



# Australasian Lichenology

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The epithet of *Degelia duplomarginata* refers to the unusual double margin of the apothecia. In young apothecia, the proper margin rises above the disc. In older apothecia, it is much narrowed and can be entirely overtopped by the thalline margin. Found throughout New Zealand on the twigs and bark of trees and shrubs in humid forest up to 700 m elevation, *Degelia duplomarginata* has been collected also in Tasmania, South America, and Hawaii.

1 mm 

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Four new species and a new record of *Tephromela*  
(lichenized Ascomycota) from Australia

John A. Elix

Research School of Chemistry, Building 33,  
Australian National University, Canberra, A.C.T. 0200, Australia  
email: John.Elix@anu.edu.au

**Abstract:** *Tephromela bullata* Elix, *T. disjuncta* Elix, *T. lillipillensis* Elix and *T. olivetorica* Elix are described as new to science. In addition, *Tephromela buelliana* (Müll.Arg.) Kalb is reported for the first time from Australia. An updated key to *Tephromela* in Australia is given.

In an ongoing effort to describe and document the biodiversity of Australian lichens (McCarthy 2012), I have encountered several new taxa, four of which are described in the present paper. The genus *Tephromela* in Australia was previously revised by Elix & Ernst-Russell (2009). 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**

***Tephromela bullata*** Elix, sp. nov.  
Mycobank No.: **MB800992**

Fig. 1

Similar to *Tephromela atra*, but differs in being primarily corticolous and in having a white prothallus, thinner hypothecium and larger ascospores.

Type: **Australia**. *South Australia*: • Eyre Peninsula, Mangalo, 22 km NE of Cleve, 33°32'S, 136°37'E, 270 m, on *Callitris* in remnant *Eucalyptus-Callitris* woodland on flats beside road, J.A. Elix 41829, 23.ix.1994 (CANB – holotype; B – isotype).

*Thallus* crustose, corticolous or lignicolous, continuous, rimose to areolate, 0.1–0.25 mm thick and up to 5 cm wide; *areoles* angular to irregularly shaped or rounded, 0.2–0.4 mm wide; *surface* whitish, creamy white or grey-white, verrucose or often distinctly bullate, lacking isidia and soredia. *Prothallus* white or rarely not apparent. *Apothecia* common, scattered to crowded, innate then adnate to sessile, ±constricted at the base, 0.8–2.0 mm wide; disc ±flat, undulate or convex, roundish, black, glossy, epruinose; thalline exciple usually prominent, thin, persistent, smooth, rarely reduced or not developed; proper exciple poorly defined; epihymenium dark reddish violet to violet-brown, 5–10 µm thick; hymenium violet to violet-red in the upper part, 75–100 µm thick, not interspersed; hypothecium yellow-brown, 50–70 µm thick, K+ orange-brown. *Paraphyses* 3–5 µm wide, simple or sparingly branched, thick-walled; apices swollen or not. *Asci* clavate, *Bacidia*-type, 8-spored. *Ascospores* simple, ellipsoidal, thick-walled, 12–17 × 6–9 µm. *Pycnidia* common, immersed. *Conidia* filiform, straight, 14–20 × 1–1.2 µm.

*Chemistry*: Cortex K+ yellow, C–, KC–, P– or P+ pale yellow; medulla K–, C–, KC+ pink, P–, UV+ blue-white; containing atranorin [major], α-collatolic acid [major], alectoronic acid [major or minor], ±4-O-methylphysodic acid [minor], ±physodic acid [trace], ±dehydrocollatolic acid [trace].

*Etymology*: The specific epithet derives from the bullate surface of the thallus.

**Notes.** This new species is characterized by the whitish to creamy white or grey-white thallus, the distinctly verrucose to bullate surface, the absence of soredia and

isidia and the presence of atranorin and  $\alpha$ -collatolic acid. It differs from the chemically similar *T. atra* (Huds.) Hafellner by its preference for corticolous or lignicolous substrata (*T. atra* is primarily saxicolous), in having a white prothallus (black in *T. atra*), a thinner hypothecium (50–70  $\mu\text{m}$  versus 100–150  $\mu\text{m}$  thick) and larger ascospores (12–17  $\times$  6–9  $\mu\text{m}$  versus 10–14  $\times$  6–8  $\mu\text{m}$ ).

The species is common on bark and lignum in South Australia, but it also occurs in Western Australia and New South Wales. Associated species include *Buellia dissa* (Stirt.) Zahlbr., *B. tetrapla* (Nyl.) Müll.Arg., *Flavoparmelia rutidota* (Hook.f. & Taylor) Hale, *Lecanora symmetrica* (Ach.) Ach., *Parmotrema reticulatum* (Taylor) M.Choisy, *Physcia austrostellaris* Elix, *Usnea scabrida* subsp. *elegans* (Stirt.) G.N.Stevens and *U. subciliata* (Motyka) Swinscow & Krog.

#### SPECIMENS EXAMINED

*Western Australia*: • Donnelly Well, along Donnelly River, 21 km N of Manjimup, 34°04'16"S, 116°10'37"E, 190 m, on *Melaleuca* and *Banksia* in swampy area, *J.A. Elix* 39467, 39469, 7.iv.2006 (CANB); • Lake Muir Flood Plain, 57 km ESE of Manjimup, 36°26'25"S, 116°41'53"E, 190 m, on *Melaleuca* in thicket, *J.A. Elix* 43518, 43525, 8.iv.2006 (CANB).

