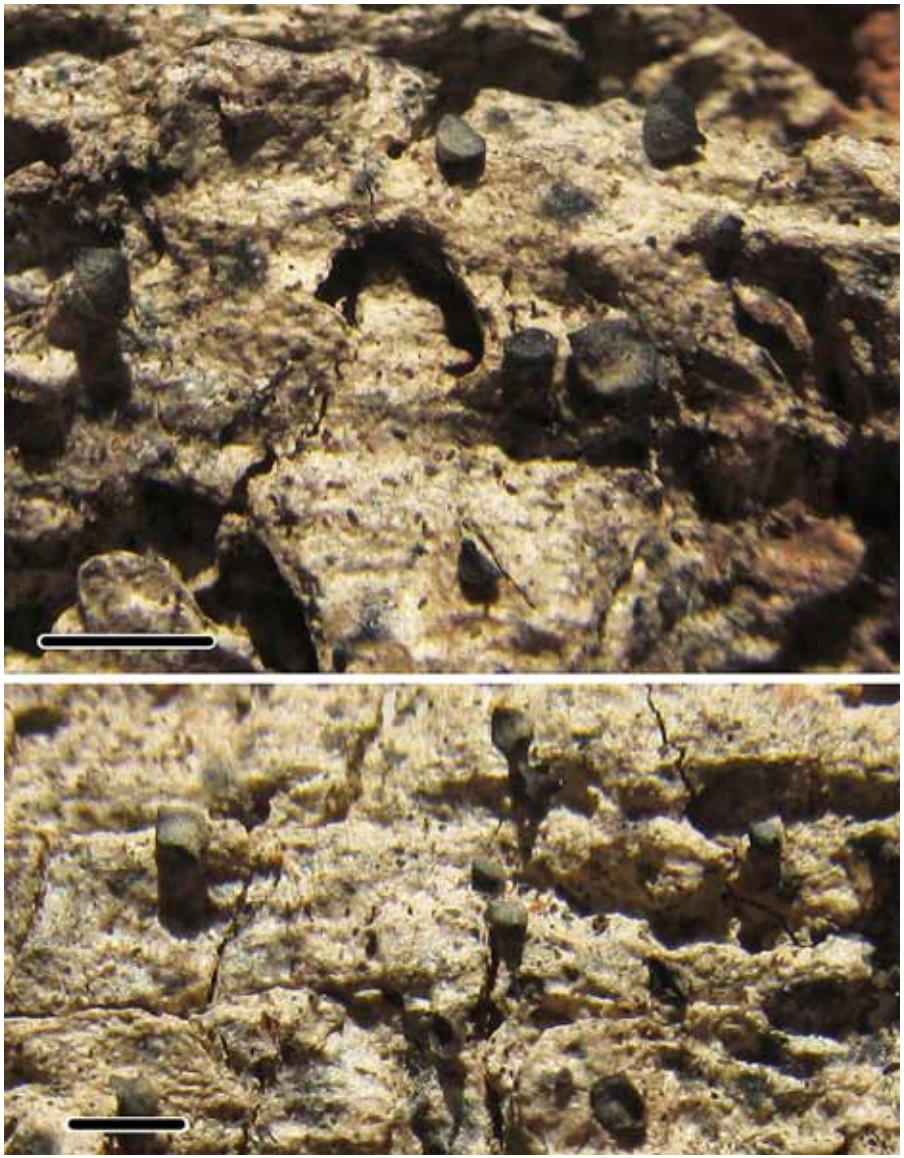

Figure 1. *Lasioloma corticola* (holotype). Scales: 2 mm.

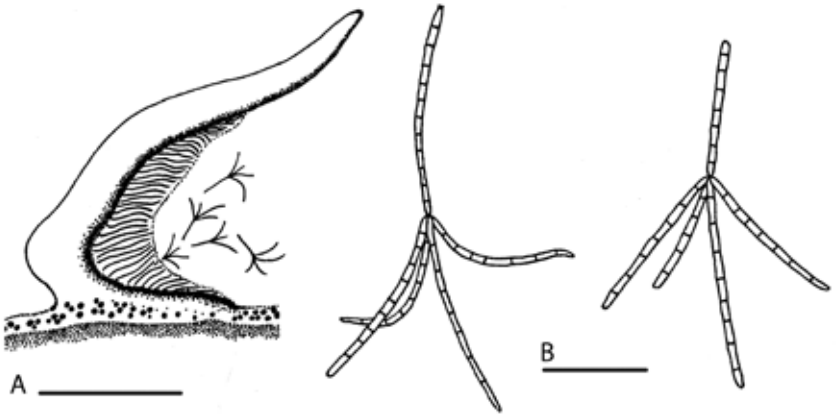

Figure 2. *Lasioloma corticola* (holotype). A, Vertical section of a mature campylidium (semi-schematic). B, Conidia. Scales: A = 0.2 mm; B = 20 µm.

New species and new records of *Micarea* (Pilocarpaceae) from Australia

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Abstract

Micarea crassa P.M.McCarthy & Elix sp. nov. (Pilocarpaceae) is described from bark in the wet tropics of the Northern Territory, and the corticolous *M. queenslandica* P.M.McCarthy & Elix sp. nov. is described from rainforest in north-eastern Queensland. *Micarea synotheoides* (Nyl.) Coppins and *M. ternaria* (Nyl.) Vězda are reported for the first time from Australia (both from New South Wales), while new state and territory records are provided for four other species.

Introduction

The predominantly temperate lichen genus *Micarea* Fr. (Pilocarpaceae) includes approximately 110 species, occurring mainly on acidic bark, decorticated wood, siliceous rock, soil and plant detritus as well as moribund bryophytes. An outstanding monographic revision of the European species by Coppins (1983), was followed by improved national flora treatments (Czarnota 2007; Coppins, 2009; Galloway 2009; Brand *et al.* 2014) as well as progress towards the clarification of phylogeny, the recognition of generic segregates, accounts of new species and reassessments of the taxonomy of species and species groups (Coppins 1999; Czarnota & Guzow-Krzemińska 2010; Ekman & Svensson 2014; van den Boom *et al.* 2017; Konoreva *et al.* 2018; Guzow-Krzemińska *et al.* 2019; Launis *et al.* 2019a, b; and others). Until very recently, a more gradual improvement in our understanding of the Australian *Micarea* species saw the description of new species and the recognition of previously Northern Hemisphere taxa in the Australian lichen flora (Coppins & Kantvilas 1990; Coppins, 2009; McCarthy & Elix 2016a, b; Elix & McCarthy 2018; Kantvilas 2018; and others). However, a substantial revision, mainly of the Tasmanian taxa, documented ten newly described species, six other additions to the Australian flora and a key to the 35 Tasmanian representatives (Kantvilas & Coppins 2019). This brings the known total for Australia and its island territories to 42 species (McCarthy 2020).

In the current contribution, two corticolous species are described as new from the Australian wet-tropics (Northern Territory and Queensland), two others, both from montane localities in New South Wales, are reported for the first time from Australia, while new state and territory records are provided for four other species.

Methods

Observations and measurements of photobiont cells, thalline and apothecial anatomy, asci, ascospores, pycnidial anatomy and conidia were made on hand-cut sections mounted in water and treated with 10% potassium hydroxide (K), 50% nitric acid (N) and 5% sodium hypochlorite (C). Calcium oxalate was detected by treatment of thalline and apothecial sections with a 10% aqueous solution of sulfuric acid; it forms colourless, needle-shaped crystals. Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K. Chemical constituents were identified by thin-layer chromatography (Elix 2014) and by comparison with authentic samples.

The species

1. Micarea almbornii Coppins, *Lichenologist* **31**, 559 (1999)
This lichen was initially described from sandstone in South Africa (Coppins 1999). It was subsequently reported from consolidated soil in northern New South Wales (Elix 2012) and, most recently, from soil in dry sclerophyll woodland in Tasmania (Kantvilas & Coppins 2019).

SPECIMENS EXAMINED
Australian Capital Territory. ● Canberra Nature Park, Aranda Bushland, Powerline Track, *c.* 4 km W of Canberra, 35°16'00"S, 149°04'54"E, 650 m alt., on consolidated, siliceous soil bank in dry *Eucalyptus* woodland, *P.M. McCarthy 4872, 4874, 4875*, 14.viii.2019 (CANB); ● *loc. id.*, *J.A. Elix 46818*, 14.viii.2019 (CANB).

2. Micarea argopsinosa P.M.McCarthy & Elix, *Telopea* **19**, 32 (2016)
This species was first described from montane granite in the A.C.T. (McCarthy & Elix 2016a), and later from compacted soil in dry sclerophyll woodland in Tasmania (Kantvilas & Coppins 2019). Remarkably, while McCarthy & Elix (2016a) reported macroconidia in the type specimen to be narrowly oblong to filiform, straight, curved or arcuate, with (1–)3 septa and 10–19 × 1–1.5 µm, microconidia and mesoconidia were not observed. However, while the newly reported specimen from New South Wales (below) lacks macroconidia, it produces both narrower microconidia (oblong to filiform and 6–9 × 0.7–1 µm) and broader mesoconidia (oblong to bacilliform and 3.5–6 × 1.2–1.8 µm).

SPECIMENS EXAMINED
New South Wales. ● Central Tablelands, Gillindich Nature Reserve, 10 km N of Binda, 34°12'59"S, 149°20'09"E, 830 m alt., on sandstone in dry *Eucalyptus* woodland, *P.M. McCarthy 4897*, 30.ix.2019 (CANB).
Victoria. ● Strzelecki State Forest, Whitelaws Rd, 29 km S of Traralgon, 38°28'S, 146°31'E, 520 m alt., on siliceous rock in wet sclerophyll forest, *J.A. Elix 29898*, 14.iv.1993 (CANB).

3. Micarea byssacea (Th.Fr.) Czarnota, Guzow-Krzemińska & Coppins, *in* Czarnota & Guzow-Krzemińska, *Lichenologist* **42**, 17 (2010)
According to Kantvilas & Coppins (2019), this name is applicable to most of the Tasmanian specimens previously ascribed to *M. prasina* Fr. and *M. micrococca* (Körb.) Gams ex Coppins. The Lord Howe Island specimen of *M. byssacea* is typical in having, *inter alia*, a thallus with methoxymicareic acid and apothecia containing the pigment Sedifolia-grey [see Czarnota & Guzow-Krzemińska (2010), Launis & Myllys (2014) and Kantvilas & Coppins (2019)].

SPECIMEN EXAMINED
Lord Howe Island. ● between Little Island and The Cross, 31°24'20"S, 159°04'30"E, 10 m alt., on base of dead palm on *Ficus* etc.-dominated slope with very large basalt boulders, *H. Streimann 50118*, 24.vi.1992 [B (*n.v.*), CANB].

4. Micarea crassa P.M.McCarthy & Elix, sp. nov. Figs 1 & 2
MycoBank No.: **MB834688**

Thallus corticolous, olive-green, to 1(–1.5) mm thick, minutely granulose or composed of goniocysts and containing methoxymicareic acid. Apothecia innate to adnate, dark greyish brown to dull jet-black, solitary and 0.12–0.28 mm wide or clustered; proper excipulum mainly pale, annular; hypothecium very pale; hymenium not inspersed, 33–50 µm thick, it and the epihymenium containing Sedifolia-grey. Asci 27–35 × 9–12 µm; ascospores 0–1-septate, narrowly ellipsoid to narrowly oblong or oblong-fusiform, 5.5–10 × 2–3.5 µm.

Type: Australia. Northern Territory, Baroalba Creek, 16 km SSE of Jabiru airfield, 12°49'S, 132°55'E, 210 m alt., on bark of dead *Syncarpia* in poor remnant vegetation in an area of large

boulders and outcrops with a westerly aspect, *H. Streimann 42317*, 21.iv.1989 (holotype – CANB; duplicates: B, ESS, *n.v.*).

