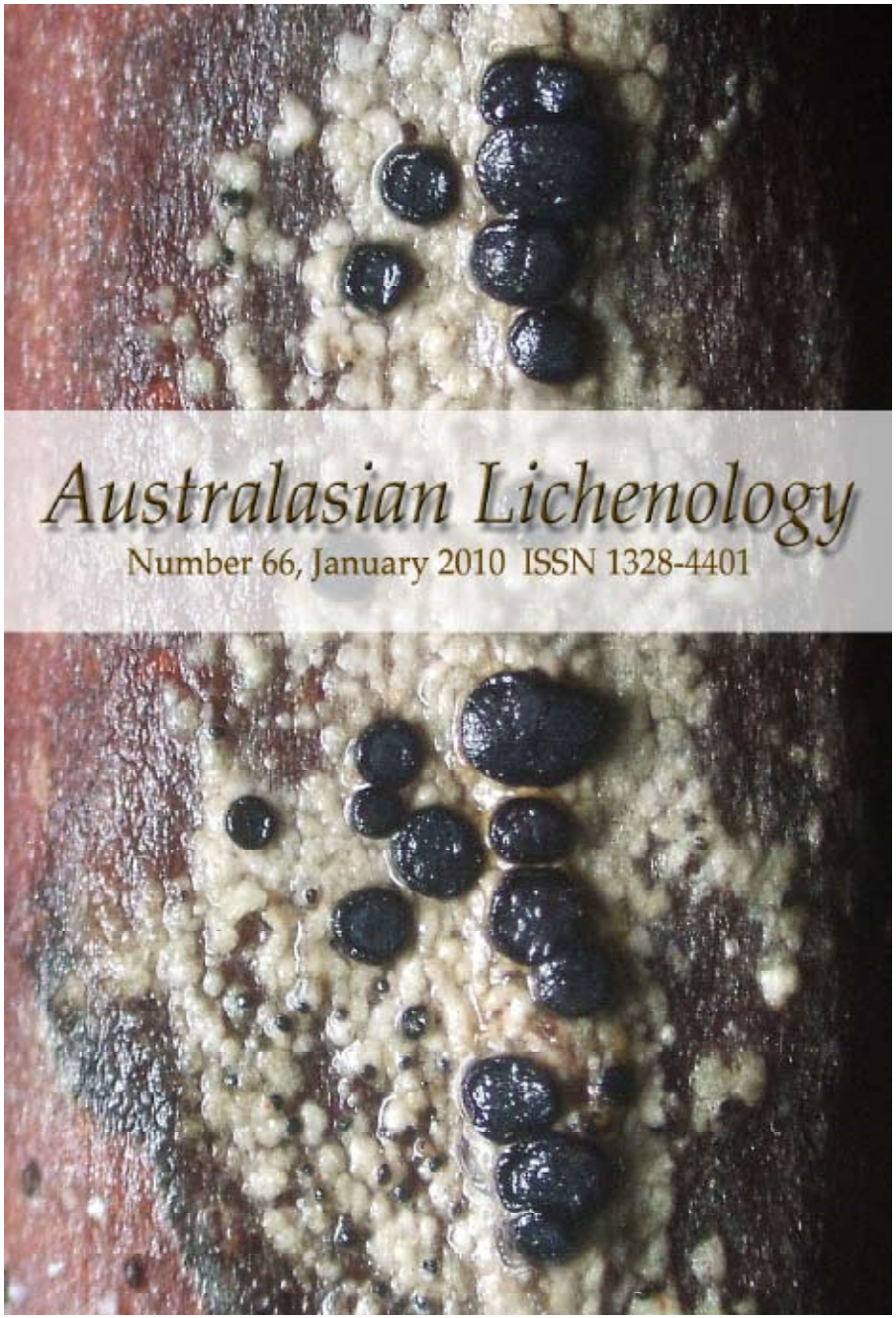

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The New Zealand endemic *Lecidea dracophylli* is widespread on the bark of *Dracrophyllum* in subalpine scrub on both islands. Some authors consider it misplaced in *Lecidea sensu stricto*.

CONTENTS

ANNOUNCEMENT — AUSTRALASIAN LICHENOLOGISTS' MEETING

The 19th meeting of Australasian lichenologists will be held at Narooma, N.S.W., and adjacent localities on Saturday and Sunday, 10–11 April, 2010.

Lichen forays to several habitat types near Narooma (the most distant is 70 km) will be undertaken on both Saturday and Sunday. The habitats to be visited include moist, coastal *Eucalyptus* forest, rocky foreshores, and hinterland warm temperate rainforest. A group dinner is planned for Saturday evening and if desired will be followed by an informal discussion session.

Assembly will be at 9:30 a.m. on Saturday, April 10, in the carpark at the Narooma Visitor Information Centre and Lighthouse Museum, Princes Highway, at the north end of town on the left-hand side of the highway when heading south.

Narooma has a wide range of accommodation, including hotels, motels, resorts, cabins, and camping grounds. Information on accommodation is available at http://www.takeabreak.com.au/Narooma/SouthCoastNSW/accommodation.html

To assist with dinner and field-trip logistics, you should register in advance with Jack Elix. If you have any questions on accommodation or other details of the meeting, you can contact him by post at the Research School of Chemistry, Building 33, Australian National University, Canberra, A.C.T 0200, or by phone at +61–(02)–6125–2937, or by e-mail at <John.Elix@anu.edu.au>

Please note that a license is required to collect flora in N.S.W., and applications should be made prior to attending the meeting for both N.S.W. State Forest (Bodalla State Forest) and National Parks (Eurobodalla National Park). Application forms are available respectively from
http://www.dpi.nsw.gov.au/forests/permits and
http://www.environment.nsw.gov.au/wildlifelicences/ScientificResearchLic

NEWS — JACK ELIX ELECTED HONORARY MEMBER OF BLS

Jack Elix was elected an honorary member of the British Lichen Society at the Society's annual meeting at Norwich in January of this year. The proposal was made by David Galloway, and in his absence was seconded by Peter Crittenden who described Jack as a "towering figure" of international lichenology. The nomination was supported by Prof. Per Magnus Jørgensen (University of Bergen), Dr Gintaras Kantvilas (Tasmanian Herbarium), Dr Ingvar Kärnefelt (University of Lund), and Dr Tom Nash (University of Arizona), and was carried unanimously by the meeting.

New and interesting foliicolous lichens from Australia

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Abstract: Five foliicolous lichens are described as new from New South Wales and Queensland: *Phylloblastia excavata* P.M.McCarthy (Verrucariaceae), *Porina danbullensis* P.M.McCarthy & Lücking, *P. elixiana* P.M.McCarthy & Lücking and *P. flavoaurantiaca* P.M.McCarthy (Porinaceae) and *Verrucaria inquilina* P.M.McCarthy (Verrucariaceae). *Phylloblastia bielczykiae* Flakus & Lücking and *Strigula delicata* Sérus. are reported for the first time from Australia.

The foliicolous lichen flora of Australia and its island territories currently comprises 227 species (McCarthy 2009). Diversity is greatest in eastern Queensland and north-eastern New South Wales, but future fieldwork there and in south-eastern Australia is likely to bring the total to 300 taxa. In this paper, new *Phylloblastia* and *Porina* taxa are described and illustrated from the Central Tablelands of New South Wales, along with the first report of a foliicolous member of the cosmopolitan genus *Verrucaria*, and two new species of *Porina* from rainforest in north-eastern Queensland. In addition, *Phylloblastia bielczykiae* and *Strigula delicata*, new records for Australia, are reported from New South Wales and Lord Howe Island, respectively.

NEW SPECIES

Phylloblastia excavata P.M.McCarthy sp. nov. Fig. 1
Thallus foliicola, epicuticularis, continuus, pallido vel medio griseoviridis, *c.* 10–15 μm crassus. Algae chlorococcoidea, 8–15(–20) μm diametro. Perithecia fuscoviridia, convexa, (0.23–)0.38(–0.54) mm diametro, apicibus profunde concavis. Involucrellum 30–40 μm crassum, partim thallo tecto. Excipulum fuscum, 18–25 μm crassum. Centrum 0.14–0.30 mm diametro. Paraphyses maturitate adsunt. Periphyses 10–20 × 2–4 μm. Asci fissitunicati, 8-spori, 80–110 × 23–32 μm. Ascosporae incoloratae, (7–)9–11(–13)-septatae, (42–)59(–84) × (6–)8(–11) μm, apicibus rotundatis.

Type: Australia: *New South Wales*: Central Tablelands, Budderoo Natl Park, Minnamurra Falls Rainforest Walk, 34°34′06″S, 150°42′43″, alt. 550 m, on leaves of a tree in disturbed temperate rainforest, *P.M. McCarthy 2691*, 15.ix.2008 (holotype NSW; isotype CANB).

Thallus crustose, foliicolous, epicuticular, hyphal, pale to medium greyish green, effuse or solitary, determinate and 0.5–1.5 mm wide, or coalescing to form colonies up to 5 mm wide, *c.* 10–15 μm thick, ecorticate; surface continuous, matt to slightly glossy, ± smooth to minutely uneven or radially rugulose. *Algae* chlorococcoid; cells 8–15(–20) μm diam., sparsely distributed to densely clustered; thalline hyphae long-celled, 3–4(–5) μm wide, thin-walled. *Prothallus* usually not apparent, occasionally silvery grey and arachnoid. *Perithecia* moderately numerous, usually solitary and scattered, (0.23–)0.38(–0.54) mm diam. [*n* = 30], medium to dark olive-brown, initially low-convex, becoming more prominent, the base spreading and the apex becoming broadly and deeply concave; concavity 0.10–0.25 mm wide, with a smooth rim; ostiole inconspicuous or slightly darker than the surrounding tissue and 20–40 μm wide. *Involucrellum* 30–40 μm thick, dark brown in thin section, extending to excipulum base level, initially overgrown by a thin layer of thallus, this persisting to the rim of the apical concavity or only near the perithecial base; cells broadly ellipsoid and thick-walled above, grading to loosely hyphal between the base of the involucrellum and the excipulum. *Excipulum* uniformly dark brown, 18–25 μm thick. *Centrum* subglobose to depressed-obovate, 0.14–0.30 mm diam.; ascoplasma IKI+ red-brown, initially IKI+ blue (fugitive) when pretreated with K. *Paraphyses* absent at maturity. *Periphyses* simple, 10–20 × 2–4 μm. *Asci* fissitunicate, 8-spored, broadly ellipsoid or narrowly to broadly clavate, 80–110 × 23–32 μm [*n* = 20], with or without a distinct ocular chamber. *Ascospores* massed in a single fascicle in the ascus, colourless, transversely (7–)9–11(–13)-septate, narrowly oblong to elongate-cylindrical, straight or slightly curved, with rounded ends, slightly constricted at the septa, (42–)59(–84) × (6–)8(–11) μm [*n* = 70]; wall *c.* 0.7–1.0 μm thick; septa thin; apical cells non-mucronate; contents minutely granulose and guttulate. *Pycnidia* not seen.

Notes:
Phylloblastia excavata is characterized by minute, thin, inconspicuous thalli with a chlorococcoid photobiont, dark medium-sized perithecia with a spreading base, a broad and deep apical depression and a well-developed involucrellum, the absence of paraphyses and the presence of periphyses, fissitunicate asci and elongate multiseptate ascospores. Most of the *c.* 12 known species of *Phylloblastia* have 3–7-septate or submuriform to muriform ascospores (Santesson 1952, Vězda 1975, McCarthy 1999, Flakus & Lücking 2008, Lücking 2008). However, the East African *P. marattiae* (Vězda) Lücking has ascospores with up to 15 transverse septa, smaller than those of *P. excavata*, and a vestigial involucrellum (Vězda 1975). *Phylloblastia mucronata* (P.M.McCarthy) Lücking, from Lord Howe Island and Christmas Island, also with 7–15-septate ascospores, has minute, orange-brown, non-involucrellate perithecia and considerably narrower ascospores with mucronate apical cells (McCarthy 1999); it was reported from southern U.S.A. by Lücking (2008), but with involucrellate perithecia, far larger asci, and ascospores with gelatinous appendages rather than their apical cells having mucronate projections.
This new foliicolous lichen is known only from the type locality in disturbed temperate rainforest in south-eastern New South Wales. The epithet *excavata* alludes to the deeply concave perithecial apex.

Porina danbullensis P.M.McCarthy & Lücking sp. nov. Fig. 2
Thallus foliicola, epicuticularis, pallidogriseoviridis, continuus, *c.* 10–12 μm crassus. Algae ad *Phycopeltem* pertinentes, cellulis plerumque 12–20 × 4–7 μm, filamentis non radiantibus. Perithecia hemispherica vel subglobosa, aurantiaca, (0.18–)0.22(–0.25) mm diametro, setis (11–)17(–23)-nae, elongatis-acutis, horizontalibus, hyalinis vel pallido-flavis, 0.05–0.18 mm mm longis. Asci elongati-cylindrici vel elongati-obclavati, 68–82 × 9–11 μm. Ascosporae 3-septatae, elongatae-fusiformes vel oblongae, (16–)20(–23) × (3.5–)4.5(–5.0) μm.

Type: Australia, *Queensland*: Atherton Tableland, Danbulla State Forest, Danbulla Forest Drive, Kauri Creek, 24 km NE of Tolga, 17°08′02″S, 145°35′55″E, alt. 660 m, on leaves of a tree in disturbed rainforest, *J.A. Elix 38990*, 4.viii.2006 (holotype CANB).

Thallus foliicolous, epicuticular, growing on the upper leaf surface and on marginal wounds, scattered and diffuse to coalescing and determinate, pale greyish green, *c.* 10–12 μm thick, continuous, ±smooth. Algae *Phycopeltis*; cells mostly elongate-ellipsoid to oblong, 12–20 × 4–7 μm, occasionally ellipsoidal and 8–12 × 4–8 μm; branching loose and irregular, the cells not forming radiate plates. Prothallus not apparent. *Perithecia* scattered, superficial, hemispherical to subglobose, not or slightly to strongly attenuated at the base, (0.18–)0.22(–0.25) mm diam. (not including setae) [*n* = 19], orange, matt; apex ±plane to slightly convex; ostiole inconspicuous or in a conical to hemispherical, 20–30 μm wide papilla. *Setae* (11–)17(–23), 0.05–0.18 mm long, ± evenly spaced in a subapical crown, initially lanceolate or acute, eventually narrowly to broadly acute, usually remaining ±horizontal, uniformly hyaline to pale yellow,

usually remaining discrete, rarely coalescing, often becoming torn and ragged with age. *Involucrellum* contiguous with and extending to the base of the excipulum, 20–30(–40) μm thick, yellow-orange in thin section, K+ deep orange-red. *Excipulum* hyaline to pale yellow-orange, 10–15 μm thick. *Centrum* subglobose or depressed-obovate, 0.10–0.18 mm diam. *Paraphyses* simple, 0.7–1.0 μm thick. *Asci* elongate-cylindrical to elongate-obclavate, 8-spored, 68–82 × 9–11 μm [*n* = 10], with a subtruncate apex and an apical chitinoid ring (in Congo Red). *Ascospores* elongate-fusiform or oblong, 3-septate, colourless, irregularly biseriate or obliquely arranged in the asci, (16–)20(–23) × (3.5–)4.5(–5.0) μm [*n* = 50]; perispore *c*. 1 μm thick or not apparent. *Pycnidia* convex to hemispherical, 0.07–0.11 mm diam., pale yellow-orange. *Conidia* oblong to fusiform, 1.5–2.5 × 0.5–0.7 mm.

Notes:

Porina danbullensis is characterized by the non-radiate photobiont, minute orange perithecia (the involucrellum K+ orange-red in thin section) with a crown of horizontal, acute and very pale setae and very small 3-septate ascospores. This suite of characters distinguishes it from all species of *Trichothelium sens. lat.* and the *Porina rubescens*-group (*sensu* Lücking 2004, 2008).

The pantropical *Porina triseptata* (Vězda) Lücking (*Trichothelium triseptatum* Vězda) also has 3-septate ascospores, but the photobiont is radiate, and the dark brownish red perithecia have sparse (4–8) and very pale setae (Lücking 2008). *Porina rubescens* (Lücking) Hafellner & Kalb (*Trichothelium rubescens* Lücking), recently reported from north-eastern Queensland (Elix *et al.* 2009), has a similar thalline and perithecial morphology, but the algae form radiate plates and the 7-septate ascospores are 24–38 × 3.0–4.5 μm. Lücking's (2004) key to the foliicolous species of Porinaceae included a member of the *Porina rubescens*-group with 3-septate ascospores and the "perithecia brownish orange, with [a] dense crown of setae", called "Porina sp. nov. ined. (Kalb, in prep.)". It is possible, though not certain, that this long-overdue unnamed entity is referable to *P. danbullensis*.

The transfer of orange- and red-fruited *Trichothelium* species to *Porina* has brought the setose *Porina rubescens*-group and their non-setose counterparts in the *Porina rufula*-group closer together (Lücking 2004, 2008). However, maintaining the usually black-fruited species of *Trichothelium sens. str.* as being generically distinct from their non-setose equivalents in the *Porina nitidula*-group suggests that the circumscription of the genera of Porinaceae and, possibly, the placement of *P. danbullensis* have yet to be conclusively resolved.

This new lichen is known only from the leaves of rainforest trees at the type locality, Danbulla State Forest, on the Atherton Tableland in north-eastern Queensland.

Porina elixiana P.M.McCarthy & Lücking sp. nov. Fig. 3

Thallus foliicola, epicuticularis, pallidocinereoviridis, continuus, laevigatus vel minute rugulosus, usque ad 10(–15) mm crassus. Algae ad *Phycopeltem* pertinentes, cellulis elongatis-rectangularibus, 8–15 × 3–5 μm, plagas continuas radiantes formantibus. Perithecia applanata vel leviter convexa aut conica, (0.23–)0.40(–0.64) mm diametro, medio- vel atrocinerea, saepe thallo partim tecto. Involucrellum 25–40 μm crassum, in sectione violaceocinereum vel purpuraceocinereum, K–. Excipulum *c*. 10–15 μm crassum, praecipue hyalinum. Centrum 0.18–0.25 mm latum. Asci anguste vel late obclavati, 50–75 × 13–22 μm, ab angulis centri crescentes. Ascosporae oblongae vel oblongae-fusiformes, 7-septatae, (26–)32(–38) × (3.5–)5.0(–6.0) μm.

Type: Australia, *Queensland*: 27.2 km S of Cape Tribulation, Steep Creek, 16°14′52″S, 145°25′25″E, alt. 195 m, on leaves of a tree in disturbed rainforest along coastal creek, *J.A. Elix 38985*, 3.viii.2006 (holotype CANB).

Thallus foliicolous, epicuticular, scattered and diffuse or coalescing and forming small determinate colonies to 10(–15) mm wide, pale greyish green, continuous, *c*. 10–15(–20) μm thick, smooth to irregularly rugulose (where thalli become contiguous), matt to slightly glossy; prothallus very thin and whitish or not apparent. *Algae Phycopeltis*; cells elongate-rectangular but with slightly rounded corners, 8–15 × 3–5 μm, forming radiate plates. *Perithecia* applanate to low-convex or subconical in the centre, thinly spreading laterally, (0.23–)0.40(–0.64) mm diam. [*n* = 51], medium to dark grey, paler when partly to almost completely overgrown by the thallus, not containing crystals; surface smooth, matt; apex rounded to slightly pointed; ostiole usually inconspicuous. *Involucrellum* extending to excipulum base level, medium to dark violet-grey or purple-grey in thin section, 25–40 μm thick, K–. *Excipulum c*. 10–15 μm thick, predominantly hyaline, with or without a violet-greyish outer zone. *Centrum* strongly depressed-conical, 0.18–0.25 mm wide. *Paraphyses* simple, 1.0–1.5 μm thick. *Periphyses* absent. *Asci* narrowly to broadly obclavate, growing from the lower corners of the centrum (thin median section), not from the base, 50–75 × 13–22 μm [*n* = 20] , with a subtruncate apex and an apical chitinoid ring (in Congo Red). *Ascospores* oblong to oblong-fusiform, 7-septate, mostly straight, occasionally slightly curved, rarely faintly sigmoidal, (26–)32(–38) × (3.5–)5.0(–6.0) μm [*n* = 52]; perispore *c*. 1.0–2.0(–2.5) μm thick at maturity. *Pycnidia* not seen.

Notes:

Porina elixiana is a member of the small but highly distinctive *P. applanata*-group, five Palaeotropical species with flattened perithecia in which the asci grow not from the base of the the strongly depressed centrum but from its lower margins (Lücking 2004). Thus, removing a mature perithecium of *P. elixiana* from the substratum, inverting it and observing it under 40X magnification can reveal a centripetal ring of tightly packed asci arising from the rim of the centrum.

The new species is characterized within the *P. applanata*-group by having outwardly medium to dark grey perithecia that are low-convex to subconical in the centre, have a thin spreading involucrellum that is violet-grey to purple-grey in thin section and uniquely small 7-sepate ascospores (26–38 × 3.5–6.0 μm). Lücking (2004) included "*Porina subhomala* Lücking & Schumm (Lücking & Schumm, in prep.)", with "perithecia entirely grey" and "ascospores 27–33 × 3–5 μm", but there has been no subsequent attempt to validate that name. It is likely that it will be shown to be conspecific with *P. elixiana*. The most closely related Australian species, *P. tolgensis* P.M.McCarthy, originally described from north-eastern Queensland (McCarthy, 2001a) and subsequently reported from the Solomon Islands (McCarthy 2003), has a similar thallus and perithecial morphology, but the perithecia are 0.6–1.3 mm diam. and more strongly overgrown by the thallus, and the 7-septate ascospores are 54–68 × 7–12 μm.

Porina elixiana is known only from the type locality in north-eastern Queensland. It is named for my friend and colleague Jack Elix who collected the type and associated specimens.

ADDITIONAL SPECIMENS EXAMINED

Queensland: • type locality, on leaves of a tree in disturbed temperate rainforest, *J.A. Elix 38986–38988*, 3.viii.2006 (CANB).

Porina flavoaurantiaca P.M.McCarthy sp. nov. Fig. 4

Thallus foliicola, epicuticularis, continuus, pallidoviridis vel aurantiacoviridis, 8–10(–12) μm crassus. Algae ad *Phycopeltem* pertinentes, cellulis oblongis vel rectangularibus, plerumque non radiantibus, 6–12(–14) × 2–4 μm. Perithecia convexa vel hemisphaerica, (0.15–)0.20(–0.26) mm diametro, thallo concolora vel flavoaurantiaca, saepe albopilosa, apicibus saepe rotundatis. Involucrellum 20–25 μm crassum, ad basin excipuli descendens. Excipulum 8–10 μm crassum, hyalinum vel pallido-flavoaurantiacum. Centrum 0.08–0.17 mm latum. Asci anguste obclavati vel oblongi-

fusiformes, 40–55(–62) × 8–10 μm. Ascosporae oblongae-fusiformes, 3-septatae, (12.0–)15.5(–18.0) × (3.0–)4.0(–4.5) μm.

Type: Australia: *New South Wales*: Central Tablelands, Morton Natl Park, Barrengarry Mtn, 34°41′08″S, 150°29′54″, alt. 480 m, on leaves of a tree in temperate rainforest, *P. M. McCarthy 2706*, 16.ix.2008 (holotype NSW; isotype: CANB).

Thallus foliicolous, epicuticular, pale green or with a faint orange tint, 8–10(–12) μm thick, diffuse, 2–10(–15) mm wide, occasionally coalescing to form larger colonies, smooth to rugulose, but usually adopting the microtopography of the substratum, dull to slightly glossy; prothallus usually not apparent, occasionally visible as a very narrow, slightly paler marginal rim. *Algae Phycopeltis*; cells of immature thalli and those at the margins of older thalli forming loosely packed, radiating arrays, narrowly oblong to rectangular, 6–12(–14) × 2–4 μm; cells nearer the centre of mature and post-mature thalli angular-rounded, irregular or short-oblong, 4–10 × 4–6 μm. *Perithecia* superficial, low-convex to almost hemispherical, (0.15–)0.20(–0.26) mm diam. [*n* = 160], initially yellowish green (and with a more noticeable thalline covering), becoming yellowish orange or orange (the thalline covering limited to the basal half), usually matt, opaque when dry, rather translucent and paler when wetted; surface glabrous to sparsely or densely white-pilose; hairs short, 10–15 × 2.0–2.5 μm, predominantly on immature and submature perithecia, most common on the thalline covering, less so on the exposed involucrellum and least common apically; apex usually rounded, occasionally somewhat flattened; ostiole inconspicuous or in a minute, shallow depression; perithecial bases often visible as residual rings on the thallus after the decay of the perithecia. *Involucrellum* extending almost to excipulum base level, scarcely spreading outward, pale yellow-orange in thin section, 20–25 μm thick, K+ deep orange or orange-red; space between the basal third of the involucrellum and the excipulum occupied by a loose mesh-work of *c*. 2 μm thick hyphae. *Centrum* 0.08–0.17 mm wide, rounded to depressed-obovate. *Excipulum* 8–10 μm thick, hyaline to pale yellowish orange, K–. *Paraphyses* simple, 0.07–1.0 μm thick. *Periphyses* absent. *Asci* 8-spored, narrowly obclavate to oblong-fusiform, 40–55(–62) × 8–10 μm [*n* = 20]; apex subtruncate, with a chitinoid ring (in Congo Red). *Ascospores* oblong-fusiform, with rounded to subacute ends, 3-septate, colourless, (12.0–)15.5(–18.0) × (3.0–)4.0(–4.5) μm [*n* = 100]. *Pycnidia* low-convex to hemispherical, 0.05–0.08(–0.10) mm diam., resembling diminutive perithecia. *Conidia* narrowly ellipsoidal, 1.5–2.0 × 0.7–1.0 μm.

