

Standard Paper

Contributions to the lichen genus *Cresponea* (Roccellaceae)

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Abstract

Two Tasmanian species of the genus *Cresponea* are treated: *C. graemeannae* Kantvilas sp. nov., characterized by a very thin, saxicolous thallus, apothecia with a thick, radially fissured margin, thinly pruinose disc, hypothecium inspersed with oil droplets, and 5–9-septate ascospores, 25–40 × 6–8 µm; and *C. subpremnea* (Kantvilas & Vězda) Kantvilas comb. nov. The latter has ascospores 30–58 × 4.5–7 µm, which distinguish it from the related *C. plurilocularis* (Nyl.) Egea & Torrente (ascospores 27–45 × 6–8 µm). The taxa are illustrated, discussed and compared. *Cresponea litoralis* Elix, based on an Australian type, is considered a synonym of *Bactrospora myriadea* (Fée) Egea & Torrente. A key to the species of *Cresponea* reported from Australia is presented.

Key words: Australia, *Bactrospora*, lichens, new species, Tasmania

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Introduction

The lichen genus *Cresponea* was erected by Egea & Torrente (1993a) to accommodate the *Lecanactis premnea* (Ach.) Arnold group. It shares with *Lecanactis* the salient features of a chiefly crustose thallus containing a trentepohlioid photobiont, apothecoid, lecidine ascumata where the dark excipular tissues react a shade of green or olive green in KOH, simple to sparingly branched paraphysoids, a hemiamyloid hymenium, 8-spored, *abietina*-type asci (terminology after Egea & Torrente 1994) and transversely septate, fusiform, hyaline ascospores. *Cresponea* differs from *Lecanactis* s. str. by having typically epruinose apothecia and, when a pruina is present, it is usually confined to the disc and inner edge of the exciple, and is typically greenish, orange or reddish; in contrast, the apothecia of *Lecanactis* species are usually entirely and persistently greyish or pale yellowish pruinose. In addition, *Cresponea* has relatively thick-walled ascospores. Further differences between the two genera, pertaining to secondary chemistry, exciple anatomy and pycnidia, were noted by Egea & Torrente (1993a) although these features tend to be less consistent and reliable. *Cresponea* has now been widely taken up by lichenologists and DNA-sequence data suggest that it is only distantly related to *Lecanactis* (Ertz *et al.* 2015).

The genus comprises c. 20 species (Index Fungorum Partnership 2019) and is chiefly corticolous and tropical or subtropical in distribution, although there are taxa known from cool temperate zones (e.g. *C. premnea* (Ach.) Egea & Torrente and *C. chloroconia* (Tuck.) Egea & Torrente) and from the Subantarctic (*C. sorediata* Elix *et al.*). McCarthy (2018) lists six species for Australia, with most found in Queensland and New

South Wales. In Tasmania, the name *C. plurilocularis* (Nyl.) Egea & Torrente, a widespread species ranging from south-eastern Australia to New Zealand, the western Pacific and Malesia, has been generally applied, albeit with some misgivings (Kantvilas 2004). The recent discovery of a second Tasmanian species, described here as new, has prompted a reappraisal of the genus in Tasmania.

Materials and Methods

The study is based chiefly on material collected by the author in Tasmania and eastern mainland Australia, and housed in the Tasmanian Herbarium (HO). Anatomical and morphological observations were undertaken using light microscopy, with thin hand-cut sections mounted in water, 10% KOH, lactophenol cotton blue, Lugol's iodine after pretreatment with KOH, and ammoniacal erythrosin. Ascospore measurements are presented in the format: 5th percentile–average–95th percentile, with outlying values given in brackets and *n* being the number of measurements. Routine chemical analyses using thin-layer chromatography follow standard methods (Elix 2014).

The *abietina*-type ascus was first recognized by Egea & Torrente (1994). It is hemiamyloid, reacting I+ brownish, but with pretreatment in 10% KOH, distinct, bluish amyloid reactions can be observed. The walls and tholus are non-amyloid apart from a very thin outer cap at the apex of the ascus, and faintly amyloid 'shoulders' at the sides of a short, blunt ocular chamber. Of the *Roccellaceae* genera recorded for the Australian region, the *abietina*-type ascus is found in *Cresponea* and *Lecanactis* and is illustrated by Kantvilas (2004) and in Fig. 2A below.

