

Six new lichen species from Australia

Klaus Kalb

Lichenological Institute Neumarkt, Im Tal 12, D-92318 Neumarkt, Germany
e-mail: klaus.kalb@arcor.de

André Aptroot

ABL Herbarium, G. v.d. Veenstraat 107, NL-3762 XK Soest, The Netherlands
e-mail: andreaptroot@gmail.com

Abstract

Carbacanthographis uniseptata Kalb & Aptroot (Graphidaceae; Queensland), *Coenogonium bryophilum* Kalb & Aptroot (Coenogoniaceae; Borneo, Queensland), *Coniarthonia minima* Kalb & Aptroot (Arthoniaceae; New South Wales), *Punctonora brunneosedata* Kalb & Aptroot (Lecanoraceae; New South Wales), *Roccellinastrum leprocauloides* Kalb & Aptroot (Pilocarpaceae; Queensland) and *Traponora flavothallina* Kalb & Aptroot (Lecanoraceae; Queensland) are described as new to science.

Among hitherto unidentified collections of Australian lichens, we have encountered several new taxa, six of which are described in the present paper. Chemical constituents were identified by thin-layer chromatography (Elix 2014).

The new species

1. *Carbacanthographis uniseptata* Kalb & Aptroot, sp. nov.
Mycobank No. **MB 824617**

Fig. 1

Carbacanthographis with 1-septate ascospores, 7–8 × 3–4 µm.

Type: Australia, Queensland, Fitzroy Island, 16°56'S, 146°00'E, c. 20 m alt., on tree bark in rain forest, *K. Kalb & A. Kalb 21255*, 25.viii.1988 (holotype – CANB).

Thallus dull, granular, more or less continuous, chalky to pale ochraceous white, not corticate, without hypothallus; algae trentepohlioid, cells 7–10 µm diam. Apothecia sessile, white, linear to curved or a few times branched, arranged in rather dense groups, basally and laterally covered by a thalline cover, apically with a thick, dense white pruina, not striate, c. 0.3–1.3 mm long, 0.2–0.3 mm wide. Exciple completely carbonized, in the upper part with spiny periphysoids. Hymenium not interspersed. Paraphyses unbranched, partly with spiny tips. Asci cylindrical, *Graphis*-type (Staiger & Kalb 1999: 73), 40–50 × 8–9 µm; ascospores 8 per ascus, almost uniseriate in the ascus, 1-septate, hyaline, 7–8 × 3–4 µm, ends rather pointed. Pycnidia unknown.

Chemistry: Thallus UV–, C–, K+ brownish yellow, P+ red. TLC: Protocetraric acid (major).

This species is unique in the genus (Lücking *et al.* 2009) in having 1-septate ascospores. *Carbacanthographis* is a comparatively small genus in Graphidaceae (26 species described), characterized by having lirelliform ascomata laterally or completely covered by a conspicuous white thalline margin, a laterally or completely carbonized exciple and spiny periphysoids. Four species are known from Australia, viz. *C. hertelii* Kalb & Staiger, an endemic, corticolous species in rainforests in south-eastern Qld and eastern N.S.W., *C. marcescens* (Fée) Staiger & Kalb, which is widely distributed in the tropics and uncommon in rainforests in north-eastern Qld., *C. salazinicola* (A.W.Archer) A.W.Archer, which is rare in rainforests in north-eastern N.S.W. and also occurs in Indonesia, and the here described *C. uniseptata* from Qld. The latter is most similar to *C. hertelii* in having a completely carbonized exciple, only transseptate ascospores and in producing protocetraric acid, but *C. uniseptata* is easily separated in having 1-septate ascospores (3-septate in *C. hertelii*) and in lacking isidia.

2. *Coenogonium bryophilum* Kalb & Aptroot sp. nov.
Mycobank No. **MB 824618**

Fig. 2

Coenogonium growing on *Fissidens* sp. with medium sized apothecia and small, broadly ellipsoid ascospores.

Type: Malaysia. Borneo: Sabah; Kota Kinabalu, Gaya Island, coastal rainforest on trail embankment on *Fissidens crassinervius*, 10–20 m alt., 6°00' N, 116°00' E, *K. Kalb & A. Mertens 40467*, 6.viii.2014 (holotype – B; isotype NY).

