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The cosmopolitan *Lecidella elaeochroma* is common on smooth-barked trees and shrubs in forests and cityscapes throughout Australia and New Zealand (also throughout Europe, the Americas, Macaronesia, Asia and Africa). Its dark marginal prothalli can form complex mosaics. Its chemistry is largely xanthonones, among them arthothelin, isoarthothelin, 4,5-dichlorolichexanthone, and thiophanic acid (K+ yellow, C+ orange, KC+ yellow, and Pd-). Five chemodemes have been discovered in its populations.

1 mm 

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The structure of xantholepinone A, a new secalonic acid derivative from the lichen *Chrysothrix sulphurella*

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Abstract

Xantholepinone A [8,8^l-dideoxysecalonic acid D] (1) has been isolated from the lichen *Chrysothrix sulphurella* and the structure established by mass spectrometry and NMR spectroscopy. A detailed assignment of the ¹³C-NMR spectrum of secalonic acid A (2) is also reported.

Introduction

Xantholepinone A was first detected in the lichen *Myelochroa xantholepis* (Mont. & Bosch) Elix & Hale, and subsequently found to be the major component of *Chrysothrix sulphurella* (Räsänen) Kantvilas & Elix (Kantvilas & Elix 2007). It has since been found to be quite widely distributed in other lichen genera, including *Endohyalina* (Elix & Kantvilas 2015, 2016) and *Phaeographis* (Rambold *et al.* 2018). Although xantholepinone A could readily be characterized by thin-layer chromatography (Elix 2014), the structure of this compound remained unknown. This paper describes the structural elucidation of xantholepinone A.

Methods

All nuclear magnetic resonance spectra (NMR) were recorded on a Bruker Biospin GmbH spectrometer at 300 K with probe 5 mm PABBO BB/19F-1H/D Z-GRD Z116098/0258. ¹H and ¹³C NMR experiments were undertaken at 400 MHz and 100 MHz respectively. Low resolution electrospray mass spectra (LRESIMS) were recorded on a Waters Micromass ZMD single quadrupole mass spectrometer using an ionization field of 3500V, source temperature 100°C, desolvation temperature 150°C, coupled to a Waters Alliance 2995 HPLC system. High resolution electrospray mass spectra (HRESIMS) were recorded on a Waters LCT Premier mass spectrometer using an ionization field of 2500 V, source temperature 100°C, desolvation temperature 150°C, coupled to a Waters Alliance 2995 HPLC system. All MS used positive electrospray ionization mode. Fluorescent active thin layer-chromatographic (TLC) plates (silica gel 60 F254) and silica gel (230–400 mesh) for flash chromatography were supplied by Merck Millipore Pty Ltd, Bayswater, Victoria 3153, Australia.

Extraction of *Chrysothrix sulphurella* (Räsänen) Kantvilas & Elix

The lichen *Chrysothrix sulphurella* was collected at Rutherfords Creek Picnic Area, 19 km SE of Nimmitabel, 36°34'29"S, 149°26'36"E, 850 m alt., New South Wales, *J.A. Elix 43053*, 4.ix.2007 (CANB). The dried lichen thallus (3.2 g) was extracted in a Soxhlet extractor with anhydrous diethyl ether (350 mL) for 48 h. The ether extract was concentrated to dryness to yield 113.7 mg of a bright yellow solid. This solid was purified by flash column chromatography over silica gel using 70% ethyl acetate / light petroleum as eluent. Five major bands developed and the slowest moving band was bright yellow. This yellow band was collected from the chromatographic column and concentrated to afford 13.9 mg of a bright yellow solid mixed with a more massive white solid. This white solid had low solubility in organic solvents, so the

mixture was triturated with acetone (5 mL), and the yellow supernatant was concentrated to dryness to afford pure xantholepinone A (1) (1 mg).

The spectroscopic properties of (1) were found to be very similar to those of secalonic acid A (2), secalonic acid E (3) and secalonic acid D (4) (Figure 1), but the chromatographic properties of (1) differed significantly from those of (2), (3) and (4). Unfortunately, no detailed assignment of the ^{13}C -NMR spectrum of secalonic acid A (2) had been reported previously, so we record it here because these assignments were essential in confirming the structure of xantholepinone A (1). Correlations in the gHMBC spectrum of (2) are illustrated in Figure 2.

Structural elucidation of xantholepinone A

Xantholepinone A (1) was obtained as a bright yellow solid with m/z $[\text{M}+\text{H}]^+$ 607.1816 on high resolution ESIMS with a protonated molecule due to $\text{C}_{32}\text{H}_{31}\text{O}_{12}$, thus establishing the molecular formula of this compound as $\text{C}_{32}\text{H}_{30}\text{O}_{12}$. The spectroscopic properties of (1) were very similar to those of secalonic acid A (2), secalonic acid E (3) and secalonic acid D (4) (Figure 1). Assignments in the ^1H -NMR spectrum of (1) are summarized in Table 1 together with those of (2), (3) and (4). The ^1H -NMR data observed for (2) were identical to that reported previously (El-Elimat *et al.* 2015, 2017). The ^{13}C -NMR spectrum of both (1) and (2) exhibited sixteen carbon signals due to their highly symmetric structures (8/8'-OH ---13.77, s 13.78, s ---13.60, brs (2006) Table 2). In the HSQC spectrum of (1), a carbon signal (δ 18.2) was strongly associated with a doublet proton signal (δ 1.14, 3H), as expected for a methyl bonded to a CH group. The carbon signal (δ 53.1) was associated with a singlet proton signal (δ 3.65, 3H), as expected for a methoxy group in 1. Two singlet proton signals (δ 5.16, 12.53) were not associated with any carbon signals, indicating that these were due to hydroxy groups, the latter (δ 12.53) forming an intramolecular H bond. Two doublet proton signals (δ 6.59, d, J = 8.5 Hz) and (7.53, d, J = 8.5 Hz) were associated with the carbon signals (δ 108.2) and (δ 141.6) respectively, indicating that two adjacent aromatic protons were present in (1). Further the proton signal (δ 7.25, dd, J = 5.6, 2.7 Hz) was associated with a carbon signal (δ 143.6), consistent with the presence of the C6 ethylenic proton. A carbon signal (δ 34.4) was correlated with two proton signals (δ 2.26, 2.74), consistent with the presence of a methylene group on C7. Correlations in the gHMBC spectrum of (1) are illustrated in Figure 4. All these observations were consistent with structure (1) for xantholepinone A, with the same carbon skeleton as secalonic acid A (2) and secalonic acid D (4) but lacking the 8- and 8'-hydroxy groups.

In the NOESY spectrum of (2) (Figure 3), the H11 (δ 1.17) and H5 (δ 3.97) protons are strongly correlated with one another, whereas the H6 (δ 2.47-2.49), H13 (δ 3.65) and 5-OH (δ 5.13) protons are weakly correlated with one-another. These correlations confirm that C11 has β configuration, whereas C12 and 5-OH have α configurations. This was as expected given the established configuration of secalonic acid A (2) (Howard *et al.* 1976).

Similarly in the NOESY spectrum of xantholepinone A (1) (Figure 3), the H11 (δ 1.14) and H5 (δ 3.94) protons were strongly correlated with one another, whereas the H6 (δ 2.39-2.44), H13 (δ 3.65) and 5-OH (δ 5.16) protons were weakly correlated with one another. These correlations suggest that xantholepinone A (1) and secalonic acid A (2) have the same relative stereochemistry at the chiral centres at C5, C6 and C10a, rather than that of (3) in this region. However, the specific rotation of xantholepinone A (1) was determined as $[\alpha]_{\text{D}}^{22} = +50$ (c 0.1, CHCl_3), consistent with that of secalonic acid D (4), the enantiomer of secalonic acid A, with $[\alpha]_{\text{D}}^{25} = +61$ (c 0.11, CHCl_3) (Ren *et al.* 2006). This confirmed that in xantholepinone A, the C11 methyl group has α configuration while the C12 and 5-OH have β configurations. The carbon chemical shifts of compound (1), (2) and (4) were well matched except for C7, C8, C8a and C9, in particular C8 and C8a. As expected, the chemical shift of C8 decreased from δ 179.5 in (2) or δ 178.2 in (4) to δ 143.6 in (1) since C8 is substituted by a hydrogen atom rather than a hydroxy group. At the same time the chemical shift of C8a in (1) increased from δ 102.9 in (2) or δ 101.7 in (4) to δ 131.1.

The structure of xantholepinone A (1) has been elucidated, and shown to be a further representative of a number of secalonic acid derivatives isolated from lichenized fungi (Huneck & Yoshimura 1996).

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Table 1 ¹H-NMR data of compounds **1-4** (chemical shifts in δ, coupling constants in Hz)

Position	δ_{H} mult (<i>J</i> in Hz)				
	1 [(CD ₃) ₂ CO]	2 [(CD ₃) ₂ CO]	2 (CDCl ₃)*	3 (C ₅ D ₃ N)*	4 [(CD ₃) ₂ SO] #
3-H	7.53, d (8.5)	7.50, d (8.5)	7.45, d (8.6)	7.42, d (8.6)	7.45, d (8.4)
4-H	6.59, d (8.5)	6.58, d (8.5)	6.63, d (8.6)	6.57, d (8.6)	6.63, d (8.4)
5-H	3.94, dd (11.5, 4.8)	3.97, dd (11.0, 4.6)	3.92, dd (11.2, 0.5)	4.11, d (1.2)	3.81, d (9.5)
6-H	2.39-2.44, m	2.47-2.49, m	2.41, m	2.10, m	2.31, m
7-H	2.26, ddd (20.6, 10.0, 2.7)	2.46, d (13.0)	2.31, dd (19.2, 10.7)	2.40, dd (18.9, 6.3)	2.49, dd (19.8, 6.2)
	2.74, ddd (20.6, 5.6, 5.6)	2.74, d (13.0)	2.73, dd (19.2, 6.4)	2.52, dd (18.9, 11.4)	2.65, dd (19.8, 8.4)
8-H	7.25, dd (5.6, 2.7)	---	---	---	---
11-H	1.14, d (6.6)	1.17, d (6.2)	1.17, d (6.4)	1.17, d (6.9)	1.03, d (6.2)
13-H	3.65, s	3.65, s	3.72, s	3.72, s	3.61, s
1-OH	12.53, s	11.64, s	11.76, s	11.87, s	11.62, s
5-OH	5.16, d (4.8)	5.13, d (4.6)	2.81, d (2.7)	2.60, brs	---
8-OH	---	13.77, s	13.78, s	---	13.60, brs
3'-H	7.53, d (8.5)	7.50, d (8.5)	7.45, d (8.6)	7.42, d (8.6)	7.45, d (8.4)
4'-H	6.59, d (8.5)	6.58, d (8.5)	6.63, d (8.6)	6.57, d (8.6)	6.63, d (8.4)
5'-H	3.94, dd (11.5, 4.8)	3.97, dd (11.0, 4.6)	3.92, dd (11.2, 0.5)	4.11, d (1.2)	3.81, d (9.5)
6'-H	2.39-2.44, m	2.47-2.49, m	2.41, m	2.10, m	2.31, m
7'-H	2.26, ddd (20.6, 10.0, 2.7)	2.46, d (13.0)	2.31, dd (19.2, 10.7)	2.40, dd (18.9, 6.3)	2.49, dd (19.8, 6.2)
	2.74, ddd (20.6, 5.6, 5.6)	2.74, d (13.0)	2.73, dd (19.2, 6.4)	2.52, dd (18.9, 11.4)	2.65, dd (19.8, 8.4)
8'-H	7.25, dd (5.6, 2.7)	---	---	---	---
11'-H	1.14, d (6.6)	1.17, d (6.2)	1.17, d (6.4)	1.17, d (6.9)	1.03, d (6.2)
13'-H	3.65, s	3.65, s	3.72, s	3.72, s	3.61, s
1'-OH	12.53, s	11.64, s	11.76, s	11.87, s	11.62, s
5'-OH	5.16, d (4.8)	5.13, d (4.6)	2.81, d (2.7)	2.60, brs	---
8'-OH	---	13.77, s	13.78, s	---	13.60, brs

* El-Elimat *et al.* (2015)# Ren *et al.* (2006)Table 2 ¹³C-NMR data of compounds **1, 2** and **4** (chemical shifts in δ)

Position	δ_{C}		
	1 [(CD ₃) ₂ CO]	2 [(CD ₃) ₂ CO]	4 [(CD ₃) ₂ SO] #
1-C	161.2	160.2	158.9
2-C	118.3	118.6	117.3
3-C	141.6	141.2	140.2
4-C	108.2	108.4	107.5
4a-C	160.8	160.2	158.5
5-C	77.7	77.2	75.2
6-C	31.4	30.8	29.9
7-C	34.4	36.8	35.8
8-C	143.6	179.5	178.2
8a-C	131.1	102.9	101.7
9-C	186.5	188.5	186.6
10-C	108.2	107.5	106.3
10a-C	87.5	86.2	85.2
11-C	18.2	18.3	17.8
12-C	169.9	171.0	170.0
13-C	53.1	53.0	52.6
1'-C	161.2	160.2	158.9
2'-C	118.3	118.6	117.3
3'-C	141.6	141.2	140.2
4'-C	108.2	108.4	107.5
4a'-C	160.8	160.2	158.5
5'-C	77.7	77.2	75.2
6'-C	31.4	30.8	29.9
7'-C	34.4	36.8	35.8
8'-C	143.6	179.5	178.2
8a'-C	131.1	102.9	101.7
9'-C	186.5	188.5	186.6
10'-C	108.2	107.5	106.3
10a'-C	87.5	86.2	85.2
11'-C	18.2	18.3	17.8
12'-C	169.9	171.0	170.0
13'-C	53.1	53.0	52.6

Ren *et al.* (2006)

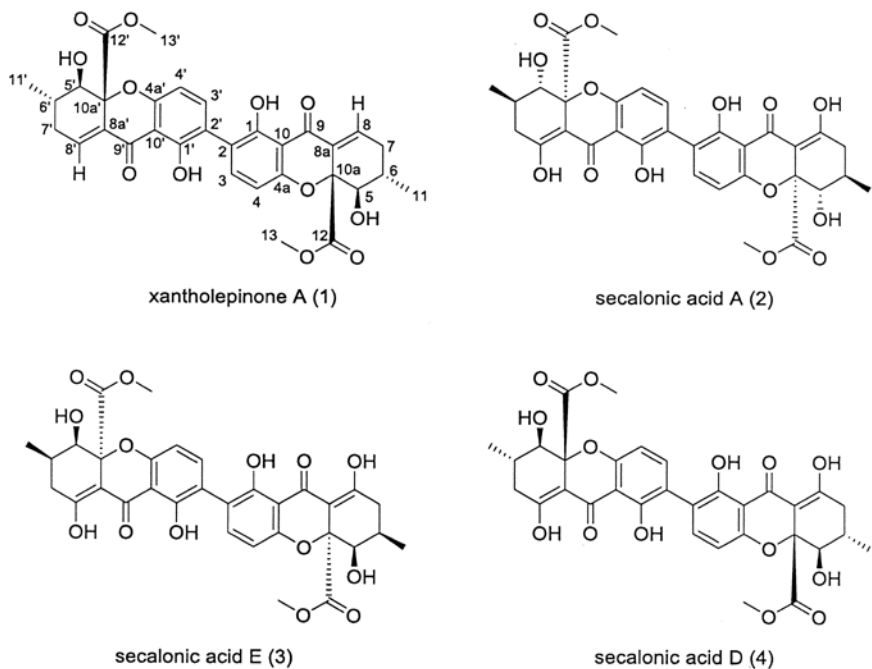


Figure 1. Structures of compounds 1–4

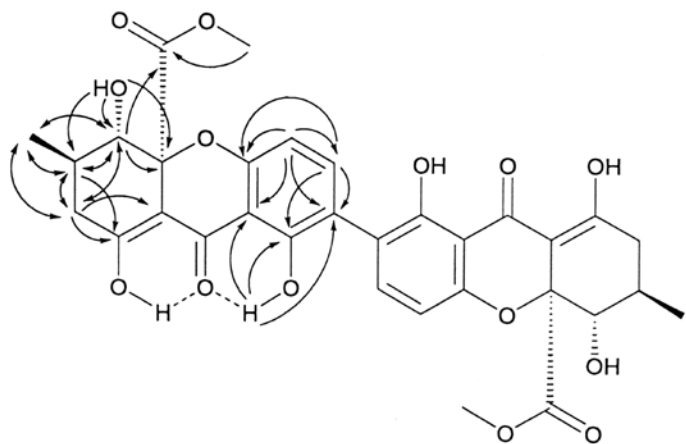


Figure 2. gHMBC correlations of secalonic acid A (2)

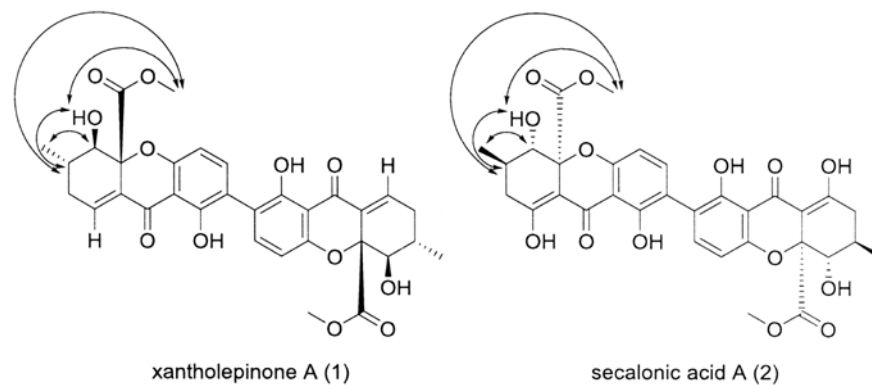


Figure 3. NOESY associations of xantholepinone A (1) and secalonic acid A (2)

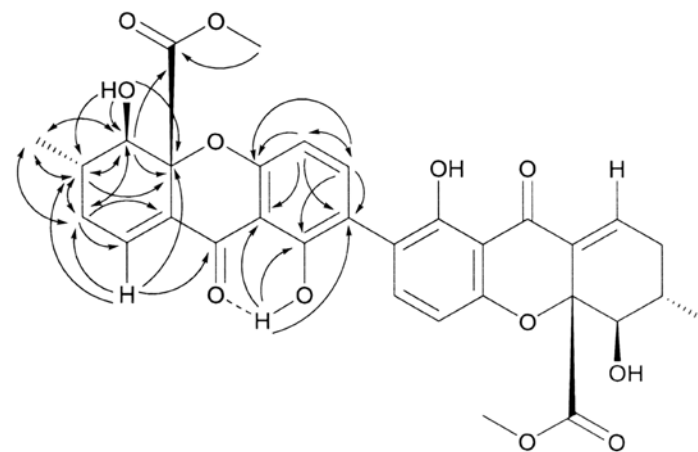


Figure 4. gHMBC correlations of xantholepinone A (1)

Two new species of *Rinodina* (Physciaceae, Ascomycota) from southern Australia

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Abstract

Rinodina argopsina Elix & P.M.McCarthy, characterized by the presence of argopsin and zeorin, and *R. teniswoodiorum* Elix & Kantvilas, containing zeorin and arthothelin, are described as new to science from southern New South Wales and eastern Tasmania, respectively.

The saxicolous species of *Rinodina* (Ach.) S.F.Gray in Australia are relatively well known following the initial treatment by Mayrhofer (1984), further additions by Mayrhofer *et al.* (1990), Matzer & Mayrhofer (1994), Matzer *et al.* (1998) and Trinkaus *et al.* (1999), and the more recent revisions by Kaschik (2006) and Elix (2011); also the description of two additional species (Elix & Giralt 2015; Mayrhofer & Elix, 2018). In this paper we describe two further new saxicolous species of *Rinodina*, one from New South Wales and the other from Tasmania.

Methods

Observations and measurements of photobiont cells, thalline and apothecial 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 (H₂SO₄) and apothecial sections with 50% nitric acid (N). Chemical constituents were identified by thin-layer chromatography (Elix 2014) and comparison with authentic samples. Nomenclature of ascospore types and their ontogeny follows that of Kaschik (2006).

The new species

Rinodina argopsina Elix & P.M.McCarthy, sp. nov. Figs 1, 2
Mycobank number: **MB 828250**

Similar to *Rinodina reagens* Matzer & H.Mayrhofer and *R. murrayi* H.Mayrhofer, but differs in having an interspersed hymenium and in containing atranorin and argopsin.

Type: Australia, New South Wales, Southern Tablelands, South-East Forests National Park, Rutherfords Creek Picnic Area, 19 km SE of Nimmitabel, 36°34'29"S, 149°26'36"E, 850 m alt., temperate rainforest, on shaded, seasonally inundated granite boulder in stream bed, *J.A. Elix 46514*, 4.xi.2017 (holotype – CANB).

Thallus crustose, up to 50 mm wide, continuous, rimose, to 0.15 mm thick; upper surface pale whitish green to yellow-green, smooth, shiny or matt; prothallus marginal, dark brown, very thin, arachnoid; vegetative propagules absent; medulla thin, white, I–, lacking crystals; photobiont cells 7–10 µm diam. *Apothecia* 0.2–0.7 mm wide, lecanorine, immersed at first, then

broadly adnate or sessile and constricted at the base; disc brown to brown-black, epruinose, plane or weakly convex; thalline margin concolorous with the thallus, entire, prominent, persistent, in section 60–120 µm thick; proper margin thin, not prominent, concolorous with the disc. *Epihymenium* 15–25 µm thick, pale brown to brown, K–, N–. *Hypothecium* 70–110 µm thick, colourless to pale yellow-brown, K+ yellow-orange. *Hymenium* 100–110 µm thick, colourless, interspersed with oil droplets; paraphyses 1–1.7 µm wide, simple to sparsely branched, capitate, with brown apices 3–3.5 µm wide. *Asci* of the *Lecanora*-type, with 8 or fewer spores. *Ascospores* 1-septate, olive-brown then brown, ellipsoid, *Teichophila*-type (with internal wall thickenings grading from *Pachysporaria*- to *Milvina*-, *Physcia*- and *Mischoblastia*-types at different stages of development), 18–[23.9]–30 × 10–[11.9]–17 µm, not constricted at the septum, with ontogeny of type-A; torus present in mature ascospores only; outer spore-wall smooth. *Pycnidia* rare, immersed; conidia bacilliform, 3–5.5 × 1–1.5 µm. *Chemistry:* Thallus K+ yellow, P+ pale yellow; containing atranorin (major) and argopsin (major).

Etymology: The species is named for its unique chemistry.

Remarks

This is the first report of the depsidone argopsin from the genus *Rinodina*. However, the closely related depsidone pannarin is known from a number of species, including the Australasian *R. murrayi* H.Mayrhofer (Kaschik 2006) and nine species from North America (Sheard 2010). *Rinodina murrayi* is also morphologically similar to *R. argopsina* in having ascospores of the *Milvina*-type grading into *Physcia*-type, but those are smaller, 16–22 × 10–13 µm; furthermore, this species lacks an interspersed hymenium. The ascospores of *R. argopsina* are most similar to those of *R. reagens*, but that species lacks lichen substances and an interspersed hymenium. *Rinodina fimbriata* Körb., from Europe and North America, also grows on irrigated rocks, but it differs in having *Mischoblastia*-type ascospores and in lacking an interspersed hymenium and secondary chemistry (Mayrhofer & Poelt 1979; Mayrhofer & Moberg 2002; Sheard 2010).

At present the new species is only known from seasonally inundated granite at the type locality in south-eastern New South Wales. Associated species include *Halecania subsquamosa* (Müll.Arg.) van den Boom & H.Mayrhofer, *Porina leptalea* (Durieu & Mont.) A.L.Sm., *Porpidia albocaerulescens* (Wulfen) Hertel & Knoph var. *albocaerulescens* and *Rinodina oxydata* (A.Massal.) A.Massal.

ADDITIONAL SPECIMEN EXAMINED

New South Wales: ● type locality, on seasonally inundated granite rocks in stream bed, *P.M. McCarthy 4688*, 4.xi.2017 (CANB).

