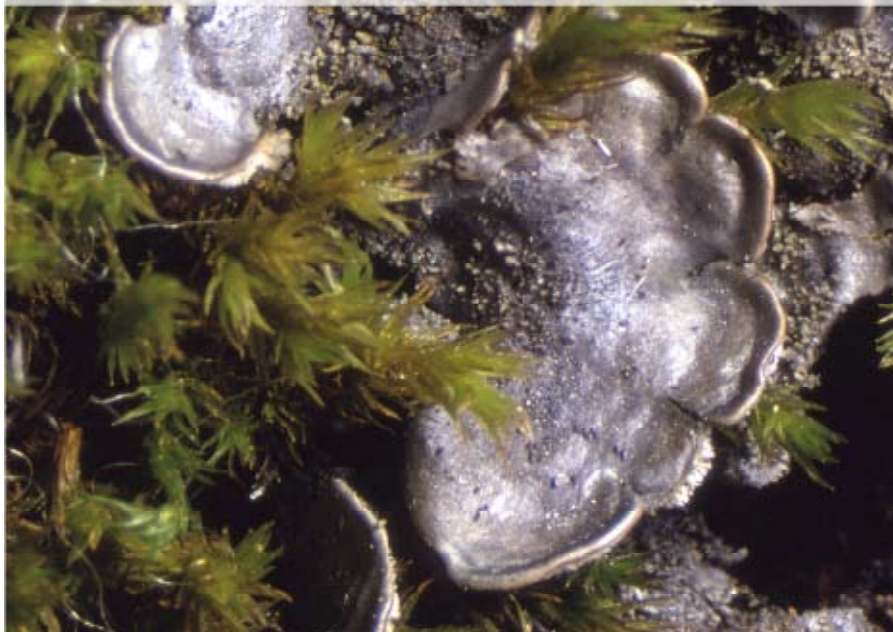


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Coccocarpia palmicola is widespread in both New Zealand and Australia. It's a common epiphyte in humid lowland forests, but also invades bryophyte turves and colonizes clay banks. Its gun-metal grey colour can vary with exposure and altitude.

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**Additional lichen records from Indonesia and Malaysia 6.
Lichens from Maliau Basin, Sabah, Malaysia**

Laily B. Din, A. Latiff and Ikram M. Said

Faculty of Science and Technology, Universiti Kebangsaan Malaysia,
43600 UKM Bangi, Malaysia

John A. Elix

School of Chemistry, Building 33,
Australian National University, Canberra, ACT 0200, Australia

Abstract: *Cladonia floerkeana*, *Parmotrema pseudonilgherrense*, *Pertusaria umbricola*, *Phaeographis ceratoides*, *Pseudocyphellaria homalosticta* and *Sticta weigelii* are reported as new to Malaysia.

Maliau Basin Conservation Area is located in south-central Sabah on the island of Borneo. It is a rugged and uninhabited forested area with steep slopes up to 1500 m in elevation. The basin (c. 390 square kilometres in area) is drained by a series of radiating tributaries of the Maliau River. For the most part, the vegetation comprises tropical submontane dipterocarp forest, but that intergrades into heath forest at higher elevations. In this paper, we report on 24 lichens collected from Maliau Basin, six of which are new records for Malaysia.

The following is common to all specimen citations: *Malaysia*: • Sabah: Maliau Basin, Eucalyptus Camp, 4°52'18"N, 106°49'35"E, c. 1000 m, ix.2006 (CANB, UKM). Only information on microhabitat and the collector's number are noted in addition.

1. *Cladonia floerkeana* Flörke, *De Cladon.*: 99 (1828)

This species was previously known from North, Central and South America, Europe and Australasia (Ahti 2000). It is characterized by podetia with a mostly or totally corticated surface, sometimes with rather sparse, granulose soredia, incised esorediate squamules, bright red discs, and the presence of rhodocladonic acid (minor), barbatic acid (minor), didymic acid (major), and thamnolic acid (minor). A detailed description is given in Ahti (2000) and Archer (1992).

SPECIMEN EXAMINED

- on soil in submontane rainforest, *L.B. Din MBS 9*.

2. *Parmotrema pseudonilgherrense* (Asahina) Hale, *Mycotaxon* 5: 441 (1977)

This species was previously known from East, South and West Africa, India, Nepal, Korea, Australia (Elix 1994) and mainland China (Chen *et al.* 2005). It is characterized by the large, loosely adnate, coriaceous thallus, the marginally and sub-marginally sorediate lobes that become revolute, the maculae on the upper surface, and alecronic acid and α -collatolic acid in the medulla. A detailed description is given in Elix (1994).

SPECIMEN EXAMINED

- on tree in submontane rainforest, *L.B. Din MBS 24A, 36*.

3. *Pertusaria umbricola* A.W.Archer & Elix in A.W.Archer, *Biblioth. Lichenol.* 69: 158 (1997)

Previously, this species was known only from Australia and Papua New Guinea (Archer 1997). It is characterized by the corticolous, isidiate thallus and the presence of protocetraric acid. A detailed description is given in Archer (1997, 2004).

SPECIMEN EXAMINED

- on tree in submontane rainforest, *L.B. Din MBS 25*.

4. *Phaeographis ceratoides* (Vain.) Zahlbr., *Cat. Lich. Univ.* 2: 365 (1923)

This species was previously known from Australia, Norfolk Island, the Philippines and Indonesia (Archer 2006). It is characterized by the repeatedly branched, thin, black, immersed lirellae, the very small, 4-locular ascospores and by the absence of lichen compounds. A detailed description is given in Archer (2006).

SPECIMEN EXAMINED

- on tree in submontane rainforest, *L.B. Din MBS 14*.

5. *Pseudocyphellaria homalosticta* Vain., *Philipp. J. Sci.* sect. C, 8: 117 (1913)

Previously known from the Philippines and the south-west Pacific [Fiji, Raratonga and the Marquesas] (Galloway 1994), the species is distinguished by a white medulla, a green photobiont and white pseudocyphellae on both upper and lower surfaces and characteristically also at the margins of the lobes, and the marginal and occasionally laminal, terete isidia that can become dorsiventral, flattened phyllidia. The Malaysian material contained tenuiorin (major), methyl gyrophorate (minor), gyrophoric acid (minor), 7 β -acetoxyhopane-22-ol (major), hopane-15 α ,22-diol (major), and hopane-7 β ,22-diol (trace). A detailed description is given in Galloway (1994).

SPECIMEN EXAMINED

- on tree in submontane rainforest, *L.B. Din MBS 26*.

6. *Sticta weigeli* (Ach.) Vain., *Acta Soc. Fauna Fl. Fennica* 7: 189 (1890)

A widespread species in tropical and temperate regions (Galloway 2001), this species is distinguished by a cyanobacterial photobiont, irregular, clustered, rosette-forming lobes with densely isidiate margins, and isidia densely developed in patches or continuously over the upper surface. It has a dark red-brown or grey-brown upper surface and a dark brown to black, thickly tomentose lower surface with scattered, round to irregular, white cyphellae deeply immersed in the tomentum, and lacks lichen substances. A detailed description is given in Galloway (2001).

SPECIMEN EXAMINED

- in submontane rainforest, *L.B. Din MBS 17*.

Other Species Collected

The following species were also collected from Maliau Basin: *Bunodophoron formosanum* (Zahlbr.) Wedin, *Cladonia adspersa* Mont. & Bosch, *C. didyma* (Fée) Vain., *Coccocarpia dissecta* Swinscow & Krog, *C. erythroxyli* (Spreng.) Swinscow & Krog, *C. glaucina* Kremp., *Lobaria pseudopulmonaria* Gyeln., *Ocellularia* sp., *Parmotrema acrotrychum* (Kurok.) Streim., *P. cristiferum* (Taylor) Hale, *P. gardneri* (C.W.Dodge) Hale, *P. mellissii* (C.W.Dodge) Hale, *Pertusaria velata* (Turner) Nyl., *Physma byrsaenum* (Ach.) Müll.Arg., *Pseudocyphellaria gilva* (Ach.) Malme, *Relicina circumnodata* (Nyl.) Hale, *R. palmata* Elix, *Siphula decumbens* Nyl. and *Usnea baileyi* (Stirt.) Zahlbr.

Acknowledgements

The authors would like to thank the Science Academy of Malaysia for providing a travel grant to LBD, AL and IMS. The authors would also like to thank the Universiti Kebangsaan Malaysia for allowing them to participate in the Maliau Basin Scientific Expedition 2006 (MBSE 2006), the Sabah Foundation for their hospitality rendered during the MBSE 2006, and Dr A.W. Archer for identifying *Phaeographis ceratoides*.

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**Additional lichen records from Australia 65.
Pyrenulaceae from Lord Howe Island, Norfolk Island
and the Cocos (Keeling) Islands**

André Aptroot

ABL Herbarium, G.v.d.Veenstr. 107, NL-3762 XK Soest, The Netherlands

Abstract: New records of Pyrenulaceae are reported from Lord Howe Island (11) and Norfolk Island (14) in the south-western Pacific Ocean. *Pyrenula ochraceoflava* is the first lichen to be reported from the Cocos (Keeling) Islands in the Indian Ocean. Previous records from Norfolk Island are rejected.

Introduction

A continuing investigation of Australian Pyrenulaceae for the *Flora of Australia* has revealed many collections from Lord Howe Island and Norfolk Island, and one from the Cocos (Keeling) Islands. Thus far, only the presumed endemics *Lithothelium austropacificum* P.M.McCarthy (McCarthy 1996) and *Pyrenula howeana* Aptroot (Aptroot 2007) are known from Lord Howe Island. The two species previously reported from Norfolk Island, *P. nitida* (Weigel) Ach. and *P. ravenelii* (Tuck.) R.C.Harris (Cheel 1904, Elix & McCarthy 1998), are based on misidentifications. The former does not occur in the Southern Hemisphere, and the latter is found in Australia only at temperate latitudes.

A total of 14 corticolous species of Pyrenulaceae are reported here for the first time from Norfolk Island, and 11 from Lord Howe Island. Moreover, *Pyrenula ochraceoflava* is the first lichen to be reported from the Cocos (Keeling) Islands in the Indian Ocean. In most cases, only selected specimens are listed below. For more information on taxonomy, synonymy and distribution, see Aptroot (2007) and McCarthy (2007).

Seven species of *Pyrenula* and *Lithothelium* are known from Christmas Island, an Australian territory in the Indian Ocean (McCarthy 2007), including the endemic *L. quiescens* P.M.McCarthy.

Anthracotheceum australiense (Müll.Arg.) Aptroot, in A. Aptroot, P. Diederich, E. Sérusiaux & H.J.M. Sipman, *Biblioth. Lichenol.* **64**, 17 (1997)

SPECIMENS EXAMINED

Lord Howe Island: • Goat House Cave, *J.A. Elix* 42191, 7.ii.1995 (CANB).

Norfolk Island: • Prince Phillip Drive, *J.A. Elix* 18799 & *H. Streimann*, 9.xii.1984 (CANB).

Anthracotheceum gregale (C.Knight) Aptroot, *Australas. Lichenol.* **60**, 35 (2007)

SPECIMENS EXAMINED

Lord Howe Island: • track to Goat House Cave, *J.A. Elix* 42075, 42127, 42197 & 42199, 7.ii.1995 (B, CANB).

Norfolk Island: • Mount Pitt National Park, near Duncombe Road, *J.A. Elix* 29235, 18.vi.1992 (CANB).

Anthracotheceum toowoombense (Müll.Arg.) Aptroot, *Australas. Lichenol.* **60**, 35 (2007)

SPECIMEN EXAMINED

Lord Howe Island: • track to Goat House Cave, *J.A. Elix* 42132, 7.ii.1995 (B, CANB).

Lithothelium obtectum (Müll.Arg.) Aptroot, *Biblioth. Lichenol.* **44**, 62 (1991)

SPECIMEN EXAMINED

Lord Howe Island: • escarpment between Neds Beach and Searles Point, *J.A. Elix* 42002, 7.ii.1995 (B, CANB).

Pyrenula anomala (Ach.) Vain., *Ann. Acad. Sci. Fenn., Ser. A*, **6**(7), 189 (1915)

SPECIMENS EXAMINED

Lord Howe Island: • escarpment between Neds Beach and Searles Point, *J.A. Elix* 41993, 7.ii.1995 (CANB).

Norfolk Island: • Mount Pitt Reserve, near Broken Pine, *J.A. Elix* 18302 & *H. Streimann*, 2.xii.1984 (CANB).

Pyrenula aspistea (Ach.) Ach., *Syn. Meth. Lich.*: 123 (1814)

SPECIMEN EXAMINED

Norfolk Island: • Point Blackburne Reserve, *H. Streimann* 34210, 4.xii.1984 (CANB).

Pyrenula concatervans (Nyl.) R.C.Harris, in S. Tucker & R.C. Harris, *Bryologist* **83**, 15 (1980)

SPECIMENS EXAMINED

Lord Howe Island: • junction of Kims Lookout and Max Nicholls Tracks, *J.A. Elix* 42065, 6.ii.1995 (CANB).

Norfolk Island: • Mount Pitt Reserve, above road from Broken Pine, *J.A. Elix* 18290 & *H. Streimann*, 2.xii.1984 (CANB).

Pyrenula cruenta (Mont.) Vain., *Étud. Class. Lich. Brésil* **2**, 197 (1890)

SPECIMEN EXAMINED

Norfolk Island: • Just S of Captain Cook Memorial, Duncombe Bay, *J.A. Elix* 18353 & *H. Streimann*, 3.xii.1984 (CANB).

Pyrenula mamillana (Ach.) Trevis., *Consp. Verruc.*: 13 (1860)

SPECIMEN EXAMINED

Norfolk Island: • Mount Pitt Reserve, track from Red Road to Mount Bates, *H. Streimann* 34473, 6.xii.1984 (CANB).

Pyrenula massariospora (Starb.) R.C.Harris, *Mem. New York Bot. Gard.* **49**, 95 (1989)

SPECIMEN EXAMINED

Norfolk Island: • Mount Pitt Reserve, Mount Bates summit trail, *J.A. Elix* 18633 & *H. Streimann*, 6.xii.1984 (CANB).

Pyrenula microcarpa Müll.Arg., *Bot. Jahrb. Syst.* **6**, 412 (1885)

SPECIMENS EXAMINED

Lord Howe Island: • track from Smoking Tree Ridge to Rocky Run, *J.A. Elix* 42454, 10.ii.1995 (CANB)

Norfolk Island: • Mount Pitt Reserve, Mount Bates summit trail, *J.A. Elix* 18666 & *H. Streimann*, 6.xii.1984 (CANB).

Pyrenula neoculata Aptroot, *Australas. Lichenol.* **60**, 38 (2007)

SPECIMENS EXAMINED

Lord Howe Island: • track to Goat House Cave, *J.A. Elix* 42133, 7.ii.1995 (CANB).

Norfolk Island: • Mount Pitt Reserve, near Broken Pine, *J.A. Elix* 18312 & *H. Streimann*, 2.xii.1984 (CANB).

Pyrenula nitidula (Bres.) R.C.Harris, in A. Aptroot, P. Diederich, E. Sérusiaux & H. J.M. Sipman, *Biblioth. Lichenol.* **64**, 165 (1997)

SPECIMENS EXAMINED

Lord Howe Island: • track to Goat House Cave, *J.A. Elix* 42079, 7.ii.1995 (CANB).
Norfolk Island: • Mount Pitt Reserve, Mount Pitt Road, *H. Streimann* 31911, 2.xii.1984 (CANB).

Pyrenula ochraceoflava (Nyl.) R.C.Harris, *Mem. New York Bot. Gard.* **49**, 96 (1989)

SPECIMEN EXAMINED

Cocos (Keeling) Islands: • West Island (Pulu Panjang), 300 m N of meteorological station, *D.G. Williams* 190, 15.v.1986 (B, CANB).

Pyrenula pyrenuloides (Mont.) R.C.Harris, *Mem. New York Bot. Gard.* **49**, 99 (1989)

SPECIMEN EXAMINED

Norfolk Island: • Mount Pitt Reserve, Filmy Fern Trail, *J.A. Elix* 18412 & *H. Streimann*, 3.xii.1984 (CANB).

Pyrenula quassiaecola Fée, *Essai Crypt. Écorc.*, Suppl.: 79 (1837)

SPECIMENS EXAMINED

Lord Howe Island: • escarpment between Neds Beach and Searles Point, *J.A. Elix* 42000, 5.ii.1995 (CANB).
Norfolk Island: • Mount Pitt Reserve, Red Road Track to Mount Bates, *J.A. Elix* 18655 & *H. Streimann*, 6.xii.1984 (CANB).

Pyrenula subcongruens Müll.Arg., *Rep. Australas. Assoc. Advancem. Sci.* **1895**, 457 (1895)

SPECIMENS EXAMINED

Lord Howe Island: • track to Kims Lookout, *J.A. Elix* 42391, 9.ii.1995 (CANB).
Norfolk Island: • just S of Captain Cook Memorial, Duncombe Bay, *J.A. Elix* 18395 & *H. Streimann*, 3.xii.1984 (CANB).

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Additional lichen records from Australia 66. Graphidaceae

Alan W. Archer

National Herbarium of New South Wales
Mrs. Macquaries Road, Sydney, N.S.W. 2000, Australia
e-mail: alanw.archer@bigpond.com

John A. Elix

Department of Chemistry, Building 33, College of Science
Australian National University, Canberra, A.C.T. 0200, Australia
e-mail: John.Elix@anu.edu.au

Abstract: *Acanthothecis tetrachora* (Nyl.) Staiger & Kalb, *Graphis analoga* Nyl., *Graphis virescens* Müll. Arg., *Hemithecium implicatum* (Fée) Staiger and *Phaeographis colligata* (Stirt.) Zahlbr. are reported as new to Australia.