Thallus crustose, epiphloeodal, determinate and forming colonies to *c.* 30 mm wide, pale (in patches) to predominantly medium olive-green (bright green when wetted), granular-verrucose or of goniocysts that are (20–)30–50(–60) µm wide and compacted to form a crust to 1(–1.5) mm thick, dull, continuous to pseudoareolate, non-amyloid (I–), not containing calcium oxalate (H_2SO_4–), K–, C–, i.e. probably not containing Sedifolia-grey pigment (Meyer & Printzen 2000), ecorticate; soredia and isidia absent. *Algae* dominating the thallus; cells micareoid, greyish green to bright green, ± globose to broadly ellipsoidal, thin-walled, 4–7 (–10) µm wide; interstitial hyphae 1.5–2(–2.5) µm wide, short-celled, thin-walled and richly branched. *Medulla* poorly delimited. *Prothallus* not apparent or patchy and whitish. *Apothecia* moderately numerous, innate among goniocysts to adnate, very dark greyish brown to, usually, dull jet-black (slightly paler when wetted), rounded, ellipsoid or rounded-irregular, immarginate in surface view, mostly solitary and (0.12–)0.19(–0.28) mm wide [*n* = 40], or clustered-tuberculate and in tight, proliferating groups of up to 5(–10) and measuring (0.3–)0.48(–0.66) mm wide; disc slightly, moderately or very strongly convex, dull, ± smooth to somewhat undulate, epruinose. *Proper excipulum* (in section) annular, 15–25 µm thick laterally and with a dark brown outer edge subtended by radiating, simple to anastomosing hyphae that are hyaline and 1.5–2 µm wide; excipulum 15–20 µm thick at the apothecial base, K+ violet-brown, N–, C–. *Hypothecium* hyaline to very pale yellowish brown, 40–70 µm thick in the centre, 30–40 µm thick laterally, paraplectenchymatous below, distally with short-celled, deeply pigmented, anticlinal hyphae 1.5–3(–4) µm wide, not inspersed with granules or oil globules, K+ intensifying, N–, C–. *Hymenium* hyaline, 33–45(–50) µm thick, not inspersed, K+ pale violet (Sedifolia-grey, the colour slow to develop), N–, C–; subhymenium not apparent. *Epihymenium* olive-brown, 6–10 µm thick, or the pigment more diffuse but visible to mid-way into the hymenium, K+ violet-brown (Sedifolia-grey), N–, C–. *Paraphyses* uniform, conglutinate in water, loosening and separating abruptly in K, richly furcate-branched towards the apices, or laterally branched and with sparse to numerous anastomoses, long-celled, (0.8–)1–1.2 µm wide, not constricted at the septa; apices not pigmented, not swollen. *Asci* mostly narrowly to cylindroclavate, 27–35 × 9–12 µm [*n* = 15], 8-spored, *Byssoloma*-type, i.e. with an amyloid outer coat, the tholus well-developed, predominantly amyloid, with or usually without a minute, conical ocular chamber subtending a paler, apical cushion bounded by a more darkly amyloid tube structure. *Ascospores* colourless, 0–1-septate, narrowly ellipsoid to narrowly oblong or oblong-fusiform, usually straight, occasionally slightly bent or curved, irregularly massed or obliquely stacked in the asci, not or slightly constricted medially (when the spore is simple) or at the septum, (5.5–)7.5(–10) × (2–)2.6(–3.5) µm [*n* = 65], thin-walled, lacking a perispore at maturity (very thin and faint when immature); apices rounded to subacute; contents clear. *Pycnidia* not seen.
Chemistry: Containing methoxymicareic acid (major) by TLC (Elix 2014).

Etymology: The epithet *crassa* refers to the comparatively thick thallus of the new species.

Remarks
Micarea crassa is characterized by the combination of a greenish thallus of granules or goniocysts containing methoxymicareic acid, as well as very small, blackish apothecia, a hymenium that lacks granules but contains Sedifolia-grey pigment and very small 0–1-septate ascospores. This pigment is probably present in low concentrations, because while the hymenium and epihymenium turn violet on application of K, no such reaction was observed with C. The occurrence of thalline methoxymicareic acid rather than micareic or superlatolic (= prasinic) acids distinguishes *M. crassa* from *M. prasina* Fr. and its close allies, while diminutive, blackish apothecia separate it from the *M. byssacea* complex of species. Furthermore, very small apothecia with Sedifolia-grey, but which are blackish rather than creamy white or pale grey, separates the new Australian species from broadly similar taxa in the *M. micrococca* (Körb.) Gams ex Coppins complex (Czarnota & Guzow-Krzemińska 2010; Launis & Myllys 2014; Launis *et al.* 2019a, b). Among the latter, *M. czarnotae* Launis, v.d.Boom, Sérus. & Myllys, from northern Europe, has a similar thallus, similar-sized apothecia and equally minute ascospores. However, the apothecia are creamy white, pale brown or pale grey (Launis *et al.* 2019b). The bipolar to subtropical *M. byssacea* has a thallus that contains Sedifolia-grey (K+ violet), as well as larger, paler and mostly greyish apothecia, and somewhat larger ascospores, *viz.* (7–)8–14 × 2.5–4 (–5) µm (Kantvilas & Coppins 2019) or (6–)8–12(–13) × 2.7–3.5(–4.2) µm (Czarnota & Guzow-Krzemińska 2010).
Micarea crassa is known only from the type locality in the wet tropics of the Northern Territory.

5. Micarea deminuta Coppins, *Bibliotheca Lichenologica* **58**, 58 (1995)
Known principally as a lignicolous species in Europe, North America and Japan (Coppins 1995, 2009), *M. deminuta* also occurs on consolidated soil and rotting logs in Tasmania (Kantvilas & Coppins 2019).

SPECIMEN EXAMINED
New South Wales. ● Central Tablelands, Gillindich Nature Reserve, 10 km N of Binda, 34°12’59”S, 149°20’09”E, 830 m alt., on consolidated, siliceous soil in dry *Eucalyptus* woodland, *P.M. McCarthy 4911*, 30.ix.2019 (CANB).

6. Micarea queenslandica P.M.McCarthy & Elix, sp. nov. Figs 3 & 4
MycoBank No.: **MB834689**

Thallus corticolous, scurfy, granular-verruculose, pale grey to pale grey-brown, continuous to sparingly rimose, 70–120 µm thick, containing methoxymicareic acid. Apothecia adnate to subsessile, dark grey-brown, 0.24–0.60 mm diam.; proper excipulum annular, 30–50 µm thick laterally, 50–90 µm thick at the base, medium to dark brown; hypothecium brown-black (Laurocerasi-brown), 70–180 µm thick; hymenium not inspersed, 30–40 µm thick, K–; epihymenium hyaline, indistinct. Asci 28–37 × 8–14 µm; ascospores 3(–5)-septate, elongate, 9–17 × 2–3 µm. Microconidia bacilliform, 3–5 × 0.5–0.8 µm.

Type: Australia. Queensland, Kareeya Power Station, Tully River Falls, 49 km NW of Tully, 17°46’03”S, 147°34’48”E, 220 m alt., on vine in rainforest along river, *J.A. Elix 37456*, 28.vii.2006 (CANB).

Thallus crustose, epiphloeodal, effuse to determinate and forming well-delimited colonies to *c.* 5(–10) mm wide, scurfy, granular-verruculose, pale grey to pale grey-brown, dull, continuous to sparingly rimose, 70–100(–120) µm thick, non-amyloid (I–), not containing calcium oxalate (H_2SO_4–); thallus ecorticate, but the uppermost 6–10 µm a greyish, alga-free zone of non-descript anatomy; soredia and isidia absent. *Algae* dominating the thallus either as a continuous layer or clustered in compacted and ill-defined goniocysts 30–50 µm wide; cells micareoid, greyish green, ± globose to broadly ellipsoidal, thin-walled, 6–10 µm wide; interstitial hyphae 1.5–2.5 µm wide. *Medulla* poorly delimited; hyphae 2–3.5 µm wide, short-celled, thin-walled and richly branched. *Prothallus* not apparent or whitish and effuse. *Apothecia* numerous, adnate to subsessile, occasionally sessile, dark grey-brown, becoming blackish when wetted, rounded, ellipsoid, rounded-irregular (often due to mutual pressure among clustered apothecia) or faintly lobulate, solitary or proliferating in groups of up to 4(–6), and often appearing tuberculate, (0.24–)0.40(–0.60) mm diam. [*n* = 70]; compound, tuberculate ascomata only slightly larger; disc moderately to very strongly convex, dull, smooth, epruinose; proper margin scarcely apparent in surface view or very thin (when immature) and slightly darker than the disc. *Proper excipulum* (in section) annular, 30–50 µm thick laterally, 50–90 µm thick at the apothecial base, of outwardly radiating, simple to anastomosing hyphae that are 1.5–2.5 µm wide, medium to dark brown, K+ intensifying, N+ red-brown, C–; the lowermost 10–20 µm much paler. *Hypothecium* brown-black [Laurocerasi-brown of Meyer & Printzen (2000)], 70–120(–180) µm thick, paraplectenchymatous below, distally with short-celled, deeply pig-

mented, anticlinal hyphae 1.5–2.5(–3) µm wide, not inspersed with granules or oil globules, K+ intensifying, N+ deep red-brown, C–. *Hymenium* hyaline, 30–40 µm thick, not inspersed, K–, N–, C–; subhymenium not apparent. *Epihymenium* hyaline, indistinct and scarcely distinguishable from the hymenium, K–, N–, C–. *Paraphyses* uniform, conglutinate in water, loosening slightly to markedly in K, richly furcate-branched towards the apices, or laterally branched and with sparse anastomoses, long-celled, (0.8–)1–1.2(–1.5) µm wide, not constricted at the septa; apices not pigmented, not swollen. *Asci* mostly narrowly to broadly clavate, occasionally cylindroclavate, 28–37 × 8–14 µm [*n* = 35], 8-spored, *Byssoloma*-type, i.e. with an amyloid outer coat, the tholus well-developed, predominantly amyloid, with or usually without a minute, conical ocular chamber subtending a paler, apical cushion bounded by a more darkly amyloid tube structure. *Ascospores* colourless, 3(–5)-septate (fewer than 1 percent of spores are 4- or 5-septate), narrowly oblong, bacilliform or oblong-fusiform, rarely subfiliform, usually straight, occasionally slightly curved or sigmoid, irregularly massed, irregularly biseriate or obliquely stacked in the asci, not constricted at the septa, (9–)13(–17) × (2–)2.5(–3) µm [*n* = 100], thin-walled, lacking a perispore at maturity, although some immature spores (when simple or 1-septate) have a perispore *c.* 0.5 µm thick; apices rounded to subacute or the proximal apex more sharply pointed; contents clear. *Pycnidia* sparse, inconspicuous, semi-immersed to almost completely immersed in the thallus, globose, brown-black above, somewhat paler below, 80–100 µm diam.; conidiogenous layer simple; conidiophores 8–15 × 1 µm. *Microconidia* simple, bacilliform, straight, (3–)3.5–5 × 0.5–0.8 µm; mesoconidia and macroconidia not seen.
Chemistry: Containing methoxymicareic acid (major) by HPLC and TLC (Elix 2014).

Etymology: The species epithet refers to the type locality of the new species.

Remarks
Micarea queenslandica is characterized and distinguished from all other *Micarea* species by having a thallus that produces methoxymicareic acid combined with predominantly 3-septate ascospores. Thus, this particular diphenyl ether is typical of species in the *M. byssacea* or *M. micrococca* complexes of the *M. prasina* group, all of which have simple and/or 1-septate ascospores (Czarnota 2007; Guzow-Krzemińska *et al.* 2019; Kantvilas & Coppins 2019; Launis *et al.* 2019a, b). Comparison with other temperate Australian species having dark apothecia and 3-septate ascospores confirms the distinctiveness of the new species, with the yellowish *M. isabellina* Coppins & Kantvilas containing C+ orange xanthones, the saxicolous *M. argopsinosa* with argopsin, the terricolous *M. magellanica* (Müll.Arg.) Fryday having alectorialic acid and the Tasmanian *M. sandyana* Kantvilas lacking lichen substances (Coppins & Kantvilas 1990; McCarthy & Elix 2016a; Kantvilas & Coppins 2019).

The new species is known only from the type locality in north-eastern Queensland.

7. Micarea synotheoides (Nyl.) Coppins, *in* Topham & Walker, *Lichenologist* **14**, 67 (1982)
Lecidea synotheoides Nyl., *Lichenes Japoniae* 63 (1890)

Thallus crustose, effuse or forming a continuous colony to 15 mm in maximum extent, to 50–70(–100) µm thick, pale olivaceous to darker greenish grey, granular-scurfy to rimose, slightly gelatinous when wetted, ecorticate. *Algae* micareoid, 4–7(–9) µm wide; interstitial hyphae 2–2.5 µm wide. *Medulla* poorly defined. *Prothallus* absent. *Apothecia* dull to glossy black, adnate, rounded to irregular, slightly to moderately convex, smooth, immarginate from early in their development, solitary and (0.17–)0.26(–0.35) mm diam. [*n* = 50] or forming irregular, tuberculate clusters (0.30–)0.48(–0.67) mm wide. [*n* = 20]. *Proper excipulum* cupulate but rather indistinct in thin section, pale greenish brown, 15–25 µm thick. *Hypothecium* hyaline, 50–80(–120) µm thick, not inspersed with granules or oil globules, K–, C–. *Hymenium* dark greenish above, hyaline below, 45–55 µm thick, not inspersed, I+ dark blue, K+ pale violet, C+ pale violet (Sedifolia-grey); upper parts dark greenish, the pigmentation continuous with that of the epihymenium. *Epihymenium* dark olive-green to greenish black, 10–20 µm thick. *Paraphyses* loose or tightly conglutinate in water, very loose in K, 1–1.5(–2) µm thick, sparingly to richly furcate-branched above; apical cells not swollen, hyaline or pale greenish.