Rinodina teniswoodiorum Elix & Kantvilas, sp. nov. Figs 3, 4
Mycobank number: **MB 828251**

Similar to *Rinodina thiomela* (Nyl.) Müll.Arg., but differs in having smaller ascospores, 19–27 × 10–14 µm, and in containing arthothelin as the major xanthone present.

Type: Australia, Tasmania, Windsong Property, Ronnies Spur, 42°21'14"S, 147°55'01"E, 30 m alt., on rocks in dry sclerophyll forest, *G. Kantvilas 255/17*, 25.x.2017 (holotype – HO).

Thallus crustose, up to 30 mm wide, continuous, verrucose-areolate to subsquamulose; areoles 0.1–0.4 mm wide, rounded or irregular, up to 0.15 mm thick; upper surface pale yellow to yellow-green, matt, smooth or becoming granular; prothallus marginal and black or absent; vegetative propagules absent; medulla thin, pale yellow, I–, lacking crystals of calcium oxalate; photobiont cells 7–12 µm diam. *Apothecia* 0.2–1 mm wide, lecanorine, broadly adnate then sessile and constricted at the base; disc brown to brown-black, epruinose, weakly concave then plane; thalline margin concolorous with the thallus, prominent, entire but soon dentate, in

section 80–125 µm thick; proper margin prominent in older apothecia, concolorous with the disc, in section 40–50 µm thick, brown to dark brown. *Epihymenium* 10–15 µm thick, pale brown to olive-brown K⁻, N⁻. *Hypothecium* 80–100 µm thick, colourless to pale yellow-brown, K⁻. *Hymenium* 80–100 µm thick, colourless, with prominent oil paraphyses 4–6 µm wide; regular paraphyses 1–1.7 µm wide, simple to sparsely branched, capitate, with pale brown apices 2.5–3 µm wide. *Asci* of the *Lecanora*-type, with 8 or fewer spores. *Ascospores* 1-septate, pale brown then brown, ellipsoid to citriform, with internal wall thickenings, grading from *Pachysporaria*-type to *Milvina*-type at different stages of development, 19–[21.7]–27 × 10–[12.3]–14 µm, not constricted at the septum; ontogeny of type-A; torus present in mature ascospores only; outer spore-wall smooth. *Pycnidia* rare, immersed; conidia bacilliform, 3.5–5 × 1 µm.

Chemistry: Thallus K⁻, C⁺ orange, P⁻, UV⁺ yellow; containing 2,5- and 4,5-dichlorolichexanthone (minor), arthothelin (major), zeorin (major), 4,5-dichloronorlichexanthone (trace), thiomelin (trace), ± lichexanthone (trace).

Etymology: The species is named for Tom and Jane Tenniswood, owners of the property where the type material was collected.

Remarks

This is the first report of dichlorolichexanthenes from the genus *Rinodina*. However, the presence of arthothelin and zeorin is also observed in *R. fijiensis* Elix & Giralto from the Fiji Islands, but that species differs in lacking the dichlorolichexanthenes and in having smaller, *Pachysporaria*-type ascospores, 15–21 × 8–12 µm (Elix & Giralto 2015). In many respects the new species closely resembles the common *R. thiomela*. Both have adnate to sessile, lecanorine apothecia, *Pachysporaria*-type ascospores and prominent oil paraphyses, and they contain zeorin and xanthenes. However, *R. thiomela* lacks 2,5-dichlorolichexanthone, and it contains thiomelin and satellites rather than arthothelin, as well as having somewhat larger ascospores, 20–34 × 11–17 µm (Elix 2011).

At present this new species is only known from the type locality in eastern Tasmania, where it grows on low rock outcrops in a very open, dry sclerophyll forest with widely scattered *Eucalyptus globulus* and *E. viminalis* and virtually devoid of shrubs and lesser trees. The rock type at the site is very unusual for Tasmania, being a deep reddish, very coarsely gritty, remnant tertiary laterite containing alluvial quartz pebbles, fragments of petrified wood and pisolitic ironstone (M. de Salas, pers. comm.). It supports a rich association of chiefly crustose lichens, with the most common species being *Acarospora veronensis* A.Massal., *Buellia homophyllia* (C.Knight) Zahlbr., *Caloplaca rexfilsonii* S.Y.Kondr. & Kärnefelt, *L. farinacea* Fée, *Lecidella sublapicida* (C.Knight) Hertel, *Parapropidia leptocarpa* (C.Bab. & Mitt.) Rambold & Hertel, *Ramboldia blastidiata* Kantvilas & Elix, *R. plicatula* (Müll.Arg.) Kantvilas & Elix and *Tephromela atra* (Huds.) Hafellner.

ADDITIONAL SPECIMEN EXAMINED

Tasmania: • type locality, on rocks in dry sclerophyll forest, *G. Kantvilas 240/17*, 4.xi.2017 (CANB).

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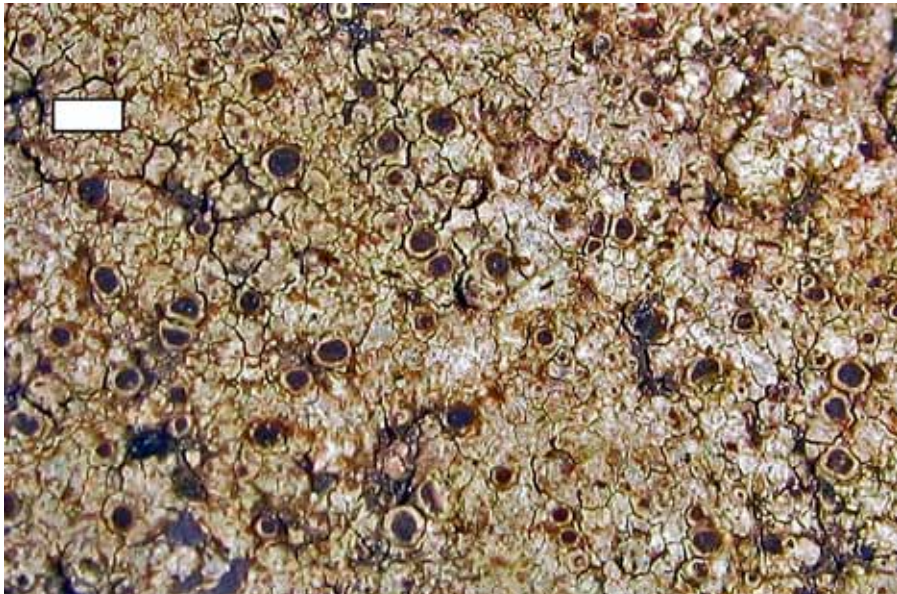


Figure 1. *Rinodina argopsina* (holotype in CANB). Scale = 1 mm.

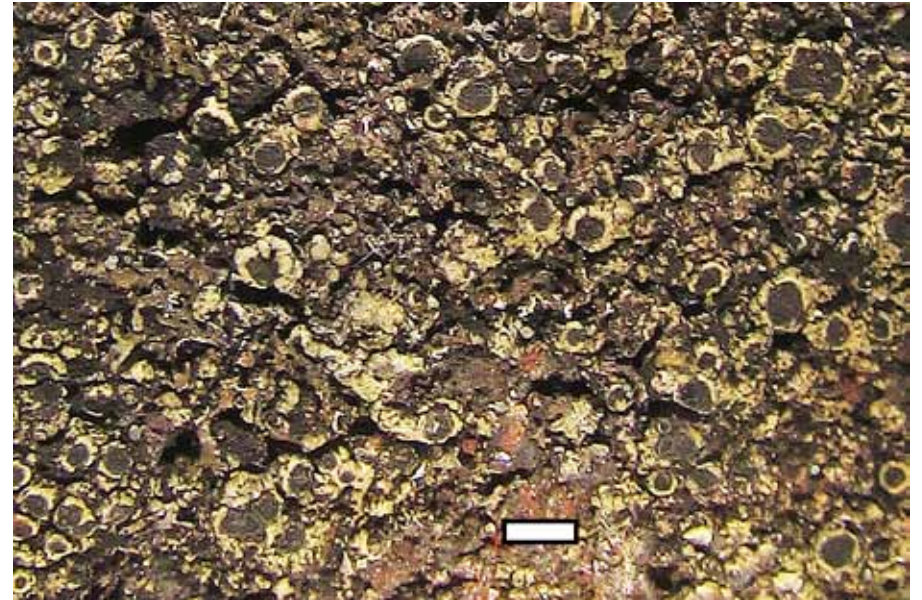


Figure 3. *Rinodina teniswoodiorum* (holotype in HO). Scale = 1 mm.



Figure 2. Ascospore ontogeny of *R. argopsina*. Scale = 10 μ m



Figure 4. Ascospore ontogeny of *R. teniswoodiorum*. Scale = 10 μ m

**A new species and new records of buellioid lichens
(Caliciaceae, Ascomycota) from the Kerguelen Islands**

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Abstract

Sixteen taxa of buellioid lichens are reported from the Kerguelen Islands in the southern Indian Ocean. *Buellia kerguelenica* Elix is new to science, while 12 taxa are new records for the islands. The new combination *Amandinea tristiuscula* (Nyl.) Elix is proposed for *Lecidea tristiuscula* Nyl. A detailed description and illustrations are provided for the latter species, and a key to the buellioid lichens of the islands is included.

The Kerguelen Islands are located in the southern Indian Ocean at 48°27'–50°01'S and 68°25'–70°33'E. The main island, Grande Terre, is 6,675 km² in area and is surrounded by a further 300 smaller islands and islets, forming an archipelago of 7,215 km². The highest point is Mont Ross in the Gallieni Massif, which rises along the southern coast of the island and has an elevation of 1,850 metres. The Cook Ice Cap (Calotte Glaciaire Cook) is a glacier with an area of about 403 km², and lies on the central-western part of the island. The island is volcanic in origin, mountainous with numerous bays, peninsulas and fiords. The archipelago has a subpolar oceanic climate, and is extremely windswept. Plant life is mainly limited to grasses, mosses and lichens, although the islands are also known for the indigenous, edible Kerguelen cabbage, *Pringlea antiscorbutica*.

Five species of buellioid lichens have previously been reported from the Kerguelen Islands, namely *Buellia disciformis* (Fr.) Mudd [as *B. parasema* deNot.] and *B. stellulata* (Taylor) Mudd (Tuckermann 1875); *Amandinea subplicata* (Nyl.) Øvstedal and *A. tristiuscula* (Nyl.) Elix (Crombie 1877) and *Buellia kerguelensis* C.W.Dodge (Dodge 1966). However, the report of *B. disciformis* from rocks is obviously incorrect, because that species is restricted to corticolous or lignicolous substrata.

In this contribution, *Buellia kerguelenica* Elix is described as new to science, and twelve new records of buellioid lichens are reported from the islands. A detailed description and illustrations are provided for the poorly known *Amandinea tristiuscula*.

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) and 50% nitric acid (N). 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 comparison with authentic samples. Most of the collections were made in 1971 by Dr R.C. Harris and the late Drs G.C. Bratt and H.A. Imshaug, and are lodged in MSC.

The new species

Buellia kerguelenica Elix, sp. nov. Fig. 1
Mycobank No. **MB 827345**

Similar to *Buellia subtegens* B.J.Murray, but differs in having irregular to angular, flat areoles, a much thinner hymenium (35–55 µm) and an inspersed subhymenium.

Type: Kerguelen Islands. Île Haute, shaded rock slope on SW edge of Table des Mouflons, 150 m alt., R.C. Harris 7084, 8.iii.1971 (MSC – holotype).

Thallus crustose, areolate; areoles separate, rarely contiguous, irregular and angular, ± flat, 0.1–0.5 mm wide, dark brown to dark olive-brown, often centred around base of apothecia; prothallus not apparent; photobiont cells 5–12 µm wide. *Medulla* white, lacking calcium oxalate (H₂SO₄-), I-. *Apothecia* 0.2–0.5 mm wide, abundant, lecideine, roundish, broadly adnate to sessile; disc black, epruinose, plane to convex with age; proper exciple thin, distinct, slightly raised above the disc, excluded in older convex apothecia, in section 35–40 µm thick; outer part brown-black, K-, N+ orange-brown; inner part brown. *Epihymenium* 10–15 µm thick, dark olive-brown to aeruginose-black, K-, N+ purple-brown. *Hypothecium* 85–170 µm thick, dark brown to brown-black, K-. *Hymenium* 35–55 µm thick, colourless, not inspersed; subhymenium 20–25 µm thick, brown, inspersed with oil droplets; paraphyses 1–2 µm wide, sparingly branched, with apices 3–4 µm wide, with dark olive-brown caps. *Asci* 8-spored, *Bacidia*-type. *Ascospores* *Buellia*-type, 1-septate, pale brown then dark brown, ellipsoid, 9–[11.8]–14 × 6–[7.1]–9 µm, very rarely constricted at the septum, not curved; outer wall smooth to finely ornamented. *Pycnidia* immersed, black, punctiform; conidia bacilliform, 6–8 × 1 µm. *Chemistry:* Medulla K-, C-, PD-, UV-; no lichen substances detected.

Remarks

Both *Buellia subtegens* and *B. kerguelenica* are characterized by discontinuous, areolate thalli, the absence of a prothallus, similar-sized *Buellia*-type ascospores that are not constricted at the septum, an aeruginose epihymenium, a brown hypothecium, a non-amyloid medulla and bacilliform conidia. However, *Buellia subtegens* differs in forming convex, hemispherical areoles, in having a much thicker hymenium, 80–100 µm thick, and a non-inspersed subhymenium (Murray 1963). Presently *B. subtegens* is only known from Antarctica. *Buellia evanescens* Darb. is also rather similar to *B. kerguelenica*, but it has a colourless to very pale brown hypothecium and commonly constricted ascospores (Lamb 1968).

New combination

Amandinea tristiuscula (Nyl.) Elix, comb. nov. Figs 2, 3
Mycobank No.: **MB 826924**

Lecidea tristiuscula Nyl. in Crombie, *J. Bot. (London)* **15**, 190 (1877).

Buellia tristiuscula (Nyl.) Zahlbr., *Catal. Lich. Univ.* **7**, 424 (1931).

Type: Îles Kerguelen, Swain's Bay, on coastal rock, A.E. Eaton [Transit of Venus Expedition], i.1875 (BM 001097145 – holotype!).

Buellia kerguelensis C.W.Dodge, *Comité Français des Recherches Antarctiques (Paris)* **15**, 8 (1966).

Type: Kerguelen Islands, Presqu'île Courbet, Plaine des Drumlins, on pebbles of denuded moraines with *Usnea*, E. Aubert de la Rüe 77, 1963 (HUH – holotype!).

Thallus crustose, forming extended patches to c. 20 mm wide, epilithic, grey-white to grey-brown, to 0.4 mm thick, effuse and discontinuous to rimose-areolate, individual areoles 0.2–0.4 mm wide; prothallus black when abutting other lichens or not apparent; medulla white, lacking calcium oxalate (H₂SO₄-), I-; photobiont cells 7–14 µm wide. *Apothecia* 0.1–0.5 mm wide, lecideine, immersed then broadly adnate or becoming sessile and constricted at the base, scattered or crowded, rounded or irregular through mutual pressure; disc dark brown to black, epruinose, weakly concave to plane; proper excipulum distinct, persistent, often slightly higher than the disc, in section 35–60 µm thick; outer zone dark brown to black-brown, K-, paler brown within. *Epihymenium* 12–15 µm thick, dark brown, K-, N-. *Hypothecium* 150–250 µm thick, dark brown to brown-black, K-, N+ orange-brown. *Hymenium* 80–90 µm thick, colourless; subhymenium 30–50 µm thick, pale brown, densely inspersed with oil droplets; paraphyses 1.5–1.8 µm wide, simple to sparsely branched; apices 4–5 µm wide, with dark brown caps. *Asci* of the *Bacidia*-type, 8-spored. *Ascospores* at first of the *Orcularia*-type, later of the *Physconia*-type, 1-septate, pale olive-green to brown, ellipsoid, 17–[20.1]–24 × 8–[11.4]–14 µm, rarely constricted or dilated at the septum; outer spore-wall rugulate. *Pycnidia*

common, pyriform, superficial, black; conidia filiform, curved, 16–24 × 0.7–1 µm.
Chemistry: Thallus K–, C–, P–, UV–; no lichen substances detected.

Remarks

This species is most likely to be confused with *A. variabilis* (see below) in that both have *Orcularia*-type ascospores in the early stages of their development, a subhymenium interspersed with oil droplets, similar thalli, numerous pycnidia, and both lack lichen substances. However, the ascospores of *A. variabilis* are smaller, 11–[16.0]–20 × 6–[8.7]–12 µm, and are consistently dilated at the septum (Blaha *et al.* 2016).

Authentic material of *A. tristiuscula* has only been seen from the Kerguelen Islands, although it has also been reported for Prince Edward Island (Øvstedal & Gremmen 2007), Heard Island (Øvstedal & Gremmen 2008) and Marion Island (Øvstedal & Gremmen 2014).

SPECIMENS EXAMINED

Kerguelen Islands. • Presqu'île Jeanne d'Arc, seashore just W of Port-Jeanne d'Arc, sea level, on rock, *R.C. Harris 6649*, 19.ii.1971 (MSC); • Isthme du Lac, stonefield on Anse de St. Marlo side of saddle, 220 m alt., on rock, *H.A. Imshaug 48799*, 4.iii.1971 (MSC).

New records

1. *Amandinea antipodensis* Elix, *Australas. Lichenol.* **81**, 69 (2017)

This species was previously known from the subantarctic Antipodes, Auckland, Campbell and the Snares Islands (Elix 2017b). It is characterized by the crustose, rimose, continuous, off-white to creamy white thallus with a granular upper surface, an interspersed subhymenium and hypothecium, a medulla containing high concentrations of calcium oxalate, *Physconia*- then *Buellia*-type ascospores, 13–[15.4]–18 × 5–[7.5]–9 µm, which become constricted at the septum and have rugulate outer walls, curved, filiform conidia, 12–18 × 0.7–1 µm, and a lack of lichen substances. A detailed description and illustrations are given in Elix (2017b).

SPECIMENS EXAMINED

Kerguelen Islands. • Île Haute, leeward shore on point on W side of Anse des Rennes, sea level, *R.C. Harris 7013 pr. p.*, 6.iii.1971 (MSC); • Île Haute, seashore at eastern-most point of island, sea level, *R.C. Harris 7018 pr. p.*, 6.iii.1971 (MSC).

2. *Amandinea austroconiops* Elix & Kantvilas, *Australas. Lichenol.* **78**, 23 (2016)

This species was previously known from Tasmania, the South Island of New Zealand, Macquarie Island and Campbell Island (Elix & Kantvilas 2016; Elix 2017a,b). It is characterized by the crustose, white to grey-white rimose-areolate thallus, broadly adnate to rarely sessile, lecideine apothecia, 0.3–1 mm in diam., relatively large, 1-septate *Physconia*- then *Buellia*-type ascospores, 15–[19.6]–25 × 8–[11.2]–14 µm, which become constricted at the septum and have rugulate outer walls, curved, filiform conidia, (15–)20–27 × 0.7–1 µm, an amyloid medulla, interspersed hymenium and a lack of lichen substances. A detailed description and illustrations are given in Elix & Kantvilas (2016).

SPECIMENS EXAMINED

Kerguelen Islands. • Presqu'île Jeanne d'Arc, 2 km SSE of Port-Jeanne d'Arc, sea level, on old wood, *G.C. Bratt 71/297*, 24.ii.1971 (MSC); • Presqu'île Ronarc'h, sea cliffs 0.25 km E of Port-Douzième, sea level, on rock, *G.C. Bratt 71/766*, 22.ii.1971 (MSC); • Île Haute, coastal rocks along bay NE of Anse des Rennes, sea level, *R.C. Harris 6616*, 18.ii.1971 (CANB, MSC); • Presqu'île Jeanne d'Arc, lower part of stream in Ravin du Charbon, 50–100 m alt., on rock, *R.C. Harris 6640*, 19.ii.1971 (MSC); • Presqu'île Jeanne d'Arc, dry field just behind Port-Jeanne d'Arc, 20 m alt., on small stones, *R.C. Harris 6777*, 23.ii.1971 (MSC); • Île Haute, wet stony area on N side of isthmus, E of cabin, sea level, *R.C. Harris 6943*, 5.iii.1971 (MSC); • Péninsule Courbet, sheltered cliffs near summit of Pointe Molloy, 50–100 m alt., on rock,

H.A. Imshaug 48302, 16.iii.1971 (MSC); • Île Longue, first small headland E of Port-Bizet, on rock, *H.A. Imshaug 49188*, 19.iii.1971 (MSC).

3. *Amandinea babingtonii* (Hook.f. & Taylor) Søchting & Øvstedal, *Biblioth. Lichenol.* **88**, 615 (2004)

This species was previously known from the Antarctic Peninsula, Bouvetøya and the South Shetlands Islands (Øvstedal & Lewis Smith 2001; Søchting *et al.* 2004). It is characterized by a crustose, brownish grey thallus with subeffigurate margins, a thin, brown marginal prothallus, a non-amyloid medulla that lacks calcium oxalate, broadly adnate to sessile, lecideine apothecia, 0.3–0.5 mm in diam., ellipsoid to slightly curved, 1-septate *Physconia*- then *Buellia*-type ascospores, 15–[17.6]–20 × 7–[8.0]–9 µm, which become constricted at the septum and have microrugulate outer walls, curved, filiform conidia, 10–21 × 0.7 µm, and a lack of lichen substances. A detailed description and illustrations are given in Lamb (1968, as *Buellia babingtonii*).

SPECIMEN EXAMINED

Kerguelen Islands. • Péninsule Courbet, Pointe Denis on Baie de l'Aurore Australe, W of Port-aux-Français, on rock, *H.A. Imshaug 49083*, 15.iii.1971 (MSC).

4. *Amandinea fuscoatrata* (Zahlbr.) Elix, *Australas. Lichenol.* **77**, 39 (2015)

This species was previously known from New Zealand, Tasmania and southern-most South America (Blaha *et al.* 2016; Elix *et al.* 2018). It is characterized by the crustose, rimose-areolate, pale to dark grey or grey-brown thallus, the initially immersed then broadly adnate to sessile apothecia, the non-amyloid medulla, non-interspersed subhymenium, 1-septate, *Physconia*- then *Buellia*-type ascospores, 11–16 × 5–10 µm, curved, filiform conidia, 15–25 µm long, and an absence of lichen substances. A detailed description and illustrations are given in Blaha *et al.* (2016).

SPECIMEN EXAMINED

Kerguelen Islands. • Presqu'île du Prince de Galles, summit of cliffs and top of hill at Pointe Guite, 97 m alt., on rock, *H.A. Imshaug 48700*, 28.ii.1971 (MSC).

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

This taxon was previously known from Australia, New Zealand and Campbell Island (Elix & Kantvilas 2013a; Mayrhofer *et al.* 2016; Elix 2018). It is distinguished by a conspicuous, well-developed, whitish to pale grey or olive-brown, crustose to squamulose thallus with a smooth to often granular or sorediate upper surface. It is further characterized by having a non-interspersed hymenium, *Physconia*- then *Buellia*-type, 1-septate, ellipsoid ascospores, (11–)13–20 × (5–)6–8 µm, with a smooth to weakly ornamented outer wall, curved, filiform conidia (12–)18–26 × 0.7–1 µm, and an absence of lichen substances. A detailed description and illustrations are provided in Elix & Kantvilas (2013a).

SPECIMEN EXAMINED

Kerguelen Islands. • Presqu'île Jeanne d'Arc, seashore just W of Port-Jeanne d'Arc, sea level, on old wood, *R.C. Harris 6642*, 19.ii.1971 (MSC).

6. *Amandinea nitrophila* (Zahlbr.) Elix, *Australas. Lichenol.* **77**, 40 (2015)

This species was previously known from New Zealand, Heard Island, southern-most South America (Blaha *et al.* 2016) and Campbell Island (Elix 2017b). It is characterized by the crustose, rimose- to verrucose-areolate, grey-white to grey-brown or brown thallus, broadly immersed to adnate apothecia, a non-amyloid medulla, interspersed subhymenium, 1-septate, *Physconia*- then *Buellia*-type ascospores, 12–20 × 7–12 µm, curved, filiform conidia, 12–27 µm long, and an absence of lichen substances. A detailed description and illustrations are provided in Blaha *et al.* (2016).

