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Standard Paper

Additions to the genus *Cliostomum (Ramalinaceae)* from Australia

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Abstract

Seven species of *Cliostomum* Fr. recorded from Australia are treated. These include the widespread *C. griffithii* (Sm.) Coppins, the austral *C. praepallidum* (Müll. Arg.) Kantvilas & Fryday and the Tasmanian endemic *C. vezdae* Kantvilas, a reinstated name previously subsumed under *C. flavidulum* Hafellner & Kalb. Three species are described as new: *C. latisporum* Kantvilas, a corticolous species containing atranorin and gangaleoidin from coastal Tasmania and New South Wales, characterized by pale pink, soon immarginate apothecia, 0.3–0.9 mm wide, non-capitate, unpigmented paraphyses, and relatively wide, 1(–3)-septate ascospores, 9–15 × 4–6 µm; *C. litorale* Kantvilas, a saxicolous species containing atranorin and confluentic acid, recorded only from Tasmania, with relatively large, usually pale pinkish apothecia, 0.6–1.5 mm wide, non-capitate paraphyses, and 1(–2)-septate ascospores, 9–13 × 4–6 µm; and *C. saxatile* Kantvilas, a saxicolous species containing atranorin and lecanoric acid, also known only from Tasmania, with dark brown to black apothecia, 0.3–0.5 mm wide, pigmented with Laurocerasi-brown, capitate paraphyses, and 1-septate ascospores, 7–14 × 3–5 µm. The widespread, coastal Australasian species *Tylothallia verrucosa* (Müll. Arg.) Kantvilas is transferred to *Cliostomum*, with the additional synonym *Catillaria brisbanensis* Räsänen. *Megalaria variegata* (Müll. Arg.) D. J. Galloway, based on a New Zealand type, is a further synonym of *Cliostomum griffithii*. All species are illustrated and described on the basis of Australian and Tasmanian specimens.

Keywords: *Catillaria*; lichens; *Megalaria*; new species; Tasmania; taxonomy; *Tylothallia*

(Accepted 15 November 2023)

Introduction

Although described by Fries (1825), the genus *Cliostomum* was not generally taken up until it was reinstated by Hawksworth *et al.* (1980). Subsequent studies, including those of Gowan (1990: North America), Kalb & Hafellner (1992: Madeira), Tønsberg (1992: Norway) and Kantvilas & Elix (1995: Australia), gradually added more species. In his overview of the genus, by then comprising seven species, Ekman (1997) speculated that further taxa of *Cliostomum* remained to be found, either lurking within large genera such as *Bacidia*, *Biatora* or *Catillaria*, or in poorly studied habitats or regions. This certainly proved to be the case, with species from both hemispheres being added by Hawksworth *et al.* (2006), Kantvilas & Fryday (2010), Wirth & Kalb (2011), Fryday & Coppins (2012), Fryday & Øvstedal (2012), Aptroot (2014), Tønsberg & Goward (2016), Holien & Tønsberg (2017), van den Boom *et al.* (2017) and Fryday (2019). Today the genus comprises *c.* 20 species, of which three are recognized for Australia by McCarthy (2023). Molecular investigations involving *Cliostomum* have been few (e.g. Spjut *et al.* 2020) and offer little insight into the relationships between individual species.

For many years, the author has noted several additional but undetermined taxa in Australia. After an extensive search for existing overlooked names in other genera, comparative study of *Cliostomum* species and specimens in many herbaria, and much fieldwork, mostly in Tasmania, these taxa are described here as new to science, and are discussed in the context of a general review of the genus in Australia.