Asci broadly clavate, 35–45 × 9–13 µm, *Byssoloma*-type, 8-spored, the ascospores usually arranged side-by-side in a single fascicle. *Ascospores* colourless, (1–)3(–5)-septate at maturity, narrowly oblong to oblong-fusiform or bacilliform to ± filiform, usually slightly or strongly curved, occasionally straight or faintly sigmoid, (17–)23(–31) × (2–)2.5(–3) µm [*n* = 50]. *Pycnidia* sparse, inconspicuous, black, semi-immersed in the thallus, 70–100(–120) µm wide; wall dark greenish brown in thin section, K+ violet. *Macroconidia* simple, elongate-filiform, curved, arcuate, sigmoid or otherwise contorted, (20–)25–33(–38) × 0.7–1 µm; microconidia and mesoconidia not seen.
Chemistry: No substances detected by TLC. (Fig. 5).

This usually corticolous species is known from Europe, Macaronesia, the west coast of the U.S.A. and Japan (Coppins 1983, 2009; Czarnota 2007). Coppins (1983) reported microconidia of 3.8–4.8 × 0.8–l µm and mesoconidia measuring 4.5–6 × l.2–l.5 µm in European material of *M. synotheoides*; macroconidia have not been documented previously. The endemic *M. eucalypti* P.M.McCarthy & Elix also grows on the bark and wood of snow gum (*Eucalyptus pauciflora*), but in the Australian Capital Territory and at an altitude of *c.* 1800 m (McCarthy & Elix 2016b). It has a rather similar thallus and apothecial dimensions and anatomy to *M. synotheoides*, and the elongate ascospores are 3-septate, although broader and 2.5–4 µm wide. However, the apothecia of *M. eucalypti* lack the Sedifolia-grey pigment of *M. synotheoides* (they are K– and C–), and its macroconidia are (1–)3-septate and 12–22 × 0.5–1 µm.

SPECIMEN EXAMINED
New South Wales. ● Central Tablelands, Mount Canobolas State Conservation Area, summit plateau of Mt Canobolas, 13 km SW of Orange, 33°20’40”S, 148°58’56”E, *c.* 1350 m alt., on branch of solitary snow gum (*Eucalyptus pauciflora*), *P.M. McCarthy 4889*, 5.iv.2016 (CANB).

8. Micarea ternaria (Nyl.) Vězda, *Schedae Lichenes Selecti Exsiccati* 3 [858] (1970)
Lecidea sabuletorum f. *ternaria* Nyl., *Notiser ur Sällskapets pro Fauna et Flora Fennica Förhandlingar* **8**, 151 (1866)

Thallus superficial on peat and overgrowing bryophytes, forming extensive colonies, dull pale to medium grey, with patchy greenish or cream tints, 0.2–0.5(–0.8) mm thick; rimose to convex-areolate, the surface coarsely rugose to granular-verrucose; thallus ecorticate, but with an upper, hyaline, necral layer 10–30 µm thick. *Algal layer* 70–150 µm thick; cells micareoid, 4–7(–9) µm wide. *Medulla* thick, white, a loose network of anastomosing hyphae. *Prothallus* not apparent. *Apothecia* numerous, adnate to subsessile, dull to slightly glossy black, rounded, ellipsoid, rounded-irregular or faintly lobate, solitary or proliferating in tuberculate clusters of up to 10; individual apothecia 0.3–0.8(–1.1) mm diam.; clusters 1.2–2.5 mm wide; disc moderately or very strongly convex to subglobose; margin usually excluded at maturity. *Proper excipulum* (in section) persistent, annular, pale to dark blue-green, 30–50 µm thick, of outwardly radiating, simple to anastomosing hyphae, K+ intensifying, N+ pale purple, C becoming decolourized. *Hypothecium* 150–250 µm thick, upper half deep red-brown, slightly or markedly paler (to almost hyaline) below, not inspersed, K–, N+ orange-brown, C–. *Hymenium* hyaline or with traces of dark epihymenial pigment, 50–70 µm thick, not inspersed, K–, N–, C–. *Epihymenium* deep blue-green to almost black, 10–15 µm thick, K+ intensifying, N+ purple, C+ pale brown, then decolourized. *Paraphyses* mainly simple below to richly branched near the apices, with few anastomoses, 1–1.5(–2) µm wide; apices not pigmented, slightly to more distinctly swollen and up to 2.5 µm wide. *Asci* mostly narrowly to broadly clavate, 8-spored, *Byssoloma*-type. *Ascospores* colourless, 1–3-septate, oblong-fusiform to fusiform, straight, slightly curved or, occasionally, sigmoid, 14–22 × 4–6 µm. *Pycnidia* not seen. According to Coppins (1983), these are sessile, black, 100–140(–200) µm diam.; walls dark olive-green above and at the sides, becoming hyaline towards the base; conidia (mesoconidia) cylindrical or oblong-ellipsoid, sometimes faintly biguttulate and slightly constricted in the middle, 4.6–6.3 × 1.2–1.7 µm.
Chemistry: No substances detected by TLC. (Fig. 6)

Micarea ternaria occurs on peat, plant debris and bryophytes in North America, Iceland and northern Europe (Coppins 1983, 2009; Thompson 1997). Along with other Australian species in the *M. lignaria-M. ternaria* group, it has solitary or clustered, black, convex apothecia with a K– and C– hymenium and mostly 3-septate ascospores. However, it can be distinguished from *M. argopsinosa*, *M. isabellina* and *M. magellanica* by the absence of lichen substances, and from *M. sandyana* which has ascospores 7–13.5 × 3.5–6 µm (Coppins & Kantvilas 1990; Fryday 2004; McCarthy & Elix 2016a; Kantvilas & Coppins 2019).

SPECIMEN EXAMINED
New South Wales. ● Mount Kosciuszko Natl Park, 7.5 km NE of Mt Kosciuszko, Blue Lake, 36°24'S, 148°19'E, 2020 m alt., on dry ground in small rock cave, *H. Streimann 47110*, 3.ii.1991 [B (*n.v.*), CANB].

Acknowledgements
We thank Dr Christine Cargill and Ms Judith Curnow (CANB) for their kind assistance.

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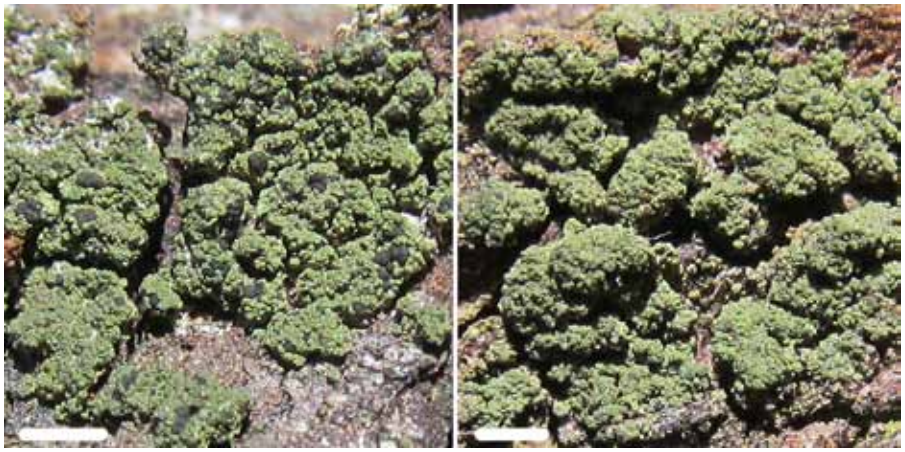

Figure 1. *Micarea crassa* (holotype). Scales: 1 mm.

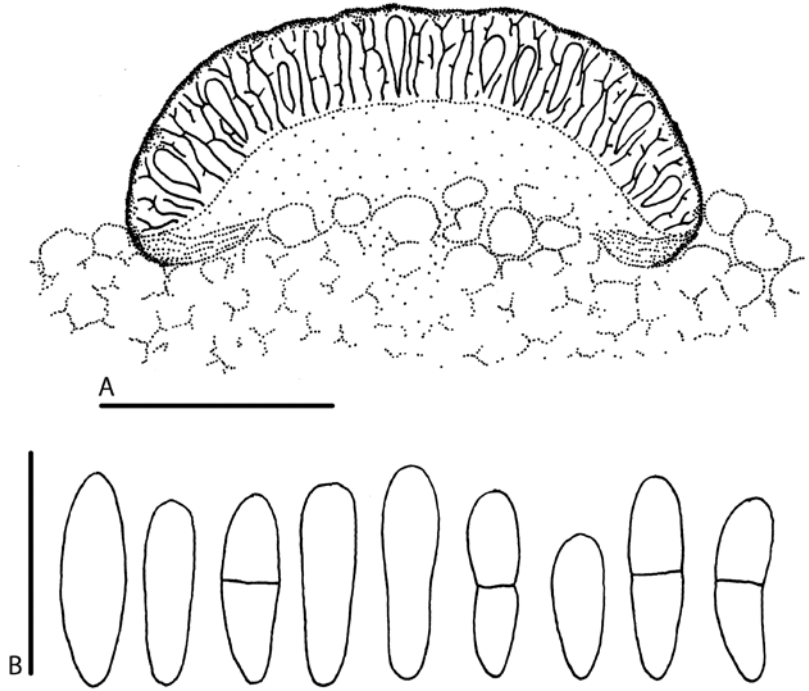

Figure 2. *Micarea crassa* (holotype). A, Vertical section of an apothecium (semi-schematic); B, Ascospores. Scales: A = 0.1 mm; B = 10 µm.

Figure 3. *Micarea queenslandica* (holotype). Scale: 1 mm.

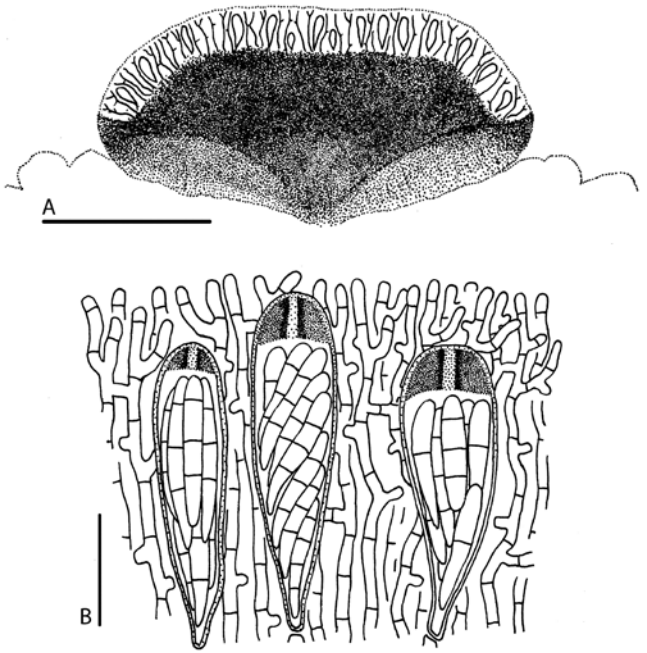

Figure 4. *Micarea queenslandica* (holotype). A, Vertical section of an apothecium (semi-schematic); B, Hymenium. Scales: A = 0.2 mm; B = 10 µm.

Figure 5. *Micarea synotheoides* (*McCarthy 4889*, CANB). Scale: 1 mm.

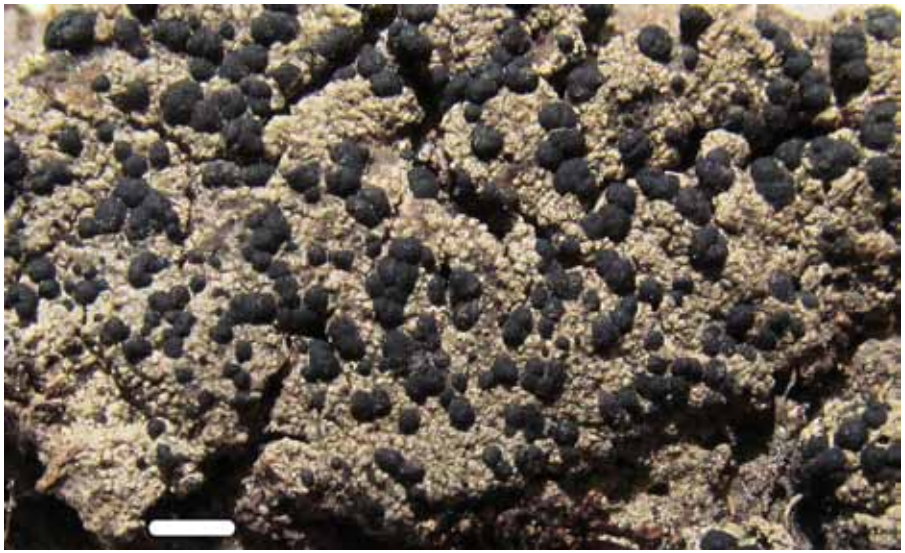

Figure 6. *Micarea ternaria* (*Streimann 47110*, CANB). Scale: 2 mm.