An examination of recent collections from northern Australia and elsewhere has shown the presence of five species of Graphidaceae not previously reported from Australia: two of *Graphis* and one each of *Acanthothecis*, *Hemithecium* and *Phaeographis*. The species were identified by microscopic examination, the identification of secondary lichen products (where present), and comparison with published descriptions.

Acanthothecis tetrachora (Nyl.) Staiger & Kalb, *Mycotaxon* **73**, 112 (1999) Fig. 1
Graphina tetrachora (Nyl.) Zahlbr., *Cat. Lich. Univ.* **2**, 429 (1923).
Graphis tetrachora Nyl., *Ann. Sci. Nat., Bot.*, sér. 4 (Bot.), **20**, 265 (1863).

Type: Nova Granata [Colombia] Canoas, Tequendama, *Lindig s.n.*, ix.1860; (holotype – H-NYL 6124 pro parte maxima)

Thallus corticolous, off-white to yellowish white, thin, the surface minutely powdery. Apothecia lirelliform, sparse, scattered, inconspicuous, sessile, concolorous with the thallus or becoming pale pink, lips closed or becoming slightly open, simple, straight, curved or sinuous, 0.7–2 mm long, 0.3–0.4 mm wide. Exciple non-carbonized, inconspicuous. Hymenium 100–130 µm tall, I–, not interspersed. Ascospores 4 per ascus, narrow, elongate-ellipsoid, hyaline, muriform, 57–70 µm long, 10–15 µm wide, 19–24 x 3–4-locular, I–.

Chemistry: norstictic acid.

This species is characterized by the non-carbonized exciple, the non-interspersed hymenium, the narrow muriform ascospores giving no reaction with iodine, and the presence of norstictic acid. It is distinguished from other *Acanthothecis* species in Australia with muriform ascospores by its larger ascospores. It is known in Australia from the one specimen; it also occurs in Brazil, Colombia and Kenya (Staiger 2002).

SPECIMEN EXAMINED

N.S.W.: • Crosslands, by side of Berowra Creek, 33°38'S, 151°06'E, alt. c. 5 m, 30 km NNE of Sydney, *A.W. Archer* G 74, 8.i.1998 (NSW 748271).

Graphis analoga Nyl., *Ann. Sci. Nat., Bot.*, sér. 4, **11**, 244 (1859) Fig. 2
Graphina analoga (Nyl.) Zahlbr., *Denkschr. Akad. Wiss. Wien, Math.-Naturwiss. Kl.* **83**, 107 (1909).

Type: Taiti [Tahiti], *Vieillard & Panchet s.n.*; (holotype – H-NYL 7432).

Thallus corticolous, pale fawn, surface smooth and dull, somewhat cracked. Apothecia lirelliform, numerous, conspicuous, semi-immersed with a conspicuous thalline margin, simple, straight, curved or sinuous, or sometimes branched, 1–3 mm long, 0.15–0.3 mm wide, lips closed. Exciple laterally carbonized, largely concealed by the

thalline margin. Hymenium 100–120 μm tall, not interspersed, I–. Ascospores 6–8 per ascus, ellipsoid, hyaline, muriform, 22–35(–40) μm long, 10–16 μm wide, 4–7 \times 1–3 locular, I+ blue.

Chemistry: norstictic acid (major) and connorstictic acid (minor).

This species is characterized by the laterally carbonized exciple, the non-interspersed hymenium, the presence of norstictic acid and the muriform ascospores. It resembles *Graphina gracilis* (Fr.) Müll. Arg. (Müller 1887), but that species is reported to possess sulcate lirellae (Müller *loc. cit.*). The Australian specimen somewhat resembles *G. analoga* var. *subtecta* Nyl., which Nylander (1863) reported to differ from the type by the “somewhat covered lirellae and the larger spores [saepius subtectis et sporis majoribus, 27–48 \times 11–16 μm]” (Nylander 1863), but because Nylander reported a range of ascospore sizes from 18 μm to 80 μm long (*vide infra*) the specimen is retained as var. *analoga*. In the protologue, Nylander (1859) reported the ascospores to be 18 μm long and 8 μm wide, but later he (Nylander 1869) reported them to be 46–80 μm long and 18–30 μm wide. Subsequently, Awasthi & Singh (*in sched.* 1975) reported the ascospores in the type specimen to be 20–30 \times 8–12 μm , Vainio (1921) gave the dimensions as 21–38 \times 7–13 μm , and Redinger (1933) reported 24–40(–57) \times 12–15 μm , all three of those reports not differing markedly from the ascospore dimensions observed in the Australian specimen.

Originally described from Tahiti, *Graphis analoga* has also been recorded from Hong Kong (Aptroot & Sipman 2001), the Philippines (Vainio 1921), Brazil (Redinger 1933) and Indonesia (Redinger 1936).

SPECIMEN EXAMINED

Queensland: • Conway State Forest, 18 km E of Proserpine, 20°21'S, 148°45'E, 180 m, on *Albizia* trunk in lowland rainforest, *J.A. Elix 20794* and *H. Streimann*, 28.vi.1986 (CANB).

Graphis virescens Müll. Arg., *Flora* 63, 20 (1880)

Fig. 3

Type: Brazil, Apiahy [Apiai], *J.I. Puiggari 337, 334*; (syntypes – G).

Thallus corticolous, pale greenish fawn or greenish grey, surface scurfy and minutely cracked. Apothecia lirelliform, black, scattered, conspicuous, sessile, lacking a thalline margin, simple, straight or slightly curved, 0.7–3.5 mm long, 0.2–0.3 mm wide, the lips closed or becoming slightly open to reveal a weak white-pruinose epithecium. Exciple completely carbonized. Hymenium 120–140 μm tall, not interspersed, I–. Ascospores elongate-ellipsoid, 6–8 per ascus, hyaline, 30–50 μm long, 6–10 μm wide, (8–) 10–12-locular, I+ blue.

Chemistry: no lichen compounds detected.

This species is characterized by the greenish thallus, the conspicuous, sessile, simple lirellae, the non-interspersed hymenium and the absence of lichen compounds. It is morphologically similar to *Graphis emersa* Müll. Arg., but that species contains norstictic acid, and to *G. anfractuosa* (Eschw.) Eschw., which differs in having an interspersed hymenium. *Graphis geraensis* Redinger also has a completely carbonized exciple, ascospores similar in size to those of *G. virescens*, and has no lichen compounds, but it lacks the greenish thallus and robust, simple lirellae without a thalline margin; in contrast, *G. virescens* has slender lirellae with a thalline margin. *Graphis virescens* was previously known from Brazil (Staiger 2002).

SPECIMENS EXAMINED

Queensland: • Bunya Mountains National Park, summit of Mt. Kiangarow, 68 km N of Dalby, 26°50'S, 151°33'E, alt. 1146 m, on margin of rainforest, on fallen branch, *J.A. Elix 37626*, 6.v.2005 (CANB).

New South Wales: • Allyn River Forest Park, Burruga Swamp, 32°06'30"S, 151°25'30"E, alt. 1000 m, on *Acmena*, *G. Kantvilas 232/88*, 29.vi.1988 (HO, NSW).

Hemithecium implicatum (Fée) Staiger, *Biblioth. Lichenol.* 85, 287 (2002)

Fig. 4

Graphis implicata Fée, *Bull. Soc. Bot. France* 21, 27 (1874).

Type: Brazil, *A. Glaziou 5036*; (isotype – MICH *vide* Wirth & Hale 1963).

Graphis chlorocarpella Nyl. in *A. Krempelhuber, Flora* 59, 413 (1876).

Type: Brazil, Rio de Janeiro, *A. Glaziou 5036*; (holotype – H-NYL 7723 *vide* Staiger, *loc. cit.*).

Thallus corticolous, pale fawn, surface smooth and dull. Apothecia lirelliform, inconspicuous, pale orange-brown, scattered, initially fissurine, becoming slightly raised, simple, straight, curved or sinuous, or rarely branched, 1–2 mm long, 0.1–0.2 mm wide, lips closed. Exciple non-carbonized, pale orange-brown. Hymenium 80–100 μm tall, I–, not interspersed. Ascospores 8 per ascus, elongate-ellipsoid, hyaline, 30–40 μm long, 6–8 μm wide, 9–12-locular, I+ blue.

Chemistry: no lichen compounds detected.

The species is characterized by the thin inconspicuous, initially fissurine, pale orange-brown lirellae, the *Graphis*-like ascospores and the absence of lichen compounds. The lirellae are thin and inconspicuous when compared with other species in the genus such as *H. aphanes* (cf. Archer 2006: 173, Fig. 81). Staiger (2002) reported the ascospores to be 40–50 \times 8–10 μm and 12–15-locular, whereas Nylander (in Krempelhuber 1876) reported the ascospores to be 36–39 \times 8–9 μm and 12-locular. Nylander rejected Fée's epithet as unsuitable, and based his species *G. chlorocarpella* on the same type material as Fée's *G. implicata* (Nylander in Krempelhuber 1876); *G. chlorocarpella* thus becomes a later synonym (Staiger 2002). The species is also known from Brazil and French Guiana, and from Mexico (Wirth & Hale 1963).

SPECIMEN EXAMINED:

Western Australia: • Mitchell Plateau, 14°53'S, 125°50'E, on tree trunk with smooth bark in vine thicket, *R. Hnatiuk MP196D*, 25.vi.1976 (PERTH 02898071).

Phaeographis colligata (Stirt.) Zahlbr., *Cat. Lich. Univ.* 2, 366 (1924)

Fig. 5

Graphis colligata Stirt., *Proc. Philos. Soc. Glasgow* 12, 185 (1881)[1882].

Type: India, Assam, *A. Watt s.n.*, 1879; (lectotype – BM *vide* Singh & Awasthi 1979).

Thallus corticolous, off-white to pale fawn, surface smooth and dull. Apothecia lirelliform, numerous, crowded, conspicuous, in stellate clusters to 2 mm diam., individual lirellae 1–1.5 mm long, 0.1–0.15 mm wide, terminally acute, lips open. Exciple dark brown, thin, complete. Epithecium matt brownish black, pruinose. Hymenium 80–90 μm tall, I–, interspersed. Ascospores 8 per ascus, pale brown, oblong-ellipsoid, 16–18 μm long, 6–8 μm wide, 4-locular.

Chemistry: norstictic acid (major) and connorstictic acid (minor).

This species is characterized by the stellate lirellae, the small 4-locular ascospores, the presence of norstictic acid and the interspersed hymenium. It resembles *P. brasiliensis* (A. Massal.) Kalb & Matthes-Leicht and *P. inconspicua* (Fée) Müll. Arg.; both of those species have open lirellae and small 4-locular ascospores, and they contain norstictic acid, but neither has an interspersed hymenium. It also resembles *P. inusta* (Ach.) Müll. Arg., but that species lacks both an interspersed hymenium and norstictic acid. Singh & Awasthi (1979) reported the hymenium to react I+ pale blue, but this was not found in the specimen cited above, in agreement with Stirton's observation in the protologue “*Todo gel. hym. pallide rufescens vel non tincta*” (Stirton 1882).

This species occurs in Assam and West Bengal, India (Singh & Awasthi 1979), but previous reports from Christmas Island and Fiji (Archer 2003) were erroneous because the specimens lacked norstictic acid.

SPECIMEN EXAMINED

Queensland: • Edmund Kennedy National Park, Picnic Ground, 10 km NNE of Cardwell, 18°12'49"S, 146°00'44"E, alt. 2 m, strand vegetation along margin of coastal *Eucalyptus* forest, on vine, *J.A. Elix 37765*, 27.vii.2006 (CANB).

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Fig. 1. *Acanthothecis tetraphora*. Archer G74 (NSW).



Fig. 2. *Graphis analoga*. Elix 20794 (CANB). Fig. 3. *Graphis virescens*. Elix 37626 (CANB). Fig. 4. *Hemithecium implicatum*. Hnatiuk MP196D (PERTH). Fig. 5. *Phaeographis colligata*. Elix 37765 (CANB).

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THELOTREMATACEAE WORKSHOP — Bangkok, Thailand, March 12–15, 2008

On March 12–15 (Wednesday–Saturday) of this year, a Thelotremataceae workshop will be held at Ramkhamhaeng University in Bangkok, Thailand, organized by Kansri Boonpragob (Bangkok) and Thorsten Lumbsch (Chicago). The workshop is intended for East Asian students who have a general interest in lichens as well as students from outside the region with a particular interest in tropical crustose lichens. Up to 25 can attend. The workshop is financially supported by the National Science Foundation.

Wednesday will be devoted to talks: general lectures on Thelotremataceae biology and taxonomy, and recent studies in the family. To date, speakers include Klaus Kalb (Neumarkt), Robert Lücking (Chicago), Armin Mangold (Essen), and Khwanruan Papong (Khon Kaen), as well as the two organizers. Colleagues who wish to contribute oral presentations should contact Thorsten for more information. A field trip to the Khao yai National Park is planned for Thursday and Friday, with an overnight stay in the park. On Saturday, the collections will be identified and discussed.

On March 10–11 (Monday and Tuesday), a preliminary course will be offered to students with only limited experience of lichens. Monday will be an introduction to lichen taxonomy and identification methods, and Tuesday will be a practical course.

For local information, contact Kansri (e-mail: kansri@ram1.ru.ac.th)

Dr H. Thorsten Lumbsch
 THE FIELD MUSEUM, Botany Department
 1400 South Lake Shore Drive, Chicago, ILLINOIS, 60605, USA
 phone: +1-312-665-7881, fax: +1-312-665-7158

18th MEETING OF AUSTRALASIAN LICHENOLOGISTS — 12–13 April, 2008

The 18th meeting of Australasian Lichenologists will be held in Traralgon, Victoria (Gippsland), on 12–13 April, 2008 (Saturday and Sunday). The meeting will begin at 9 a.m. Saturday at the Regional Office of the Department of Sustainability and Environment (DSE). You can park all day on Service Street at the rear of the building, or you can park in the DSE carpark on the corner of Service Street and Franklin Street (see below for a link to an on-line map). Enter the building at the front on Hotham Street.

Several talks are scheduled for Saturday morning, with fieldwork following in the afternoon at Morwell National Park. The park lies 25 km SSW of Traralgon, and contains remnants of the original Strzelecki Ranges forest, including wet forest with fern gullies and drier stringy bark vegetation. A group dinner is planned for the evening.

Sunday will be devoted to fieldwork in the Baw Baw Ranges. Departure will be at 8:30 a.m. from the DSE Office in Traralgon. The main collecting site will be subalpine granite outcrops called Mushroom Rocks. If time permits, we'll stop at other sites, but we plan to be back in Traralgon by 3 p.m., where the meeting will end.

The DSE and Parks Victoria have issued a permit for small personal collections at the fieldwork sites during the two days of the meeting.

A preliminary announcement of the meeting appeared in the last issue (Volume 61) of *Australasian Lichenology*. If you wish to attend, please contact Simone Louwhoff by March 20 with details of which days you'll attend (Saturday, Sunday, or both), and if you plan to attend the dinner, plus if you need transport on the fieldtrips, and if you'd like to present a talk. Hope to see you there!

Simone Louwhoff contact details: post: RMB 3137, Traralgon South, Victoria 3844, AUSTRALIA. phone: +61-(03)-5195-5006. e-mail: slouwhoff@hotmail.com

Web-site information: Traralgon DSE Office map — map 5, J7 at:

<http://www.arta.com.au/vicmaps/traralgon/traralgon5.html>

Accommodation: <http://www.travelvictoria.com.au/traralgon/accommodation/>

Two new species of *Letrouitia* (Letrouitiaceae: Ascomycota) from Australia

John A. Elix

School of Chemistry, Building 33
Australian National University, Canberra, ACT 0200, Australia
e-mail: John.Elix@anu.edu.au

Sergey Y. Kondratyuk

M.H. Kholodny Institute of Botany, Tereshchenkivska Str. 2, 01601 Kiev, Ukraine
e-mail: ksya_net@ukr.net

Abstract: *Letrouitia hafellneri* S.Y.Kondr. & Elix and *L. leprolytoidea* S.Y.Kondr. & Elix are described as new to science and are compared with allied taxa. A key to the sorediate and isidiate species of *Letrouitia* is provided.

The examination of various collections of crustose lichens in preparation for a further lichen volume of the *Flora of Australia* has led to the identification of two undescribed species, namely *Letrouitia hafellneri* S.Y.Kondr. & Elix and *L. leprolytoidea* S.Y.Kondr. & Elix. Chemical constituents were identified by high-performance liquid chromatography (Elix *et al.* 2003) and comparison with authentic samples.

Letrouitia hafellneri S.Y.Kondr. & Elix, sp. nov.

Figs 1, 2

Sicut *Letrouitia domingensis* sed superfice isidiatis et sorediatis differt.

Type: Australia. Queensland: Machans Beach, a few km N of Cairns, 16°51'S, 145°45'E, 3 m, on an old mangrove along the Barron River, K. & A. Kalb *s.n.*, 26.viii.1988, (holotype CANB; isotype herb. Kalb).