Thallus crustose, muscicolous (*Fissidens* sp.), thin, smooth, greyish green to olive-green, dull. Apothecia sessile, rounded in outline, up to 0.9 mm diam., up to 300 µm high; disc plane or slightly concave, pale orange to yellow-orange, margin prominent, slightly denticulate in young apothecia, becoming smooth with age. Exciple paraplectenchymatous with irregularly arranged cells, laterally up to 80 µm broad, basally up to 130 µm high. Hypothecium up to 20 µm high, colourless. Hymenium 60–80 µm high, 1+ blue, then quickly reddish brown. Asci c. 45 × 5 µm, 8-spored. Ascospores oblique-uniseriate, broadly ellipsoid (for definition see Kalb *et al.* 2016: 102), 1-septate, 7–10 × 2–3 µm, 2.5–4.2 times as long as broad. Pycnidia wart-shaped, c. 0.1 mm diam., light cream. Conidia bacillar, 2.5–3 × 1–1.2 µm.

ADDITIONAL SPECIMEN EXAMINED:

Queensland: • A few km N of Noosa Heads, edge of coastal rainforest on road embankment on *Fissidens oblongifolius*, alt. 10 m, 26°24' S, 153°06' E, *K. Kalb & A. Mertens 39777*, 7.viii.2012 (paratype – hb. K. Kalb).

In the global key presented by Rivas Plata *et al.* (2006), this species would key out at couplet 64, *Coenogonium frederici* (Kalb) Kalb & Lücking, but that species grows on bark and differs further in having larger ascospores (8–12 × 3–4 µm, 2.2–3.1 as long as broad) and smaller apothecia (up to 0.6 mm diam). Another species similar to *C. bryophilum* is the epiphyllous *C. geralense* (P. Henn.) Lücking, but it differs in having thinner apothecia (up to 175 µm high), broader pycnidia (1.7–2 µm broad) and asci with irregularly biseriolate ascospores.

3. *Coniarthonia minima* Kalb & Aptroot, sp. nov.
Mycobank No. **MB 824619**

Fig. 3

Coniarthonia without a thallus, apothecia 0.1–0.2 mm diam., ascospores clavate, 1-septate, 9.5–10.5 × 2.5–3.0 µm.

Type: Australia, New South Wales, Morton National Park, 8 km NE of Nerriga, 35°07'S, 150°08'E, c. 650 m alt., on tree bark in rain forest, *K. Kalb, A. Kalb & J.A.Elix 26648*, 5.viii.1992 (holotype – CANB).

Thallus absent. Apothecia sessile, convex, immarginate, 0.1–0.2 mm diam., bright red. Hymenium hyaline, without gel. Asci clavate, c. 30 × 15 µm, interascal filaments paraphysoids, c. 2 µm wide, branched and anastomosing. Hymenium not interspersed. Epithymenium with bright orange crystals. Hypothecium hyaline. Ascospores clavate, 1-septate, hyaline, 9.5–10.5 × 2.5–3.0 µm, with rounded ends, not curved, without a gelatinous sheath. Pycnidia unknown. *Chemistry:* apothecia UV–, C–, K+ blood red (almost black). An unidentified anthraquinone.

This species is the smallest known in the genus (Grube 2001; Aptroot *et al.* 2015), and the only one that is not lichenized. *Coniarthonia* is a very small genus with only twelve species described worldwide, and only one from Australia, namely *C. wilmsiana* (Müll.Arg.) Grube, which is known from a single corticolous collection in a rainforest in north-eastern Qld. It occurs also in South Africa and Central and South America, and has 3-septate ascospores, 22–38 µm long, 11–16 µm wide. *C. minima* is very similar to *C. pulcherrima* (Müll.Arg.)

Grube in having rounded ascomata and 1-septate ascospores, thus belonging in the *C. pulcherrima* group (Grube 2001), but the latter is easily separated by broader ascospores (3.5–5 µm broad) and much larger ascomata (0.5–1.5 mm in diam.).

4. *Punctonora brunneosorediata* Kalb & Aptroot, sp. nov.
Mycobank No. **MB 824620**

Fig. 4

Punctonora with soredia.

Type: Australia, New South Wales, Patonga Creek, 40 km N of Sydney, 33°33'S, 151°16'E, alt. 1 m, on bark of *Casuarina* sp. in mangrove, *K.Kalb, A.Kalb, A.Archer & P.Archer 41151*, 10.viii.1992 (holotype – CANB).