Outline of the genus

Delimiting *Cliostomum* can be somewhat complex. Ekman (1997) reviewed in considerable detail its characterization at generic rank, discussing such critical features as the photobiont, apothecial morphology and anatomy, in particular the presence of crystals in the epithecium and proper exciple, the asci and paraphyses, ascospores, pycnidia, conidia and secondary chemistry. Based on morphological and anatomical examination undertaken in the present study, *Cliostomum* can be characterized by: an ecorticate, crustose thallus; a unicellular, green photobiont with globose cells 6–16 µm diam.; usually pinkish to pale grey, biatorine apothecia with a cupulate proper exciple and epithecium both densely inspersed with minute crystals that mostly dissolve in K; simple to sparsely branched, generally ±straight, often capitate paraphyses; clavate, 8-spored asci approximating the *Biatora*-type, with an amyloid wall, well-developed amyloid tholus, usually with a slightly more intensely amyloid band adjacent to a conical masse axiale, and a poorly developed or absent ocular chamber (illustrated by Hafellner (1984) and Kantvilas & Elix (1995)); hyaline, non-halonate, (0–)1(–3)-septate ascospores; a secondary chemistry that often includes atranorin and/or usnic acid, together with fatty acids or depsidones.

The closest genus to *Cliostomum* is *Tylothallia*, which shares with *Cliostomum* similar, *Biatora*-type asci and usually 1-septate

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ascospores, and also has apothecia where the exciple and epithecium are inspersed with crystals. The close relationship between these two genera has been noted by Ekman (1997) and Cannon *et al.* (2021) and clearly deserves further exploration. These authors refer to the more branched and anastomosed paraphyses and immersed pycnidia of *Tylothallia* as distinguishing features. Certainly the paraphyses of the type species, *T. biformigera* (Leight.) P. James & H. Kilias, are somewhat thinner (1–1.5 µm), flexuose and distinctly branched and anastomosing towards the apices in comparison to those of *Cliostomum* species. However, the Australasian species *T. verrucosa* (Müll. Arg.) Kantvilas has simple to sparingly branched paraphyses (Kantvilas 2014). In the past, this species, with its saxicolous thallus containing atranorin with the depsidones gangaleoidin or lecideoidin, and its black apothecia with greenish pigments, meant it was unlikely to be confused for a *Cliostomum*. However, in recent times (Fryday & Coppins 2012; Fryday & Øvstedal 2012; Fryday 2019), as well as in the present paper, *Cliostomum* has come to include several saxicolous species with black apothecia. Furthermore, gangaleoidin is now also found in one species (*C. latisporum* Kantvilas, described below) whose inclusion in *Cliostomum* is unequivocal. On this basis, *Tylothallia verrucosa* is transferred to *Cliostomum* (see below).

Material and Methods

The study is based on specimens housed in the Tasmanian Herbarium (HO), collected mainly by the author, and on the holdings of the Australian National Herbarium (CANB) and the National Herbarium of Victoria (MEL). Comparative data for non-Australian species were drawn mostly from the literature and from exsiccata housed in the herbaria cited above. Anatomical observations and measurements are based on thin, hand-cut sections of the thallus, apothecia and pycnidia, mounted in water, 10% KOH (K), Lugol's iodine, ammoniacal erythrosin and/or lactophenol cotton blue. Ascospore measurements are presented in the format 5th percentile–*average*–95th percentile, with outlying values in brackets and *n* signifying the number of observations. Chemical analyses were undertaken mostly by thin-layer chromatography (TLC) using standard methods (Orange *et al.* 2010); solvent A was the preferred routine medium. The presence of gangaleoidin was confirmed by Dr E. Lacey, Sydney, using high-performance liquid chromatography (Feige *et al.* 1993).

The more widespread species, notably *C. griffithii* (Sm.) Coppins and *C. verrucosum* (Müll. Arg.) Kantvilas, have extensive synonymies. Only new synonyms or those that have been explicitly recorded for Australia are listed in this paper.

Key to *Cliostomum* in Australia

1 Thallus sorediate 2
Thallus not sorediate 3

2(1) Thallus with a yellowish tinge, P+ red (containing fumarprotocetraric acid and atranorin); soredia continuous and dominating the thallus . . . . . **C. vezdae**
Thallus whitish grey, P− (containing atranorin and roccellic acid); soredia patchy, spreading irregularly, or in discrete soralia . . . . . **C. griffithii**

3(1) Thallus exclusively saxicolous 4
Thallus corticolous, lignicolous or on dead leaves, very rarely saxicolous 6