SELECTED SPECIMENS EXAMINED

Kerguelen Islands. • Péninsule Courbet, rock outcrops 0.5 km W of church at Port-aux-Français, sea level, on rock, *G.C. Bratt 71/574*, 13.iii.1971 (MSC); • Presqu'île Ronarc'h, sea cliffs 0.25 km E of Port-Douzième, sea level, on rock, *G.C. Bratt 71/765*, 22.ii.1971 (MSC); • Péninsule Courbet, E side of base of Pointe Molloy Peninsula, sea level, on rock, *R.C. Harris 6573*, 16.ii.1971 (MSC); • Presqu'île Jeanne d'Arc, lower part of stream in Ravin du Charbon, 50–100 m alt., on rock, *R.C. Harris 6632*, 19.ii.1971 (MSC); • Presqu'île Jeanne d'Arc, small bay at mouth of stream 1 km W of Port Jeanne d'Arc, sea level, on rock, *R.C. Harris 6795*, 24.ii.1971 (MSC); • Presqu'île du Prince de Galles, summit of cliffs and top of hill at Pointe Guite, 97 m alt., on rock, *H.A. Imshaug 48699*, 28.ii.1971 (MSC).

7. *Amandinea subcervina* (Nyl.) Elix, *Australas. Lichenol.* **81**, 9 (2017)

This species was known previously from southern-most South America (Lamb 1968), Macquarie Island (Elix 2017a), Campbell Island and Stewart Island (Elix 2017b). It is characterized by a continuous, rimose to rimose-areolate, pale grey to grey-brown or tawny brown thallus that lacks secondary lichen substances and is often delimited by a dark prothallus, its small, often immersed, lecideine apothecia, 0.2–0.5 mm in diam., with *Physconia*- then *Buellia*-type ascospores, 15–[17.9]–22 × 8–[9.8]–13 µm, which become constricted at maturity and have a rugulate outer spore-wall, and curved, filiform conidia, 12–22 × 0.7–1 µm. A detailed description is given in Lamb (1968) and illustrations in Elix (2017a).

SPECIMENS EXAMINED

Kerguelen Islands. • Presqu'île Ronarc'h, sea cliffs 1.5 km E of Port-Douzième, 50–100 m alt., on rock, *G.C. Bratt 71/663*, 18.iii.1971 (MSC); • Péninsule Courbet, E side of base of Pointe Molloy Peninsula, sea level, on rock, *R.C. Harris 6565*, 16.ii.1971 (MSC); • Péninsule Courbet, bluff above Baie Norvégienne, near mouth of Rivière du Château, 25 m alt., on rock, *R.C. Harris 7140*, 14.iii.1971 (MSC).

8. *Amandinea variabilis* Elix, Blaha & H.Mayrhofer, *Australas. Lichenol.* **79**, 43 (2016)

This species was previously known from southern Victoria, Tasmania, New Zealand (Blaha *et al.* 2016) and Campbell Island (Elix 2017b). It is characterized by having immersed then broadly adnate or sessile apothecia, *Orcularia*- then *Physconia*-type ascospores, (11–)13–16.0–18(–20) × 6–8.7–12 µm, which are not constricted but swollen at the septum, a subhymenium interspersed with oil droplets, and no lichen substances. *Amandinea otagensis* (Zahlbr.) Blaha, H.Mayrhofer & Elix is similar, but differs in having mainly immersed apothecia, a non-interspersed subhymenium and shorter ascospores, 12–[14.1]–16(–17) µm. A detailed description is given in Blaha *et al.* (2016).

SELECTED SPECIMENS EXAMINED

Kerguelen Islands. • Bras de la Fonderie, coastal rocks and cliffs W of Col Demi-Lune, sea level, on rock, *G.C. Bratt 71/548*, 8.iii.1971 (MSC); • Presqu'île Jeanne d'Arc, small bay at mouth of stream 1 km W of Port-Jeanne d'Arc, sea level, on rock, *R.C. Harris 6787*, 24.ii.1971 (MSC); • Péninsule Courbet, fieldmark N of Port-aux-Français on E end of Plateau des Drumlins, on rock, *H.A. Imshaug 49062*, 14.iii.1971 (MSC); • Péninsule Courbet, Pointe Denis on Baie de l'Aurore Australe, W of Port-aux-Français, on rock, *H.A. Imshaug 49082*, 15.iii.1971 (MSC); • Île Longue, first small headland E of Port-Bizet, on rock, *H.A. Imshaug 49186*, 19.iii.1971 (MSC).

9. *Buellia melanostola* (Hue) Darb., *Lichens. British Antarctic (Terra Nova) Expedition, 1910. Natural History Report 3*, 63 (1923)

This species was previously known from the Antarctic Peninsula, Bouvetøya, South Georgia and the South Orkney Islands (Øvstedal & Lewis Smith 2001). It is characterized by a thin, crustose, dark brownish grey to black-brown, effuse to verruculose thallus with a black, marginal prothallus, a non-amyloid medulla that lacks calcium oxalate, broadly adnate to

sessile, lecideine apothecia, 0.3–0.5 mm in diam., an olive-brown, N+ purple-brown epiphytenium, a brown hypothecium, ellipsoid, 1-septate *Orcularia*- then *Physconia*-type ascospores, 15–[19.1]–22 × 8–[11.0]–14 µm, which become constricted at the septum and have microrugulate outer walls, the bacilliform conidia, 3–4 × 0.7 µm, and a lack of lichen substances. A detailed description and illustrations are given in Lamb (1968). *Buellia perlata* (Hue) Darb. is very similar, but has a thicker, verrucose, pale grey thallus and smaller ascospores, 14–[16.1]–18 × 6–[7.8]–9 µm (Lamb 1968).

SPECIMENS EXAMINED

Kerguelen Islands. • Péninsule Courbet, 1.5 km N of Port-aux-Français, near Rivière du Château, 50 m alt., on rock, *R.C. Harris 6873*, 28.ii.1971 (MSC); • Péninsule Courbet, on SE side of rock dome (La Taupinière) and on surrounding talus, 250 m alt., on rock, *H.A. Imshaug 48888*, 6.iii.1971 (MSC).

10. *Buellia pygmaea* (Räsänen) Elix, H.Mayrhofer & J.M.Rodr., *Australas. Lichenol.* **83**, 5 (2018)

This species was previously known from Tierra del Fuego (Elix *et al.* 2018). It is characterized by a crustose, areolate thallus of white to yellow-white areoles that can be aggregated or dispersed, irregular, angular, ± flat, 0.1–0.4 mm wide, on a prominent black prothallus. The medulla lacks calcium oxalate, but is always amyloid. This species has immersed, lecideine apothecia, 0.1–0.3 mm in diam., an interspersed subhymenium, ellipsoid, 1-septate *Buellia*-type ascospores, 8–[10.5]–12 × 5–[7.2]–8 µm, not constricted at the septum, that have microrugulate outer walls and bacilliform conidia, 4.5–6.5 × 1 µm. It contains norstictic acid. A detailed description and illustrations are given in Elix *et al.* (2018).

SPECIMEN EXAMINED

Kerguelen Islands. • Presqu'île Jeanne d'Arc, rock pinnacles S of Mont du Refuge, 500–600 m alt., on rock, *R.C. Harris 6744*, 22.ii.1971 (MSC).

11. *Buellia stellulata* var. *tasmanica* Elix & Kantvilas, *Australas. Lichenol.* **73**, 32 (2013)

This taxon was previously known from Australia (Elix & Kantvilas 2013b), New Zealand (Elix *et al.* 2017) and southern-most South America (Elix *et al.* 2018). Morphologically, it is identical to *Buellia stellulata* (Taylor) Mudd var. *stellulata*, but it can be readily distinguished chemically because the latter contains additional 2'-*O*-methylperlatolic acid (major) and confluent acid (minor). A detailed description is given in Elix & Kantvilas (2013b).

SPECIMEN EXAMINED

Kerguelen Islands. • Presqu'île Jeanne d'Arc, rock outcrop 1.5 km W of Port-Jeanne d'Arc, 100 m alt., on rock, *R.C. Harris 6774 pr. p.*, 23.ii.1971 (MSC).

12. *Monerolechia badia* (Fr.) Kalb, *Biblioth. Lichenol.* **88**, 312 (2004)

A detailed description of this cosmopolitan species is given in Elix (2011).

SPECIMEN EXAMINED

Kerguelen Islands. • Péninsule Courbet, rock outcrops 0.5 km W of church at Port-aux-Français, sea level, on rock, *G.C. Bratt 71/572*, 13.iii.1971 (MSC).

Distribution

A total of 16 buellioid lichens have been identified from the Kerguelen Islands. Two species were found on old wood, although there are no endemic trees on the island. One of those species, *Amandinea austroconiops*, is very common on rocks on Kerguelen, so the colonization of wood appears fortuitous. The second taxon, *Amandinea lignicola* var. *australis* is more interesting, in that it also occurs in southern Australia, New Zealand and Campbell Island. Two of the species in the Kerguelen Islands were previously known only from Antarctica and South Georgia (*A. babingtonii* and *B. melanostola*), nine taxa have a southern cool-temperate to

subantarctic distribution (*A. antipodensis*, *A. austroconiops*, *A. fuscoatratura*, *A. nitrophila*, *A. subcervina*, *A. subplicata*, *A. tristiuscula*, *A. variabilis*, *B. pygmaea* and *B. stellulata* var. *tasmanica*), and two species are cosmopolitan (*Buellia stellulata* and *Monerolechia badia*). At the present time, *B. kerguelenica* is known only from these islands.

Key to the species of buellioid lichens in the Kerguelen Islands

- 1 Thallus lignicolous 2
 1: Thallus saxicolous 3
- 2 Ascospores 15–25 × 8–14 µm; subhymenium inspersed .. **Amandinea austroconiops**
 2: Ascospores 11–20 × 5–8 µm; subhymenium not inspersed
 **Amandinea lignicola** var. **australis**
- 3 Thallus containing lichen substances 4
 3: Thallus lacking lichen substances 6
- 4 Thallus K+ red; norstictic acid present **Buellia pygmaea**
 4: Thallus K–; norstictic acid absent 5
- 5 Atranorin, ± roccellic acid present **Buellia stellulata** var. **tasmanica**
 5: Atranorin, 2'-*O*-methylperlatolic, ± confluent, ± roccellic acids present
 **Buellia stellulata** var. **stellulata**
- 6 Thallus squamulose, initially lichenicolous **Monerolechia badia**
 6: Thallus crustose, never lichenicolous 7
- 7 Medulla I+ purple-blue; ascospores 15–25 × 8–14 µm **Amandinea austroconiops**
 7: Medulla I– 8
- 8 Medulla containing calcium oxalate, H₂SO₄+ **Amandinea antipodensis**
 8: Medulla lacking calcium oxalate, H₂SO₄– 9
- 9 Ascospores with marked, medial wall-thickenings, *Orcularia*- to *Physconia*-type . 10
 9: Ascospores *Buellia*-type 12
- 10 Subhymenium not inspersed; conidia bacilliform, 3–4 µm long
 **Buellia melanostola**
 10: Subhymenium inspersed; conidia curved, filiform, 16–24 µm long 11
- 11 Ascospores 17–[20.1]–24 × 8–[11.4]–14 µm **Amandinea tristiuscula**
 11: Ascospores 11–[16.0]–20 × 6–[8.7]–12 µm **Amandinea variabilis**
- 12 Ascospores persistently *Buellia*-type; conidia bacilliform, 6–8 µm long
 **Buellia kerguelenica**
 12: Ascospores with weak medial wall-thickenings during spore ontogeny, mature
 spores *Buellia*-type; conidia curved, filiform, 10–27 µm long 13
- 13 Ascospores 11–16 × 5–10 µm **Amandinea fuscoatratura**
 13: Ascospores 12–25 × 7–16 µm 14
- 14 Thallus margins subeffigurate **Amandinea babingtonii**
 14: Thallus margins not subeffigurate 15

- 15 Disc gyrose; subhymenium not inspersed **Amandinea subplicata**
 15: Disc not gyrose; subhymenium inspersed or not 16
- 16 Subhymenium not inspersed; thallus thick, chinky **Amandinea subcervina**
 16: Subhymenium inspersed; thallus thin, rimose-areolate **Amandinea nitrophila**

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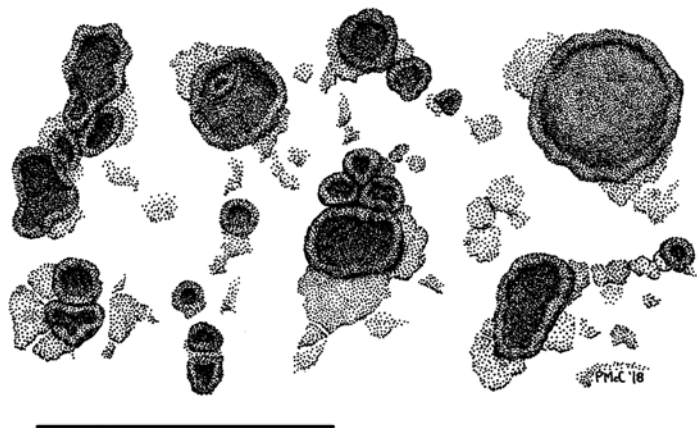


Figure 1. *Buellia kerguelenica* (holotype in MSC). Scale bar = 1 mm.



Figure 2. *Amandinea tristiuscula* (Harris 6649 in MSC). Scale bar = 2 mm.

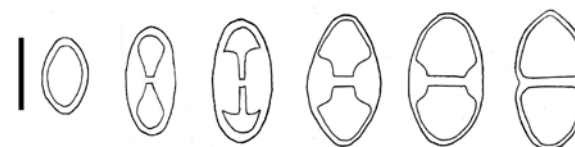


Figure 3. Ascospore ontogeny of *A. tristiuscula*. Scale bar = 10 µm.

Corrections to reports of buellioid lichens from New Zealand's subantarctic islands, including *Sclerococcum thelotrematicola* comb. nov. and *Epilichen scabrosus* new to the Southern Hemisphere

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Abstract

The type, and only, collections of *Buellia campbelliana* Elix and *Buellia thelotrematicola* Elix are shown to be referable to *Epilichen scabrosus* (Ach.) Clem. and *Sclerococcum*, respectively. *Epilichen scabrosus* is here reported for the first time from the Southern Hemisphere. The new combination *Sclerococcum thelotrematicola* (Elix) Fryday is made, and the host species is shown to be *Gintarasia lamellifera*. The report of *Buellia sharpiana* Lendemer & R.C.Harris from New Zealand is also re-assessed.

Introduction

The herbarium of Michigan State University (MSC) holds a large collection of lichens from New Zealand (mostly from the subantarctic islands), which were collected by Henry Imshaug and Richard Harris between 1969 and 1972 (Fryday & Prather 2001). As part of a revision of buellioid lichen in Australasia, 72 collections provisionally assigned to *Buellia* s. lat. were sent on loan to John (Jack) Elix (CANB) who examined and annotated all these collections, describing five new species (Elix 2017, 2018) and adding several new records for New Zealand. However, inspection of the type specimens of the two lichenicolous species described by Elix upon their return to MSC has shown that they have been mis-interpreted and are, in fact, referable to genera other than *Buellia*. Elix also identified a collection from South Island as *Buellia sharpiana*, which is otherwise known only from a single locality in the Appalachian Mountains of eastern North America.

Buellia campbelliana Elix, *Australas. Lichenol.* **82**, 60 (2018)

The specimen from Campbell Island agrees morphologically in all respects with Northern Hemisphere specimens of *Epilichen scabrosus* (Ach.) Clem. Excellent descriptions of that species are already present in the literature (Gilbert & Hawksworth 2009; McCune 2017), and images are available online, so those are not included here. The only apparent difference from Northern Hemisphere collections is the reported chemistry. Elix (2018) reported 2-*O*-methylsekikaic acid (major) and usnic acid (minor), whereas Northern Hemisphere collections are said to contain pulvinic acid derivatives (Hafellner 1978). However, comparative tic of the Campbell Island collection with two collections from North America (Fryday 8161, Weber S 7147 - see below) and a specimen of the same exsiccati number as that tested by Leuckert (*Plant. Graec. Lich.* 21) revealed an almost identical chemistry in all four samples (Fig. 1). The chemistry is currently under investigation by the author and Prof. Elix, and will be reported on in due course.

Elix (2018) reported the host species as an undetermined *Cladonia* with a dull, grey-brown squamulose thallus containing the stictic acid chemosyndrome, but the thallus is an areolate crust with occasional marginal lobes and almost certainly represents a species of *Baeomyces* Pers., which is the usual host for *E. scabrosus*. The only species of *Baeomyces* reported from New Zealand is *B. heterophyllus* Nyl. ex C. Bab & Mitt., but that contains norstictic acid. The present lichen more closely resembles *B. rufus* (Huds.) Rebert., which has been reported from Tasmania (Kantvilas *et al.* 2012), but without ascomata that determination must remain provisional.

Epilichen scabrosus (Ach.) Clem., *Gen. Fung.* (Minneapolis) 174 (1909)
Lecidea scabrosa Ach., *Methodus*, Sectio prior (Stockholmia) 48 (1803); *Buellia scabrosa* (Ach.) A.Massal., *Geneac. Lich.* (Verona) 20 (1854).
Buellia campbelliana Elix *syn. nov.*, *Australas. Lichenol.* **82**, 60 (2018).

SPECIMENS EXAMINED

Buellia campbelliana Elix: **New Zealand**. • Campbell Island, cliffs and shingle feldmark at summit of Mt. Fizeau (1655 ft.), *H.A. Imshaug* 46790, 10.i.1970 (holotype – MSC0101815).
Epilichen scabrosus (Ach.) Clem.: **Austria**. • *Steiermark*, Ostalpen, Schladminger Tauern, Kleinsölk-Obertal, zwischen Putzenalm und Prebertörl, 1940 m, *J. Hafellner*, 9.viii.1975, (WIS — *Plant. Graeceneses Lich.* 21). **U.S.A. Alaska**. • Denali Natl Park, NW slope to summit of Mt. Eielson, 63° 25'N, 150° 20'W, 3,500 – 5,500 ft, moist tundra, *W.A. Weber*, 25.vii.1956 (S 7147) & *L.A. Viereck* (MSC); • North Slope Borough, Atkasuk, disused airstrip, on *Baeomyces carneus* on compacted soil, *A.M. Fryday* 8161, 12.vii.2001 (MSC).

Buellia sharpiana Lendemer & R.C.Harris, *Castanea* **78**, 148 (2013)

Elix & Knight (2017) reported *B. sharpiana* as new to New Zealand from a single collection made by Richard Harris from a grassy roadside hillside on South Island in 1973 (see below). *Buellia sharpiana* is a narrow endemic species that was described from a single mountain summit in Great Smoky Mountains National Park in the southern Appalachian Mountains of eastern North America. The rock outcrops at the type locality are at an altitude of 1920 m and of Precambrian age (>500 mybp), belonging to the Anakeesta Formation, which is characterized by iron sulfide-rich slate, shale, and sandstone that weathers to a rusty brown colour and hosts a distinctive community of crustose lichens including heavy-metal-tolerant species such as *Acarospora sinopica* (Wahlenb.) Körb. and *Rhizocarpon oederi* (Weber) Körb. (Lendemer & Harris 2013). The locality of the collection reported by Elix & Knight (2017) is given as “Grassy hillside on north side of Route 73 along Craigieburn River”, but other collections in MSC which were made at the same time are more specific, giving it as “at junction of Craigieburn River and Route 73” which puts it at an altitude of c. 675 m. The rock of this area is Torlesse greywacke (sedimentary sandstone and mudstone) of early Cretaceous age (100–150 mybp; Reznichenko 2012). There is no visual indication that iron sulfide or any other heavy metal is present in the substratum of the *Buellia*. Nor is this suggested by the other species collected at the site (*Cladia aggregata* aggr., *Cladonia capitellata*, *C. pleurota*, *Lecanora epibryon* subsp. *broccha*, *Placopsis perrugosa*, *Stereocaulon ramulosum*), which are all widespread in New Zealand. Although intercontinental disjunct distributions are relatively frequent in lichenized-fungi — for example, see *Epilichen scabrosus* above — the fact that *B. sharpiana* is otherwise known from only a single locality 13,700 km away on a different continent in ecologically different circumstances casts doubt on the determination of the New Zealand collection.

The New Zealand collection resembles *B. sharpiana* in having a thallus containing arthothelin and an amyloid (I+ blue) medulla but whereas *B. sharpiana* has a brown to yellow thallus reacting KC+ orange-red and UV+ dull orange, the thallus of the New Zealand collection is grey and KC and UV– (Fig. 2A–B). The apothecia of *B. sharpiana* are also consistently innate with a hyaline, poorly differentiated exciple whereas the apothecia of the New Zealand collection become sessile upon maturity with a well-developed blue-black (N+ red) exciple c. 50 µm wide (Fig. 2E). The New Zealand collection also differs in the dilute brown hypothecium (hyaline in *B. sharpiana*) and slightly larger ascospores (Fig. 2C–E).

In spite of the similarities between the New Zealand collection and *B. sharpiana*, the differences are significant, and *B. sharpiana* should be removed from the New Zealand lichen checklist.

SPECIMENS EXAMINED

Buellia sharpiana Lendemer & R.C. Harris (all NY): **U.S.A.** • *Tennessee*, Sevier Co., Great Smoky Mountains National Park, Myrtle Point, c. 0.3 mi E of the summit of Mt LeConte, 35.6533°–83.4317°, 6482 ft [1976 m] alt., open Anakeesta rock outcrop with spruce (*Picea*) – fir (*Abies*) forest including *Rhododendron*, *Vaccinium* and *Sorbus*, *J.L. Allen* 3966, 28.ix.2014; • *ibid.*, Myrtle Point to summit of Mt. LeConte, 35.653239°–83.431689°, 1991 m alt., boreal forest intermixed with exposed rocks (Anakeesta Formation) *Abies fraseri*, *Picea rubens*, *Sorbus americana*, *Rhododendron catawbiense*, *Rhododendron minus*, *Leiophyllum buxifolium*, *E.A. Tripp* 5015, 5920, 28.ix.2014; • *ibid.*, summit area of Mt. LeConte, Bullhead Trail, 5–6.8 mi from

parking area on Cherokee Orchard Road, cliff tops, and 0–2 mi on Rainbow Falls Trail from summit, 35.6769°–83.4481°, *Abies-Picea-Betula alleghaniensis-Sorbus-Acer spicatum-Sambucus* forest with exposed Anakeesta outcrops covered with *Rhododendron minus*, E.A. Tripp 2168A, 2214, 9.x.2011, (topotypes).

Buellia sp. **New Zealand** [Canterbury]. • Malvern County, grassy hillside on north side of Route 73 along the Craigieburn River, [43° 8.270' S, 171° 45.525' E, 675 m alt.], R.C. Harris 6433, 24.i.1971 (MSC).

Buellia thelotrematicola Elix, *Australas. Lichenol.* **82**, 61 (2018)

The specimen from Auckland Island is clearly a species of the lichenicolous genus *Sclerococcum* (Fig. 3), which was recently shown to be the correct name for *Dactylospora* Körb. (Diederich *et al.* 2018). It closely resembles *Sclerococcum parasiticum* (Flörke) Diederich & Ertz, which occurs on the thallus of species of *Ochrolechia* and *Pertusaria* (Hafellner 1979, 2004). *Sclerococcum parasiticum* has previously been reported from New Zealand (Galloway 2007) from a single collection made by William Colenso (as *Lecidea parasitica* Flörke; Nylander 1888), but because the host of the present species is not closely related to *Ochrolechia* and *Pertusaria* (Pertusariales), it appears prudent to maintain the Auckland Island collection as a distinct species, and the necessary new combination is made below.

Elix (2018) reported the host of his new species as *Thelotrema* sp., presumably because Imshaug had annotated the packet “parasitic on *Thelotrema concentricum*”. However, *Thelotrema concentricum* was Imshaug’s working (unpublished) name for the species later described as *Chroodiscus lamelliferus* Kantvilas & Vězda (Kantvilas & Vězda 2000), for which the current name is *Gintarasia lamellifera* (Kantvilas & Vězda) Kraichak, Lücking & Lumbsch (Kraichak *et al.* 2013).