Thallus slightly shiny, pale yellowish grey, originating as isolated minute granules becoming more or less continuous, thin, not surrounded by a hypothallus, mostly obscured by soredia. Soralia brownish, initially punctiform, but soon coalescent, with farinose soredia. Algae chlorococcoid, 5–10 µm diam. Apothecia sessile, glossy, initially flat, later somewhat convex, round to lobate, 0.3–0.5 mm diam.; disc dark brown (almost black); margin dark brown (almost black), not higher than the disc, *c.* 0.05 mm wide. Excipulum brown outside, hyaline inside, structure somewhat gelatinous. Hymenium not interspersed. Paraphyses with brown clavate top cells of *c.* 7 × 3.5 µm. Asci of *Lecanora*-type (Aptroot *et al.* 1997: 152), 30–35 × 9–11 µm; ascospores 8 per ascus, hyaline, simple, 8–10 × 3.5–5 µm. Pycnidia unknown.
Chemistry: Thallus UV–, C–, K+ yellow. TLC: sekikaic acid (major).

This is only the second species attributed to this rare genus, and the first report of the genus in Australia. The large pigmented apical cells of the paraphyses are characteristic. It differs from the type species, *P. nigropulvinata* Aptroot (Aptroot *et al.* 1997) in having soredia. *Punctonora* was described as a monotypic genus (Aptroot *et al.* 1997) with *P. nigropulvinata* Aptroot as the only species from Papua New Guinea.

5. *Roccellinastrum leprocauloides* Kalb & Aptroot, sp. nov.
Mycobank No. **MB 824622**

Fig. 5

Roccellinastrum with norstictic, connorstictic, hypoconstictic and protocetraric acids and dispersed pseudoisidia and a surface with many extruding hyphae.

Type: Australia, Queensland, a few km N of Noosa Heads, at the edge of a tropical rainforest, 26°23'S, 153°05'E, *c.* 40 m alt., on tree bark in rain forest, *K.Kalb 40537*, 10.viii.2015 (holotype – CANB).

Thallus dull, whitish grey, more or less continuous, thin, with pseudoisidia, not surrounded by a hypothallus. Pseudoisidia rather dispersed, upright, densely branched, *c.* 0.2 mm wide and up to 1.5 mm high, of thallus colour, surface hyphal with many extruding hyphae; hyphae densely encrusted with tiny crystals (probably of the secondary chemistry components). Algae chlorococcoid, 6–8 µm diam. Apothecia and pycnidia unknown.
Chemistry: Thallus UV–, C–, K+ yellow then red, P+ red. TLC: Norstictic, connorstictic, hypoconstictic and protocetraric acids.

The species is not known to be fertile, but it most probably belongs to *Roccellinastrum* because of the byssoid thallus with thick-walled hyphae. It differs from the few species known in that genus (Henssen *et al.* 1982; Kantvilas 1990) by its chemistry and pseudoisidium morphology. Hafellner & Vězda (1992) give an overview and key to lichen genera with a byssoid thallus. This new species differs from most genera by the presence of extruding hyphae. The only other genus that is somewhat similar is *Crocynia*, but the few species currently accepted in that genus have more clearly delimited thalli, usually with a black prothallus, and they are closely

appressed, unlike species of the genus *Roccellinastrum*, including our new species. The new species superficially somewhat resembles the historical concept of *Leprocaulon*, but that genus is not considered byssoid by Hafellner & Vězda (1992), and it has been segregated into several genera by Lendemer & Hodkinson (2013), none of which contains species close to our new species, nor any species with pseudoisidia.

6. *Traponora flavothallina* Kalb & Aptroot, sp. nov.
Mycobank No. **MB 824623**

Fig. 6

Traponora with a yellowish thallus containing atranorin and thiophaninic acid and sessile apothecia with dentate margins.

Type: Australia, Queensland, 12 km SE of Mareeba, along Davies Creek road, 17°00'08"S, 145°34'05"E, *c.* 450 m alt., on tree bark in dry *Eucalyptus* forest, *K.Kalb & D.Kalb 40557*, 21.viii.2015 (holotype – CANB).

Thallus dull, pale yellowish green, continuous, not corticate, not surrounded by a hypothallus. Algae chlorococcoid, 5–8 µm diam. Apothecia sessile, dark brown, dull, initially flat, later somewhat convex, round to lobate, 0.3–1.1 mm diam.; disc dark brown, not pruinose; margin pale yellowish green, irregular and somewhat coronate, evanescent, not higher than the disc, *c.* 0.05 mm wide. Hymenium not interspersed. Paraphyses with greenish black tips. Hypothecium brownish. Asci of *Lecanora*-type (Aptroot *et al.* 1997: 200), 40–50 × 13–18 µm; ascospores 8 per ascus, simple, hyaline, ellipsoid, 14–16 × 7–8 µm, wall 1 µm thick. Pycnidia unknown.
Chemistry: Thallus UV–, C–, K+ yellow. TLC: Atranorin (minor), thiophaninic acid (major)