Thallus up to 10 cm wide, dull to bright yellow or yellow-grey, K+ slowly purple, thin, continuous to areolate; soredia and isidia present. Areoles 0.3–0.5 mm wide, more apparent near the margins. Isidia very thin, 60–70 µm diam., up to 0.3 mm high, simple or branched and becoming coralloid, forming dense aggregations in places. Soralia 0.5–1.5 mm wide, ±orbicular, forming a convex sorediose mass. Soredia very fine at first, (12–)15–20(–25) µm diam., powdery, of irregular shape with numerous pigment granules on the surface, soon becoming aggregated in the larger, ±rounded or irregular aggregations (25–)40–55 µm diam. Hypothallus not apparent. Apothecia dispersed, round to somewhat distorted, thick (to 0.45 mm) and rising above level of thallus, constricted at base, 0.5–1.0 mm wide; disc concave at first, yellowish brown or ±yellowish pruinose, then flat and dark orange-brown to dark brown or blackish brown; margin prominent, thick, 0.1–0.15(–0.2) mm wide, bright yellow at first but soon becoming orange to brownish orange, disc and margin K+ blue-violet (appearing black under the microscope); proper exciple (in cross-section) up to 200 µm thick in the uppermost and lower lateral portions, with numerous anthraquinone crystals in the inner layers; outer layers K+ violet. Epithemium encrusted with orange anthraquinone crystals, K+ violet. Hymenium colourless, 100–110 µm high. Paraphyses conglutinated, usually branched sparingly, not expanding towards the tips, c. 2 µm diam. Hypothecium colourless, 40–50 µm thick. Asci 8-spored. Ascospores ellipsoidal, transversely septate with 6–8 lens-shaped locules, 25–37 x (9–)11–14(–15) µm in water, becoming longer in K, 27–46 x (10–)11–14(–15) µm. *Conidia* long, bacilliform, 4–6(–7) x 0.9–1 µm.

Chemistry: Thallus and apothecia K+ blue-violet; containing fragilin (major), ±parietin (minor), ±7-chloroemodin (trace), ±7-chloroemodinal (trace), ±7-chloroparietinic acid (trace), flavo-obscurin A (minor), ±physcoin bisanthrone (trace).

Etymology: This species is named in honour of the well-known Austrian lichenologist Josef Hafellner, author of the world monograph on the genus *Letrouitia*.

Remarks

This new species is distinguished by the simultaneous presence of true isidia and soredia on the upper surface. Both *L. corallina* (Müll. Arg.) Hafellner and *L. leprolyta* (Nyl.) Hafellner have isidia, but lack soredia and have different ascospores. Thus *L. corallina* has 2-spored asci with much larger (45–58 x 16–21 µm) submuriform ascospores. *Letrouitia hafellneri* differs from *L. leprolyta* in having longer, mainly 8-locular (6-locular in *L. leprolyta*) ascospores (25–37 µm *vs.* 18–30 µm long), as well as in having soralia. *Letrouitia coralloidea* (Müll. Arg.) Hafellner is sorediate [but is so far known only in the sterile state], but the soredia are larger (20–50 µm *vs.* 12–25 µm diam.), and it lacks isidia. The chemistries of these taxa are essentially identical (Johansson *et al.* 2005). The apothecia and ascospores of *L. hafellneri* are very similar to those of *L. domingensis* (Pers.) Hafellner & Bellem., but the latter lacks soredia and isidia.

SPECIMEN EXAMINED

Queensland: • Ellis Beach, 27.4 km N of Cairns, 16°44'S, 145°39'E, 1 m, on trees along the foreshore, J.A. Elix 2570, 25.viii.1976 (CANB).

Letrouitia leprolytoidea S.Y.Kondr. & Elix, sp. nov.

Figs 3, 4

Sicut *Letrouitia leprolyta* sed isidiis digitiformis vel coralloidibus, asci 4–8-sporis et ascosporis 6–8-locularibus differt.

Type: Australia. Queensland, Cairns, road to airport, 16°53'24"S, 145°45'41"E, 3 m, on mangrove bark [thallus and apothecia damaged by *Opegrapha* sp.], J. Vondrák 5080, 18.viii.2006 (holotype CANB; set of isotypes prepared for exsiccata).

Thallus 2–3 cm wide, greenish or greenish yellow, ±distinctly areolate, sometimes indistinct due to the development of a concolorous or yellow hypothallus, thin; isidia present, soredia absent. Areoles 0.2–0.5 mm wide, with isidiate margins. Isidia initially short and thin, 50–70 µm diam., c. 0.1 mm high, finger-like and concolorous with areoles, then becoming thicker and longer, 70–90 µm diam., 0.2–0.3(–0.4) mm high, pointed towards the tips, branched and becoming coralloid, dark orange to brownish orange, distinctly brighter and paler yellow at the apices, often aggregated in a lax isidiose mass. Hypothallus yellow, usually present. Apothecia rare, biatorine, round to somewhat distorted, thick (to 0.35 mm) and rising above level of thallus, constricted at base, 0.4–0.9 mm wide; disc concave at first, dark orange to dull brownish orange or dark brown; margin prominent, thick, 0.1–0.2 mm wide, yellow to pale brownish yellow, disc and margin K+ purple-violet; proper exciple (in cross-section) 120–150 µm thick in the uppermost lateral portions, c. 130 µm thick in the lower lateral portion and 150–170 µm thick in basal portion of 'textura intricata' in which single, thick-walled hyphae 4–6 µm wide are present; cell lumina 1–1.5 µm diam., with outer layers in lateral portions and on underside somewhat brownish orange, outer layers K+ purple. Epithemium brownish orange, K+ violet. Hymenium colourless, 80–90 µm high. Paraphyses thin, not branched or swollen towards the tips, c. 2 µm diam. Hypothecium colourless, 50–70 µm thick, with small oil droplets. Asci (4–6)–8-spored. Ascospores ellipsoidal, transversely septate with (4–)6(–8) lens-shaped locules, (17–)23–30(–31) x (8–)9–12(–14) µm in water, (22–)28–38(–42) x 12–14(–16) µm in K. Pycnidia not seen.

Chemistry: Thallus and apothecia K+ purple-violet; containing fragilin (major), ±parietin (minor), ±7-chloroemodin (trace), ±7-chloroemodinal (trace), ±7-chloroparietinic acid (trace), flavo-obscurin A (minor), ±physcoin bisanthrone (trace).

Etymology. The specific epithet derives from the Greek *-oides* (resembling or having the form of) and *L. leprolyta*, the species that the new taxon most closely resembles.

Remarks

This new species is distinguished by the presence of finger-like to coralloid isidia on the upper surface, (4–)6–(8)-spored asci and (4–)6–(8)-locular ascospores. This species has previously been confused with *L. leprolyta*, but re-examination of the type material has confirmed that the latter has short, wart-like or erumpent isidia (0.1–0.15 mm wide and 0.1–0.2 mm long), whereas *L. leprolytooides* has cylindrical, finger-like to coralloid-branched isidia (50–70 μm wide and 0.3–0.4 mm long). In addition, *L. leprolytooides* differs from *L. leprolyta* in having mainly (4–)6–(8)-spored asci and somewhat longer ascospores [(17–)23–30(–31) μm vs. (18–)19–26(–30) μm in water]. We were only able to detect 2–4 well-developed ascospores in asci of the type of *L. leprolyta*, but other specimens exhibited (2)–4(–8)-spored asci.

SPECIMENS EXAMINED

Queensland: • Ingham-Kangaroo Hills road, 30 km WSW of Ingham, 18°46'S, 145°54'E, 200 m, on sapling in disturbed rainforest, J.A. Elix 20461 & H. Streimann, 19.vi.1986, (CANB); • Conway Road, 13 km SE of Proserpine, 20°27'S, 148°42'E, 1 m, on *Rhizophora* in mangrove swamp, J.A. Elix 20960 & H. Streimann, 30.vi.1986 (CANB); • First Turkey, Mount Archer Environmental Park, 7 km NE of Rockhampton, 23°21'S, 150°34'E, 200 m, on tree trunk in low monsoon scrub beside seasonal stream, J.A. Elix 34538, 24.viii.1993 (CANB); • Ross Creek, Yeppoon, 23°08'S, 150°45'E, 2 m, on *Bruguiera* in mangrove swamp, J.A. Elix 34593, 24.viii.1993 (B, CANB).

Northern Territory: • Channell Point, 23 km NNW of mouth of Daly River, 13°07'S, 130°13'E, 10 m, on tree trunk in monsoon forest, J.A. Elix 27725, H.T. Lumbsch & H. Streimann 48285, 5.vii.1991 (CANB); • Black Jungle, 42 km ESE of Darwin, 12°33'S, 131°13'E, 15 m, on treelet in scrub dominated by *Acacia* and *Barringtonia*, H. Streimann 48638, 22.vii.1991 (B, CANB, ESS, MINN), H. Streimann 48644 (CANB).

Key to species of *Letrouitia* with soredia or isidia

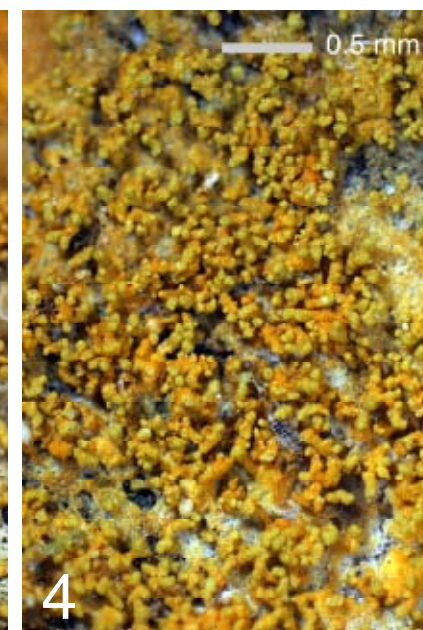
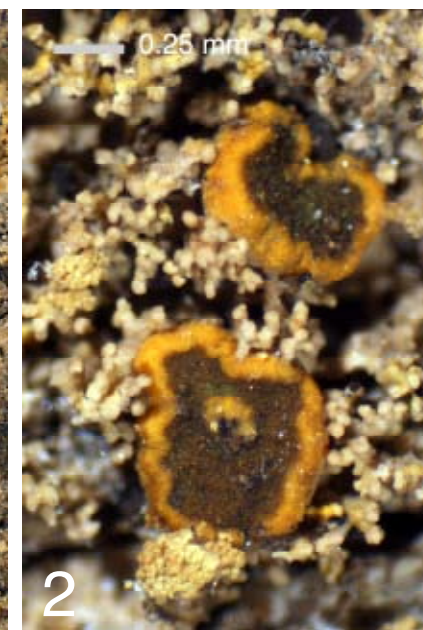
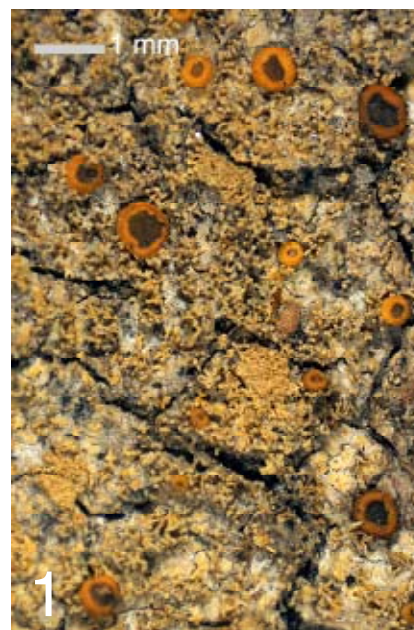
- 1 Thallus with soredia and \pm pseudoisidia; true isidia absent.....**coralloidea**
 1: Thallus isidiate; soralia present or absent.....2
- 2 Isidia wart-like, erumpent or flattened; soralia absent.....3
 2: Isidia cylindrical, finger-like or coralloid; soralia present or absent.....4
- 3 Isidia wart-like or erumpent; asci (2)–4(–8)-spored; ascospores transversely septate, 18–30 x 8–13 μm **leprolyta**
 3: Isidia \pm flattened; asci 1- or 2-spored; ascospores submuriform, 36–42 x 15–20 μm**corallina**
- 4 Soralia present; asci 8-spored; ascospores 25–37 x 9–15 μm **hafellneri**
 4: Soralia absent; asci (4)–6–8-spored; ascospores 17–31 x 8–14 μm .. **leprolytooides**

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We thank the herbaria G, H and W for the loan of critical specimens, and K. Kalb and J. Vondrák for providing us with their personal collections on loan.

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Figures: 1–2. *Letrouitia hafellneri* (holotype in CANB); 3–4. *Letrouitia leprolytooides* (holotype in CANB).

A further new species of *Hafellia* (Physciaceae, lichenized Ascomycota) from Australia

John A. Elix

Department of Chemistry, Faculty of Science, Building 33
Australian National University, Canberra, ACT 0200, Australia
e-mail: John.Elix@anu.edu.au

Patrick M. McCarthy

Australian Biological Resources Study, GPO Box 787
Canberra, ACT 2601, Australia
e-mail: Patrick.McCarthy@environment.gov.au

Abstract: The examination of various collections of crustose lichens in preparation for a further lichen volume of the *Flora of Australia* has led to the identification of several undescribed species. A new further species of *Hafellia* is described in the present paper. 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.

Hafellia subtropica Elix, sp. nov.

Figs. 1–2

Sicut *Hafellia curatellae* sed ascosporae latus et acidum hafellicum continente differt.

Type. Australia. New South Wales, Mann River Nature Reserve, Diehard Creek, 50 km E of Glen Innes, 29°40'29"S, 152°05'19"E, 595 m, on *Allocasuarina* in *Allocasuarina-Eucalyptus* woodland along stream, *J.A. Elix* 37066, 1.v.2005 (holotype CANB).

Thallus corticolous, 1–3 cm wide, thin, c. 0.7 mm thick, finely rimose to deeply cracked and areolate. Prothallus black or not apparent. Upper surface whitish, grey-white to grey, weakly to markedly verruculose. Apothecia common, 0.2–1.2 mm wide, moderately immersed to sessile; disc black, epruinose, concave at first then flat to weakly convex, ±tuberculate; margin black, narrow or excluded in convex apothecia. Exciple brown-black, with or without a paler in the inner part. Epihymenium 10–15 µm thick, olive-brown to dark brown, K–. Hymenium 70–120 µm thick, interspersed with oil droplets particularly towards the base. Hypothecium 80–150 µm thick, brown-black. Asci 8-spored, 45–65 x 10–20 µm. Ascospores narrowly to broadly ellipsoidal, 1-septate, olive to brown, 16–23 x 8–14 µm, with weak subapical wall thickenings; outer wall moderately ornamented. Pycnidia not seen.

Chemistry: Thallus K+ red, C–, P+ yellow or yellow-orange; containing norstictic acid (major), hafellic acid (major), neopaludonic acid (trace), neosubpaludonic acid (trace), connorstictic acid (minor or trace).

Etymology: The specific epithet derives from the subtropical habitats occupied by this species.

Notes. This new species is characterized by the whitish, grey-white to grey thallus, the 8-spored asci, the olive-brown to dark brown epihymenium (reacting K–), the relatively small, ellipsoid ascospores (16–23 x 8–14 µm) with relatively weak subapical wall thickenings, a moderately ornamented outer spore wall, and the presence of norstictic and hafellic acids. Hafellic acid exhibits the following Rf values in the standard TLC solvent systems: A 0.50, B 0.32, C 0.33 [the spot appears fluorescent sky-blue under long wavelength ultraviolet light after sulfuric acid treatment and charring] (Elix & Ernst-Russell 1993). *Hafellia curatellae* (Malme) Marbach is superficially similar but differs in having narrower ascospores (15–22 x 6–8 µm *vs.* 16–23 x 8–14 µm), an epihymenium that often reacts K+ clear yellow-green or olive, a more or less smooth outer spore wall and contains only norstictic and connorstictic acids (Etayo & Marbach 2003, Marbach 2000).

The new species occurs on bark in coastal and montane forests in southern Queensland and northern New South Wales. Commonly associated species include *Brigantiaea microcarpa* (Räsänen) Hafellner, *Flavoparmelia euplecta* (Stirt.) Hale, *Fuscidea elixii* Kantvilas, *Heterodermia speciosa* (Wulfen) Trevis., *Lecanora achroa* Nyl., *Parmelia erumpens* Kurok., *Parmotrema reticulatum* (Taylor) M. Choisy, *Pertusaria commutata* Müll. Arg., *P. erythrella* Müll. Arg., *Relicina sydneyensis* (Gyeln.) Hale, *Ramalina peruviana* Ach., *Usnea dasaea* Stirt. and *U. confusa* Asahina.

ADDITIONAL SPECIMENS EXAMINED

Queensland: • Bunya Mountains State Forest, Nanango Road, 64 km NE of Dalby, 26°51'49"S, 151°38'51"E, 670 m, on twigs of shrub in mixed *Eucalyptus-Araucaria* forest, *J.A. Elix* 37958, 7.v.2005 (CANB).

New South Wales: • type locality, on *Allocasuarina* in *Allocasuarina-Eucalyptus* woodland along stream, *J.A. Elix* 37054, 1.v.2005 (holotype CANB); • Washpool National Park, Gibraltar Range, Hakea Walk, 78 km E of Glen Innes, 29°28'10"S, 152°21'01"E, 895 m, on fallen *Acacia* in mixed rainforest with scattered *Eucalyptus*, *J.A. Elix* 37259, 2.v.2005 (CANB).

Acknowledgement

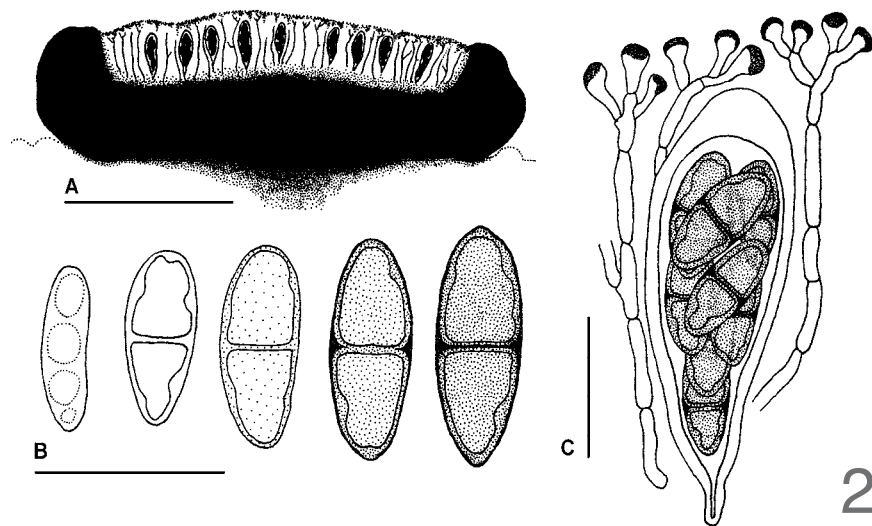
We thank Neal McCracken of ANU Photography for the photograph.