Notes:

A member of the *Porina rufula*-group (*sensu* Lücking 2004, 2008), *P. flavoaurantiaca* is characterized by its essentially non-radiate photobiont, very small, convex to hemispherical yellow-orange perithecia (K+ orange-red) with an often white-pilose surface that is partially overgrown by the thallus, and comparatively small asci and 3-septate ascospores. The specimens collected at Mount Tomah, *c*. 100–130 km north of the other sites, included very rare 5-septate ascospores (*c*. 1 percent of the total seen in those specimens).

The pantropical *P. rufula* (Kremp.) Vain. has a photobiont in radiate plates, darker and non-pilose perithecia and 18–31 μm long ascospores (Lücking 2008). The Neotropical *Porina boliviana* Flakus & Lücking is also rather similar to the new species, but its photobiont cells are considerably larger (15–23 × 3–6 μm) and form continuous radiate plates, the smaller perithecia remain covered by a layer of thallus, and the ascospores are 17–22 × 3–4 (Flakus & Lücking 2008). *Porina flavoaurantiaca* outwardly resembles the pantropical *P. fulvella* Müll.Arg., which has the southern limit of its known Australian distribution in the Robertson area of south-eastern New South Wales. That lichen also has a non-radiate photobiont and pilose, yellow-orange perithecia, but the perithecia are larger, usually with a depressed ostiole, they have a diagnostic layer of algae between the involucrellum and the excipulum, and the ascospores are 17–25 μm long (McCarthy 2001a, Lücking 2008). The south-western Pacific species *P. cerina* (Zahlbr.) R.Sant. (not known from Australia) has photobiont cells in radiate plates and yellowish green, applanate perithecia that are slightly prominent in the centre and have a spreading margin (Santesson, 1952).

This lichen is locally abundant on the leaves of trees, shrubs and *Lomandra* tussocks in temperate rainforest in southern parts of the Central Tablelands of New South Wales. It is named for its yellow-orange perithecia.

ADDITIONAL SPECIMENS EXAMINED

New South Wales: • Central Tablelands, Budderoo Natl Park, Minnamurra Falls Rainforest Walk, 34°34′06″S, 150°42′43″, alt. 550 m, on leaves of a tree in disturbed temperate rainforest, *P.M. McCarthy 2705*, 15.ix.2008 (CANB); • Robertson Nature Reserve, Robertson, 34°35′30″S, 150°34′48″, alt. 690 m, on leaves of a tree in disturbed temperate rainforest, *P.M. McCarthy 2684*, 16.ix.2008 (CANB); • Morton Natl Park, Barrengarry Mtn, 34°41′08″S, 150°29′54″, alt. 480 m, on monocot leaves in temperate rainforest, *P. M. McCarthy 2709*, 16.ix.2008 (CANB); • Budderoo Natl Park, Jamberoo Mtn, 34°38′03″S, 150°43′46″, alt. 210 m, on leaves of a tree in temperate rainforest, *P.M. McCarthy 2699*, 16.ix.2008 (CANB); • Blue Mountains Natl Park, Mount Tomah Botanic Garden, Lady Fairfax Walk, 33°32′23″S, 150°25′38″, alt. 870 m, on leaves of *Lomandra* sp. in disturbed temperate rainforest, *P.M. McCarthy 2782*, 5.v.2009 (CANB, NSW).

Verrucaria inquilina P.M. McCarthy sp. nov. Fig. 5

Thallus foliicola, continuus, pallidogriseoviridis vel medioviridis, *c*. 10–15 μm crassus. Algae chlorococcoidea, 6–12(–14) μm diametro. Perithecia numerosa, nigra, superficialia, convexa vel hemisphaerica aut subconica, thallo vix tecto, (0.25–)0.39(–0.59) mm diametro. Involucrellum 60–90(–100) μm crassum, ad basin excipuli descendens. Excipulum 15–25 μm crassum, viridifuscum vel viridiatrum. Centrum *c*. 0.15–0.34 mm latum. Periphyses simplices vel parce ramosae, 20–30 × 2–3 μm. Asci fissitunicati, 68–78 × 16–20 μm. Ascosporae simplices, late ellipsoideae vel subglobosae, (9–)12(–14) × (7.0–)8.5(–10.0) μm.

Type: Australia: *New South Wales*: Central Tablelands, Morton Natl Park, Cambrewarra Mtn, 34°47′01″S, 150°33′25″, alt. 330 m, on leaves of *Ficus coronata* on roadside in temperate rainforest, *P.M. McCarthy 2700*, 16.ix.2008 (holotype NSW; isotype CANB).

Thallus crustose, foliicolous, probably epicuticular, pale greyish green to pale green, effuse or determinate and 1–2(–3) mm wide, usually not coalescing to form larger colonies, *c*. 10–15 μm thick, ecorticate; surface continuous, matt, ± smooth to minutely uneven. *Algae* chlorococcoid; cells ± globose, 6–12(–14) μm diam., densely clustered; thalline hyphae short- to long-celled, 2–4 μm wide, hyaline, thin-walled. *Prothallus* not apparent. *Perithecia* numerous, superficial, initially convex, becoming hemispherical to subconical, (0.25–)0.39(–0.59) mm diam. [*n* = 50], smooth to minutely and irregularly uneven, jet-black, dull to glossy, becoming brittle and hollow when post-mature, the base scarcely overgrown by the thallus. *Involucrellum* extending to excipulum base level, greenish black to black in thin section, 60–90 μm thick, contiguous with the excipulum in the upper half of the perithecium, spreading slightly below. *Perithecial apex* plane to convex; ostiole inconspicuous or in a narrow and shallow depression. *Excipulum* dark olive-brown to blackish, 15–25 μm thick, firmly and persistently attached to the epidermis of the host. *Centrum* obpyriform to subconical, *c*. 0.15–0.30 mm diam., IKI+ orange-brown. *Periphyses* 20–30 × 2–3 μm, simple to sparingly branched. *Paraphyses* absent at maturity. *Asci* fissitunicate, 8-spored, narrowly clavate, rarely seen intact, 68–78 × 16–20 μm [*n* = 7]. *Ascospores* simple, hyaline, broadly ellipsoid to subglobose, irregularly biseriate in the asci, (9–)12(–14) × (7.0–)8.5(–10.0) μm [*n* = 70]; wall usually *c*. 1 μm thick; contents granulose and frequently guttulate. *Pycnidia* absent.

Notes:

Verrucaria Schrad. (Verrucariaceae) is a cosmopolitan genus of perhaps 300–500 species, a more exact figure being impossible to determine with any accuracy considering the numerous undoubtedly superfluous Eurasian names and many other unresolved and undescribed taxa. It is most diverse at temperate and cooler latitudes, and while 40 taxa have been confirmed from mainland Australia (McCarthy 2001b, 2009), at least 20 others have been collected but remain unidentified. More than 95 percent of all species are saxicolous, these being supplemented by small numbers of corticolous, terricolous and lichenicolous taxa. Until now, the genus has not been known to grow on living leaves.

Verrucaria inquilina and the endemic *Ficus coronata* do not exhibit a conventional epiphyll-host relationship. The leaves are thin but leathery when fresh, and the surface is minutely uneven, with a dense covering of short, sharp, curved spines with broader siliceous(?) bases, giving the tree its colloquial name, "Sandpaper Fig". The bases of the lichen excipulum and involucrellum are firmly and persistently attached to the large-celled epidermis of the host. Indeed, when the perithecia decay, these tissues remain in place as blackish discs and, in time, they can develop a thin rim of scar tissue laid down by the leaf. However, there is no indication of any damage to the host epidermis, no penetration of hyphae into the cell lumina, and the subtending palisade layer appears functional. The foliicolous flora of the *Ficus* leaves was dominated by *V. inquilina*, along with much smaller quantities of *Bacidina apiahica* (Müll.Arg.) Vězda, *Gyalectidium microcarpum* (Vězda) Lücking, Sérus. & Vězda, *Sporopodium flavescens* (R.Sant.) Vězda and *Tapellaria phyllophila* (Stirt.) R.Sant. It is possible that the highly distinctive microtopography and texture of the leaves of this particular host provide *V. inquilina* with a substratum not too far removed, in terms of texture and stability, from those normally associated with *Verrucaria*.

In spite of its abundance at the type locality and the presence of numerous perithecia, these are less than ideal type specimens. Most of the perithecia are postmature, brittle and hollow, and at least 10 were opened before asci, ascospores and the hamathecium could be observed. Apart from the novelty of its substratum, *V. inquilina* is characterized by its comparatively large and prominent perithecia and unusually small broadly ellipsoid to subglobose ascospores.

The specific epithet is based on the Latin *inquilinus* (a squatter or lodger), in reference to the fact that the predominantly saxicolous genus *Verrucaria* has not been reported from leaves previously and is clearly not "at home" on leafy substrata.

NEW RECORDS

Phylloblastia bielczykiae Flakus & Lücking, *Lichenologist* **40,** 426 (2008) Fig. 6

Thallus crustose, foliicolous, epicuticular, hyphal, pale to greyish green or pale green, effuse or determinate, *c.* 10–15 μm thick, ecorticate; surface continuous, smooth, dull, resembling a gelatinous film when wetted. *Algae* chlorococcoid; cells 4–8(–10) μm diam., scattered or densely clustered; thalline hyphae long-celled, 2–4 μm wide, thin-walled. *Prothallus* usually not apparent.

Perithecia moderately numerous, usually solitary and scattered, (0.17–)0.23(–0.29) mm diam. [*n* = 70], initially convex, becoming more prominent and hemispherical to subglobose, often appearing greyish brown-farinose, occasionally becoming smooth and dark grey-brown; apex initially plane or convex, or becoming shallowly or deeply concave; concavity 50–120 μm wide, often markedly darker than the involucrellum; ostiole inconspicuous. *Involucrellum* 25–40 μm thick, grey-brown in thin section; inner cells elongate and periclinal; outer cells becoming rounded, angular or irregular, 6–12 × 5–8 μm. *Excipulum* greyish brown at the sides and near the apex, darker brown at the base, 10–15 μm thick, composed of thin-walled periclinal hyphae 10–15(–20) × 3–5 μm. *Centrum* subglobose, 0.1–0.2 mm diam.; ascoplasma IKI+ red-brown, initially IKI+ blue (fugitive) when pretreated with K. *Paraphyses* absent at maturity. *Periphyses* simple, 20–40 × 2–4(–6) μm. *Asci* fissitunicate, 8-spored, broadly ellipsoid or narrowly to broadly clavate, 65–105 × 26–42 μm [*n* = 15], usually with a distinct tuberculate to subconical ocular chamber when immature. *Ascospores* irregularly massed in the asci, colourless, submuriform, with (3–)5–9(–11) transverse septa and (3–)5–7(–9) longitudinal septa, narrowly ellipsoid to broadly fusiform or oblong, straight or slightly curved, with rounded ends, slightly constricted at the septa, (32–)40(–52) × (8–)9(–13) μm [*n* = 70]; wall *c.* 1.0 μm thick; septa thin; apical cells non-mucronate; contents minutely granulose and guttulate. *Pycnidia* not seen.

Phylloblastia bielczykiae was recently described from lowland forest in Bolivia (Flakus & Lücking, 2008). It is characterized by the small but rather prominent and morphologically and anatomically distinctive perithecia and comparatively small, submuriform ascospores. The Australian material was collected in disturbed temperate rainforest in south-eastern New South Wales. The thallus is less well-developed than in the type specimen, and the septal constrictions of the ascospores are less pronounced (Flakus & Lücking 2008; A. Flakus, pers. comm., 2009).

SPECIMEN EXAMINED

New South Wales: • Central Tablelands, Budderoo Natl Park, Minnamurra Falls Rainforest Walk, 34°34′06″S, 150°42′43″, alt. 550 m, on leaves of a tree in disturbed temperate rainforest, *P.M. McCarthy 2692*, 15.ix.2008 (CANB, NSW).

Key to the Australian species of *Phylloblastia*

1 Ascospores submuriform. 2
1: Ascospores with transverse septa only. 3
2 Ascospores 32–52 × 8–13 μm, with 3–11 transverse septa..... **P. bielczykiae**
2: Ascospores 110–180 × 5–10 μm, with 40–70 transverse septa..... **P. dolichospora**
3 Thallus usually isidiate, often sterile..... **P. borhidii**
3: Thallus lacking isidia, commonly fertile..... 4
4 Ascospores 3-septate..... **P. triseptata**
4: Ascospores with 7 or more septa 5
5 Ascospores 7-septate..... **P. septemseptata**
5: Ascospores (7–)9–13(–15)-septate 6
6 Perithecia orange-brown; involucrellum absent; ascospores 4–6.5 μm wide, with mucronate apices..... **P. mucronata**
6: Perithecia medium to dark olive-brown; involucrellum present; ascospores 6–11 μm wide, non-mucronate..... **P. excavata**

Strigula delicata Sérus., *Bryologist* **101**, 147 (1998)

Thallus subcuticular, whitish grey to greyish brown, cushion-like and composed of tightly anastomosing lobes or with narrow radiating lobes with a discontinuous blackish edge. *Perithecia* uncommon, glossy black above, 0.25–0.28 mm diam. *Ascospores* irregularly biseriate in the asci, 1-septate, occasionally spuriously 3-septate, 13–17 × 3.5–5.5 μm; cells not separating within or outside the asci. *Macroconidiomata* very numerous, 0.15–0.20 mm diam.; conidia 1-septate, 10–16 × 3.0–3.5 μm.

Previously known only from New Zealand (Northland and Wellington), the Australian specimens closely match those described and illustrated by Sérusiaux (1998). The material was collected on the upper slopes of Mount Gower, Lord Howe Island, presumably above an altitude of 700 m. Lücking (2008) suggested that *S. delicata* might be conspecific with the rare Brazilian species *S. tremens* Müll.Arg.; however, the ascospores of the latter are 17–23 × 4.0–4.5 μm (Lücking 2008).

SPECIMEN EXAMINED

Lord Howe Island: • Mt Gower, on leaves of *Dysoxylum pachyphyllum*, *E.D. Edwards 2464257*, 9.vii.1995 (CANB).

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I am grateful to Jack Elix for his company and assistance in the field, and to Adam Flakus for very useful discussions on *Phylloblastia bielczykiae*.

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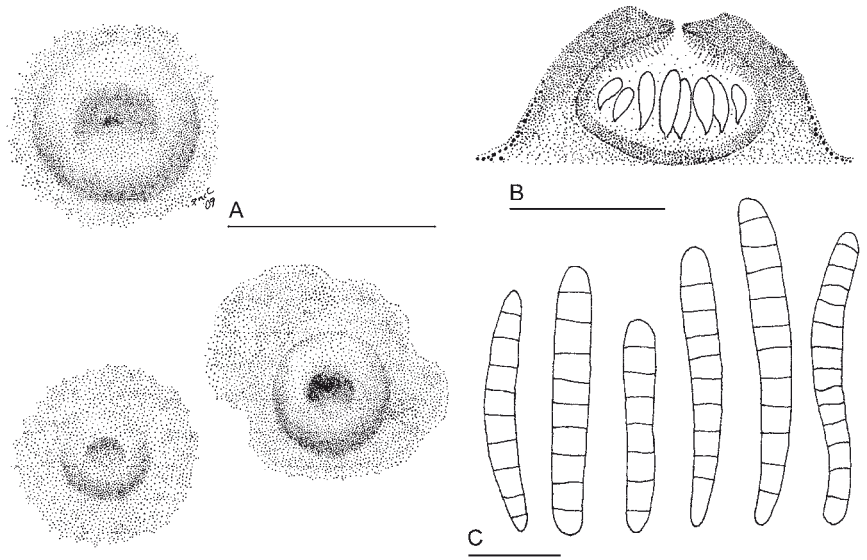

Figure 1. *Phylloblastia excavata* (holotype). A, Fertile thalli. B, Sectioned perithecium (semi-schematic). C, Ascospores. Scales: A = 0.5 mm; B = 0.2 mm; C = 20 μm.

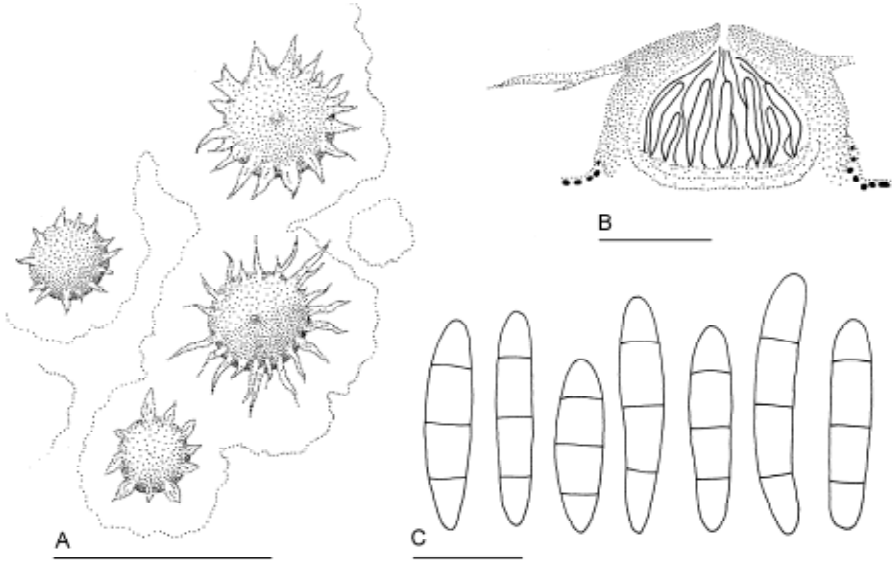

Figure 2. *Porina danbullensis* (holotype). A, Perithecia. B, Sectioned perithecium (semi-schematic). C, Ascospores. Scales: A = 0.5 mm; B = 0.1 mm; C = 10 μm.

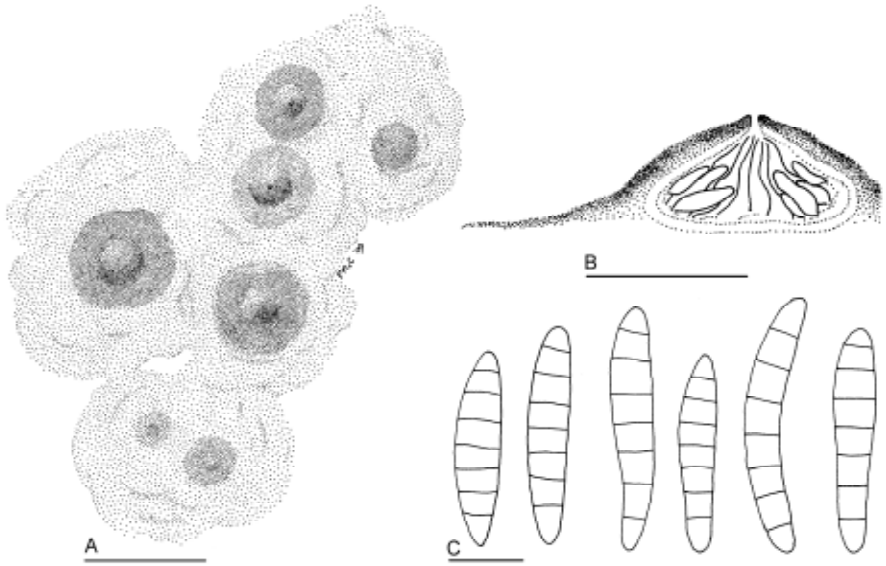

Figure 3. *Porina elixiana* (holotype). A, Fertile thalli. B, Sectioned perithecium (semi-schematic). C, Ascospores. Scales: A = 0.5 mm; B = 0.2 mm; C = 10 μm.

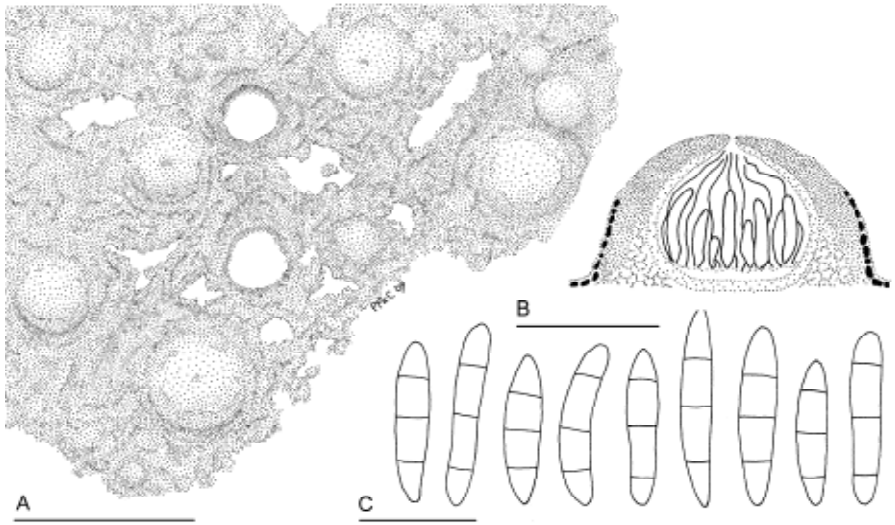

Figure 4. *Porina flavoaurantiaca* (holotype). A, Fertile thallus. B, Sectioned perithecium (semi-schematic). C, Ascospores. Scales: A = 0.5 mm; B = 0.1 mm; C = 10 μm.

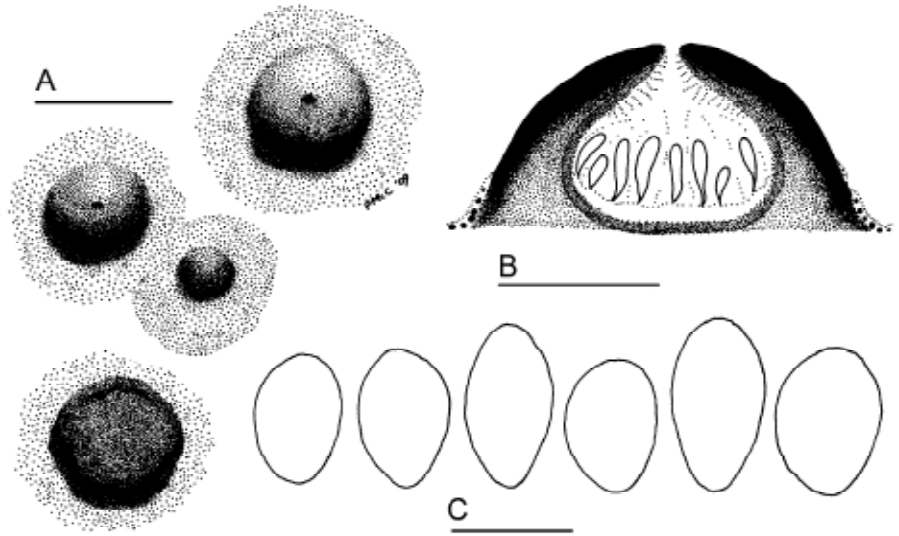

Figure 5. *Verrucaria inquilina* (holotype). A, Immature, mature and post-mature thalli. B, Sectioned perithecium (semi-schematic). C, Ascospores. Scales: A = 0.5 mm; B = 0.2 mm; C = 10 μm.

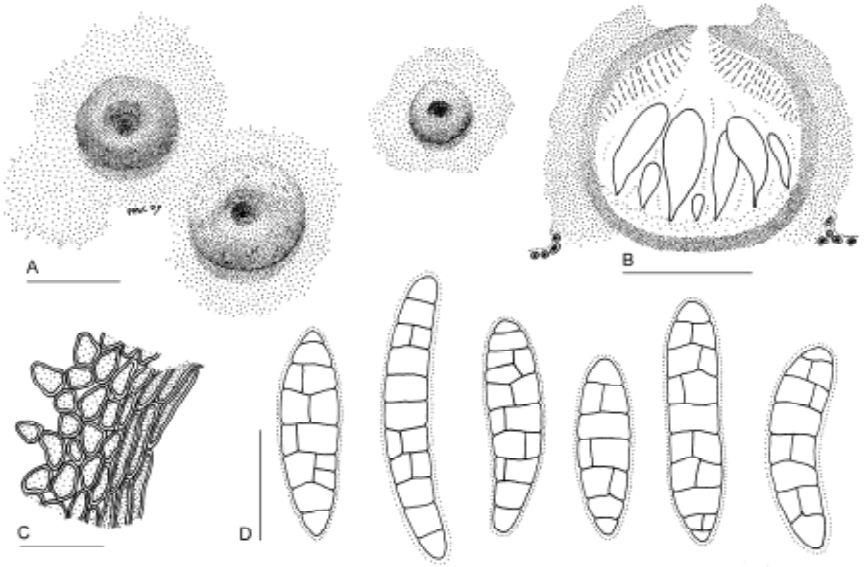

Figure 6. *Phylloblastia bielczykiae* (*McCarthy 2692*). A, Fertile thalli. B, Sectioned perithecium (semi-schematic). C, Detail of excipulum and involucrellum. D, Ascospores. Scales: A = 0.2 mm; B = 0.1 mm; C, D = 20 μm.

A new species and a new record of Australian *Scoliciosporum*

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Abstract

A sterile crustose lichen from Tasmania presented considerable difficulties for identification. The investigation to find a generic placement for this species, based on morphology, anatomy, chemistry and molecular data is outlined. The species is described tentatively as *Scoliciosporum coniectum* Kantvilas & Lumbsch, based on collections from wet forests in Tasmania and Victoria. A second species, *S. intrusum*, is recorded from Australia (Tasmania) for the first time.

Introduction

Sterile specimens have always posed problems for lichenologists, because lichen taxonomy is based largely on the anatomy and morphology of the fruiting bodies of the mycobiont. With macrolichens, the more elaborate morphological development of the thallus inevitably offers clues to the systematic placement of particular species, and thus the classification of many obligately sterile members from families such as the Parmeliaceae or Physciaceae has never been in doubt. Where entire groups of species with no fertile relatives are involved, the problem becomes more complex. A classic case is that of the macrolichen genus *Siphula* Fr. or more generally the family Siphulaceae Reichenb., which accommodated a range of superficially similar lichen groups, none of which had ascomata (Poelt 1973). In such cases, additional data come into play, and with *Siphula*, an elucidation of its relationships was attempted by Kantvilas (2002), using chemical, morphological, ecological and biogeographical information. That preliminary study was developed further using DNA-sequence data that more precisely assessed the taxonomic relationships of the genus (Grube & Kantvilas 2006).