4(3) Thallus C+ pink (containing lecanoric acid in addition to atranorin); a species of the hinterland . . . . . **C. saxatile**
Thallus C− (lecanoric acid lacking); ±confined to the coast 5

5(4) Apothecia black; thallus containing gangaleoidin or lecideoidin in addition to atranorin . . . . . **C. verrucosum**
Apothecia pale pinkish; thallus containing confluentic acid plus atranorin . . . . . **C. litorale**

6(3) Ascospores polarilocular; septum thickened and pierced by a narrow channel . . . . . **C. praepallidum**
Ascospores (0–)1(–3) septate, with septum simple and unthickened 7

7(6) Thallus containing atranorin and roccellic acid; apothecia usually persistently marginate, pinkish, grey or blackened with Laurocerasi-brown pigment, sometimes piebald; ascospores 3–4.5 µm wide . . . . . **C. griffithii**
Thallus containing atranorin and gangaleoidin; apothecia soon immarginate, persistently pinkish and lacking dark pigments; ascospores 4–6 µm wide . . . . . **C. latisporum**

The Australian Species

Cliostomum griffithii (Sm.) Coppins

In D. L. Hawksworth, *Lichenologist* **12**, 106 (1980).—*Lichen griffithii* Sm., *in* J. E. Smith & J. E. Sowerby, *Engl. Bot.* **25**, plate 1735 (1807).—*Catillaria griffithii* (Sm.) H. Magn., *Svensk Bot. Tidskr.* **13**, 80 (1919).

Cliostomum spermogoniatum (Zahlbr.) Kantvilas & Elix, *Biblioth. Lichenol.* **58**, 204 (1995).—*Lecidea spermogoniata* Zahlbr., *Denkschr. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Kl.* **104**, 310 (1941); type: New Zealand, Wellington, Halcombe near Palmerston North, on *Podocarpus totara* in forest, *H. H. Allan* ZA 3340 (CHR347059—lectotype!, *fide* Galloway (1985); BM—isolectotype!).

Catillaria banksiae (Müll. Arg.) Zahlbr., *Cat. Lich. Univ.* **4**, 11 (1926).—*Patellaria banksiae* Müll. Arg., *Bull. Herb. Boissier* **1**, 47 (1893); type: [Australia, Victoria], corticola, in *Banksia serrata* prope Cheltenham, *F. R. M. Wilson* n 632 (G—lectotype!, *fide* Kantvilas & Fryday (2010)).

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Megalaria variegata (Müll. Arg.) D. J. Galloway, *N. Z. J Bot.* **42**, 116 (2004).—*Patellaria variegata* Müll. Arg., *Bot. J. Linn. Soc.* **32**, 205 (1896).—*Catillaria variegata* (Müll. Arg.) Zahlbr., *Cat. Lich. Univers.* **4**, 84 (1926); type: New Zealand, *W. Colenso* 1578 (BM—lectotype!, *fide* Galloway (1985)).

(Fig. 1A–D)

Thallus rimose areolate, greyish white to cream-white, ±smooth and to 100–200 µm thick, or rather unevenly granular, verruculose or scurfy, sometimes sorediate, typically forming irregular, diffuse, rather discontinuous, widely spreading patches; soredia farinose to granular, white or greenish when fresh, irregularly patchy or, rarely, in discrete soralia; medulla densely inspersed with minute crystals that partially dissolve in K.

Apothecia 0.3–0.8(–1) mm wide, roundish, superficial, basally constricted; disc pale pink, greyish or blackened, sometimes piebald, occasionally lightly grey-pruinose, plane to undulate to convex, sometimes markedly so and becoming dimpled; proper exciple concolorous with the disc, or pinkish brown and paler, or darker and sometimes black and glossy, usually persistent, a little higher than the disc, entire or, rarely, becoming flexuose or lobed, in section 30–60 µm thick laterally, hyaline to pale yellowish brown within, sometimes brownish, K+ purple-brown at the upper, outer edges, composed of radiating, short-celled, branched hyphae 2–3 µm wide, densely inspersed with minute crystals that dissolve in K. *Hypothecium* 40–80 µm thick, hyaline, not inspersed. *Hymenium* 45–70 µm thick, hyaline, overlain by a brownish, K+ purple-brown epithecium composed of the pigmented apices of the paraphyses and inspersed with minute, pale yellow-brown crystals that dissolve fleetingly yellowish in K. *Paraphyses* 1.5–2 µm wide, markedly capitate, with the apices 3.5–5 µm wide, hyaline to brownish. *Asci* 30–40 × 11–15 µm. *Ascospores* ellipsoid-oblong, (0–)1(–2)-septate, 8–*11.2*–15(–16) × 3–*3.5*–4(–4.5) µm ($n = 70$), with a very thin, often indistinct wall and septum.