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1



2

Figures 1–2. *Hafellia subtropica* (holotype in CANB): 1, habit (scale in mm); 2A, sectioned apothecium [scale 0.2 mm]; 2B, stages of ascospore development [scale 20 μm]; 2C, mature ascus and paraphyses [scale 20 μm].

Verrucaria pluviostilvestris sp. nov., a common lichen of rainforest in north-eastern Queensland

Patrick M. McCarthy

Australian Biological Resources Study,
GPO Box 787, Canberra, ACT 2601, Australia

Abstract: *Verrucaria pluviostilvestris* P.M.McCarthy (Verrucariaceae) is described as new. This lichen is common on sheltered, non-aquatic siliceous rocks of various types in lowland and montane rainforest in north-eastern Queensland.

In July and August, 2006, a collecting trip to rainforest and associated habitats between Townsville and Cape Tribulation, north-eastern Queensland, confirmed the significance of pyrenocarpous lichens in the saxicolous communities of creeks and creek-banks, cliffs, gorges and sheltered outcrops. While Porinaceae are especially diverse in the region, species of *Anisomeridium*, *Strigula* and Verrucariaceae are also prominent. One previously undocumented *Verrucaria* is particularly common on non-aquatic rocks, and is described here.

***Verrucaria pluviostilvestris* P.M.McCarthy, sp. nov.**

Thallus epilithicus, laevigatus, rimosus vel areolatus, 30–60 μm crassus, albidus vel pallidogriseus, sine strato basali, madefactus pallidoviridis. Perithecia numerosa, fere omnino immersa, (0.2–)0.38(–0.55) mm diametro, apicibus nigris, (0.08–)0.15–0.22(–0.35) mm diametris. Involucrellum ad basim excipuli descendens, deinde late expansum. Centrum 0.15–0.28 mm diametro. Periphyses 15–30(–40) \times (1.5–)2–2.5 μm . Asci 65–115 \times 24–40 μm . Ascosporae plerumque elongatae-ellipsoideae, (22–)31(–39) \times (9–)12(–15) μm .

Fig. 1

Type: Australia, Queensland, Tully Gorge Natl Park, Tully Gorge, banks of Tully R. below Kareeyah Power Station, 55 km NW of Tully, 17°46'03"S, 145°34'48"E, on shaded siliceous rocks in rainforest gorge, alt. 220 m, P.M.McCarthy 2577, 28.vii.2006 (holotype CANB; isotype BRI).

Thallus crustose, epilithic, sometimes coalescing to form colonies to 5(–10) cm wide, usually off-white to pale grey when dry, occasionally darker, richly rimose to areolate (less rimose in deep shade), with a smooth to rugulose or irregularly and minutely uneven surface, matt, 30–60 μm thick in the absence of ascomata, to 100(–120) μm thick between ascomata in richly fertile thalli; moist thalli pale greenish (when ascomata are sparse) to medium greenish grey (when ascomata are numerous and densely aggregated); areolae angular to irregular, separated by thin cracks. True cortex lacking, but the uppermost 10–20 μm of the thallus without algae; cells rounded to angular and vertically elongate, 3–8 \times 3–5 μm , hyaline, thin-walled. Algae chlorococcoid, dominating the rest of the thallus (vertical section), bright green, globose, subglobose or ellipsoidal, 5–10(–12) \times 4–8(–10) μm ; interstitial cells similar to those of the alga-free layer. Prothallus not apparent. Basal layer absent; however, overlapping involucrellum bases in abundantly fertile thalli can give the misleading impression of a thick continuous layer of blackish basal hyphae. Perithecia usually very numerous, almost entirely immersed in the thallus, with only the upper part of the involucrellum exposed; wetting the thallus often shows the full extent of the immersed involucrellum; perithecia less commonly semi-immersed in the thallus. Involucrellum black, (0.2–)0.38(–0.55) mm diam. [25 measured], usually exposed only towards the apex, c. 40–60 μm thick, contiguous with the excipulum but also spreading laterally into the thallus and towards the substratum. Perithecial apex usually plane to convex, (0.08–)0.15–0.22(–0.35) mm diam. [50 measured], with a central, hyaline to grey-brown plane shallowly depressed or, occasionally, crateriform ostiole (40–)80(–100) μm diam. Excipulum hyaline to greyish brown in thin section, 20–25(–30) μm thick. Centrum

subglobose to obpyriform, 0.15–0.28 mm diam. Periphyses 15–30(–40) × (1.5–)2–2.5 μm, simple to sparingly branched. Paraphyses absent at maturity. Hymenial gel IKI+ orange-brown. Asci fissitunicate, 8-spored, narrowly to broadly clavate to cylindro-clavate or obclavate, occasionally almost subglobose, 65–115 × 24–40 μm. Ascospores simple, hyaline, narrowly to broadly ellipsoidal, occasionally subcylindrical or broadly clavate, biseriate or irregularly massed in the asci, (22–)31(–39) × (9–)12(–15) μm [80 measured]; wall usually 0.7–1 μm thick, occasionally to 2 μm (due to environmental stress?); contents granulose and, frequently, large-guttulate.

Etymology: From the Latin *pluvius* (rainy) and *silvestris* (of the forest), in reference to the habitat of the species.

Remarks

The new species is characterized by a combination of very pale areolate thallus, very numerous and largely immersed perithecia, each with a spreading involucrellum, and comparatively large asci and ascospores. The aquatic and semi-aquatic *V. praetermissa* (Trevis.) Anzi occurs, among other places, in south-eastern and north-eastern Queensland (including the Atherton Tableland). However, while the thallus is outwardly and anatomically quite similar to that of *V. pluviostilvestris*, it is subtended by a thick brownish black basal layer. In addition, the ascospores are considerably smaller [15–24 × 6.5–9.5 μm; McCarthy (2001)]. The newly described lichen does not grow in creeks or on seasonally inundated rocks.

Verrucaria pluviostilvestris was collected from shaded, fine- and coarse-grained siliceous rock outcrops, boulders and cliff faces in rainforest at ten localities between Wallaman Falls (18°35'S) and Mossman Gorge (16°28'S) and at elevations of 55–980 m. It is likely to be as common in similar habitats further south in Queensland.

ADDITIONAL SPECIMENS EXAMINED

Queensland: • Girringun Natl Park, Wallaman Falls, 50 km W of Ingham, Jinda Track, 18°35'21"S, 145°48'20"E, on shaded siliceous rocks in deep gorge, alt. 300–500 m, *P.M. McCarthy 2549*, 25.vii.2006 (CANB); • Murray Falls State Forest Park, 19 km WSW of Bilyana, 18°09'14"S, 145°48'58"E, on deeply shaded rocks in rainforest, alt. 55 m, *P.M. McCarthy 2592, 2596*, 27.vii.2006 (CANB); • Tully Gorge Natl Park, Tully Gorge, banks of Tully R., below Kareeyah Power Station, 55 km NW of Tully, 17°46'03"S, 145°34'48"E, on shaded siliceous rocks in rainforest gorge, alt. 220 m, *P.M. McCarthy 2578, 2630*, 28.vii.2006 (CANB); • Atherton Tableland, Elinjaa Creek, below Elinjaa Falls, c. 5 km ENE of Millaa Millaa, 17°29'38"S, 145°39'20"E, on deeply shaded fine-grained siliceous rock in rainforest, alt. 705 m, *P.M. McCarthy 2514, 2517*, 29.vii.2006 (CANB); • Wooroonooran National Park, tributary of North Johnstone River, track to Tchupala Falls, 34 km W of Innisfail, 17°36'25"S, 145°46'44"E, on deeply shaded siliceous rocks in rainforest, alt. 300–350 m, *P.M. McCarthy 2538*, 30.vii.2006 (CANB); • Mossman Gorge, 6 km W of Mossman, 16°28'21"S, 145°19'54"E, on deeply shaded siliceous rocks in rainforest, alt. 60 m, *P.M. McCarthy 2621*, 1.viii.2006 (CANB); • Atherton Tableland, Mount Hypipamee Natl Park, track to Dinner Falls, 25 km S of Atherton, 17°25'42"S, 145°29'10"E, on moderately shaded siliceous rocks, alt. 980 m, *P.M. McCarthy 2589*, 5.viii.2006 (CANB); • Atherton Tableland, Wongabel State Forest, 10 km S of Atherton, 17°19'56"S, 145°30'01"E, on shaded siliceous rocks in rainforest, alt. 775 m, *P.M. McCarthy 2574*, 5.viii.2006 (CANB); • Atherton Tableland, Danbulla State Forest, Danbulla Forest Drive, Kauri Creek, 24 km E of Tolga, 17°08'02"S, 145°35'55"E, on deeply shaded siliceous rocks in rainforest, alt. 660 m, *P.M. McCarthy 2565*, 6.viii.2006 (CANB); • Atherton Tableland, Tully Falls Natl Park, Charmillin Creek, 12.5 km S of Ravenshoe, 17°46'36"S, 145°33'51"E, deeply shaded siliceous rocks near a creek in rainforest, alt. 620 m, *P.M. McCarthy 2527*, 7.viii.2006 (CANB); • Wooroonooran National Park, tributary of North Johnstone River, above Wallicher Falls, 35 km W of Innisfail, 17°36'18"S, 145°46'21"E, on moderately shaded riverside siliceous rocks, alt. 300–350 m, *P.M. McCarthy 2614*, 10.viii.2006 (CANB).

Acknowledgements

I am grateful to Jack Elix for company and assistance in the field, and to Judith Curnow for arranging collecting permits.

Reference

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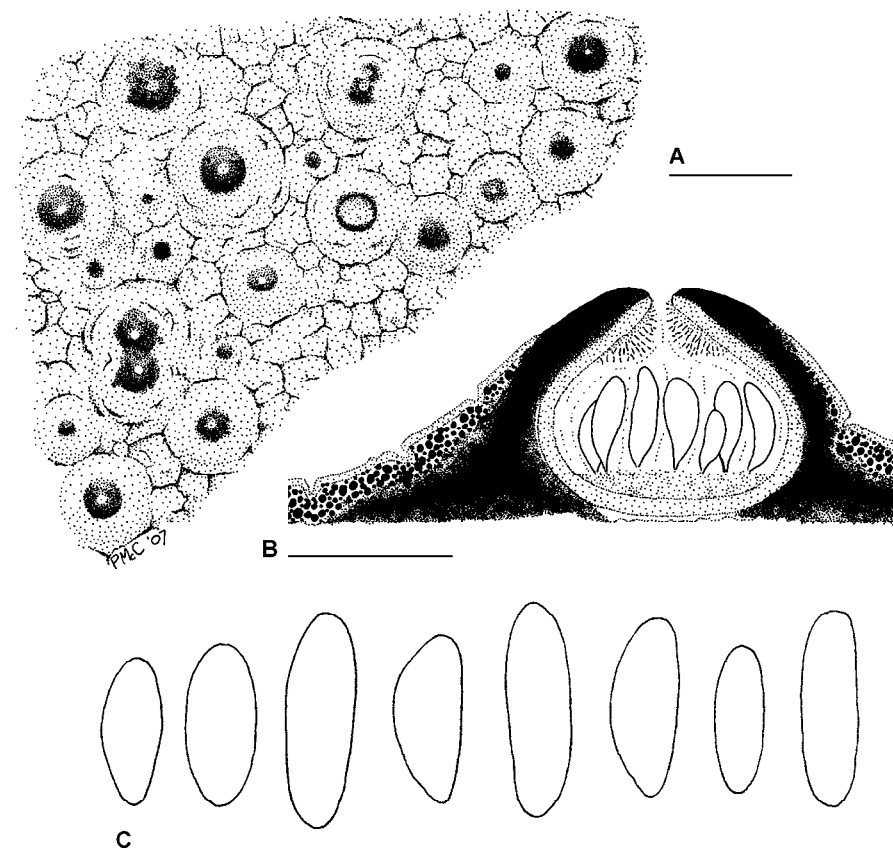


Figure 1. *Verrucaria pluviostilvestris* (holotype). A, Habit of thallus and perithecia. B, Sectioned perithecium and adjacent thallus (semi-schematic). C, Ascospores. Scales: A = 0.5 mm; B = 0.2 mm; C = 20 μm.

A new species of *Melanophloea* (Thelocarpaceae) from north-eastern Queensland

Patrick M. McCarthy

Australian Biological Resources Study,
GPO Box 787, Canberra, ACT 2601, Australia

Abstract: *Melanophloea montana* P.M. McCarthy (Thelocarpaceae) is described as new from sheltered siliceous rocks in montane rainforest in north-eastern Queensland.

In August, 2006, a remarkable lichen with perithecioid ascomata was collected from siliceous rock in the montane rainforest of the Atherton Tableland in north-eastern Queensland. It is described here as *Melanophloea montana* (Thelocarpaceae).

Melanophloea montana P.M. McCarthy sp. nov.

Fig. 1

Thallus epilithicus, rimosus, laevigatus, medioviridigriseus vel griseobrunneus, 30–50(–80) μm crassus, ecorticatus; algae chlorococcoidea. Ascomata perithecia simulant, convexa vel hemisphaerica, superficialia, (0.24–)0.35(–0.42) mm diametro, parietibus viridiatris; paries algae includens. Hymenium amyloideum. Pseudoparaphyses simplices vel anastomosantes. Asci c. 150–200-sporae, 70–150 \times 12–22 μm , parietibus aequae tenuibus. Ascospores numerosae, simplices, hyalinae, plerumque ellipsoideae, 4–6(–6.5) \times (2–)2.5–3 μm .

Type: Australia, Queensland, Atherton Tableland, Ravenshoe State Forest, Tully Falls Weir, 28 km S of Ravenshoe, 17°41'57"S, 145°31'24"E, on deeply shaded, damp siliceous rocks in rainforest, alt. 885 m, P.M. McCarthy 2520, 7.viii.2006 (holotype CANB; isotype HO).

Thallus crustose, epilithic, to 4 cm wide, determinate, sparingly to richly rimose but not areolate, smooth, slightly glossy, medium greenish grey to greyish brown, 30–50(–80) μm thick, ecorticate, tending to peel in places, somewhat pulpy and translucent when wetted. Algae chlorococcoid; cells bright green, globose, (4–)5–7(–8) μm diam., less commonly subglobose to broadly ellipsoidal. Hyphae c. 2 μm wide. Prothallus not apparent; hypothallus absent. Ascomata resembling perithecia, rather numerous, mostly solitary and semi-immersed to almost superficial, convex to hemispherical, (0.24–)0.35(–0.42) mm diam. [50 measured], greenish black, not overgrown by the thallus. Ascomatal apex usually rounded, occasionally somewhat flattened or depressed, with a whitish, grey-green, medium grey-brown or dark brown, (50–)80–120 μm diam. area, viz. the uppermost level of the hymenium. Even when ascomata are uniformly \pm black when dry, when wetted the 'epihymenium' is visible as a brownish disc. Ascomatal wall with an outer, 20–45 μm thick, greenish black hyphal layer (thinner towards the apex, thicker below), with cells 2–4 μm wide, subtended at the apex by the excipulum and, laterally, by thalline hyphae and algal cells. Excipulum enclosing the hymenium, uniformly hyaline to pale yellowish brown, 20–25(–35) μm thick at the base, 30–50(–60) μm thick near the apex, composed of numerous periclinal layers of thin-walled elongate hyphae. Hymenium subglobose to depressed-ovate, 0.18–0.25 mm diam.; hymenial gel IKI+ blue-black; contents remaining coherent in KOH and water. Subhymenium pale brown to medium orange-brown, 40–60 μm thick. Paraphyses rather sparse at maturity, initially more numerous and simple, becoming sparingly branched and anastomosing, (0.5–)1(–1.5) μm wide. Periphyses absent. Asci obclavate, narrowly clavate to elongate-cylindrical, containing c. 150–200 ascospores, 70–150 \times 12–22 μm , IKI+ pale blue; wall uniformly c. 1 μm thick at maturity; apex rounded, apparently lacking dehiscence apparatus, with a very intensely blue cap outside the wall of the apex (G. Kantvilas, pers. comm.); empty post-mature asci remaining visible in the hymenium. Ascospores simple, hyaline, narrowly to broadly ellipsoidal or short-cylindrical, massed in the asci, 4–6(–6.5) \times (2–)2.5–3 μm [50 measured], lacking a perispore; contents clear, non-guttulate. Conidiomata not seen.

Etymology: The epithet *montana* refers to the montane habitat in which the species was found. This is in contrast to the lowland habitats of previous collections of *Melanophloea*.

Remarks

The previously monotypic *Melanophloea* was originally characterized by a granulose corticolous thallus with a chlorococcoid photobiont, prominent perithecioid ascomata with a carbonized wall, a hamathecium of anastomosing filaments, an amyloid hymenium, and thin-walled asci containing very numerous, simple, globose ascospores (James & Vězda 1971). *Melanophloea pacifica* P.W. James & Vězda is known from the bark of rainforest trees in the Solomon Islands and at Cape Tribulation, north-eastern Queensland (James & Vězda 1971, Thor 1995).

While the newly described species can be accommodated in *Melanophloea*, placement there is not entirely satisfactory. The saxicolous thallus is thin and rather smooth, the ascomata are less prominent, and while these are externally rather deeply pigmented, in section the ascomatal wall is not 'carbonized', and it encloses algal cells. Moreover, the ascospores are ellipsoidal to short-cylindrical. Nevertheless, a well-defined suite of thallus and ascomatal characters confirm *Melanophloea* as the most appropriate available genus: a chlorococcoid photobiont, a firm involucrellum-like ascomatal wall, anastomosing filaments resembling pseudoparaphyses, the absence of periphyses, a firmly coherent amyloid hymenium, thin-walled multispored asci, and minute, simple hyaline ascospores.