Many similar examples are found in the crustose lichens where morphological and anatomical data can be scant. A wonderful example is provided by the genus *Lepraria* Ach, essentially a 'form genus' comprising obligately sterile species with a leprose thallus. Here molecular investigations led to the recognition that some species of *Lepraria* are actually sterile members of other, well-known genera, whereas the core of *Lepraria* is most closely related to *Stereocaulon* Hoffm., a genus of fruticose lichens (Ekman & Tønsberg 2002).

Even crustose lichens with fruiting bodies can pose problems of taxonomic placement. There remain many unrelated and clearly misplaced species within the old Zahlbruckner 'form genera' such as *Lecidea* Ach. and *Catillaria* A.Massal.; only time and extensive study will reassign those taxa to more appropriate groups. Meanwhile the 'form genera' continue to provide pragmatic solutions for problem taxa, as, for example, applied by Spribille & Printzen (2007) who after much consideration described the North American *Lecidea rubrocastanea* whilst recognizing that it bore no relationships with *Lecidea sensu stricto* in the manner generally applied since the work of Hertel (1984) and others.

When working on a lichen flora such as Tasmania's, unidentified and even unidentifiable specimens are inevitably encountered. Ecological studies in particular, where there is often a greater imperative to attempt to identify all species encountered, can generate such collections in great numbers. Certainly the first author has boxes of

such entities, as have most of his colleagues; they are oddities for which from time to time, some study somewhere triggers a clue and produces a name, or subsequent fertile collections that elucidate their identity are found.

In an extensive, long-term study of lichens and bryophytes in commercial, *Eucalyptus obliqua*-dominated wet scerophyll forests in southern Tasmania (Jarman & Kantvilas 2001), one distinctive but sterile crustose lichen was encountered which could not be identified. The results of this study are expected to contribute to a better understanding of the cryptogam floristics in such forests, better management of the forests to maintain biodiversity, and improved species conservation outcomes. Such studies are not unusual in many other parts of the world, especially in North America and Scandinavia. In our opinion, species conservation arguments in those instances are not aided by the overuse of 'dustbin' taxonomic categories such as '*Lecidea*' or 'species A'. Resource managers and conservation bureaucrats tend to require more precise labels, such as are conveyed by validly published scientific names. Moreover, validly named taxa are also more likely to attract further investigation by taxonomists, whereas 'unknown' taxa tend to remain just that. Thus, given the interesting ecology of the sterile lichen in question, and a desire to include it in ecological discussions, we were forced to attempt to find it a taxonomic pigeon-hole. This paper describes our investigation in the course of describing, with considerable hesitation and candour, this lichen as a new species in the genus *Scoliciosporum* A.Massal.

Material and methods

The study is based on collections made by the first author and housed in the Tasmanian Herbarium (HO). A wide range of herbarium specimens of other genera (also housed in HO) were also consulted. Anatomical and morphological investigations were undertaken on hand-cut sections mounted in water, 10% KOH, ammoniacal erythrosin and lactophenol cotton blue. Chemical analyses by thin-layer chromatography follow standard methods (Orange *et al.* 2001).

Molecular Methods

Total DNA was extracted using the DNeasy Plant Mini Kit (Qiagen) following the manufacturer´s instructions. PCR amplifications and direct sequencing was done as described previously (Mangold *et al.* 2008) using the following primers: (a) for the nuclear LSU rDNA: nu-LSU-0155-5′ (Döring *et al.* 2000) and nu-LSU-1125-3′ (= LR6) (Vilgalys & Hester 1990), and (b) for the mitochondrial SSU rDNA: mr SSU1 (Zoller *et al.* 1999) and MSU 7 (Zhou & Stanosz 2001). Sequence fragments obtained were assembled with SeqMan 4.03 (DNASTAR) and manually adjusted. Alignments for the single data sets were undertaken using Clustal W (Thompson *et al.* 1994) and ambiguously aligned regions were manually excluded. The alignments were analysed by a Bayesian approach (B/MCMC).

The B/MCMC analyses were conducted using the MrBayes 3.1.1 program (Huelsenbeck & Ronquist 2001). The analyses were performed assuming the general time-reversible model of nucleotide substitution (Rodriguez *et al.* 1990) including estimation of invariant sites, assuming a discrete gamma distribution with six rate categories, and no molecular clock was assumed. A run with 6,000,000 generations starting with a random tree and employing 12 simultaneous chains was executed. Every 100th tree was saved into a file. The first 400,000 generations (i.e. the first 4000 trees) were deleted as the "burn in" of the chain. Of the remaining 112,000 trees (56,000 from each of the parallel runs), a majority rule consensus tree with average branch lengths was calculated using the sumt option of MrBayes. Posterior probabilities were obtained for each clade.

General investigation

In general appearance, the lichen is a thin, inconspicuous crust with bright yellowish, ±rounded soralia (Figs 1–2). It contains atranorin and gyrophoric acid and

grows mainly on the smooth bark of twigs and young stems in wet forest. Although encountered frequently in the study area in Tasmania's southern forests, it has been seen elsewhere but has not been commonly collected because most of the thalli are minute, scattered and invariably sterile. Its appearance is reminiscent of several other species from a range of genera, which provided hypotheses for closer consideration.

Mycoblastus Norm.

With its yellow, round soralia, the new species closely resembles *M. alpinus* (Fr.) Kernst. from the cool temperate Northern Hemisphere and, to a lesser extent, the austral *M. campbellianus* (Nyl.) Zahlbr. However, no *Mycoblastus* species is known to contain gyrophoric acid-type compounds, and all but one Southern Hemisphere species contains perlatolic acid; furthermore, *Mycoblastus* has a distinctive photobiont, possibly with affinities to *Dictyochloropsis*, with globose cells 5–16 μm wide (Kantvilas 2009).

Fuscidea V.Wirth & Vězda

The soralia are also very similar to those of *Fuscidea australis* var. *montana* Kantvilas, which contains fumarprotocetraric acid (Kantvilas 2001). Gyrophoric acid, however, is unknown in *Fuscidea*, and the photobiont of *Fuscidea* is *Chlorella* and unlike that of the unknown lichen.

Trapelia M.Choisy, *Trapeliopsis* Hertel & Gott.Schneider

In these genera, gyrophoric acid-type compounds are very common. Furthermore, there are several sorediate species and one, *Trapelia corticola* Coppins & P.James, has some superficial similarities to the unknown lichen. However, *Trapelia* is reported to have a *Chlorella*-type photobiont (Tschermak-Woess 1978).

Micarea Fr.

This is a very species-rich genus in the Tasmanian flora, especially in wet forests, and gyrophoric acid is found in many taxa. Most species have a distinctive 'micareoid' photobiont (after Coppins 1983), but other photobionts are also known from the genus. We were unable to properly characterize the photobiont of the unknown lichen, but it does not appear to be micareoid. However, *Micarea* provides a very real option for the species, and there are a few species, such as *M. leprosula* (Th.Fr.) Coppins & Fletcher, which produce yellowish soredia.

Molecular investigation

The genera discussed above provided working hypotheses for further investigation. The combined analyses of nu LSU and mt SSU rDNA sequences confirmed that the Tasmanian species [Genbank nos. nu LSU: xxx, mt SSU: xxx] belongs to Lecanorales *s.str.*, indicating that it is unrelated to *Fuscidea* or *Trapelia,* which were shown to belong to Umbilicariales and Baeomycetales respectively (Bylin *et al.* 2007, Lumbsch *et al.* 2007). The species clustered with *Psilolechia lucida*, but that relationship lacked support (tree not shown). Those two taxa were found in a well-supported clade that included Micareaceae, Pilocarpaceae, Psoraceae, Scoliciosporaceae and Sphaerophoraceae without support for most nodes within the clade. *Mycoblastus sanguinarius*, which was also included in the analysis, was sister to Parmeliaceae and unrelated to the Tasmanian species. Because the relationships in the clade that included the Tasmanian species were unsupported and Genbank has only few sequences of nu LSU and mt SSU of the aforementioned families, our molecular analyses could not reveal the phylogenetic placement of the Tasmanian species beyond the fact that it belongs to that clade.

Conclusions

No aspect of the investigation offered any unequivocal pointers as to the affinities of the lichen. The molecular data certainly did not support any connections with

Trapeliaceae, *Mycoblastus* or Fuscideaceae, and only weak affinities to *Micarea*. However, the data confirm that the species belongs in Lecanorales, and is somewhere close to other 'bacidioid' groups.

Using that information, we considered various options, one of which was to follow the approach of Spribille & Printzen (2007) and describe the species in the form genus '*Lecidea*'. However, in the Australasian flora, *Lecidea* is already enough of a dustbin, and it was felt that the new species would be lost there amongst many historical names of uncertain application. Our aim was not just to describe this species, but also to flag it for future studies. Hence we decided to describe it under *Scoliciosporum* for two reasons. Firstly, that genus is small and of rather uncertain affinities, and will in time attract the interest of molecular studies. Secondly, the ecology of the species is not far removed from that of other members of the genus, especially *S. umbrinum* (Ach.) Arnold, nor are its anatomy and morphology inconsistent with that placement.

Scoliciosporum coniectum Kantvilas & Lumbsch sp. nov. Figs 1 & 2

Thallo crustaceo, tenui, soraliis flavovirentibus vel citrinis, primum rotundatis discretisque, 0.2–0.7 mm latis, tandem coalescentibus instructo, atranorinum et acidum gyrophoricum continenti recognitum, huic generi dubitatione multa adsignatum.

Type: Tasmania: West of Tahune Bridge in the Warra SST, Coupe 8I, 43°06'S, 146°41'E, on *Nematolopis squamea* in *Eucalyptus obliqua*-dominated wet sclerophyll forest, *G. Kantvilas 109/09*, 4.iii.2009 (HO – holotype; F – isotype).

Thallus crustose, forming small irregular patches typically 10–20 mm wide, dull olive to pale greyish, mostly rather patchy, occasionally continuous and smooth or cracked, 10–50 μm thick, ecorticate, mostly with a hyaline epinecral layer *c.* 5 μm thick, sorediate; soralia pale to bright greenish yellow to lemon-yellow, initially discrete, ±neatly roundish, 0.2–0.7 mm wide and scattered, occasionally ±excavate, soon becoming diffuse, confluent and spreading across the thallus; individual grains of soredia 20–40 μm wide; prothallus black, effuse, clearly evident at the thallus margins and also where the thallus is patchy. *Photobiont* a unicellular green alga with ±globose cells that are sometimes irregularly rhomboid when squashed together, 5–13 μm diam., mostly with a well-developed gelatinous sheath to 2(–5) μm thick, generally conglutinated in clumps and not separating readily in squash preparations. *Fungal hyphae* short-celled and much branched and anastomosing, 1–1.5 μm thick. *Apothecia* not known. *Pycnidia* not found.
Chemistry: atranorin and gyrophoric acid; soralia K–, KC+ red, C+ red, P–, UV–.

Etymology: The specific epithet *coniectum* is derived from the Latin *coniectus*, meaning conjecture or a throwing together, and refers to our tentative generic placement of this taxon.

Remarks

As discussed above, the placement of this taxon in *Scoliciosporum* is a pragmatic decision. With its discrete, bright yellow soralia, this species is very distinctive and eye-catching, and we are aware of few potentially confusing species in the Tasmanian flora. One possible exception is *Fuscidea australis* var. *montana*, which also has yellowish soralia, although they are more punctiform; furthermore the thallus is thicker and olive-brown and contains fumarprotocetraric acid. There are also some as yet unidentified sorediate species of *Lecidella* in the Tasmanian lichen flora, although they invariably contain xanthones and react C+ orange. In specimens of the new species where the soralia become very well-developed and confluent, to the extent that the entire thallus is virtually a yellow sorediate crust, then the most similar species is likely to be *Chrysothrix sulphurella* (Räsänen) Kantvilas & Elix. However, that species

differs chemically in containing the pigment xantholepinone, and it occurs in deeply shaded trunk habitats in the interior of wet forest.

Comparisons between *S. coniectum* and other lichens are outlined above. The species also shows some significant differences from other species of *Scoliciosporum*. Whereas the general '*gestalt*' of the thallus is not far removed from *S. umbrinum* (or any number of other lichens for that matter), the photobiont in other species of the genus appears to be different, with larger, ±globose cells 7–21 µm wide (Coppins 1983). Whereas most species of *Scoliciosporum* do not have any secondary chemistry, gyrophoric acid has been recorded in some species (Edwards *et al.* 2009).

The source of the yellow colour of the soralia of *S. coniectum* remains a mystery, because no known yellow pigments have been detected in any of the numerous chemical extractions undertaken.

Ecology and distribution: This is a rather widespread species in wetter parts of Tasmania, and it has also been recorded in a similar environment in Victoria. It occurs on smooth bark on twigs and young branches of a wide variety of host trees, usually either beneath a broken forest canopy or in forest gaps. Associated lichen species include those typical of twig communities; for example, *Cliostomum* sp., *Fuscidea australis* Kantvilas, *Loxospora solenospora* (Müll.Arg.) Kantvilas, *Pertusaria novaezelandiae* Szatala, *Sarrameana albidoplumbea* (Hook.f. & Taylor) Farkas, *Coccotrema cucurbitula* (Mont.) Müll.Arg., *Austroblastenia pauciseptata* (Shirley) Sipman and *Thelotrema lepadinum* (Ach.) Ach.

Because its thalli are small and are never found fertile, the species is rather infrequently collected. Herbarium collections span a wide range of vegetation types from coastal scrub to lowland wet eucalypt forest and rainforest, to subalpine scrubby rainforest. It is likely that it will prove to be quite widespread.

SPECIMENS EXAMINED
Tasmania: • Gordon River near Richea Creek, 42°37′S, 146°22′E, 450 m alt., *G. Kantvilas* 36/09, 4.ii.2009 (HO); • Florentine Bridge, 42°30′S, 146° 27′E, 360 m, *G. Kantvilas 298/05*, 2.xi.2005 (HO); • Hartz Mountains, track to Lake Osborne, 43°13′S, 146°46′E, 830 m alt., *G. Kantvilas 1/07*, 30.i.2007 (HO); • Murchison Hwy near Mountain Creek, 41°47′S, 145°34′E, 400 m alt., *G. Kantvilas 56/08*, 18.v.2008 (HO); • Junction Creek, 43°06′S, 146°17′E, 200 m alt., *G. Kantvilas 433/06*, 3.xii.2006 (HO); • W of Tahune Bridge, Coupe 1E, 43°06′S, 146°41′E, 100 m alt., *G. Kantvilas 356/08*, 11.xi.2008 (E, HO); • South Cape Bay, 43°37′S, 146°50′E, 5 m alt., *G. Kantvilas 353/06*, 7.x.2006 (HO). *Victoria*: • Errinundra Saddle, Rainforest Walk, 37°19′03″S, 148°50′19″E, 910 m alt., *G. Kantvilas 176/08*, *179/08 & J. Elix*, 16.iv.2008 (HO, MEL).

New record
Scoliciosporum intrusum (Th.Fr.) Hafellner
Fritschiana **49**, 31 (2004); – *Lecidea intrusa* Th.Fr., *Bot. Not.* 1867: 152 (1868)

Thallus crustose to scurfy-granular, dingy olive-brownish. *Photobiont* with cells globose, 7–23 µm wide. *Apothecia* 0.2–0.4 mm wide, convex to subglobose, black, epruinose, scattered, basally constricted to adnate, ±immarginate from the first. *Excipulum* soon excluded, in section bluish green to brownish, composed of richly branched and anastomosing, conglutinated hyphae. *Hypothecium* mostly hyaline, 70–100 µm thick. *Hymenium* 40–50 µm thick, hyaline, olive-green to bluish green, K± intensifying, N+ crimson in the upper part. *Asci* 25–35 × 11–15 µm, 8-spored, of the *Lecanora*-type: outer wall intensely amyloid; tholus well-developed, amyloid, penetrated entirely by a broad, cylindrical to barrel-shaped, non-amyloid *masse axiale*; ocular chamber short and blunt, usually rather poorly developed. *Paraphyses* 1.5–2 µm thick, with apices bluish green and expanded to 3 µm wide. *Ascospores* oblique in the ascus, ellipsoid to fusiform, straight or slightly curved, simple or with up to 2 often eccentric septa, 10–*12.8*–17(–18) × 3–3.7–4.5 µm. *Pycnidia* frequent, adjacent to the apothecia; conidia bacilliform, 3.5–4.5 × 1.5 µm. *Chemistry*: no substances detected by t.l.c.

Remarks
Detailed descriptions of this species are also provided by Coppins (1983) (as *Micarea intrusa*) and Hafellner (2004). Macroscopically it is virtually identical to *Scoliciosporum umbrinum* but that species differs by having spiralled, transversely multiseptate, filiform ascospores that are indistinctly *c.* 3–7 septate, 20–35 × 2–3 µm, and remain sigmoid or curved on release from the asci (Kantvilas 2008). *Scoliciosporum intrusum* is also highly likely to be mistaken for one of several species of *Micarea* that occur in similar habitats, but it is readily distinguished from that genus by the large-celled photobiont and the *Lecanora*-type asci. Although the Tasmanian collection has a habitat ecology in Tasmania very different from that of Northern Hemisphere populations, it accords with published descriptions in every other respect.

Ecology and distribution: Scoliciosporum intrusum is known in Tasmania from a single collection overgrowing the thallus of *Rinodina asperata* (Shirley) Kantvilas on the bark of *Bursaria* in a dry, degraded rocky pasture. The area represents a remnant lowland grassland of exceptional conservation value and supports a diverse lichen flora rich in unusual lichens with highly restricted Tasmanian distributions. The species is widespread in the temperate Northern Hemisphere, where it occurs on rock, closely associated with the thalli of other crustose lichens.

SPECIMEN EXAMINED
Tasmania: • Pontville Small Arms Range Complex, 42°40′S, 147°17′E, 110 m alt., *G. Kantvilas 212/03*, 2003 (HO).

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Figure 1. *Scoliciosporum coniectum* habit (holotype). Scale = 1 mm.

Figure 2. *Scoliciosporum coniectum*, detail of soralia (holotype). Scale = 250 μm.

The genus *Fissurina* Fée in Tasmania

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Abstract

The genus *Fissurina* comprises four taxa in Tasmania: *F. elixii* (A.W.Archer) A.W.Archer, *F. insidiosa* C.Knight & Mitt., *F. nigririmis* (Nyl.) Müll.Arg. var. *deficiens* (A.W.Archer) A.W.Archer and *F. triticea* (Nyl.) Staiger. A key and full descriptions of the species are provided, based on Tasmanian collections.

Introduction

The lichen genus *Fissurina* Fée is one of several genera with elongate (lirellate) ascomata that for many years was subsumed within *Graphis* and *Graphina*, chiefly on the basis of its hyaline, transversely septate or muriform ascospores. It was not until the work of B. Staiger that a more natural classification of the family Graphidaceae was defined and generally accepted, and the genus *Fissurina* reinstated (Staiger & Kalb 1999, Staiger 2002). The genus is distinguished from other lirellate lichens of the Graphidaceae by a combination of a thallus with a well-developed cortex of periclinal hyphae, a generally non-carbonized excipulum, paraphyses and periphysoids with spinose apices, and broadly ellipsoid, prominently halonate ascospores with round to lens-shaped locules. The most closely related genus, *Acanthothecis* Clem., also has a non-carbonized excipulum and paraphyses with spinose apices, but differs by having an ecorticate thallus, and ellipsoid to oblong ascospores with cylindrical to lens-shaped lumina. Most of the Tasmanian members of *Fissurina* are usually best recognized by the swollen lips of the lirellae. The genus comprises approximately 50–60 species, found mostly on bark (rarely on rock), especially in tropical and warm-temperate latitudes.

The most recent and most comprehensive account of the genus for the Australian region is by Archer (2009), who treated 10 taxa from mainland Australia. New Zealand species were initially dealt with by Hayward (1977), within a broader concept of *Graphis*, and Galloway (2007) recorded eight species. Much useful information on the genus is also available in an account of Indian species by Makhija & Adawadkar (2007), and in the extensive monograph by Staiger (2002). Although one species, *F. insidiosa* C.Knight & Mitt., was recorded for Tasmania (under *Graphis*) by Kantvilas & James (1991), curiously no taxa of *Fissurina* are listed for Tasmania by Archer (2009). A review of collections of the genus from Tasmania has revealed as many as four taxa for the island. These are reported here.

Material and methods

The work is based on collections held in the Tasmanian Herbarium (HO). The descriptions are based on original observations. Observations of thallus and ascomatal anatomy are based on hand-cut sections mounted in water, 10% KOH, or in Lugol's Iodine or Lactophenol Cotton Blue after pre-treatment with KOH; the last medium is particularly useful for examining the morphology of periphyses and paraphyses. Measurements of ascospores are based on at least 50 observations from sections mounted exclusively in water; other media, especially dilute KOH, cause extensive swelling of the gelatinous perispore. This can cause some confusion, and it is not clear from the literature exactly what other workers have measured. In this paper, the spore sizes given do not include the perispore, which is mentioned separately. Ascospore measurements are presented in the format: smallest measurement-*mean*-largest measurement; single outlying values are given in parentheses. Routine chemical analysis of all specimens was undertaken using the standard methods of thin-layer chromatography (Orange *et al.* 2001). A few selected extracts were checked by Jack Elix (Canberra) using high-performance liquid chromatography (Feige *et al.* 1993).

Key to the Tasmanian taxa

1 Lirellae persistently slit-like, with slightly carbonized lips, seen as a thin black line when viewed at low-power magnification 2
1. Lirellae soon developing highly swollen lips, completely non-carbonized 3

2 (1) Containing psoromic acid-type compounds; area of thallus around lirellae occasionally P+ yellow ..... **F. elixii**
2. Lacking any substances detectable by spot tests or t.l.c. ..... **F. nigririmis var. deficiens**

3 (1.) Containing stictic acid, albeit in only trace amounts ..... **F. triticea**
3. Containing no substances detectable by t.l.c ..... **F. insidiosa**

Fissurina elixii (A.W.Archer) A.W.Archer
Telopea 11: 71 (2005); – *Graphis elixii* A.W.Archer, *Australas. Lichenol.* **43**, 16 (1998).

Thallus pale olive-grey, glossy, continuous, cracked, 40–100 μm thick, forming irregular, undelimited patches to 60 mm wide. *Lirellae* scattered, simple, straight or slightly curved, 0.5–2 mm long, arising as a crack in the thallus, with the cortex turned upwards to form a pair of lips 0.3–0.5 mm wide, gaping a little to reveal the upper edge of the slightly carbonized excipulum; disc usually obscured. *Excipulum* in section poorly differentiated from adjacent tissues, laterally and basally 10–20 μm thick, colourless to yellowish, apically to 40–70 μm thick, brown-black to olive-black, unchanged in K; periphysoids usually numerous, 2.5–4 μm thick, with apices smooth. *Hypothecium* colourless, poorly differentiated, 10–20 μm thick. *Hymenium* 80–120 μm thick; asci 6–8-spored, 70–100 x 17–25 μm; paraphyses simple, straight, 1.5–2 μm wide, with apices minutely spinose. *Ascospores* uniseriate in the ascus when young, later irregularly biseriate, I+ pale blue when mature, broadly ellipsoid with rounded apices, transversely 3-septate, (15–)16–*21.2*–26 x 8–*9.4*–11 μm, plus an additional halo 1–3 μm thick; locules initially lens-shaped, soon becoming rounded.
Chemistry: 2-methoxypsoromic (major) and 2'-*O*-demethyl-2-methoxypsoromic (minor); the thallus is generally too thin for reliable spot tests although a P+ yellow reaction might be achieved at the lirellae.

Remarks

Fissurina elixii is distinguished from the other Tasmanian species of the genus chiefly by its unusual chemical composition. On t.l.c. plates, the two compounds appear exactly like psoromic and conpsoromic acids, and their identification relies on h.p.l.c. The species also has a distinctive, slightly carbonized excipulum very similar to that seen in *F. nigririmis* var. *deficiens*. It is clearly very uncommon in Tasmania and can be considered 'at risk', having been recorded only once, from the trunk of *Anopterus glandulosus* Labill. in a relict stand of *Atherosperma*-dominated rainforest in a fire-prone, sclerophyll-dominated landscape. The species is also known from eastern New South Wales, where it is apparently uncommon (Archer 2009).

SPECIMEN EXAMINED
Tasmania: • track to Cape Surville, 42°57'S, 147°59'E, 150 m alt., *G. Kantvilas 295/09*, 18.vii.2009 (HO).

Fissurina insidiosa C.Knight & Mitt. Fig. 1
Trans. Linn. Soc. London 23: 102 (1860).

Thallus dull grey to dingy olive-grey, glossy, continuous, usually cracked, 20–100 μm thick, forming rather wide-spreading, usually undelimited patches to *c.* 100 mm

wide. *Lirellae* scattered, usually very numerous, simple or occasionally furcate, straight, curved or sinuous, to 2.5 mm long, initially arising as a crack in the thallus, with the cortex edges curved upwards to form a pseudo-margin, eventually developing a pair of swollen, pale beige-brown, often cracked and scabrid lips 0.3–0.5(–0.9) mm wide; disc obscured. *Excipulum* in section poorly differentiated from adjacent tissues, 10–30 µm thick, yellow, K+ orange-red; periphysoids very rarely observed, *c.* 3 µm thick, not warty. *Hypothecium* colourless, poorly differentiated, 10–20 µm thick. *Hymenium* 90–120 µm thick; asci (6–)8-spored, 85–110 x 18–25 µm (few intact asci observed); paraphyses simple, straight, 1–1.5 µm wide, with apices not expanded and neither warted nor spinose. *Ascospores* uniseriate in the ascus when young, I–, broadly ellipsoid with rounded apices, transversely 3-septate, (13–)14–*17.5*–22(–25) x 6–*7.3*–9 µm, plus an additional, well-developed halo to 4 µm thick that swells markedly in KOH; locules initially lens-shaped, soon becoming rounded.
Chemistry: no substances detected by t.l.c.