Ascospore size is critical in species delimitation in *Cresponea* (see Egea & Torrente 1993a; Kantvilas 2006). In this study, measurements and illustrations of ascospores were made exclusively in water, as elution in dilute KOH may shrink or strip away the spore wall. Size also varies with age, and young ascospores

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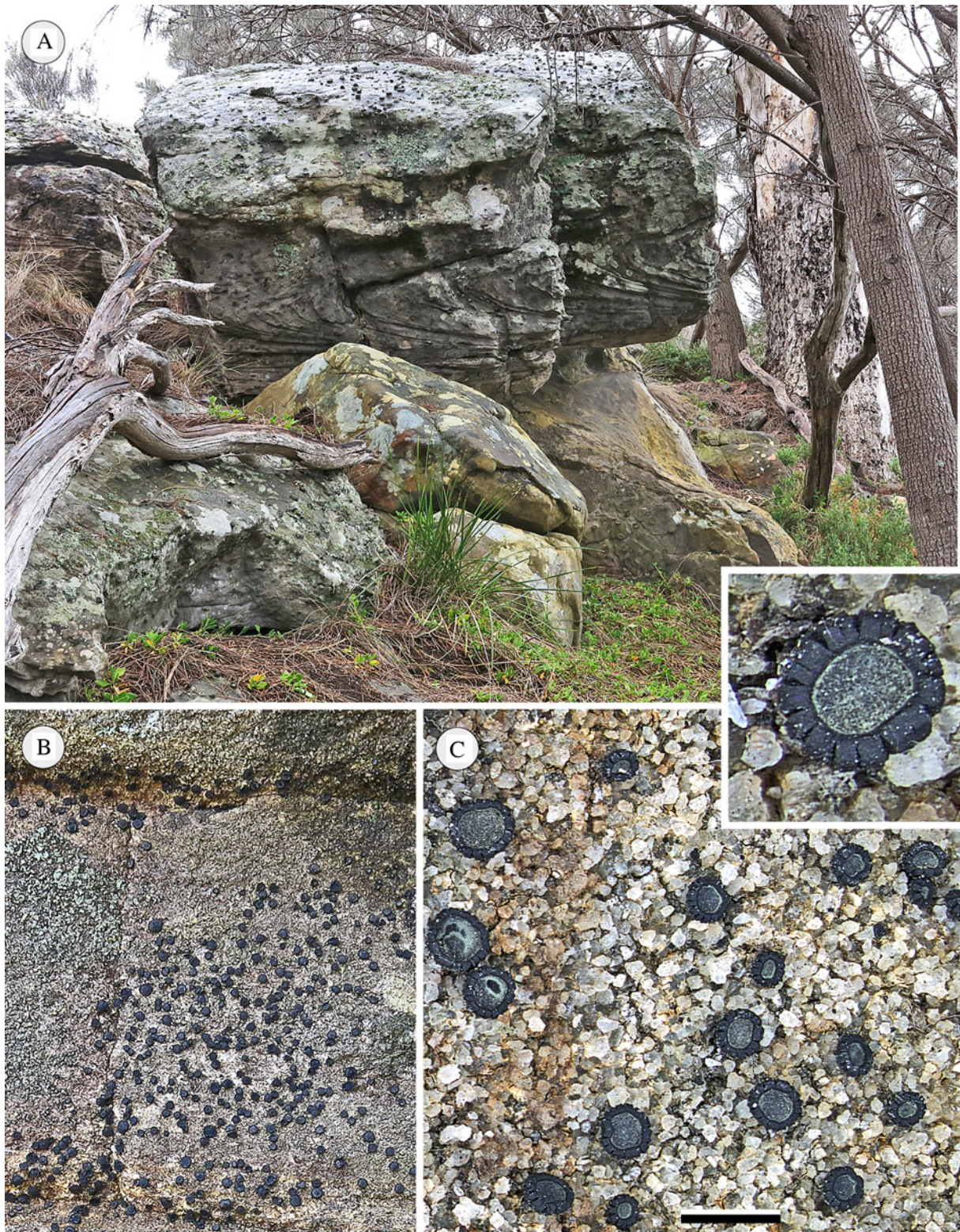


Fig. 1. *Cresponia graemeanae*. A, habitat, on vertical and overhanging surfaces of sandstone rock outcrops in dry sclerophyll forest. B, habit, showing thin, patchy and effuse thallus. C, habit, with inset showing detail of an apothecium with a radially split exciple. Scale: C = 2 mm.

retained within the asci tend to have very thin walls and septa, and cylindrical locules. Measurements given below were made on clearly mature ascospores, preferably free of the ascus, where the typical thick walls and septa, as highlighted by Egea &

Torente (1993a), were clearly developed. The identification key provided below is based strongly on ascospore size and septation and a caveat for using the key is that multiple observations are required.