Pycnidia emergent, black, usually very abundant, 0.1–0.3 mm wide; wall *c.* 25 µm thick in section, brown, K+ purple-brown; conidia ellipsoid, 3–4.5 × 1.5–2 µm.

Chemistry. Atranorin and roccellic acid (major compounds); thallus weakly K+ yellowish, KC−, C−, P−. The thinness of the thallus and low concentration of these compounds can sometimes render TLC analyses ambiguous.

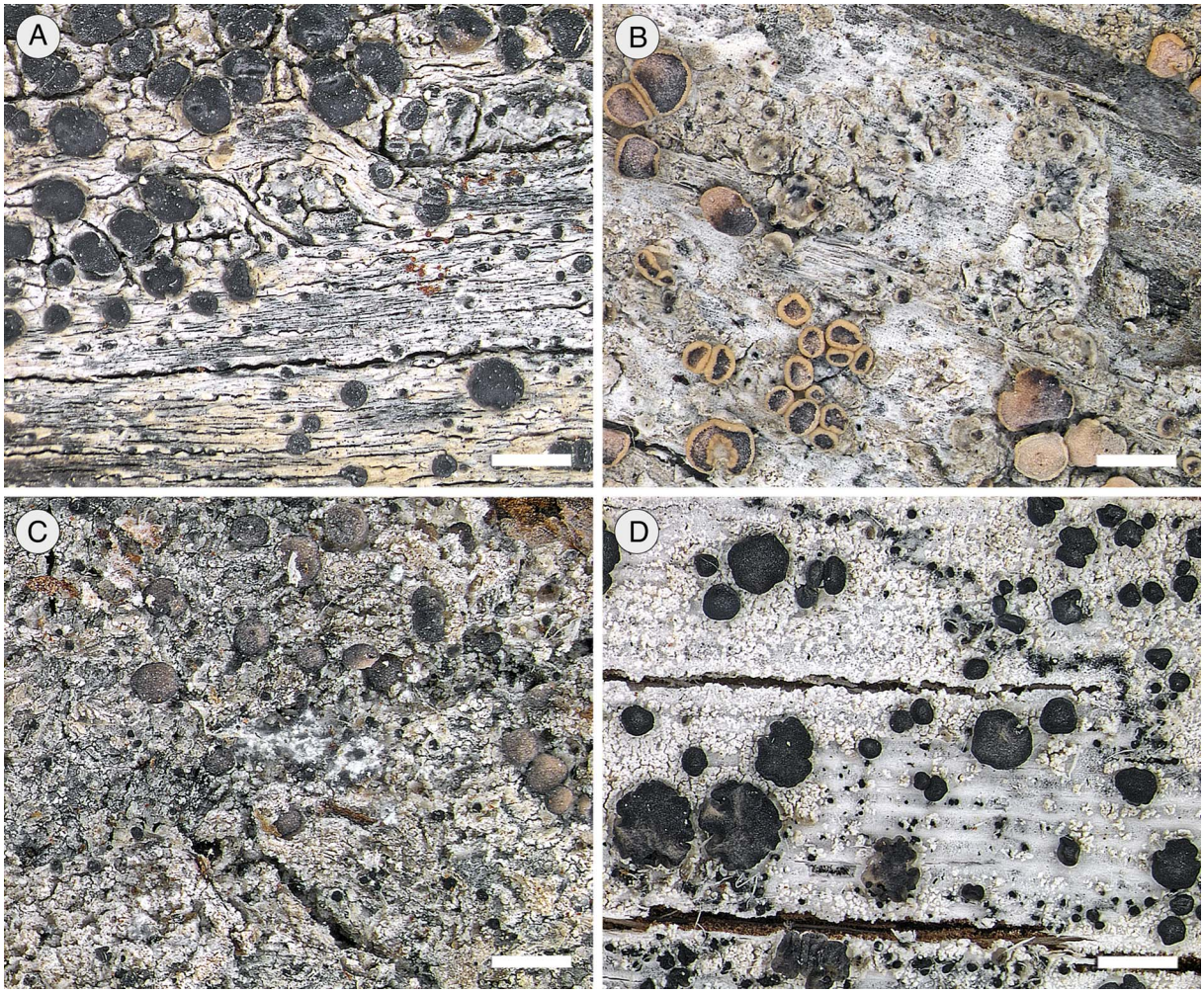

Figure 1. Morphological variation in *Cliostomum griffithii*. A, coastal form with a smooth thallus and dark-pigmented apothecia. B, swamp woodland form with a ±smooth to scurfy thallus and apothecia with a pale margin and pale to piebald disc. C, 'old forest' form, with a scurfy thallus and piebald apothecia. D, alpine form from leaves of *Richea pandanifolia*, with a distinctly sorediate thallus and dark-pigmented apothecia. Scales = 1 mm. Images: Jean Jarman. In colour online.

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Remarks. This essentially pan-temperate/cosmopolitan species has an extensive synonymy (see Ekman 1997; Galloway 2007). Only synonyms based on an Australian type or which have been explicitly recorded for Australia are listed above, with the exception of *Megalaria variegata*, a further synonym based on a type from New Zealand. Additional descriptive data can be found in Galloway (1985), Gowan (1990), Kantvilas & Elix (1995), Ekman (1997) and Cannon *et al.* (2021).

Cliostomum griffithii is a highly variable species, best characterized within the genus by the often scurfy thallus containing atranorin and roccellic acid, the black, usually numerous pycnidia, and the small, relatively narrow, mostly 1-septate ascospores. The characteristic pigment found in the apothecia and walls of the pycnidia is Laurocerasi-brown, which gives a purplish brown reaction in K (Meyer & Printzen 2000; Kantvilas & Coppins 2019). In occasional specimens, a trace of additional Fucatus-violet, yielding a vivid K+ turquoise reaction (Kantvilas 2009), was also present in the pycnidia. Pigments are absent or barely present in pale-coloured apothecia, but intense and present in the epithecium