*South Australia*: • Yorke Peninsula, 19 km E of Stenhouse Bay on road to Warooka, 35°17'S, 136°57'E, 16 m, on *Melaleuca* shrubs in dense scrubland, *J.A. Elix* 3761, 31.viii.1977 (CANB); • Eyre Highway near Conderla Tank, 37 km E of Penong, 31°56'S, 133°24'E, 90 m, on *Leptospermum* in low, dry sclerophyll forest, *J.A. Elix* 41681, 20.ix.1994 (CANB); • Eyre Peninsula, Marble Range, 28 km SW of Cummins, 34°25'S, 135°30'E, 400 m, on *Casuarina stricta* on rocky ridge with scattered shrubs and trees, *J.A. Elix* 41726, 22.ix.1994 (CANB); • High Eden Road, 6 km NW of Springton, 34°41'S, 139°02'E, 400 m, on *Hakea* shrub in dry sclerophyll forest, *J.A. Elix* 41937, 24.ix.1994 (CANB); • Mount Lofty Ranges, Corrynton Park Road, 8 km W of Eden Valley, 34°38'37"S, 139°00'33"E, 520 m, on base of *Eucalyptus* in remnant *Eucalyptus* woodland, *J.A. Elix* 37225, 37226, 37227, 5.xii.2006 (CANB); • Mount Lofty Ranges, Talbots Reserve, 4.5 km W of Tepko, 34°57'40"S, 139°09'02"E, 200 m, on dead *Callitris* twigs in remnant *Eucalyptus*-*Callitris* woodland, *J.A. Elix* 37480, 5.xii.2006 (CANB); • Ferries-McDonald Conservation Park, 10 km S of Monarto, 34°14'02"S, 139°07'54"E, 50 m, on trunk of *Callitris* in mallee scrub, *J.A. Elix* 39397, 8.xii.2008 (CANB).

*New South Wales*: • 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 twigs in mixed rainforest with scattered *Eucalyptus*, *J.A. Elix* 37268, 2.v.2005 (CANB).

***Tephromela disjuncta*** Elix, sp. nov.

Fig. 2

Mycobank No.: **MB800993**

Like *Tephromela isidiosa* but containing alectoronic acid.

Type: **Australia**. *Queensland*: Davies Creek National Park, Davies Creek Falls, 17°01'S, 145°35'E, 660 m, on *Casuarina* in dry sclerophyll forest with *Acacia*, *Eucalyptus* and *Xanthorrhoea*, H.T. Lumbsch 11147a & R. Guderley, 27.vi.1996 (CANB – holotype).

*Thallus* corticolous or lignicolous, crustose, continuous or becoming cracked, areolate and rugulose with age, 0.1–0.3 mm thick, up to 7 cm wide; *areoles* angular to irregularly shaped, 0.1–0.3 mm wide; *surface* white, rarely pale grey, flat and smooth to weakly convex, lacking soredia. *Isidia* dense, laminal, subglobose to cylindrical, not or sparingly branched,  $\pm$ granular, 0.05–0.5 mm tall, 0.10–0.15 mm diam. *Prothallus* thin, whitish or not apparent. *Apothecia* common, scattered, at first innate, then adnate or rarely sessile, usually not constricted at the base, 0.5–1.5 mm wide; disc plane or  $\pm$ undulate, roundish to subirregular, black, glossy, epruinose; thalline exciple very irregular, becoming isidiate, often reduced; proper

exciple poorly defined; epihymenium violet-black, 7–12  $\mu\text{m}$  thick; hymenium reddish purple to purple-brown, 40–70  $\mu\text{m}$  thick; hypothecium pale yellow-brown to purple brown, 30–100  $\mu\text{m}$  thick. *Paraphyses* 3–5  $\mu\text{m}$  wide, simple or sparingly branched, thick-walled; apices swollen or not. *Ascospores* simple, subglobose to ellipsoidal, thick-walled, 7–13  $\times$  5–7  $\mu\text{m}$ . *Pycnidia* not seen.

*Chemistry*: Thallus K+ yellow, C–, KC+ pink, P–, UV+ blue-white; containing atranorin [major], alectoronic acid [major],  $\pm$ physodic acid [trace].

*Etymology*: The specific epithet refers to the disjunct distribution of this species in Australia.

**Notes**. This new species is characterized by the white to pale grey thallus, the subglobose to cylindrical isidia on the surface and the presence of atranorin and alectoronic acid. Morphologically *T. disjuncta* is very similar to *T. isidiosa* Kalb & Elix (Kalb 2004) in that both species are corticolous or lignicolous and have an isidiate surface. They differ mainly in their thallus chemistry. *Tephromela isidiosa* contains only atranorin, whereas *T. disjuncta* contains atranorin, alectoronic acid and traces of physodic acid. Chemically *T. disjuncta* is identical to *T. alectoronica* Kalb, but the latter species lacks isidia. *Tephromela alectoronica* is a very common species throughout temperate and tropical Australia, and also occurs in Southeast Asia and South America, but *T. disjuncta* is only known from Western Australia and Queensland.

At present *T. disjuncta* is only known from two localities – the type locality in north Queensland, and the second in south-western Western Australia. In the latter, *T. disjuncta* grows on dead wood in open *Eucalyptus* woodland where associated species include *Hertelidea pseudobotryosa* R.C.Harris, Ladd & Printzen, *Hypocenomyce australis* Timdal, *H. isidiosa* Elix, *Ochrolechia africana* Vain., *Parmelina pseudorelicina* (Jatta) Kantvilas & Elix, *Protoparmelia nebulosa* Elix & Kantvilas, *Ramboldia subnexa* (Stirt.) Kantvilas & Elix and *Usnea inermis* Motyka. Associated species at the type locality include *Coccocarpia palmicola* (Sprenng.) Arv. & D.J.Galloway, *Gassicurtia subpulcella* (Vain.) Marbach, *Hypotrachyna osseocalba* (Vain.) Y.S.Park & Hale, *Lecanora achroa* Nyl., *Parmotrema reticulatum*, *P. tinctorum* (Nyl.) Hale, *Relicina sydneyensis* (Gyeln.) Hale and *Tephromela alectoronica*.

#### SPECIMEN EXAMINED

*Western Australia*: • Brookton Nature Reserve, Darling Plateau, 25 km W of Brookton, 32°23'50"S, 116°44'03"E, 285 m, on dead wood in *Eucalyptus* woodland with laterite outcrops, *J.A. Elix* 38725, 5.iv.2006 (CANB).

***Tephromela lillipillensis*** Elix, sp. nov.

Fig. 3

Mycobank No.: **MB800994**

Like *Tephromela alectoronica*, but saxicolous and with smaller ascospores and shorter conidia.