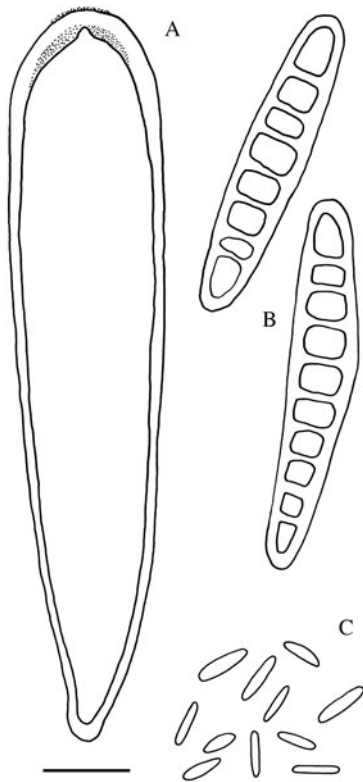


Fig. 2. *Cresponea graemeanae*. A, abietina-type ascus, with amyloid parts stippled (after pretreatment with dilute KOH). B, ascospores. C, microconidia. Scale: A–C = 10 μm .

The Species

Cresponea graemeanae Kantvilas *sp. nov.*

Mycobank No.: MB 835129

Cresponeae pluriloculari similis sed thallo saxicola, tenuissimo vel destituto, apotheciis margine crassa, radiatim fissa, disco tenuiter pruinoso, hypothecio guttulis olei insperso et ascosporis (25–) 25.5–39(–40) μm longis, 6–8 μm latis, 5–9-septatis differt.

Typus: Australia, Tasmania, Spring Bay Mill, Cresponea Cliffs, 42°33'S, 147°56'E, 15 m elev., in sheltered crevices on sandstone boulders in *Allocasuarina*-dominated coastal woodland, 21 November 2019, G. Kantvilas 316/19 (HO—holotypus; CANB, S—isotypi).

(Figs 1A–C, 2A–C, 4A)

Thallus \pm absent, or very thin, patchy and effuse, and barely discernible as a greenish or somewhat pinkish green discoloration of the substratum, forming extensive, undelimited patches to 30 cm wide; photobiont trentepohlioid, with cells subglobose to oblong-ellipsoid, 7–15 \times 6–11 μm , occurring singly or in irregular clusters.

Apothecia 0.7–2 mm wide, markedly basally constricted to sometimes almost substipitate; disc brown-black to black, thinly pale greyish pruinose, concave only when very young, becoming plane to a little convex and sometimes epruinose when old, occasionally with a central 'plug' of sterile tissue or excavate and eroded; exciple prominent and persistent, inrolled and markedly radially split, especially in younger apothecia, in section opaque

dark brown, K+ greenish (mainly at the edges), 90–150 μm thick laterally, 150–350 μm thick basally, composed of amorphous, cellular hyphae. *Hypothecium* hyaline to pale yellowish, 30–50 μm thick, interspersed with oil droplets. *Hymenium* 80–110 μm thick, hyaline in the lower part, dark orange-brown to brown, K+ strongly olive-yellow in the upper 10–20 μm ; paraphysoids 1.5–2 μm thick, internally olive-brown in the uppermost part, with apices expanded to 2.5–5 μm wide and with a distinct external cap; asci 70–90 \times 14–20 μm . *Ascospores* fusiform, 5–9-septate, (25–)25.5–32.5–39(–40) \times 6–6.9–8 μm ($n = 75$); locules cylindrical, rounded or rhomboid; wall to c. 2 μm thick.

Pycnidia superficial on the substratum, black, 0.1–0.3 mm wide; conidia (microconidia) bacilliform to fusiform, 4–6 \times 1–1.2 μm .