Three new corticolous species and two new records of *Rinodina* (Physciaceae, Ascomycota) from subtropical and tropical Australia

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Abstract

The corticolous *Rinodina gerhardii* H.Mayrhofer & Elix and *R. heronensis* H.Mayrhofer & Elix from Queensland and *R. klauskalbii* H.Mayrhofer & Elix from New South Wales are described as new to science. In addition, *Rinodina galapagoensis* Giralt & Bungartz and *R. maculans* (Kremp.) Müll.Arg. are reported for the first time from Australia. A revised key to the corticolous species of *Rinodina* in Australia is provided.

Introduction

The corticolous and lignicolous species of *Rinodina* (Ach.) S.F.Gray in temperate Australia were revised by Mayrhofer *et al.* (1999), who recorded nine taxa, and a tenth has been recorded subsequently (Elix 2008). Those include five endemic taxa, *R. asperata* (Shirley) Kantvilas, *R. austroleprosa* Elix, *R. confusa* H.Mayrhofer & Kantvilas, *R. elixii* H.Mayrhofer & Kantvilas and *R. obscura* Müll.Arg., as well as the widespread *R. conradii* Körb. and *R. pyrina* (Ach.) Arnold. Further species include the pantropical *R. connectens* Malme and *R. dolichospora* Malme, the southern-temperate *R. australiensis* Müll.Arg., now known from Australia, southern Africa (Mayrhofer & Wirth 2011; Mayrhofer *et al.* 2014) and New Zealand (Elix *et al.* 2020). In this paper, we describe three new corticolous species of *Rinodina* from tropical and subtropical Australia, and we report the occurrence of *R. galapagoensis* Giralt & Bungartz and *R. maculans* (Kremp.) Müll.Arg. from Queensland.

Methods

Observations and measurements of photobiont cells, thallus and apothecium anatomy, asci and ascospores 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 pretreatment in K. Medullary sections were treated with 10% sulfuric acid (H_2SO_4) and apothecial sections with 50% nitric acid (N).

New species

1. Rinodina gerhardii H.Mayrhofer & Elix, sp. nov. Figs 1, 2
MycoBank number: **MB834816**

Similar to *Rinodina asperata*, but differs in having biatorine to lecideine apothecia and smaller ascospores.

Type: Australia, Queensland, Cape Hillsborough National Park, Hidden Valley, 30 km N of Mackay, 20°55'S, 149°03'E, 10 m alt., on trees and shrubs at the edge of rainforest, *G. Rambold 4682 pr. p.*, 21.ii.1986 (M – holotype).

Thallus to 15 mm wide, crustose, continuous, rimose, to 0.1 mm thick; upper surface matt, smooth, grey-brown; prothallus marginal, dark grey or black; medulla white, lacking calcium oxalate (H_2SO_4–), I–; photobiont cells 8–12 µm diam. *Apothecia* 0.1–0.4 mm wide, scattered or crowded, biatorine to lecideine, erumpent, then broadly adnate or sessile; disc dark brown to black, epruinose, weakly concave to plane or convex; thalline exciple apparent in only

juvenile apothecia, soon excluded in mature and older apothecia, concolorous with the thallus; proper excipulum black, persistent, in section 30–55 µm thick, outer zone deep red-brown, K–, N–, inner zone pale brown. *Epihymenium* 10–15 µm thick, red-brown, K–, N–. *Hypothecium* 30–40 µm thick, colourless to pale yellow, K–, N–. *Hymenium* 90–120 µm thick, colourless, not inspersed; paraphyses 1.5–2.5 µm wide, simple to branched, capitate, with apices 3.5–5 µm wide and brown caps. *Asci* of the *Lecanora*-type, 8-spored. *Ascospores* with internal wall thickenings of *Pachysporaria*-type II, 1-septate, brown, broadly ellipsoid, 11–[*13.1*]–16 × 6–[*7.2*]–8 µm, not constricted at the septum; ontogeny of type-A; torus broad, distinct; outer spore-wall smooth to finely ornamented. *Pycnidia* immersed, dark brown; conidia bacilliform, 3.5–5.5 × 1 µm.
Chemistry: Thallus K–, C–, P–, UV–; no lichen substances detected by TLC.

Etymology: The species is named after Prof. Dr Gerhard Rambold, the collector of the type.

Remarks
The new species is characterized by the thin, grey-brown, rimose thallus, the lecideine apothecia, the relatively small, persistently *Pachysporaria*-type II ascospores, 11–16 × 6–8 µm, and by the absence of lichen substances. The common Australian species *R. asperata* has persistently *Pachysporaria*-type II ascospores, but its spores are larger, 15–25 × 7–12 µm. *Rinodina asperata* also differs in having persistently lecanorine apothecia with a prominent thalline margin (Mayrhofer *et al.* 1999).

Rinodina ficta (Stizenb.) Zahlbr. also has small *Pachysporaria*-type II ascospores, but they differ in having type-B ontogeny. In addition, *R. ficta* has lecanorine apothecia with a persistent thalline margin, a thin, colourless proper excipulum, 5–20 µm wide, and a thinner hymenium to 80 µm high (Giralt & Mayrhofer 1991; Giralt 2001, as *R. boleana*).

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

1. Rinodina heronensis H.Mayrhofer & Elix, sp. nov. Figs 3, 4
MycoBank number: **MB834817**

Similar to *Rinodina confusa* H.Mayrhofer & Kantvilas, but differs in having smaller, *Physcia*- to *Mischoblastia*-type ascospores.

Type: Australia, Queensland, Heron Island [23°26'32"S, 151°54'53"E], on branch of *Pisonia grandis*, *G. Hand*, v.1965 (COLO 235573 – holotype; MEL – isotype, not seen).

Thallus to 30 mm wide, crustose, rimose to verrucose-areolate or areolate; individual areoles 0.1–0.5 mm wide, to 0.2 mm thick; upper surface matt, uneven, esorediate, pale grey-brown; prothallus not apparent; medulla white, lacking calcium oxalate (H_2SO_4–), I–; photobiont cells 8–20 µm diam. *Apothecia* 0.1–0.4 mm wide, scattered or crowded, lecanorine, broadly adnate to sessile and basally constricted; disc pale brown to dark brown, epruinose, plane to convex; thalline exciple thick and raised above the disc at first, ± dentate, becoming thinner and reduced in older apothecia, concolorous with the thallus; proper excipulum brown to pale brown, persistent, thick, in section 20–30 µm thick, outer zone brown, K–, N–, inner zone colourless. *Epihymenium* 8–12 µm thick, brown, K–, N–. *Hypothecium* 25–35 µm thick, colourless, K–, N–. *Hymenium* 40–60 µm thick, colourless, not inspersed; paraphyses 1.5–2 µm wide, simple to branched, capitate, with apices 3–4 µm wide and pale brown caps. *Asci* of the *Lecanora*-type, 8-spored. *Ascospores* with internal wall thickenings transitioning from *Mischoblastia*- to *Physcia*-types at different stages of development (*Teichophila*-type), 1-septate, brown, broadly ellipsoid, 11–[*13.3*]–17 × 5–[*6.0*]–7 µm, not constricted at the septum; ontogeny of type-A; torus indistinct; outer spore-wall finely ornamented. *Pycnidia* not seen.
Chemistry: Thallus K–, C–, P–, UV–; no lichen substances detected by TLC.

Etymology: The species is named after the type locality.

Remarks
In many respects, the new species closely resembles *R. confusa*, which is widespread in temperate southern Australia (Mayrhofer *et al.* 1999). Both have broadly adnate to sessile, lecanorine apothecia and *Teichophila*-type ascospores where the spore lumina transition from *Physcia*-, *Mischoblastia*-, *Milvina*- or *Pachysporaria*-types at different stages of development. However, the spore lumina of *R. confusa* and *R. heronensis* differ significantly, those of *R. heronensis* transitioning from *Mischoblastia*- to mainly *Physcia*-type, whereas those of *R. confusa* transition from *Physcia*-, rarely *Mischoblastia*- to mainly *Pachysporaria*-types. In addition, the ascospores of *R. confusa* are consistently larger, 14–[*17.5*]–23 × 6–[*8.7*]–13 µm.

The new species is known only from Heron Island, a coral cay located near the Tropic of Capricorn in the southern Great Barrier Reef, 80 km NE of Gladstone, Queensland. Associated lichens include a species of *Bacidia* and *Caloplaca subpyracea* (Nyl.) Zahlbr.

3. Rinodina klauskalbii H.Mayrhofer & Elix, sp. nov. Figs 5, 6
MycoBank number: **MB834818**

Similar to *Rinodina asperata*, but differs in having a squamulose to subsquamulose thallus and somewhat smaller ascospores that develop with type-B ontogeny.

Type: Australia, New South Wales, Patonga, E side of Patonga Creek, 33°33'S, 151°16'E, 1–2 m alt., on *Avicennia marina* in strand and mangrove vegetation, *K. Kalb 26206, A.Kalb, A. & P. Archer*, 10.viii.1992 (GZU – holotype).

Thallus to 15 mm wide, squamulose to subsquamulose, continuous, rimose, to 0.1 mm thick; upper surface matt, smooth, grey-brown; prothallus marginal, dark grey or black; medulla white, lacking calcium oxalate (H_2SO_4–), I–; photobiont cells 8–12 µm diam. *Apothecia* 0.1–0.4 mm wide, scattered or crowded, lecanorine, erumpent then broadly adnate or sessile; disc dark brown to black, epruinose, weakly concave to plane or convex; thalline exciple thick, well-developed, ± subsquamulose, concolorous with the thallus; proper excipulum black, persistent, in section 30–55 µm thick, outer zone deep red-brown, K–, N–, inner zone pale brown. *Epihymenium* 10–15 µm thick, red-brown, K–, N–. *Hypothecium* 30–40 µm thick, colourless to pale yellow, K–, N–. *Hymenium* 90–120 µm thick, colourless, not inspersed; paraphyses 1.5–2.5 µm wide, simple to branched, capitate, with apices 3.5–5 µm wide and brown caps. *Asci* of the *Lecanora*-type, 8-spored. *Ascospores* with internal wall thickenings of *Pachysporaria*-type II, 1-septate, brown, broadly ellipsoid, 11–[*13.1*]–16 × 6–[*7.2*]–8 µm, not constricted at the septum; ontogeny mainly of type-B; torus broad, distinct; outer spore-wall smooth to finely ornamented. *Pycnidia* immersed, dark brown; conidia bacilliform, 3.5–5.5 × 1 µm.
Chemistry: Thallus K–, C–, P–, UV–; no lichen substances detected by TLC.

Etymology: The species is named after the collector of the type specimen, Dr Klaus Kalb.

Remarks
The new species is characterized by its squamulose to subsquamulose, grey-brown, rimose thallus, lecanorine apothecia, persistently *Pachysporaria*-type II ascospores, 11–16 × 6–8 µm, which develop with type-B ontogeny, and the absence of lichen substances. The common Australian species *R. asperata* has persistently *Pachysporaria*-type II ascospores, but its spores are larger, 15–22 × 7–12 µm, and they develop with type-A ontogeny (Mayrhofer *et al.* 1999). *Rinodina klauskalbii* and *R. ficta* have similar-sized, *Pachysporaria*-type II ascospores with type-B ontogeny, but *R. ficta* has a discontinuous, crustose, very thin to effuse granulose thallus with a narrower, colourless proper excipulum, 5–20 µm wide, and a thinner hymenium to 80 µm high (Giralt & Mayrhofer 1991, as *R. boleana*).

At present the new species is known from two localities in eastern New South Wales. Associated species occurring on mangroves at the type locality include *Caloplaca pulcherrima*

(Müll.Arg.) S.Y.Kondr. & Kärnefelt, *Chrysothrix xanthina* (Vain.) Kalb, *Dirinaria applanata* (Fée) D.D.Awasthi, *Lecanographa microcarpella* (Müll.Arg.) Egea & Torrente, *Pannaria elixii* P.M.Jørg. & D.J.Galloway, *Austroparmelina conlabrosa* (Hale) A.Crespo, Divakar & Elix, *Parmotrema crinitum* (Ach.) M.Choisy, *P. reticulatum* (Taylor) M.Choisy, *P. tinctorum* (Nyl.) Hale and *Relicina sydneyensis* (Gyeln.) Hale.