Type: **Australia**. *New South Wales*: Lilli Pilli Beach, 35°46'S, 150°12'E, 2 m, on rocks of cliff face, *J.A. Elix* 1196, 5.ix.1975 (CANB – holotype).

*Thallus* saxicolous, crustose, superficial, pale grey-white, continuous, rimose to areolate, 0.05–0.13 mm thick, up to 6 cm wide; *areoles* angular, irregularly shaped to rounded, 0.3–1.0 mm wide; *surface* flat to verruculose, lacking isidia and soredia. *Prothallus* thin, whitish or not apparent. *Apothecia* common, crowded, sessile, 0.8–3.0 mm wide; disc  $\pm$ flat, undulate or weakly concave, roundish to subirregular, black, matt, epruinose; thalline exciple prominent, persistent, smooth, crenulate, 0.1–0.25 mm wide; true exciple not apparent; epihymenium purple-brown to dark brown,

10–15 µm thick; hymenium purple-brown to brown, 75–95 µm thick; hypothecium purple-brown to dark brown, 30–40 µm thick. *Paraphyses* 4–5 µm wide, weakly branched and anastomosing; apices not conspicuously swollen. *Asci* 8-spored, *Bacidia*-type. *Ascospores* broadly ellipsoid, colourless, thick-walled, 7.5–14 × 6–7.5 µm. *Pycnidia* immersed; *conidia* filiform, straight, 10–15 × 1 µm.

**Chemistry:** Cortex K+ yellow, C-, KC-, P+ pale yellow; medulla KC+ pink, P-, UV+ blue-white; containing atranorin [minor], alectoronic acid [major], physodic acid [trace], methyl alectoronate [trace].

**Etymology:** The specific epithet derives from the type locality.

**Notes.** This saxicolous species is characterized by its pale grey-white, areolate thallus containing atranorin and alectoronic acid, by its large (0.8–3.0 mm wide), black apothecia with a prominent thalline margin and its small, broadly ellipsoid ascospores, 7.5–14 × 6–7.5 µm. It resembles some saxicolous specimens of *T. atra*, but can be distinguished by its thinner thallus (0.05–0.13 mm versus 0.3–0.5 mm thick), the shorter conidia (10–15 µm versus 12–24 µm long), and in containing alectoronic acid rather than alectoronic acid [minor] and α-collatolic acid [major]. Chemically *T. lillipillensis* resembles *T. alectoronica* (Kalb 2008). However, the latter is restricted to corticolous and lignicolous substrata, has a white or rarely pale grey thallus, larger ascospores (12–17 × 6.0–9 µm versus 7.5–14 × 6–7.5 µm) and longer conidia (14–20 µm long).

At present this species is known from only two localities in New South Wales. Associated species include *Parmotrema reticulatum*, *P. tinctorum*, *Pertusaria subventosa* Malme var. *subventosa*, *P. xanthoplaca* Müll.Arg., *Xanthoparmelia australasica* D.J.Galloway and *X. scabrosa* (Taylor) Hale.

#### SPECIMEN EXAMINED

**New South Wales:** • Morton National Park, 8 km NE of Nerriga, 35°06'S, 150°08'E, 760 m, on sandstone rocks in open *Eucalyptus* woodland, *J.A. Elix* 33034, 12.vii.1992 (CANB).

***Tephromela olivetorica*** Elix, sp. nov.  
Mycobank No.: **MB800995**

Fig. 4

Like *Tephromela physodica*, but containing olivetoric rather than physodic acid.

**Type: Australia.** **Queensland:** Wongabel State Forest, walking track c. 10 km S of Atherton, 17°19'56"S, 145°30'01"E, 775 m, on canopy branch in remnant, montane rainforest, *J.A. Elix* 44425, 5.viii.2006 (BRI – holotype).

Thallus corticolous, crustose, creamy white to pale grey-white, continuous or becoming cracked, areolate and rugulose with age, c. 0.1 mm thick, up to 6 cm wide; *areoles* angular to irregularly shaped, 0.4–2.0 mm wide; *surface* smooth to verrucose, verrucae 0.1–0.5 mm wide, lacking isidia and soredia. *Prothallus* not apparent. *Apothecia* common, dispersed, immersed then adnate, not constricted at the base, 0.5–1.4 mm wide; disc flat or ±weakly concave, roundish, black, shiny, epruinose; thalline exciple prominent, persistent, smooth then crenulate; proper exciple poorly developed; epihymenium intense violet-brown, 12–16 µm thick; hymenium violet-brown to pale violet-brown in the lower part, 75–125 µm thick; hypothecium purple-brown to yellow-brown, 70–85 µm thick. *Paraphyses* 3–5 µm wide, simple or sparingly branched, thick-walled; apices swollen or not, often pigmented green to violet-black. *Asci* clavate, *Bacidia*-type, 8-spored. *Ascospores* simple, broadly ellipsoid to subglobose, thick-walled, 10–13 × 5–8 µm. *Pycnidia* rare, immersed; *conidia* filiform, straight, 8–12 × 1.5 µm.

**Chemistry:** Cortex K+ yellow, C-, KC-, P- or P+ pale yellow; medulla K-, C-, KC+

pink, P-, UV+ blue-white; containing atranorin [minor], olivetoric acid [major], demethylmicrophyllinic acid [minor].

**Etymology:** The specific epithet derives from the major metabolite, olivetoric acid.

**Notes.** The growth habit, apothecial anatomy and ascospores of this species closely resemble those of *Tephromela physodica* Kalb & Elix (Kalb 2008), but *T. physodica* can be distinguished by the typically larger thalli (6–10 cm versus 3–6 cm wide), larger, sessile apothecia 1–2.5 mm wide which are constricted at the base (smaller, immersed to adnate apothecia, 0.5–1.4 mm wide and not constricted at the base in *T. olivetorica*) and by the chemistry. In contrast to *T. olivetorica*, *T. physodica* contains atranorin [minor], physodic acid [major], ±norcolensoic acid [trace] and ±2'-*O*-methylphysodic acid [trace].