Chemistry. No substances detected by TLC.

Etymology. The new species is named in honour of the philanthropists Graeme Wood and Anna Cerneaz, in appreciation of their sponsorship of the 2019 TMAG 'Expedition of Discovery', when this species was discovered and collected.

Ecology and distribution. The new species was discovered on Tasmania's east coast in a narrow, c. 300 m-long band of remnant coastal *Allocasuarina verticillata*-dominated woodland at the edge of a south-facing sea cliff. It occupies a highly specialized ecological niche, growing in sheltered overhangs and clefts on large boulders and outcrops of relatively soft, very coarse-grained Triassic sandstone (Fig. 1A). It forms extensive patches, as large as 30 cm across, but is not common; a search of the area revealed only six well-spaced populations. Other saxicolous lichens occurring in this habitat, although not necessarily in immediate juxtaposition to the new species, include *Buellia halonia* (Ach.) Tuck., *Diploicia canescens* (Dicks.) A. Massal., *Lecanora margarodes* (Körb.) Nyl., *Ochrolechia apiculata* Verseghy, *Porina corrugata* Müll. Arg., *P. leptalea* (Durieu & Mont.) A. L. Sm., *P. whinrayi* P. M. McCarthy, *Rinodina murrayi* H. Mayrhofer, *Verrucaria fusconigrescens* Nyl., *Xanthoparmelia subprolixa* (Nyl. ex Kremp.) O. Blanco *et al.* and unidentified species of *Buellia*, *Opegrapha* s. lat. and *Porpidia*. An additional, smaller collection of the new species, previously tentatively identified as *C. plurilocularis*, is known from a coastal pinnacle some 100 km to the north. Overgrown with *Cystocoleus ebeneus* (Dillwyn) Thwaites, this specimen grew in underhangs of Jurassic dolerite in sclerophyllous scrub.

Remarks. Saxicolous species of *Cresponea* are few and all differ markedly from the new species. *Cresponea ancistrosporelloides* Sparrius & Sipman, described from south-western Western Australia differs by its well-developed, grey, areolate thallus and its markedly attenuated ascospores, (30–)45–50 \times 5 μm , where the 'tail' of the spore is c. 20 μm long (Lumbsch *et al.* 2011). Another saxicolous taxon, *C. premnea* var. *saxicola* (Leight.) Egea & Torrente, is known from the cool temperate Northern Hemisphere and differs from the new species by its shorter, narrower ascospores with fewer septa (18–25 \times 4.5–6(–7) μm , (4–) 5-septate; Wolseley *et al.* 2009).

The only other species of *Cresponea* known from Tasmania is *C. subpremnea*, which is exclusively corticolous in cool temperate rainforest. It is not unknown in Tasmania for some normally epiphytic lichens to occasionally occur in sheltered microhabitats on

Table 1. Comparison of salient features of *Cresponea* species.

	<i>C. graemeanae</i>	<i>C. plurilocularis</i>	<i>C. subpremnea</i>
Habitat	sheltered rocks in dry sclerophyll forest	smooth bark of understorey trees in warm temperate and subtropical rainforest	dry, flaky bark on mature trees and tree ferns in cool temperate rainforest
Apothecia	to 2 mm wide	to 1.5 mm wide	to 1.7 mm wide
Disc	thinly pale greyish pruinose only when very young, soon epruinose	pale yellowish pruinose when young, sometimes remaining pruinose at maturity	sometimes thinly pale yellowish grey pruinose when very young, soon epruinose
Exciple	90–150 µm thick, radially fissured	50–110 µm thick, entire or rarely radially fissured	80–120 µm thick, always entire
Hypothecium	inspersed	not inspersed	not inspersed
Hymenium	80–110 µm thick	80–110 µm thick	90–130 µm thick
Ascospores	(25–)25.5–32.5–39(–40) × 6–6.9–8, 5–9-septate	(27–)30–35.2–42(–45) × 6–6.8–8 µm, 5–9-septate*	(30–)31–44.3–54(–58) × (4.5–)5–5.4–6.5(–7) µm, 6–11-septate

*this study; Egea & Torrente (1993a) cite 30–43(–45) × 6–8(–9) µm, with 7–10(–11) septa.

rocks, especially away from their usual rainforest environment. However, in the case of *C. subpremnea*, apart from habitat ecology, it differs clearly from the new species by its longer, narrower ascospores, non-inspersed hypothecium and entire, somewhat thinner exciple (Table 1; Fig. 4).