ADDITIONAL SPECIMEN EXAMINED
New South Wales. ● Southern Tablelands, Jembaicumbene Creek, Araluen–Braidwood road, 35°32'S, 149°47'E, on twigs, *W.H. Ewers 4061*, 3.ix.1989 (CANB).

New records

Rinodina galapagoensis Giralt & Bungartz, *Bryologist* **119**, 67 (2016)
Type: Ecuador, Galapagos Islands, Santa Fé Island, near the beach and the ravine on the north coast of the island, 0°48'12.8"S, 90°02'35.2"W, 26 m alt., on bark of *Bursera graveolens* in dry area of open forest with shrubs and *Bursera graveolens* and *Opuntia echios* var. *barringtonensis* the dominant trees, *F. Nugra 486*, 25.x.2007. (holotype – CDS).

This species was previously known only from the Galapagos Islands (Bungartz *et al.* 2016). It is characterized by its brownish beige to olivaceous brown, rimose to areolate, distinctly squamulose thallus when well developed, usually containing the yellow pigment skyrin (often patchy, but present in the lower medulla or below the apothecia in the Australian specimen), and narrowly ellipsoid, *Pachysporaria*-type II ascospores, 14–[*18.2*]–22 × 7–[*8.6*]–11 µm, with elongated, lacrimiform lumina when young, wrinkled walls when old and mainly type-B ontogeny. A detailed description and illustrations are provided in Bungartz *et al.* (2016).

AUSTRALIAN SPECIMEN EXAMINED
Queensland. ● Approach to the Bunya Mountains, *c.* 12 km NNE of Mt Mowbullan, 26°50'S, 151°38'E, 680 m alt., on bark, *K. Kalb 18977 pr. p. & R. Rogers*, 14.viii.1988 (herb. Kalb).

Rinodina maculans (Kremp.) Müll.Arg., *Flora* **72**, 66 (1889)
Type: Argentina, *Lorentz s.n.,* 1892 (holotype – G, not seen).

This corticolous species is widely distributed in eastern North America, Central and South America (Sheard 2010). It is characterized by a thin, pale grey to dark greenish grey, rimose to rimose-areolate, crustose thallus and narrowly ellipsoid *Pachyspora*-type II ascospores, 12–[*17.5*]–23 × 6–[*8.1*]–10 µm, which show type-B ontogeny. A detailed description and illustrations are provided by Sheard (2010).

SPECIMENS EXAMINED
Queensland. ● Cairns, 5 km N of city near the airport, 16°54'S, 145°45'E, 0 m alt., on *Rhizophora* in mangrove forest, *A. & M. Aptroot 22184*, iii.1988 (herb. Aptroot); ● Green Island, E of Cairns, 16°46'S, 145°58'E, on coastal trees, *H. Mayrhofer 11414 & E. Hierzer*, 5.viii.1993 (GZU); ● Cape Hillsborough National Park, Hidden Valley, 30 km N of Mackay, 20°55'S, 149°03'E, 10 m alt., on trees and shrubs at the edge of rainforest, *G. Rambold 4682 pr. p.*, 21.ii.1986 (M).
Jamaica. ● Saint Elizabeth, between Crawford and Sandy Ground, 4 km NW of Black River, 18°03'N, 77°52'W, on roadside tree, *K. & A. Kalb 36400*, 15.iv.1992 (CANB - W. Obermayer, *Dupla Graecensis Lichenum* no. 554 [2007]).
U.S.A. ● New Jersey, Peaslee Wildlife Management Area,1.5 miles N of jct NJ 49 and CR 671 (Union Rd), W of CR 671 (Union Rd), S of powerline cut, 5 miles E of Millville, Vineland Township, 39°23'30"N, 74°56'30"W, on *Quercus* branches in open *Quercus-Pinus rigida* barrens with sandy openings, *J.C. Lendemer 15124*, 2.ii.2009 (CANB - *Lichens of Eastern North America Exsiccati*, Fasc. VII, no. 346 [2009]).

Key to the corticolous and lignicolous species of *Rinodina* in Australia [for illustrations of spore types and ontogeny, see Mayrhofer *et al.* 1999 and Sheard 2010].

1 Ascospores 4-celled 2
1: Ascospores 2-celled 3

2 Ascospores with type-B ontogeny; immature 2-celled ascospores with subcircular lumina [*Physcia*-type] ..... **R. conradii**
2: Ascospores with type-A ontogeny; immature 2-celled ascospores with bone-shaped lumina ..... **R. connectens**

3 Most ascospores longer than 22 µm 4
3: Most ascospores shorter than 22 µm 6

4 Ascospores *Pachysporaria*-type I; usually with minute granular or droplet-like inclusions ..... **R. dolichospora**
4: Ascospores *Physcia*-type or *Mischoblastia*-, then *Pachysporaria*-type I; lacking minute granular or droplet-like inclusions 5

5 Ascospores *Physcia*-type; apothecia emerging from thalline warts ..... **R. elixii**
5: Ascospores *Mischoblastia*- then *Pachysporaria*-type I; apothecia adnate to sessile from earliest stages ..... **R. australiensis**

6 Ascospores *Physconia*-type; lacking apical thickenings when mature ..... **R. pyrina**
6: Ascospores *Physcia-, Dirinaria- Mischoblastia*- or *Pachysporaria*-type II; with apical thickenings when mature 7

7 Apothecia initially immersed, lecideine when mature 8
7: Apothecia adnate to sessile from the beginning, distinctly lecanorine 9

8 Ascospores *Pachysporaria*-type II, 11–16 µm long ..... **R. gerhardii**
8: Ascospores *Physcia*-type, 16–20 µm long ..... **R. obscura**

9 Ascospores persistently *Pachysporaria*-type II 10
9: Ascospores otherwise 13

10 Hypothecium and subhypothecium yellow-orange, K+ blood-red ... **R. galapagoensis**
10: Hypothecium and subhypothecium colourless, K– 11

11 Thallus thick, squamulose to subsquamulose; ascospores dark brown; torus broad, distinct ..... **R. klauskalbii**
11: Thallus thin, crustose; ascospores pale brown; torus narrow, indistinct 12

12 Ascospore lumina rounded; ontogeny type-A; temperate ..... **R. asperata**
12: Ascospore lumina elongate; ontogeny type-B; tropical ..... **R. maculans**

13 Thallus sorediate; atranorin and zeorin present; ascospores persistently *Physcia*-type ..... **R. austroleprosa**
13: Thallus esorediate; atranorin and zeorin absent; ascospores transitioning through *Mischoblastia*-, *Pachysporaria*-type II or *Physcia*-types 14

14 Ascospores *Mischoblastia*- to mainly *Physcia*-type, 11–17 × 5–7 µm; tropical .... **R. heronensis**
14: Ascospores *Physcia*-, *Mischoblastia*- then mainly *Pachysporaria*-type, 16–23 × 8–11 µm; temperate ..... **R. confusa**

Acknowledgements
H.M. acknowledges financial support from the Austrian Science Fund (FWF-projects P8500-BIO, P10514-BIO and P25237-B16). He is indebted to his wife Eleonore for her support during the field trip in 1993. We also thank Prof. Dr Gerhard Rambold, Dr Klaus Kalb and the curators of CANB and COLO for providing key specimens.

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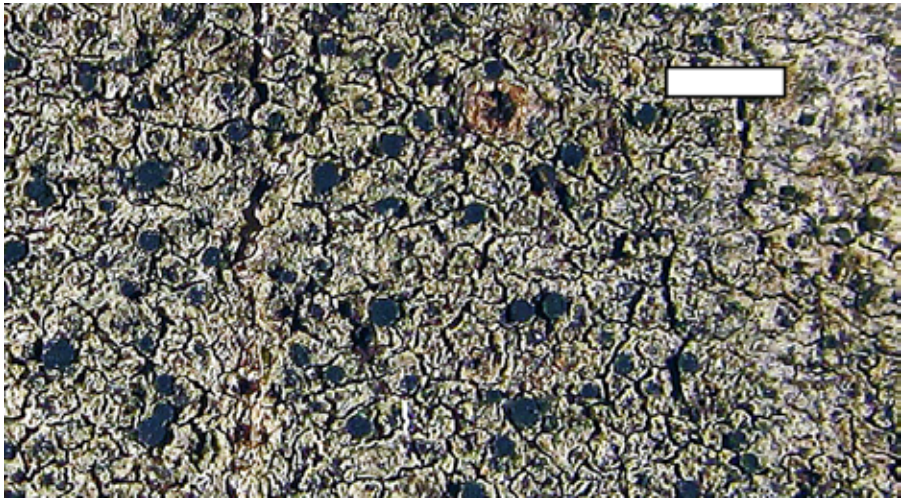

Figure 1. *Rinodina gerhardii* (holotype in M). Scale = 1 mm.

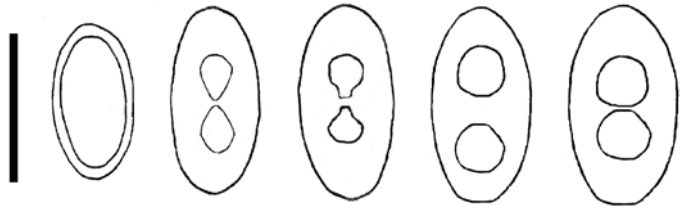

Figure 2. Ascospore ontogeny of *R. gerhardii*. Scale = 10 µm.

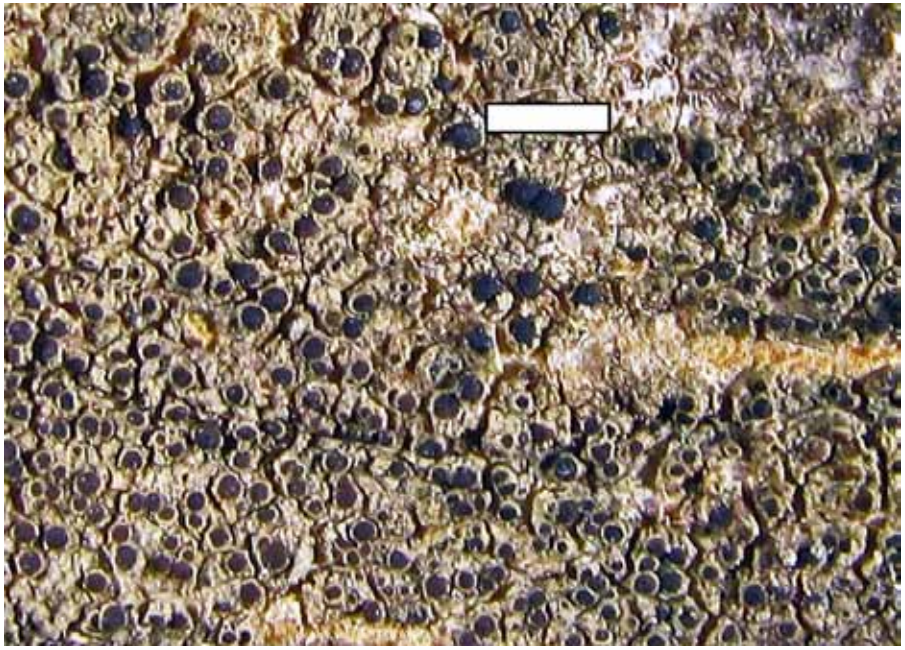

Figure 3. *Rinodina heronensis* (holotype in COLO). Scale = 2 mm.

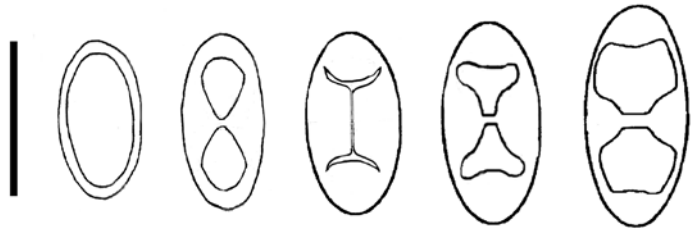

Figure 4. Ascospore ontogeny of *R. heronensis*. Scale = 10 µm.