At present the species is known from only the type collection. Associated species include *Coccocarpia palmicola* (Spreng.) Arv. & D.J.Galloway, *Erioderma sorediatum* D. J.Galloway & P.M.Jørg., *Hypotrachyna ossealba* (Vain.) Y.S.Park & Hale, *Lecanora achroa* Nyl., *Megalospora melanoderma* (Müll.Arg.) Zahlbr., *Pannaria fulvescens* (Mont.) Nyl., *Parmotrema mellissii* (C.W.Dodge) Hale, *P. tinctorum*, *Parmelinopsis subfatisceus* (Kurok.) Elix & Hale, *Phyllopsora buettneri* (Müll.Arg.) Zahlbr., *Relicina sydneyensis* (Gyeln.) Hale and *Usnea dasaea* Stirt.

#### New Record for Australia

***Tephromela buelliana*** (Müll.Arg.) Kalb, *Biblioth. Lichenol.* **88**, 319 (2004) Fig. 5  
*Lecidea buelliana* Müll.Arg., *Flora* **63**, 280 (1880).

This saxicolous species is characterized by small, innate to adnate, convex apothecia with a very poorly developed or no thalline margin and an areolate thallus with a prominent black prothallus visible between adjacent areoles (resembling a *Buellia* or *Rhizocarpon* species), as well as having a dark brown to purple-brown epihymenium. Chemically it resembles some saxicolous specimens of *T. atra*, but the latter can be distinguished in having a less prominent prothallus, by its larger (0.8–2.5 mm versus 0.3–1 mm in diam.), sessile, lecanorine apothecia with a prominent, swollen, thalline margin and an intense violet-brown epihymenium and much longer conidia (12–24 µm versus 6–13 µm). A detailed description of the species was published by Vainio (1890, as *Lecidea buelliana*). It was previously known from South America (Brazil).

**Chemistry:** Cortex K+ yellow, C-, KC-, P- or P+ pale yellow; medulla K-, C-, KC+ pink, P-, UV+ blue-white; containing atranorin [minor], α-collatolic acid [major], alectoronic acid [minor or trace], ±4-*O*-methylphysodic acid [trace], ±physodic acid [trace].

#### SPECIMENS EXAMINED

**Victoria:** • Mt Arapiles, near campground, 33 km W of Horsham, 36°45'S, 141°51'E, 300 m, on quartzite rocks in dry sclerophyll woodland, *J.A. Elix* 26084, 17.xii.1990 (CANB).

**South Australia:** • Mt Lofty Ranges, 8 km E of Springton, 34°40'S, 139°10'E, 300 m, on schist rock in pasture, *J.A. Elix* 2758, 15.xii.1976 (CANB); • Mt Lofty Ranges, along Saunders Creek, 6.5 km E of Springton, 34°42'S, 139°10'E, 300 m, on schist rocks in pasture and dry *Eucalyptus* woodland, *J.A. Elix* 23499, 23500, 23516, 2.i.1990 (CANB); • Mt Lofty Ranges, Talbots Reserve, 4.5 km W of Tepko, 34°57'02"S, 139°09'02"E, 200 m, on schist rocks in remnant *Eucalyptus-Callitris* woodland, *J.A. Elix* 44236, 44240, 20.v.2010 (CANB); • Flinders Ranges National Park, summit of St Mary Peak, 21°30'S, 138°33'E, 1165 m, on exposed sandstone rocks, *G. Rambold*, 8.iv.1986 (H. Hertel, *Lecideaceae Exsiccatae*, no. 219, CANB).

**Key to *Tephromela* in Australia**

- 1 Thallus lichenicolous on *Dirinaria* spp. .... **T. cerasina**  
 1: Thallus not lichenicolous, occurring as an independent lichen..... 2
- 2 Thallus sorediate or isidiate. .... 3  
 2: Thallus lacking soredia and isidia ..... 5
- 3 Thallus sorediate ..... **T. sorediata**  
 3: Thallus isidiate ..... 4
- 4 Medulla UV-, KC-; only atranorin present ..... **T. isidiosa**  
 4: Medulla UV+ blue-white, KC+ pink or red; alectoronic acid present .....  
 ..... **T. disjuncta**
- 5 Medulla UV-, KC-; only atranorin present ..... 6  
 5: Medulla UV+ blue-white or KC+ pink or red. .... 7
- 6 Thallus saxicolous; ascospores ovoid to subglobose, 6.5–12.0 × 6–9 μm .....  
 ..... **T. korundensis**  
 6: Thallus corticolous; ascospores ellipsoidal, 9–11 × 6.0–6.5 μm ... **T. brisbanensis**
- 7 Medulla KC-; pannaric acid and pannaric acid 6-methyl ester present .....  
 ..... **T. connivens**  
 7: Medulla KC+ pink or red; pannaric acid and pannaric acid 6-methyl ester absent..... 8
- 8 Medulla C+ red; olivetoric acid present..... **T. olivetorica**  
 8: Medulla C-; olivetoric acid absent. .... 9
- 9 Perlatolic and glomelliferic acids [major]; thallus saxicolous..... **T. arafuensis**  
 9: Stenosporonic, colensoic, alectoronic, physodic or α-collatolic acids [major];  
 thallus corticolous, lignicolous or saxicolous ..... 10
- 10 Physodic, colensoic or norcolensoic acids [major] ..... 11  
 10: Stenosporonic, alectoronic or α-collatolic acids [major] ..... 13
- 11 Colensoic and norcolensoic acids present; thallus corticolous ..... **T. bunyana**  
 11: Physodic acid [major], colensoic and norcolensoic acid absent; thallus cortic-  
 olous, lignicolous or saxicolous ..... 12
- 12 Thallus corticolous or lignicolous; ascospores 8–12 × 6.0–8.5 μm .... **T. physodica**  
 12: Thallus saxicolous; ascospores 7.5–8.0 × 5.0–6.5 μm..... **T. territoriensis**
- 13 Stenosporonic acid [major]; thallus saxicolous; thalline exciple thick .....  
 ..... **T. stenosporonica**  
 13: Alectoronic or α-collatolic acids [major]; thallus corticolous, lignicolous or  
 saxicolous; thalline exciple thin..... 14
- 14 Alectoronic acid [major], α-collatolic acid [trace or absent]..... 15  
 14: α-Collatolic acid [major], alectoronic acid [major, minor or absent]..... 16
- 15 Thallus corticolous or lignicolous; ascospores 12–17 × 6–9 μm... **T. alectoronica**  
 15: Thallus saxicolous; ascospores 7–14 × 6–7.5 μm..... **T. lillipillensis**