Melanophloea montana is more remote from *Thelocarpon* Nyl., with its pale, often translucent and more fragile ascomatal wall that lacks all traces of an involucrellum-like layer (Salisbury 1966). However, their relationship is confirmed by the morphology of the ascomata which, rather than being true perithecia, are essentially apothecia with an upwardly curved excipulum that encloses the hymenium but which nevertheless leaves a narrow disc of exposed epihymenium consisting of hamathecial filaments and ascus apices (Fig. 1A, B).

This lichen is known only from the type locality in montane rainforest in north-eastern Queensland. Associated taxa included the locally common pyrenolichens *Anisomeridium australiense* (P.M. McCarthy) R.C. Harris and *Strigula australiensis* P.M. McCarthy.

Melanophloea pacifica P.W. James & Vězda

SPECIMEN EXAMINED

Queensland: • Cape Tribulation National Park, c. 45 km NE of Mossman, Cape Tribulation beach, 16°05'S, 145°30'E, at the base of a tree in open rainforest, alt. 2–10 m, G. Thor 5309, 19.xi.1985 (CANB).

Acknowledgements

Thanks to Jack Elix for company and assistance in the field, and to Judith Curnow for arranging collecting permits. I am especially grateful to Gintaras Kantvilas for discussing the specimen and the options for its generic placement.

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Patrick M. McCarthy

Australian Biological Resources Study,
GPO Box 787, Canberra, ACT 2601, Australia

Abstract: The corticolous *P. kennedyensis* P.M. McCarthy (Porinaceae) is described as new from coastal forest in north-eastern Queensland.

***Porina kennedyensis* P.M. McCarthy sp. nov.**

Fig. 1

Thallus epiphloeodalis, continuus vel leviter rimosus, minute rugulosus vel verruculosus, mediogriseofuscus, 30–80 μm crassus. Perithecia semiimmersa vel plerumque superficialia, (0.32)–0.39(–0.48) mm diametro. Involucrellum dimidiatum aut ad basim excipuli descendens, partim thallo tectis, 30–40 μm crassum, externe griseoatrum vel viridiatrum, interne pallidius. Centrum 0.18–0.28 mm diametro. Excipulum hyalinum, 30–40 μm crassum. Asci elongatae-fusiformes, 118–132 x 14–19 μm , apicibus rotundatis. Ascospores aciculares, (11)–15(–19)-septatae, (61)–82(–98) x (3.5)–4.5(–6) μm .

Type: Australia, Queensland, Edmund Kennedy National Park, 10 km N of Cardwell, 18°12'49"S, 146°00'44"E, on tree bark in coastal forest, alt. 2 m, *P.M. McCarthy* 2562, 27.vii.2006 (holotype CANB).

Thallus crustose, epiphloeodal, c. 2–3 cm wide, determinate, continuous to very sparingly rimose, medium greyish brown, matt, minutely rugulose to verruculose, to 30–80 μm thick, ecorticate; prothallus not apparent; basal layer absent. Algae *Trentepohlia*; cells globose to broadly ellipsoid, 7–16 x 7–12 μm . Hyphae long, branching, 2–2.5 μm thick. Ascomata perithecia, semi-immersed to (mostly) almost superficial, becoming hemispherical, usually solitary, (0.32)–0.39(–0.48) diam. [n = 25], greyish or greenish black above, but the lower parts often remaining covered by the thallus at maturity; apex rounded; ostiole inconspicuous or in a shallow c. 50 μm diam. depression. Involucrellum extending to mid-way down the sides of the excipulum or almost to the base, outer layers dark brown to blackish, medium brown internally, 30–40 μm thick, K–. Centrum subglobose to globose, 0.18–0.28 mm wide. Excipulum c. 30–40 μm thick at the base and sides of the centrum, hyaline, the outer layers hyaline to very pale brownish. Subhymenium 30–40 μm thick. Paraphyses unbranched, 0.7–1(–1.5) μm thick. Periphyses absent. Asci 8-spored, elongate-fusiform, with a rounded apex that lacks an apical chitinous ring, 118–132 x 14–19 μm . Ascospores acicular, usually straight or slightly curved, occasionally almost sigmoidal, massed and overlapping in the ascus, hyaline, (11)–15(–19)-septate, (61)–82(–98) x (3.5)–4.5(–6) μm [n = 50]; apices acute, but occasionally the distal end more rounded; perispore not apparent; contents usually clear, occasionally guttulate. Conidiomata not seen.

Etymology: From the type locality, Edmund Kennedy National Park.

Remarks

This lichen is characterized by the superficially blackish perithecia, the unusually thick excipulum, elongate-fusiform asci with a rounded apex, and long, multiseptate acicular spores. Two other Australian species are outwardly very similar, and also produce elongate, multiseptate spores. *Porina raphidiophora* (Nyl.) Müll.Arg. is known from south-eastern New South Wales, Tasmania, New Caledonia, southern New Zealand and Madagascar; its spores are 9–11(–15)-septate and 41–73 x 2–4 μm (McCarthy 2001). *Porina meridionalis* P.M. McCarthy occurs on islands in the Bass Strait and on the north coast of Tasmania; it has elongate-fusiform spores that are

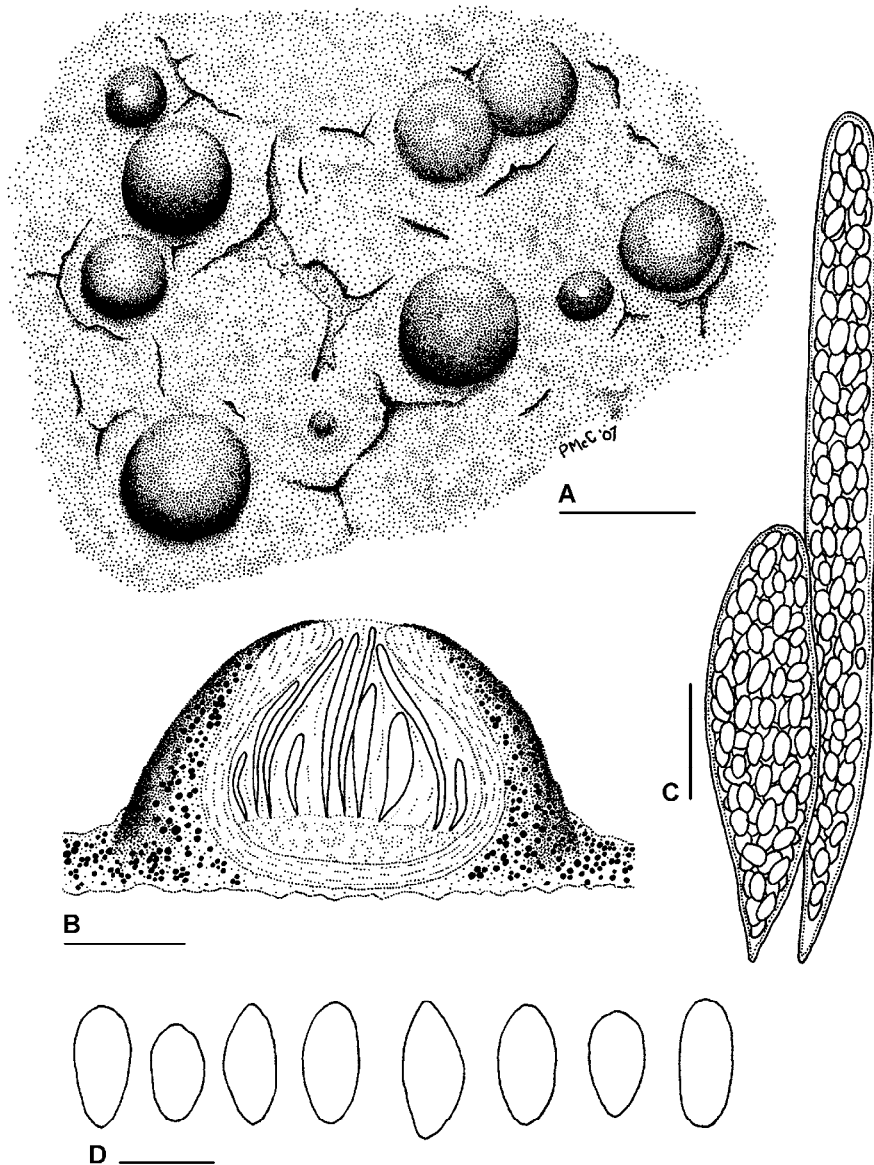


Figure 1. *Melanophloea montana* (holotype). A, Habit of thallus and ascomata. B, Sectioned ascoma and adjacent thallus (semi-schematic). C, Two mature asci. D, Ascospores. Scales: A = 0.5 mm; B = 0.1 mm; C = 20 μm ; D = 5 μm .

often broader towards the distal end, (11–)17(–21)-septate and $41\text{--}73 \times 6\text{--}9.5 \mu\text{m}$ (McCarthy 2001). A third species, *P. raphidosperma* Müll.Arg., is known from eastern and southern U.S.A.; it has filiform, 13–20-septate spores that are $100\text{--}140 \times 3\text{--}5 \mu\text{m}$ (Harris 1995).

These three species have perithecia that are not or scarcely overgrown by the thallus even when immature, have a well-defined, black involucrellum, a comparatively thin excipulum, and elongate-cylindrical asci with a subtruncate apex and an apical chitinous ring that becomes more sharply defined in Congo Red.

Porina kennedyensis is known only from the type locality, a coastal forest in north-eastern Queensland. Other corticolous species at this site include *Bulbothrix goebellii* (Zenker) Hale, *Cratiria lauricassiae* (Fée) Marbach, *Graphis streimannii* A.W.Archer, *Haematomma africanum* (J.Steiner) C.W.Dodge, *H. stevensiae* R.W.Rogers, *Letrouitia leprolytoides* S.Y.Kondr. & Elix, *Parmotrema gardneri* (C.W.Dodge) Sérus., *Pertusaria velata* (Turner) Nyl., *Phaeographis colligata* (Stirt.) Zahlbr., *Porina eminentior* (Nyl.) P.M.McCarthy, *P. internigrans* (Nyl.) Müll. Arg., *P. tetracerae* (Ach.) Müll.Arg., *Pyxine australiensis* Kalb, *P. schmidtii* Vain. and *Ramalina tropica* G.N.Stevens (J.A.Elix, pers. comm.).

Acknowledgements

I am grateful to Jack Elix for company and assistance in the field, and for information on other lichens at the type locality of *Porina kennedyensis*. Alan Archer identified the specimens of *Graphis* and *Phaeographis*.

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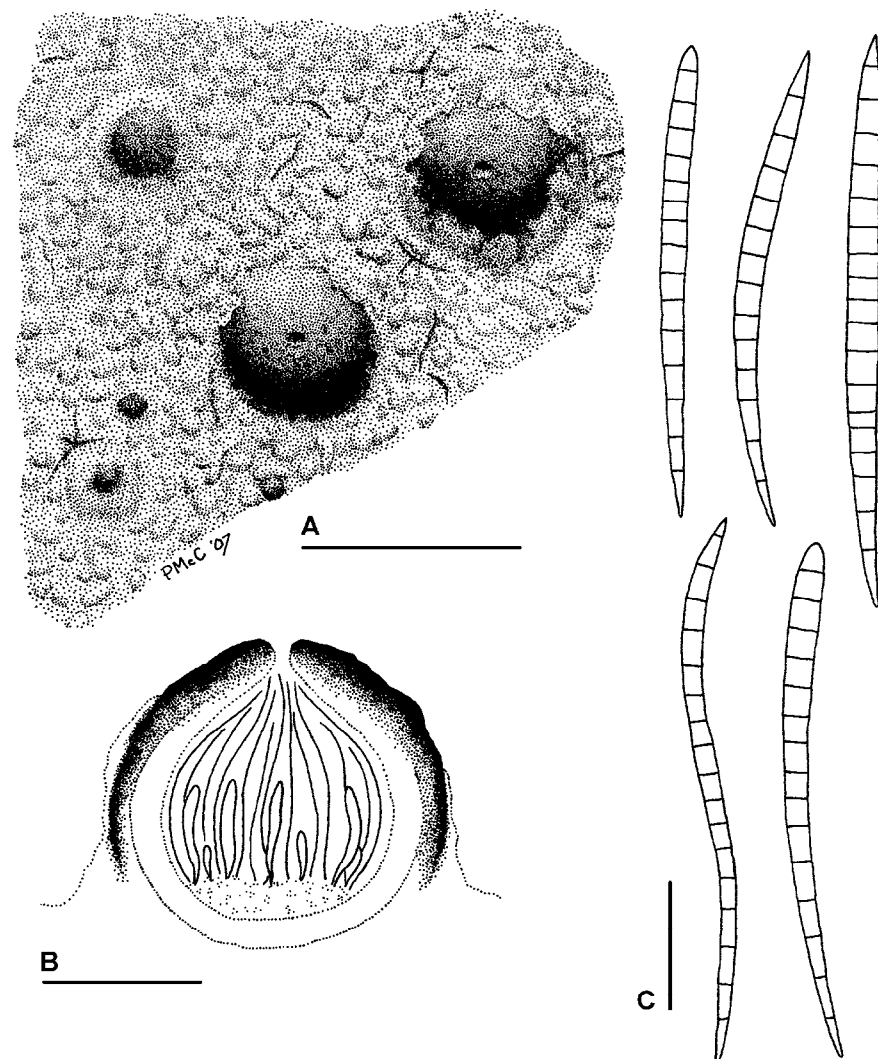


Figure 1. *Porina kennedyensis* (holotype). A, Habit of thallus and ascomata. B, Sectioned ascoma and adjacent thallus (semi-schematic). C, Ascospores. Scales: A = 0.5 mm; B = 0.2 mm; C = 20 μm .

***Hemithecium rimulosum* comb. nov. (Ostropales,
Graphidaceae), a widespread species in eastern Australia**

Armin Mangold and H. Thorsten Lumbsch
Department of Botany, The Field Museum,
1400 South Lake Shore Drive, Chicago, ILLINOIS 60605, USA

Klaus Kalb

Lichenological Institute Neumarkt, Im Tal 12, D-92318 Neumarkt, Germany

Abstract: *Thelotrema rimulosum* Müll. Arg. is shown to be an older available name for *Hemithecium hadrosporum* (A.W.Archer) A.W.Archer. Consequently, the new combination *Hemithecium rimulosum* (Müll.Arg.) Mangold, Lumbsch & Kalb is proposed. The species was previously believed to be restricted to north-eastern Queensland. Here it is shown to be widespread along the east coast of Queensland and north-eastern New South Wales, most specimens hidden among undetermined material of Thelotremataceae.

Introduction

Phaeographina hadrospora A.W.Archer was described based on material from north-eastern Queensland (Archer 2001). The species is characterized by inconspicuous lirellae, the absence of secondary metabolites and large pale brown, muriform ascospores. It was regarded as rare and with a restricted distribution. Following the revised generic concept in Graphidaceae (Staiger & Kalb 1999, Kalb & Staiger 2000, Staiger 2002, Kalb *et al.* 2004), Archer (2005) transferred the species to *Hemithecium*. In a recent monograph, Archer (2006) did not cite any additional specimens. As part of our revision of Australian Thelotremataceae, we became aware of *Thelotrema rimulosum*, a species described from Queensland (Müller 1891). This is a *Hemithecium* species and represents an older available name for *H. hadrosporum*. Further, we found several collections referable to that species among undetermined collections of Thelotremataceae and report a significant range expansion.

Material and Methods

Material from the following herbaria was examined for this study: ABL, B, BRI, CANB, F, G, GZU, MEL, NSW, UPS, US, WELT, and the private herbarium of Klaus Kalb (Neumarkt). Thalli and apothecia were cut using a razor blade and a freezing microtome, and examined in water and lactophenol cotton blue. Thin-layer chromatography was carried out using solvent system B' (Lumbsch 2002) and high-performance liquid chromatography according to Feige *et al.* (1993).

Results and Discussion

***Hemithecium rimulosum* (Müll.Arg.) Mangold, Lumbsch & Kalb, comb. nov.**
Basionym: *Thelotrema rimulosum* Müll.Arg., Nuov. Giorn. Bot. Ital. **23**: 396 (1891). Type: Australia, Queensland, Brisbane, 1887, *Bailey s.n.* (G! - lectotype, here selected). = *Hemithecium hadrosporum* (A.W.Archer) A.W.Archer, *Telopea* **11**: 17 (2005); *Phaeographina hadrospora* A.W.Archer, *Telopea* **9**: 337 (2001). Type: Australia, Queensland, Goodna, no date, F.R.M. Wilson *s.n.* (NSW 426677 – holotype!). = *Thelotrema monosporum* Knight ex Shirley, nom. illegit. (non *T. monosporum* Nyl., *Ann. Sci. Nat., Bot.*, sér. 4, **15**: 46 [1861]), *Proc. Roy. Soc. Queensland* **6**: 191 (1889). Type: Australia, Queensland, Helidon [Toowoomba], Shirley 33 (ex hb. Knight 36: 5, n. 126) (WELT! – lectotype, here selected).

A full description is given by Archer (2001, 2006). The majority of collections examined, including the type of *Hemithecium hadrosporum*, have roundish or only slightly elongate ascomata, and are reminiscent of thelotremoid species. Therefore, it is not

surprising that most material examined was misidentified as *Thelotrema s.lat.* The species is characterized by a corticate, rather thick, strongly fissured and mostly distinctly verruculose thallus, immersed to somewhat emergent ascomata with rather small, roundish to ±elongate pores that are often paler at the rim. The proper exciple is predominantly fused, rather thick, hyaline to greyish or brownish. The hymenium is clear, has slightly branched paraphyses, and is up to c. 300 µm high. The asci are 1-spored. The ascospores are hyaline to yellowish (brown when old), amyloid, thin-walled, eumuriform, and c. 150–250 x 35–65 µm in size. The majority of specimens lack secondary compounds as stated by Archer (2001). However, a few collections contain lichexanthone and/or an unknown substance that appears as a ±faint yellowish spot above psoromic acid on TLC plates in solvent system B'.