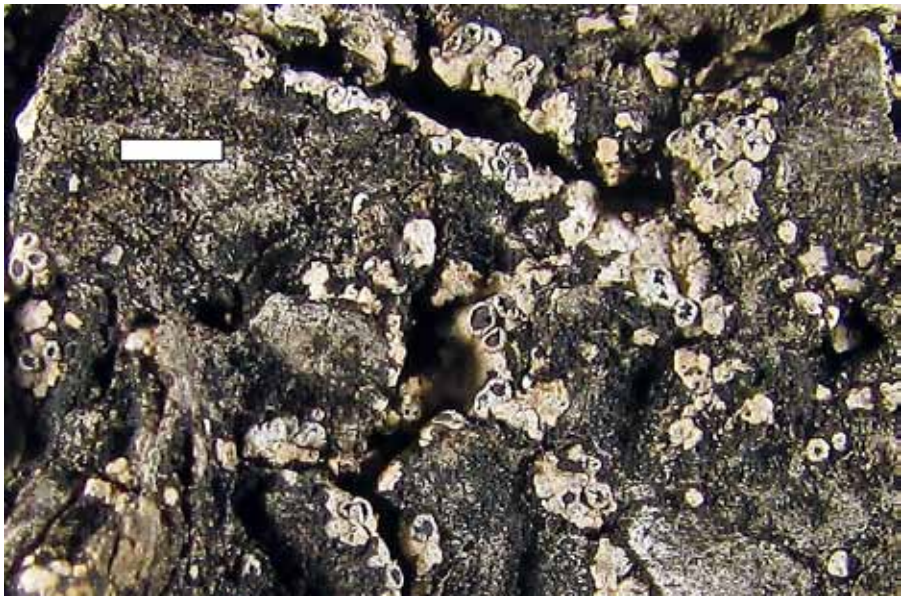

Figure 5. *Rinodina klauskalbii* (holotype in herb. KALB). Scale = 2 mm.

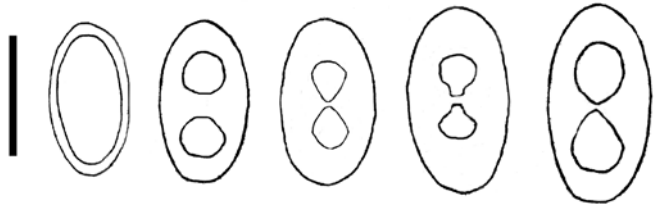

Figure 6. Ascospore ontogeny of *R. klauskalbii*. Scale = 10 µm.

A new isidiate species and a new record of *Rinodina* (Physciaceae, Ascomycota) from Tasmania

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Abstract

Rinodina austroisidiata Elix & Kantvilas is described as new to science, and *Rinodina cana* (Arnold) Arnold is reported for the first time from Tasmania and New South Wales.

This paper continues our investigation of the genus *Rinodina* and its relatives in Australia. For the most recent additions see Elix *et al.* (2019) and Grube *et al.* (2019) and references cited therein. Methods are as described in the papers cited above.

New species

Rinodina austroisidiata Elix & Kantvilas, sp. nov. Figs 1, 2
MycoBank No. **MB835679**

Similar to *Rinodina blastidiata* Matzer & H.Mayrhofer, but differing in having a densely isidiate upper surface and somewhat larger ascospores, 24–37 × 11–18 µm.

Type: Australia, Tasmania, *c*. 0.5 km S of Snug Point, 43°05′S, 147°18′E, *c*. 10 m alt., on exposed coastal sandstone outcrops and cliffs, *G. Kantvilas 555/01*, 15.viii.2001 (holotype – HO; isotype – CANB).

Thallus up to 60 mm wide and 2 mm thick, crustose to pulvinate, densely isidiate; isidia cylindrical, becoming densely coralloid-branched, 0.05–0.2 mm wide, to 2 mm high, corticate; upper surface matt, dark chocolate-brown; prothallus not apparent; medulla white, lacking calcium oxalate (H_2SO_4–), I–; photobiont cells 7–16 µm diam. *Apothecia* 0.5–1.5 mm wide, common, lecanorine, broadly adnate to sessile and basally constricted; disc dark brown to black, epruinose, plane to undulate or weakly convex; thalline exciple 0.1–0.15 mm thick, raised above the disc, densely white-pruinose; proper excipulum dark brown to black, in section 25–50 µm thick, outer zone dark brown, K–, N+ red-brown, inner zone paler brown. *Epihymenium* 10–15 µm thick, pale brown to brown, K–, N–. *Hypothecium* 75–100 µm thick, colourless to pale yellow, K–, N–. *Hymenium* 75–110 µm thick, colourless, not or sparingly inspersed with oil droplets; paraphyses 1.5–3.5 µm wide, simple to branched, capitate, with scattered oil vacuoles 4–7 µm wide; apices brown, 4–5 µm wide; asci of the *Lecanora*-type, with 8 or fewer spores. *Ascospores* of the *Teichophila*-type (with internal wall thickenings transitioning from *Pachysporaria*- to *Milvina*- or *Physcia*-types at different stages of development), 1-septate, brown, broadly ellipsoid, 24–[*29.2*]–37 × 11–[*13.5*]–18 µm, not constricted at the septum; ontogeny of type-A; outer spore-wall finely ornamented. *Pycnidia* pyriform, immersed, brown to brown-black. *Conidia* bacilliform, 5–8 × 1 µm.
Chemistry: Thallus K–, C–, P–, UV–; no lichen substances detected by TLC.

Etymology: The species is named for its isidiate upper surface and austral distribution.

Remarks

In some respects this new species closely resembles the well-known *R. blastidiata.* Both have adnate to sessile, lecanorine apothecia, similar apothecial anatomy, *Teichophila*-type ascospores, where the spores transition from mainly *Pachysporaria*-type to *Milvina*- or *Physcia*-types at different stages of development, and lack lichen substances. However, the two species differ markedly in the morphology of their upper surface. Whereas *R. blastidiata* has a blastidiate upper surface, *R. austroisidiata* is densely isidiate, with the cylindrical or coralloid isidia remaining corticate and not becoming sorediate or blastidiate. Futhermore, *R. blastidiata* has somewhat smaller ascospores, 16–32 × 9–15 µm, and shorter conidia, 3–4 µm long. The Arctic *R. balanina* (Wahlenb.) Vain. is also similar, but is isidiate only in the central parts of the thallus, and it differs further in having an effigurate thallus with radiating lobes and smaller ascospores, 14–18 × 7–9 µm (Mayrhofer & Moberg 2002; Sheard *et al*. 2017).

The new species was collected from exposed bluffs of coastal Triassic sandstone. This habitat is not uncommon in south-eastern Tasmania, and because it is known to support several unusual lichen species, has been frequently investigated. However, at present *R. austroisidiata* is known only from the type collection, where it grows in a rich lichen association dominated by macrolichens, including *Xanthoparmelia amplexula* (Stirt.) Elix & J.Johnst., *X. australasica* D.J.Galloway, *X. mougeotina* (Nyl.) D.J.Galloway, *X. scabrosa* (Taylor) Hale and *Punctelia borreri* (Sm.) Krog. The occurrence of species such as *Coccocarpia palmicola* (Spreng.) Arv. & D.J.Galloway, *Pannaria elixii* P.M.Jørg. & D.J.Galloway and *Trapelia glebulosa* (Sm.) J.R.Laundon on adjacent rocks suggests a moister, cooler, more sheltered situation. In contrast, *R. blastidiata* is most commonly seen in Tasmania on coastal granite, associated with *Tylothallia verrucosa* (Müll.Arg.) Kantvilas, *Catillaria austrolittoralis* Kantvilas & v.d.Boom and species of *Caloplaca*.

New record

Rinodina cana (Arnold) Arnold, *Verh. Zool.-Bot. Ges. Wien* **30**, 125 (1880)
This species was known previously from Europe and North America (Sheard 2010), and in Australia from Queensland and Victoria (McCarthy *et al.* 2017). It is characterized by its continuous, cracked to areolate, pale grey to yellow-grey, crustose thallus that lacks secondary lichen substances and is often delimited by a dark prothallus, its small cryptolecanorine or lecideine apothecia with *Mischoblastia*- or *Milvinia*-type ascospores, 16–23 × 8.5–13 µm, which sometimes become rounded (*Pachysporaria*-type) when mature. It is distinguished from the very common *R. oxydata* (A.Massal.) A.Massal. by the absence of atranorin and by smaller ascospores. A detailed description is given in Sheard (2010) and an illustration in McCarthy *et al*. (2017). It is here reported from Tasmania and New South Wales for the first time.

SPECIMENS EXAMINED
New South Wales. ● South Coast, Boat Harbour, Gerringong, 34°44’59”S, 150°49’55”E, 1–3 m alt., on sandstone rocks along the foreshore, *J.A. Elix 46429,* 24.v.2017 (CANB).
Tasmania. ● Slopes of Mt Murray, 42°28’S, 147°58’E, 200 m alt., on dolerite stones in rough pasture, *G. Kantvilas 273/06 pr.p.,* 5.vii.2006 (HO).

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McCarthy, PM; Elix, JA; Kantvilas, G; Archer, AW (2017): Additional lichen records from Australia 83. *Australasian Lichenology* **80**, 62–77.
Sheard, JW (2010): *The Lichen Genus* Rinodina (*Ach.*) *Gray* (*Lecanoromycetidae, Physciaceae*) *in North America, North of Mexico*. NRC Research Press, Ottawa.
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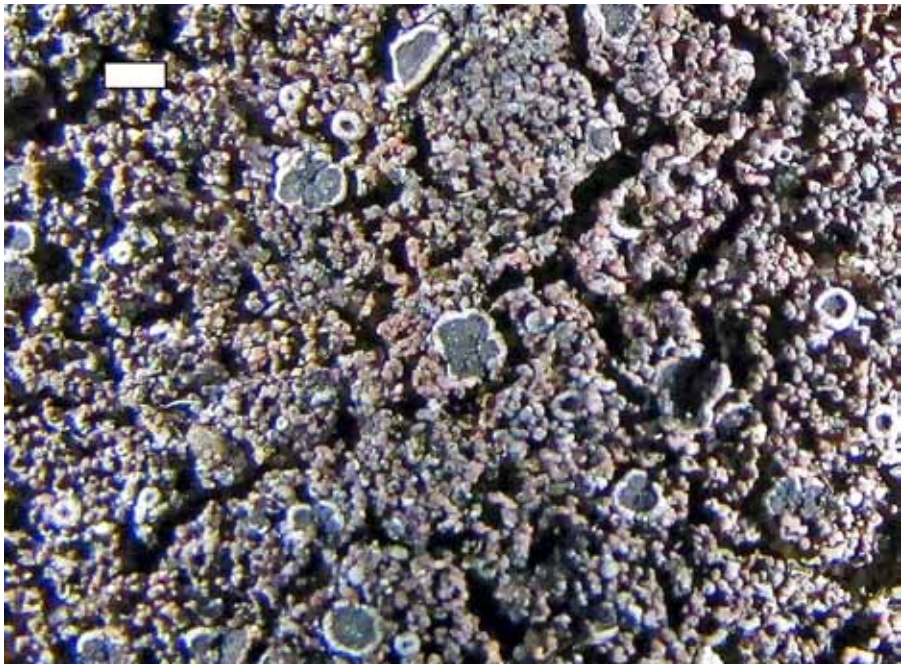

Figure 1. *Rinodina austroisidiata* (holotype in HO). Scale = 1 mm.

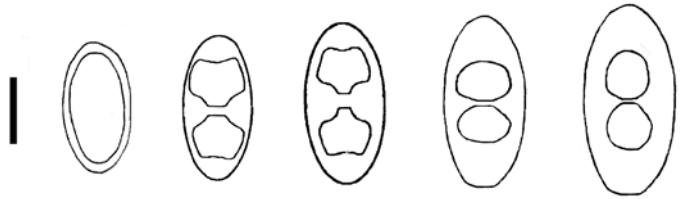

Figure 2. Ascospore ontogeny of *Rinodina austroisidiata*. Scale = 10 µm.

Observations on the vertical distribution of lichens on a *Eucalyptus radiata* subsp. *radiata* tree in burnt lowland forest, Victoria, including a new State record

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Abstract

A large, recently fallen branch presented an opportunity to record the previously undocumented vertical lichen distribution and canopy species on *Eucalyptus radiata* Sieber ex DC. subsp. *radiata* (narrow-leaf peppermint) in burnt lowland forest in Victoria, Australia. Ten species were detected from the canopy and eight were recorded from a shaded, unburnt part of the buttress. The heavily charred bark on the remainder of the lower trunk supported only *Hypocenomyce australis* and *Cladonia rigida* var. *rigida* squamules. Fifteen species were recorded overall, with the lignicolous *Xylographa isidiosa* a new record for Victoria. The zone near the base of the tree supported a Cladoniaceae-dominated community with *C. rigida* var. *rigida* extending higher up the trunk and into the lower canopy. *Pannoparmelia wilsonii* and *X. isidiosa* occurred only on canopy branches and attained the greatest coverage of all species observed. These observations provide a preliminary insight into the lichen flora of *Eucalyptus radiata* subsp. *radiata*, and the contribution this makes to biodiversity in a fire-affected, lowland forest by providing suitable lichen habitat.