and/or exciple of darker ones. Pigmented apothecia have markedly capitate paraphyses; in paler apothecia, the swollen apices are less pronounced but are nevertheless observable. Specimens with essentially unpigmented apothecia could be confused with *C. latisporum*, but usually, at least in the case of larger thalli, there will be some apothecia that show hints of dark pigmentation. Furthermore, whereas the apothecial margin in *C. latisporum* tends to become excluded as the apothecia age and become increasingly convex, in *C. griffithii* the margin tends to be a little higher than the disc and persistent into maturity. The two species can also be distinguished by their ascospores (4–6 µm wide in *C. latisporum*). The chemical difference between the two, although helpful, can be difficult to confirm due to the frequently low concentration of substances.

Also a little similar to *C. griffithii* is *C. praepallidum* (Müll. Arg.) Kantvilas & Fryday, but this species is readily distinguished by its larger, polarilocular ascospores (Kantvilas & Fryday 2010). The saxicolous *C. litorale* and *C. saxatile* Kantvilas differ from *C. griffithii* chemically as well as morphologically (*q.v.*). In the Tasmanian and Australian biota in general, *C. griffithii* could also be confused with several other species, including as yet not fully determined species of *Lecania* and *Biatora* s. lat., which are known to occur in similar habitats. In such cases, the presence of crystals in the exciple and epithecium, characteristic of the genus as a whole, is a helpful identifying character, as is the combination of capitate paraphyses, ascospore size and thallus chemistry. One species, ascribed tentatively to *Lecania chlorotiza* (Nyl.) P. James s. lat., differs further by containing gyrophoric acid and having *Bacidia*-type asci. Two additional taxa, *C. corrugatum* (Ach.) Fr. and *C. piceicola* Holien & Tønsberg, share some features with *C. griffithii* but differ in thallus characters, lack roccellic acid and contain usnic acid in their apothecia (Ekman 1997; Holien & Tønsberg 2017). Both are confined to the Northern Hemisphere.