The species is widespread from north-eastern Queensland to north-eastern New South Wales (Fig. 1). It occurs in tropical and subtropical rainforests and wet sclerophyll forests.

SPECIMENS EXAMINED

New South Wales: •Lions Tourist Rd near Queensland border, N of Wiangaree, *Hale* 830717, 830872 (US); Border Ranges NP, NE of Wiangaree, *Hafellner* 19365 (GZU); •Mt Warning NP, W of Murwillumbah, *Hale* 830986 (US); •Tweed Range, Mebbin NP, 25 km SW of Murwillumbah, *Mangold* 21-e (F); •Night Cap Forest Drive, W of Mullumbimby: Big Scrub Flora Reserve, *Hale* 830125 (US); •Gibbergunyah Roadside Reserve, Whian Whian SF, *Hale* 831095 (US); •Cambridge Plateau Forest Drive, Richmond Range SF, 30 km W of Casino, *Hale* 832485 (US); •Rawson Falls, 31 km NNW of Taree, *Streimann* 61533 (B, CANB).

Queensland: •Mt Windsor logging area, E of old Forestry Camp, NW of Mossman, *Hale* 832357 (US); •Atherton Tableland: S of Tolga on Kennedy Hwy, *Hale* 831694 (US); •Lake Barrine NP, *Hale* 831013 (US); •W side of Lake Eacham NP, *Hale* 830704, 832317 (US); •9 km W of Plath Rd, Herberton Range, S of Atherton, *Hale* 832360 (US); •Mt Hypipamee NP, S of Atherton, *Hale* 830997, 832361, 832678 (US); •SW of K-1 tree road off Palmerston Hwy, SE of Millaa Millaa, *Hale* 832561 (US); •Tumoulin Rd, 5 km from turnoff to Ravenshoe, *Mangold* 30-j (F); •S of hwy, 13 km E of junction of Kennedy Hwy and Palmerston Hwy, E of Ravenshoe, *Hale* 832359 (US); •Ravenshoe SF, Culpa Ck Catchment, Cardwell Range, 41 km SE of Ravenshoe, *Elix* 16089 (CANB); •Blencoe Creek, Cardwell Range, 48 km NW of Cardwell, *Elix* 20108 (CANB); •Clark Range, 46 km SSW of Proserpine, *Elix* 20837 (CANB); •Kalpowar Forest Drive, c. 40 km NE of Monto, SW of Gladstone, *Hale* 831241, 831364, 832402 (US); •3 km E of junction of Pinnacle Rd and Kalpowar Forest Dr, NE of Monto, *Hale* 831706, 832519 (US); •Mary Cairncross Park, SE of Maleny, *Hale* 831464 (US); •5 km N of Yarraman: Yarraman Forest Drive, *Hale* 831323, 832025, 832537 (US); •On road to Nanango, *Hale* 831211 (US); •Bunya Mountains NP: Just before leaving on the north, *Hale* 831584; Paradise Carpark Trail, *Hale* 832562 (US); •Mt Mee SF near Mt Mee, N of Brisbane: *Hale* 58577, 58624, 58661 (US); •6 km NW of Forestry Office, *Hale* 830940, 832167, 832169, 832356, 832743 (US); Moreton, Lowood, *Wilson* (MEL 26216, NSW 539332); •Upper Coomera, *Wilson* (NSW 539345); •Woolston, *Wilson* (NSW 603837); •Goodna, *Wilson* (NSW 539411 pr.p.); •Rosewood, *Wilson* (NSW 539378); •Cunninghams Gap NP, 50 km NE of Warwick: *Hale* 830300, 830711 (US); •N of Cunningham Hwy, A. & K. *Kalb* 34257, 34258 (hb. Kalb); •Mt Cordeaux, *Hafellner* 8416 (BRI), 16223, 16233, 16282 (GZU); •S Bend near Mossy Gardens, 12 km NE Killarney, *Hale* 59437, 59438 (US); •Killarney, *Wilson* (NSW 539333, 539348, 539417); •13 km N of O'Reillys Guesthouse on road to Lamington NP, *Hale* 830902, 831927 (US); •Lamington NP: Near Lost World, A. & M. *Aptroot* 21911 (ABL); •O'Reillys Guesthouse, A. & K. *Kalb* 19209, 21535 (hb. Kalb); •Main Border Track out of O'Reillys, *Hale* 830252, 830257, 830339 (US); •Moran Falls, *Tibell* 12683 (UPS); •Python Rock Track, *Hale* 830862 (US).

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Figure 1. Known distribution of *Hemithecium rimulosum*.

Four new lichens from tropical and subtropical Australia

John A. Elix

School of Chemistry, Building 33, Australian National University,
Canberra, ACT 0200, Australia
e-mail: John.Elix@anu.edu.au

Abstract: *Cryptothecia queenslandica* Elix, *Dirinaria sekikaica* Elix, *Fellhanera tropica* Elix and *Protoparmelia rogersii* Elix are described as new to science, and the new names *Menegazzia menyamyensis* Elix and *Rinodina austroleprosa* Elix are proposed.

The examination of various collections of lichens in preparation for a further lichen volume of the *Flora of Australia* has led to the identification of several undescribed species. Four such new species are described in the present paper: *Cryptothecia queenslandica* Elix, *Dirinaria sekikaica* Elix, *Fellhanera tropica* Elix and *Protoparmelia rogersii* Elix. 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

Cryptothecia queenslandica Elix, sp. nov.

Fig. 1

Sicut *Cryptothecia australasica* sed acidum gyrophoricum et acidum confluenticum continente differt.

Type: Australia. Queensland, Mossman-Mount Molloy road, 1 km S of Lions Lookout, 20 km N of Mount Molloy township, 16°32'05"S, 145°22'59"E, 390 m, on leaves of roadside treelet at margin of rainforest, J.A. Elix 36915, 4.viii.2006 (holotype BRI; isotype CANB).

Thallus crustose, foliicolous, adnate, ecorticate, pale grey to grey or greenish grey, with scattered paler slightly raised areas, continuous, thin (to 0.1 mm thick), effuse, forming irregularly spreading patches 2–5 cm wide; prothallus very thin and narrow, byssoid, comprising radiating hyphae, whitish. Photobiont a species of *Trentepohlia*, cells rounded to oblong, 7–12 × 5–8 μm, solitary or a few cells aggregated. Medulla indistinct, white. Isidia present, cylindrical, simple, sparsely branched or subcoralloid, 0.1–0.3 mm long, 0.03–0.07 mm wide. Ascigerous parts and pycnidia not seen. Chemistry: Thallus K–, C+ red, KC+ red, P–, UV+ pale grey-white; containing gyrophoric acid (minor), confluent acid (major), lecanoric acid (trace), constipatic acid (minor), and protoconstipatic acid (minor).

Etymology: The specific epithet denotes the occurrence of the species in Queensland.

Notes:

Cryptothecia queenslandica is characterized by the adnate, grey to greenish grey thallus which reacts C+ red (gyrophoric and confluent acids) and the presence of cylindrical isidia. Its morphology closely resembles that of *C. australasica* Elix, but the latter reacts C–, P+ yellow due to the presence of psoromic acid and, in part, develops an orange-red pigmented prothallus (white in *C. queenslandica*) (Elix 2007). *Cryptothecia philippinum* (Vain.) G.Thor is also similar to *C. queenslandica*, but lacks confluent acid and is known from only corticolous substrata (Thor 1997).

At present *C. queenslandica* is known from only the type locality. Associated species included *Bulbothrix tabacina* (Mont. & Bosch) Hale, *Cryptothecia australasica* Elix, *C. faveomaculata* Mukhija & Patw., *Haematomma sorediatum* R.W.Rogers, *Laurera meritospora* (Mont. & Bosch) Zahlbr., *Parmotrema gardneri* (C.W.Dodge) Hale, *Pertusaria scaberula* A.W.Archer, *Pyxine copelandii* Vain. and *P. fallax* (Zahlbr.) Kalb.

Dirinaria sekikaica Elix, sp. nov.

Fig. 2

Sicut *Dirinaria applanata* sed acidum sikikaicum continente differt.

Type: Australia. New South Wales, Old Macleay River estuary, Stuarts Point, 30°49'S, 153°00'E, 1 m, on *Casuarina glauca* in strand vegetation adjacent to mangrove swamp, J.A. Elix 21346, 18.i.1987 (holotype CANB).

Thallus 5–10 cm wide, adnate to tightly adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous, longitudinally plicate and rugose, flat to convex, ±concave towards the tips, 0.5–2.0 mm wide, distinctly flabellate towards the apices. Upper surface grey, bluish grey to yellow-grey or off-white, ±pruinose, sorediate, dactyls absent. Soralia laminal, hemispherical or becoming elongate, sometimes erose and crateriform, soredia farinose. Medulla white, rarely the lower medulla orange towards the apices. Lower surface black in the centre, ±brown at the margins. Apothecia rare, sessile to ±constricted at base, 0.5–1.5 mm wide; disc black, rarely sparsely grey-pruinose; thalline exciple prominent or reflexed, distinct and persistent. Epithecium dark yellow-brown, c. 10 µm thick; hymenium colourless, 75–85 µm thick; hypothecium dark brown to brown-black, 160–200 µm thick. Ascospores brown, 1-septate, thick-walled, *Dirinaria*-type, ellipsoid, 15–22 × 6–8 µm. Pycnidia black, laminal, immersed in elevated warts. Conidia bacilliform, 3.5–5 × 0.8–1 µm.

Chemistry: Cortex K+ yellow, C-, KC-, P+ yellow; medulla K-, C-, KC-, P-; containing atranorin (minor), chloroatranorin (minor), sekikaic acid (major), 4'-O-demethyl-sekikaic acid (minor), ramalinic acid (trace), homosekikaic acid (trace), 3β-acetoxypentane-1β,22-diol (minor), ±unknown terpenes (minor).

Etymology. The specific epithet is derived from the presence of sekikaic acid in this species.

Notes:

Morphologically, *D. sekikaica* closely resembles *D. applanata* (Fée) D.D.Awasthi in that both have adnate to tightly adnate thalli with pinnately to subpinnately branched, contiguous, longitudinally plicate and rugose lobes with flabellate apices, with laminal soralia and distinctly farinose soredia. However, *D. sekikaica* can be distinguished by its chemistry. Whereas *D. applanata* contains divaricatic acid as the major medullary substance, *D. sekikaica* contains sekikaic acid. Previous authors (Swinscow & Krog 1978) considered this taxon a chemical race of *D. applanata*.

At present this new species is known to occur on bark, wood and rocks in coastal and montane forests in eastern Queensland and New South Wales. Commonly associated species included *Dirinaria applanata* (Fée) D.D.Awasthi, *Lecanora helva* Stizenb., *L. melacarpella* Müll.Arg., *Parmotrema reticulatum* (Taylor) M.Choisy, *Pertusaria lordhowensis* A.W.Archer & Elix, *P. montpittensis* A.W.Archer, *Pyxine cocoes* (Sw.) Nyl., *Ramalina pacifica* Asahina, and *R. peruviana* Ach.

ADDITIONAL SPECIMENS EXAMINED

Queensland: • 10 km NW of Crows Nest, c. 50 km N of Toowoomba, 27°12'S, 152°00'E, 600 m, K. Kalb & R.W. Rogers, 15.viii.1988 (herb. Kalb 21459).

New South Wales: • Several km N of Gloucester, 32°00'S, 151°30'E, 50 m, on free-standing tree along road, K. & A. Kalb, 9.viii.1988 (herb. Kalb 20362).

Fellhanera tropica Elix, sp. nov.

Fig. 3

Sicut *Fellhanera microdiscus* sed corticola, saxicola vel lignicola, superfice granulosus et zeorinum et 4,5-dichlorolichexanthoneum continente differt.

Type: Australia. Northern Territory, Howard Springs National Park, 37.5 km SE of Darwin, 12°28'03"S, 131°02'54"E, 15 m, on dead log in monsoon vine forest along stream, J.A. Elix 36741, 3.viii.2005 (holotype DNA; isotype CANB).

Thallus crustose, whitish green to pale green, continuous to rimose-areolate, areolae 0.5–2.0 mm wide, granular, ecorticate, forming extensive, irregularly spreading patches to 10 cm wide; not delimited, hypothalline line not apparent. Photobiont a chlorococcoid green alga; cells single or a few cells aggregated, 7–10 µm wide. Apothecia common, biatorine, 0.2–0.6 mm wide, sessile, roundish, ±constricted at the base; proper margin thin, smooth, not prominent, paler than the disc, reduced or excluded with age; disc ±flat or becoming convex, flesh-coloured to pale tan at first, becoming brown or dark brown with age, epruinose; excipulum paler than the disc, colourless to very pale brown, up to 50 µm thick in the lower part, lower part paraplectenchymatous, without photobiont cells; hymenium colourless, 40–60 µm thick, 1+ blue; hypothecium red-brown to brown, 50–65 µm thick, K-; paraphyses branched and anastomosing, 1.0–1.5 µm thick, apical cells not thickened. Asci (6–)8-spored, clavate, 45–65 × 10–18 µm. Ascospores colourless, fusiform to narrowly ellipsoid, 3–5-septate, 15–20 × 4–6 µm; not or very slightly constricted at septa. Pycnidia not seen.

Chemistry. Thallus K- C-, KC- P-, UV-; containing 4,5-dichlorolichexanthone (major), zeorin (major), 4,5-dichloro-6-O-methylorlichexanthone (minor), unknown (minor).

Etymology. The specific epithet refers to the tropical habitat of this species.

Notes:

Fellhanera tropica is characterized by the whitish green to pale green, granulose thallus, the abundant, flesh-coloured to brown, roundish apothecia with a paler proper margin, the 4–5-septate, fusiform to narrow ellipsoid ascospores and the chemistry. The apothecia and ascospores of this new species resemble those of *F. microdiscus* (Vain.) Vězda, but the latter species is foliicolous rather than being lignicolous, corticolous or saxicolous, the thallus is non-granulose, the apothecia are somewhat smaller (0.15–0.3 mm vs. 0.2–0.6 mm wide), and the ascospores are 3-septate (Vainio 1921). Furthermore, *F. microdiscus* lacks lichen substances.

At present this new species is known from several localities in the Northern Territory, where it occurs on dead wood, rocks or bark in moist, monsoon vine forests. Commonly associated species included *Chrysothrix xanthina* (Vain.) Kalb, *Coccocarpia palmicola* (Spreng.) Arv. & D.J.Galloway, *Coenogonium luteum* (Dicks.) Kalb & Lücking, *Cratiria lauricassiae* (Fée) Marbach, *Cryptothecia faveomaculata* Makhija & Patw., *Dirinaria consimilis* (Stirt.) D.D.Awasthi, *D. picta* (Sw.) Schaer. ex Clem., *Hafellia rechingeri* (Zahlbr.) Marbach, *Letrouitia leprolytoides* S.Y.Kondr. & Elix and *Pertusaria velata* (Turner) Nyl.

ADDITIONAL SPECIMENS EXAMINED

Northern Territory: • type locality, on exposed root, J.A. Elix 36742, 3.viii.2005 (CANB), on rocks on forest floor, J.A. Elix 36745, 36746, 36747, 3.viii.2005 (CANB); • Howard Springs Road, 34.5 km SE of Darwin, 12°28'37"S, 131°01'59"E, 30 m, on laterite rocks in *Callitris* plantation, J.A. Elix 37116, 37119, 37121, 37122, 37123, 3.viii.2005 (CANB, DNA, F).

Protoparmelia rogersii Elix, sp. nov.

Fig. 4

Sicut *Protoparmelia badia* sed acidum alectoronicum continente differt.

Type: Australia. Queensland: by road to Mt. Nebo, 10 km past the Enoggera Reservoir, 27°26'S, 152°57'E, on granitic rock in *Eucalyptus* forest, R.W. Rogers 2342, 1.x.1981 (holotype BRI; isotype M).

Thallus saxicolous, pale to medium brown, thin, rimose and areolate to coarsely warted, ±bullate, 0.5–1.2 mm thick, 3–4 cm wide, effuse, no prothallus seen. Photobiont a unicellular green alga, cells 8–12 µm diam. Areolae irregularly shaped, contiguous, 0.5–1.2 mm wide; upper surface subconvex to convex, lacking soredia and isidia. Apothecia common, dispersed, sessile, constricted at the base, round, 0.4–2.0 mm

wide; disc dark brown, ±plane to undulating or convex, glossy, darker than the margin; thalline exciple concolorous with the thallus, persistent; excipulum poorly delimited; epithecium 5–10 µm tall, dark brown; hymenium 40–60 µm tall, colourless to brownish; hypothecium colourless to pale yellow-brown, 60–100 µm thick. Paraphyses with clavate to capitate apical cells 3–5 µm wide, with a brown cap. Ascospores ellipsoidal-fusiform, often with distinctly pointed apices, 10–13 × 4–5 µm. Pycnidia scattered, immersed, black. Conidia acicular, straight or slightly curved, 6–11 × 0.7–1.2 µm.

Chemistry: Cortex K–, C–, KC–, P–, N–; medulla K–, C–, KC+ pink, P–, UV+ blue-white; containing alectoronic acid (major), dehydroalectoronic acid (trace), ±β-alectoronic acid (trace).

Etymology. The species is named in honour of the collector, the Australian botanist and lichenologist Dr Roderick W. Rogers.