Cresponea graemeanae was also compared with the warm temperate-tropical, corticolous species *C. plurilocularis*, which has served as something of a placeholder in Australian herbaria for numerous collections of *Cresponea*. The two species have similar ascospores (Fig. 4) but *C. plurilocularis* differs by being a far more delicate species, with a well-developed, grey-green thallus, smaller apothecia with a thinner, usually entire exciple and frequently a yellowish-pruinose disc (Table 1). Interestingly, the sterile plug of tissue in the apothecial disc of *C. graemeanae* is occasionally seen in *C. plurilocularis*; it appears to be a secondary exciple, developing in the centre of the disc of older apothecia.

Additional specimens examined. **Australia:** *Tasmania:* South Sister, 41°32'S, 148°10'E, 750 m, 2004, G. Kantvilas 425/04 (HO); Spring Bay Mill, *Cresponea* Cliffs, western end, 42°33'S, 147°56'E, 10 m, 2019, G. Kantvilas 362/19, 366/19 (HO).

***Cresponea subpremnea* (Kantvilas & Vězda) Kantvilas comb. nov.**

Mycobank No.: MB 835128

Lecanactis subpremnea Kantvilas & Vězda, *Telopea* 4, 688 (1992); type: Australia, Tasmania, Corinna Road, c. 6 km W of Waratah, on old trunk of *Nothofagus cunninghamii* in rainforest, 600 m elev., 9 February 1982, G. Kantvilas 71/82 (holotype—HO!; isotypes—GZU!, PRA-V!, WELT!).

(Figs 3 & 4B)

Descriptions of this species were provided by Kantvilas & Vězda (1992; as *Lecanactis*) and, subsequently, by Kantvilas (2004; under the name *Cresponea plurilocularis*). Salient features are repeated here, modified on the basis of additional collections and study.

Thallus effuse, scurfy, dull olivaceous grey-green, very thin and sometimes patchy to absent, forming extensive, undelimited

patches 10–30 cm wide; photobiont trentepohlioid, with cells subglobose to oblong-ellipsoid, 8–14 × 7–13 µm.

Apothecia to 1.7 mm wide; disc brown-black to black, plane to concave, sometimes eroded when old, rarely with a very thin, cobweb-like, pale yellowish grey pruina when very young but soon epruinose; exciple prominent and persistent, entire, in section 80–120 µm thick laterally. *Hypothecium* hyaline to pale yellowish, 60–110 µm thick, not inspersed. *Hymenium* 90–130 µm thick, hyaline, overlain by a dark yellow-brown, K+ olive-yellow epithelial layer 6–20 µm thick; asci (65–)80–100 × (13–)16–18 µm; paraphysoids 1.2–1.5 µm thick, with apices usually expanded to 2.5–5 µm wide, hyaline or internally pigmented olive-brown. *Ascospores* fusiform, straight or a little curved, (30–)31–44.3–54(–58) × (4.5–)5–5.4–6.5(–7) µm (*n* = 67), 6–11-septate; locules mostly cylindrical, occasionally rounded or rhomboid; wall to c. 1.5 µm thick.

Pycnidia uncommon, immersed, visible as minute black specks; conidia (microconidia) bacilliform to fusiform, 3.5–5.5 × 0.5–1 µm.

Chemistry. No substances detected by TLC.

Remarks. *Cresponea subpremnea* was first described in *Lecanactis* but was not considered in the study that led to the erection of the genus *Cresponea* by Egea & Torrente (1993a). Kantvilas (2004) synonymized it with *C. plurilocularis*, albeit with considerable reservations after noting the narrower, longer ascospores. Since then, study of further Tasmanian collections, as well as of collections of *C. plurilocularis* from eastern mainland Australia, have reinforced the previously noted differences between these taxa and, consequently, *L. subpremnea* is brought out of synonymy and combined into *Cresponea*. Salient differences between the two species are summarized in Table 1. *Cresponea plurilocularis* differs chiefly by having wider and shorter ascospores, generally with fewer septations (Fig. 4). In addition, the apothecial disc of *C. plurilocularis* is frequently pruinose. The shape of the ascospore locules (rounded versus cylindrical), a character applied by Egea & Torrente (1993a), is likely to be an artefact of age.