SPECIMENS EXAMINED

Sclerococcum thelotrematicola (Elix) Fryday comb. nov.

Mycobank No.: **MB 829598**

Basionym: *Buellia thelotrematicola* Elix (as ‘*thelotremicola*’), *Australas. Lichenol.* **82**, 61 (2018). *Type*: New Zealand, Auckland Islands, Auckland Island, west arm of Musgrave Harbour, east of Fleming Plateau, 28 December 1972, H.A. Imshaug 57066 (holotype – MSC0110627).

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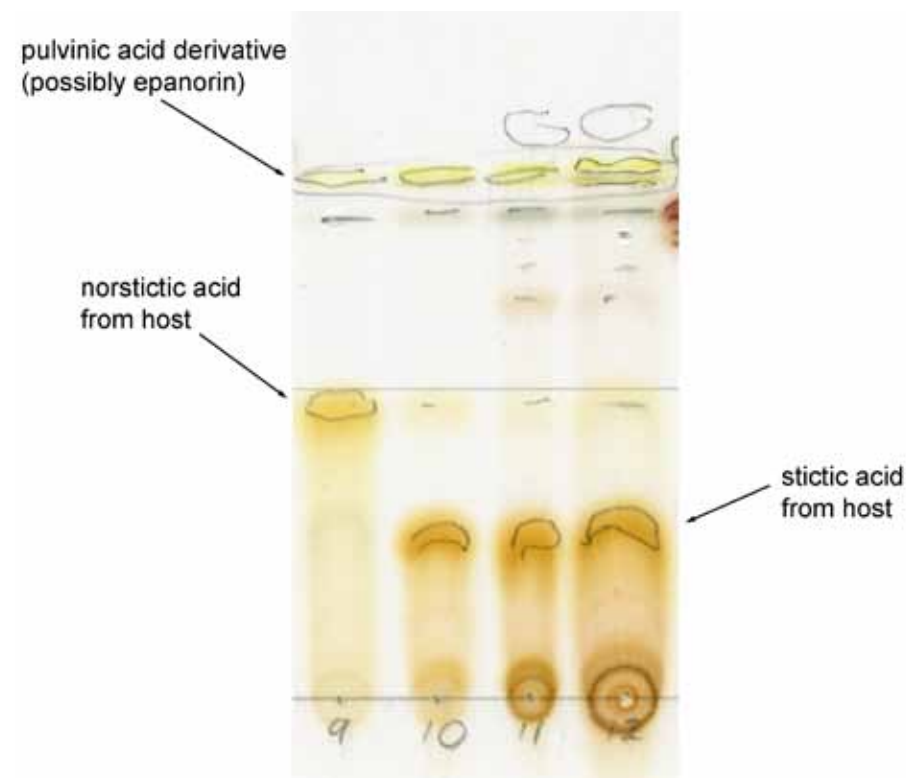


Figure 1: thin-layer chromatography plate (solvent C: toluene 200; acetic acid 30).

- 9: *Epilichen scabrosus* (Fryday 8161)
 10: *Epilichen scabrosus* (Plant. Graec. Lich. 21)
 11: *Buellia campbelliana*
 12: *Epilichen scabrosus* (Weber S 7147).

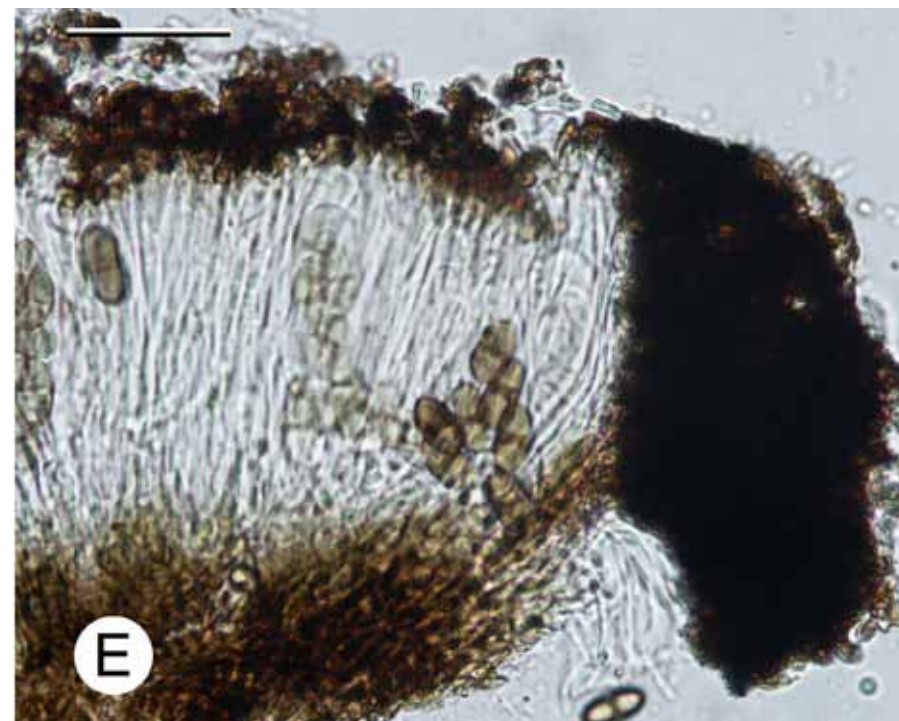
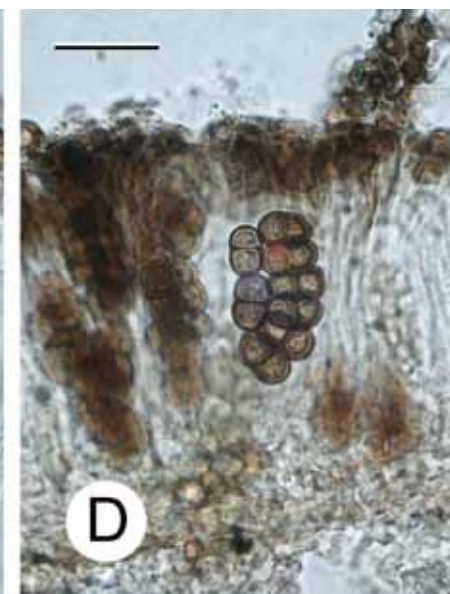
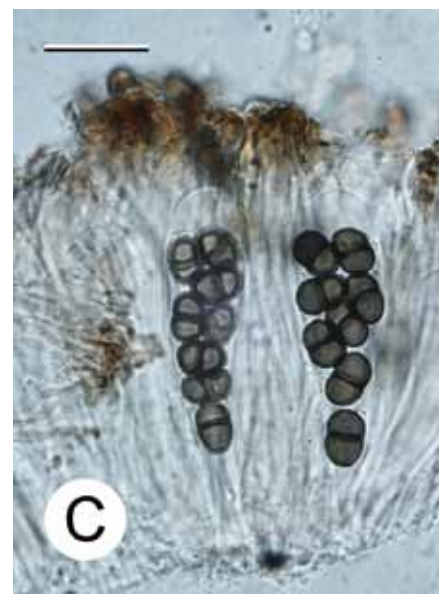
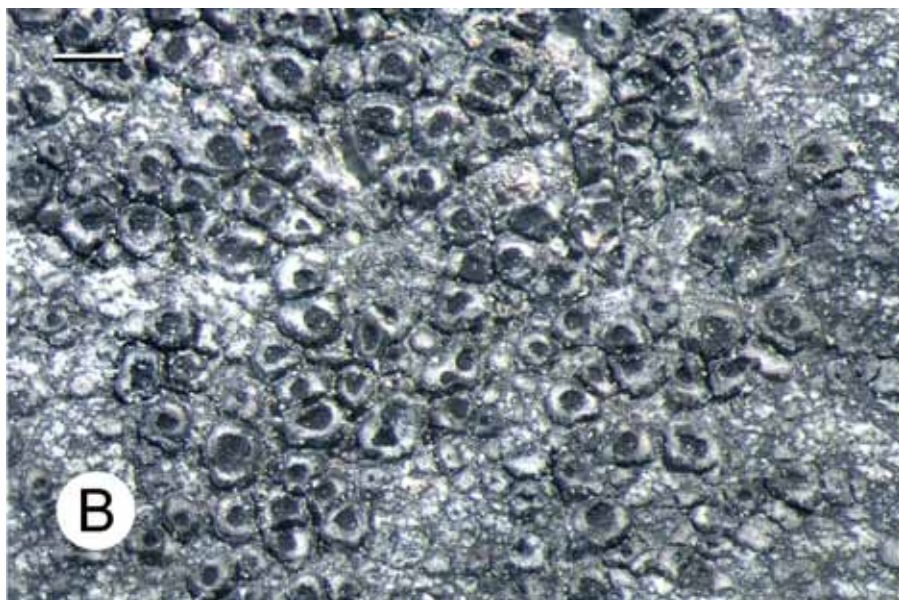
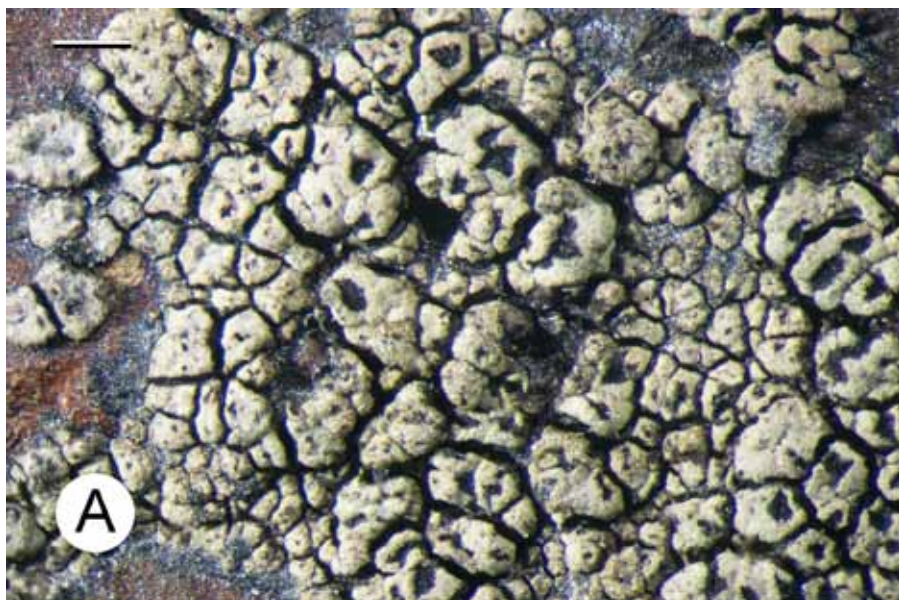


Figure 2: *Buellia sharpiana* and *Buellia* sp. A & C, *B. sharpiana* (Allen 3396); B, D–E, *Buellia* sp. (Harris 6433). Scale bars: A–B = 0.5 mm; C–E = 25 μ m.

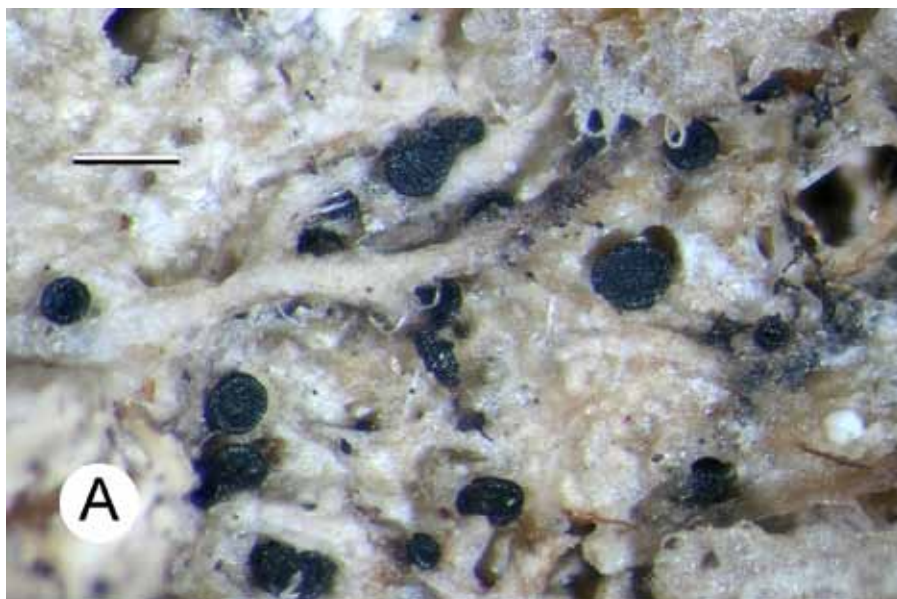


Figure 3: *Sclerococcum thelotrematicola* (Imshaug 57066 – holotype). A. Apothecia. B: Ascospores. Scale bars: A = 1.0 mm: B = 25 μ m.

Four new species and new records of buellioid lichens (Caliciaceae, Ascomycota) from Antarctica

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Abstract

Amandinea windmillensis Elix, *Buellia minispora* Elix, *B. rodseppeltii* Elix and *Tetramelas lokenensis* Elix are described as new to science. The new combination *Tetramelas filsonii* (C.W.Dodge) Elix is proposed for *Buellia filsonii* C.W.Dodge. In addition, *Buellia vilis* Th.Fr. is reported for the first time from Antarctica and *Amandinea isabellina* (Hue) Söchting & Øvstedal and *Buellia illaetabilis* I.M.Lamb are recorded for the first time from continental Antarctica.

In their monograph *Lichens of Antarctica and South Georgia*, Øvstedal & Lewis-Smith (2001) reported three species of *Amandinea* and 30 species of *Buellia sens. lat.* Four of the latter species have since been transferred to *Amandinea* (Söchting *et al.* 2004) and nine to *Tetramelas* (Kalb 2004; Nordin 2004; Elix 2017, 2018). Øvstedal subsequently described a further species of *Buellia* from Antarctica (Øvstedal & Lewis-Smith 2004), which has also been transferred to *Tetramelas* (Elix 2017). Following the study of 1105 Antarctic collections housed in BM, CANB, MEL and HO, I am describing new species of *Amandinea*, *Buellia sens. lat.* and *Tetramelas*, and reporting the occurrence of *Buellia vilis* Th.Fr. from the continent.

Methods

Observations and measurements of thalline and apothecial anatomy, asci, ascospores and conidia were made on hand-cut sections mounted in water and treated with 10% potassium hydroxide (K) and 50% nitric acid (N). Asci were also observed in Lugol's Iodine (I), with and without pretreatment in K. Chemical constituents were identified by thin-layer chromatography (TLC) (Elix 2014) and comparison with authentic samples. Most of the collections were made by Dr R.D. Seppelt, and are housed in HO.

The new species

1. *Amandinea windmillensis* Elix, sp. nov. Figs 1, 2
Mycobank No. **MB 828954**

Similar to *Buellia evanescens* Darb., but differs in having larger, *Physconia*-type ascospores, 11–[14.1]–17 \times 6–[6.8]–9 μ m, a dark brown, N– epihymenium, a dark brown hypothecium and curved, filiform conidia.

Type: Antarctica, Wilkes Land, Windmill Islands, Clark Peninsula, [66°15'S, 110°33'E – 66°15'12"S, 110°34'E] on stones, *M. Hovenden s.n.*, 1993 (holotype – HO).

Thallus crustose, epilithic, areolate to granular; areoles dispersed or becoming congested and heaped, subglobose to hemispherical, 0.05–0.5 mm wide, grey-white to pale brown; prothallus thin, black, marginal or not apparent; photobiont cells 8–20 μ m wide. *Medulla* white, lacking calcium oxalate (H₂SO₄–), I–. *Apothecia* 0.1–0.5 mm wide, abundant, lecidine, scattered and roundish, broadly adnate to sessile; disc black, epruinose, plane to convex; proper exciple thin, distinct, initially raised above disc but excluded in older, convex apothecia, in section 25–30 μ m thick; outer part dark brown, K–, N–; inner part brown. *Epihymenium* 8–10 μ m thick, dark brown, K–, N–. *Hypothecium* 75–125 μ m thick, brown to dark brown, K–. *Hymenium* 60–80 μ m thick, colourless, not interspersed; subhymenium 20–25 μ m thick, yellow-brown, not interspersed; paraphyses 1–1.5 μ m wide, sparingly branched, with apices 3.5–4 μ m wide, with

brown caps. *Asci* 8-spored, *Bacidia*-type. *Ascospores* *Physconia*-type, 1-septate, pale brown then brown, ellipsoid, 11–[14.1]–17 × 6–[6.8]–9 µm, not constricted at the septum, sometimes curved; outer wall smooth to finely ornamented. *Pycnidia* common, punctiform, superficial or emergent; ostiole black. *Conidia* curved, filiform, 23–29 × 0.7–1 µm. *Chemistry*: Medulla K–, C–, PD–, UV–; no lichen substances detected.

Etymology: The species is named after the type locality.

Remarks

The areolate thallus of this new species closely resembles that of *B. evanescens*, which is also present in Antarctica. However, the latter has significantly smaller, *Buellia*-type ascospores, 11–12 × 6–8.5 µm, an aeruginose-black, N+ purple-brown epihymenium and a colourless or very pale brown hypothecium and bacilliform conidia *c.* 2 × 0.3 µm (Lamb 1968). Morphologically, the thallus of *A. windmillensis* also resembles *B. minispora* (described below), but that species differs in having very small *Buellia*-type ascospores, 7–10 × 3–4 µm.

At present the new species is only known from the Windmill Islands in Wilkes Land. Associated species include *Buellia frigida* Darb., *Pseudophebe minuscula* (Nyl. ex Arnold) Brodo & D.Hawksw., *Umbilicaria decussata* (Vill.) Zahlbr. and *Usnea spachelata* R.Br.

ADDITIONAL SPECIMEN EXAMINED

Antarctica. • Wilkes Land, Windmill Islands, Bailey Peninsula, SSSI, 30 m E of CMS1 study site, 66°17'S, 110°32'E, on stones amongst moraine debris, *R.D. Seppelt 18368*, 18.ii.1989 (HO).

2. *Buellia minispora* Elix, sp. nov. MycoBank No. MB 828955

Fig. 3

Similar to *Buellia subtegens* B.J.Murray, but differs in having smaller ascospores, 7–[8.1]–10 × 3–[3.8]–4 µm, and a dark brown, N– epihymenium.

Type: Antarctica, Wilkes Land, Windmill Islands, Clark Peninsula, 50 m NE of old Wilkes Station radio transmitter building refuge hut, 66°15'30"S, 110°32'E, 10 m alt., on stones in moraine debris, *R.D. Seppelt 13489*, 29.xii.1982 (holotype – HO).

Thallus crustose, epilithic, areolate to bullate-areolate; areoles dispersed or becoming congested and heaped, subglobose to hemispherical, 0.2–1 mm wide, grey-white to pale brown; prothallus thin and black or not apparent; photobiont cells 8–20 µm wide. *Medulla* white, lacking calcium oxalate (H₂SO₄–), I–. *Apothecia* 0.1–0.4 mm wide, abundant, lecideine, scattered and roundish, broadly adnate to sessile; disc black, epruinose, plane to convex; proper exciple thin, distinct, initially raised above the disc but excluded in older convex apothecia, in section 25–40 µm thick; outer part brown-black, K–, N+ orange-brown; inner part brown. *Epihymenium* 5–10 µm thick, dark brown, K–, N–. *Hypothecium* 85–125 µm thick, dark brown to brown-black, K–. *Hymenium* 35–50 µm thick, colourless, not interspersed; subhymenium 20–25 µm thick, brown, not interspersed; paraphyses 1–1.5 µm wide, sparingly branched, with apices 3.5–5 µm wide, with brown caps. *Asci* 8-spored, *Bacidia*-type. *Ascospores* *Buellia*-type, 1-septate, brown, ellipsoid, 7–[8.1]–10 × 3–[3.8]–4 µm, becoming constricted at the septum, not curved; outer wall smooth to finely ornamented. *Pycnidia* not seen.

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

Etymology: This species is named after its very small ascospores.

Remarks

The dispersed areoles of this new species resemble those of *B. subtegens*, which is also present in Antarctica. However, the latter has larger ascospores, 9–[11.8]–14 × 6–[7.1]–9 µm, and an

aeruginose-black, N+ purple-brown epihymenium (Murray 1963; Elix 2019). Another morphologically very similar Antarctic species is *Buellia lignoides* Filson, but that species has a strongly amyloid medulla and a very prominent black prothallus (Filson 1966; Øvstedal & Lewis-Smith 2001).

At present the new species is only known from the type collection. Associated species include *Amandinea petermannii* (Hue) Matzer, H.Mayrhofer & Scheid., *Buellia frigida* Darb., *Pseudophebe minuscula* (Nyl. ex Arnold) Brodo & D.Hawksw., *Rhizoplaca melanophthalma* (Ram.) Leuckert & Poelt, *Usnea antarctica* Du Rietz and *Xanthoria elegans* (Link) Th.Fr.

3. *Buellia rodseppeltii* Elix, sp. nov. MycoBank No. MB 828956

Fig. 4

Similar to *Buellia russa* Darb., but differs in having sublobate to subeffigurate margins, larger, bacilliform to elongate-ellipsoid conidia, 5–7 × 1–2 µm, constricted ascospores, and in lacking norstictic acid.

Type: Antarctica, Wilkes Land, Windmill Islands, Clark Peninsula, W end of Wilkes Peninsula, 66°15'S, 110°31'E, 20 m alt., on rock flakes in ice-plucked rock, *R.D. Seppelt 18592*, 17.i.1989 (holotype – HO; isotype – CANB).

Thallus crustose, to 45 mm wide, rimose-areolate, verruculose-areolate or bullate, margins sublobate to subeffigurate; areoles and verrucules 0.4–1 mm wide, irregular, angular or rounded, rarely becoming pulvinate; upper surface white, off-white to brown or brown-black; prothallus pale to usually black, prominent; photobiont cells 7–20 µm wide. *Medulla* lacking calcium oxalate (H₂SO₄–), I–. *Apothecia* 0.2–1 mm wide, abundant, lecideine, roundish, scattered or crowded, immersed then adnate to sessile; disc black, epruinose, plane to convex; proper exciple thin, excluded in convex apothecia, in section 50–60 µm thick; outer part aeruginose-black, K–, N+ purple-brown; inner part dark brown. *Epihymenium* 10–13 µm thick, dark aeruginose, K–, N+ purple-brown. *Hypothecium* 125–150 µm thick, brown to dark brown, K–. *Hymenium* 80–100 µm thick, colourless, not interspersed; subhymenium 15–25 µm thick, pale brown, not interspersed; paraphyses 1.5–2 µm wide, sparingly branched, with apices 3–4 µm wide and aeruginose caps. *Asci* 8-spored, *Bacidia*-type. *Ascospores* of the *Buellia*-type, 1-septate, brown, ellipsoid, 12–[15.6]–20 × 6–[9.1]–12 µm, becoming constricted at the septum, not curved; outer spore-wall finely ornamented (microrugulate). *Pycnidia* common, superficial; ostiole brown-black. *Conidia* straight, bacilliform to elongate-ellipsoid, 5–7 × 1–2 µm.

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

Etymology: The species is named after the Australian biologist Dr Rod Seppelt.

Remarks

This species is characterized by a rimose-areolate to verrucose-areolate or bullate, white, off-white to brown or brown-black thallus with sublobate to subeffigurate margins, a non-amyloid medulla and the absence of lichen substances. It has immersed then adnate to sessile lecideine apothecia 0.2–1 mm wide, an aeruginose, N+ purple-brown epihymenium, relatively large, *Buellia*-type ascospores, 12–20 × 6–12 µm, which become constricted at maturity, and bacilliform to elongate-ellipsoid conidia, 5–7 × 1–2 µm. It is morphologically similar to *B. russa*, but the latter differs in containing norstictic acid, in having a thallus with effuse margins, non-constricted ascospores and shorter bacilliform conidia, 3–4 × 0.5–0.7 µm (Lamb 1968).