Notes:

The growth habit, apothecial anatomy and ascospores of this species closely resemble those of *Protoparmelia badia* (Hoffm.) Hafellner, but *P. badia* can readily be distinguished by its typically darker brown upper surface, the crowded, immersed to sessile, round or subangular apothecia (dispersed, round, sessile and constricted at the base in *P. rogersii*) and by the chemistry. Whereas *P. badia* contains lobaric acid (major), oxolobaric acid (minor), conlobaric acid (trace), sublobaric acid (trace), norlobaric acid (trace), ±zeorin (minor), and ±usnic acid (minor), *P. rogersii* contains alectoronic acid (major), dehydroalectoronic acid (trace), and ±β-alectoronic acid (trace). *Protoparmelia pulchra* Diederich, Aptroot & Sérus. is chemically identical to *P. rogersii*, but grows on dead wood and bark rather than rocks, and has narrower ascospores (2–3 µm vs. 4–5 µm wide) that are ellipsoid and not pointed at the ends (Aptroot *et al.* 1997).

At present this species is known from only the type collection. Associated species included *Lecanora farinacea* Fée, *Parmotrema reticulatum* (Taylor) M.Choisy and *Relicina sydneyensis* (Gyeln.) Hale.

The New Names

Menegazzia menyamyaensis Elix, nom. nov.

Synonym: *Menegazzia fumarprotocetrarica* Elix, *Biblioth. Lichenol.* **96**, 63 (2007), *nom. illeg., non Menegazzia fumarprotocetrarica* Calvelo & Adler, *Mycotaxon* **59**: 369 (1996).

Type: Papua New Guinea. Morobe Province, Spreader Divide, Aseki-Menyamya road, 9 km NW of Aseki, 7°18'S, 146°08'E, 2180 m, on fallen twigs in *Nothofagus-Podocarpus* forest, J.A. Elix 12018A & M. Tota, 5.xii.1982 (holotype CANB).

Rinodina austroleprosa Elix, nom. nov.

Synonym: *Rinodina leprosa* Elix, *Australas. Lichenol.* **61**, 22 (2007), *nom. illeg., non Rinodina leprosa* (Schaer.) A.Massal., *Sched. Crit.*: 160 (1855).

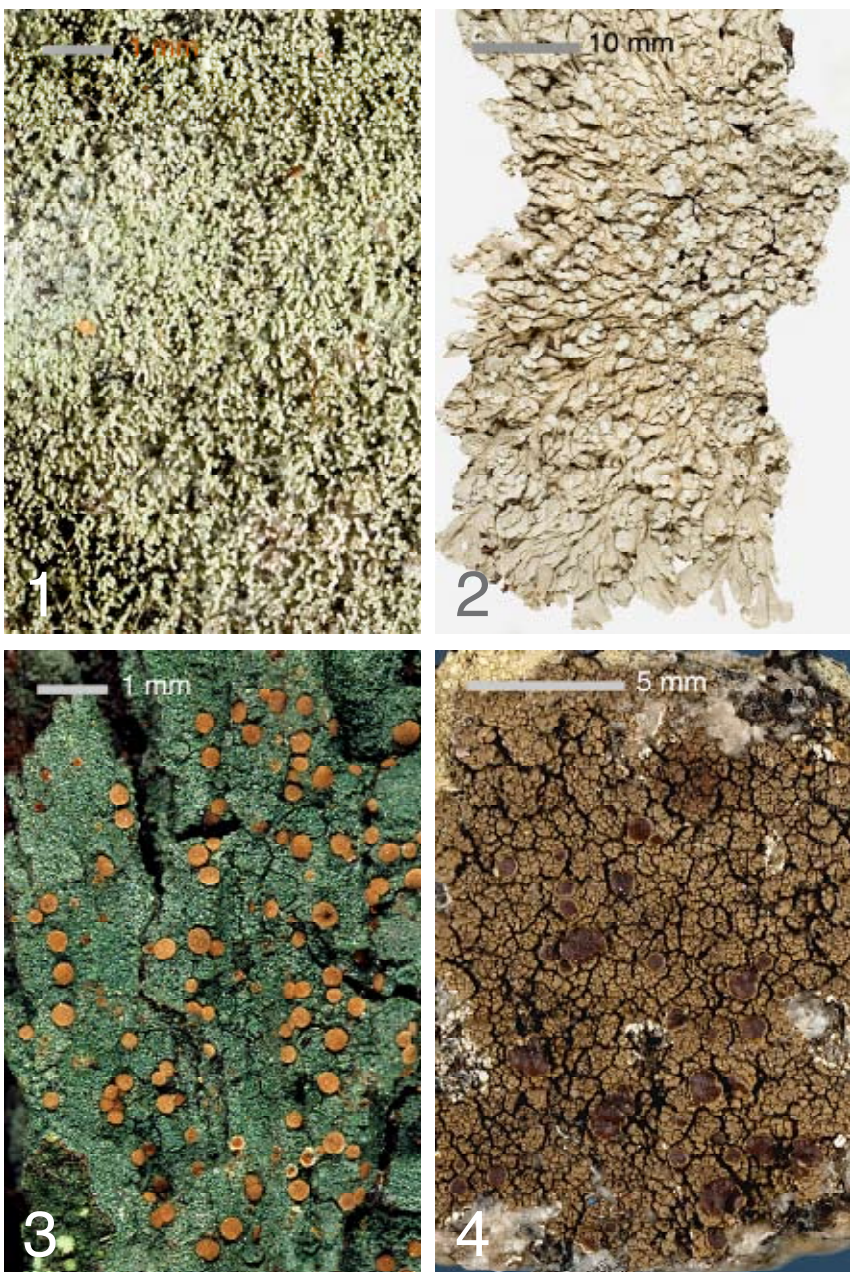
Type: Australia. Victoria, Reef Hills State Park, 7 km SSW of Benalla, 36°36'53"S, 145°56'03"E, 155 m, on base of *Eucalyptus* in open *Eucalyptus* woodland, J.A. Elix 37189, 5.v.2006 (holotype MEL; isotypes CANB, HO).

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Figures: 1. *Cryptothecia queenslandica* (holotype in BRI); 2. *Dirinaria sekikaica* (holotype in CANB); 3. *Fellhanera tropica* (isotype in CANB); 4. *Protoparmelia rogersii* (holotype in BRI).

Foliicolous lichens in the Northern Territory

Patrick M. McCarthy

Australian Biological Resources Study,
GPO Box 787, Canberra, ACT 2601, Australia

Continental Australia supports a rich foliicolous lichen flora of at least 209 species, 18 of which are considered to be endemic (McCarthy 2007). In August, 2005, ahead of a field excursion to the tropical Northern Territory, it was hoped that localized but moderately diverse foliicolous communities might be found along creek banks and in sheltered gorges in monsoon vine forest where the most severe effects of winter drought might be ameliorated. However, 12 days of intensive exploration in many of the most likely habitats yielded only seven taxa usually in very sparse communities dominated by species of *Strigula* and including much depauperate, nondescript and sterile growth.

1. *Fellhanera bouteillei* (Desm.) Vězda, *Folia Geobot. Phytotax.* **21**, 214 (1986)

This cosmopolitan lichen is also known from bark and rock. In Australia, it has been reported from leaves in Queensland and Tasmania, as well as Christmas Island (McCarthy 2007).

SPECIMENS EXAMINED

Northern Territory: • Howard Springs Nature Park, 38 km SE of Darwin, 12°28'03"S, 131°02'54"E, monsoon vine forest along stream, on leaves, alt. 20 m, P.M. McCarthy 2426, 3.viii.2005 (CANB); • Wangi Falls, Litchfield Natl Park, 74 km SW of Batchelor, 13°09'48"S, 130°41'00"E, monsoon vine forest at base of falls, on leaves, alt. 60 m, P.M. McCarthy 2411, 5.viii.2005 (CANB). *Australian Capital Territory*: • Rainforest Gully, Australian National Botanic Gardens, Canberra, 35°17'S, 149°07'E, on leaves of *Atherosperma moschatum*, alt. c. 570 m, P.M. McCarthy 2660, 4.ix.2007 (CANB).

2. *Porina perminuta* Vain., *Univ. Calif. Publ. Bot.* **12**, 14 (1924)

A rather common lowland species in the Palaeotropics and western Pacific (McCarthy 2003), this lichen, previously known from Christmas Island, is reported for the first time from mainland Australia.

SELECTED SPECIMENS EXAMINED

Northern Territory: • Sandy Creek Track, Casuarina Coastal Reserve, 12 km NNE of Darwin, 12°21'19"S, 130°52'20"E, on leaves in strand vegetation, alt. c. 5 m, P.M. McCarthy 2419, 14.viii.2005 (CANB); • *loc. id.*, J.A. Elix 37707 (CANB).

3. *Strigula nemathora* Mont., in Sagra, *Hist. Phys. Cuba, Bot. Pl. Cell.* **2**, 139 (1842)

Known throughout the tropics and subtropics, *S. nemathora* was reported from Pethericks Rainforest, Litchfield National Park, Northern Territory by Elix (1992), and it also occurs in Queensland. In 2005 it was found to be especially abundant as orbicular, scarcely dissected thalli (var. *hypothelia*, *sensu* Santesson 1952) on a single tree at Fogg Dam Conservation Reserve.

SELECTED SPECIMENS EXAMINED

Northern Territory: • Pethericks Rainforest, Litchfield Natl Park, 39 km WSW of Batchelor, 13°08'S, 130°49'E, disturbed lowland forest with *Ficus* and *Gmelia*, on leaves, alt. 60 m, J.A. Elix 27564, H.T. Lumbsch & H. Streimann, 3.vii.1991 (CANB; *Lichenes Australasici Exsiccati* No. 246); • Wangi Falls, Litchfield Natl Park, 74 km SW of Batchelor, 13°09'48"S, 130°41'00"E, monsoon vine forest at base of falls, on leaves, alt. 60 m, P.M. McCarthy 2412, 5.viii.2005 (CANB); • Monsoon Forest Walk, Fogg Dam Conservation Reserve, 65 km ESE of Darwin, 12°34'03"S, 131°18'29"E, on leaves in monsoon vine forest, alt. 25 m, P.M. McCarthy 2413, 11.viii.2005 (CANB); • Black

Jungle Conservation Reserve, 42 km ESE of Darwin, 12°32'41"S, 131°14'04"E, on leaves in remnant lowland monsoon forest dominated by *Acacia* and *Barringtonia*, alt. 10 m, *P.M. McCarthy* 2423, 12.viii.2005 (CANB).

4. *Strigula nitidula* Mont., in Sagra, Hist. Phys. Cuba, Bot. Pl. Cell. 2, 139 (1842)

This common pantropical species is known from Queensland, New South Wales, Tasmania and Lord Howe Island (McCarthy 2007).

SPECIMEN EXAMINED

Northern Territory: • Berry Springs Nature Park, 62 km S of Darwin, 12°42'06"S, 130°59'57"E, on leaves in monsoon vine forest along stream, alt. 45 m, *P.M. McCarthy* 2408, 4.viii.2005 (CANB).

5. *Strigula orbicularis* Fr. : Fr., *Linnaea* 5, 549 (1830)

This common pantropical species is known from Queensland and New South Wales (McCarthy 2007).

SELECTED SPECIMENS EXAMINED

Northern Territory: • Wangi Falls, Litchfield Natl Park, 74 km SW of Batchelor, 13°09'48"S, 130°41'00"E, monsoon vine forest at base of falls, on leaves, alt. 60 m, *J.A. Elix* 37691, 5.viii.2005 (CANB); • track to Tjaetaba Falls, Greenant Creek, Litchfield Natl Park, 60 km SW of Batchelor, 13°12'04"S, 130°42'03"E, monsoon vine forest, on leaves, alt. c. 50 m, *J.A. Elix* 37692 (part), 5.viii.2005 (CANB); • Florence Creek, below Florence Falls, Litchfield National Park, 42 km SW of Batchelor, 13°05'58"S, 130°47'05"E, monsoon forest with *Syzygium* and *Gordenia* along stream, on leaves, alt. 75 m, *P.M. McCarthy* 2422, 6.viii.2005 (CANB); • Surprise Creek Falls, Litchfield National Park, 17 km N of Daly River Rd, 13°24'17"S, 130°47'06"E, remnant monsoon vine forest with *Carallia* and *Calophyllum*, on leaves, alt. 45 m, *J.A. Elix* 37694 (part), 9.viii.2005 (CANB); • Gungarre Forest Walk, South Alligator, Kakadu Natl Park, 12°40'36"S, 132°28'44"E, monsoon forest, on leaves, alt. 30 m, *J.A. Elix* 37696, 37697, 10.viii.2005 (CANB); • Black Jungle Conservation Reserve, 42 km ESE of Darwin, 12°32'41"S, 131°14'04"E, on leaves in remnant lowland monsoon forest dominated by *Acacia* and *Barringtonia*, alt. 10 m, *P.M. McCarthy* 2423, 12.viii.2005 (CANB); • Sandy Creek Track, Casuarina Coastal Reserve, 12 km NNE of Darwin, 12°21'19"S, 130°52'20"E, on leaves in strand vegetation, alt. c. 5 m, *J.A. Elix* 37707 (part), 14.viii.2005 (CANB).

6. *Strigula smaragdula* Fr. : Fr., *Linnaea* 5, 550 (1830)

This is among the most common and widely distributed foliicolous lichens, especially in drier lowland habitats. It was reported from Channel Point, north of Daly River, Northern Territory by Elix (1992), and it also occurs in Queensland, New South Wales, Christmas Island, Lord Howe Island and Norfolk Island (McCarthy 2007).

SELECTED SPECIMENS EXAMINED

Northern Territory: • Channel Point, 23 km NNW of Daly River, 13°07'S, 130°31'E, monsoon forest on seasonal and spring-fed flats with palms, *Acacia*, *Corallina* and *Canarium*, on leaves, alt. 10 m, *J.A. Elix* 27686, *H.T. Lumbsch & H. Streimann*, 5.vii.1991 (CANB); *Lichenes Australasici Exsiccati* No. 247); • Howard Springs Nature Park, 38 km SE of Darwin, 12°28'03"S, 131°02'54"E, monsoon vine forest along stream, on leaves, alt. 20 m, *P.M. McCarthy* 2425, 3.viii.2005 (CANB); • Berry Springs Nature Park, 62 km S of Darwin, 12°42'06"S, 130°59'57"E, monsoon vine forest along stream, on leaves, alt. 45 m, *P.M. McCarthy* 2409, 2428, 4.viii.2005 (CANB); • Darwin River Dam Recreation Park, 77 km S of Darwin, 12°49'36"S, 130°57'59"E, monsoon vine forest along stream, on leaves, alt. 40 m, *J.A. Elix* 2409, 37528, 4.viii.2005 (CANB); • Wangi Falls, Litchfield Natl Park, 74 km SW of Batchelor, 13°09'48"S, 130°41'00"E, monsoon vine forest at base of falls, on leaves, alt. 60 m, *P.M. McCarthy* 2410, 5.viii.2005 (CANB);

• track to Tjaetaba Falls, Greenant Creek, Litchfield Natl Park, 60 km SW of Batchelor, 13°12'04"S, 130°42'03"E, monsoon vine forest, on leaves, alt. c. 50 m, *P.M. McCarthy* 2430, 5.viii.2005 (CANB); • Florence Creek, below Florence Falls, Litchfield National Park, 42 km SW of Batchelor, 13°05'58"S, 130°47'05"E, monsoon forest with *Syzygium* and *Gordenia* along stream, on leaves, alt. 75 m, *P.M. McCarthy* 2421, 6.viii.2005 (CANB); • Surprise Creek Falls, Litchfield National Park, 17 km N of Daly River Rd, 13°24'17"S, 130°47'06"E, remnant monsoon vine forest with *Carallia* and *Calophyllum*, on leaves, alt. 45 m, *J.A. Elix* 37694, 9.viii.2005 (CANB); • Gungarre Forest Walk, South Alligator, Kakadu Natl Park, 12°40'36"S, 132°28'44"E, monsoon forest, on leaves, alt. 30 m, *P.M. McCarthy* 2427, 10.viii.2005 (CANB); • Monsoon Forest Walk, Fogg Dam Conservation Reserve, 65 km ESE of Darwin, 12°34'03"S, 131°18'29"E, on leaves in monsoon vine forest, alt. 25 m, *P.M. McCarthy* 2416, 11.viii.2005 (CANB); • Black Jungle Conservation Reserve, 42 km ESE of Darwin, 12°32'41"S, 131°14'04"E, on leaves in remnant lowland monsoon forest dominated by *Acacia* and *Barringtonia*, alt. 10 m, *P.M. McCarthy* 2424, 12.viii.2005 (CANB); • Sandy Creek Track, Casuarina Coastal Reserve, 12 km NNE of Darwin, 12°21'19"S, 130°52'20"E, on leaves in strand vegetation, alt. c. 5 m, *P.M. McCarthy* 2420, 14.viii.2005 (CANB).

7. *Tricharia* sp.

Several minute, sterile thalli with stiff, black hairs were found at two localities.

SPECIMENS EXAMINED

Northern Territory: • Wangi Falls, Litchfield Natl Park, 74 km SW of Batchelor, 13°09'48"S, 130°41'00"E, monsoon vine forest at base of falls, on leaves, alt. 60 m, *P.M. McCarthy* 2431, 5.viii.2005 (CANB); • Florence Creek, below Florence Falls, Litchfield National Park, 42 km SW of Batchelor, 13°05'58"S, 130°47'05"E, monsoon forest with *Syzygium* and *Gordenia* along stream, on leaves, alt. 75 m, *J.A. Elix* 37693 (part), 6.viii.2005 (CANB).