Remarks
This is one of the most common graphids in Tasmania. It is a widespread taxon, recorded from mainland Australia, New Zealand, the Pacific, the Caribbean and India. In the rainforests of western Tasmania, it is very common and colonizes smooth-barked twigs and young trunks of many tree and shrub species in the understorey. It also persists into later stages of succession and can be found forming extensive thalli on older trees with rough, gnarled bark. When occurring on young twigs, the lirellae tend to be simple and scattered, but on older trunks they become more crowded and sinuous (Fig. 1). This taxon is distinguishable from *F. triticea* only by the absence of lichen compounds.
Two specimens (*Kantvilas 316/81, 349/81*) from the extensive rainforests of north-western Tasmania, from a site logged in 1981, remain problematical. Although they accord with *F. insidiosa* with respect to general morphology, ecology and thallus chemistry, they have statistically significantly longer and wider ascospores, 20–*22.9*–28 x 8–*9.4*–11 µm, with the halo 3–7 µm wide. I contemplated describing a separate taxon at varietal rank. However, given the ambiguity surrounding published spore dimensions, and the notoriously fickle response of *Fissurina* ascospores in different mounting media, I have delayed any action in the hope that future collections will clarify the situation.

SELECTED SPECIMENS EXAMINED
Tasmania: • Butler Island Camp, Gordon River, 42°34′S, 145°41′E, 3 m alt., *J.M. Gilbert 76/61*, 12.i.1976 (HO); • Weindorfers Forest, 41°38′S, 145°56′E, 1000 m alt., *G. Kantvilas 15/88*, 9.ii.1988 (BM, HO); • Tayatea Road, Spur 14, 41°11′S, 145°11′E, 240 m alt., *G. Kantvilas 267/82*, 18.ii.1982 (BM, HO); • S of Meunna, 41°08′S, 145°28′E, 370 m alt., *G. Kantvilas 53/82*, 16.ii.1982 (BM, HO); • Anthony Road, 41°50′S, 145°38′E, 600 m alt., *G. Kantvilas 178/91*, 13.v.1991 (HO); • south side of King River near Teepookana, 42°12′S, 145°26′E, *G. Kantvilas 269/82*, 9.iii.1982 (HO); • Mt Sprent, 42°47′S, 145°59′E, 350 m alt., *G. Kantvilas 12/87*, 10.ii.1987 (HO, PR); • Sumac Road, Spur 2, S of Arthur River, 41°08′S, 145°02′E, 170 m alt., *G. Kantvilas 316/81*, 19.v.1981 (BM, HO).

Fissurina nigririmis (Nyl.) Müll.Arg. var. **deficiens** (A.W.Archer) A.W.Archer Fig. 2
Telopea 11: 71 (2005).

Thallus pale olive-grey, glossy, continuous, unevenly verruculose, mostly 20–70 µm thick, delimited by a black, marginal prothallus. *Lirellae* scattered, simple or occasionally furcate, straight or curved, to 2 mm long, arising as a crack in the thallus, soon forming prominent, elongate thalline verrucae to *c.* 0.5 mm thick and to 1.2 mm wide; margin persistently corticate but with the upper edge of the slightly carbonized excipulum visible as a thin, grey-black line; disc pale greyish, usually obscured. *Excipulum* in section poorly differentiated from adjacent tissues, laterally and basally *c.* 10 µm thick, yellowish, K+ orange, apically to 40 µm thick, brown-black, unchanged in K; periphysoids not observed. *Hypothecium* colourless, poorly differentiated, 10–20 µm thick. *Hymenium* 90–120 µm thick; asci 8-spored, 80–100 x 17–25 µm; *paraphyses* simple, straight, 1–1.5 µm wide, with apices minutely warted. *Ascospores* uniseriate in the ascus when young, I+ pale blue, broadly ellipsoid with rounded apices, transversely 3-septate, 15–*19*–22 x 9–*10.8*–13 µm, plus an additional halo *c.* 1 µm thick; locules initially lens-shaped, soon becoming rounded.
Chemistry: no substances detected by t.l.c. or h.p.l.c.

Remarks
This species is distinguished from the other Tasmanian species of the genus by the slightly carbonized lirellae that remain slit-like and do not form swollen lips (Fig. 2). Superficially it is most similar to *F. elixii*, which differs by containing psoromic acid-type compounds. Like *F. elixii*, this species is very uncommon and 'at risk' in Tasmania. It is known from only one collection, from the trunk of *Pomaderris apetala* in a tiny relict stand of *Atherosperma*-dominated rainforest in south-eastern Tasmania. It has also been recorded from Victoria where it is apparently uncommon (Archer 2009).

SPECIMEN EXAMINED
Tasmania: • Bun Hill, Forestier Peninsula, 42°58′S 147°56′E, 320 m alt., *G. Kantvilas 323/89*, 10.xii.1989 (HO).

Fissurina triticea (Nyl.) Staiger
Biblioth. Lichenol. **85**: 156 (2002); – *Graphis triticea* Nyl., *Acta Soc. Sci. Fenn.* **7**, 470 (1863).

Identical morphologically and anatomically to *F. insidiosa* var. *insidiosa* except for the marginally larger ascospores, 15–*19.3*–24(–26) x 6–*7.8*–10 µm, and the presence of stictic and hypostictic acids, often in very trace amounts; spot tests are generally unreliable, although the thicker parts of the thallus in the vicinity of the ascomata can display a P+ orange reaction.

Remarks
The name *F. triticea* is applied with some caution: differences in ascospore size between the two taxa as cited by other authors (e.g. Staiger 2002, Makhija & Adawadkar 2007, Wirth & Hale 1978) are not unequivocal, especially because the ascospores vary in size in the course of development. As in other species of the genus, the halo can swell to enormous proportions or be stripped away altogether.
This is a widespread pantropical species, in Australasia recorded also from New Zealand. Tasmanian records are mainly from the extensive rainforests of the Northwest, where the species occurs as an understorey epiphyte on a variety of host trees and shrubs. It appears to be much less common than *F. insidiosa*.

SPECIMENS EXAMINED
Tasmania: • near Rapid River, 41°16′S, 145°19′E, 220 m alt., *G. Kantvilas 588*, 19.ii.1982 (HO); • Savage River Pipeline Road, 41°12′S, 145°19′E, 410 m alt., *G. Kantvilas 702/03*, 26.xi.2003 (HO); • Pieman Road near Huskisson River, 41°44′S, 145°29′E, 180 m alt., *G. Kantvilas 22/89*, 1.ii.1989 (HO); • S side of Pieman R near Reece Dam, 41°43.5′S, 145°07′E, 170 m alt., *G. Kantvilas 268/89*, 8.x.1989 (HO).

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Fig. 1. *Fissurina insidiosa* (*Kantvilas 316/81*). Scale = 2 mm.

Fig. 2. *Fissurina nigririmis* var. *deficiens* (*Kantvilas 323/89*). Scale = 1 mm.

Six new species of *Caloplaca* (Teloschistaceae, Ascomycota) from Australasia

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Abstract: *Caloplaca arandensis, C. archeri, C. craggyensis, C. queenslandica* and *C. wallabyensis* from Australia and *Caloplaca subsaxicola* from New Zealand are described as new to science and compared with allied taxa.

The genus *Caloplaca* Th.Fr. is particularly well represented in Australia and New Zealand (Galloway 2007, McCarthy 2009), and although more than 50 new species have been described in recent years (Galloway 2004; Kärnefelt & Kondratyuk 2004; Kondratyuk *et al.* 2007a, 2007b, 2008, 2009), further undescribed species continue to be discovered. In the present paper six new species are described: *Caloplaca arandensis* Elix, S.Y.Kondr. & Kärnefelt, *C. archeri* Kalb, S.Y.Kondr., Elix & Kärnefelt, *C. craggyensis* S.Y.Kondr., Elix & Kärnefelt, *C. queenslandica* Kalb, S.Y.Kondr., Elix & Kärnefelt and *C. wallabyensis* Elix, S.Y.Kondr. & Kärnefelt from Australia and *Caloplaca subsaxicola* S. Y.Kondr., Elix & Kärnefelt from New Zealand. The new species are illustrated and compared with allied taxa. Our data confirm that Australasia is a centre of high species diversity of *Caloplaca*, with more than 50% of the taxa endemic to the region.

Materials and Methods

This study is largely based on material collected during several field trips to Australia and New Zealand. In addition, extensive herbarium collections were used for comparison, particularly those in CANB, LD, MEL and PERTH, complemented with specimens from B, BCRU, BG, BM, BRI, C, COLO, GZU, H, KOELN, KW, LE, MIN, S, SGO, TNS and UPS.

For anatomical studies, microscope slides of lichen sections were prepared manually or with a Kryomat Leitz freezing microtome. The sections were mounted in water or in lactophenol cotton blue and studied using a Zeiss Axioscope light microscope. The slides were photographed with a digital OLYMPUS DP-11 camera. The morphology of specimens was examined using an OLYMPUS stereo microscope and photographed with a digital camera and DS-L1 Camera Control Unit. Chemical constituents were identified by thin-layer chromatography (Elix & Ernst-Russell 1993), high-performance liquid chromatography (Elix *et al.* 2003) and comparison with authentic samples.

The New Species

Caloplaca arandensis Elix, S.Y.Kondr. & Kärnefelt, sp. nov. Fig. 1
Caloplacae marchantii similis, sed aureolis thalli fere planis, apothecia maioris (0.4–1.3 mm), hymenio altiore (90–100 μm), ascosporis maioribus [12–15(–16) × (6–)7–8(–10) μm], septis ascosporarum angustioribus, pagina non squamulosa nec verruculosa/pustulosa, et praesentia *O*-methylvioxanthini et di-*O*-methylvioxanthini differt.

Type: Australia. *Australian Capital Territory*: Canberra Nature Park, Aranda Bushland, 4 km W of Canberra, 35º16′08″S, 149º04′51″E, 650 m, on consolidated soil along ridge in dry *Eucalyptus* woodland, *J.A. Elix 39381*, 10.i.2009 (CANB – holotype, LD – isotype).

Thallus 1–3 cm wide, but sometimes coalescing to form larger colonies, distinctly areolate or occasionally only numerous, scattered or aggregated apothecia present. *Areoles* 0.5–1.3 mm wide, somewhat immersed or level with the substratum, flat, with a ±even surface, yellowish brown to brownish yellow-green or dull brownish orange. *Hypothallus* not developed.

Apothecia 0.4–1.3 mm wide [0.3 mm thick in section], usually numerous and dominating the thallus, biatorine; disc usually flat, dull brownish orange, proper margin to 0.1 mm wide, ±distinct, persistent, dull yellow-orange; in section zeorine, thalline exciple usually well-developed, 60–70 μm thick; proper exciple 60–70 μm thick in the uppermost lateral portion, becoming somewhat convex, 20–30 μm thick in the lower lateral part and 20–50 μm thick in the basal portion, sometimes somewhat thicker in the centre; hymenium 90–100 μm high; paraphyses 1.5 μm wide in lower portion and to 3–5 μm diam. at the apices; subhymenium with numerous oil droplets to 4(–6) μm diam. (resembling those on *C. flavorubescens* (Huds.) J.R.Laundon). *Asci* 8-spored, often with some ascospores becoming brownish. *Ascospores* broadly oval 12–15(–16) × (6–)7–8(–10) μm in water and 10–14(–19) × (6–)7–11 μm in K, septum very narrow, usually not well-developed, seen in only the lateral portions, 2–3(–4) μm thick in water and (2–)3–5(–8) μm thick in K.

Chemistry: Thallus and apothecia K+ purple; containing parietin (major), emodin (minor), fallacinal (minor), teloschistin (minor), parietinic acid (trace), *O*-methylvioxanthin (minor), and di-*O*-methylvioxanthin (minor).

Etymology: The specific epithet is derived from the Latin suffix *-ensis* (place of origin) and the type locality.

Distribution and ecology: At present this species is known only from the type locality where it was common. Associated species included *Aspicilia contorta* (Hoffm.) Kremp., *Lecidea terrena* Nyl., *Xanthoparmelia flavescentireagens* (Gyeln.) D.J.Galloway, *X. pulla* (Ach.) O.Blanco, A.Crespo, Elix, D.Hawksw. & Lumbsch and *X. substrigosa* (Hale) Hale.

Taxonomic notes: Caloplaca arandensis is similar to *C. marchantii* S.Y.Kondr. & Kärnefelt, another terricolous Australian species, known from saline areas and open localities of Western Australia, New South Wales and Victoria (Kondratyuk *et al.* 2007a), but it differs in having mainly flat thalline areoles and much more numerous and larger apothecia (0.4–1.3 mm vs. 0.4–0.7 mm diam.), a thicker hymenium (90–100 μm vs. 60–75 μm high), longer and slightly wider ascospores (12–15 × 7–8 μm vs. 11–13 × 6–7.5 μm), and a narrower ascospore septum (2–3 μm vs. 2.5–5 μm), and in containing *O*-methylvioxanthin and di-*O*-methylvioxanthin. Unlike *C. marchantii, C. arandensis* lacks squamule-like thalline formations with a verruculose or pustulose surface.

The general habit of the thallus and apothecia of *C. arandensis* is similar to that of the widely distributed saxicolous Australian species, *C. rexfilsonii* S.Y.Kondr. & Kärnefelt, but it differs in having poorly developed thalline areoles (which are not subumbilicate), shorter and narrower ascospores (12–15 × 7–8 μm vs. 16–20 × 7–10 μm), a narrower ascospore septum (2–3 μm vs. 2–5 μm wide), in containing *O*-methylvioxanthin and di-*O*-methylvioxanthin, and in its ecology.

Caloplaca arandensis is similar to the widely distributed epilithic *C. flavorubescens* in having numerous oil droplets in the subhymenium (making it difficult to observe anatomical details in parts of the apothecium), but differs in having much darker, brownish orange apothecia, as well as shorter and narrower ascospores (12–15 × 7–8 μm vs. 15–18 × 7–10 μm), a much narrower ascospore septum (2–3 μm vs. 6–9 μm thick, in containing *O*-methylvioxanthin and di-*O*-methylvioxanthin, and in its ecology.

The general habit of the thallus and apothecia somewhat resembles the epilithic Australasian species *C. scarlatina* Zahlbr., but *C. arandensis* differs in having a narrower ascospore septum (2–3 μm vs. 4–6 μm wide), in containing *O*-methylvioxanthin and di-*O*-methylvioxanthin, and in its ecology.

Vioxanthin, a yellow-green naphthopyrone pigment, was initially isolated from microfungi and subsequently detected in the lichen *Hypotrachyna osseoalba* (Vain.) Park & Hale (Elix 2004). More recently vioxanthin and demethylvioxanthin have been detected in *Buellia vioxanthina* Elix (Elix 2009).

Caloplaca archeri Kalb, S.Y.Kondr., Elix & Kärnefelt, sp. nov. Figs 2, 3

Caloplacae chlorinae similis, sed isidiis veris praesens, sorediis absens, caloplocino multo preasens, et praesentia *O*-methylvioxanthini et 5-chloroemodini et atranorini et fulgidini et isofulgidini et vicanicini et diploicini differt.

Type: Australia. *New South Wales*: trail from the Woy Woy Road to Kariong Brook, *c.* 45 km N of Sydney, 33°21′S, 151°16′E, 100 m, on sandstone rocks in dry *Eucalyptus* forest, *K. & A. Kalb & A. & P. Archer s.n.* (CANB – holotype ex Herb Kalb 35546).

Thallus 3–5 cm wide, but usually forming smaller fragments among other crustose lichens, distinctly areolate with ±scattered, whitish to grey-white areoles, areoles obvious on peripheral black hypothallus but becoming more aggregated in the central part to form a continuous isidiate crust, upper surface grey-white at first but darkening to greyish blue or blackish blue-grey with age, with scattered, indistinct apothecia. *Areoles* 0.3–0.7 mm wide, usually with an undulating upper surface, warty at first but soon becoming ±completely covered by isidia, subconvex, loosely attached to substratum, ±scattered at the periphery but densely aggregated in the centre. *Isidia* short and thick, forming corona-like or finger-like projections or becoming coralloid, white or grey-white at first, then dark bluish grey or grey-black, 0.075–0.1 mm diam., 0.2–0.25 mm high, usually darker at the apices. *Hypothallus* black, obvious between adjacent areoles at the periphery.

Apothecia 0.4–0.8 mm diam. [0.2–0.25 mm thick in section], usually scattered and indistinct, sessile or somewhat constricted at the base, rounded**,** usually lecanorine, rarely ±biatorine with a brownish disc and blackish proper margin; thalline exciple white or grey-white, rather thick, 0.15–0.2 mm wide, entire to crenulate and densely isidiate; disc dull yellowish brown, brownish orange to blackish blue; in section lecanorine, thalline exciple well-developed, 50–60 μm thick, cortical layer 20–30 μm thick, well-developed, palisade plectenchymatous, becoming bluish black in the outermost layer; true exciple 50–100 μm wide or indistinct in the uppermost lateral portion, 15–20 μm thick in the lower lateral portion and 30–40 μm thick in the basal portion, scleroplectenchymatous with a well-developed matrix and elongated cell lumina *c.* 1 μm wide; hymenium 70–80 μm high, hyaline, without oil droplets; epihymenium bright, yellowish green to dull brownish yellow or bluish green in darker areas; subhymenium 70–80 μm thick, becoming distinctly brownish; paraphyses 1.5–2.0 μm diam. at the base, slightly widened towards the tips to 4(–5) μm wide, richly broom-like branched. *Asci* with 1–2 mature, bipolar ascospores, but with very variable, narrow lens-like to broadly rounded or almost spherical aborted spores. Ascospores soon becoming brownish or g**r**eyish-brown, broadly ellipsoid with rounded ends, 9–12(–17) × 6–8(–10) μm in water and 8–13 × 6–9 μm in K [cell wall *c.* 1 μm thick in K], septum narrow, 2–3 μm thick in water and K. *Conidiomata* not seen.

Chemistry: Thallus and cortex of thalline exciple K–; epihymenium K+ purple but soon becoming brownish purple to crimson-violet; the brownish portion of epithecium K– or becoming blackish green; containing caloploicin (major), *O*-methylvioxanthin (minor), 5-chloroemodin (minor), atranorin (minor), fulgidin (minor), isofulgidin (minor), vicanicin (minor), diploicin (trace), parietin (trace).

Etymology: This species is named in honour of the Australian lichenologist Alan W. Archer, in recognition of his enormous contribution to our knowledge of the Graphidaceae**,** Pertusariaceae and Cladoniaceae.

Distribution and ecology: At present this species is known from coastal localities in New South Wales and Tasmania, where it grows on siliceous rocks together with *Caloplaca craggyensis, C. jackelixii* S.Y.Kondr., Kärnefelt & A.Thell and *C. tomareeana* S.Y.Kondr. & Kärnefelt.

Taxonomic notes: In overall morphology, *C. archeri* resembles *C. chlorina* (Flot.) H. Olivier, but it differs chemically and in the nature of the vegetative propagules. Whereas in *C. archeri* the isidia remain intact, and caloploicin, *O*-methylvioxanthin, 5-chloroemodin, atranorin, fulgidin, isofulgidin, vicanicin and diploicin are present, in *C. chlorina* the short globular isidia become sorediate, and parietin, emodin, fallacinal, teloschistin and parietinic acid are present. The colour of the thallus and vegetative propagules of *C. archeri* also resemble the European *C. virescens* (Sm.) Coppins, but the latter species has pseudoisidia or coarsely granular soredia rather than true isidia, and also contains the parietin chemosyndrome.

The small ascospores and apothecia of *C. archeri* resemble those of *C. cerinoides* (Anzi) Jatta, but it differs in having a whitish thallus of scattered, subconvex areoles and a black hypothallus (*C. cerinoides* is distinctly areolate with ±flat areoles a ±grey to blue-grey hypothallus), larger apothecia (0.4–0.8 mm vs. 0.15–0.3 mm wide), 1–2-spored asci (vs. 8-spored asci), in having richly broom-like branched paraphyses, much wider ascospores (7–8 μm vs. 5–6 μm wide) with a narrower septum (2–3 μm vs. 3–5 μm wide), and in its chemistry. *Caloplaca archeri* is similar to *C. queenslandica* (described below), but it differs in having warty, verruculose to isidiate thalline areoles. The asci, ascospores, paraphyses and chemistry of the two species are very similar, but *C. queenslandica* has areoles with a ±smooth surface, and it lacks verrucae and isidia.

SPECIMEN EXAMINED

Australia. *Tasmania*: • Bass Strait, Craggy Island, on south-eastern coast about 110 m NE of southern point, 39°40′S, 147°40′E, 8–14 m, on low coastal granite, growing with *Caloplaca jackelixii* and *C. craggyensis*, *J.S. Whinray s.n.*, 22.vi.1972 (MEL 1013054).

Caloplaca craggyensis S.Y.Kondr., Elix & Kärnefelt, sp. nov. Figs 4, 5

Caloplacae verruculiferae similis, sed thallo minore, lobis angustioribus (1.5–3.0 × 0.2–0.3 mm), apotheciis minoribus (0.3–0.7 mm) et ascosporis valde latioribus (6–7(–8) μm) et septis latioribus differt.

Type: Australia. *Tasmania*: Bass Strait, Craggy Island, 64 m SSW of the tip of the NE point, 39°40′S, 147°40′E, 6 m, on three granite boulders *c.* 20 m from high water level, *J.S. Whinray s.n.*, 30.iii.1972 (MEL 1013018 – holotype).

Thallus 0.5–3 cm wide, but often forming larger aggregations, distinctly lobate in the peripheral zone but areolate and verruculose with numerous isidia-like formations and apothecia in the centre; yellow-orange to bright yellow in the peripheral zone, and whitish yellow to greenish or greyish yellow in the centre or sometimes appearing brownish orange due to the numerous ±aggregated apothecia. *Lobes* long and very narrow, 1.5–3 mm long, 0.2–0.3(–0.5) mm wide, often with separate, secondary lobules 0.2–0.3 mm wide, which form fern-like branches 0.7–1.2 mm wide. *Areoles* in the central portion to 1.5 mm wide, bearing numerous rounded or irregular granular isidia, 0.07–0.2 mm wide. Upper surface usually uniformly coloured with irregular, paler [pseudocyphellae-like] spots, ±brownish yellow and glossy in places, while the granular isidia are a much brighter yellow. Isidia like rounded warts, ±ill-defined, 0.1–0.2 mm wide.

Apothecia 0.3–0.7 mm diam. [in section to 0.33 mm thick], often very numerous, scattered to aggregated, sessile or weakly attenuated at the base; zeorine to biatorine; thalline exciple often crenulate, ±evanescent and apparent only at the base; disc subconcave at first then flat, true exciple very thin, 0.04–0.05 mm wide, slightly paler yellow or concolorous with disc; thalline exciple 0.05–0.07 mm wide, much brighter yellow or citrine yellow, markedly crenulate, sometimes apparent only at the base; in section zeorine, thalline exciple well-developed to 100–170 μm thick, cortical layer 25–50 μm thick, paraplectenchymatous; true exciple 40–50 μm wide in the uppermost lateral portion, 50–100 μm thick in the lower lateral portion and 40–50 μm thick in the basal portion, paraplectenchymatous with a well-developed matrix and rounded or ellipsoid cell lumina *c*. 3–4 μm wide; hymenium 80–100 μm high, hyaline, without oil droplets, epihymenium bright yellowish green to dull brownish yellow; subhymenium 40–50 μm thick, hyaline, without oil droplets; paraphyses *c*. 2 μm diam. at the base, broadening towards the tips to 5–6 μm wide; asci (1, 2, 4, 6–)8-spored, with ascospores of variable size. *Ascospores* elongate-ellipsoid, rather narrow (11–)12–15(–19) × 6–7(–8) μm in water and 12–16 × (7–)8–10 μm in K, the septum 4–6 μm thick in water and 5–7(–8) μm thick in K.
Chemistry: Thallus and apothecia K+ purple; containing arthothelin (major), atranorin (minor), 4,5-dichloronorlichexanthone (minor), parietin (minor), erythroglaucin (trace), xanthorin (trace), parietinic acid (trace).

Etymology: The specific epithet is derived from the Latin suffix *-ensis* (place of origin) and the type locality, Craggy Island in Bass Strait.

Distribution and ecology: At present this species is known only from Craggy Island in Bass Strait where it grows on siliceous rocks together with *Caloplaca archeri*, *C. jackelixii*, *C. cribosa* (Hue) Zahlbr. and *Xanthoria ligulata* (Körb.) P.James.

Taxonomic notes: Caloplaca craggyensis resembles the European *C. verruculifera* (Vain.) Zahlbr. in having convex lobes at the periphery and isidioid formations in the centre, but differs in its smaller thallus, shorter (1–3 mm vs. 1–6 mm long) and narrower (0.2–0.3 mm vs. 0.2–0.6 mm wide) lobes, smaller apothecia, and broader ascospores [(11–)12–15(–19) × 6–7(–8) μm vs. (9–)11–14(–15) × (4–)5–6(–7) μm] and wider spore septum [4–6 μm vs. 3–4(–5) μm wide], in having a high concentration of arthothelin, and detectable amount of atranorin, 4,5-dichloronorlichexanthone, erythroglaucin, xanthorin, and parietinic acid. *Caloplaca verruculifera* contains only the parietin chemosyndrome.

Caloplaca craggyensis is also similar to the European lobate, isidioid *Caloplaca granulosa* (Müll.Arg.) Jatta, but differs in having a better developed areolate central portion of the thallus, in having a much thicker ascospore septum (4–6 μm vs. 2.5–3.5 μm wide), and in containing arthothelin, atranorin and 4,5-dichloronorlichexanthone.