The morphological variation of the thallus and apothecia displayed by *C. griffithii* is remarkable (see Fig. 1), but a detailed examination of a wide range of specimens, both from Tasmania and elsewhere, failed to reveal consistent differences that could suggest that several cryptic species might be involved. The thallus ranges from rather thick, smooth and continuous, to scurfy and granular, to patchy with scattered soralia. Apothecia can be unpigmented and pale, or entirely black, or piebald, or various combinations of a dark disc with a pale exciple, or a dark exciple with a pale disc. However, lurking within what is regarded here as *C. griffithii* is one entity that may well represent an undescribed taxon, but which requires considerable further study. It grows on the dead leaves of *Richea pandanifolia*, together with *C. griffithii* and *C. vezdae* Kantvilas & Elix, but differs by containing usnic acid in the thallus in addition to atranorin and roccellic acid, atranorin only in the apothecia, having discrete, roundish soralia 0.3–0.7 mm wide, at least when young, and somewhat smaller ascospores, 7.5–11 × 2.5–3.5 µm.

Distribution and ecology. This species has a very wide global distribution and has been recorded from most temperate regions of the world (Ekman 1997). It is chiefly corticolous or lignicolous, but is also rarely found on rocks.

In Tasmania, *C. griffithii* displays a remarkably broad distribution, occurring abundantly in at least four very distinct and widely spatially and ecologically separate vegetation formations. In cool temperate rainforest, it occurs commonly on the dry, flaky bark of *Nothofagus cunninghamii* within the rich association of lichens that predominates on dry, sheltered aspects of the largest, oldest trees. In analogous forests in New South Wales, it is found on *N. moorei*. Associated species in this habitat include calicioid lichens, *Lecanactis abietina* (Ach.) Körb. and *L. mollis* (Stirt.) Frisch & Ertz, *Arthonia apteropteridis* Kantvilas & Vězda, *Chrysothrix xanthina* (Vain.) Kalb and species of *Micarea*. This dry, sheltered corticolous habitat in ancient climax forests is typical for *Cliostomum griffithii* in other parts of the world (Ekman 1997; Cannon *et al.* 2021). At subalpine elevations, *C. griffithii* occurs in woodlands and tall heathlands, frequently in communities dominated by the ancient conifer *Athrotaxis cupressoides*. Here it is one of the dominant lichens found on the dead, dry leaves of the arborescent heath *Richea pandanifolia*. This lichen community is also very species-rich and whilst it shares many species with that of the dry, ancient trunk, forest community, it also supports several additional species characteristic of this unusual habitat; for example, *Chiodecton flavovirens* G. Thor, *Clistomum vezdae*, *Lecanactis latispora* Egea & Torrente and *Opegrapha* cf. *atra* Pers. In coastal scrub and heathland, *Cliostomum griffithii* can be common on the twigs and trunks of small trees and shrubs such as *Banksia marginata*, *Myoporum insulare* and *Leucopogon parviflorus*, where it can be associated with *Austroparmelina pseudorelicina* (Jatta) A. Crespo *et al.*, *Flavoparmelia rutidota* (Hook.f. & Taylor) Hale, *Halegrapha mucronata* (Stirt.) Lücking, *Lecanora flavopallida* Stirt. and *Ramalina inflata* (Hook.f. & Taylor) Hook.f. & Taylor. Finally, *Cliostomum griffithii* is often the dominant epiphytic species in swampy, lowland *Melaleuca ericifolia*-dominated woodland, forming extensive thalli that cover entire trunks of papery bark for several metres. These woodlands are considered to be of very high conservation value, especially for their lichens (Baker *et al.* 2021; de Salas *et al.* 2023), and *C. griffithii* is associated with numerous lichen species that are considered rare and highly localized, for example *Bactrospora metabola* (Nyl.) Egea & Torrente, *B. paludicola* Kantvilas, *Bacidia septosior* (Nyl.) Zahlbr., *Coniocarpon cinnabarinum* DC., *Enterographa micrographa* (Nyl.) Redinger, *Haematomma sorediatum* R. W. Rogers and *Pseudocyphellaria aurata* (Ach.) Vain. Vastly different though these vegetation types are, they are all essentially 'old growth' communities with an extended history of ecological stability and continuity. One Tasmanian collection is from sheltered conglomerate outcrops in high elevation buttongrass (*Gymnoschoenus*) moorland, a habitat not unusual for other chiefly corticolous, wet forest species.