Discussion

In Australia, foliicolous lichen diversity is greatest in the coastal and hinterland areas of eastern Queensland, which support 174 species. Eastern and south-eastern New South Wales (including the A.C.T.) has 62 species, Victoria 12 and Tasmania 27 (McCarthy 2007). Such communities thrive in the absence of the prolonged drought coupled with high temperatures which clearly play a significant role during the dry season in tropical areas of the Northern Territory.

Coastal and subcoastal areas of the Northern Territory experience an alternating cycle of flood and drought. The wet season, from late October to April, is characterized by high rainfall and humidity, high temperatures and comparatively low rates of evaporation. The dry season (from late April to October) has very low or no rainfall, while high temperatures are maintained, with low to very low humidity and high evaporation rates (Bureau of Meteorology 2007). By contrast, coastal areas of north-eastern Queensland experience appreciably lower temperatures and sufficient rainfall even in the dry season to maintain rich foliicolous communities.

The striking disparity between foliicolous lichen diversity in the Northern Territory tropics and at low elevations in coastal areas of north-eastern Queensland is also seen among other elements of the lichen flora. Thus, while creeks, sheltered gullies and shaded rock outcrops in Queensland provide niches for 20–30 saxicolous species of Monoblastiaceae, Porinaceae, Strigulaceae and Verrucariaceae, the most suitable comparable habitats in the Northern Territory included only *Porina chlorotricula* and the rare *P. nuculastrum*. Similarly, while 10–15 corticolous species of *Porina* occur, often in considerable abundance, along the Queensland coast, only *P. eminentior* and rare and usually sterile thalli of *P. tetracerae* were seen in coastal areas of the Northern Territory.

Acknowledgements

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Notes on some Australian species of *Umbilicaria*

S.H.J.J. Louwhoff

Royal Botanic Gardens Melbourne, Birdwood Avenue
South Yarra, Victoria 3141, Australia

Abstract: Eight species of *Umbilicaria* are confirmed for Australia: *U. cylindrica*, *U. decussata*, *U. hirsuta*, *U. nylanderiana*, *U. polyphylla*, *U. subglabra*, *U. umbilicarioides* and the first Australian record of *U. cinereorufescens*.

Introduction

The current checklist of Australian lichens lists nine species in the macrolichen genus *Umbilicaria* (McCarthy 2008). A recent investigation of Tasmanian collections documented six species; *Umbilicaria cylindrica* (L.) Delise ex Duby, *U. decussata* (Vill.) Zahlbr., *U. nylanderiana* (Zahlbr.) H.Magn., *U. polyphylla* (L.) Baumg., *U. subglabra* (Nyl.) Harm. and *U. umbilicarioides* (B.Stein.) Krog & Swinscow (Kantvilas & Louwhoff 2007). Two additional taxa, *Umbilicaria hirsuta* (Sw.) Ach. and *U. cinereorufescens* (Schaer.) Frey, are reported here from the Australian mainland; neither is common, and the latter is a new record for Australia. Earlier records of *U. hyperborea* (Ach.) Hoffm. and *U. proboscidea* (L.) Schrad. were based on misidentifications of *U. nylanderiana*.

Australian species of *Umbilicaria* are monophyllous or polyphyllous, with a smooth, scabrid, pustulate or sharply ridged upper surface, and black apothecia that are gyrose (folded) or leiodisc (smooth). Asci usually contain eight simple spores. However, while *U. cinereorufescens* produces brown muriform spores, the Australian specimen was sterile. Some species produce rhizinomorphs, which while they resemble rhizines, their primary function is not attachment. The rhizinomorphs, as well as the lower surface of the thallus, can be covered with specialized vegetative diaspores called thalloconidia, creating a lumpy texture. *Umbilicaria hirsuta* is the only soreidiate species in Australia, and isidiate species do not occur here. Gyrophoric acid is common in the genus and occurs in all but two Australian species, and it may or may not have associated umbilicarinic and/or lecanoric acids. Only *U. polyphylla* has umbilicarinic acid as the major medullary substance.

This paper provides a key to the Australian species of *Umbilicaria*, a discussion of variation in *U. cylindrica*, as well as descriptions and taxonomic, ecological and distributional notes on *U. cinereorufescens* and *U. hirsuta*. Additional information relevant to mainland *Umbilicaria* species is also included, as well as a short discussion on some biogeographical aspects of the genus in Australasia.

Key to Australian species of *Umbilicaria*

- 1 Rhizinomorphs present..... 2
- 1: Rhizinomorphs absent..... 5
- 2 Rhizinomorphs of two types: short, thick and clavate, interspersed with long, slender structures; lower cortex trabeculate around the umbilicus **U. cinereorufescens**
- 2: Rhizinomorphs uniform, thin, not clavate; lower surface not trabeculate around the umbilicus 3
- 3 Rhizinomorphs sparse to moderately dense on lower surface only; upper cortex becoming soreidiose along the margins..... **U. hirsuta**
- 3: Rhizinomorphs typically very abundant on the lower surface and/or margins and/or upper surface of the thallus, often forming a shaggy fringe around the lobes; upper cortex esorediate..... 4

- 4 Rhizinomorphs shrubby and densely dendroid-branched to coralloid, mostly to 1.5 mm long, sparsely to densely beset with clusters of thalloconidia and appearing uneven and lumpy **U. umbilicarioides**
- 4: Rhizinomorphs elongate and mostly furcate-branched, never coralloid, 1–4 mm long, mostly smooth, glossy and lacking thalloconidia **U. cylindrica**
- 5 Upper surface extensively folded, wrinkled or puckered 6
- 5: Upper surface predominantly smooth..... 7
- 6 Thallus dark brownish, very fragile and brittle, with soft folds and wrinkles, sometimes whitish and angular only near the centre **U. nylanderiana**
- 6: Thallus black, grey or grey-brown, frequently covered in a white necral layer, relatively thick and robust, with ridged and angular folds and wrinkles forming a reticulate-faveolate pattern across entire surface **U. decussata**
- 7 Thallus polyphyllous, black or brown, epruinose; lobes richly divided and tangled; margins undulate or ±deflexed; apothecial disc gyrose..... **U. polyphylla**
- 7: Thallus mostly monophyllous, whitish or greyish pruinose; margins undulate to upturned; apothecial disc smooth, not gyrose..... **U. subglabra**

The species

Umbilicaria cinereorufescens (Schaer.) Frey, *Hedwigia* 71, 109 (1931)

Thallus 5–12 cm diam., mostly monophyllous, with lobes entire, rigid, coriaceous, orbicular, with or without broad folds; margins entire or incised-torn. Upper surface dull, smooth to scabrous, areolate-cracked, occasionally with rhizinomorphs protruding through cracks or tears, cream-buff or pale grey to violet-grey or slate-grey, with occasional reddish staining, pruinose or not, rarely somewhat eroding. Lower surface mostly coarsely papillate-verrucose, covered with a thick matt of rhizinomorphs; umbilicus flat or slightly raised, ±trabeculate nearby, frequently with lamellae fading or extending to margins and becoming fimbriate, black with occasional dark brown margins. Rhizinomorphs of two types: dense, short, stout, black, clavate and covered in thalloconidia, interspersed with scattered, longer, cylindrical, dark brown to black structures, blackened at the base due to thalloconidia. Thalloconidia on lower surface of thallus, on surface of clavate rhizinomorphs, or at the base and tips of cylindrical rhizinomorphs; individual cells roundish 5–7(–10) µm wide, brown, thick-walled, frequently clumping together, forming clusters 17–25 µm wide. Apothecia not seen in Australian material. Hestmark (2004) reported apothecia rare, gyrose; ascospores brown, muriform, 8–15 × 4–9 µm. Pycnidia scattered, immersed, visible as black dots on the upper surface; conidia bacilliform, 3–4(–5) × 0.5–0.7 µm. Chemistry: medulla K–, C+ red, KC+ red, P–; containing gyrophoric acid (major).

Umbilicaria vellea (L.) Ach. closely resembles *U. cinereorufescens*, and the two can be difficult to separate (Llano 1950, Krog & Swinscow 1986, Wei & Jiang 1993). That was especially true of specimens collected by Thomson from New Zealand (Wei & Jiang 1993), which were identified as *U. vellea*. *Umbilicaria vellea* has longer (2 mm cf. 1.5 mm), branched, often (pale) brown and somewhat “shaggy” rhizinomorphs that are abundant, and larger thalloconidia (23 × 28 µm cf. 17 × 25 µm in *U. cinereorufescens*). Unfortunately, the type of *U. cinereorufescens* was not available for study, and published descriptions of the species vary. Llano (1950) described the “rhizinae” [rhizinomorphs] as absent or very short, stubby and occasionally club-tipped, while Krog & Swinscow (1986) described them as short, stout and ball-tipped, with some branched, slender, black rhizinomorphs with blunt tips and short, coarse, black outgrowths. Wei & Jiang (1993) state that the “rhizines” [rhizinomorphs] are absent or very short and occasionally club-tipped but never capitate.

Umbilicaria cinereorufescens is known from Europe, Greenland, North America (Llano 1950), Asia (Wei & Jiang 1993) and East Africa (Swinscow & Krog 1988). This new record for Australia is based on a collection from a granite overhang in alpine New South Wales.

SPECIMEN EXAMINED

New South Wales: • Spencers Ck, Snowy Mountains, alt. c. 1700 m, on granite, D. McVean 682, i.1968 (CANB).

Umbilicaria cylindrica (L.) Delise, in Duby, *Bot. Gall.* 2(2), 595 (1830)

See Kantvilas & Louwhoff (2007) for a description of this species.

Three varieties of *U. cylindrica* have been recognized for Australia (Llano 1950): *Umbilicaria cylindrica* var. *fimbriata* (Ach.) Nyl. (MEL 11061), *U. cylindrica* var. *tornata* (Ach.) Nyl. (MEL 1013295) and *U. cylindrica* var. *delisei* (Despr.) Nyl. (MEL 11046). The specimen determined as *U. cylindrica* var. *fimbriata* (Ach.) Nyl. is, in fact, a mixture of *U. cylindrica* and *U. umbilicarioides*. *Umbilicaria umbilicarioides* bears a strong similarity to *U. cylindrica*, and the two often grow side-by-side. A detailed discussion of the two taxa is provided by Kantvilas & Louwhoff (2007). Material determined as *U. cylindrica* var. *tornata* (Ach.) Nyl. typically has small, crowded, polyphyllous thalli, but these are not unusual in *U. cylindrica* and are within the natural variation exhibited by the species. The collection determined as *U. cylindrica* var. *delisei* (Despr.) Nyl. has a monophyllous thallus that is more robust than typical *U. cylindrica* specimens, and it lacks marginal rhizinomorphs. A number of other specimens from New South Wales and Victoria resemble this variety, but nevertheless they fall within the circumscription of *U. cylindrica* because characters often intergrade. There is no doubt that the species is very polymorphic, and the name *U. cylindrica sens. str.* as applied by Kantvilas & Louwhoff (2007) may still represent more than one taxon. However, this would require a worldwide re-assessment, as suggested by Kantvilas & Louwhoff (2007). The *U. cylindrica* complex in the broader sense would benefit from phylogenetic analyses incorporating molecular data.

Umbilicaria hirsuta (Sw.) Ach., *Kongl. Vetensk.-Akad. Nya Handl.* 15, 97 (1794)

Thallus 2–8(–14) cm diam., monophyllous or polyphyllous, orbicular, thin but rigid; umbo obscure to moderately elevated, with or without a few soft folds; margins irregularly lacerate, edges eroded, frequently reflexed dorsally. Upper surface dull, pale to dark grey or camel-brown, particularly towards margins, covered with a fine network of fissures, areolate, becoming powdery-soresiose along lobe apices; soresiose fine, pale grey, coalescing to form irregular brown granules. Lower surface camel-brown to grey-brown to chestnut-brown, dark brown around the umbilicus, granular-areolate, flat to folded or wrinkled, occasionally with small pits; umbilicus small to medium-sized, compact. Rhizinomorphs sparse to moderately dense, solitary or forming small tufts, concolorous with lower surface, cylindrical, simple or branched. Thalloconidia not seen. Apothecia and pycnidia not seen in Australian material. Hestmark (2004) reports apothecia rare, with narrow gyri; ascospores simple, hyaline, 10–14 × 4–8 µm. Chemistry: medulla K–, C+ red, KC+ red, P–; containing gyrophoric acid (major), lecanoric acid (minor).

Umbilicaria hirsuta superficially resembles *U. cinereorufescens* but is readily distinguishable because the latter species is not soresiose, has characteristic short, clavate rhizinomorphs interspersed with slender, blunt-tipped structures and is trabeculate around the umbilicus.

This species is known from Asia, U.S.A. and Mexico (Wei & Jiang 1993). It has not been reported from New Zealand (Galloway 2007). Rarely collected in Australia (subalpine N.S.W. and A.C.T.).

SPECIMENS EXAMINED

New South Wales: • Tinderry Peak, 10 km E of Michelago, 35°41'S, 149°16'E, alt. 1618 m, on exposed subalpine granite boulder on granite ledge, *J.A. Elix* 362, 13.ix.1974 (CANB); *Australian Capital Territory*: • Mt Coree, 29 km W of Canberra, 35°18'S, 148°48'E, alt. 1400 m, under rock overhang at summit, *D. McVean* 65133, xii.1965 (CANB).

Discussion

Most *Umbilicaria* species in Australia occur in subalpine and alpine habitats, from c. 1400–1600 m upwards in south-eastern mainland Australia, and above c. 900 m in Tasmania. The greatest diversity is in New South Wales, where all eight species occur, followed by the Australian Capital Territory with seven, and Victoria and Tasmania with six. *Umbilicaria polyphylla* occurs in the Stirling Ranges, Western Australia, and the genus is absent from Queensland, the Northern Territory and South Australia.

On the mainland, *Umbilicaria* is best represented along the Great Dividing Range, from Lake Mountain in Victoria to Mt Coree in the Australian Capital Territory. In Victoria, there are additional collections from the Grampians (1167 m altitude) in western Victoria and Mt Macedon (1011 m altitude) in central Victoria, areas that are not subalpine in a strict sense, but they do receive occasional snow. The genus extends as far north as Mt Kaputar and Ben Lomond in northern New South Wales. Both areas are at an altitude of around 1500 m and receive snowfall during winter. The southern limit of *Umbilicaria* in Australia is in the South West National Park in Tasmania, but it occurs throughout the central regions of the State, from Mount Field National Park to The Cradle Mountain-Lake St Clair National Park, as well as Ben Lomond National Park in the north-east. A more detailed discussion on the distribution and ecology of *Umbilicaria* in Tasmania is provided by Kantvilas & Louwhoff (2007).

Umbilicaria species occur predominantly on hard rocks such as Ordovician to Upper Devonian granite outcrops (e.g. Mt Buffalo, Mt Bogong, Mt Baw Baw, parts of the Grampians and the Kosciuszko region), as well as on hard siliceous Upper Devonian to Lower Carboniferous sedimentary rocks (e.g. Mt Wellington and Mt Howitt).

Four of the Australian *Umbilicaria* species occur only at high latitudes in both the Northern and Southern Hemispheres: *U. hirsuta*, *U. subglabra*, *U. umbilicarioides* and *U. nylanderiana* (Table 1). They essentially occupy similar alpine or tundra-like habitats in both hemispheres (Galloway 2007). More than half of New Zealand's *Umbilicaria* species are bipolar in their distribution (Table 1). *Umbilicaria hirsuta* is predominantly a Northern Hemisphere species that has not been reported from elsewhere in the Southern Hemisphere.

The remaining four *Umbilicaria* species in Australia can be regarded as cosmopolitan: *U. cylindrica*, *U. polyphylla*, *U. decussata* and *U. cinereorufescens*. *Umbilicaria decussata* has a widespread distribution worldwide, but it is restricted to high alpine habitats (Krog & Swinscow 1986). In Australia, it occurs on exposed, alpine windswept rocks or on sheltered rock outcrops, in exposed subalpine herbfields or alpine grasslands. It was mostly collected from alpine New South Wales (13 collections), less commonly from the Victorian Alps (three collections), and it is rare in Tasmania with only two known localities from dolerite summits (Kantvilas & Louwhoff 2007). In New Zealand it was collected from Mt Cook at 3507 m altitude, the highest exposed rocks in the country (Galloway & Sancho 2005).

Table 1 lists the species of *Umbilicaria* confirmed for Australia and New Zealand (Galloway 2007). Seventeen of the 19 species recorded for Australasia occur in New Zealand. In addition, New Zealand has three endemic species of *Umbilicaria* (Table 1). There, the genus is most commonly seen in the foothill ranges east of the Main Divide in the South Island (Galloway & Sancho 2005, Galloway & Ledingham 2006, Galloway 2007). Many of the peaks along the Southern Alps are at elevations of at least 2500 m, whereas most peaks along the Great Dividing Range in Australia are below 2000 m. Thus, the alpine and subalpine habitats favoured by *Umbilicaria* are much more extensive in New Zealand, probably accounting for the greater diversity of *Umbilicaria* there.

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Table 1. Distribution patterns of *Umbilicaria* in Australia and New Zealand

	Australia	New Zealand	cosmopolitan	bipolar	Australasian	endemic
<i>cylindrica</i>	●	●	●			
<i>decussata</i>	●	●	●			
<i>cinereorufescens</i>	●		●			
<i>polyphylla</i>	●	●	●			
<i>subglabra</i>	●	●		●		
<i>umbilicarioides</i>	●	●		●		
<i>nylanderiana</i>	●	●		●		
<i>hirsuta</i>	●			●		
<i>hyperborea</i>		●	●			
<i>vellea</i>		●	●			
<i>deusta</i>		●		●		
<i>grisea</i>		●		●		
<i>krascheninnikovii</i>		●		●		
<i>virginis</i>		●		●		
<i>zahlbruchneri</i>		●			●	
<i>durietzii</i>		●				●
<i>murihikuana</i>		●				●
<i>robusta</i>		●				●
<i>subaprina</i>		●				●

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