Caloplaca craggyensis is similar to the lobate Australian species *C. whinrayi* S.Y.Kondr. & Kärnefelt and *C. tomareeana* S.Y.Kondr. & Kärnefelt, but it differs in having more convex lobes, small, fern-like branched secondary lobes 0.2(–0.5) mm wide and isidia-like warts, in containing arthothelin, and in a low concentration of parietin. The latter chemical features also distinguish *C. craggyensis* from the isidiate Antarctic species *C. isidioclada* Zahlbr. and *C. millegrana* (Müll.Arg.) Zahlbr., both of which have long finger-like, cylindrical isidia.

Caloplaca craggyensis differs from the Southern Hemisphere species *C. lucens* (Nyl.) Zahlbr. in having a smaller thallus, narrower lobes, smaller isidia (0.07–0.2 mm wide, rounded or irregular grain-like isidia vs. 0.3–0.5 mm wide and 0.7–1 mm high papillae in the central portion of the thallus (Øvstedal & Smith (2001)), in lacking oil droplets in the paraphyses, and in containing arthothelin.

SPECIMENS EXAMINED
Australia. *Tasmania*: • type locality, on granite boulders with *C. jackelixii*, *J.S. Whinray s.n.*, 30.iii.1972 (MEL 1013019); • Craggy Island, on the SE coast, *c.* 120 m NE of the southern point, 3 m, 17–21 m inland from high water level, on large granite blocks at the boundary of the coastal granite, growing with *C. jackelixii* and *C. cribrosa*, *J.S. Whinray s.n.*, 22 .iv.1972 (MEL 1013067); • Craggy Island, on south-eastern coast, *c.* 110 m NE of southern point, 39°40'S 147°40'E, on low coastal granite, 8–13 m from high water level, growing with *C. jackelixii* and *C. archeri*, *J.S. Whinray s.n.*, 22.iv.1972 (MEL 1013054).

Caloplaca queenslandica Kalb, S.Y.Kondr., Elix & Kärnefelt, sp. nov. Fig. 6
Caloplacae cerinoidie similis, sed thallo clare albo, areolis subconvexis disperses, hypothallo nigro, apotheciis maioribus (0.4–1.0 mm), ascis 1–2-sporae, paraphysibus ramosis scopulatis, ascosporis valde latioribus ((6–)7–8(–10) μm), septis angustioribus, caloplocino multo preasens, et praesentia *O*-methylvioxanthini et 5-chloroemodini et atranorini et fulgidini et isofulgidini et vicanicini et diploicini differt.

Type: Australia. *Queensland*: Mount Nebo Road, *c.* 30 km W of Brisbane, 27°24'S, 152°49'E, 400 m, on granite rocks in subtropical *Eucalyptus* forest with *E. crebra*, *K. & A. Kalb & R. Rogers s.n.*, 29.viii.1995 (CANB – holotype ex Herb K. Kalb 27764).

Thallus 1–3 cm wide, but often in smaller fragments among other crustose lichens or *Xanthoparmelia* species (which often grow over it), distinctly areolate with numerous glossy, white areoles, areoles more aggregated in the centre and scattered at the periphery, with scattered apothecia with whitish to greyish white, greyish blue or even blackish blue discs. *Areoles* (0.1–)0.2–0.5(–0.8) mm wide, subconvex, closely attached to the substratum or rarely ±suberect and sublobulate, scattered in the peripheral zone to densely aggregated in the centre, white with blackish conidiomata, in section 0.08–0.22 mm thick, appearing subconvex due to the edges being folded downwards, cortical layer 10–20 μm thick, palisade plectenchymatous. Upper surface white to snow-white with bluish or bluish black spots (similar to *C. archeri* above). *Hypothallus* black, obvious between adjacent areoles at the periphery.

Apothecia 0.4–1.0 mm diam. [in section 0.2–0.25 mm thick], scattered to aggregated, usually not numerous, sessile to somewhat constricted at the base; lecanorine or zeorine; thalline exciple *c.* 0.1 mm wide, entire and crenulate to reduced and seen only at the base or becoming excluded, concolorous with the thallus (white or greyish white); disc subconcave at first to flat or weakly subconvex, dull yellowish brown, brownish orange to rusty brown or blackish blue; true exciple very thin, 0.03–0.05 mm wide, blackish brown, contrasting with the disc to somewhat indistinct; thalline margin 0.05–0.07 mm wide, much brighter yellow or citrine yellow, markedly crenulate, sometimes only at the base; apothecia in section zeorine, thalline exciple well developed, 50–100 μm thick, cortical layer 20–30 μm thick, well-developed laterally, palisade plectenchymatous, hyphae 3–5(–6) μm diam.; true exciple 40–50 μm wide in the uppermost lateral portion, *c.* 15–20 μm thick in lower lateral and basal portions, of radially oriented hyphae or *textura intricata* in lateral portion, to scleroplectenchymatous with a well-developed matrix and elongated cell lumina *c.* 1–1.5 μm wide at base; hymenium 70–80 μm high, hyaline, without oil droplets; epihymenium bright yellowish greenish to dull brownish yellow or blackish blue-green in places; subhymenium 70–80 μm thick, becoming distinctly brownish; paraphyses *c.* 1.5–2 μm diam. at the base, scarcely widened towards the tips, richly branched, the secondary branches 10–17 μm long. *Asci* 1–2(–4)-spored, usually with aborted spores. *Ascospores* very variable in size and shape (from narrow lens-like to widely rounded or almost spherical), soon becoming brownish; mature hyaline bipolar ascospores only 1–2 per ascus, also becoming greyish or brownish when over-mature; bipolar ascospores broadly ellipsoid, 10–13(–15) × (6–)7–8(–10) μm in water and (8–)10–15(–18) × (6–)8–12(–14) μm in K [cell walls to 1 μm thick in K], septum narrow, 2.5–3(–4) μm thick in

water, (1–)2–4(–6) μm thick in K. *Conidiomata* black, with brownish black walls in section; conidia bacilliform, 3–4 × 0.8–1 μm.
Chemistry: Thallus and cortex of thalline exciple K–; epithecium K+ purple but soon becoming brownish purple to crimson-violet; containing caloploicin (major), *O*-methylvioxanthin (minor), 5-chloroemodin (minor), atranorin (minor), fulgidin (minor), isofulgidin (minor), vicanicin (minor), diploicin (trace), parietin (trace).

Etymology: The specific epithet is derived from the Latin suffix *-icus* (belonging to) and the type locality, Queensland.

Distribution and ecology: At present the species is known from scattered localities in Queensland and New South Wales, where it grows on siliceous rocks in the coastal zone with other crustose lichens and *Xanthoparmelia* species.

Taxonomic notes: *Caloplaca queenslandica* is characterized by several unique microscopic features, namely paraphyses that are very thin towards the tips and densely broom-like branched, asci that contain mainly simple or 1-septate aborted ascospores while well-developed bipolar spores are rarely present and then only 1–2(–4) per ascus, ascospores (both aborted and bipolar) soon becoming greyish brown. The chemistry of the species is also unique (epithecium K+ purple then crimson violet). As for macroscopic characters, it is characterized by the white thallus, the dispersed or aggregated, flat areoles that lack isidia and soredia and contrast strongly with the black hypothallus, and the lecanorine or zeorine apothecia with yellowish brown, brownish orange to rusty brown or blackish blue discs.
Caloplaca queenslandica is similar to *C. cerinoides* (Anzi) Jatta from Europe, but differs in having a glossy white thallus of scattered subconvex areoles and a contrasting black hypothallus (*C. cerinoides* is distinctly areolate with ±plane areoles, and a hypothallus absent or grey to greyish blue), larger apothecia (0.4–1 mm vs. 0.15–0.3 mm wide), 1–2-spored asci (vs. 8-spored asci), narrow, broom-like branched paraphyses not swollen towards the tips (2–2.5 μm vs. 3–4 μm wide), much wider ascospores (7–8 μm vs. 5–6 μm wide), a narrower septum (2.5–3 μm vs. 3–5 μm thick, and a different chemistry (*C. cerinoides* contains the parietin chemosyndrome).
Caloplaca queenslandica is similar to another eastern Australian species, *C. archeri,* but it differs in having ±subconvex areoles with wavy edges and a relatively smooth surface rather than the verruculae or isidia-like structures typical of *C. archeri* (see above).

SPECIMENS EXAMINED
Australia: *Queensland*: • type locality, on granite boulders, *K. & A. Kalb & R. Rogers s.n.*, 29.viii.1995 (Herb K. Kalb 27759, CANB, LD, BRI ex Herb K. Kalb 27760).
New South Wales: • trail from the Woy Woy Road to Kariong Brook, *c.* 45 km N of Sydney, 33°21′S 151°16′E, 100 m, on sandstone outcrops in a dry *Eucalyptus* forest, *K. & A. Kalb, A. & P. Archer s.n.*, 10.viii.1992 (CANB ex Herb K. Kalb 35831; Herb K. Kalb 35832).

Caloplaca subsaxicola S.Y.Kondr., Elix & Kärnefelt, sp. nov. Fig. 7
Caloplacae saxicolae similis, sed ascosporis longioribus latioribusque (10–)12–14 × (4–)4.5–6.0 μm et brialmontino erythroglaucinoque multis praesens differt.

Type: New Zealand. *North Island*: NW Ruahine limestone plateau, 39º39′S, 176º08′E, 1150 m, on limestone or limestone-covered with a thin layer of soil, *J.K. Bartlett 27979*, 9.xi.1983 (MEL 1045940 – holotype).

Thallus 0.5–1 mm wide, but often aggregated in larger colonies where individual thalli are difficult to identify, initially distinctly lobate, with well-developed lobes in the peripheral zone, in other parts areolate. Some specimens exhibit a narrow but distinct whitish yellow peripheral zone, 1–1.5 mm wide, while the centre is brownish yellow to brownish orange due to the numerous apothecia (but with no pink or reddish tinge). *Areoles* 0.3–0.5 mm wide, sparse and scattered to densely aggregated, convex, yellow or with ±whitish pruina; areoles sometimes elongated to 1 mm long and 0.2–0.4(–0.7) mm wide or consisting of fern-like, radially oriented lobules, 0.2–0.4 mm wide, with total lobe width of 0.7–1.0 mm.
Apothecia 0.5–1.5 mm diam. [in section ***c.*** 0.3 mm thick], initially scattered then numerous to densely aggregated and crowded, lecanorine to zeorine, with a ±persistent thalline margin, up to 0.1 mm wide at first, then becoming thinner (*c.* 0.05 mm wide) or excluded, concolorous with the thallus, yellow with sparse whitish pruina; true exciple more obvious on larger apothecia, to 0.05 mm wide, ±concolorous with disc, slightly raised above the level of the disc, dull brownish cream to dull brownish orange, epruinose; disc flat to weakly subconvex, dull brownish cream to dull brownish orange; in section thalline exciple 90–100 μm thick, with a somewhat lax cortical layer becoming much thicker on the underside; true exciple 40–75 μm thick in the uppermost lateral portion, 20–30 μm thick in the lower lateral and to 50 μm thick in the basal portion, pseudoprosoplectenchymatous with cell lumina *c.* 2–3 μm diam.; hymenium 70–90 μm high; epihymenium with numerous square or rhombic crystals, 4–5 μm long, insoluble in K; paraphyses 5–8 μm thick towards the tips, apices often appearing pear-shaped to 13 μm long, oil cells 5–6 μm diam., 1 or 2 per paraphysis, becoming distinctly brownish in K; subhymenium 40–50 μm thick. *Asci* 8-spored. Ascospores elongate-ellipsoid to slightly fusiform, distinctly widened at the septum, (10–)12–14 × (4–)4.5–6 μm in water, (10–)12–14 × 4.5–6(–7) μm in K, septum thin, 3–4 μm thick in water and (2.5–)3.5–5 μm thick in K.
Chemistry: Epihymenium K+ dark purple at first then crimson purple; containing brialmontin 1 (major), erythroglaucin (major), parietin (minor), xanthorin (minor), and an unknown fatty acid (minor).

Etymology: The specific epithet derives from the similarity of this species to *Caloplaca saxicola* (Hoffm.) Nordin.

Distribution and ecology: The species is known from the North and South Islands, New Zealand, where it grows on limestone or limestone covered with a thin layer of soil.

Taxonomic notes: Caloplaca subsaxicola is similar to the cosmopolitan *C. saxicola*, particularly when only young rosette-like thalli are present, and often with different coloured peripheral and central portions. However, *C. subsaxicola* has larger apothecia (0.5–1.5 mm vs. 0.4–0.7 mm), longer and wider ascospores ((10–)12–14 × 4.5–6 μm vs. 9–11 × 3.5–4.5(–7) μm), a yellow or whitish yellow thallus and the distinctive pink or reddish tinge present in the thallus and apothecia of *C. saxicola*, and high concentrations of brialmontin 1 and erythroglaucin). *Caloplaca saxicola* contains parietin (major), parietinic acid (minor), fallacinal (minor), teloschistin (minor), erythroglaucin (trace), and xanthorin (trace).

SPECIMENS EXAMINED
New Zealand. *North Island*: • type locality, on limestone or limestone covered with a thin layer of soil, *J.K. Bartlett 28104*, 9.xi.1983 (MEL 1045927).
South Island: • Marlborough, Branch River, high peaks on headwaters of Gordon Stream, 1300 m, *J.K. Bartlett 28053*, 19.i.1984 (MEL 1045931, 1045928).

Caloplaca wallabyensis Elix, S.Y.Kondr. & Kärnefelt, sp. nov. Fig. 8
Caloplacae approximatae similis, sed ascosporis aliquot angustioribus (3.5–4.5(–6) μm), septis ascosporarum distincte latioribus et praesentia brialmontini (ultra chemosyndromum parietini) differt.

Type: Australia. *Western Australia*: Wallaby Hills Nature Reserve, 20 km E of York on the Goldfield Road, 31°50′48″S, 116°59′16″E, 280 m, on old termite mound in *Eucalyptus salmonophloia* woodland with *Xanthorrhoea* shrubs and laterite rocks, *J.A. Elix 38576*, 4.iv.2006 (PERTH – holotype; CANB, LD – isotypes).

Thallus 1–2 cm wide or aggregated into larger colonies, usually indistinct and apparent only because of the aggregation of numerous dark brownish orange apothecia, rarely forming a very thin membrane between sand particles to somewhat thicker and areolate, with sparse, minute areoles 0.3–0.5 mm wide, whitish grey to brownish white. *Hypothallus* absent.

Apothecia 0.3–1 mm diam. [*c.* 0.3 mm thick in section], common, rising above the level of the substratum, flat to subconvex, soon developing an undulating surface, biatorine; disc dull orange to brownish orange with a ±reddish tinge; margin paler, dull yellow, yellowish orange to yellowish pink at first, soon excluded; in section zeorine or lecanorine, thalline exciple better developed on the underside, 100–110 μm thick, cortical layer 10–20 μm thick; true exciple 50–60 μm thick in the uppermost lateral portion, 10–20 μm thick in the lower lateral portions, markedly thickened to 40–70(–100) μm thick in the basal portion, pseudoprosoplectenchymatous with cell lumina 2–3 μm diam., or with ±densely packed *textura intricata*, hyaline, in contrast to the much darker subhymenium; hymenium 50–60 μm high; subhymenium 50–70 μm thick with numerous, irregular oil droplets, 1.5–4 μm wide, giving it a straw or brownish colour; paraphyses distinctly widened towards the tips, 4–5(–6) μm diam. *Asci* 8-spored, often with brownish to golden ascospores. *Ascospores* mainly immature and simple, with oil droplets, brownish to golden, mature bipolar ascospores narrowly ellipsoid to fusiform, slightly wider at the septum, 10–12 × 3.5–4.5(–6) μm in water and 11–14 × 4–5(–5.5) μm in K, septum 2–2.5(–4) μm thick in water and (2.5–)3–4 μm thick in K.
Chemistry: Epihymenium K+ brownish purple, invariant with time; containing parietin (major), brialmontin 1 (minor), parietinic acid (minor), teloschistin (minor).

Etymology: The specific epithet is derived from the Latin suffix *-ensis* (place of origin) and the type locality.

Distribution and ecology: At present the species is known from only the type locality where it was common. Associated species included *Lecidea ochroleuca* Pers., *Thysanothecium hookeri* Mont. & Berk. and *Xanthoparmelia subprolixa* (Nyl. ex Kremp.) O. Blanco, A.Crespo, Elix, D.Hawksw. & Lumbsch.

Taxonomic Notes: *Caloplaca wallabyensis* is similar to the Arctic *C. approximata* (Lynge) H.Magn., which grows on rocks or rarely on bryophytes, but differs in having slightly narrower ascospores (3.5–4.5 μm vs. 4–5 μm wide), and a distinctly thicker ascospore septum (2–2.5 μm vs. 1–1.5 μm wide), in containing brialmontin 1 in addition to the parietin chemosyndrome, and its ecology and distribution.

Caloplaca wallabyensis is also similar to *C. nubigera* (Kremp.) Dalle Torre & Sarnth., which grows on limestone outcrops in the subalpine and alpine belts of the Northern Hemisphere, but differs in having much narrower ascospores (3.5–4.5 μm vs. 5–6(–7) μm wide), as well as containing brialmontin 1 plus the parietin chemosyndrome, and in its ecology and distribution. *Caloplaca raesenenii* Bredk., known from soil and plant debris in the steppes and semi-deserts of Eurasia, differs from *C. wallabyensis* in having broader ascospores (5–6 μm vs. 3.5–4.5 μm wide), and in lacking brialmontin 1. *Caloplaca ochrochroa* (Müll.Arg.) Zahlbr., from Victoria, has ascospores very similar to those of *C. wallabyensis*, i.e. 10–12 × 3–5 μm (Müller 1893), but differs in having a better developed, verruculose-areolate, dull brownish thallus, a brownish yellow hypothallus, convex, biatorine, brownish yellow apothecia, a non-inspersed subhymenium and wider ascospores (4–6 μm vs. 3.5–4.5 μm wide in water and 6–7 μm vs. 4–5 μm wide in K).

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Captions for figures
Figures: 1. *Caloplaca arandensis* (isotype in LD). Scale 1 mm; 2. *Caloplaca archeri* (holotype in CANB), thallus. Scale 1 mm; 3. *Caloplaca archeri* (holotype in CANB), apothecia. Scale 1 mm; 4. *Caloplaca craggyensis* (holotype in MEL). Scale 4 mm; 5. *Caloplaca craggyensis* (holotype in MEL). Scale 1 mm; 6. *Caloplaca queenslandica* (holotype in CANB). Scale 1 mm; 7. *Caloplaca subsaxicola* (holotype in MEL). Scale 2 mm; 8. *Caloplaca wallabyensis* (isotype in LD). Scale 1 mm.

Fig. 1. *Caloplaca arandensis* (isotype in LD). Scale 1 mm.

Fig. 2. *Caloplaca archeri* (holotype in CANB), thallus. Scale 1 mm.

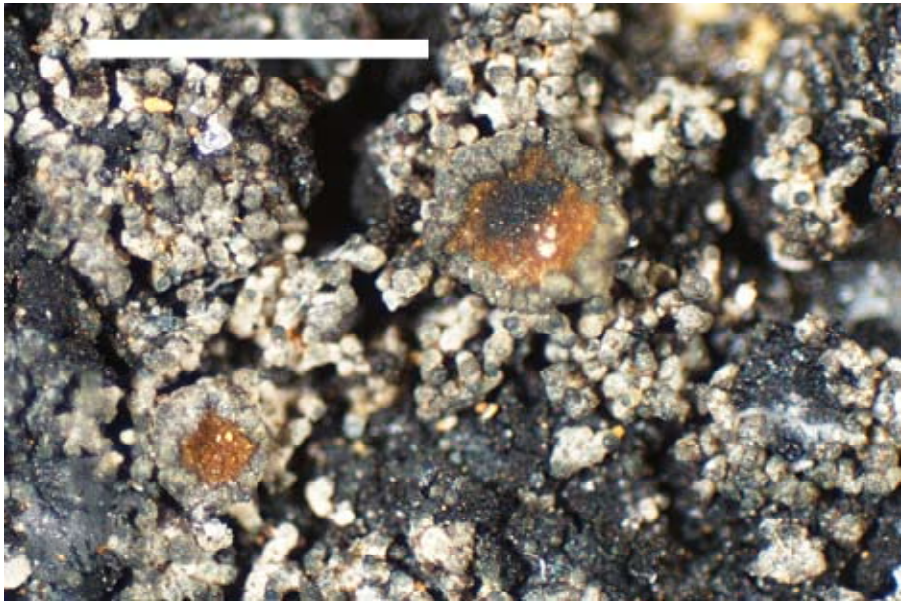

Fig. 3. *Caloplaca archeri* (holotype in CANB), apothecia. Scale 1 mm.

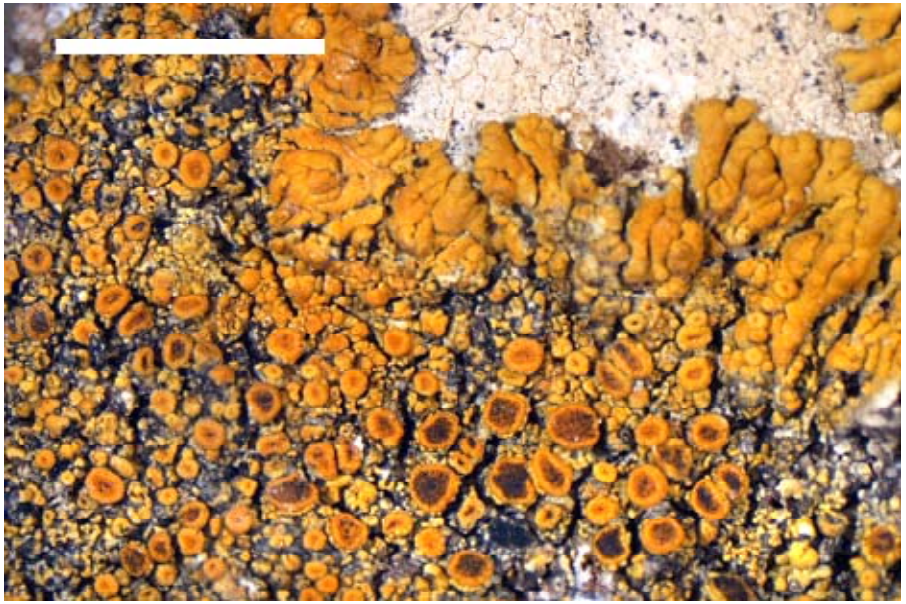

Fig. 4. *Caloplaca craggyensis* (holotype in MEL). Scale 4 mm.

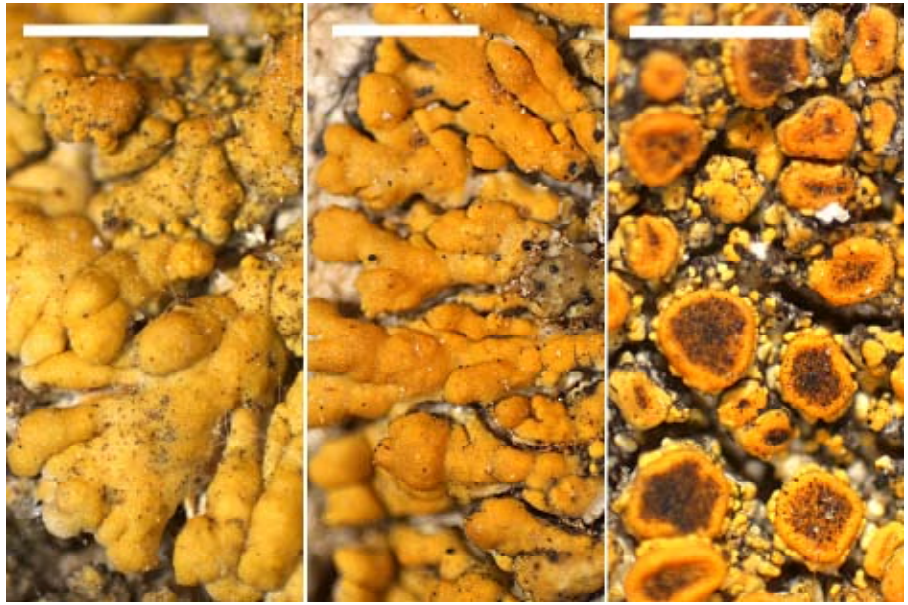

Fig. 5. *Caloplaca craggyensis* (holotype in MEL). Scale 1 mm.

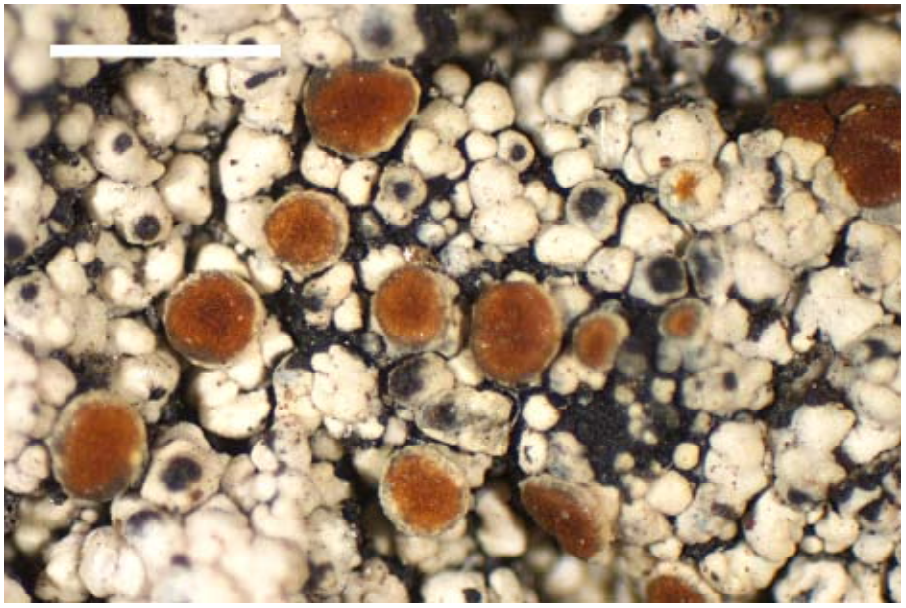

Fig. 6. *Caloplaca queenslandica* (holotype in CANB). Scale 1 mm.