At present the new species is known only from continental Antarctica (MacRobertson Land, Princess Elizabeth Land, Wilkes Land). Associated species include *Candelariella flava* (C.W.Dodge & G.E.Baker) Castello & Nimis, *Buellia frigida* Darb., *Pseudophebe minuscula* (Nyl. ex Arnold) Brodo & D.Hawksw., *Rhizoplaca melanophthalma* (Ram.) Leuckert & Poelt, *Umbilicaria decussata* (Vill.) Zahlbr., *Usnea antarctica* DuRietz and *Xanthoria mawsonii* C.W.Dodge.

ADDITIONAL SPECIMENS EXAMINED

Antarctica. ● MacRobertson Land, Falla Bluff, 67°34'S, 61°29'E, on stones in moraine debris, *K. Kerry ADT-1344*, 8.ii.1972 (HO); ● MacRobertson Land, Chapman Ridge area, 67°28'S, 60°57'E, 40 m alt., on weathered fine-grained rock, *L. Williams 224*, 10.x.1984 (CANB, HO). ● Princess Elizabeth Land, Ingrid Christensen Coast, Rauer Islands, Cape Rybachi, 68°54'S, 77°56'E, on weathered western coastal ridge of outcrop, *G. Cracknell R225*, 15.xii.1983 (HO); ● Princess Elizabeth Land, Vestfold Hills, Clear Lake area, 66°38'15"S, 77°59'36"E, 10 m alt., on charnockite, *R. Williams ADT-23265*, 10.i.1979 (HO). ● Wilkes Land, Windmill Islands, Clark Peninsula, old Wilkes Station area, near old radio transmitter building refuge hut, 66°15'30"S, 110°32'E, 8 m alt., on stones in moraine debris, *R.D. Seppelt 13530*, 30.xii.1982 (HO).

4. *Tetramelas lokenensis* Elix, sp. nov.
Mycobank No. **MB 828957**

Figs 5, 6

Similar to *Buellia lignoides* Filson, but differs in having longer, ellipsoid to broadly fusiform, *Callispora*- to *Physconia*- then *Buellia*-type ascospores 12–[15.5]–20 µm long.

Type: Antarctica, Wilkes Land, Clark Peninsula, Loken Moraine line, E of old Wilkes Station, 66°16'S, 110°37'E, 140 m alt., on stones in moraine, *R.D. Seppelt 13732*, 3.i.1983 (holotype – HO).

Thallus crustose, areolate, to 90 mm wide and 0.4 mm thick; areoles irregular, rounded or angular, flat or often convex, 0.2–0.5 mm wide, separate and scattered or becoming contiguous and crowded; upper surface white to grey-white, brown or blackening, dull, epruinose; prothallus black, marginal, continuous or often fimbriate, rarely not apparent; photobiont cells 8–18 µm wide. *Medulla* white, lacking calcium oxalate (H₂SO₄-), I+ purple-blue. *Apothecia* 0.1–0.6 mm wide, lecideine, broadly adnate to sessile on or at the margin of areoles; disc black, epruinose, plane to markedly convex with age; proper exciple distinct but excluded in older, convex apothecia, in section 40–50 µm thick; outer part aeruginose-black, K-, N+ reddish purple to purple-brown, dark brown within. *Hypothecium* 125–200 µm thick, brown to dark brown. *Epithymenium* 10–15 µm thick, dark olive-brown to aeruginose-black, K-, N+ reddish purple to purple-brown. *Hymenium* 60–75 µm thick, colourless, with ± scattered oil droplets; subhymenium 15–20 µm thick, pale brown; paraphyses 1–2 µm wide, simple to sparsely branched, with apices 3–5 µm wide and aeruginose caps. *Asci* of the *Bacidia*-type, 8-spored or sometimes with 2, 4 or 6 spores. *Ascospores* initially *Callispora*- to *Physconia*-type, then of the *Buellia*-type, 1-septate, brown, ellipsoid to broadly fusiform, 12–[15.5]–20 × 7–[8.1]–11 µm, becoming constricted at the septum, sometimes curved, rarely with additional endosepta; outer spore-wall finely ornamented (microrugulate). *Pycnidia* immersed, punctiform. *Conidia* bacilliform to elongate-ellipsoid, 3–4 × 1 µm.

Chemistry: Thallus K-, P-, C-, UV-; no lichen substances or traces of atranorin detected by TLC.

Etymology: The species is named after the type locality.

Remarks

The thalline morphology of the new species closely resembles that of some specimens of the common and very variable Antarctic lichen *Buellia lignoides*, but the latter has shorter, *Buellia*-type ascospores and longer bacilliform conidia, 7–9 µm long. The ascospores of *T. lokenensis* closely resemble those of another Antarctic species, *Tetramelas nelsonii* (Darb.) Elix, but *T. nelsonii* contains 6-*O*-methylarthonin and traces of atranorin, and has a non- or only weakly amyloid medulla (Lamb 1968; Elix 2018).

At present the new species is only known from Wilkes Land in eastern Antarctica. Associated species include *Buellia frigida* Darb., *Lecidea cancriformis* C.W.Dodge & G.E.Baker, *Pseudophebe minuscula* (Nyl. ex Arnold) Brodo & D.Hawksw., *Umbilicaria decussata* (Vill.) Zahlbr. and *Usnea sphaelata* R.Br.

ADDITIONAL SPECIMENS EXAMINED

Antarctica. ● Wilkes Land, Windmill Islands, Loken Moraine, E of Wilkes Station, 66°16'S, 110°37'E, 140 m alt., on stones in moraine, *R.D. Seppelt 13745*, 3.i.1983 (HO); ● Wilkes Land, Bunge Hills, Obruchev Hills, NE end, 66°35'S, 99°45'E, on stones in talus, *D. Adamson & R.D. Seppelt 17064 pr. p.*, 4.ii.1986 (HO).

New combination

Tetramelas filsonii (C.W.Dodge) Elix, comb. nov.
Mycobank No.: **MB 828958**

Figs 7, 8

Buellia filsonii C.W.Dodge, *Lichen Flora of the Antarctic Continent and Adjacent Islands* 313 (1973).

Type: Antarctica, MacRobertson Land, North Masson Range, Painted Peak, 67°45'S, 62°51'E, [710 m alt.] on rock, *R.B. Filson 4418*, 27.xi.1962 (MEL 1063078 – isotype, labelled as *R.B. Filson 4418a*).

Thallus crustose, to 25 mm wide, verruculose-areolate or granular; verruculae 0.1–0.5 mm wide, compacted and becoming elevated to form small, pulvinate cushions to 3.5 mm high; upper surface dull, off-white, cream to pale brown or brown-black; prothallus pale or not apparent; photobiont cells 7–20 µm wide. *Medulla* lacking calcium oxalate (H₂SO₄-), I+ purple. *Apothecia* 0.2–0.8 mm wide, abundant, lecideine, roundish, scattered or crowded, adnate to sessile; disc black, epruinose, plane to strongly convex; proper exciple thin, soon excluded, in section 45–55 µm thick; outer part dark brown to brown-black, K-, N-; inner part brown. *Epithymenium* 10–12 µm thick, dark brown, K-, N-. *Hypothecium* 150–200 µm thick, deep red-brown, K-. *Hymenium* 50–75 µm thick, colourless, not interspersed; subhymenium 20–30 µm thick, pale brown, not interspersed; paraphyses 1.5–2 µm wide, sparingly branched, with apices 4–6 µm wide and brown caps. *Asci* 8-spored, *Bacidia*-type. *Ascospores* initially of the *Callispora*-type, then of the *Buellia*-type, 1-septate, brown, ellipsoid, 12–[14.4]–18 × 6–[7.5]–10 µm, becoming constricted at the septum, sometimes curved; outer spore-wall finely ornamented (microrugulate). *Pycnidia* common, superficial; ostiole brown-black. *Conidia* straight, bacilliform, 4–6 × 0.7–1 µm.

Chemistry: Thallus K- or K+ yellow then red, P- or P+ yellow, C+ yellow, UV+ pale orange; containing 6-*O*-methylarthonin (major or minor), ± norstictic acid (major or minor).

Remarks

This species is characterized by a verruculose, off-white, cream to brown or brown-black thallus, the verruculae becoming compacted and elevated, forming small cushion-like clumps to 3.5 mm high; it contains 6-*O*-methylarthonin and often norstictic acid, but lacks medullary calcium oxalate. It has an amyloid medulla, adnate to sessile, lecideine apothecia, 0.3–0.8 mm wide, a dark brown to olive-brown, N- epithymenium, *Callispora*- then *Buellia*-type ascospores, 12–17 × 6–10 µm, which become constricted at maturity, and bacilliform conidia, 4–6 × 0.7–1 µm. It is morphologically very similar to *T. darbishirei* (I.M.Lamb) Elix, but the latter differs in having longer ascospores, 14–[17.4]–21 µm, and contains additional atranorin but lacks norstictic acid (Lamb 1968; Elix 2018). *Tetramelas austropapillatus* (Øvstedal) Elix has identical chemistry to *T. filsonii*, but that species grows on moribund mosses and bryophytes, has larger ascospores, 15–[17.6]–23 × 8–[9.5]–11 µm, and contains calcium oxalate in its medulla (Øvstedal & Lewis-Smith 2004; Elix 2017).

At present the species is known from several localities in the Masson Range, MacRobertson Land, continental Antarctica. Associated lichens include *Candelariella flava* (C.W.Dodge & G.E.Baker) Castello & Nimis, *Buellia frigida* Darb., *Rinodina olivaceobrunnea* C.W.Dodge & G.E.Baker and *Usnea antarctica* Du Rietz.

ADDITIONAL SPECIMENS EXAMINED

Antarctica. ● MacRobertson Land, South Masson Range, Branson Nunatak, 67°55'07"S, 62°45'35"E, on rock, *R.B. Filson 4476*, 16.xii.1962 (MEL); ● MacRobertson Land, Masson Range, Mt Twintops, 68°05'S, 62°63'E, on rock in scree debris, *K.R. Kerry ADT-33794*, 2.ii.1972 (HO).

New records

1. *Amandinea isabellina* (Hue) Søchting & Øvstedal, *Biblioth. Lichenol.* **88**, 615 (2004)

This species was previously known from the Antarctic Peninsula, the South Orkney Islands, South Shetland Islands, South Georgia (Lamb 1968; Øvstedal & Lewis Smith 2001; Søchting *et al.* 2004) and from alpine areas in south-eastern Australia, Tasmania (Elix & Kantvilas 2013) and New Zealand (Elix *et al.* 2015). It is characterized by a grey-white to pale brown or brown thallus composed of congested verruculae, a thin black to brown-black marginal prothallus, broadly adnate to sessile apothecia up to 0.8 mm wide with epruinose discs, straight to slightly curved, ellipsoid, *Physconia*- then *Buellia*-type ascospores, (12–)14–18(–20) × 7–10 µm, which become constricted at the septum, filiform conidia 10–23 × 0.7–1.0 µm and by the absence of lichen substances. A detailed description is given in Lamb (1968, as *Buellia isabellina*). This species has shorter conidia than *A. coniops* (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer and grows on exposed rocks, typically forming small, well-separated thalli amongst other crustose lichens. New to continental Antarctic

SPECIMENS EXAMINED

Antarctica. • Victoria Land, Cape Hallett, 72°19'08"S, 170°14'20"E, 30 m alt., on stones near edge of late snow bank, *R.D. Seppelt 22799, 22800*, 3.i.1999 (HO); • Victoria Land, Cape Hallett area, 72°19'23"S, 170°13'24"E, 30 m alt., on stones in scree slopes E of camp beach, *R.D. Seppelt 35052*, 10.i.1999 (HO).

2. *Buellia illaetabilis* I.M.Lamb, *British Antarctic Survey Reports* **61**, 29 (1968)

This species was previously known from the Antarctic Peninsula and South Shetland Islands (Lamb 1968; Søchting *et al.* 2004). It is characterized by an areolate thallus that often forms small rosettes to 10–40 mm wide, with flat to more often convex, dispersed or contiguous areoles, 0.1–0.3 mm wide, an off-white to grey or blackening upper surface, a prominent effuse to fimbriate, black prothallus, a non-amyloid medulla, sessile apothecia, 0.2–0.5 mm wide, an aeruginose, N+ purple-brown epihymenium, a brown hypothecium, brown, ellipsoid, *Buellia*-type ascospores, 9–14 × 5–8 µm, bacilliform conidia, 3–4 × 0.7–1 µm, and lacks lichen substances. New to continental Antarctica.

SPECIMENS EXAMINED

Antarctica. • MacRobertson Land, Prince Charles Mountains, Else Platform, 70°22'S, 68°48'E, on small stones in moraine debris, *N. Conrick ADT-35445, ADT-35448*, 28.i.1990 (HO); • MacRobertson Land, Prince Charles Mountains, Beaver Lake, Jetty Peninsula area, 100 m alt., on sandstone, *A. Drinnan 29A, 31A*, 16.i.1992 (HO). • Princess Elizabeth Land, Ingrid Christensen Coast, Vestfold Hills, 1 km N of Lake Druzhby field camp, 68°35'S, 78°16'E, 10 m alt., on stones in debris, *R.D. Seppelt 8250*, 13.i.1979 (HO). • Victoria Land, Cape Hallett area, Football Saddle, 72°30'20"S, 169°42'43"E, 652 m alt., on basalt, *R.D. Seppelt 25028, 25054*, 20.xi.2004 (HO); • Victoria Land, Cape Hallett area, Red Castle Ridge, 72°26'54"S, 169°56'51"E, 652 m alt., on basalt, *R.D. Seppelt 25224*, 30.xi.2004 (HO). • Wilkes Land, Windmill Islands, Beall Island, 66°18'S, 110°29'E, on stones amongst moraine debris, *R.D. Seppelt 13756, 13758*, 4.i.1983 (HO); *R.D. Seppelt 18574*, 13.i.1989 (HO); • Wilkes Land, Windmill Islands, Herring Island, W end of island, 66°24'S, 110°37'E, on stones amongst moraine debris, *R.D. Seppelt 14220, 14222, 14225*, 17.i.1983 (HO).

3. *Buellia vilis* Th.Fr., *Kongl. Vetensk. Akad. Handl.* **7**(2), 44 (1867)

This species was previously known from temperate to Arctic regions in Europe and North America (Bungartz *et al.* 2007). It is characterized by a discontinuous, thin or mainly endolithic

thallus, a white medulla that lacks calcium oxalate (H₂SO₄⁻), a deep reddish brown outer exciple (N+ deep purple), a dark brown, N+ deep purple epihymenium, and a colourless inner exciple and hypothecium. The inner exciple, hypothecium and thalline hyphae react deep blue with iodine. It has brown, ellipsoid *Buellia*-type ascospores, 12–20 × 5–10 µm, which are constricted at the septum and with smooth outer walls, bacilliform conidia, 4–7 × 0.7–1 µm, and it lacks lichen substances. A detailed description is given in Bungartz *et al.* (2007) and an illustration in Bungartz (2004, p. 109). New to Antarctica.

SPECIMENS EXAMINED

Antarctica. • Wilkes Land, Bungler Hills, NE end of Obruchev Hills, 66°35'S, 99°45'E, on stones in talus, *R.D. Seppelt 17177 pr. p.*, 4.ii.1986 (HO); • Wilkes Land, Bungler Hills, DeLay Point, N side of Melba Peninsula, 12 km W of Cape Charcot, 66°27'S, 98°15'E, on stones in scree, *R.D. Seppelt 17179*, 4.ii.1986 (HO); • Wilkes Land, Windmill Islands, Bailey Peninsula SSSI, SW end, on small stones in moraine debris, *R.D. Seppelt 18496*, 4.i.1989 (HO).

Acknowledgements

I thank the curators of BM, CANB, HO, MEL and WELT for their kind cooperation in providing loans of key collections and to Mr Brendan Lepschi (CANB) for organizing most of these loans for me. Many thanks to Dr Patrick McCarthy (Scullin, A.C.T.) for his excellent illustration of *Amandinea windmillensis*.

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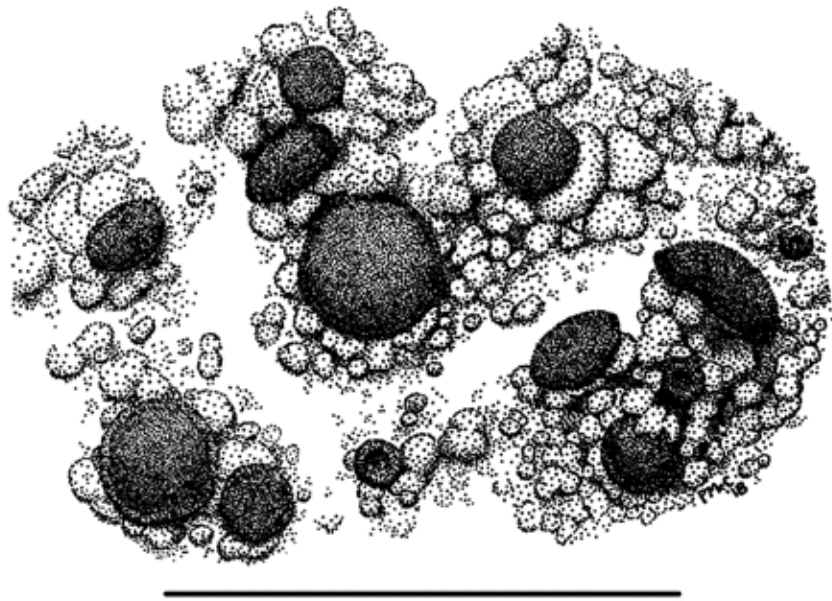


Figure 1. *Amandinea windmillensis* (holotype in HO). Scale = 1 mm



Figure 2. Ascospore ontogeny of *A. windmillensis*. Scale = 10 μ m.

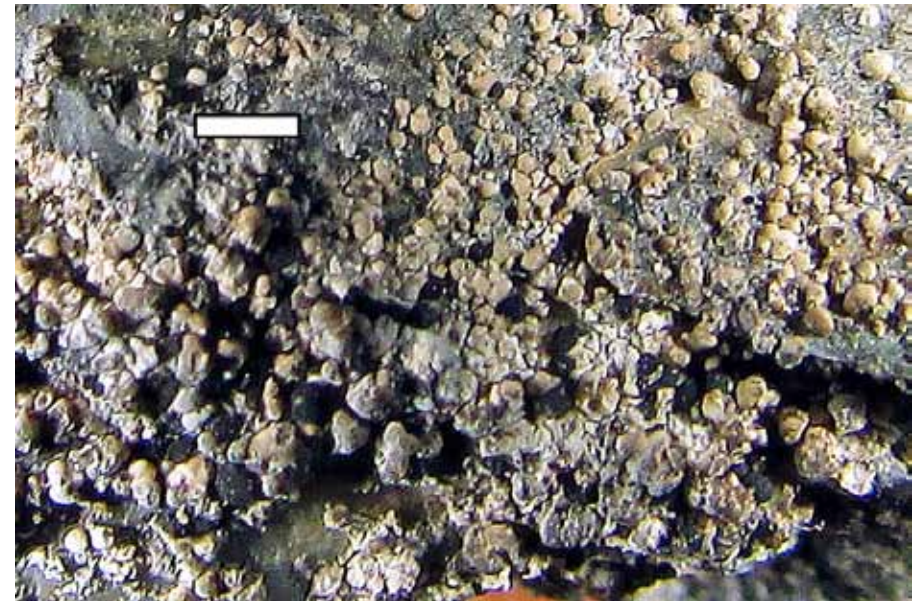


Figure 3. *Buellia minispora* (holotype in HO). Scale = 1 mm.

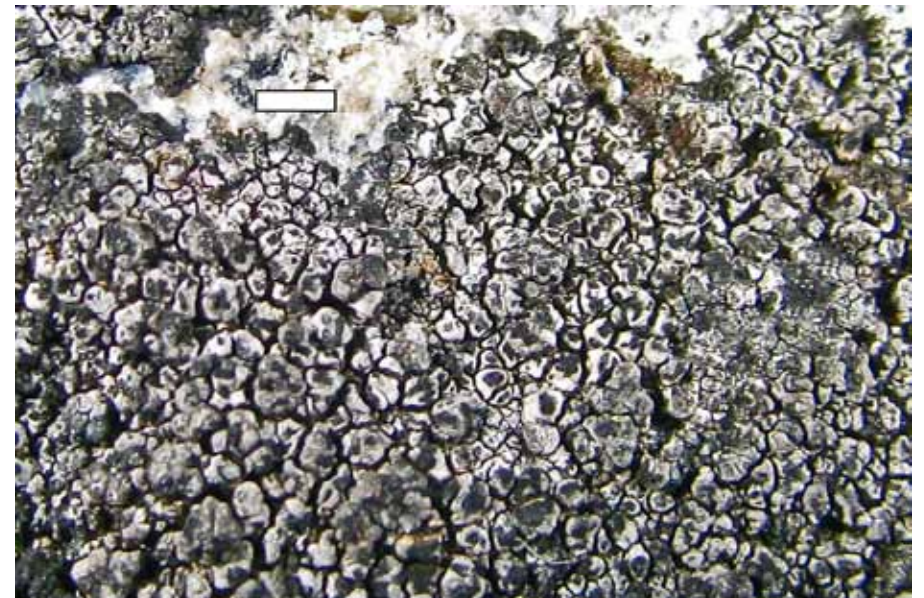


Figure 4. *Buellia rodseppeltii* (holotype in HO). Scale = 1 mm.



Figure 5. *Tetramelas lokenensis* (holotype in HO). Scale = 1 mm.



Figure 7. *Tetramelas filsonii* (Kerry ADT-33794 in HO). Scale = 1 mm.



Figure 6. Ascospore ontogeny of *T. lokenensis*. Scale = 10 μ m.



Figure 8. Ascospore ontogeny of *T. filsonii*. Scale = 10 μ m.

The lichen genus *Pertusaria sens. lat.* (Pertusariaceae, Ascomycotina) in Papua New Guinea: checklist and keys

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Abstract

A checklist and keys are provided to the 82 species of *Lepra*, *Pertusaria* and *Varicellaria* in Papua New Guinea.

Introduction

Papua New Guinea is the eastern half of the island of New Guinea to the north of Australia, lying south of the Equator between latitudes 4°S and 10°S and rising to 4509 m at its highest point, Mount Wilhelm, in the centre of the country. A detailed account of the topography, geology, climate and vegetation of Papua New Guinea is given by Lambley (Lambley 1991).

In his account of the lichen flora of New Guinea, Szatala (1956) recorded only one species, *P. rechingeri* Zahlbr. Thirty years later, Streimann's *Catalogue of the lichens of Papua New Guinea and Irian Jaya* (Streimann 1986) recorded an additional species, *P. gyalectoides* Vězda. In 1993, *Pertusaria epitheciifera* Sipman, known originally from Malaysia, was reported from Papua New Guinea (Sipman 1993), and further species were recorded by Aptroot *et al.* (1993) and Streimann & Sipman (1994). Additional new taxa and new reports were subsequently published (Archer *et al.* 1995; Elix *et al.* 1997; Archer & Elix 1998a, b), bringing the total number of reported taxa to 82. A preliminary key to the genus, including 67 taxa, was provided in 1998 (Archer & Elix 1998).