Professor Jack Elix (unpublished annotations) recorded consimonyellin, with traces of isosimonyellin, from two collections of *C. subpremnea*, and simonyellin in one of *C. plurilocularis*,



Fig. 3. *Cresponea subpremnea* habit, with inset showing detail of an apothecium with an intact exciple. Scale = 2 mm.

suggesting a possible chemical difference between the two taxa. However, these results could not be repeated in the present study and no secondary compounds were detected by thin-layer chromatography in the specimens examined.

Ecology and distribution. *Cresponea subpremnea* occupies a narrow, specialized ecological niche and colonizes dry, sheltered, shaded habitats, exclusively on the flaky bark of the oldest trees (typically *Nothofagus cunninghamii*) in cool temperate rainforest. This habitat is where calicioid lichens, *Lecanactis abietina* (Ach.) Körb., *L. mollis* (Stirt.) Fritsch & Ertz and species of *Lepraria* and *Micarea* occur, although the *Cresponea* forms such extensive, widely spreading thalli that few associated lichens tend to be ‘captured’ on herbarium specimens. The tree fern *Dicksonia antarctica* may also be colonized where its fibrous trunk provides a similarly dry microhabitat. *Cresponea subpremnea* is very conspicuous because it forms very large thalli, but at the same time it is rather rare and known from just a small number of collections. All Tasmanian specimens are from the west and north-west of the island, where the most extensive tracts of cool temperate rainforest occur. These rainforests are known for supporting several lichen species that are rare or absent elsewhere in Tasmania. Examples include *Arthothelium subspectabile* Vězda & Kantvilas, *Bactrospora granularis* Kantvilas, *B. homalotropa* (Nyl.) Egea & Torrente, *Hypotrachyna laevigata* (Sm.) Hale, *Lecanographa nothofagi* Kantvilas, *Menegazzia tarkinea* Kantvilas and *Notoparmelia tarkinensis* (Elix & Kantvilas) A. Crespo *et al.* It is also known from cool temperate rainforest in Victoria. In contrast, *C. plurilocularis* has been collected from smooth bark on small-diameter trees and shrubs in warm temperate and subtropical rainforest in New South Wales and Queensland. Egea & Torrente (1993a) also list collections from the Malesian region, New Caledonia (including the type), Lord Howe Island and New Zealand.

Specimens examined. **Australia:** **Tasmania:** near Delville Saddle, 41°43’S, 145°00’E, 140 m, 1982, G. Kantvilas s. n. (HO); Anthony Road, 41°49’S, 145°38’E, 450 m, 1991, G. Kantvilas 215/91 (HO, LSU, PRA-V); Anthony Road, 41°50’30’’S, 145°37’30’’E, 540 m, 1992, G. Kantvilas 553/92 (HO); Savage River Pipeline at 22 mile peg, 41°15’S, 145°20’E, 1993, G. Kantvilas 316/93 (HO); Savage River NP, E side of Baretop Ridge, 41°18’37’’S, 145°26’51’’E, 580 m, 2015, G. Kantvilas 61/15 (HO); Savage River Pipeline Road near Rapid River, 41°16’S, 145°20’E, 450 m, 2015, G. Kantvilas