Fig. 7. *Caloplaca subsaxicola* (holotype in MEL). Scale 2 mm.

8. *Caloplaca wallabyensis* (isotype in LD). Scale 1 mm.

A new species, new combinations and synonymy of saxicolous species of *Buellia sens. lat.* and *Rinodinella* (Physciaceae, Ascomycota) in Australia

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Abstract:
Buellia cranfieldii Elix is described as new to science. The synonymy of the common but poorly understood *Buellia homophylia* (C.Knight) Zahlbr. has been studied and a detailed description is given. The new combinations *Rinodinella fertilis* (Körb.) Elix var. *fertilis* and *Rinodinella fertilis* var. *hypostictica* (Elix) Elix are made. A key is provided for the saxicolous Australian species of *Buellia* and *Rinodinella* con-taining norstictic, stictic and hypostictic acids.

Buellia sens. str. [formerly *Hafellia* Kalb, H.Mayrhofer & Scheid.] is one of the few well-delimited groups within *Buellia sens. lat.* (Bungartz *et al.* 2007). It is characterized by the *Callispora*-type ascospores, bacilliform conidia, often by a strongly oil-inspersed hymenium and the presence of norstictic acid, diploicin and atranorin or 4,5-dichlorolichexanthone (Elix 2009a). For nomenclatural reasons, the generic name *Hafellia* must be regarded as a synonym of *Buellia sens. str.* because *B. disciformis*, the listed type of *Buellia*, shares all the typical characters of *Hafellia*. Other species of *Buellia sens. lat.*, which are not closely related, must now be excluded from *Buellia sens. str.*, but a precise generic circumscription must await the results of molecular investigations (Elix 2009b). The saxicolous species recorded in this paper belong to *Buellia sens. lat.* Chemical constituents were identified by thin-layer chromatography (Elix & Ernst-Russell 1993), high-performance liquid chromatography (Elix *et al.* 2003) and comparison with authentic samples.

1. **Buellia homophylia** (C.Knight) Zahlbr., *Cat. Lich. Univ.* **7**, 366 (1931) Fig. 1
Basionym: *Lecidea homophylia* C.Knight, *Trans. Linn. Soc. London*, ser. 2, **2**, 45 (1882).
Type: 'Ad saxa', [neighbourhood of Sydney, N.S.W.], *C. Knight no. 9* (WELT! – lectotype here designated).

Synonyms: *Lecidea homophylia* var. *amphibola* C.Knight, *Trans. Linn. Soc. London*, ser. 2, **2**, 45 (1882); *Buellia homophylia* var. *amphibola* (C.Knight) Zahlbr., *Cat. Lich. Univ.* **7**, 366 (1931). *Type*: 'Ad saxa', [neighbourhood of Sydney, N.S.W.], *C. Knight no. 22/15* (WELT! – lectotype here designated).

Lecidea homophylia var. *emphytocarpa* C.Knight, *Trans. Linn. Soc. London*, ser. 2, **2**, 45 (1882); *Buellia homophylia* var. *emphytocarpa* (C.Knight) Zahlbr., *Cat. Lich. Univ.* **7**, 366 (1931).
Type: 'Ad saxa', [neighbourhood of Sydney, N.S.W.], 28.vii.1880, *C. Knight no. 22/4* (WELT! – lectotype here designated).

Lecidea substellulata C.Knight in F.M. Bailey, *Syn. Queensland Fl.* Suppl. **1**, 75 (1886); *Buellia substellulans* Zahlbr., *Cat. Lich. Univ.* **7**, 420 (1931).
Type: Queensland, *F.M. Bailey* (WELT! – lectotype here designated).

Lecidea substellulata Nyl., *Flora* **69**, 325 (1886).
Type: 'Super saxa arenacea' [New South Wales] *C. Knight* (H-NYL 9232! – holotype). *nom. superf.*

This endemic species has been reported from New South Wales, Western Australia, the Northern Territory, Queensland, the Australian Capital Territory and Tasmania (McCarthy 2009) [as *B. substellulans*]. Morphologically it closely resembles *B. spuria* (Schaer.) Anzi, but is distinguished from that species by the initially immersed then adnate, commonly crowded, angular apothecia, a prominent hypothallus and larger ascospores. A detailed description of this common but variable species follows.

Description: *Thallus* crustose, thin, ±continuous, epilithic, areolate, whitish to grey-white or grey, up to 5 cm wide and 0.4 mm thick; hypothallus usually conspicuous, black, surrounding the thallus, *c.* 0.2 mm wide, also ±growing among the areoles; upper surface glossy or matt, epruinose, phenocorticate; areoles 0.3–1.1 mm wide, angular, ±flat to weakly convex; phenocortex 20–25 µm thick; algal layer 20–25 µm thick, algal cells 5–13 µm wide; medulla white, lacking calcium oxalate (H_2SO_4–), 95–110 µm thick, IKI+ purple or IKI–. *Apothecia* lecideine, 0.2–0.6 mm wide, numerous, round, immersed to adnate or rarely becoming sessile with age; proper margin thin, persistent, rarely excluded with age, black or rarely masked by a necrotic thalline veil; disc black, epruinose, flat, rarely becoming convex with age. *Excipulum* 45–55 µm thick, poorly differentiated, *aethalia*-type. Epihymenium 7–10 µm thick, dark greenish to olive-brown due to the pigmented caps of the paraphyses, K–, N+ red-violet to red-brown (*cinereorufa*-green and *elaschista*-brown); hymenium colourless, not inspersed, 35–45 µm high; hypothecium *c.* 50 µm high, reddish brown (*leptoclinoides*-brown). Paraphyses simple to weakly branched, 1.7–2.5 µm wide, with distinctly broadened, dark green to olive-brown pigmented caps to 5 µm wide. Asci 8-spored, *Bacidia*-type. *Ascospores* brown, with apical wall thickenings when young, ellipsoid, ±constricted at septum, 10–22 x 6–10 µm. *Pycnidia* not seen.
Chemistry: Upper surface K+ yellow, P+ yellow, C–, UV–; medulla K+ yellow then red, P+ yellow-orange, C–, UV–; containing atranorin (major), norstictic acid (major), connorstictic acid (minor).

ADDITIONAL SPECIMENS EXAMINED
Australian Capital Territory: • Mulligans Flat, near N.S.W.-A.C.T. border, 35°10′S, 149°09′E, 670 m, on shale rocks in pasture, *J.A. Elix 1429*, 11.xii.1975 (CANB); • Canberra Nature Park, Aranda Bushland, 4 km W of Canberra, 35°16′03″S, 149°04′40″E, 680 m, on sandstone rocks in dry *Eucalyptus* woodland, *J.A. Elix 28732*, 29.xii.2004 (CANB).
South Australia: • South Mt Lofty Ranges, along Saunders Creek, 6.5 km E of Springton, 34°42′S, 139°10′E, 300 m, on schist rocks in pasture and dry *Eucalyptus* woodland, *J.A. Elix 23506, 23518*, 2.i.1990 (CANB).
Victoria: • Mt Raymond, 13 km E of Orbost, 37°43′S, 148°36′E, 290 m, on exposed granite rocks in regrowth *Eucalyptus* forest, *J.A. Elix 19452*, 27.xi.1985 (CANB); • Gippsland, Middle Mtn, 2 km NE of Suggan Buggan, 36°57′S, 148°20′E, 700 m, on granite rocks in *Eucalyptus-Callitris* woodland, *D. Verdon 3591*, 21.ix.1978 (CANB).

2. **Buellia cranfieldii** Elix, sp. nov. Fig. 2
Sicut *Buellia leptocline* sed excipulum et epihymenium *cinereorufa*-green continens differt.

Type: Australia. *Western Australia*: Boyagin Rock, Boyagin Nature Reserve, 20 km NW of Pingelly, 32°28′S, 116°53′E, 350 m, on granite on large, exposed granite outcrop, *J.A. Elix 40978, H.T. Lumbsch & H. Streimann*, 11.ix.1994 (PERTH – holotype).

Thallus crustose, thin, ±continuous, epilithic, areolate, whitish to grey-white or grey, up to 10 cm wide and 0.35 mm thick; hypothallus conspicuous or not, black, surrounding the thallus, *c.* 0.2 mm wide, ±growing among the areoles; upper surface matt, epruinose, phenocorticate; areoles 0.4–0.8 mm wide, angular, ±flat to weakly convex; phenocortex 20–25 µm thick; algal layer 150–200 µm thick, algal cells 5–18 µm wide;

medulla white, lacking calcium oxalate (H_2SO_4–), 100–200 µm thick, sometimes filled with algal cells, IKI–. *Apothecia* lecideine, 0.1–0.5 mm wide, scattered, round or distorted by mutual pressure, immersed then adnate with age; proper margin thin, persistent, rarely excluded with age, black or masked by a necrotic thalline veil; disc black, epruinose, flat, rarely becoming slightly convex with age. *Excipulum* 25–55 µm thick, poorly differentiated, *aethalia*-type. Epihymenium 7–18 µm thick, aeruginose due to the pigmented caps of paraphyses, K–, N+ red-violet (*cinereorufa*-green); hymenium colourless, not inspersed, 40–50 µm high; hypothecium 30–50 µm high, pale brown to brown (*leptoclinoides*-brown). Paraphyses simple to weakly branched, 2.0–2.5 µm wide, with weakly broadened, brown-pigmented caps to 3.5 µm wide. Asci 8-spored, *Bacidia*-type. *Ascospores* brown, *Buellia*-type, ellipsoid, not or weakly constricted at septum, 10–14 x 5–8 µm. *Pycnidia* not seen.
Chemistry: Upper surface K+ yellow, P+ yellow, C–, UV–; medulla K+ yellow, P+ yellow, C–, UV–; containing atranorin (major), chloroatranorin (minor).

Etymology: This species is named in honour of the Western Australian lichenologist Raymond Cranfield.

Notes: The gross morphology and chemistry of this new species closely resemble those observed in *B. leptocline* (Flot.) A.Massal., but the two species differ in their apothecial anatomy. The *leptocline*-type exciple present in the latter species is evenly pigmented throughout by a dull brown pigment (cf. *elachista*-brown, Bungartz *et al.* 2007) which gives no coloration on treatment with N (50% nitric acid). In contrast, *B. cranfieldii* has an *aethalia*-type exciple characterized by the pigment *cinereorufa*-green, an aeruginose N+ violet pigment in the outer exciple and epihymenium. Furthermore, the ascospores of *B. cranfieldii* are smaller (10–14 x 5–8 µm versus 12–18 x 6–11 µm), and the apothecia are immersed and become adnate with age. In contrast, the apothecia of *B. leptocline* are adnate at first and then become sessile. *Buellia leptocline* is a Northern Hemisphere species known from North America, Europe, Asia, Africa and Macaronesia (Coppins *et al.* 2009), but *B. cranfieldii* seems to be an Australian endemic.

At present this new species is known from several localities in south-western Western Australia where it occurs on granitic or lateritic rocks in *Eucalyptus* woodland. Commonly associated species include *Buellia homophylia*, *Diploschistes actinostomus* (Pers.) Zahlbr., *Lecanora farinacea* Fée, *L. galactiniza* Nyl., *L. pseudistera* Nyl., *Lecidella carpathica* Körb., *Parmelia signifera* Nyl., *Pertusaria remota* A.W.Archer and various *Xanthoparmelia* species, in particular *X. antleriformis* (Elix) Elix & J.Johnst.

SPECIMEN EXAMINED
Western Australia: • Caernarvon Hills, Dryandra Woodland, 17 km NW of Narrogin, 32°48′21″S, 117°03′21″E, 325 m, on laterite rocks in open *Eucalyptus salmonophloia* woodland, *J.A. Elix 39856*, 6.iv.2006 (CANB).

3. **Rinodinella fertilis** (Körb.) Elix var. **fertilis**, comb. nov.
Basionym: *Buellia fertilis* Körb., *Abh. Schles. Ges. Vaterl. Cult. Abth. Naturwiss.* **2**, 33 (1862).
Type: Ad saxa arenaria Novae Hollandiae [Australia], Missit beat, *F. v. Hochstetter s.n.* (L 910.128.1111! – lectotype here designated; L! 910.128.1110 – isolectotype).

Synonyms: *Rinodinella halophila* (Müll.Arg.) H.Mayrhofer, *Lichenologist* **12**, 301 (1980); *Buellia halophila* Müll.Arg., *Bull. Herb. Boissier* **1**, 51 (1893). *Type*: Cheltenham (maritime rock), Victoria, *F.R.M. Wilson s. n.*, 2.iv.1897 (MEL! – isolectotype).

4. **Rinodinella fertilis** var. **hypostictica** (Elix) Elix, comb. nov.
Basionym: *Rinodinella halophila* var. *hypostictica* Elix, *Australas. Lichenol.* **65**, 14 (2009).
Type: Australia. *New South Wales*: Tuross Heads, 36°04′S, 150°08′E, 1 m, on rocks along the foreshore, *J.A. Elix 2086*, 24.iv.1976 (CANB – holotype)

A key to the saxicolous species of *Buellia* and *Rinodinella* in Australia containing stictic, hypostictic or norstictic acids

1a On non-calcareous rocks 2
1b On calcareous rocks 13

2a Ascospores submuriform [norstictic acid present] ..... ***B. bongongensis*** Elix
2b Ascospores 1-septate 3

3a Thallus subsorediate, with bald, ecorticate patches [norstictic acid present] ..... ***B. subcoronata*** (Müll.Arg.) Malme
3b Thallus not subsorediate, lacking bald, ecorticate patches 4

4a Vioxanthin present**;** lower medulla pigmented [norstictic acid present] ..... ***B. vioxanthina*** Elix
4b Vioxanthin absent**;** lower medulla not pigmented 5

5a Xanthones present ..... ***B. mamillana*** (Tuck.) W.A.Weber
5b Xanthones absent 6

6a Stictic acid present ..... ***B. spuria*** var. ***spuria***
6b Norstictic acid or hypostictic acid present 7

7a Hypostictic acid present 8
7b Norstictic acid present 9

8a Atranorin and chloroatranorin absent; on littoral rocks ..... ***Rinodinella fertilis*** var. ***hypostictica***
8b Atranorin and chloroatranorin present; on arid inland rocks ..... ***B. inturgescens*** Müll.Arg.

9a Atranorin and chloroatranorin present 10
9b Atranorin and chloroatranorin absent 11

10a Apothecia soon adnate or sessile, scattered, round; hypothallus not prominent; apothecia with thalline veil; medulla I+; ascospores 10–16 x 5–7 µm ..... ***B. spuria*** var. ***amblyogona*** Elix
10b Apothecia immersed then adnate, often crowded and angular; hypothallus prominent; apothecia usually lacking a thalline veil; medulla I±; ascospores 10–22 x 6–10 µm ..... ***B. homophylia***

11a Apothecia superficial; ascospores *Rinodinella*-type; on coastal rocks ..... ***Rinodinella fertilis*** var. ***fertilis***
11b Apothecia immersed; ascospores *Buellia*-type; on hinterland rocks 12

12a Apothecia remaining immersed, deformed [comma-shaped]; thalline veil absent ..... ***B. aethalia*** (Ach.) Th.Fr.
12b Apothecia becoming sessile, round; thalline veil present when young ..... ***B. kimberleyana*** Elix

13a Ascospores submuriform ..... ***B. chlorophaea*** Hepp. ex Leight.
13b Ascospores 1-septate 14

14a Epihymenium yellow-brown to dark brown, N– ..... ***B. albula*** (Nyl.) Müll.Arg.
14b Epihymenium olive- to greenish black, N+ red-violet ..... ***B. subalbula*** (Nyl.) Müll.Arg.

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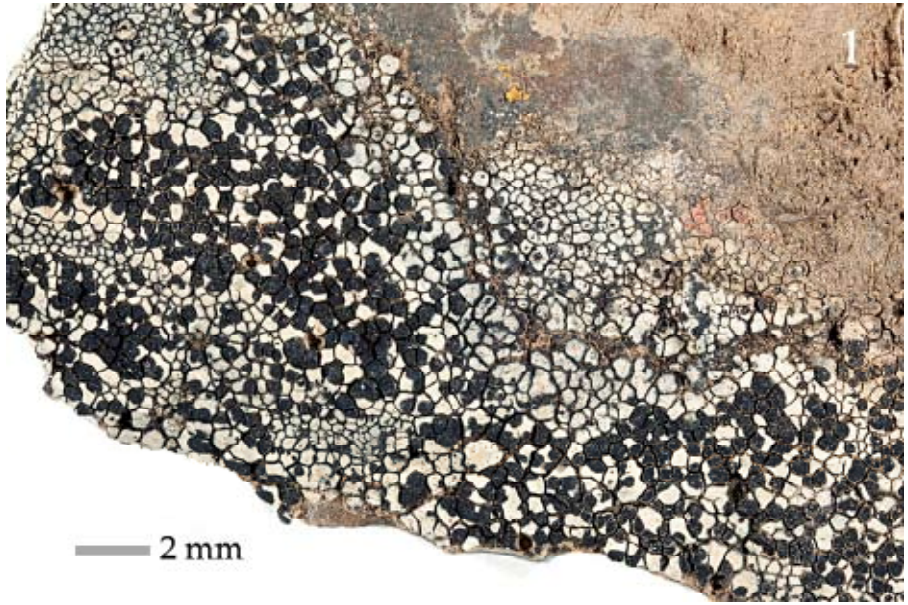

Fig. 1. *Buellia homophylia* (*J.A. Elix 1429* in CANB)

Fig. 2. *Buellia cranfieldii* (holotype in PERTH)

The lichen genus *Cryptothecia* (Arthoniaceae) in Java

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Abstract: The species of the lichen genus *Cryptothecia* in Java have been reassessed. This is a preliminary revision, based mainly on the rich collections gathered by Pieter Groenhart in the first half of the twentieth century. Nineteen species are reported, including *Cryptothecia methylmicrophyllinica* new to science, and two undescribed species.

The genus *Cryptothecia* Stirt. (Arthoniaceae) comprises conspicuous but, until recently, little-studied elements of tropical lichen floras. From most tropical countries only a handful of species have been reported, most commonly foliicolous. Only the *Cryptothecia* species of the following countries have been studied in detail: India (Makhija & Patwardhan 1986, 1987, 1994), Australia (Thor 1997, Elix 2009), north-eastern Brazil (Cáceres 2007) and Thailand (Wolseley & Aptroot 2009). Those of Java, Indonesia, an area from which many species of *Cryptothecia* have been reported, are the subject of this paper.

The *Cryptothecia* species of Java were reported (in Dutch) by Groenhart (1938). This was intended to be a precursor to a more complete treatment, and included 14 undescribed species which forever remained *nomina nuda*. Groenhart lived for many years in Java, and published about a dozen papers on lichens, in which he described 33 species new to science. Most of those were among his earlier collections, which remained in Bogor. When he moved to Leyden in the 1950s, he took with him his more recent extensive collections, now housed in L, on which he continued to work.

Unfortunately he died early, and before he died he asked Maas Geesteranus to destroy his unpublished work. Geesteranus did as he was asked (pers. comm.), leaving several hundred lichen collections in L marked as types of unpublished herbarium names. Only a few of those species were later described by others, sometimes as "Groenhart ex", e.g. by Makhija & Patwardhan (1998). Because of his interest in the group, the specimens of Arthoniaceae are among the largest and most valuable parts of the Groenhart collections in L. They were filed under almost 100 different names, mainly herbarium names, not only in *Cryptothecia* but also in the synonymous and rarely used genus *Myriostigma* Kremp. as well as unpublished generic names derived from it by adding the endings *-ella* and *-opsis*. Most were collected by Groenhart, but he also received collections by others. That material is a remarkably large and rich set of specimens, and forms the basis of this study. All species are new reports for Indonesia, except for the ubiquitous foliicolous *Cryptothecia candida* (Kremp.) R.Sant.

Material and methods

Identification and description work was carried out using an Olympus SZX7 stereomicroscope and an Olympus BX50 compound microscope with interference contrast connected to a Nikon Coolpix digital camera. The materials are preserved in L. Groenhart left extensive notes on the morphology of many specimens as well as spot reactions. His observations have generally not been repeated for this study. Chemical spot reactions are abbreviated. TLC was performed using at least solvent system A (TDA). The Groenhart collecting numbers are not sequential, and were applied much later, so specimens bearing identical names and provenance are essentially duplicates, thus drastically reducing the number of primary collections studied. Numbers cited are packets, and include those duplicates.

Key to the species of *Cryptothecia* in Java

1 Thallus with psoromic acid, P+ yellow 2
1: Thallus without psoromic acid, generally P– 5

2 Ascospores 1 or 2 per ascus ..... **C. subnidulans**
2: Ascospores 6–8 per ascus 3

3 Ascospores 38–43 × 22–25 µm ..... **C. sp. 2**
3: Ascospores 60–70 × 15–30 µm 4

4 Thallus foliicolous; ascigerous areas linear ..... **C. irregularis**
4: Thallus corticolous; ascigerous areas roundish ..... **C. verrucominuta**

5 Medulla C+ red, with gyrophoric acid or 2′-*O*-methylanziaic and 2′-*O*-methylperlatolic acids 6
5: Medulla C–, without gyrophoric or 2′-*O*-methylanziaic and 2′-*O*-methylperlatolic acids 12

6 Thallus with norstictic acid ..... **C. eungellaeae**
6: Thallus without norstictic acid 7

7 Thallus on living leaves or bamboo; gyrophoric acid or 2′-*O*-methylanziaic and 2′-*O*-methylperlatolic acids present 8
7: Thallus on bark; gyrophoric acid present 9

8 Thallus on living leaves or bamboo; 2′-*O*-methylanziaic and 2′-*O*-methylperlatolic acids present ..... **C. candida**
8: Thallus on bamboo; gyrophoric acid present ..... **C. inexspectata**

9 Thallus generally > 0.2 mm thick; ascospores 1 per ascus ..... **C. scripta**
9: Thallus generally < 0.2 mm thick; ascospores 8 per ascus 10

10 Ascospores 16–40 × 16–25 µm ..... **C. dispersa**
10: Ascospores 66–160 × 26–48 µm 11

11 Ascospores 66–86 × 26–30 µm ..... **C. obtecta**
11: Ascospores 82–160 × 36–48 µm ..... **C. macrospora**

12 Thallus with norstictic acid, K+ yellow then red 13
12: Thallus without norstictic acid, K– 14

13 Ascospores 27–32 × 13–15 µm; thallus on bamboo ..... **C. sp. 1**
13: Ascospores 99–132 × 25–50 µm; thallus on bark ..... **C. genuflexa**

14 Medulla UV+ white, with 5-*O*-methylmicrophyllinic acid 15
14: Thallus UV–, with confluentic or perlatolic acids or without any secondary metabolites 16

15 Ascospores 40–45 × 20–22 µm ..... **C. aleurinoides**
15: Ascospores 60–70 × 25–30 µm ..... **C. methylmicrophyllinica**

16 Thallus with confluentic or perlatolic acids 17
16: Thallus without secondary metabolites 19

17 Thallus with perlatolic acid ..... **C. filicina**
17: Thallus with confluentic acid 18

18 Ascospores 62–86 × 30–36 µm ..... **C. porosa**
18: Ascospores 82–160 × 36–48 µm ..... **C. macrospora**

19 Ascospores 60–76 × 17–30 µm ..... **C. aleurella**
19: Ascospores 75–108 × 42–50 µm ..... **C. aleurocarpa**

Cryptothecia methylmicrophyllinica Aptroot & Spier, sp. nov. Fig.1
Cryptothecia corticola, mediosporis, acidum 5-*O*-microphyllinicum continens.

Type: Indonesia. *Java*: West Bantam, track along the South brink of the Tjitadjur ravine, alt. 100 m, on tree, *P. Groenhart 9555*, 3.ii.1954 (L–holotype; L–isotypes).

Thallus dull, greyish white, very thin but continuous, surrounded by a thin, dark brown hypothalline line when contiguous with other lichens. *Ascigerous areas* white, brighter than the thallus, starting as slightly elevated dots of *c.* 0.1–0.2 mm diam., soon confluent in irregularly branching lines of 0.2–0.4 mm wide and up to 2 mm long. *Asci* nearly globose, visible from above as pale, pruinose parts in the centres of the ascigerous areas, 80–120 × 65–100 µm. *Ascospores* hyaline, rather densely muriform, 6–8 per ascus, 60–70 × 25–30 µm. All structures IKI–. Herbarium names used by Groenhart for it are *Cryptothecia ngantangensis* and *Myriostigma phlyctoides*.
Chemistry: 5-*O*-microphyllinic acid present (tlc). Thallus and ascigerous zones C–, P–, K–, UV+ whitish.

SPECIMEN EXAMINED
Indonesia. *Java*: • Pass of Ngantang, *P. Groenhart 4169*, 14.vii.1937 (L).

Cryptothecia aleurella (Nyl.) Makhija & Patw., *Biovigyanam* **11**, 3 (1985)
This corticolous species is characterized by medium-sized ascospores and the absence of thallus chemistry. Reported from a few countries, e.g. Papua New Guinea; the type is from Singapore. For a description and illustrations, see Makhija & Patwardhan (1986). Herbarium names used by Groenhart for it are *Myriostigma crebremaculata* and *M. pseudosoralifera*.

SPECIMENS EXAMINED
Indonesia. *Java*: • Cibodas, Mt Gede, *Nurta & Madrodji*, 20.iv.1950 (L); • West Bantam, track along the South brink of the Tjitadjur ravine, *P. Groenhart 9570a*, 3.ii.1954 (L).