Checklist

***Lepra* Scop.**

L. clarkeana (A.W.Archer) I.Schmitt, Hodkinson & Lumbsch, *PLoS ONE* 12(7), 7/14 (2017)
[syn: *Pertusaria clarkeana* A.W.Archer, *Mycotaxon* 53, 280 (1995)]

L. erythrella (Müll.Arg.) I.Schmitt, Hodkinson & Lumbsch, *PLoS ONE* 12(7), 8/14 (2017)
[syn: *Pertusaria erythrella* Müll.Arg., *Bull. Herb. Boissier* 1, 41 (1893)]

L. lacerans (Müll.Arg.) I.Schmitt, Hodkinson & Lumbsch, *PLoS ONE* 12(7), 8/14 (2017)
[syn: *Pertusaria lacerans* Müll.Arg., *Flora* 67, 270 (1884)]

L. muricata (J.C.David) A.W.Archer & Elix, *Australas. Lichenol.* 82, 132 (2018)
[syn: *Pertusaria muricata* J.C.David, *Biblioth. Lichenol.* 57, 102 (1995)]

L. psoromica (A.W.Archer & Elix) A.W.Archer & Elix, *Australas. Lichenol.* 82, 132 (2018)
[syn: *Pertusaria psoromica* A.W.Archer & Elix, *Mycotaxon* 50, 206 (1994)]

L. scaberula (A.W.Archer) I.Schmitt, Hodkinson & Lumbsch, *PLoS ONE* 12(7), 9/14 (2017)
[syn: *Pertusaria scaberula* A.W.Archer]

L. tropica (Vain.) Lendemer & R.C.Harris, *Bryologist* 120, 189 (2017)
[syn: *Pertusaria tropica* Vain., *Catal. Welw. Afr. Pl.* 2, 404 (1901)]

L. umbricola (A.W.Archer & Elix) A.W.Archer & Elix, *Australas. Lichenol.* 82, 134 (2018)
[syn: *Pertusaria umbricola* A.W.Archer & Elix, *Biblioth. Lichenol.* 69, 158 (1997)]

***Pertusaria* DC.**

P. allogibberosa A.W.Archer & Elix, *Mycotaxon* 67, 155 (1998)

P. angabangensis A.W.Archer & Elix, *Mycotaxon* 67, 156 (1998)

P. anomalospora A.W.Archer, Elix & Streimann, *Mycotaxon* 56, 388 (1995)

P. aptrootii A.W.Archer & Elix, *Mycotaxon* 67, 157 (1998)

P. asterella Aptroot, *Mycotaxon* 64, 18 (1997)

P. atropilota A.W.Archer & Elix, *Mycotaxon* 67, 158 (1998)

P. balekensis A.W.Archer & Elix, *Mycotaxon* 67, 158 (1998)

P. bogia A.W.Archer & Elix, *Mycotaxon* 67, 160 (1998)

P. buloloensis A.W.Archer, Elix & Streimann, *Mycotaxon* 56, 388 (1995)

P. bundiense A.W.Archer & Elix, *Mycotaxon* 69, 311 (1998)

P. burburana Elix & A.W.Archer, *Mycotaxon* 64, 19 (1997)

P. ceylonica Müll.Arg., *Flora* 67, 351 (1884)

P. cicatricosa Müll.Arg., *Proc. Roy. Soc. Edinburgh* 11, 461 (1882)

P. cicatricosa var. *deficiens* A.W.Archer, Elix & Streimann, *Mycotaxon* 56, 389 (1995)

P. consanguinea Müll.Arg., *Flora* 67, 283 (1884)

P. copelandii Vain., *Philipp. J. Sci. Sect. C*, 8, 2, 105 (1913)

P. damiense A.W.Archer, Elix & Streimann, *Mycotaxon* 56, 390 (1995)

P. dehiscens Müll.Arg., *Flora* 67, 349 (1884)

P. elliptica Müll.Arg., *Bull. Herb. Boissier* 3, 635 (1895)

P. endoxantha Vain., *Hedwigia* 37, 41 (1898)
[syn: *P. norstictica* A.W.Archer, *Mycotaxon* 41, 232 (1991)]

P. epitheciifera Sipman, *Tropical Bryology* 8, 301 (1994)

P. flavosidiata A.W.Archer & Elix, *Mycotaxon* 49, 144 (1993)

P. gongylospora Elix & A.W.Archer, *Mycotaxon* 64, 21 (1997)

P. gorokorana Elix & A.W.Archer, *Mycotaxon* 64, 23 (1997)

P. gyalectoides Vězda, in W.A. Weber, *Bryologist* 74, 191 (1971)

P. hermaka A.W.Archer, *Mycotaxon* 41, 227 (1991)

P. hypoprotocetrarica A.W.Archer & Elix, *Mycotaxon* **67**, 161 (1998)
P. inconspicua A.W.Archer & Elix, *Mycotaxon* **67**, 161 (1998)
P. irregularis Müll.Arg., *Bull. Herb. Boissier* **3**, 638 (1895)
P. isidiosa A.W.Archer, *Mycotaxon* **41**, 228 (1991)
P. kagamugana Elix & A.W.Archer, *Mycotaxon* **64**, 23 (1997)
P. kaindiensis A.W.Archer, Elix & Streimann, *Mycotaxon* **56**, 393 (1995)
P. karkarensis A.W.Archer & Elix, *Mycotaxon* **67**, 162 (1998)
P. laeana A.W.Archer & Elix, *Mycotaxon* **67**, 164 (1998)
P. leiocarpella Müll.Arg., *Bull. Herb. Boissier* **3**, 636 (1895)
P. leioplacella Nyl., *Bull. Soc. Linn. Normandie sér. 2*, **2**, 71 (1867)
P. manamensis A.W.Archer & Elix, *Mycotaxon* **67**, 164 (1998)
P. mesotropa Müll.Arg., *Flora* **67**, 350 (1884)
[syn: *P. paragibberosa* A.W.Archer, *Mycotaxon* **31**, 236 (1991)]
P. microstoma Müll.Arg., *Flora* **65**, 328 (1882)
P. modesta Müll.Arg., *Flora* **67**, 352 (1884)
P. montpittensis A.W.Archer, *Proc. Linn. Soc. N.S.W.* **113**, 65 (1992)
P. myola A.W.Archer & Elix, *Mycotaxon* **67**, 165 (1998)
P. naduriensis A.W.Archer & Elix, *Mycotaxon* **67**, 166 (1998)
P. novaeguineae A.W.Archer & Elix, *Mycotaxon* **67**, 166 (1998)
P. oblongata Müll.Arg., *Flora* **67**, 401 (1884)
[syn: *P. howeana* A.W.Archer & Elix, *Telopea* **6**, 15 (1994)]
P. orarensis A.W.Archer & Elix, *Biblioth. Lichenol.* **69**, 117 (1997)
P. papuana A.W.Archer & Elix, *Mycotaxon* **67**, 167 (1998)
P. parmatica A.W.Archer & Elix, *Mycotaxon* **67**, 168 (1998)
P. perthwaitesii A.W.Archer & Elix, *Mycotaxon* **67**, 168 (1998)
P. pertusella Müll.Arg., *Flora* **67**, 283 (1884)
P. petrophytes C.Knight, *Trans. Linn. Soc. London*, ser. 2, **2**, 47 (1881)
P. philippina Vain., *Philipp. J. Sci. Sect. C*, **8**, **2**, 105 (1913)
P. plethocarpa A.W.Archer, Elix & Streimann, *Mycotaxon* **56**, 395 (1995)

P. porinella Nyl., *Ann. Sci. Nat. Bot.*, sér. 3 **19**, 321 (1863)
[syn: *P. ramuensis* A.W.Archer & Elix, *Mycotaxon* **69**, 315 (1998)]
P. praecipua A.W.Archer & Elix, *Mycotaxon* **69**, 312 (1998)
P. pseudococcodes Müll.Arg., *Flora* **67**, 287 (1884)
P. puffina A.W.Archer & Elix, *Telopea* **6**, 22 (1994)
P. pycnophora Nyl., *Acta Soc. Sci. Fenn.* **7**, 449 (1863)
P. pycnothelia Nyl., *Syn. Lich. Novae Caledoniae*, 31 (1868)
P. ramulifera H.Magn, *Ark. Bot.* **31A**(6), 56 (1944)
P. rechingeri Zahlbr., *Denkschr. Kaiserl. Akad. Wien, Math.-Naturwiss. Kl.* **88**, 24 (1911)
P. sipmanii A.W.Archer & Elix, *Mycotaxon* **67**, 170 (1998)
P. streimannii Elix & A.W.Archer, *Mycotaxon* **64**, 24 (1997)
P. subplanaica A.W.Archer & Elix, *Mycotaxon* **45**, 422 (1992)
P. subsorodes Elix & A.W.Archer, *Mycotaxon* **64**, 25 (1997)
P. subventosa var. *hypothamnicola* A.W.Archer & Elix, *Mycotaxon* **49**, 147 (1993)
P. thwaitesii Müll.Arg., *Flora* **67**, 460 (1884)
P. trachyspora A.W.Archer, *Mycotaxon* **41**, 247 (1991)
P. vulpina A.W.Archer, *Mycotaxon* **41**, 249 (1991)
P. wauensis Elix & A.W.Archer, *Mycotaxon* **64**, 25 (1997)
P. weberi Elix & A.W.Archer, *Mycotaxon* **64**, 26 (1997)
P. xanthoplaca Müll.Arg., *Flora* **65**, 485 (1882)
P. yupna A.W.Archer & Elix, *Mycotaxon* **67**, 155 (1998)

Varicellaria Nyl.

Varicellaria velata (Turner) I.Schmitt & Lumbsch, *Myckeys* **4**, 31 (2012)
[syn: *P. velata* (Turner) Nyl., *Lichenes Scandinaviae* 179 (1861)]

Keys

Some of the species present in groups A, B and C (lacking chlorinated xanthenes and perlatolic acid derivatives) belong to the recently resurrected genus *Lepra* Scop. (see above), but not all of the required new combinations have been made.

Chloroxanthenes refers to a mixture, in varying proportions, of 2,4,5-trichlorolichexanthone, 2,4-dichlorolichexanthone, 2,5-dichlorolichexanthone and 2-chlorolichexanthone.

1 Thallus saxicolous or terricolous	GROUP G
1: Thallus corticolous	2
2 Thallus sterile, isidiate or sorediate	GROUP A
2: Thallus fertile	3
3 Thallus with disciform apothecia	4
3: Thallus with verruciform apothecia	5
4 Ascospores 1 or 2 per ascus	GROUP B
4: Ascospores 8 per ascus	GROUP C
5 Ascospores 1 or 2 per ascus	GROUP D
5: Ascospores 4 or 8 per ascus	6
6 Ascospores 4 per ascus	GROUP E
6: Ascospores 8 per ascus	GROUP F

GROUP A: Thallus corticolous, sterile, isidiate or sorediate

1 Thallus isidiate	2
1: Thallus sorediate	11
2 Xanthenes present	3
2: Xanthenes absent	6
3 Lichexanthone and salazinic acid present	<i>Pertusaria parmatica</i>
3: Chlorinated xanthenes present	4
4 Thiophaninic and stictic acids present	<i>Pertusaria flavoisidiata</i>
4: 4,5-Dichlorolichexanthone and stictic acid present	5
5 Methyl barbatate absent	<i>Pertusaria montpittensis</i>
5: Methyl barbatate present	<i>Pertusaria angbangensis</i>
6 Thallus K+ red or yellow	7
6: Thallus K-	8
7 Thallus K+ red; norstictic acid present	<i>Pertusaria ramulifera</i>
7: Thallus K+ yellow; stictic acid present	<i>Lepra muricata</i>
8 Thallus Pd+ yellow or red	9
8: Thallus Pd-	10
9 Thallus Pd+ yellow; psoromic acid present	<i>Pertusaria wauensis</i>
9: Thallus Pd+ red; protocetraric acid present	<i>Lepra umbricola</i>

10 2'- <i>O</i> -Methylperlatolic acid present	<i>Pertusaria burburana</i>
10: Hypoprotocetraric acid present	<i>Pertusaria hypoprotocetrarica</i>
11 Soralia Pd+ orange	12
11: Soralia Pd-; picrolichenic and subpicrolichenic acids present	<i>Pertusaria buloloensis</i>
12 Soralia K-; psoromic acid present	<i>Lepra psoromica</i>
12: Soralia K+ yellow or red	13
13 Soralia K+ red; norstictic acid present	<i>Lepra erythrella</i>
13: Soralia K+ yellow	14
14 Thamnic acid present	<i>Lepra scaberula</i>
14: Stictic acid present with chloroxanthenes	<i>Pertusaria puffina</i>

GROUP B: Thallus corticolous; apothecia disciform; ascospores 1 or 2 per ascus

1 Ascospores 2 per ascus, 105–125 µm long; thallus C+ red; lecanoric acid present	<i>Pertusaria philippina</i>
1: Ascospores 1 per ascus	2
2 Discs K+ yellow or violet	3
2: Discs K-	4
3 Discs K+ yellow; thamnic acid present; ascospores 112–132 µm long	<i>Pertusaria yupna</i>
3: Discs K+ violet; hypothamnic acid present; ascospores 150–180 µm long	<i>Lepra tropica</i>
4 Discs KC-; lichexanthone only present; ascospores 100–150 µm long	<i>Pertusaria asterella</i>
4: Discs KC+ red or violet	5
5 Discs KC+ red; lecanoric acid present; ascospores 110–155 µm long	<i>Varicellaria velata</i>
5: Discs KC+ violet; picrolichenic acid present	6
6 Lichexanthone absent; ascospores 170–220 µm long	<i>Lepra lacerans</i>
6: Lichexanthone present	7
7 Ascospores 175–195 µm long	<i>Pertusaria myola</i>
7: Ascospores 135–150 µm long	<i>Lepra clarkeana</i>

GROUP C: Thallus corticolous; apothecia disciform; ascospores 8 per ascus

1 Discs K+ yellow; thamnic acid present	2
1: Discs K-; thamnic acid absent	3
2 Ascospores globular, 20–25 µm diam., 1-seriate	<i>Pertusaria gongylospora</i>
2: Ascospores ellipsoid, 30–50 µm long, 2-seriate	<i>Pertusaria epitheciifera</i>
3 Discs KC-; lichen compounds absent; ascospores 45–50 µm long	<i>Pertusaria gyalectoides</i>
3: Discs KC+ red; lecanoric acid present	4

- 4 Ascospores 1-seriate, 30–50 µm long *Pertusaria pycnophora*
 4: Ascospores 2-seriate, 58–75 µm long *Pertusaria kaindiensis*

GROUP D: Thallus corticolous; apothecia verruciform; ascospores 2 per ascus

- 1 Inner ascospore wall rough 2
 1: Inner ascospore wall smooth 8
- 2 Pd–; 2'-*O*-methylperlatolic acid present; ascospores 212–255 µm long
 *Pertusaria suborodes* 3
 2: Pd+ red or orange 3
- 3 Pd+ red; protocetraric acid present; ascospores 110–160 µm long ... *Pertusaria thwaitesii*
 3: Pd+ orange 4
- 4 Norstictic acid present; ascospores 150–200 µm long *Pertusaria perthwaitesii*
 4: Stictic acid present 5
- 5 Stictic acid only present; ascospores 110–125 µm long
 *Pertusaria cicatricosa* var. *deficiens* 6
 5: Stictic acid with chloroxanthenes or 4,5-dichlorolichexanthone or 2'-*O*-methylperlatolic acid 6
- 6 2'-*O*-Methylperlatolic acid present; ascospores 150–175 µm long .. *Pertusaria bundiensis*
 6: Chloroxanthenes or 4,5-dichlorolichexanthone present 7
- 7 Chloroxanthenes present; ascospores 100–150 µm long *Pertusaria cicatricosa*
 7: 4,5-Dichlorolichexanthone and 2'-*O*-methylperlatolic acid present; ascospores 95–120 µm long *Pertusaria trachyspora*
- 8 Chloroxanthenes and stictic acid present 9
 8: Chloroxanthenes absent 10
- 9 Ascospores 80–105 µm long *Pertusaria damiensis*
 9: Ascospores 100–140 µm long *Pertusaria pertusella*
- 10 4,5-Dichlorolichexanthone absent 11
 10: 4,5-Dichlorolichexanthone present 12
- 11 Stictic acid present; ascospores 80–105 µm long *Pertusaria porinella*
 11: Stictic and 2'-*O*-methylperlatolic acids and lichexanthone present; ascospores 100–112 µm long *Pertusaria isidiosa*
- 12 4,5-Dichlorolichexanthone only present; ascospores 130–155 µm
 *Pertusaria irregularis* 13
 12: 4,5-Dichlorolichexanthone present with stictic and/or 2'-*O*-methylperlatolic acids 13
- 13 Stictic and 2'-*O*-methylperlatolic acids present; ascospores 163–200 µm long (can have 4 ascospores per ascus) *Pertusaria copelandii*
 13: Stictic or 2'-*O*-methylperlatolic acids present 14
- 14 Stictic acid present; ascospores 85–110 µm long *Pertusaria pseudococcodes*
 14: 2'-*O*-Methylperlatolic acid present; ascospores 110–125 µm long
 *Pertusaria pycnothelia*

GROUP E: Thallus corticolous; apothecia verruciform; ascospores 4 per ascus

- 1 Arthothelin or thiophanic acid present 2
 1: Other chlorinated compounds present or absent 3
- 2 Arthothelin and 6-*O*-methylarthothelin present; ascospores 50–62 µm long
 *Pertusaria inconspicua* 2
 2: Thiophanic and 2'-*O*-methylperlatolic acids present; ascospores 95–120 µm long
 *Pertusaria rechingeri*
- 3 Chloroxanthenes or 4,5-dichlorolichexanthone present 4
 3: 2-Chlorolichexanthone present or chlorinated compounds absent 11
- 4 Chloroxanthenes present 5
 4: 4,5-Dichlorolichexanthone present 6
- 5 Stictic acid present; ascospores 95–125 µm long; inner spore wall smooth
 *Pertusaria ceylonica* 5
 5: 2'-*O*- and 2-*O*-Methylperlatolic acids present; ascospores 80–110 µm long; inner spore wall rough *Pertusaria elliptica*
- 6 2-*O*-Methylisohyperlatolic acid present; ascospores 105–115 µm long
 *Pertusaria streimannii* 7
 6: Stictic acid, with 2'-*O*-methylperlatolic acid, 2-*O*-methylperlatolic acid or 2-*O*-methylconfluent acid present 7
- 7 2-*O*-Methylconfluent acids present; ascospores 100–120 µm long *Pertusaria bogia*
 7: 2'-*O*-Methylperlatolic acid or 2-*O*-methylperlatolic acids present 8
- 8 Stictic and 2-*O*-methylperlatolic acids present; ascospores 100–120 µm long
 *Pertusaria laeana* 9
 8: Stictic and 2'-*O*-methylperlatolic acids present 9
- 9 Ascospores 163–200 µm long ... *Pertusaria copelandii* (can have 2 ascospores per ascus)
 9: Ascospores 82–125 µm long 10
- 10 Ascospores 90–125 µm long; apothecia 0.7–1.4 mm diam.; ostioles pale
 *Pertusaria hermaka* 10
 10: Ascospores 82–105 µm long; apothecia 0.4–0.7 mm diam.; ostioles black
 *Pertusaria microstoma*
- 11 2-Chlorolichexanthone, lichexanthone and 2-*O*-methylsuperlatolic acid present; ascospores 90–115 µm long *Pertusaria modesta*
 11: Xanthenes absent 12
- 12 Lichen compounds absent; ascospores 90–110 µm long *Pertusaria plethocarpa*
 12: Lichen compounds present 13
- 13 Norstictic acid present; ascospores 70–80 µm long *Pertusaria naduriensis*
 13: Norstictic acid absent 14
- 14 2'-*O*-Methylperlatolic and stictic acids present; ascospores 125–150
 *Pertusaria novaeguineae* 14
 14: 2-*O*-Methylsuperlatolic acid present; ascospores 80–100 µm long
 *Pertusaria manamensis*

GROUP F: Thallus corticolous; apothecia verruciform; ascospores 8 per ascus

1 Arthothelin or thiophanic acid present.....	2
1: Other chlorinated compounds present or absent.....	4
2 Thiophanic and stictic acids present; ascospores 52–72 µm long.....	
2: Arthothelin present.....	3
3 6- <i>O</i> -Methylarthothelin present; ascospores 75–87 µm long.....	<i>Pertusaria oblongata</i>
3: Thiophanic acid present; ascospores 85–95 µm long.....	<i>Pertusaria karkarensis</i>
4 Chloroxanthones or 4,5-dichlorolichexanthone present.....	5
4: 2-Chlorolichexanthone present or chlorinated compounds absent.....	11
5 Chloroxanthones present; ascospores 105–134 µm long, with rough inner walls.....	
5: 4,5-Dichlorolichexanthone present.....	<i>Pertusaria anomalospora</i> 6
6 2'- <i>O</i> -Methylperlatolic acid present.....	7
6: Other compounds present.....	8
7 2,4,5-Trichlorolichexanthone and 2'- <i>O</i> -methylperlatolic acid present; ascospores 55–65 µm long.....	<i>Pertusaria allogibberosa</i>
7: 2,4,5-Trichlorolichexanthone absent; 2'- <i>O</i> -methylperlatolic acid present; ascospores 75–100 µm long.....	<i>Pertusaria mesotropa</i>
8 Alternariol or stictic acid present.....	9
8: 2,2'-Di- <i>O</i> -methylstenosporic acid or confluent acid present.....	10
9 Alternariol present; ascospores 75–87 µm long.....	<i>Pertusaria praecipua</i>
9: Stictic acid present; ascospores 55–80 µm long.....	<i>Pertusaria leiocarpella</i>
10 2,2'-Di- <i>O</i> -methylstenosporic acid present; ascospores 80–100 µm long.....	
10: Confluent acid present; ascospores 60–75 µm long.....	<i>Pertusaria subplanaica</i> <i>Pertusaria weberi</i>
11 Divaricatic acid present; ascospores 70–92 µm long.....	<i>Pertusaria orarensis</i>
11: Chlorinated xanthonones absent.....	12
12 Norstictic acid present.....	13
12: Norstictic acid absent.....	14
13 Ascospores 1-seriate, 60–95 µm long.....	<i>Pertusaria endoxantha</i>
13: Ascospores 2-seriate, 150–210 µm long.....	<i>Pertusaria sipmanii</i>
14 Lichexanthone and stictic acid present; ascospores 100–140 µm long.....	
14: Divaricatic, 2- <i>O</i> -methylstenosporic or confluent acid present.....	<i>Pertusaria dehiscens</i> 15
15 Confluent acid present; ascospores 50–60 µm long.....	<i>Pertusaria gorokorana</i>
15: Divaricatic or 2- <i>O</i> -methylstenosporic acid present.....	16
16 Divaricatic acid present.....	<i>Pertusaria papuana</i>
16: 2- <i>O</i> -Methylstenosporic acid present.....	<i>Pertusaria kagamugana</i>

GROUP G: Thallus saxicolous or terricolous

1 Thallus terricolous, sorediate; chloroxanthones and stictic acid present.....	
1: Thallus saxicolous.....	<i>Pertusaria puffina</i> 2
2 Thallus sorediate, sterile.....	3
2: Thallus with verruciform apothecia.....	5
3 Lichexanthone, picrolichenic and hypothamnolic acids present.....	
3: 4,5-Dichlorolichexanthone or thiophanic acid present.....	<i>Pertusaria subventosa</i> var. <i>hypothamnolica</i> 4
4 4,5-Dichlorolichexanthone and stictic acid present.....	<i>Pertusaria balekensis</i>
4: Thiophanic acid and stictic acid present.....	<i>Pertusaria xanthoplaca</i> (also fertile, see below)
5 Asci with 8 ascospores.....	6
5: Asci with 2 or 4 ascospores.....	8
6 Thiophanic acid absent; lichexanthone and 2- <i>O</i> -methylperlatolic acid present; ascospores 75–90 µm long.....	<i>Pertusaria consanguinea</i>
6: Thiophanic acid present.....	7
7 Stictic acid present; ascospores 50–75 µm long.....	<i>Pertusaria xanthoplaca</i>
7: 2- <i>O</i> -Methylperlatolic acid present; ascospores 60–85 µm long.....	<i>Pertusaria petrophyes</i>
8 Asci 4-spored; 2-chlorolichexanthone, stictic acid and 2- <i>O</i> -methylperlatolic acid present.....	<i>Pertusaria aptrootii</i>
8: Asci 2-spored; 4,5-dichlorolichexanthone and stictic acid present.....	9
9 Ascospores 95–115 µm long.....	<i>Pertusaria atropilota</i>
9: Ascospores 140–175 µm long.....	<i>Pertusaria vulpina</i>

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Abstract

Seven lichen species, *Arthonia vinosa* Leight., *Caloplaca chalybaea* (Fr.) Müll. Arg., *Pertusaria alboatra* Zahlbr., *P. labuensis* A.W. Archer & Elix, *P. neilgherrensis* (Müll. Arg.) D.D. Awasthi & P. Srivast., *Rhizocarpon ridescens* (Nyl.) Zahlbr. and *Varicellaria hemisphaerica* (Flörke) I. Schmitt & Lumbsch, are reported from Australia for the first time. New state, territory and oceanic island records are provided for 50 other taxa.