- 16 Hymenium inspersion; thallus saxicolous ..... **T. skottsbergii**  
 16: Hymenium not inspersion; thallus corticolous or saxicolous ..... 17
- 17 Thallus corticolous; prothallus white; ascospores 12–17 × 6–9 μm..... **T. bullata**  
 17: Thallus saxicolous; prothallus black or white; ascospores 7–14 × 5.5–8 μm..... 18
- 18 Apothecia sessile, lecanorine; epihymenium violet-brown; conidia 12–24 μm  
 long ..... **T. atra**  
 18: Apothecia immersed to adnate, zeorine; epihymenium dark brown; conidia  
 7–17 μm long..... **T. buelliana**

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Figure 1. *Tephromela bullata* (holotype in CANB).



Figure 2. *Tephromela disjuncta* (holotype in CANB).



Figure 4. *Tephromela olivetorica* (holotype in BRI).



Figure 3. *Tephromela lillipillensis* (holotype in CANB).

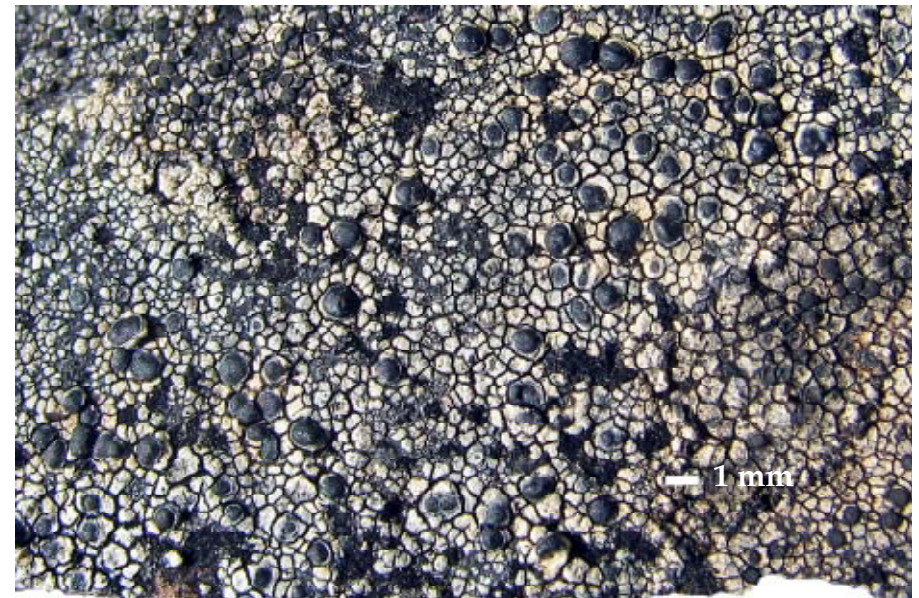


Figure 5. *Tephromela buelliana* (J.A. Elix 23499 in CANB).

*Rhizocarpon austroamphibium* (Rhizocarpaceae,  
lichenized Ascomycota), a new species from Tasmania

Alan M. Fryday

Herbarium, Dept of Plant Biology, Michigan State University,  
East Lansing, MI 48824–1312, U.S.A.

email: fryday@msu.edu

Gintaras Kantvilas

Tasmanian Herbarium, Tasmanian Museum and Art Gallery  
Private Bag 4, Hobart, Tasmania 7001, Australia

email: Gintaras.Kantvilas@tmag.tas.gov.au

**Abstract:**

The new species *Rhizocarpon austroamphibium* Fryday & Kantvilas is described from two alpine localities in south-western Tasmania. It is separated from all other species of the genus by its smooth grey thallus, innate apothecia with a white margin, ±unbranched paraphyses, and large, eumuriform, pigmented ascospores. *Rhizocarpon clausum* (C.Knight) Zahlbr., described from Queensland, is a synonym of *Ramboldia petraeoides* (Nyl. ex C.Bab. & Mitt.) Kantvilas & Elix. A key is provided for the species of *Rhizocarpon* reliably reported from Australia.

**Introduction**

The cosmopolitan genus *Rhizocarpon* Ramond ex DC. contains *c.* 200 species (Fletcher *et al.* 2010), most of which occur on siliceous rocks in high altitude/latitude regions. However, the genus is poorly studied in the Southern Hemisphere, especially in Australia where the current checklist (McCarthy 2012) indicates only 15 species (plus three infra-specific taxa). Of those, *R. tinei* (Tornab.) Runemark is a synonym of *R. geographicum* (L.) DC., three others (*R. johnsonii*, *R. kerguelensis* and *R. mawsonii*) are reported in Australia only from Heard Island, and were described by the notorious C.W. Dodge (Fryday 2011) and so are of dubious status, and *R. nidificum* (Hue) Darb. is likewise of uncertain status. In addition, the correct name for *R. obscuratum* auct. has been shown to be *R. reductum* Th.Fr. (Fryday 2000). The other species reported from Australia (i.e., *R. badioatrum* (Flörke) Th.Fr., *R. clausum* (C. Knight) Zahlbr., *R. disporum* (Hepp) Müll.Arg., *R. distinctum* Th.Fr., *R. geographicum* (L.) DC., *R. petraeum* (Wulfen) A.Massal., *R. polycarpum* (Hepp) Th.Fr., *R. superficiale* (Schaer.) Vain. and *R. viridiatrum* (Wulfen) Körb.) are all common in the Northern Hemisphere except for *R. clausum* (basonym *Lecidea clausa* C.Knight), which is known only from the Queensland type collection. As part of this study, one of us (AMF) examined that collection (Shirley 21-17; AQ721202), and found it to be referable to *Ramboldia petraeoides* (Nyl. ex C.Bab. & Mitt.) Kantvilas & Elix. Consequently, only nine species are reliably reported from Australia, compared, for example, with 39 from the British Isles (Fletcher *et al.* 2010).