Cryptothecia aleurinoides Aptroot & Wolseley, in Wolseley & Aptroot, *Biblioth. Lichenol.* **99**, 413 (2009)
This corticolous species is characterized by its small ascospores and the presence of 5-*O*-microphyllinic acid in the thallus. So far known only from Thailand. For a full description and illustrations, see Wolseley & Aptroot (2009). Herbarium names used by Groenhart for it are *Myriostigma simile* and *M. praetervisum*.

SPECIMENS EXAMINED
Indonesia. *Java*: • Cibodas, Mt Gede, *C.C. Schröter 4625*, 1.ii.1950 (L); • Same locality, *C.C. Schröter 3746*, 5.xii.1949 (L). *Sumatra*: • along the road from Lubuk Selasih to Padang, *P. Groenhart 9422*, xii.1958 (L).

Cryptothecia aleurocarpa (Nyl.) Makhija & Patw., *Biovigyanam* **11**, 3 (1985)
This species is characterized by large ascospores and the absence of any thallus chemistry. So far known from a few countries; the type is from Colombia. For a description and illustrations, see Makhija & Patwardhan (1986). The herbarium name used by Groenhart for it is *Myriostigma obsoletum*.

SPECIMEN EXAMINED
Indonesia. *Java*: • Cibodas, Mt Gede, *Schröter 4422 p.p.*, 25.i.1950 (L).

Cryptothecia candida (Kremp.) R.Sant., *Symb. Bot. Upsal.* **12**(1), 65 (1952)
This species is recognized by the foliicolous or bambusicolous habit and the presence of 2-*O*-methylanziaic and 2-*O*-methylperlatolic acids. Palaeotropical. For a description and illustrations see Lücking *et al*. (2006). Herbarium names used by Groenhart for it are *Myriostigma candidum, M. coertii, M. dispersum,* and *M. maculatum.* A common species in Java, with 28 specimens studied.

SELECTED SPECIMENS EXAMINED
Indonesia. *Java*: • Bogor, Hortus Botanicus, *Docters van Leeuwen 11868*, 28.vi.1928 (L); • Mt Ardjuno, Djunggo, *P. Groenhart 4704,* 27.vii.1939 (L); • Mt Tengger, *P. Groenhart 690*, 7.xi.1937 (L); • Mt Tangkubanprahu, *P. Groenhart 3151*, 11.vii.19418 (L); • Mt Willis, *P. Groenhart 4797*, 29.v.1938 (L).

Cryptothecia dispersa Makhija & Patw., *Biovigyanam* **13**, 44 (1987)
This corticolous species is characterized by its small ascospores and the presence of gyrophoric acid in the thallus. So far known from India. For a description and illustrations see Makhija & Patwardhan (1987). The herbarium name used by Groenhart for it is C*ryptothecia tenuis*.

SPECIMEN EXAMINED
Indonesia. *Java*: • Bay of Nglijep, *P. Groenhart 572*, 21.viii.1932 (L)

Cryptothecia eungellaeae G.Thor, *Symb. Bot. Upsal.* **32**(1), 280 (1997)
This corticolous species is characterized by the joint presence of gyrophoric and norstictic acid in the thallus. So far known from Australia. For a description and illustrations see Thor (1997). Herbarium names used by Groenhart for it are *Myriostigma farinulosa, M. pulverulenta, M. subcretacea,* and *M. tuberitacea.*

SELECTED SPECIMENS EXAMINED
Indonesia. *Java*: • Malang, *P. Groenhart 5282*, 1.iii.1940 (L); • Ardjuno complex, *P. Groenhart 4700,* 27.vii.1939 (L); • Tengger-Semeru complex, *P. Groenhart 6373*, 26.x.1939 (L); • Mt Andjasmoro, *P. Groenhart 7664*, 27.vii.1938 (L); • Salak, *P. Groenhart 6772*, ix.1940 (L); • Cibodas, Mt Gede, *P. Groenhart 3423*, 5.xi.1949 (L); • Mt Panderman, *P. Groenhart 4803*, 26.xii.1939 (L).

Cryptothecia filicina (Ellis & Everh.) Lücking & G.Thor, in Lücking, Thor, Aptroot, Kalb & Elix, *Lichenologist* **38**, 238 (2006)
This species is recognized by the medium-sized ascospores and the presence of perlatolic acid. It is so far known to be foliicolous and neotropical, but in Java it is found on bark. For a description and illustrations see Lücking *et al*. (2006). Herbarium names used by Groenhart for it are *Myriostigma chiodectonoides, M. modesta, M. parvisporum, M. sublaevigata,* and *M. sumatrana*.

SPECIMENS EXAMINED
Indonesia. *Java*: • Malang, garden of the Agricultural school, *P. Groenhart 9902*, 1.iii.1940 (L); • Same locality, *Kurz*, 21.viii.1860 (L). *Sumatra*: • Taluk Kabung S of Padang, *P. Groenhart 8914*, 7.v.1953 (L); • *Halmahera*: Mt Siu, Ake Biour, *P. Groenhart 8360, 8383, 8387*, 11.x.1951 (L).

Cryptothecia genuflexa (Müll.Arg.) R.Sant., *Symb. Bot. Upsal.* **12**(1), 65 (1952)
This corticolous species is characterized by its large ascospores and the presence of norstictic acid in the thallus. Up until now known from Tanzania and Thailand. For a description and illustrations see Makhija & Patwardhan (1986) and Wolseley & Aptroot (2009). Herbarium names used by Groenhart for it are *Cryptothecia punctifera, Myriostigma javanicum, M. lacteum, M. leucaenae, M. porifera,* and *M. rubescens*.

SPECIMENS EXAMINED
Indonesia. *Java*: • Malang, garden of the Agricultural school, *P. Groenhart 4735*, 20. i.1939 (L); • Same locality, *P. Groenhart 6409*, 1.ix.1939 (L); • Mt Willis, above desi Besuki, *P. Groenhart 683, 4796*, 29.v.1938 (L); • Pass of Ngantang, *P. Groenhart 4167*, 14.vii.1937 (L); • Mt Tengger, Pontjokosumo, *P. Groenhart 6371*, 26.x.1939 (L);• Mt Ardjuno, above Tretes, *P. Groenhart 684*, 29.iii.1937 (L); • Mt Kendeng, between Drudja and Sumber Mandjing S of Turen, *P. Groenhart 4760*, 9.vii.1939 (L).

Cryptothecia inexspectata G.Thor, *Symb. Bot. Upsal.* **32**(1), 283 (1997)
This species is characterized by its small ascospores which are 1 per ascus, and the presence of gyrophoric acid in the thallus. So far known from leaves in Papua New Guinea and Australia. In Java, it was found on bamboo. For a description and illustrations see Thor (1997). Herbarium names used by Groenhart for it are *Cryptothecia bambusicola* and *C. bambusicola* f. *foliicola.*

SPECIMENS EXAMINED
Indonesia. *Java*: • Malang, garden of the Agricultural school, *P. Groenhart 7616, 7617, 7618, 7619, 7620*, 11.iv.1939 (L); • Same locality, *H. Raap*, 14.v.1894 (L); • South Semeru Lands, ravine of the Glidik river, *P. Groenhart 1683, 4815, 4816, 4817*, 17.ix.1939 (L); *Mentawei Islands*: • Sipora, Sioban, *P. Groenhart 9479*, 7.vii.1953 (L).

Cryptothecia irregularis Lücking, Aptroot, Kalb & Elix, in Lücking, Thor, Aptroot, Kalb & Elix, *Lichenologist* **38**, 239 (2006)
This species is recognized by its medium-sized ascospores and the presence of psoromic acid. It is foliicolous and palaeotropical. For a description and illustrations see Lücking *et al*. (2006). Groenhart's herbarium names for it are *Myriostigma bambusicola, M. boedijnii, M. irregulare, M. simile* var. *parva, M. submentawiensis,* and *M. subsimile*.

SELECTED SPECIMENS EXAMINED
Indonesia. *Java*: • Cibodas, Mt Gede, *P. Groenhart*, 20.iii.1952 (L); • Mt Gegerbentang, *A.M. Mervoort*, 11.x.1949 (L); • Bogor, Mt Bunder, *K. Boedijn 1186*, iv.1931 (L); • Mt Tengger, *P. Groenhart 4771*, 22.v.1938 (L). *Halmahera*: • Upper Kau Distr., Tolewang, *P. Groenhart 8432*, 20.x.1951 (L).

Cryptothecia macrospora Makhija & Patw., *Biovigyanam* **11**, 7 (1985)
This corticolous species is characterized by its large ascospores and the presence of confluentic acid and often also gyrophoric acid. So far known from India and Thailand. For a description and illustrations see Makhija & Patwardhan (1986) and Wolseley & Aptroot (2009). Herbarium names used by Groenhart for it are *Myriostigma elongatum* and *M. simile.* A rather commonly collected species in Java, with 21 specimens studied, all from one region.

SELECTED SPECIMENS EXAMINED
Indonesia. *Java*: • Cibodas, Mt Gede, *C.C. Schröter 4416*, 25.i.1950 (L); Mt Gegerbentang, Sentang, *C.C. Schröter 5058*, 19.iv.1950 (L). *Sumatra*: • Padang, Lubuk Selasih, *P. Groenhart 9423*, 1.vii.1953 (L).

Cryptothecia obtecta Makhija & Patw., *Biovigyanam* **13**, 46 (1987)
This corticolous species is characterized by its medium-sized ascospores and the presence of gyrophoric acid (sometimes with additional confluentic acid in the thallus). So far known from India. For a description and illustrations see Makhija & Patwardhan (1987). Herbarium names used by Groenhart for it are *Cryptothecia albidoglauca, C. erythrina, C. floccata*, *Myriostigma albizziae, M. glauca, M. incerta, M. laevigata, M. porifera, M. straminea, M. striatopunctatum,* and *M. vulcanica.* A rather commonly collected species in Java, with 40 specimens studied.

SELECTED SPECIMENS EXAMINED
Indonesia. *Java*: • Malang, garden of the Agricultural school, *P. Groenhart 364*, 21.vii.1932 (L); • Bogor, Hortus Botanicus, *P. Groenhart 4791*, 11.iv.1939 (L); • Bantam, Mt Pulasari, *P. Groenhart 9722*, 12.ii.1954 (L); • Mt Kelud, above Durga ravine, *P. Groenhart 240*, 17.vii.1932 (L); • Mt Ardjuno, above Tretes, *P. Groenhart 4669*, 10.x.1938 (L); • Bay of Tapen S of Wlingi, *P. Groenhart 651*, 14.v.1939 (L).

Cryptothecia porosa Makhija & Patw., *Curr. Res. Pl. Sci.* **1994**, 67 (1994)
This corticolous species is characterized by its medium-sized ascospores and the presence of confluentic acid in the thallus. So far known from India. For a description and illustrations see Makhija & Patwardhan (1994). Groenhart's herbarium names for it are *Cryptothecia malmei, Myriostigma albizziae, M. ardjunensis, M. bogoriensis, M. litoralis, M. multicarpum, M. nudum,* and *M. viridomarginata.* A rather commonly collected species in Java, with 12 specimens studied.

SELECTED SPECIMENS EXAMINED
Indonesia. *Java*: • Malang, garden of the Agricultural school, *P. Groenhart 5281*, xi.1936 (L); • Bogor, Hortus Botanicus, *P. Groenhart 4785*, 11.iv.1939 (L); • Cibodas, Mt Gede, *C.C. Schröter 4422 p.p.*, 25.i.1950 (L); • Andjasmoro complex, *P. Groenhart 4801*, 11.ix.1938 (L); • Mt Ardjuno, above Tretes, *P. Groenhart 4684*, x.1938 (L); • Bay of Tapen S of Wlingi, *P. Groenhart 4844*, 14.v.1939 (L); • *Irian Jaya*: Manokwari, *W. Vink 1n*, ii.1959 (L).

Cryptothecia scripta G.Thor, *Symb. Bot. Upsal.* **32**(1), 285 (1997)
This corticolous species is characterized by its white linear ascigerous areas in a rather thick thallus with gyrophoric acid present. So far known from Papua New Guinea, Australia and Thailand. For a description and illustrations see Thor (1997). Groenhart's herbarium names for it are *Cryptothecia albida, C. albidoglauca, C. bogoriana, C. cinereoglauca, C. cretacea, C. fungoides, C. grisea, C. microcarpa, C. pertenuis, C. plicata, C. sublaevigata,* and *C. tengerensis,* while some specimens were identified as *C. subnidulans.* The most commonly collected species in Java, with about 100 specimens studied.

SELECTED SPECIMENS EXAMINED
Indonesia. *Java*: • Malang, garden of the Agricultural school, *P. Groenhart 7830*, 23.viii.1938 (L); • Bogor, Hortus Botanicus, *P. Groenhart 9884*, 11.iv.1939 (L); • Cibodas, Mt Gede, *C.C. Schröter*, 25.i.1950 (L); • Mt Panderman, *P. Groenhart 4801,* 14.ii.1937 (L); • Mt Ardjuno, above Tretes, *P. Groenhart 4675*, 10.x.1938 (L); • Bay of Serang S of Blitar, *P. Groenhart 4705*, 24.x.1937 (L).

Cryptothecia subnidulans Stirt., *Proc. Phil. Soc. Glasgow* **10**, 14 (1876)
This corticolous species is characterized by its medium-sized ascospores that are 1–2 per ascus, and the presence of psoromic acid in the thallus. Reported from many countries, e.g. India and Papua New Guinea, but usually in too wide or wrong a sense, e.g. with a different chemistry. For a description and illustrations see Makhija & Patwardhan (1986). Herbarium names used by Groenhart for it are *Cryptothecia tengerensis, Myriostigma niveum* and *M. ooststroomii*.

SPECIMENS EXAMINED
Indonesia. *Java*: • Cibodas, Mt Gegerbentang, *Nurta & Madrodji*, 20.iv.1950 (L); • South Semeru Lands, ravine of the Mandjing river, *P. Groenhart 639*, 19.vi.1938 (L); • Mt Tengger, *P. Groenhart 4771*, 22.v.1938 (L); • Without locality, *P. Groenhart 3695* (L).

Cryptothecia verrucominuta Makhija & Patw., *Curr. Res. Pl. Sci.* **1994**, 70 (1994)
This corticolous species is characterized by its medium-sized ascospores and the presence of psoromic acid in the thallus. So far known from India and Thailand. For a description and illustrations see Makhija & Patwardhan (1994) and Wolseley & Aptroot (2009). Herbarium names used by Groenhart for it are *Cryptothecia pertusarioides*, *Myriostigma calcarea, M. confluens, M. griseoalba, M. insignis, M. lamii, M. macrosporum, M. malesiana, M. maritima, M. obsoletum,* and *M. subsimile*. A commonly collected species in Java, with 37 specimens studied.

SELECTED SPECIMENS EXAMINED
Indonesia. *Java*: • Salak, *P. Groenhart 6771*, 8.ix.1940 (L); • Cibodas, Mt Gegerbentang, *C.C. Schröter 4924 p.p.*, 11.iii.1950 (L); • Bay of Tapen S of Wlingi, *P. Groenhart 4828*, 14.v.1939 (L); • Bay of Serang S of Blitar, *P. Groenhart 4725*, 28.viii.1938 (L). *Sumatra*: • Padang, Lubuk Selasi, *P. Groenhart 9423*, 1.vii.1953 (L).

Cryptothecia sp. 1
This species is left unnamed because so far only one small specimen has been found. It is characterized by *Ascospores*: submuriform, 9 × 1–3-septate, 8 per ascus, 27–32 × 13–15 µm, and *Chemistry*: norstictic acid present (tlc). Thallus and ascigerous zones C–, P+ yellowish, K+ red, UV–. The herbarium name used by Groenhart for it is *Myriostigma coloratum*.

SPECIMEN EXAMINED
Indonesia. *Java*: • Mt Kendeng, above Drudju S of Turen, alt. 440 m, on bamboo, *P. Groenhart 4757*, 4.ix.1938, (L).

Cryptothecia sp. 2
This species is also left unnamed because so far only one small specimen has been found. It is characterized by *Ascospores*: muriform, 8 per ascus, 38–43 × 22–25 µm, and *Chemistry*: Psoromic acid present (tlc). Thallus and ascigerous zones C–, P+ yellow, K+ yellowish, UV–. Groenhart's herbarium name for it is *Myriostigma subparvispora*.

SPECIMEN EXAMINED
Indonesia. *Java*: • Mt Pusungsadjimah, Tengger-Semeru complex, 1000 m alt., on tree, *P. Groenhart 4783*, 7.xi.1937 (L).

Discussion
Nineteen species of *Cryptothecia* are now known from Java. With the exception of India, from which 25 species are known, that is more than currently known from any other country in the world but fewer than Groenhart supposed. He could not have known that the chemistry of *Cryptothecia* is too complex to be fully understood without TLC, and he underestimated how strongly the surface of bark affects the gross morphology of lichens growing on it. A modern lichenologist would have perceived fewer species with broader circumscriptions.

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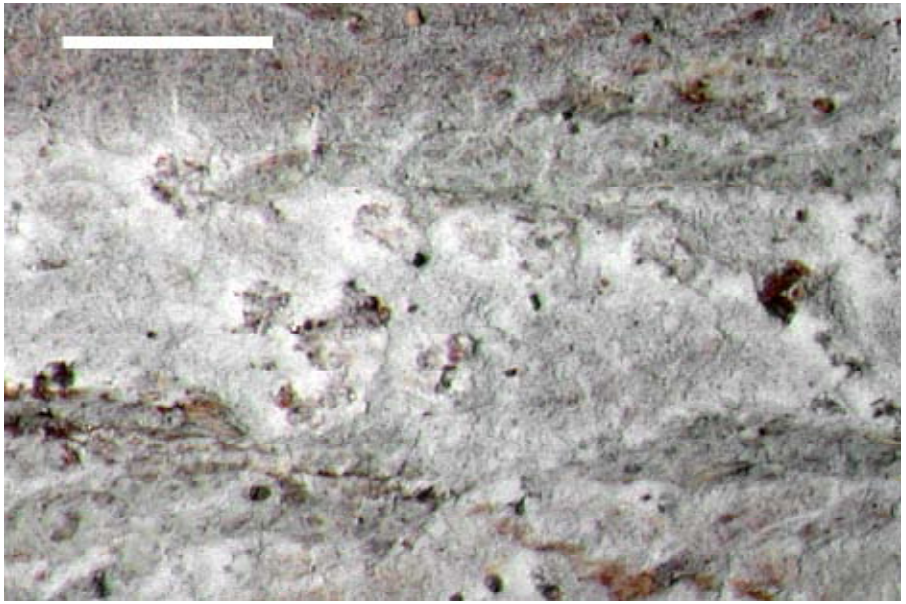

Fig. 1. *Cryptothecia methylmicrophyllinica*, holotype. Habitus. Bar = 1 mm

Fig. 2. *Cryptothecia methylmicrophyllinica*, holotype. Ascospores. Bar = 50 µm.

Validation of *Traponora* species

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Recently (Aptroot 2009), four new species were described in the formerly monotypic lichen genus *Traponora*. The genus is predominatly Australasian, and all species but one are now known from Papua New Guinea. Unfortunately, the species are invalid, because the descriptions were not accompanied by Latin descriptions. This paper remedies that omission by providing the missing descriptions. For full descriptions, typifications and illustrations of the species, see Aptroot (2009).

Traponora fusca Aptroot, *Bibliothec. Lichenol.* **100**, 24 (2009)
Sicut *Traponora asterella* sed hymenio non inspersis et apotheciis nigris differt.

Type: Taiwan. *Nantou County*: 45 km WNW of Hualien, Meifeng, around field centre, alt. 2000 m, on *Populus*, *A. Aptroot 52135*, 9.x.2001 (ABL—holotype).

Traponora globosa Aptroot, *Bibliothec. Lichenol.* **100**, 24 (2009)
Sicut *Traponora asterella* sed hymenio non inspersis et apotheciis sessilis differt.

Type: Papua New Guinea. *Eastern Highlands*: Mount Kiss-Kiss, 1 km E of Goroka, alt. 1700 m, on tree, *A. Aptroot 18930*, iii.1987 (ABL—holotype).

Traponora macrospora Aptroot, *Bibliothec. Lichenol.* **100**, 25 (2009)
Sicut *Traponora asterella* sed apotheciis sessilis et ascosporis majoribus differt.

Type: Papua New Guinea. *Eastern Highlands*: Mount Kiss-Kiss, 1 km E of Goroka, alt. 1700 m, on tree, *A. Aptroot 18938*, iii.1987 (B—holotype; ABL—isotype).

Traponora pallida Aptroot, *Bibliothec. Lichenol.* **100**, 28 (2009)
Sicut *Traponora asterella* sed hymenio non inspersis et apotheciis pallidis differt.

Type: Papua New Guinea. *Eastern Highlands*: Mount Kiss-Kiss, 1 km E of Goroka, alt. 1700 m, on tree, *A. Aptroot 18932*, iii.1987 (ABL—holotype).

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Additional lichen records from Australia 72

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Abstract: *Acarospora glaucocarpa* (Ach.) Körb., *Herpothallon granulare* (Sipman) Aptroot & Lücking, *H. granulosum* Jagadeesh Ram & G.P.Sinha, *Heterodermia koyana* (Kurok.) Elix, *H. neglecta* Lendemer, R.C.Harris & E.Tripp, *H. subascendens* (Asah.) Trass, *Letrouitia pseudomuralis* Hafellner and *Phlyctis uncinata* Stirt. are reported as new to Australia. In addition, new state or territory records are listed for 31 other taxa. The new combination *Heterodermia koyana* (Kurok.) Elix is made.

NEW RECORDS FOR AUSTRALIA

1. **Acarospora glaucocarpa** (Ach.) Körb., *Parerga Lichenol.*, 57 (1859)

This bipolar species was known previously from Europe, Asia, Africa, North and South America and New Zealand (Galloway 2007, Fletcher *et al.* 2009). It is characterized by the limestone substratum, the dispersed to contiguous or imbricate, yellow-grey to brown-grey areoles, and the large apothecia (similar in size to the areolae) with dense blue-grey pruinose discs that turn pink-red when wetted. The thallus of this species is sometimes reduced to a thalline margin-like rim around the individual apothecia. It is very close to *A. cervina* A.Massal., but the latter lacks pruinose discs and has areoles with a dense blue-white pruinose margin. A detailed description is given in Fletcher *et al.* (2009).

SPECIMENS EXAMINED
South Australia: • 17 km W of Blanchetown along Highway 20, 80 m, on limestone rocks in mallee scrub, *J.A. Elix 9265*, 28.x.1981 (CANB).
New South Wales: • Balranald district, 4 km S of Sturt Highway along the Tooleybuc Road, 34°42′26″S, 143°32′58″E, 65 m, on limestone rocks in remnant mallee scrub, *J.A. Elix 43123*, 6.iv.2009 (CANB).

2. **Herpothallon granulare** (Sipman) Aptroot & Lücking, *Biblioth. Lichenol.* **99**, 43 (2009)

This species was known from Central America and Asia (Aptroot *et al.* 2009). The off-white thallus of *H. granulare* rests mostly on a white hypothallus and is characterized by the minute, irregular, soredia-like granular pseudoisidia and by perlatolic acid as the major secondary substance. Minor or trace quantities of lichexanthone, atranorin and stenosporic acid can also occur in this species. A detailed description is given in Aptroot *et al.* (2009).

SPECIMENS EXAMINED
Northern Territory: • Litchfield National Park, below Florence Falls, 42 km SW of Batchelor, 13°05′58″S, 130°47′05″E, 75 m, on fallen branches in monsoon forest with *Syzygium* and *Gordenia* along stream, *J.A. Elix 39442*, *39456*, *39457*, 9.viii.2005 (CANB); • Solar Village, Humpty Doo, 35 km SE of Darwin, 12°36′41″S, 131°06′03″E, 27 m, on treelet in lowland monsoon woodland, *J.A. Elix 39825*, 12.viii.2005 (CANB).

3. **Herpothallon granulosum** Jagadeesh Ram & G.P.Sinha, *Lichenologist* **41**, 609 (2009)

This species was known previously from India (Jagadeesh Ram *et al.* 2009). It is characterized by the whitish grey to greenish grey thallus resting mostly on a white hypothallus, the presence of soredia-like, granular pseudoisidia and by barbatic acid as the major secondary substance. Minor or trace quantities of 4-*O*-demethylbarbatic acid also occur in this species. A detailed description is given in Jagadeesh Ram *et al.* (2009).

SPECIMENS EXAMINED
New South Wales: • Cottan-Bimbang National Park, Stockyard Creek Rest Area, *c.* 83 km E of Walcha, 31°24′10″S, 152°07′25″E, 685 m, on *Acacia* in wet *Eucalyptus* forest, *J. A. Elix 43101*, *43110*, 6.viii.2008 (CANB).

4. **Heterodermia koyana** (Kurok.) Elix, comb. nov.
Basionym: *Anaptychia dissecta* var. *koyana* Kurok., *J. Jap. Bot.* **34**, 183 (1959).
Synonym: *Heterodermia dissecta* var. *koyana* (Kurok.) D.D.Awasthi, *Geophytology* **3**, 113 (1973).

Previously this taxon was included in *H. dissecta* (Kurok.) D.D.Awasthi *sens. lat.* as the depsidone-deficient race [i.e. norstictic and salazinic acids absent] (Kurokawa 1998). However, recent phylogenetic studies utilizing molecular phylogenetic analyses of ITS sequences has confirmed that both medullary chemistry and pigmentation (and associated chemistry) of the lower surface are important species characters in *Heterodermia* (Lücking *et al.* 2008). This taxon contains atranorin [major], zeorin [major], 16β-acetoxyhopane-6α,22-diol [minor], leucotylin [minor], dissectic acid [minor], and was previously known from Asia and Central America (Kurokawa 1962).

SPECIMENS EXAMINED
Queensland: • Cook district, Great Dividing Range, Mt Baldy, 4 km SW of Atherton, 17°17′S, 145°27′E, 1080 m, on sapling along margin of regrowth rainforest, *J.A. Elix 16308 & H. Streimann*, 25.vi.1984 (CANB).
New South Wales: • Jerusalem Creek Falls, Chichester State Forest, 19 km NNE of Dungog, 32°15′S, 151°44′E, 350 m, on moist shaded rock face in cool temperate rainforest, *H. Streimann 38254*, 27.viii.1987 (CANB).