Introduction

Differences in light intensity, humidity and nature of the bark are evident between the base of the tree and canopy branches (McCune 1993; Fritz 2009; Li *et al.* 2017) and, accordingly, spatial heterogeneity appears to be a critical factor influencing the height at which different lichen communities develop (Pirintsos *et al.* 1993; Morley & Gibson 2010; Kobylinski & Fredeen 2014; Li *et al.* 2017). For practical reasons most lichen studies consider the flora up to a height of 2 m with incidental evidence of canopy species derived from recently fallen twigs and debris on the forest floor. However, surveying only the base of the tree can underestimate species of conservation concern as well as their population size (Fritz 2009). Hence, weather events leading to large, wind-thrown branches (such as reported on in this study) and/or entire trees (e.g. Jarman & Kantvilas 1995; Milne & Louwhoff 1995; Aptroot 1997; Fritz 2009; Li *et al.* 2017), present an invaluable opportunity to scrutinize the canopy lichens more systematically.

Fire is increasingly a part of our landscape, and literature on post-fire recovery of lichens indicates a link to the intensity of the blaze and time since fire (Pharo & Beattie 1997; Kantvilas & Jarman 2006; Cranfield *et al.* 2011; Kantvilas *et al.* 2015). Some lichen species are host specific and/or restricted to particular forest types. McMullin & Wiersma (2019) suggest that lichen richness and abundance can be effective indicators of forest continuity and can be used as tools to prioritise forest areas in terms of management.

While lichens are frequently overlooked, they can play an important ecological role in eucalypt forests (Pharo & Beattie 1997; Cranfield *et al.* 2011). Cranfield *et al.* (2011) documented the canopy lichens of *Eucalyptus marginata* Sm. in jarrah silviculture forest in Western Australia, and Jarman & Kantvilas (unpublished data) referred to observations on canopy lichens for *E. obliqua* in wet forest in Tasmania. No studies have investigated the canopy lichens of narrow-leaf peppermint (*E. radiata* subsp. *radiata*, hereafter referred to as *E. radiata*), a common tree species in lowland forest in Victoria. *Eucalyptus radiata* is a small woodland or tall forest tree and can grow to a height of *c.* 45 metres in mountainous forest, although in more open sites it tends to be much smaller (EUCLID 2015). The subfibrous bark is finely fissured and persistent to the smaller canopy branches, creating the potential for suitable lichen habitat into the crown.

This study provides initial observations on the canopy lichens of *E. radiata*, including evidence of continuity between the lower trunk flora and that along canopy branches, and the suitability of this tree species as a partially charred host in a previously burnt lowland forest.

Methods

Nature of the site

Traralgon South Flora and Fauna Reserve (TSFF Res) is situated in the Gippsland Plains Bioregion [Department of Environment, Land, Water & Planning (DELWP) 2019] of Victoria, Australia, where Damp Forest (EVC 29) and Lowland Forest (EVC 16) are the dominant Ecological Vegetation Classes (EVCs) [Department of Sustainability and Environment (DSE) 2007]. *Eucalyptus radiata* is a typical canopy cover species in Lowland Forest, which has a vulnerable Bioregional Conservation status (DSE 2007). The last fires to occur in the reserve (February 2009) significantly burned parts of the forest and resulted in charred *Eucalyptus* trunks and a dense regrowth of *Acacia* species. In June 2019 a weather event caused a large *E. radiata* branch at approximately 8 m height to fall. This branch, prior to detachment, would have reached roughly 16 m into the canopy. The age of the tree, based upon dbh of *c.* 70 cm, was estimated at 70 years. The tree had a fire-affected trunk, being blackened up to detachment of the large canopy branch, with some mild charring on the underside of the branch.

Sampling Method

The tree (38°17.56.4'S, 146°33.34.7'E) was divided into 10 sampling sections in order to observe any changes in the lichen flora along the length of the canopy branch, and to compare these with lichens on the charred lower trunk and unburnt part of the buttress. The first two sampling sections (ground to 99 cm, 100–200 cm) were on the upright tree trunk, and sampling sections 3–10 were *c.* 1 m apart on the fallen canopy branch. The average diameter of the canopy branch was 24 cm, being close to 32 cm at the widest point and 19.1 cm at the narrowest. An additional section (sampling section 11) comprised fallen debris such as bark, outer canopy branches and twigs, which were dislodged by the fall. Presence of lichens was recorded, and separate observations were made on their habit, maturity and abundance (based on a visual assessment). The major fallen branch had two side branches (19 and 24 cm in diameter, respectively), and the lichen flora on those was recorded (sampling sections 9 and 10) as part of the assessment to determine continuity in the canopy lichens.

Lichen identification

Lichens were identified in the field, and small samples were analysed by means of thin-layer chromatography (TLC) (Orange *et al.* 2001; Elix 2014), or by further microscopic examinations. The investigations were made under a DELWP research permit No. 10008741. Nomenclature follows that of McCarthy (2018), and Bendiksby & Timdal (2013) for *Xylographa isidiosa*. *Cladonia* squamules were collected along the various sampling sections, and their identity confirmed using TLC. Juvenile specimens of *Usnea* and *Hypogymnia* were presumed to be recruiting individuals of the same species present in greater maturity and abundance along other sections of the fallen canopy branch. One crustose specimen with a leprose habit and fumarprotocetraric acid (and two faster moving TLC spots) was tentatively identified as a species of *Placynthiella* (to be confirmed and as yet not reported for Victoria).

Results

Lichen richness in sampling sections

Fifteen lichens in 12 genera and 8 families were identified, and their habit and vertical distribution on the tree presented in Table 1. The family Cladoniaceae was best represented with 5 species, followed by Parmeliaceae with 3 and Trapeliaceae with 2. All other families had only 1 species.

Lichen richness was greatest on the lower metre of the upright trunk (8 species), with individuals almost entirely restricted to a shaded, unburnt part of the buttress, although coverage was minimal. These lichens were all fruticose, with the exception of the foliose *Hypogymnia subphysodes* var. *subphysodes* (hereafter referred to as *H. subphysodes*). The charred bark on the remainder of the lower trunk did not support any lichens, apart from a few individuals of *Hypocenomyce australis* and *C. rigida* var. *rigida* (hereafter referred to as *C. rigida*) squamules (juvenile specimens only). Although species richness was lower on the main fallen canopy branch, including the two side-branches (6 species), overall a greater number of individuals covered large parts of the bark. Apart from *X. isidiosa*, which is crustose to subsquamulose with densely isidiate clusters (but see also brief description below) at times entirely obscuring the primary thallus, all the species were macro chlorolichens with fruticose habit most common (6 species) whilst only 2 were foliose. This included established mature specimens as well as juvenile recruitments, particularly of *P. wilsonii*, *H. subphysodes* and *U. inermis*.

Five species occurred on the canopy twigs and debris surrounding the fallen branch and, apart from *H. subphysodes*, all were crustose lichens, bringing the total number of species from the canopy to 10. *Ochrolechia pallescens* occurred on the main branch, but was not seen on the secondary branches. Conversely, *Chrysothrix candelaris* was recorded from the side branches but not the main branch. Neither species was seen on the trunk nor on the debris and smaller canopy branches on the ground surrounding the main fallen branch. In all 7 crustose, 6 fruticose and 2 foliose lichens were recorded from the *E. radiata* tree.

E. radiata subsp. radiata as a lichen host and charred bark as a substratum

There is an observable zonation of trunk, lower branch canopy and upper branch canopy lichen communities with some species showing overlap. *Cladonia rigida* was very well represented by primary squamules which occurred on the trunk (including the burnt bark) and along the entire length of the fallen branch (including side branches) but not on the upper canopy twigs or fallen debris. However, fertile *C. rigida* podetia were, for the most part, observed only from the unburnt bark of the shaded buttress, as were all *Cladia* and other *Cladonia* species. *Hypocenomyce australis* was the only other lichen to occur on the charred bark of the trunk, but only juvenile individuals were observed. Two other lichens that were seen on the lower trunk were juvenile individuals of *Hypogymnia subphysodes* and *Usnea inermis.*

Pannoparmelia wilsonii and *X. isidiosa* were present along all sections of the main fallen lower branch, including side branches, but not from the upper canopy. *Usnea inermis*, *Chrysothrix candelaris* and *Ochrolechia pallescens* were not consistently present along its entire length. *Hypogymnia subphysodes* was common along the main fallen branch where it attained a healthy presence of mature and recruiting specimens, whilst only juvenile individuals were observed in the upper canopy.

The very upper canopy branches, which had only thin bark, acted as the substratum for the crustose species *Megalaria grossa, Pertusaria pertractata* and ?*Placynthiella*, and recruiting juveniles of *H. subphysodes*.

Discussion

Lichen community zonation

The lichen zone on the buttress of *E. radiata* was distinctly compromised by fire in the landscape 10 years prior. Only the protected, unburnt parts supported a "*Cladoniaceae* community" together with juvenile individuals of *H. subphysodes* and *Usnea inermis*. However, observations on a nearby eucalypt suggests that, when not affected by fire, this association becomes well developed. Kantvilas & Jarman (2004) reported a similar band at the base of messmate stringybark (*Eucalyptus obliqua* L'Hér.) in wet forest in Tasmania where *Cladia aggregata* and *Cladonia* species were most common and interspersed with crustose lichens. The latter were not observed in the Cladoniaceae community on *E. radiata* and, apart from *Hypocenomyce australis*, crustose lichens were present only higher up on the tree. Here, *Megalaria grossa, P. pertractata* and ?*Placynthiella* appeared to have a preference for the thinner bark on the outer branches, whilst *Chrysothrix candelaris, O. pallescens* and *X. isidiosa* were observed on only the fibrous bark on the main canopy branch.

Pannoparmelia wilsonii and *Hypogymnia subphysodes* were common along the main canopy branch, and Cranfield *et al.* (2011) associated those species with mature forest trees (*E. marginata*), which they considered to be imperative in retaining habitat.

Eucalyptus radiata as a lichen host

Xylographa reportedly displays strong substratum specificity for wood (Spribille *et al.* 2008), and the distinctly "isidiate" thallus of *X. isidiosa* has so far been described from only charred bark of eucalypts in western W.A., where it is considered to be a rare species although locally common (Elix 2005). It is a new record for Victoria.

These preliminary observations confirm that *E. radiata* in lowland forest is a suitable host for 15 species with lichens extending far into the canopy. Many eucalypts are poor lichen hosts due to their continuously flaking and shedding bark. However, species such as *E. radiata*, which retain their finely textured bark almost to the outer canopy branches, provide suitable habitats for a number of different lichens, including the rare *X. isidiosa*.

No lichens appeared restricted to *E. radiata*, but some degree of specificity with eucalypts in general has been observed. The bright yellow, leprose lichen *Chrysothrix candelaris* is much more conspicuous on the fibrous bark of eucalypts in damp forest in Victoria than on *Acacia* species (*A. melanoxylon* and *A. dealbata*) occurring nearby (Hunt 2019, unpublished data; Louwhoff pers. observation).

Other large trees comprising the overstorey in lowland forest (*E. obliqua* and *E. considenana*), also had bark persistent into the canopy branches, although their suitability as a lichen host was not investigated here.

Xylographa isidiosa (Elix) Bendiksby & Timdal, *Taxon* **65**, 952 (2013)

This lichen is characterised by dense black-tipped granular, globose to subglobose goniocysts (Ryan 2004; Spribille *et al.* 2008), referred to as isidia by Elix (2005), which often obscure the crustose thallus. No fertile material has been found (Elix 2005), and it is easily overlooked. The species contains the rare depsidodepsones friesiic and confriesiic acids (Timdal 1984; Elix *et al.* 2004). In Victoria, it was collected from previously burnt (in February 2009) lowland forest on a large, fallen, partly charred canopy branch of *Eucalyptus radiata* subsp. *radiata* where it was common, forming a distinct branch community with *Pannaparmelia wilsonii*.

SPECIMEN EXAMINED

Victoria. ● Traralgon South Flora and Fauna Reserve, Gippsland, behind township fire break, along Centre Track, approx. 400 m from North South Track turnoff, 38°17.56.4'S, 146°33.34.7'E, 165 m alt., *S.H. Louwhoff SL2177*, 19.vi.2019 [MEL 2476633].

Impact of fire

These initial observations of a partially burnt *E. radiata* confirm that epiphytic lichen recovery after fires is slow, with only juveniles of *C. rigida* and *Hypocenomyce australis* present on the heavily scorched bark of the trunk, most likely recolonizing from nearby trees. Indeed, other studies suggest that, while low severity fire had little effect on lichens, under moderate to high severity fires very little post-fire recolonization occurred on burnt substratum even after 15 years (Miller *et al.* 2018). Furthermore, Ivanova *et al.* (2017) indicate that lichens (and mosses) did not recover 20 years post-fire in pine forest.