The situation for New Zealand was similar, with the first edition of the New Zealand lichen *Flora* (Galloway 1985) listing only eight species, four of which have since been shown to be referable to other taxa (Galloway 2007). However, due to recent attention to the genus in New Zealand by the first author and others, the second edition of the New Zealand lichen *Flora* (Galloway 2007) lists 22 species (plus one infraspecific taxon), and a further species, *R. simillimum* (Anzi) Lettau, has recently been reported from South Island (Fryday & Øvstedal 2012). There is little doubt that similar attention to the genus in Australia would dramatically increase the number of species reported, especially in Tasmania given the extensive holdings of unidentified specimens of the genus held in the Tasmanian Herbarium (HO).

Here we report a species from Tasmania that, although it is known from only two localities in the same area, is sufficiently distinct from all other reported species that its status as new to science is beyond question.

**Material and methods**

The specimens were studied using standard microscopy techniques. The macro images of *R. austroamphibium* in Figs 1 & 2 were created from multiple images stacked using Photoshop CS5. Chemical constituents were identified by thin-layer chromatography (Orange *et al.* 2001). Nomenclature for apothecial pigments follows Meyer & Printzen (2000).

*Rhizocarpon austroamphibium* Fryday & Kantvilas sp. nov.

Figs 1 & 2

Mycobank No.: MB801010

A specibus aliis generis thallo laevi griseoque, apotheciis innatis, margine albo, paraphysibus plus minusve non ramosis et ascosporis eumuriformibus, pigmentatis, (30–)40–55 µm longis, (17–)20–25 µm latis distinguibile.

Typus: Australia, Tasmania, Mt Eliza plateau, small cirque E of peak, 42°58'S, 146°25'E, 1250 m, on quartzite pebbles at shoreline and submerged in a shallow alpine tarn in fjeldmark, 21.iv.2012, G. Kantvilas 292/12 (holotypus – HO; isotypi – E, MSC, UPS).

*Thallus* effuse, glaucous- to olivaceous-grey to pale grey to whitish where not exposed to direct light on the lower side and underside of pebbles, greyish green when fresh and moist, forming dispersed or contiguous, cracked-rimose patches 1–1.5 cm or more wide, *c.* 50 µm thick, on a black hypothallus; *cortex* lacking but surface cells blue-grey pigmented, N+ red (*cinereorufa*-green); *medulla* hyaline but with minute, pale brown inclusions clearing in K, I–, in the upper part composed of randomly organized cells, in the lower part composed of columns of ±vertically aligned cells 5–8 µm wide; *basal layer* *c.* 20 µm thick, dark red-brown, K+ purple (*atra*-brown). *Photobiont layer* discontinuous, in clumps, or occasionally in columns 20–25 µm wide; cells chlorococcoid, 10–15 µm diam. with a colourless sheath 2–3 µm thick. *Apothecia* 0.4–0.6 mm diam., scattered, immersed at first but soon emergent (Fig. 1), with the remains of the thallus forming a pseudothalline margin when young (Fig. 2A) and appearing as a white rim in mature apothecia (Fig. 2B); disc black, concave, rough and warty, prominently convex when wet; proper margin not apparent. *Hymenium* 160–170 µm tall, with minute colourless inclusions that dissolve in K; *paraphyses* ±simple and only rarely anastomosing, ±lax in K, relatively thick, 2–3 µm wide, not capitate; *epihymenium* *c.* 20 µm thick, pale chocolate-brown, K+ olivaceous-brown. *Hypothecium* thin, pale brown, *c.* 10–15 µm thick. *Asci* of the *Rhizocarpon*-type, cylindrical, *c.* 120–170 × 35–50 µm, soon disintegrating; *ascospores* 2–4(–6) per ascus, eumuriform, dark blue-black, N+ red (*cinereorufa*-green), (30–)40–55 × (17–)20–25 µm. *Exciple* annular, brown, *c.* 50 µm wide near the surface, hyaline and much narrower below. *Conidiomata* not observed.

*Chemistry*: Cortex K–, KC+ reddish, C+ reddish, P–; containing gyrophoric acid by tlc. Medulla I–.

**Distribution and ecology**

*Rhizocarpon austroamphibium* is known from only the type locality and one other nearby locality in south-western Tasmania. At the type locality, a shallow alpine tarn (Fig. 3) on the Mt Anne massif, it grows on quartzite pebbles within the tarn itself at depths of 20 cm or more, as well as around the broad pebbly shore that is seasonally or intermittently inundated. The tarn is relatively shallow and at most only *c.* 50 cm deep, and drains through a steep cut in a moraine. In the water and closest to the water's edge, the new species forms a pure colony covering the entire surface of the pebbles (Fig. 4). Further away from the water, it gradually gives way to other lichens, such as *Rhizocarpon geographicum* (L.) DC. and *Lecidea lygomma* Nyl. ex Cromb.; a species of *Rimularia* is also present, as yet unidentified and possibly new to science. At the second locality, *c.* 25 km to the south-west on the Western Arthur Range, it also occurs on quartzite rocks in and around a small alpine lake.

The type locality is remarkable in a Tasmanian context. The tarn is located in a small cirque within the largest continuous patch of fjældmark in Tasmania known to the junior author. The vascular vegetation is scarcely more than a few centimetres tall, and is dominated by monocotyledons, among them *Oreobolus* spp., small herbs such as *Aciphylla procumbens* (F.Mueller) Benth. and species of *Mitrascome*, *Celmisia* and *Erigeron*, and by cushion plants (bolsters). The vegetation is also very rich in terricolous lichens such as species of *Parasiphula* and *Cladonia*, *Pertusaria flavoexpansa* Kantvilas & Elix, *Micarea magellanica* (Müll.Arg.) Fryday, *Cetraria aculeata* (Schreb.) Fr., *Neophyllis melacarpa* (F.Wilson) F.Wilson, *Lichenomphalia chromacea* (Cleland) T.W.May & A.E.Wood, *Siphula decumbens* Nyl. and *Cladia moniliformis* Kantvilas & Elix.