5. **Heterodermia neglecta** Lendemer, R.C.Harris & E.Tripp, *Bryologist* **110**, 490 (2007)

This species was previously known from East Africa and North America (Lendemer *et al.* 2007, Swinscow & Krog 1976). *Heterodermia neglecta* is part of the *H. japonica* complex, and is characterized by the ±flat, sublinear, sympodial branched lobes with apical, labriform soralia on the lower surface of the lobe tips, a white, ecorticate lower surface with yellow or orange pigmented spots (K+ purple), black, squarrosely branched rhizines, and ascospores with sporoblastidia. This species contains atranorin [major], zeorin [major], 6α-acetoxyhopane-16β,22-diol [major], 6α,22-dihydroxyhopane-25-oic acid [trace], 6α-acetoxy-22-hydroxyhopane-25-oic acid [trace], norstictic acid [major], salazinic acid [minor], dissectic acid [trace], hybocarpone [minor], norhybocarpone [trace], chloroatranorin [trace], 7-chloroemodin [trace]. A detailed description is given in Lendemer *et al.* (2007).

SPECIMENS EXAMINED
Queensland: • Cook district, Great Dividing Range, Mt Baldy, 4 km SW of Atherton, 17°17′S, 145°27′E, 1080 m, on sapling along margin of regrowth rainforest, *J.A. Elix 16304*, *16319 & H. Streimann*, 25.vi.1984 (CANB); • Cooroo Logging Area, 16 km WNW of Innisfail, 17°31′S, 145°53′E, 100 m, on *Cerbera* in dense rainforest, *J.A. Elix 16701 & H. Streimann*, 28.vi.1984 (CANB).
New South Wales: • Minnamurra Falls Park, near Jamberoo, 34°42′26″S, 143°32′58″E, 65 m, on dead log in rainforest, *J.A. Elix 692*, 29.iii.1975 (CANB); • Port Macquarie, Shelley's Beach Reserve, 31°27′S, 152°55′E, 3 m, on moss over boulders along the foreshore, *J.A. Elix 1078*, 19.viii.1975 (CANB); • Long Beach, 3 km E of Batemans Bay, 35°42′S, 150°14′E, 6 m, on trees in remnant rainforest, *J.A. Elix 2949*, 19.iii.1977 (CANB); • Newell Falls, Dorrigo Mountain, 30°23′S, 152°45′E, 480 m, on rocks in rainforest, *J. A. Elix 3488b*, 30.vi.1977 (CANB).

6. **Heterodermia subascendens** (Asah.) Trass, *Folia Cryptog. Estonica* **29**, 20 (1992)
This species was previously known from eastern Asia (Kurokawa 1962, Trass 2000). The thallus of *H. subascendens* is characterized by the ascending or suberect lobes with marginal, sublabriform soralia and spathuliform apices, a white, ecorticate lower surface with yellow pigmented spots (K+ purple) and ascospores with sporoblastidia. It contains atranorin [major], zeorin [major], 16β-acetoxyhopane-6α,22-diol [major], leucotylin [minor], skyrin [minor] and dissectic acid [trace]. A detailed description is given in Kurokawa (1962) and Trass (2000).

SPECIMEN EXAMINED
Queensland: • Between Millaa Millaa and Ravenshoe, on trees in open rainforest, *D. McVean 6388*, xi.1963 (CANB).

7. **Letrouitia pseudomuralis** Hafellner, *Nova Hedwigia* **35**, 701 (1983)
This species was previously known from Fiji, New Caledonia and Vanuatu (Hafellner 1983). It is characterized by the absence of vegetative propagules, an inspersed hymenium, mainly 4-spored asci and large, spirally septate, submuriform ascospores 35–50 x 15–20 μm. A detailed description is given in Hafellner (1983).

SPECIMEN EXAMINED
Norfolk Island: • Mt Pitt Reserve, just S of summit of Mt Pitt, 29°01′S, 167°56′E, 230 m, on *Citrus limon* in open regrowth rainforest, *J.A. Elix 18813 & H. Streimann*, 10.xii.1984 (CANB).

8. **Phlyctis uncinata** Stirt., *Bot. J. Linn. Soc.* **14**, 464 (1875)
Phlyctis uncinata is characterized by the greenish grey to glaucous grey thallus, with an areolate, minutely granular or arachnoid upper surface, densely white-pruinose apothecia clustered in declivities in the bark, fusiform, 5–13-septate ascospores and by the presence of norstictic acid (major), and connorstictic acid (minor). It was known previously from New Zealand (Galloway 1985, 2007) and Thailand (Wolseley *et al.* 2002). A detailed description is given in Galloway (1985).

SPECIMENS EXAMINED
New South Wales: • Gibraltar Range, Washpool National Park, Hakea Walk, 78 km E of Glen Innes, 29°28′10″S, 152°21′01″E, 895 m, on dead tree and sapling in mixed rainforest with scattered *Eucalyptus*, *J.A. Elix 37275, 37290, 37291, 37292*, 2.v.2005 (CANB).

NEW STATE AND TERRITORY RECORDS

1. **Acarospora fuscata** (Nyl.) Arnold, *Verh. K.K. Zool.-Bot. Ges. Wien*, B, **22**, 279 (1872)
In Australia this cosmopolitan species was previously known from Victoria (McCarthy 2009).

SPECIMEN EXAMINED
New South Wales: • Kosciuszko National Park, summit of Round Mountain, 28 km NE of Khancoban, 36°17′S, 148°35′E, 1750 m, on sheltered basalt rocks just below the exposed summit, *J.A. Elix 19066 & H. Streimann*, 10.iv.1985 (CANB).

2. **Buellia alboatra** (Hoffm.) Th.Fr., *Gen. Heterolich*, 91 (1861)
In Australia this cosmopolitan species was previously known from Western Australia, Victoria, Tasmania, and the Northern Territory (McCarthy 2009).

SPECIMEN EXAMINED
South Australia: • Ridley National Park, 18 km S of Swan Reach, 34°38′S, 139°34′E, 30 m, on limestone rocks in mallee scrub, *J.A. Elix 2204*, 19.v.1976 (CANB).

3. **Buellia microsporella** Elix, *Fl. Australia* **57**, 660 (2009)
Hafellia microspora Pusswald, *in* Elix, *Australas. Lichenol.* **60**, 17 (2007).
This endemic species was previously known from Western Australia, South Australia, Victoria and Tasmania (Elix 2009c, McCarthy 2009).

SPECIMENS EXAMINED
Australian Capital Territory: • Molonglo Gorge Reserve, 15 km SE of Canberra, 35°16′S, 149°16′E, 650 m, on *Callitris* trunk in dry *Eucalyptus-Callitris* woodland, *J.A. Elix 33138 & H. Mayrhofer*, 26.vii.1992 (CANB).
New South Wales: • Gillenbah State Forest, 8 km S of Narrandera, 34°47′51″S, 146°30′00″E, 170 m, on *Callitris* in *Eucalyptus-Callitris* woodland, *J.A. Elix 39928A*, 16.iv.2009 (CANB).

4. **Carbonea latypizodes** Knoph & Rambold, *Lichen Flora of the Greater Sonoran Desert Region* **2**, 55 (2004)
This species was previously known from North America, South America and South Africa, and in Australia from South Australia, Queensland, New South Wales, the Australian Capital Territory, Tasmania and Victoria (McCarthy 2009).

SPECIMEN EXAMINED
Western Australia: • Caernarvon Hills, Dryandra Woodland, 17 km NW of Narrogin, 32°48′21″S, 117°03′21″E, 325 m, on laterite in open *Eucalyptus salmonophloia* woodland with laterite outcrops, *J.A. Elix 39851*, 6.iv.2006 (CANB).

5. **Caloplaca bassiae** (Ach.) Zahlbr., *Cat. Lich. Univ.* **7**, 78 (1930)
This species was previously known from Asia and Africa and in Australia from Queensland (Wetmore 2004, McCarthy 2009).

SPECIMEN EXAMINED
New South Wales: • South Coast, Buckenbowra River estuary, 7.5 km W of Batemans Bay, 34°42′S, 150°06′E, 1 m, on base of trunk of *Allocasuarina littoralis* bordering mangroves, *J. Johnston 2829*, 29.xi.1989 (CANB).

6. **Cratiria aggrediens** (Stirt.) Marbach, *Biblioth. Lichenol.* **74**, 165 (2000)
This species was known previously from the Pacific (New Caledonia), South Africa and Asia, and in Australia from Queensland (Marbach 2000, Elix 2007, McCarthy 2009).

SPECIMEN EXAMINED
New South Wales: • Mt Lindsay Highway, 1 km S of Wilsons Downfall, 28°42′24″S, 152°06′06″E, 960 m, on *Banksia marginata* in *Eucalyptus* woodland, *J.A. Elix 39588*, 4.v.2005 (CANB).

7. **Cratiria obscurior** (Stirt.) Marbach & Kalb, in Marbach, *Biblioth. Lichenol.* **74**, 186 (2000)
Previously this species was known from Central and South America, Asia, Africa and the Pacific (Hawai'i), and in Australia from Queensland (Marbach 2000, McCarthy 2009).

SPECIMEN EXAMINED
Northern Territory: • 'Pethericks Rainforest', Litchfield National Park, 39 km WSW of Batchelor, 13°08′S, 130°49′E, 60 m, on fallen palm in disturbed lowland forest with *Ficus* and *Gmelina*, *J.A. Elix 27566, H.T. Lumbsch & H. Streimann*, 3.vii.1991 (CANB).

8. **Diploschistes euganeus** (A.Massal.) J.Steiner, *Verh. Zool.-Bot. Ges. Wien* **69**, 96 (1919)
In Australia this cosmopolitan species was previously known from New South Wales, Victoria, Western Australia and South Australia (Mangold *et al.* 2009, McCarthy 2009).

SPECIMEN EXAMINED
Australian Capital Territory: • Molonglo Gorge Reserve, 13 km ESE of Canberra, 35°20′S, 149°16′E, 590 m, on exposed siliceous rocks in dry sclerophyll forest on very rocky slope, *H.T. Lumbsch 8967a & J.A. Curnow,* 13.viii.1991 (CANB).

9. **Dirinaria minuta** Kalb, *Biblioth. Lichenol.* **78**, 145 (2001)
This Australian endemic was previously known from the Northern Territory (Elix 2009d, McCarthy 2009).

SPECIMENS EXAMINED
Queensland: • 36 km E of Mt Isa, 20°43′S, 139°51′E, 430 m, on sheltered rock crevices in *Eucalyptus* woodland with *Triodia*, *J.A. Elix 20676 & H. Streimann*, 24.vi.1986 (CANB); • Cloncurry-Townsville Highway, 18 km ESE of Cloncurry, 20°44′S, 130°41′E, 220 m, on sheltered rock crevices in *Eucalyptus* woodland with *Triodia*, *J.A. Elix 20689 & H. Streimann,* 25.vi.1986 (CANB); • Mt Walker, 15 km S of Hughenden, 20°55′S, 144°14′E, 400 m, on conglomerate rocks in *Eucalyptus* woodland, *J.A. Elix 20699 & H. Streimann,* 25.vi.1986 (CANB).

10. **Fulgensia cranfieldii** S.Y.Kondr. & Kärnefelt, *in* Kondratyuk *et al.*, *Biblioth. Lichenol.* **96**, 165 (2007)
This Australian endemic was previously known from Western Australia, South Australia and Victoria (McCarthy 2009).

SPECIMEN EXAMINED
New South Wales: • Balranald District, 4 km S of Sturt Highway along the Tooleybuc Road, 34°42′26″S, 143°32′58″E, 65 m, on soil in remnant mallee scrub, *J.A. Elix 43128*, 6.iv.2009 (CANB).

11. **Heterodermia japonica** (Sato) Swinscow & Krog, *Lichenologist* **8**, 122 (1976)
This is a pantropical species that extends into warm temperate regions. In Australia it was previously known from Western Australia, Queensland, New South Wales and Tasmania (Kurokawa 1962, McCarthy 2009).

SPECIMENS EXAMINED
South Australia: • Hindmarsh Falls, Hindmarsh River, 12 km NNW of Victor Harbour, 32°26′S, 138°35′E, 220 m, on shaded rock face in steep-sided valley with *Eucalyptus* and exotic trees, *H. Streimann 54835,* 26.ix.1994 (CANB).
Victoria: • Western Highland region, Grampians, trail to Venus Bath, 2 km SW of Halls Gap, 37°08′S, 142°30′E, 320 m, on sandstone rocks in open woodland, *J.A. Elix 11536,* 8.i.1984 (CANB).

12. **Heterodermia obscurata** (Nyl.) Trevis., *Nuovo Giorn. Bot. Ital.* **1**, 114 (1869)
This species is common and widespread in tropical and subtropical regions, and extends into warm temperate latitudes. In Australia it was previously known from Western Australia, Queensland, New South Wales, Victoria and Tasmania (McCarthy 2009).

SPECIMENS EXAMINED
South Australia: • Kangaroo Island, mouth of De Male River, 18 km SSE of Cape Borda, 35°43′S, 136°46′E, 20 m, on shaded boulder in dry sclerophyll forest with *Casuarina* on rocky slopes, *H. Streimann 55060,* 30.ix.1994 (CANB).

Australian Capital Territory: • Gudgenby River Gorge, 4.5 km S of Tharwa, 35°34′S, 149°04′E, 620 m, on sheltered granite rocks along the river bank, *J.A. Elix 10903,* 10.iv.1983 (CANB).

13. **Heterodermia spathulifera** Moberg & Purvis, *Symb. Bot. Upsal* **32**, 192 (1997)
This species was previously known from the Azores, East and South Africa, North America, New Zealand and New South Wales (Moberg 2004, McCarthy 2009).

SPECIMENS EXAMINED
Queensland: • Moreton district, Wunburra Range, Best of All Lookouts, 4 km S of Springbrook, 28°14′S, 153°15′E, 1005 m, on dead *Eucalyptus* bark in rainforest, *J.A. Elix 2527,* 20.viii.1976 (CANB).
Victoria: • Alfred National Park, 19 km E of Cann River, 37°32′S, 149°20′E, 350 m, on mossy dead wood in rainforest, *J.A. Elix 5243*, 21.xi.1978 (CANB); • Gippsland region, Club Terrace-Combienbar road, 6 km N of Club Terrace, 37°29′S, 148°56′E, 120 m, on rotten log in regrowth forest with *Pittosporum, Acacia* and *Bedfordia*, *J.A. Elix 19512 & H. Streimann*, 27.ix.1985 (CANB).

14. **Heterodermia subcitrina** Moberg, *Symb. Bot. Ups.* **34**, 266 (2004)
This species was known previously from South Africa (Moberg 2004) and New South Wales (Elix 2008, McCarthy 2009).

SPECIMEN EXAMINED
Victoria: • Deadcock Gorge, Mitchell River National Park, 26 km NW of Bairnsdale, 37°42′S, 147°22′E, 80 m, on semi-exposed boulder in poor wet sclerophyll forest with numerous shrubs, *H. Streimann 50247,* 30.x.1992 (CANB).

15. **Hypocenomyce tinderryensis** Elix, *Australas. Lichenol.* **61**, 21 (2007)
This Australian endemic was previously known from Western Australia and New South Wales (Elix 2009a, McCarthy 2009).

SPECIMENS EXAMINED
Australian Capital Territory: • Canberra Nature Park, Bruce Ridge, 35°16′S, 149°05′E, 680 m, on dead wood in dry *Eucalyptus* woodland, *J.A. Elix 25059, 25061,* 27.vi.1993 (CANB); • Canberra Nature Park, Aranda Bushland, 35°16′S, 149°05′E, 680 m, on dead wood in dry *Eucalyptus* woodland, *J.A. Elix 33386, 33387,* 27.vi.1993 (CANB); • Cribbs Creek, Bimberi Range, 35 km SW of Canberra, 35°37′S, 148°46′E, 1470 m, on semi-shaded boulder in dry sclerophyll forest above creek, *H. Streimann 35001 & J.A. Curnow,* 19.ii.1985 (CANB).

16. **Immersaria athroocarpa** (Ach.) Rambold & Pietschm., *in* Rambold, *Biblioth. Lichenol.* **34**, 240 (1989)
This species has been recorded from Europe, North America, Africa and Asia, and in Australian from New South Wales, the Australian Capital Territory and Victoria (Kainz 2004, McCarthy 2009).

SPECIMENS EXAMINED
Western Australia: • Caernarvon Hills, Dryandra Woodland, 17 km NW of Narrogin, 32°48′21″S, 117°03′21″E, 325 m, on laterite in open *Eucalyptus salmonophloia* woodland with laterite outcrops, *J.A. Elix 39852,* 6.iv.2006 (CANB); • Summit of Toolbrunup Peak, Stirling Ranges National Park, 40 km SW of Borden, 34°23′S, 118°03′E, 980 m, on exposed volcanic rocks with pockets of dense, shrubby vegetation, *J.A. Elix 41520,* 17.ix.1994 (CANB).

17. **Lecidea lygomma** Nyl. ex Cromb., *J. Bot.* **13**, 334 (1875)
This species was previously known from Africa, South Georgia, Kerguelen, South America and New Zealand, and in Australia from New South Wales, Victoria and Tasmania (Galloway 2007, McCarthy 2009).

SPECIMEN EXAMINED
Western Australia: • Summit of Toolbrunup Peak, Stirling Ranges National Park, 40 km SW of Borden, 34°23′S, 118°03′E, 980 m, on exposed volcanic rocks with pockets of dense, shrubby vegetation, *J.A. Elix 41508,* 17.ix.1994 (CANB).

18. **Lecidea plana** (Lahm) Nyl., *Flora* **55**, 552 (1872)
This species occurs in Europe, North and South America and New Zealand, and in Australia in New South Wales and Western Australia (Galloway 2007, McCarthy 2009).

SPECIMEN EXAMINED
Victoria: • Alpine National Park, High Plains Road, 20 km SSE of Mt Beauty, 36°53′S, 147°19′E, 1620 m, on granite rocks in exposed alpine herbfield, *J.A. Elix 40474 & H. Streimann*, 17.ii.1994 (CANB).

19. **Lecidella asema** (Nyl.) Knoph & Hertel, *Biblioth. Lichenol.* **36**, 66 (1990)
This species was known previously from Africa, Asia, Europe and North America (Knoph & Leuckert 2004), and in Australia from Western Australia (Elix 2008, McCarthy 2009).

SPECIMEN EXAMINED
Victoria: • Errinundra National Park, Goonmirk Rocks Road, 20 km SE of Bonang, 37°16′29″S, 148°53′06″E, 910 m, on dead log in *Eucalyptus* forest with *Acacia* and *Podocarpus*, *J.A. Elix 39865*, 16.iv.2008 (CANB).

20. **Lepraria caesioalba** (de Lesd.) J.R.Laundon, *Lichenologist* **24**, 324 (1992)
This species was known previously from Europe and North and South America, and in Australia from the Australian Capital Territory (Elix 2009b). The following specimens contained atranorin, psoromic acid and roccellic acid [chemical race V of Tønsberg (2004)].

SPECIMENS EXAMINED
Western Australia: • Caernarvon Hills, Dryandra Woodland, 17 km NW of Narrogin, 32°48′21″S, 117°03′21″E, 325 m, on soil on sheltered laterite ledge in open *Eucalyptus salmonophloia* woodland with laterite outcrops, *J.A. Elix 39842*, *39843,* 6.iv.2006 (CANB).

21. **Lepraria toilenae** Kantvilas & Kukwa, *Muelleria* **23**, 3 (2006)
This endemic Australian species was previously known from Victoria and Tasmania (Elix 2009b, McCarthy 2009).

SPECIMEN EXAMINED
New South Wales: • Bondi Creek, Bondi State Forest, 50 km N of Cann River township, 37°12′21″S, 149°19′00″E, 320 m, on dead log in *Eucalyptus* forest beside stream, *J.A. Elix 43242*, 10.xi.2008 (CANB).

22. **Megalaria laureri** (Hepp ex Th.Fr.) Hafellner, *in* Nimis, *Lichens of Italy*, 429 (1993)
This species is known from Europe, Macaronesia, North America, Africa and Asia, and in Australia from Tasmania (Kantvilas 2008, McCarthy 2009).

SPECIMEN EXAMINED
New South Wales: • 7 km W of Premer, 31°27′18″S, 149°49′56″E, 390 m, on dead wood in mixed *Eucalyptus-Callitris* woodland, *J.A. Elix 39887,* 5.viii.2008 (CANB).

23. **Megalospora pulverata** Kantvilas, *Lichenologist* **26**, 355 (1994)
This Australian endemic was previously known from Tasmania and New South Wales (McCarthy 2009).

SPECIMEN EXAMINED
Victoria: • Errinundra National Park, Errinundra Road, Bonang River Picnic Area, 37°17′02″S, 148°48′25″E, 810 m, on base of *Eucalyptus* in *Eucalyptus* forest with *Athrosperma* understorey, *J.A. Elix 39887*, 16.iv.2008 (CANB).

24. **Micarea nitschkeana** (J.Lahm ex Rabenh.) Harm., *Bull. Séances Soc. Sci. Nancy II,* **33**, 64 (1899)
In Australia this cosmopolitan species was previously known from Tasmania (Coppins 2009).

SPECIMENS EXAMINED
New South Wales: • Cookamidgera State Forest, 3.5 km SSW of Cookamidgera, 33°14′43″S, 148°16′54″E, 345 m, on dead stump in *Eucalyptus* woodland, *J.A. Elix 39070,* 4.viii.2008 (CANB); • 7 km W of Premer, 31°27′18″S, 149°49′56″E, 390 m, on dead wood in mixed *Eucalyptus-Callitris* woodland, *J.A. Elix 39636,* 5.viii.2008 (CANB).

25. **Micarea viridileprosa** Coppins & van den Boom, *Lichenologist* **33**, 87 (2001)
In Australia this European species was previously known from Tasmania (Coppins 2009).

SPECIMENS EXAMINED
Victoria: • Baw Baw National Park, Mt Erica Trail, 34 km N of Morwell, 37°53′35″S, 146°21′18″E, 1050 m, on dead wood and base of *Eucalyptus* in montane *Eucalyptus* forest, *J.A. Elix 3920,* 13.iv.2008 (CANB); • Errinundra National Park, Errinundra Saddle Rainforest Walk, 37°19′03″S, 148°50′19″E, 910 m, on dead log in cool temperate rainforest, *J.A. Elix 39010*, 16.iv.2008 (CANB).

26. **Mycoblastus kalioruber** Kantvilas, *Lichenologist* **41**, 170 (2009)
This endemic species was known previously from Tasmania (Kantvilas 2009).

SPECIMEN EXAMINED
Victoria: • Errinundra National Park, Errinundra Saddle Rainforest Walk, 37°19′03″S, 148°50′19″E, 910 m, on trunk of treelet in cool temperate rainforest, *J.A. Elix 38975*, 16.iv.2008 (CANB).

27. **Pertusaria glomelliferica** Elix & A.W.Archer, *Telopea* **12**, 268 (2008)
This endemic species was previously known from Western Australia (Elix *et al.* 2008).

SPECIMEN EXAMINED
South Australia: • Ferries-McDonald Conservation Park, 10 km S of Monarto, 35°14′02″S, 139°07′54″E, 50 m, on *Melaleuca* in mallee scrub with *Callitris* and *Eucalyptus*, *J.A. Elix 39370,* 8.xii.2008 (CANB).

28. **Pertusaria irregularis** Müll.Arg., *Bull. Herb. Boissier* **3**, 638 (1895)
This species was known previously from Queensland, Fiji, New Caledonia and Papua New Guinea (Archer 2004, McCarthy 2009).

SPECIMEN EXAMINED
Northern Territory: • Litchfield National Park, Greenant Creek, trail to Tjaetaba Falls, 60 km SW of Batchelor, 13°12′04″S, 130°42′03″E, 60 m, on tree trunk in monsoon vine forest with *Corallia* and *Calophyllum*, *J.A. Elix 38417*, 5.viii.2005 (CANB). Det.: A.W. Archer.

29. **Pseudocyphellaria brattii** D.J.Galloway & Kantvilas, *Bryologist* **96**, 346 (1993)
This species was previously known only from Tasmania (Galloway *et al.* 2001, McCarthy 2009).

SPECIMENS EXAMINED
Queensland: • Zillie Falls, 12 km NE of Millaa Millaa, 17°28′29″S, 145°39′22″E, 705 m, on fallen tree in remnant rainforest, *J.A. Elix 39501, 39514,* 29.vii.2006 (CANB); • Wooroonooran National Park, Henrietta Creek Campground, 37 km W of Innisfail, 17°35′55″S, 145°45′33″E, 360 m, on fallen branch in storm-damaged tropical rainforest, *J.A. Elix 39682,* 29.vii.2006 (CANB).

30. **Solenopsora vulturiensis** A.Massal., *Lotos* **6**, 75 (1856)
This species was previously known from Europe, Macaronesia, Asia and Africa, and in Australia from Western Australia (Gilbert *et al.* 2009, McCarthy 2009).

SPECIMENS EXAMINED
New South Wales: • Near Melville Point, 13 km SSE of Batemans Bay, 35°50′S, 152°12′E, 1–2 m, on rocks in steep cliffsides along beach with herbs and scattered *Banksia*, *J.A. Elix 26605, 26608,* 15.iii.1992 (CANB).

31. **Xanthoparmelia segregata** Elix & J.Johnst., *Mycotaxon* **33**, 361 (1988)
This endemic species was previously known from Western Australia, New South Wales, Victoria and Tasmania (McCarthy 2009).

SPECIMEN EXAMINED
Queensland: • Girraween National Park, 7 km NE of Wallengarra, 28°53′07″S, 151°57′52″E, 990 m, on granite rocks in dry *Eucalyptus-Callitris* woodland, *J.A. Elix 43154,* 3.v.2005 (CANB).

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