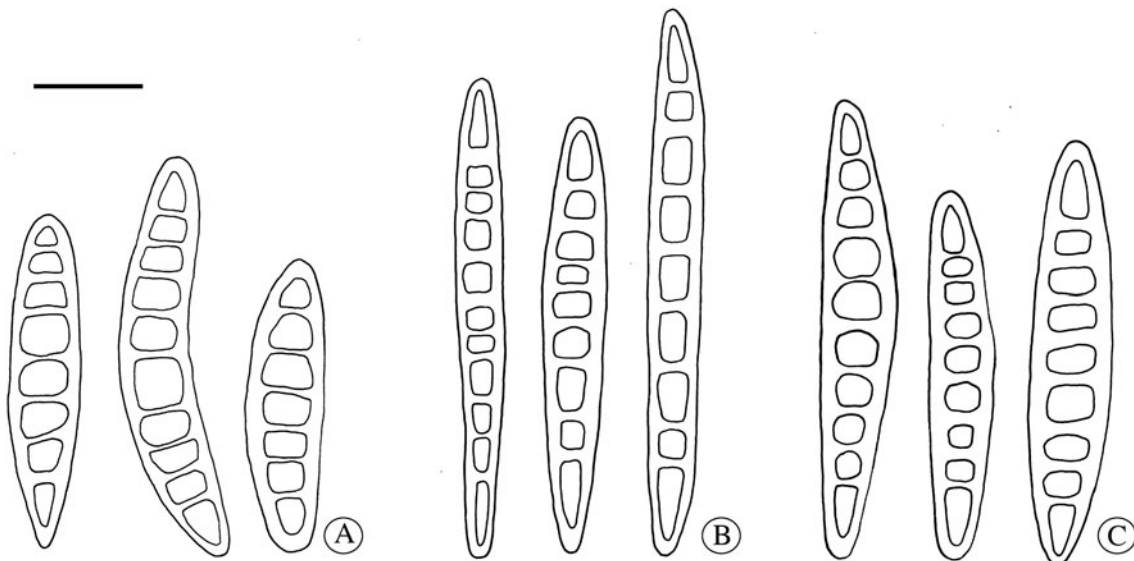


Fig. 4. Comparison of ascospores of *Cresponea* species. A, *C. graemeanae*. B, *C. subpremnea*. C, *C. plurilocularis*. Scale: A–C = 10 µm.

202/15 (HO). *Victoria*: Cement Creek, 1983, G. Kantvilas s. n. (HO); Yarra Ranges NP, Cement Creek Reserve, 1995, S. H. Louwhoff s. n. (HO).

Comparative material of *C. plurilocularis* examined. Australia: *Queensland*: Bunya Mountains, between Westcott Picnic Area and Long Plain Bald, 26°51'S, 151°35'E, 1050 m, 1995, 165/95 (BRI, HO); Lovedays Road, Mt Mee State Forest, 1996, G. Kantvilas 45/96 (BRI, HO); D'Aguilar Range, Western Windows Walk, 27°19'46"S, 152°45'27"E, 680 m, 2014, G. Kantvilas 458/14 (BRI, HO). *New South Wales*: Mt Wilson, 1988, G. Kantvilas s. n. (HO); Mt Allyn Forest Park, track to Burruga Swamp, 32°07'S, 151°25'E, 980 m, 1988, G. Kantvilas 174/88 (HO, NSW); Blue Mtns, trail to Cathedral Creek, 33°30'S, 150°24'E, 1030 m, 2002, G. Kantvilas 197/02 (HO).

Also studied

In the course of this study, other species of *Cresponea*, especially those known to occur in the Australasian region, were also

examined. One such species, *Cresponea litoralis* Elix (Elix 2007), has *Bactrospora*-type asci (after Torrente & Egea 1989), a hymenium that is very lax and separates easily in water, *Patellarioides*-type, filiform, multiseptate ascospores (after Egea & Torrente 1993b) and belongs in the genus *Bactrospora*. These ascus and ascospore types are illustrated by Kantvilas (2004). The formal synonymy follows.

Bactrospora myriades (Fée) Egea & Torrente

Lichenologist **25**, 245 (1993).—*Cresponea litoralis* Elix, *Australasian Lichenology* **60**, 15 (2007); type: Australia, Queensland, Forrest Beach, 18 km ESE of Ingham, 18°43'02"S, 146°17'50"E, on dead stump in remnant strand vegetation with *Pandanus* and *Allocasuarina*, 23 July 2006, J. A. Elix 36792 (holotype—BRI; isotypes—CANB, HO!).

Descriptions of this species are provided by Egea & Torrente (1993b) and Elix (2007). It is widespread in the tropics, ranging from Central America and the Caribbean Islands to South America, the Seychelles, India and South-East Asia (Sobreira *et al.* 2015). This species was first reported for Australia by Rogers (2018).