**Notes:** The *Rhizocarpon*-type asci and large, pigmented, muriform ascospores clearly indicate that the new species is referable to *Rhizocarpon*. The presence of the pigment *atra*-red is also consistent with *Rhizocarpon*, although its location in the basal layer of the thallus rather than the apothecia is unique in the genus. However, a number of characters are anomalous for that genus, especially the ±simple, non-conglutinate paraphyses and the immersed apothecia with a white margin, indicating that the new species occupies a peripheral position in *Rhizocarpon*. The white “margin” of the apothecia of *R. austroamphibium* (Fig. 1) appears to develop as the apothecia emerge from the thallus. Initially, the thallus immediately surrounding the nascent apothecium is pushed upwards at an angle (Fig. 2A) that becomes steeper as the apothecium increases in diameter, so that it is eventually vertically aligned and the medulla is exposed, thus resulting in a ring of white medullary tissue surrounding the apothecium (Fig. 2B).

The Northern Hemisphere species *R. amphibium* (Fr.) Körb. has similar, ±simple paraphyses and non-sessile apothecia, but the paraphyses are conglutinate and the apothecia more adnate, with a thin concolorous proper margin clearly visible. The ascospores are also much smaller (23–27 × 10.5–12 µm), submuriform and hyaline. Interestingly, as the two names suggest, *R. amphibium* and *R. austroamphibium* occur in similar habitats on semi-inundated rocks.

#### SPECIMENS EXAMINED

*Tasmania*: • Mt Eliza plateau, small cirque E of peak, 42°58'S, 146°25'E, 1250 m, on quartzite pebbles at the edge of an alpine tarn, in places submerged, 21.i.2012, G. Kantvilas 23/12 (HO, MSC). • Lake Cygnus, 43°08'S 146°14'E, 880 m, on quartzite rocks submerged at the margins of an alpine lake, 6.xii.2006, G. Kantvilas 501/06A (HO).

#### Key to the species of *Rhizocarpon* reported from Australia

*Rhizocarpon johnstonii* C.W.Dodge, *R. kerguelense* C.W.Dodge, *R. mawsonii* C.W.Dodge, and *R. nidificum* (Hue) Darb., which in Australia are reported only from Heard Island, are excluded because the names are of uncertain application and in need of critical re-evaluation. *Rhizocarpon tinei sensu* Runemark is a synonym of *R. geographicum*. Thalline chemistry is generally not included in the key, because it is often variable within species and, in the species included here, is of little value in identification.

- 1 Thallus white, brown or grey, UV– or white ..... 2
- 1: Thallus yellow-green, UV+ bright orange ..... 8
- 2(1) Ascospores 1-septate ..... 3
- 2: Ascospores muriform ..... 4
- 3(2) Ascospores hyaline; medulla I+ mauve ..... **R. polycarpum**
- 3: Ascospores pigmented; medulla I– ..... **R. badioatrum**

- 4(2): Ascospores hyaline ..... 5
- 4: Ascospores pigmented ..... 7
- 5(4) Medulla I+ mauve; epihymenium K+ purple ..... **R. distinctum**
- 5: Medulla I–; epihymenium K– ..... 6
- 6(5): Ascospores < 30 µm long, submuriform to muriform; thallus brown (rarely white), usually lacking lichen substances but occasionally with stictic acid (K+ yellow, Pd+ orange) or norstictic acid (K+ red, Pd+ yellow); on siliceous substrata..... **R. reductum**
- 6: Ascospores > 30 µm long, eumuriform; thallus white, containing stictic acid (K+ yellow, Pd+ orange); on calcareous substrata. .... **R. petraeum**
- 7(4): Ascospores 1/ ascus; apothecia sessile, with black proper margin; thallus composed of thick, contiguous, convex areoles, containing stictic acid (K+ yellow, Pd+ orange), or lacking substances (K–, Pd–) ..... **R. disporum**
- 7: Ascospores 2–4(–6)/ ascus; apothecia immersed, with a white rim; thallus composed of thin, smooth, dispersed areoles on a black hypothallus, containing gyrophoric acid (C+ red in section) ..... **R. austroamphibium**
- 8(1): Ascospores 1-septate ..... **R. superficiale**
- 8: Ascospores muriform ..... 9
- 9(8): Medulla I–; thallus dull green, parasitic on *Aspicilia* spp. .... **R. viridiatrum**
- 9: Medulla I+ mauve; thallus yellow-green to orange, not parasitic..... **R. geographicum**

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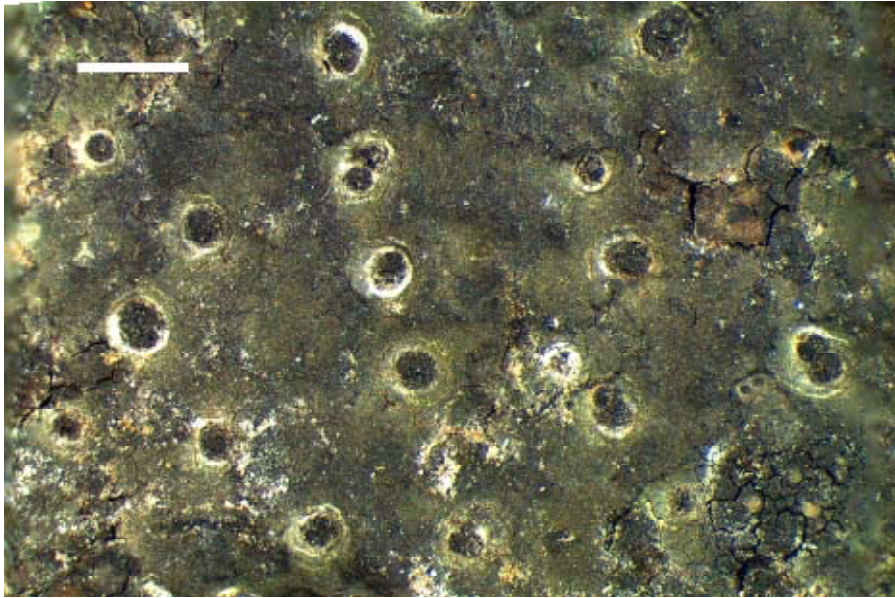


Fig. 1. *Rhizocarpon austroamphibium* (Kantvilas 23/12). Scale bar = 1 mm.