New records for Australia

Arthonia vinosa Leight., *Ann. Mag. nat. Hist.*, ser. 2, **18**, 331 (1856)

Fig. 1

This species was previously known from Europe, North America and New Zealand (Galloway 2007; Coppins & Aptroot 2009). It is characterized by a crustose, immersed or slightly powdery to scurfy, granular, whitish to yellow-orange to pale fawn thallus, often with darker yellow-orange (K+ purple) patches; lecideine apothecia, 0.2–0.6 mm wide, which are often rounded, convex, with an orange to dark brown, epruinose disc, K+ purple in section, and oval to ellipsoid, usually 1-septate ascospores, 10–15 × 3.5–5 µm, which are initially colourless but become brown and warty with age. Pycnidia frequent, conidia bacilliform, 4–6 × 1 µm, straight or slightly curved.

Chemistry: containing an anthraquinone (*O*-methylhaematommone).

A detailed description is given in Coppins & Aptroot (2009) and a colour photograph in Wirth (1995, p. 135).

SPECIMEN EXAMINED

Australian Capital Territory. • Tidbinbilla Nature Reserve, Ring Road causeway over Tidbinbilla River near Fishing Gate Trail, 35°29'S, 148°54'E, 810 m alt., on dead bark of live *Eucalyptus viminalis*, J.A. Curnow 5324, 10.vi.2001 (CANB).

Caloplaca chalybaea (Fr.) Müll. Arg., *Mém. Soc. Phys. Hist. Nat. Genève* **16**, 388 (1862)

Fig. 2

This species was previously known from Europe, Macaronesia, Asia and Africa (Fletcher & Laundon 2009). It is characterized by a crustose, grey-brown, rimose to areolate thallus with a marginal, black prothallus, scattered to crowded apothecia, 0.2–0.3(–0.5) mm wide, initially immersed then adnate, thalline margin distinct, often paler than the disc, the disc flat, level with areole surface when mature, black but often blue-grey-pruinose, a grey-green epiphytism that reacts K+ purple and polarilocular ascospores, 10–[12.5]–15 × 6–[7.1]–8 µm, with a broad septum, 3–5 µm wide.

Caloplaca chalybaea grows on hard limestone and superficially resembles *Circinaria contorta* or a member of the *Lecanora dispersa* group, but it is readily distinguished by the polariocular ascospores. A detailed description is given in Fletcher & Laundon (2009).

SPECIMEN EXAMINED

New South Wales. • 1 km N of Wee Jasper township, 35°04'21"S, 148°39'38"E, 410 m alt., on limestone rocks in pasture with scattered *Eucalyptus*, *J.A. Elix 46653*, 30.v.2016 (CANB).

Pertusaria alboatra Zahlbr., *Denkschr. Akad. Wiss. Wien math.-naturwiss. Kl.* **104**, 336 (1941) Fig. 3

This corticolous species was previously known from New Zealand (Galloway 2007). It is characterized by a pale yellow-fawn, areolate thallus with conspicuous, pore-like, verruciform apothecia, 0.5–1 mm wide. The verrucae can be flattened-hemispherical to immersed, and have conspicuous black ostioles 0.1–0.4 mm diam., 1 per verruca. The asci are usually 2-spored (rarely 3) and the ascospores are ellipsoid and (70–)85(–110)–130 × 35–45 µm. It contains thiophanic acid (major), 2-chloro-6-*O*-methylnorlichexanthone (trace) and 4-chloro-6-*O*-methylnorlichexanthone (trace). A description is given in Galloway (2007).

SPECIMEN EXAMINED

New South Wales. • Mountain Creek, Jimbaroo State Forest, 14 km NNE of Rankins Springs, 33°45'S, 146°19'E, 340 m alt., on old *Callitris* fence posts in *Callitris* woodland, *J.A. Elix 25306*, 13.vi.1990 (CANB).

Pertusaria labuensis A.W.Archer & Elix, *Nova Hedwigia* **88**, 2 (2009) Fig. 4

This corticolous species was previously known from Papua New Guinea (Archer & Elix 2009). It is characterized by a pale fawn, subtuberculate upper surface, and the presence of cylindrical isidia, 0.3–0.6 mm tall and 0.1–0.2 mm diam. and medullary divaricatic acid. Apothecia have not been observed. It is the only sterile, isidiate *Pertusaria* species known to contain divaricatic acid. A description and illustration are given in Archer & Elix (2009).

SPECIMEN EXAMINED

New South Wales. • Grassy Head, 5 km N of Stuarts Point, 30°48'S, 153°00'E, 6 m alt., on *Eucalyptus* in regrowth coastal forest behind sand dunes, *J.A. Elix 21842*, 24.i.1988 (CANB).

Pertusaria neilgherrensis (Müll.Arg.) D.D.Awasthi & P.Srivast., in D.D.Awasthi, *Biblioth. Lichenol.* **40**, 3 (1991) Fig. 5

Pertusaria leioplacoides var. *neilgherrensis* Müll.Arg., *Flora* **67**, 301 (1884)
Pertusaria tetralthalamia var. *neilgherrensis* (Müll.Arg.) Müll.Arg., *Rev. Mycol. (Toulouse)* **9**, 84 (1887).

Type: India, Neilgherries [Nilgiri Hills, c. 250 km SSW of Bangalore], *Ziegler s.n.* (holotype – G!).

Thallus pale fawn, smooth, glossy and rimose, corticolous. Apothecia verruciform, scattered, rarely confluent, flattened-hemispherical, sometimes becoming discoid, 0.6–1.5 mm wide. Ostioles inconspicuous, black, punctiform, occasionally sunken, 2–5 per verruca. Ascospores narrowly ellipsoid, hyaline, with a rough inner spore wall, 2 per ascus, 120–150 × 32–36 µm. *Chemistry*: 4,5-dichlorolichexanthone (minor), atranorin (major), stictic acid (major), constrictic acid (minor), cryptostictic acid (trace) and menegazziac acid (trace).

Pertusaria neilgherrensis was previously known from Madhya Pradesh and Tamil Nadu in India (Singh & Sinha 2010). It is characterized by the verruciform apothecia, 2-spored asci, spores with rough inner walls and the presence of 4,5-dichlorolichexanthone and stictic acid. The North American species *P. macounii* (I.M.Lamb) Dibben has similar ascospores, 154 × 52 µm, and similar chemistry, but that species occurs north from the Carolinas to New England and east through Canada to Newfoundland (Dibben 1980), and is unlikely to occur on Lord Howe Island. *Pertusaria bundiensis* A.W.Archer & Elix, from Papua New Guinea, also has

similar ascospores, 150–175 × 37–40 µm, but contains 4,5-dichlorolichexanthone, stictic acid and 2'-*O*-methylperlatolic acid as a major compound (Archer & Elix 1998).

SPECIMEN EXAMINED

New South Wales. • Lord Howe Island, Goat House Cave, 31°33'50"S, 159°05'15"E, 420 m alt., on base of tree in moist subtropical rainforest at base of Mt Lidgbird escarpment, *J.A. Elix 42215*, 7.ii.1995 (CANB).

Rhizocarpon ridescens (Nyl.) Zahlbr., in A.Engler & K.A.Prantl, *Die Natürlichen Pflanzenfamilien*, **1**, 1, 138 (1905)

This species was previously known from Europe and Central Asia (Fletcher *et al.* 2009). It is characterized by a bright yellow-green, areolate thallus dispersed on a prominent black prothallus where the convex areoles usually develop discrete, initially punctiform then capitate soralia with yellow-green granular soredia, which rarely spread over the upper surface, an I+ medulla, rare lecideine apothecia, 0.7–1 mm wide, with a red-brown, K+ purple-red epiphymenium and dark brown, muriform ascospores, 20–30 × 12–16 µm, and the presence of rhizocarpic and psoromic acids. It is distinguished from the very common *R. geographicum* (L.) DC. by the sorediate upper surface. A detailed description is given in Fletcher *et al.* (2009) and an excellent colour photograph in Wirth (1995, p. 817).

SPECIMENS EXAMINED

New South Wales. • Brown Mountain, adjacent to Pipers Lookout, 17 km SE of Nimmitabel, 36°35'50"S, 149°26'39"E, 905 m alt., on granite rocks in wet *Eucalyptus* forest, *J.A. Elix 46503*, 4.xi.2017 (CANB); • Turallo Range, Hoskinstown-Braidwood road, 10 km E of Hoskinstown, 35°26'29"S, 149°31'35"E, 890 m alt., on granite rocks in open *Eucalyptus* woodland, *J.A. Elix 46526*, 17.xii.2017 (CANB); • Turallo Range, Hoskinstown-Braidwood road, 15 km E of Hoskinstown, 35°26'41"S, 149°32'18"E, 1020 m alt., on granite rocks in open *Eucalyptus* woodland, *J.A. Elix 46539*, 17.xii.2017 (CANB).

Varicellaria hemisphaerica (Flörke) I.Schmitt & Lumbsch, *Myckeys* **4**, 29 (2012) Fig. 6

This species was previously known from Europe, Macaronesia and Asia (Chambers *et al.* 2009). It is characterized by a bluish grey to grey-brown thallus with a broad, paler or white marginal prothallus, a sorediate upper surface with markedly convex soralia 1–2 mm wide, which often become confluent, and the presence of lecanoric acid. Apothecia have not been observed. A description is given in Chambers *et al.* (2009).

SPECIMEN EXAMINED

New South Wales. • Buckenbowra River estuary, 7.5 km WNW of Batemans Bay, 35°32'S, 150°07'E, 2 m alt., on tree trunk in *Avicennia-Aegiceras*-dominated riverside, *J.A. Elix 26599*, 15.iii.1992 (CANB).

New state, territory and oceanic island records

Acarospora simplex (Taylor) Jatta, *Syll. Lich. Ital.* **25** (1900)

Common at higher latitudes of the Northern Hemisphere, but less well known in austral regions. In Australia, previously reported only from the south-west of Western Australia (Richardson & Richardson 1982; Kantvilas 1998).

SPECIMEN EXAMINED

New South Wales. • Southern Tablelands, Turallo Range, Hoskinstown-Braidwood road, 7 km E of Hoskinstown, 35°26'00"S, 149°30'24"E, 850 m alt., on weathered, roadside granite outcrops, *P.M. McCarthy 4704*, 17.xii.2017 (CANB).

Amandinea conglomerata Elix & Kantvilas, *Australas. Lichenol.* **72**, 4 (2013)

This endemic species was previously known from New South Wales (McCarthy 2018).

SPECIMEN EXAMINED

Tasmania. • Poverty Point, 43°13'S, 147°03'E, 2 m alt., on coarse quartzitic coastal rocks, *G. Kantvilas* 23/18, 3.iv.2018 (HO).

Amandinea litoralis (Zahlbr.) H.Mayrhofer & Elix, in J.Blaha *et al.*, *Australas. Lichenol.* **79**, 40 (2016)

In Australia this Australasian species was previously known from Tasmania (McCarthy 2018).

SPECIMEN EXAMINED

New South Wales. • Newcastle, Bogey Hole, 32°56'07"S, 151°46'54"E, on sandstone on coastal cliffs, *D. & H. Mayrhofer* 11138, *E. Hierzer, S. & R. Filson*, 22.vii.1992 (GZU).

Amandinea nebulosa (Elix & Kantvilas) Elix & Kantvilas, *Australas. Lichenol.* **79**, 30 (2016)
This endemic species was previously known from Tasmania (McCarthy 2018).

SPECIMENS EXAMINED

New South Wales. • Southern Tablelands, Tom Groggin Road, 0.5 km E of Snowy Mountains Highway, 15 km SE of Cooma, 36°20'49"S, 149°13'31"E, 940 m alt., on conglomerate in tussock grassland with low conglomerate boulders, *P.M. McCarthy* 4683, 4.xi.2017 (CANB, HO).

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

Amandinea prothallinata Elix & H.Mayrhofer, in J.A.Elix *et al.*, *Australas. Lichenol.* **80**, 28 (2017)

This species was known previously from Queensland, New South Wales, Victoria, Norfolk Island and New Zealand (Elix *et al.* 2017).

SPECIMEN EXAMINED

Tasmania. • E of Eldon Road, 42°29'S, 147°26'E, 410 m alt., on sheltered aspect of sandstone bluff in dry sclerophyll forest, *G. Kantvilas* 53/16, 10.v.2016 (HO).

Arthrorhaphis citrinella (Ach.) Poelt, *Bestimmungs. Eur. Flecht.* 126 (1969) var. **citrinella**
This common antitropical lichen of peat, soil and bryophytes occurs in boreal Eurasia and North America, New Zealand, Antarctica, alpine New South Wales and Tasmania (Obermayer 2001; McCarthy 2018).

SPECIMEN EXAMINED

Macquarie Island. • Mt Fletcher, 400 ft [c. 120 m] alt., NE and N aspect, growing on peat and bryophytes, *D.A. Parker*, 10.x.1971 (MEL 1023767).

Bryobilimbia hypnorum (Libert) Fryday, Printzen & S.Ekman, *Lichenologist* **46**, 31 (2014)
A common lichen on bryophytes and plant debris, mainly in Eurasia and North America; also in southern Western Australia, the Australian Capital Territory and Tasmania (McCarthy 2018).

SPECIMEN EXAMINED

Victoria. • Basalt Hill, 35 km NW of Omeo, Bogong High Plains, Alpine Natl Park, 36°53'S, 147°18'E, alt. 1650 m, on humus in swampy ground in subalpine grassland with scattered shrubs, *H. Streimann* 50585, 28.xii.1992 (CANB).

Buellia abstracta (Nyl.) H.Olivier, *Bull. Acad. Internat. Géogr. Bot.* **12**, 176 (1903)
This cosmopolitan species was known previously from Europe, North and South America, New Zealand and Tasmania (Elix & McCarthy 2018).

SPECIMENS EXAMINED

New South Wales. • Turallo Range, Hoskinstown-Braidwood road, 7 km E of Hoskinstown, 35°26'S, 149°30'24"E, 850 m alt., on granite rocks in open *Eucalyptus* woodland, *P.M. McCarthy* 4705, 4706, 17.xii.2017 (CANB).

Buellia aeruginosa A.Nordin, Owe-Larsson & Elix, *Mycotaxon* **71**, 400 (1999)
In Australia this species is known from South Australia, New South Wales, Victoria and Tasmania (McCarthy 2018); it also occurs in New Zealand (Elix & Mayrhofer 2018).

SPECIMEN EXAMINED

New South Wales. • Lord Howe Island, Boat Harbour, 31°33'40"S, 159°05'50"E, 3 m alt., on basalt rocks along foreshore, *J.A. Elix* 42469 *pr. p.*, 10.ii.1995 (CANB).

Buellia canobolasensis Elix & P.M.McCarthy, in Elix *et al.*, *Australas. Lichenol.* **80**, 29 (2017)

This endemic species was previously known from New South Wales (McCarthy 2018).

SPECIMEN EXAMINED

Australian Capital Territory. • Namadgi Natl Park, Brindabella Range, Mt Ginini-Mt Franklin road, 4 km S of Aggie Gap, 50 km WSW of Canberra, 35°30'26"S, 148°45'44"E, 1555 m alt., on schist rock in subalpine *Eucalyptus* woodland, *P.M. McCarthy* 4713, 10.i.2018 (CANB).

Buellia cranfieldii Elix, *Australas. Lichenol.* **66**, 45 (2010)

This endemic Australian species was previously known from Western Australia, Victoria and Tasmania (McCarthy 2018).

SPECIMEN EXAMINED

New South Wales. • Turallo Range, Hoskinstown-Braidwood road, 10 km E of Hoskinstown, 35°26'29"S, 149°31'35"E, 890 m alt., on granite rocks in open *Eucalyptus* woodland, *J.A. Elix* 46529, 17.xii.2017 (CANB).

Buellia halonioides Elix, in J.A.Elix *et al.*, *Australas. Lichenol.* **81**, 34 (2017)

This Australasian species was previously known from South Australia, New South Wales and New Zealand (Elix *et al.* 2017b).

SPECIMEN EXAMINED

Tasmania. • Swansea, 42°07'S, 148°44'E, 1–5 m alt., on coastal rocks, *H. Mayrhofer* 13394 *pr. p.*, 15.xi.1996 (GZU).

Buellia inturgescens Müll.Arg., *Hedwigia* **31**, 197 (1892)

This endemic Australian species was previously known from the Northern Territory, South Australia and New South Wales (McCarthy 2018).

SPECIMEN EXAMINED

Tasmania. • Wind Song Property, NW corner adjacent to Swanston Road, 42°21'S, 147°54'E, 60 m alt., on exposed dolerite rocks in paddock, *G. Kantvilas* 178/17, 26.x.2017 (HO).

Buellia kantvilasii Elix, Blanchon & A.Knight, *Australas. Lichenol.* **80**, 48 (2017)

This Australasian species was previously known from Tasmania and New Zealand (Elix *et al.* 2017a).

SPECIMENS EXAMINED

Queensland. • Cunninghams Gap Natl Park, S exposed ridge of Mt Cordeaux, 28°02'S, 152°23'E, c. 1000 m alt., on basaltic rocks, *J. Hafellner* 15370, 17.ix.1986 (GZU).

Australian Capital Territory. • Molonglo Gorge Reserve, 14 km SE of Canberra, on sheltered sandstone rocks, *P.W. James s.n.*, 27.i.1994 (BM 001231321).
Victoria. • Lederberg Gorge, 4 km N of Bacchus Marsh, 37°31'S, 144°22'E, on rock, *R. Filson & H. Mayrhofer 3031*, 18.x.1981 (GZU).

Buellia reagenella Elix, *Fl. Australia* **57**, 660 (2009)

This austral species was previously known from South America, and in Australia from Western Australia, Queensland, New South Wales, Victoria and Tasmania (Elix 2009b; McCarthy 2018).

SPECIMEN EXAMINED

Australian Capital Territory. • Blue Range, 7 km N of Condor Creek, c. 25 km W of Canberra, c. 800 m alt., on *Exocarpus cupressiformis*, *H. Mayrhofer 5347*, 1.ix.1981 (GZU).

Buellia schaeferi De Not., *Giorn. Bot. Ital.* **2**, 199 (1846)

In Australia this cosmopolitan species was previously known from New South Wales (McCarthy 2018).

SPECIMENS EXAMINED

Tasmania. • Wind Song Property, Ronnies Spur, 42°21'S, 147°55'E, 30 m alt., on bleached and charred standing eucalypt wood in dry sclerophyll forest, *G. Kantvilas 197/17*, 25.x.2017 (HO); • Wind Song Property, Callitris Gully, 42°21'S, 147°55'E, 40 m alt., on dry bleached wood of *Callitris* in *Callitris rhomboidea* woodland, *G. Kantvilas 368/17*, 24.x.2017 (HO); *loc. id.*, *G. Kantvilas 402/17*, 26.x.2017 (HO).

Buellia subadjuncta Elix & Kantvilas, in *J.A.Elix et al.*, *Australas. Lichenol.* **81**, 37 (2017)

This lichenicolous species was previously known from South Australia and New Zealand (Elix & Mayrhofer 2018; McCarthy 2018).

SPECIMEN EXAMINED

Tasmania. • Wind Song Property, Ronnies Spur, 42°21'S, 147°55'E, 30 m alt., on thallus of *Caloplaca rexifilsonii* on rocks in dry sclerophyll forest, *G. Kantvilas 278/17*, 25.x.2017 (HO).

Byssoloma adpersum Malcolm & Vězda, *Mycotaxon* **55**, 358 (1995)

This lichen was previously known from New Zealand, south-eastern New South Wales, southern Victoria and Tasmania (Malcolm & Vězda 1995; McCarthy 2018).

SPECIMENS EXAMINED

New South Wales. • Lord Howe Island, junction of tracks to Mutton Bird Point and Intermediate Hill, 31°32'43"S, 159°04'48"E, alt. 60 m, on basalt in dry lowland forest on ridge, *J.A. Elix 32755A*, 21.vii.1992 (CANB); • Lord Howe Island, track to Goat House Cave, 31°33'48"S, 159°05'11"E, 380 m alt., on basalt rocks in moist subtropical rainforest at base of Mt Lidgerbird escarpment, *J.A. Elix 42108*, 7.ii.1995 (CANB).

Cyphelium trachyloides (Nyl.) Erichsen ex Keissl., *Rabenh. Krypt.-Fl.* **9**(1), 2, 784 (1938)

In Australia this cosmopolitan species occurs in Western Australia, New South Wales, the Australian Capital Territory and Victoria (McCarthy 2018).

SPECIMEN EXAMINED

Tasmania. • Wind Song Property, Paradise, 42°21'S, 147°55'E, 30 m alt., on charred eucalypt log in dry sclerophyll forest, *G. Kantvilas 122/18*, 26.ix.2018 (HO).

Dibaeis arcuata (Stirt.) Kalb & Gierl, in *Gierl & Kalb, Herzogia* **9**, 617 (1993)

This species occurs in Australia (Queensland, New South Wales, the Australian Capital Territory, Victoria and Tasmania) and New Zealand (Johnston 2001).

SPECIMEN EXAMINED

Norfolk Island. • Cascade Road, 29°01'26"S, 167°57'51"E, 50 m alt., on soil bank in grassy area with scattered shrubs, *J.A. Elix 27337*, 14.vi.1992 (CANB).

Dibaeis sorediata Kalb & Gierl, in *Gierl & Kalb, Herzogia* **9**, 615 (1993)

This species is known from Nepal and Réunion, and in Australia from Queensland and New South Wales (Johnston 2001).

SPECIMEN EXAMINED

Norfolk Island. • Mount Pitt Reserve, track at end of Selwyn Pine Road, 29°01'S, 167°56'30"E, 200 m alt., on soil bank in open woodland with kikuyu grass, *J.A. Elix 18452 & H. Streimann*, 3.xii.1984 (CANB).

Diorygma wilsonianum (Müll.Arg.) A.W.Archer, *Australas. Lichenol.* **56**, 10 (2005)

This endemic species was previously known from Victoria (McCarthy 2018).

SPECIMEN EXAMINED

New South Wales. • Evans Head, 29°07'S, 153°26'E, 3 m alt., on bark of tree in maritime scrub, *J.A. Elix 1103*, 20.viii.1975 (CANB).

Endocarpon pallidum Ach., *Lichenogr. Universalis* 301 (1810)

In Australia, this almost cosmopolitan, terricolous species was previously known from Western Australia, South Australia, Queensland and New South Wales (McCarthy 2018).

SPECIMEN EXAMINED

Australian Capital Territory. • NE slopes of Mt Mugga Mugga, Canberra Nature Park, Woden Valley, Canberra, 35°20'43"S, 149°07'10"E, 655 m alt., on consolidated siliceous soil in *Eucalyptus* woodland, *P.M. McCarthy 4776*, 15.ix.2017 (CANB).

Lecanora epibryon (Ach.) Ach., *Lichenogr. Universalis* 396 (1810) subsp. **epibryon**

A widespread Arctic-alpine species in the Northern Hemisphere, and also recorded from southern South America (Lumbsch *et al.* 1994), this lichen was previously known in Australia only from Western Australia. Rather unusually, the Tasmanian specimen is from rock; this taxon usually grows over soil or bryophytes.

SPECIMEN EXAMINED

Tasmania. • Wind Song Property, northern rim of Callitris Gully, 42°21'S, 147°55'E, 60 m alt., on dolerite boulder in rough paddock, *G. Kantvilas 304/17*, 24.x.2017 (HO).

Lecania turicensis (Hepp) Müll.Arg., *Mém. Soc. Phys. Hist. Nat. Genève* **16**, 286 (1862)

A common species of calcareous and non-calcareous rocks in temperate regions of both hemispheres, this lichen is known from southern Western Australia, South Australia, New South Wales, the Australian Capital Territory and Tasmania (Kantvilas & van den Boom 2015; McCarthy 2018).