The coronate apothecia resembling a *Trapelia* and the pigmented paraphyse tips are characteristic of the genus. This species differs from the other species in the genus (Aptroot 2009) by the combination of sessile apothecia and a dentate apothecium margin. The thallus colour (and chemistry) are also unique within the genus. Most similar is the pantropical *T. globosa* Aptroot in having sessile apothecia and a non-interspersed hymenium, but the two species are readily separated by smaller ascospores (10–12 × 5–6 µm) and the lack of thiophaninic acid in the latter. The genus was originally described as monotypic from Papua New Guinea, with *T. asterella* Aptroot as the type species (Aptroot *et al.* 1997). A 2009 monograph of the genus (Aptroot 2009), described four further species and reported further findings of *T. asterella* (expanding its distribution to pantropical). Subsequently, Kalb & Kalb (2017) reported *T. macrospora* Aptroot as new for Thailand, and combined the neotropical *Lecidea varians* Ach. into *Traponora* as well. *Traponora* is newly reported here from Australia.

Acknowledgements

We thank Dr. W. Buck (New York) for the identification of the *Fissidens* species. The senior author (K. K.) acknowledges the companionship of A. Mertens during the trips in Australia and Malaysia where the new *Coenogonium* species was collected.

References

- Aptroot, A (2009): The lichen genus *Traponora*. *Bibliotheca Lichenologica* **100**, 21–30.
Aptroot, A; Diederich, P; Sérusiaux, E; Sipman, HJM (1997): Lichens and lichenicolous fungi from New Guinea. *Bibliotheca Lichenologica* **64**, 1–220.
Aptroot, A; Ertz, D; Silva, JR; Grube, M; Cáceres, MES (2015): The phylogenetic position of *Coniarthonia* and the transfer of *Cryptothecia miniata* to *Myriostigma* (Arthoniaceae, lichenized Ascomycetes). *Phytotaxa* **218**, 128–136.
Elix, JA (2014): A catalogue of standardized chromatographic data and biosynthetic relationships for lichen substances, 3 ed. Published by the author, Canberra.
Grube, M (2001): *Coniarthonia*, a new genus of arthonioid lichens. *Lichenologist* **33**, 491–502.
Hafellner, J; Vězda, A (1992): *Tibellia*, eine neue Gattung der Bacidiaceae mit byssoidem Thallus (lichenisierte Ascomycetes, Lecanorales). *Nova Hedwigia* **55**, 183–193.

- Henssen, A; Vobis, G; Renner, B (1982): New species of *Roccellinastrum* with an emendation of the genus. *Nordic Journal of Botany* **2**, 587–599.
- Kalb, J; Boonpragob, K; Kalb, K (2016): New *Coenogonium* species (Ostropales: Coenogoniaceae) from Thailand, new reports and a revised key to the species occurring in the country. *Phytotaxa* **283**, 101–122.
- Kalb, J; Kalb, K (2017): New lichen species from Thailand, new combinations and new additions to the Thai lichen biota. *Phytotaxa* **332**, 141–156.
- Kantvilas, G (1990): The genus *Roccellinastrum* in Tasmania. *Lichenologist* **22**, 79–86.
- Lendemer, JC; Hodkinson, BP (2013): A radical shift in the taxonomy of *Lepraria* s.l.: molecular and morphological studies shed new light on the evolution of asexuality and lichen growth form diversification. *Mycologia* **105**, 994–1018.
- Lücking, R; Archer, AW; Aptroot, A (2009): A world-wide key to the genus *Graphis* (Ostropales: Graphidaceae). *Lichenologist* **41**, 363–452.
- Rivas Plata, E; Lücking, R; Aptroot, A; Sipman, HJM; Chaves, JL; Umaña L; Lizano, D (2006): A first assessment of the Ticolichen biodiversity inventory in Costa Rica: the genus *Coenogonium* (Ostropales: Coenogoniaceae), with a world-key and checklist and a phenotype-based cladistic analysis. *Fungal Diversity* **23**, 255–321.
- Staiger, B; Kalb, K (1999): *Acanthothecis* and other graphidioid lichens with warty periphyses or paraphysis-tips. *Mycotaxon* **73**, 69–134.



Fig. 1. *Carbacanthographis uniseptata*, scale bar = 0.25 mm.



Fig. 2. *Coenogonium bryophilum*, scale bar = 0.5 mm.



Fig. 3. *Contiarthonia minima*, scale bar = 0.15 mm.



Fig. 5. *Roccellinastrum leprocauloides*, scale bar = 1 mm.



Fig. 4. *Punctonora brunneosorediata*, scale bar = 0.3 mm.



Fig. 6. *Traponora flavothallina*, scale bar = 0.25 mm.