The fallen canopy branch had only minor scorching on the lower reaches; indeed Ray *et al.* (2015) suggest that the canopy could potentially provide some refuge from fire for lichens. While a "fire response" lichen community, including *P. wilsonii*, *X. isidiosa* and *H. subphysodes*, occurred on the partly charred bark of *E. radiata*, with the exception of *X. isidiosa*, those species were also observed on blackened trunks in other areas with a longer fire history (30+ years) (Louwhoff & Harris 2014; Louwhoff pers. observations). It appears that the change in chemical or water-repelling properties of the bark following fire make it more conducive to the establishment of certain species, whilst acting as an inhibitor to others, but that possibility requires thorough investigation.

Conclusions

The lichen richness of a single *E. radiata* (15 species) in lowland forest in Victoria was similar to that of a single *E. obliqua* (18 species) in wet forest in Tasmania (Kantvilas & Jarman 2004). However, only three species were common to both studies, most likely due to differences in microclimate between the different forest types. Indeed, there was more overlap (9 species) with lichens found on *E. marginata* in silviculture forest in W.A.

These preliminary observations confirm that *E. radiata* makes a valuable contribution to the biodiversity of lowland forest in Victoria by providing suitable substratum, including for *X. isidiosa*, previously thought to be endemic to eucalypt forest in W.A. The observations, based on the examination of the upright trunk and a large, fallen canopy branch, indicate there is a recognizable lichen zone on buttress, main canopy branch and outer canopy branch, in addition to a "fire response" lichen community. Additional sampling of fire-affected eucalypt trunks in lowland forest will provide further insight into sensitivity of lichens to charred bark and their recovery period following fire.

Acknowledgements

Jack Elix is gratefully acknowledged for assistance with TLC interpretation and correspondence on *Xylographa isidiosa*. Patrick McCarthy provided much-appreciated feedback and advice on the manuscript. The observations were made in the TSFF Reserve with DELWP permit No: 10008741.

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Table 1. Lichen species and their growth form (FRU = fruticose, FOL = foliose, CRT = crustose) in each of the sampling sections (ss), where ss 1 & 2 are on the upright tree trunk (up to 200 cm height), ss 3–10 are on the main fallen branch (9 & 10 on narrower, side branches from main branch) and ss 11 is the debris surrounding the fallen branch, consisting mainly of outer canopy branches.

Form	Species	1	2	3	4	5	6	7	8	9	10	11
FRU	*Cladia aggregata* (Sw.) Nyl.#	*										
FRU	*Cladia schizopora* (Nyl.) Nyl.#	*										
FRU	*Cladonia scabriuscula* (Delise) Nyl. #	*										
FRU	*Cladonia merochlorophaea* Asahina #	*										
FRU	*Cladonia rigida* (Hook.f. & Taylor) Hampe var. *rigida* #	*	*	*	*	*	*	*	*	*	*	
CRT	*Hypocenomyce australis* Timdal *		*									
FOL	*Pamoparmelia wilsonii* (Räsänen) D.J.Galloway ∞			*	*	*	*	*	*	*	*	
CRT	*Xylography isidiosa* (Elix) Bendiksby & Timdal>			*	*	*	*	*	*	*	*	
FOL	*Hypogymnia subphysodes* (Kremp.) Filson var. *subphysodes* ∞	*		*	*	*					*	*
FRU	*Usnea inermis* Motyka ∞	*			*	*	*		*	*	*	
CRT	*Ochrolechia pallescens* (L.) A.Massal ^					*	*	*				
CRT	*Chrysothrix candelaris* (L.) J.R.Laundon °									*		
CRT	*Megalaria grossa* (Pers. ex Nyl.) Hafellner ~											*
CRT	*Pertusaria pertractata* Stirt. +											*
CRT	?*Placynthiella* sp. Elenkin >											*
	TOTAL	7	2	4	5	6	5	4	4	5	5	4
	Position of section	Upright tree			Main fallen branch			Side branches		Other		
	Total species/category	8			6			6		4		

Shaded columns denote fallen branches. Lichen families: #Cladoniaceae, *Ophioparmaceae, ∞Parmeliaceae, ^Ochrolechiaceae, °Chrysotrichaceae, ~Megalariaceae, +Pertusariaceae, >Trapeliaceae.

Additional lichen records from Australia 87.
***Monoblastiopsis nigrocortina* R.C.Harris & C.A.Morse**

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Abstract

Monoblastiopsis nigrocortina R.C.Harris & C.A.Morse (lichenized Ascomycota, Pleosporales, *incertae sedis*) and that genus are reported for the first time from Australia. Previously known only from the U.S.A., mainly on calcareous and non-calcareous sandstones, the species was collected on a bonded cement-asbestos tile in the Southern Tablelands, New South Wales.

Introduction

Harris & Morse (2008) described their new, pyrenocarpous lichen genus *Monoblastiopsis* from concrete and calcareous rocks in Colorado, Kansas, Missouri and Texas, U.S.A. Two species were reported as new, *viz. M. konzana* R.C.Harris & C.A.Morse and *M. nigrocortina* R.C.Harris & C.A.Morse. The latter was further documented by Morse & Ladd (2015), its updated range covering Arizona, Colorado, Kansas, Montana, Nebraska, South Dakota and Wyoming, as well as additional substrata including calcareous and non-calcareous sandstones. This note records the recent discovery of *M. nigrocortina* growing on a bonded cement-asbestos tile in the Southern Tablelands, New South Wales, Australia.

Monoblastiopsis nigrocortina R.C.Harris & C.A.Morse, *Opuscula Philolichenum* **5**, 93 (2008)

Thallus ± epilithic, rimose to areolate, forming colonies to *c.* 30 mm wide, pale greyish green. *Areoles* angular and usually irregular in shape, separated by noticeably whitish fissures, (0.1–) 0.3–0.6(–1) mm wide, 0.08–0.15(–0.2) mm thick, slightly concave to plane; surface dull, minutely and irregularly uneven. *Cortex* lacking, but the thallus with an uppermost alga-free layer, 15–30 µm thick, which is anatomically similar to the medulla, although lacking substratum material. *Algal layer* well delimited, dominating the thallus, 50–90(–120) µm thick; cells chlorococcoid, ± globose to broadly ellipsoid, thin- to rather thick-walled, (7–)12–22(– 26) µm wide; interstitial hyphae long-celled, 1.5–2.5(–3) µm wide. *Medulla* dominated by fragments of the substratum, including asbestos fibres; hyphae forming a rather loose network, 1.5–2 µm wide. *Prothallus* whitish, marginal, poorly delimited or not apparent. *Ascomata* perithecia, numerous, usually solitary or in small clusters, 2/3-immersed in the thallus to almost superficial, (0.06–)0.13(–0.18) µm wide [*n* = 50], ± globose or somewhat distorted due to mutual pressure when clustered; surface ± smooth, slightly glossy, jet-black; ostiole apical, in a shallow depression 20–40 µm wide; some post-mature ascomata collapsing at the apex, some others leaving the blackish remnants of the cup-like perithecial base visible in the thallus. *Involucrellum* absent. *Excipulum* pseudoparenchymatous, dark brown to blackish and 22–32 µm thick at and near the ascomatal apex, with the cells ellipsoid to globose, thick-walled, 4–6 µm wide; basal excipulum dark brown to blackish, 14–20 µm thick, consisting of periclinally elongate, moderately thick-walled cells 5–8 × 3–4 µm. *Subhymenium* hyaline, 12–20 µm thick. *Interascal hyphae* distinct and persistent, simple, branched or sparingly anastomosing and long-celled below, distally with more abundant anastomoses, shorter-celled and 1–1.5 µm wide, not constricted at the septa, without obvious inclusions. *Periphyses* rather sparse, short, unbranched or possibly sparingly branched, 8–10(–15) × 1–1.5 µm, thin-walled, short-celled, the apices subglobose or broadly clavate. *Asci* fissitunicate, 8-spored, narrowly ellipsoid or narrowly to broadly clavate, 66–80 × 15–20 µm [*n* = 12]; immature asci with a developing, needle-like ocular chamber *c.* 0.5 µm wide, this comparatively broad and shallow at maturity, sometimes scarcely apparent; ascus wall I–, KI–; ascoplasm KI+ golden yellow to pale orange-brown. *Ascospores* usually irregularly biseriate in the ascus, simple, colourless, narrowly ellipsoid or oblong-ellipsoid, occasionally soleiform, the distal end frequently slightly broader, ± straight, with rounded ends, (15–)20(–24) × (6.5–)8(–10) µm [*n* = 82]; wall *c.* 0.5 µm thick, lacking an epispore; contents minutely granulose and usually with at least 1 or 2 large vacuoles. *Pycnidia* not seen. [Figs 1, 2]

Remarks

The Australian specimen possesses most of the diagnostic attributes of *Monoblastiopsis*, including the chlorococcoid photobiont, simple perithecia with anastomosing interascal hyphae as well as periphyses, fissitunicate asci and simple ascospores. Moreover, it seems to be a good match for *M. nigrocortina* as described and illustrated by Harris & Morse (2008) and Morse & Ladd (2015). Unfortunately, the abundant pycnidia noted by Morse & Ladd (2015) and their conidia [(2.5–)3–3.5(–4) × *c.* 1 µm] were not seen in this Australian collection. Doubtfully significant differences between the Australian and American material involve the much thinner and rather nondescript thallus and somewhat larger ascomata [0.15–0.2(–0.3) mm wide] of the latter (Harris & Morse 2008).

Morse & Ladd (2015) noted potential nomenclatural difficulties due to the name *Thrombium mongolicum* H.Magn. having been applied by Anderson (1962) to American specimens that are now unambiguously referable to *M. nigrocortana*, combined with uncertainty over the actual identity of *T. mongolicum* and some similar "*Thrombium*" species.

SPECIMEN EXAMINED

New South Wales. ● Southern Tablelands, beside Kings Highway, *c.* 12 km E of Bungendore, 35°15'01"S, 149°34'29"E, 865 m alt., on discarded, bonded cement-asbestos tile on forest floor, *P.M. McCarthy 4924*, 20.ii.2020 (CANB).

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Figure 1. *Monoblastiopsis nigrocortina* (*P.M. McCarthy 4924*). Scale: 1 mm.

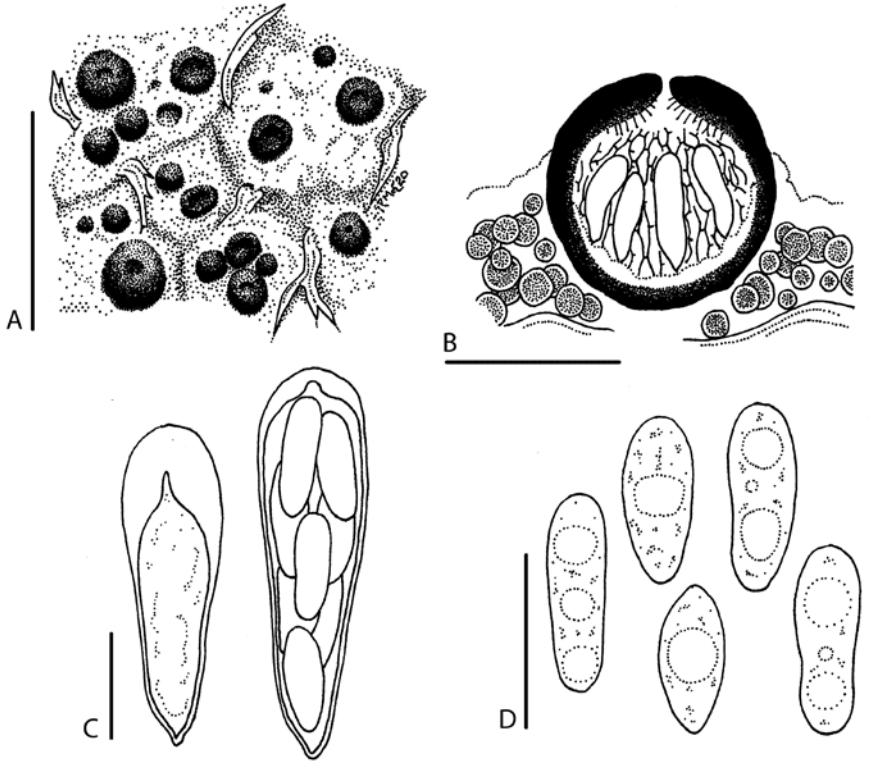

Figure 2. *Monoblastiopsis nigrocortina* (*P.M. McCarthy 4924*). A, Habit of thallus and perithecioid ascomata (with asbestos fibres); B, Sectioned perithecium and adjacent thallus (semi-schematic); C, Immature (left) and mature asci; D, Ascospores. Scales: A = 0.5 mm; B = 0.1 mm; C, D = 20 µm.

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Australasian Lichenology
Number 87, July 2020 ISSN 1328–4401

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