Key to *Cresponea* in Australia

- 1 Thallus saxicolous 2
Thallus corticolous or lignicolous 3
- 2(1) Thallus well developed, areolate; apothecia with a thin margin not extending above the disc; ascospores (5–)7-septate, (30–)45–50 × 5 µm, attenuated at the distal end into a tail c. 20 µm long **C. ancistrosporelloides**
Thallus ± inapparent; apothecia with a thick, prominently inrolled, radially fissured margin; ascospores 5–9-septate, 25–40 × 6–8 µm; apices not attenuated **C. graemeannae**
- 3(1) Ascospores 3–4(–5)-septate, 14–24 × 4–6 µm **C. flava**
Ascospores invariably more septate and longer 4
- 4(3) Ascospores to 7(–8)-septate, 25–40 µm long **C. proximata**
Ascospores generally more septate, 30–65 µm long 5
- 5(4) Ascospores 5–9-septate, 27–45 × 6–8 µm **C. plurilocularis**
Ascospores up to 14-septate, 30–65 × 5–7 µm 6
- 6(5) Ascospores 8–14-septate, 34–65 × 5–7 µm; found in tropical latitudes **C. leprieurii**
Ascospores 6–11-septate, 30–58 × 4.5–7 µm; found in cool temperate latitudes **C. subpremnea**

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Author ORCIDs.  Gintaras Kantvilas, 0000-0002-3788-4562.

References

- Egea JM and Torrente P (1993a) *Cresponea*, a new genus of lichenized fungi in the order *Arthoniales* (Ascomycotina). *Mycotaxon* **48**, 301–331.
- Egea JM and Torrente P (1993b) The lichen genus *Bactrospora*. *Lichenologist* **25**, 211–255.
- Egea JM and Torrente P (1994) El género de hongos liquenizados *Lecanactis* (Ascomycotina). *Bibliotheca Lichenologica* **54**, 1–205.
- Elix JA (2007) Four new crustose lichens (lichenized Ascomycota) from Australia. *Australasian Lichenology* **60**, 14–19.

Elix JA (2014) *A Catalogue of Standardized Chromatographic Data and Biosynthetic Relationships for Lichen Substances*. 3rd edition. Canberra: published by the author.

Ertz D, Tehler A, Irestedt M, Frisch A, Thor G and van den Boom P (2015) A large-scale phylogenetic revision of *Roccellaceae* (*Arthoniales*) reveals eight new genera. *Fungal Diversity* **70**, 31–53.

Index Fungorum Partnership (2019) *Index Fungorum* [WWW resource] URL <http://www.indexfungorum.org>. [Accessed December 2019].

Kantvilas G (2004) A contribution to the *Roccellaceae* in Tasmania: new species and notes on *Lecanactis* and allied genera. *Symbolae Botanicae Upsalienses* **34**(1), 183–203.

Kantvilas G (2006) On the identity of *Opegrapha inalbenscens*, with new Australian records of *Cresponea*. *Australasian Lichenology* **58**, 32–36.

Kantvilas G and Vězda A (1992) Additions to the lichen flora of Tasmania. *Telopea* **4**, 661–670.

Lumbsch HT, Ahti T, Altermann S, Amo de Paz G, Aptroot A, Arup U, Bárcenas Peña A, Bawingan PA, Benatti MN, Betancourt L, *et al.* (2011) One hundred new species of lichenized fungi: a signature of undiscovered global diversity. *Phytotaxa* **18**, 1–127.

McCarthy PM (2018) *Checklist of the Lichens of Australia and its Island Territories*. Australian Biological Resources Study, Canberra. Version 17 May 2018. [WWW resource] URL <http://www.anbg.gov.au/abrs/lichenlist/introduction.html>.

- Rogers RW** (2018) Additional lichen records from Australia 84. Three *Bactrospora* species (*Roccellaceae*, Ascomycota) from Queensland. *Australasian Lichenology* **83**, 62–63.
- Sobreira PNB, Aptroot A and Caceres ME** (2015) A world key to species of the genus *Bactrospora* (*Roccellaceae*) with a new species from Brazil. *Lichenologist* **47**, 131–136.
- Torrente P and Egea JM** (1989) La familia *Opegraphaceae* en el área Mediterránea de la Península Ibérica y Norte de Africa. *Bibliotheca Lichenologica* **32**, 1–282.
- Wolseley PA, Purvis OW and Rose F** (2009) *Cresponea* Egea & Torrente (1993). In Smith CW, Aptroot A, Coppins BJ, Fletcher A, Gilbert OL, James PW and Wolseley PA (eds), *The Lichens of Great Britain and Ireland*. London: British Lichen Society, p. 363.