SPECIMEN EXAMINED

Victoria. • Royal Botanic Gardens, South Yarra, W side of California Garden, 37°49'54"S, 144°59'02"E, on shale and schist, *V. Stajsic 7399*, 17.vi.2015 (CANB, MEL).

Leimonis erratica (Körb.) R.C.Harris & Lendemmer, in *R.C.Harris, Opuscula Philolich.* **6**, 151 (2009)

Known from Central and Western Europe, North America and New Zealand; in Australia it has been reported from Queensland, New South Wales and Victoria (McCarthy 2018).

SPECIMENS EXAMINED

Australian Capital Territory. • Namadgi Natl Park, Brindabella Range, summit of Mt Ginini, 35°31'47"S, 148°46'22"E, alt. 1760 m, on siliceous stones embedded in soil, *P.M. McCarthy* 4722, 4741, 10.i.2018 (CANB); • Namadgi Natl Park, Brindabella Range, Mt Franklin Road, 1 km N of Aggie Gap, c. 44 km WSW of Canberra, 35°28'02"S, 148°46'09"E, alt. 1420 m, on schist outcrop beside road in subalpine *Eucalyptus* woodland, *P.M. McCarthy* 4712, 10.i.2018 (CANB); *loc. id.*, *J.A. Elix* 46552, 10.i.2018 (CANB); • Namadgi Natl Park, Brindabella Range, Mt Franklin road, 4 km S of Aggie Gap, c. 50 km WSW of Canberra, 35°30'26"S, 148°45'44"E, alt. 1555 m, on schist outcrop beside road in subalpine *Eucalyptus* woodland, *P.M. McCarthy* 4715, 4716, 10.i.2018 (CANB); *loc. id.*, *J.A. Elix* 46547, 46549, 10.i.2018 (CANB). [Det.: C. Gueidan]

Lepra clarkeana (A.W.Archer) I.Schmitt, B.P.Hodk. & Lumbsch, *in Wei et al.*, *PLoS ONE* **12**, 7/14 (2017)

This Australian endemic species was previously known from Queensland, New South Wales and Victoria (McCarthy 2018).

SPECIMEN EXAMINED

Norfolk Island. • end of abandoned road (Marsh's Road), Mount Pitt Natl Park, 29°00'48"S, 167°56'50"E, 180 m alt., on fallen twigs, in subtropical forest on moderate slope near head of creek, *J.A. Elix* 29164, 17.vi.1992 (CANB).

Lepra psoromica (A.W.Archer & Elix) A.W.Archer & Elix, *Australas. Lichenol.* **82**, 132 (2018)

In Australia this species is known from Queensland and New South Wales (McCarthy 2018). It also occurs in Norfolk Island, Papua New Guinea and New Zealand (Archer & Elix 2016).

SPECIMEN EXAMINED

Australian Capital Territory. • Molonglo Gorge, 16 km SE of Canberra, 35°19'46"S, 149°14'59"E, 650 m alt., on rocks along the river bank, *J.A. Elix* 11785, *P.W. James & D. Verdon*, 27.i.1984 (CANB).

Lepraria jackii Tønsberg, *Sommerfeltia* **14**, 200 (1992)

In Australia this cosmopolitan species is known from Western Australia, Queensland, New South Wales, the Australian Capital Territory, Victoria and Norfolk Island (McCarthy 2018).

SPECIMENS EXAMINED

Tasmania. • Bisdee Tier, 42°26'S 147°17'E, 640 m alt., on rocks in dry sclerophyll forest, *G. Kantvilas* 158/09, 214/09, 11.iii.2009 (HO); • Crest Range, 43°17'S 146°30'E, 980 m alt., on rock, *G. Kantvilas* 214/16, 2016 (HO); • Wind Song Property, Callitris Gully, 42°21'S, 147°55'E, 40 m alt., on dolerite rocks in stream bed, *G. Kantvilas* 347/17, 26.x.2017 (HO).

Massalongia carnosa (Dicks.) Körb., *Syst. Lich. Germ.* 109 (1855)

In Australia this cosmopolitan species was previously known from alpine areas of New South Wales, Victoria and Tasmania (McCarthy 2018).

SPECIMEN EXAMINED

Australian Capital Territory. • Namadgi Natl Park, Scabby Range, Mt Scabby, 35°45'S, 148°51'E, 1750 m alt., on exposed rock in open rocky plateau, *J.A. Curnow* 4278, 11.iii.1992 (CANB).

Megalaria coralloidea P.M.McCarthy & Elix, *Australas. Lichenol.* **79**, 20 (2016)

First described from rainforest near Tolga on the Atherton Tableland (McCarthy & Elix 2016b), a second NE Queensland collection has since been recognized.

SPECIMEN EXAMINED

Queensland. • Atherton Tableland, Tully Falls, 18 km SE of Ravenshoe, 17°47'S, 145°34'E, alt. 720 m, on treelet stem in rainforest on a gentle slope, *H. Streimann* 27118, 1.iii.1983 (B. n.v., CANB).

Megalospora subtuberculosa (C.Knight) Sipman, *Biblioth. Lichenol.* **18**, 123 (1983)

This Australasian species was previously known from Queensland, New South Wales, Victoria and Tasmania (McCarthy 2018). It also occurs in New Zealand (Galloway 2007).

SPECIMENS EXAMINED

New South Wales. • Lord Howe Island, junction of Kims Lookout and Max Nicholls Tracks, 31°31'08"S, 159°03'01"E, 100 m alt., on basalt rocks on flat broad ridge in lowland forest, *J.A. Elix* 42049, 6.ii.1995 (CANB).

Norfolk Island. • Mt Bates summit trail, Mount Pitt Natl Park, 29°00'30"S, 167°56'30"E, 300 m alt., on dead *Araucaria* in subtropical forest, *J.A. Elix* 18552 & *H. Streimann*, 6.xii.1984 (CANB); • track E of Mt Bates, Mount Pitt Natl Park, 29°00'40"S, 167°56'20"E, 280 m alt., on *Nestigia* in subtropical forest, *J.A. Elix* 27464, 15.vi.1992 (CANB), on canopy branches of *Araucaria* in subtropical forest, *J.A. Elix* 29011, 15.vi.1992 (CANB); • West Palm Glen Track, Mount Pitt Natl Park, 29°01'06"S, 167°56'33"E, 140 m alt., on base of *Cyathea* in subtropical forest, *J.A. Elix* 29058, 29069, 29077, 29091, 16.vi.1992 (CANB); • Emily Bay, Kingston, 29°03'37"S, 167°57'26"E, 30 m alt., on dead wood, *J.A. Elix* 29115, 17.vi.1992 (CANB); • end of abandoned track (Marshs Road), Mount Pitt Natl Park, 29°00'408"S, 167°56'50"E, 180 m alt., on fallen twigs in subtropical forest, *J.A. Elix* 29163, 17.vi.1992 (CANB); • Pop Rock, near Mount Pitt Road, 29°01'23"S, 167°56'10"E, on dead *Cupressus* in remnant subtropical forest, *J.A. Elix* 29298, 18.vi.1992 (CANB).

Micarea globulosella (Nyl.) Coppins, *Bull. Brit. Nat. Hist. Mus. Bot.* **11**, 134 (1983)

This species was previously known from Europe, North America and Japan (Coppins 2009), and in Australia from South Australia (Kantvilas 2019).

SPECIMENS EXAMINED

Western Australia. • Walebing, Quarrell Range, Moora-New Norcia road, 22 km S of Moora, 30°41'38"S, 116°12'20"E, 275 m alt., on base of dead *Acacia* in remnant *Eucalyptus-Acacia* woodland, *J.A. Elix* 37540, 2.iv.2006 (CANB); • near summit of Mt Observation, Mount Observation Natl Park, 20 km W of York, 31°53'45"S, 116°33'26"E, 365 m alt., on base of dead *Eucalyptus* in *Eucalyptus* woodland, *J.A. Elix* 38116, 3.iv.2006 (CANB); • Charles Gardiner Flora Reserve, central track, 20 km SW of Tammin along old York Road, 31°47'24"S, 117°28'07"E, 305 m alt., on dead wood in *Eucalyptus* woodland in shallow gully, *J.A. Elix* 38476, 4.iv.2006 (CANB).

Queensland. • Broadwater State Forest, Canoe Creek, 35 km NW of Ingham, 18°27'04"S, 146°00'07"E, 40 m alt., on *Pinus caribea* wood at margin of rainforest and *Pinus caribea* plantation, *J.A. Elix* 38955, 26.vii.2006 (CANB).

Victoria. • dead-end track off Eagles Nest Road, Strathewen, c. 2.5 km from Strathewen Bridge, 37°33'S, 146°16'E, *R.A. Kilgour* 480, 28.x.1984 (HO).

Micarea argopsinosa P.M.McCarthy & Elix, *Telopea* **19**, 32 (2016)

A second specimen of this saxicolous lichen has recently been collected from within a kilometre of the type locality on Mount Ginini, A.C.T. (McCarthy & Elix 2016a).

SPECIMEN EXAMINED

Australian Capital Territory. • Namadgi Natl Park, Brindabella Range, Mt Ginini, c. 200 m S of locked gate at carpark, 35°31'36"S, 148°46'45"E, 1590 m alt., on granite outcrop among snowgums (*Eucalyptus pauciflora*), *P.M. McCarthy* 4736, 10.i.2018 (CANB).

Ochrolechia africana Vain., *Ann. Univ. Fenn. Aboensis*, Ser. A, 2(3), 3 (1926)

This species was known previously from Africa, North America and South America (Brodo 1991), and in Australia from Western Australia, South Australia, Queensland, the Australian Capital Territory, Victoria and Lord Howe Island (McCarthy 2018).

SPECIMENS EXAMINED

Tasmania. • Louisa Bay, 43°31'56"S, 146°22'20"E, sea level, on bark, *L. Cave 3010*, 2016 (HO); • West Point, 40°57'S, 144°37'E, 10 m alt., on bark, *G. Kantvilas 479/11*, 2011 (HO); • end of Bolduans Road, 40°47'S, 145°02'E, 1 m alt., on bark, *G. Kantvilas 464/11*, 2011 (HO); • Swan Basin, 42°13'S, 145°16'E, 1 m alt., on bark, *G. Kantvilas 108/13*, 2013 (HO); • Dago Plains, between mouths of Italian and Lagoon Rivers, 41°29'S, 144°49'E, 15 m alt., on bark, *G. Kantvilas 99/15*, 30.i.2015 (HO); • Black River, 40°51'S, 145°18'E, 2 m alt., on bark, *G. Kantvilas 360/16*, 2016 (HO); • Wind Song Property, Callitris Gully, 42°21'S, 147°55'E, 40 m alt., on *Callitris* in *Callitris rhomboidea* woodland, *G. Kantvilas 381/17*, 24.x.2017 (HO).

Pertusaria balekensis A.W.Archer & Elix, *Mycotaxon* 67, 158 (1998)

This species was previously known from Papua New Guinea and Queensland (Archer & Elix 2016).

SPECIMENS EXAMINED

New South Wales. • Lord Howe Island, Intermediate Hill via track to North Hummock, 31°32'45"S, 159°04'55"E, alt. 120 m, on basalt in lowland forest with dense shrub cover, *J.A. Elix 42036*, 5.ii.1995 (CANB); • Lord Howe Island, junction of Kims Lookout and Max Nicholls Tracks, 31°31'08"S, 159°03'01"E, 100 m alt., on basalt rocks on flat broad ridge in lowland forest, *J.A. Elix 42056*, 6.ii.1995 (CANB); • Lord Howe Island, Goat House Cave, 31°33'50"S, 159°05'15"E, 420 m alt., on shrubs in moist subtropical rainforest at base of Mt Lidgbird escarpment, *J.A. Elix 42186*, 7.ii.1995 (CANB); • Lord Howe Island, near pier, 31°30'59"S, 159°03'12"E, 180 m alt., on basalt rocks in stunted lowland forest, *J.A. Elix 42354*, 9.ii.1995 (CANB); • Lord Howe Island, track to Kims Lookout, 31°30'59"S, 159°03'12"E, 180 m alt., basalt rocks in stunted lowland forest, *J.A. Elix 42358*, 9.ii.1995 (CANB); • Lord Howe Island, track from Smoking Tree Ridge to Rocky Run, 31°33'35"S, 159°05'09"E, 170 m alt., on tree in lowland forest, *J.A. Elix 42446*, 10.ii.1995 (CANB).

Pertusaria crassilabra Müll.Arg., *Hedwigia* 32, 126 (1893)

This species is known from South America, South Africa and New Zealand, and in Australia from South Australia, New South Wales, the Australian Capital Territory, Victoria and Tasmania (Archer & Elix 2016; McCarthy 2018).

SPECIMENS EXAMINED

New South Wales. • Lord Howe Island, Boat Harbour, 31°33'40"S, 159°05'50"E, 3 m alt., on basalt rocks along foreshore, *J.A. Elix 42469 pr. p.*, 10.ii.1995 (CANB); • Lord Howe Island, Mt Eliza, 31°30'52"S, 159°02'20"E, 130 m alt., on exposed boulder, *H. Streimann 55785*, 6.ii.1995 (CANB).

Pertusaria georgeana var. **victoriana** Elix & A.W.Archer, in *J.A.Elix et al.*, *Teloepa* 12, 266 (2008)

This endemic taxon was previously known from New South Wales, the Australian Capital Territory and Victoria (McCarthy 2018).

SPECIMEN EXAMINED

Tasmania. • Wind Song Property, Ronnies Spur, 42°21'14"S, 147°55'01"E, 30 m alt., on bleached and charred standing eucalypt wood in dry sclerophyll forest, *G. Kantvilas 201/17*, 25.x.2017 (HO).

Pertusaria maritima A.W.Archer & Elix, *Teloepa* 6, 19 (1994)

This endemic species was previously known from Queensland, New South Wales and Lord Howe Island (McCarthy 2018).

SPECIMEN EXAMINED

Norfolk Island. • Bloody Bridge, 29°03'21"S, 167°58'E, 35 m alt., on rotting wood in grasslands on steep slope with scattered *Araucaria heterophylla*, *J.A. Elix 27330*, 14.vi.1992 (CANB).

Pertusaria puffina A.W.Archer & Elix, *Teloepa* 6, 22 (1994)

This taxon was previously known from Queensland, New South Wales, Lord Howe Island, India, Papua New Guinea, Thailand and New Zealand (Archer & Elix 2016).

SPECIMEN EXAMINED

Norfolk Island. • Track between Mt Pitt and Mt Bates, Mount Pitt Natl Park, 29°00'50"S, 167°56'05"E, 270 m alt., on dead wood in disturbed subtropical forest, *J.A. Elix 27375*, 15.vi.1992 (CANB).

Pertusaria texana Müll.Arg., *Flora* 67, 399 (1884)

In Australia this pantropical species was previously known from Queensland and New South Wales (McCarthy 2018).

SPECIMEN EXAMINED

New South Wales. • Lord Howe Island, track from Smoking Tree Ridge to Rocky Run, 31°33'35"S, 159°05'09"E, 170 m alt., on tree in lowland forest, *J.A. Elix 42437*, 10.ii.1995 (CANB).

Rhizocarpon adarensis (Darb.) I.M.Lamb, *Lilloa* 14, 221 (1948)

This species is known from Antarctica and southern Argentina, and in Australia from the Australian Capital Territory and Victoria (McCarthy 2018).

SPECIMEN EXAMINED

New South Wales. • Tallaganda Natl Park, Turallo Range, Hoskinstown-Braidwood road, 20 km E of Hoskinstown, 35°26'36"S, 149°33'10"E, 1010 m alt., on granite rocks in open *Eucalyptus* woodland, *J.A. Elix 46535*, 17.xii.2017 (CANB).

Rhizocarpon viridiatrum (Wulfen) Körb., *Syst. Lich. Germ.* 262 (1855)

In Australia this cosmopolitan species is known from Western Australia, New South Wales, the Australian Capital Territory and Victoria (McCarthy & Elix 2014).

SPECIMEN EXAMINED

Tasmania. • Wind Song Property, NW corner adjacent to Swanston Road, 42°21'S 147°54'E, 60 m alt., on exposed dolerite rocks in paddock, *G. Kantvilas 178/17A*, 26.x.2017 (HO).

Rinodina confragosa (Ach.) Körb., *Syst. Lich. Germ.* 125 (1855)

This species is known from Europe, Asia, North America and South Africa, and in Australia from Victoria (Kaschik 2006).

SPECIMEN EXAMINED

New South Wales. • Mt Canobolas State Conservation Area, W face of Mt Canobolas, 13 km SW of Orange, 33°20'13"S, 148°58'51"E, 1110 m alt., on weathered trachytic rhyolite in heath with scattered *Eucalyptus*, *J.A. Elix 46610*, 6.iv.2016 (CANB).

Rinodina conradii Körb., *Syst. Lich. Germ.* 123 (1855)

Previously known from bark and lignum in the south-west of Western Australia and Tasmania (Elix 2012), also in Europe, Asia, North and South America and New Zealand.

SPECIMEN EXAMINED

New South Wales. • Southern Tablelands, Queanbeyan River, 8 km N of Jerangle, on road to Captains Flat, 35°49'04"S, 149°25'15"E, alt. 1005 m, on soil and bryophytes overgrowing weathered roadside granite outcrops, *P.M. McCarthy 4697*, 5.xi.2017 (CANB).

Rinodina peloleuca (Nyl.) Müll.Arg., *Nuovo Giorn. Bot. Ital.* **23**, 125 (1891)

This southern circumpolar species is known from southern South America, Antarctica, South Georgia, Falkland Islands, Heard Island, Macquarie Island, Campbell Island, Auckland Islands and New Zealand, and in Australia from Tasmania (Kaschik 2006).

SPECIMEN EXAMINED

New South Wales. • Cliffs just N of Barlings Beach, 14 km SSE of Batemans Bay, 35°49'49"S, 150°12'20"E, 1–3 m alt., on shale rocks along foreshore, *J.A. Elix 46338*, 19.xi.2016 (CANB).

Tetramelas concinnus (Th.Fr.) Giralt, *Nova Hedwigia* **89**, 330 (2009)

This species was known previously from subarctic, subalpine and alpine areas of Europe, North America, New Zealand and Macquarie Island, and in Australia from the Australian Capital Territory (Elix 2017).

SPECIMEN EXAMINED

New South Wales. • Mt Canobolas State Conservation Area, W face of Mt Canobolas, 13 km SW of Orange, 33°20'13"S, 148°58'51"E, 1110 m alt., on weathered trachytic rhyolite in heath with scattered *Eucalyptus*, *J.A. Elix 46613*, 6.iv.2016 (CANB).

Triclinum cinchonarum Fée var. **janeirensis** (Müll.Arg.) Elix, *Fl. Australia* **57**, 651 (2009)

This taxon was previously known from East Asia, Central and South America, and in Australia from New South Wales (Elix 2009).

SPECIMEN EXAMINED

Queensland. • Mount Spec State Forest, Paluma to Hidden Valley Road, 40 km S of Ingham, 19°01'S, 146°09'E, 940 m alt., on *Syncarpia* margin at margin of wet sclerophyll forest and grassy area, *H. Streimann 64244A*, 20.viii.1999 (CANB).

Verrucaria alborimosa P.M.McCarthy & Kantvilas, *Muelleria* **34**, 55 (2015)

Previously known only from the type locality in Flinders Island, Tasmania, where it was collected from limestone in the upper supralittoral (McCarthy & Kantvilas 2015).

SPECIMEN EXAMINED

New South Wales. • South Coast, Gerringong, Werri Beach, headland at N end of beach, 34°43'42"S, 150°50'15"E, 1 m alt., on sandstone boulders along the foreshore, *P.M. McCarthy 4579*, 24.v.2017 (CANB).

Verrucaria aucklandica Zahlbr., *Denkschr. Akad. Wiss. Wien, math-naturwiss. Kl.* **104**, 250 (1941)

Known from maritime, siliceous rocks in northern New Zealand and in western and southern Tasmania (McCarthy 2012); also reported from Taiwan (Aptroot 2003).

SPECIMEN EXAMINED

New South Wales. • South Coast, Ben Boyd Natl Park, Green Cape Peninsula, W of lighthouse, 37°15'34"S, 150°02'52"E, c. 3 m alt., on sheltered, supralittoral sandstone, *P.M. McCarthy 4763*, 21.iii.2018 (CANB).

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Fig. 1. *Arthonia vinosana*. Scale bar = 1 mm

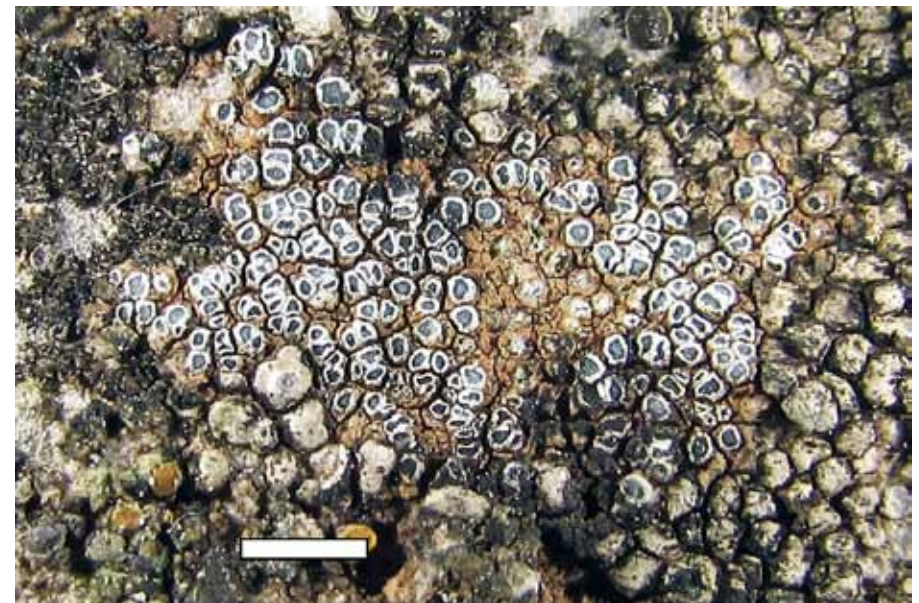


Fig. 2. *Caloplaca chalybaea*. Scale bar = 1 mm



Fig. 3. *Pertusaria alboatra*. Scale bar = 1 mm



Fig. 5. *Pertusaria neilgherrensis*. Scale bar = 1 mm

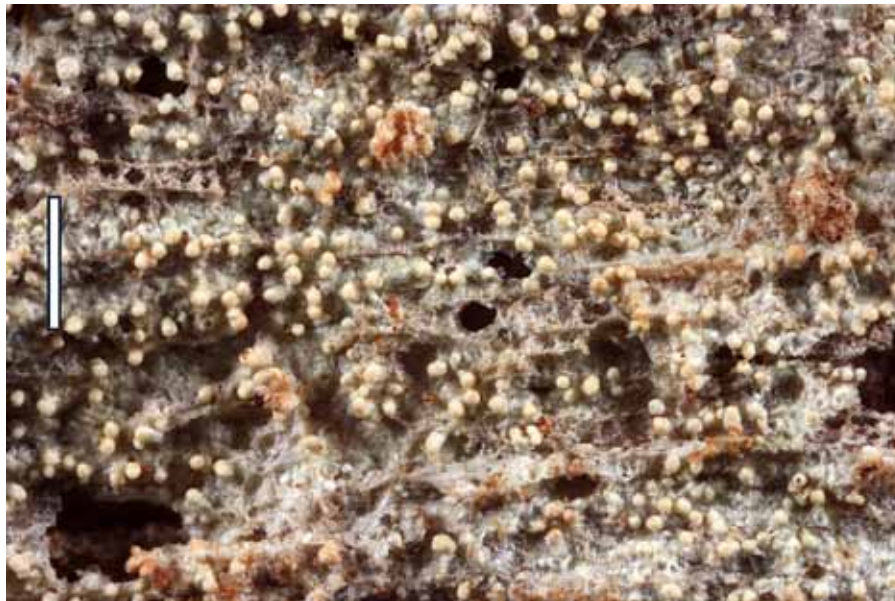


Fig. 4. *Pertusaria labuensis*. Scale bar = 1 mm



Fig. 6. *Varicellaria hemisphaerica*. Scale bar = 1 mm

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