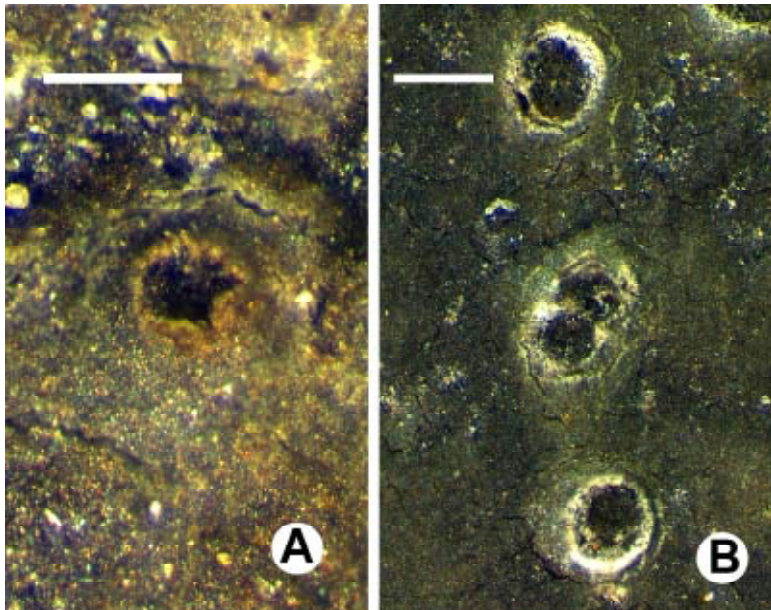


Fig. 2. Development of apothecia of *Rhizocarpon austroamphibium* (Kantvilas 23/12). A, young apothecium; B, mature apothecia. Scale bars: A = 0.2 mm; B = 0.5 mm.



Fig. 3. *Rhizocarpon austroamphibium* habitat. A shallow alpine tarn in a cirque on the Mt Anne massif. The lichen inhabits the quartzite pebbles from beneath the water-line across the pebbly shore to the limit of the green vascular vegetation (left). The surrounding vegetation is fjældmark dominated by low vascular plants and lichens.



Fig. 4. *Rhizocarpon austroamphibium* habit. The new species covers the entire surface of small pebbles in and near the water.

## *Graphis supracola* A.W.Archer is not endemic to Australia

Alan W. Archer

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

**Abstract:** *Graphis supracola* A.W.Archer, originally reported to be endemic to Australia, has since been reported from south-east Asia and the Neotropics.

*Graphis supracola* was originally known only from the type specimen from Queensland, and was reported to be "a rare endemic corticolous species" (Archer 2001). However, recent publications have shown it to occur in south-east Asia and North and South America (Fig. 1).

The species has been reported from the following localities:

**Brazil:** • *s. loc.* as *Graphis scripta* var. *candida* Zahlbr. [*nom. inval.* not published] (Lücking *et al.* 2009).

**Cambodia:** • north-western Cambodia, Siem Reap, 13°27'N, 103°53'E, where it is rather common on branches of trees, including *Ficus* sp. (Kashiwadani *et al.* 2010).

**Colombia:** • north-western Colombia, Los Córdoba, alt. 90–100 m, 8°48'N, 76°19'W (Rincón-Espitia *et al.*, 2011).

**Thailand:** • Loei Province, northern Thailand, Phu Luang Wildlife Sanctuary, in lower montane rainforest, mixed deciduous forest and dry evergreen forest (Poengsungnoen *et al.* 2010). • Khao Yai National Park, 14°22'N, 101°24'E, alt c. 1200 m; common on *Castanopsis acuminatissima* in lower montane rainforest (Senglek *et al.*, no date). • Goldenes Dreieck Thailand, Laos, Burma, am Mekong Fluss bei Chiang Saen (20°21'N, 100°05'E, alt. 450 m; *F. Schumm* 9550, 30.ii.2002 (herb. Schumm) (*F. Schumm in litt.* 2011).

**United States:** • Florida, Miami-Dade County, Everglades National Park (Seavey & Seavey 2011).

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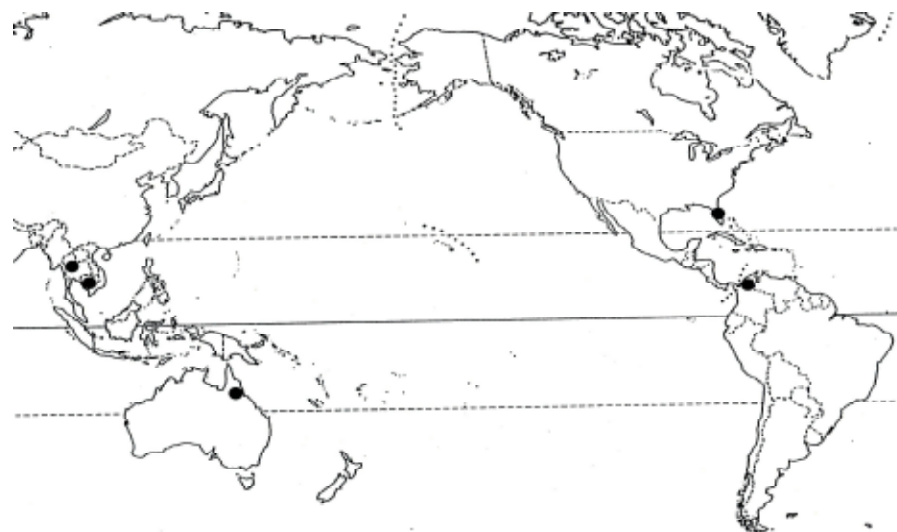


Fig. 1. Distribution of *Graphis supracola*.

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