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Selected specimens examined. **Australia:** *Tasmania*: Mt Rufus Track, 42°07′S, 146°05′E, 1120 m, 1972, *G. C. Bratt* 72/1042 (HO); Mt Field National Park, W shore of Lake Dobson, 42° 41′S, 146°35′E, 1040 m, 1981, *L. Tibell* 11097 (distributed as *Lich. Sel. Upsalienses* 265) (CANB); Robbins Island Track, N of Denium Hill, 40°44′S, 144°53′E, 2 m, 1993, *J. A. Elix* 40273 & *G. Kantvilas* 149/93 (CANB, HO, TU); Bruny Island, Cape Queen Elizabeth, 43°15′S, 147°26′E, 100 m, 2007, *G. Kantvilas* 431/07 (HO); Cuvier Valley Track, 42°01′S, 146°05′E, 790 m, 2011, *G. Kantvilas* 158/11 (HO); Cape Portland, Little Musselroe River, 40°47′S, 148°04′E, 5 m, 2018, *G. Kantvilas* 154/18 (HO); North East Ridge Track to Mt Anne, 42°54′S, 146° 24′E, 340 m, 2022, *G. Kantvilas* 320/22 (HO); Scotts Peak Road, *c.* 1.1 km S of Frodshams Pass, 42°49′S, 146°23′E, 550 m, 2023, *G. Kantvilas* 247/23 (HO) (sorediate specimen with additional usnic acid). *South Australia, Kangaroo Island*: Brown Beach, 35° 48′S, 137°50′E, 10 m, 2012, *G. Kantvilas* 425/12 & *B. de Villiers* (AD, HO); *ibid.*, *c.* 1 km SW of Ballast Head, 35°46′S, 137°48′E, 3 m, 2013, *G. Kantvilas* 349/13 & *B. de Villiers* (AD, HO). *Victoria*: S of Lake Gillear, 38°26′S, 142°36′E, 1987, *W. H. Ewers* 667 (CANB); Bemm River, 37°37′30″S, 148°53′12″E, 65 m, 2008, *G. Kantvilas* 86/08 & *J. Elix* (HO); Furnell Landing, 37°43′20″S, 149°08′14″E, 1 m, 2008, *G. Kantvilas* 153/08 & *J. Elix* (HO, MEL); Walkerville Coastal Reserve, 38°51′22″S, 145°59′50″E, 2009, *V. Stajsic* 5142b (HO, MEL). *New South Wales*: Mt William, Barrington Tops NP, 32°04′S, 151°28′E, 1400 m, 1988, *G. Kantvilas* 312/88 (CANB, HO, NSW).

Cliostomum latisporum Kantvilas sp. nov.

MycoBank No.: MB 850546

Similar to *Cliostomum griffithii* but with the apothecia persistently pale pink, lacking dark pigments and at length becoming immarginate, non-capitate, unpigmented paraphyses, somewhat wider ascospores, 9–15 × 4–6 µm, and containing atranorin and gangaleoidin as the major secondary compounds.

Type: Australia, New South Wales, Burrewarra Point, 1 km W of Tomakin, 35°51′S, 150°11′E, 20 m, on dead shrub in coastal woodland, 16 September 1993, *J. A. Elix* 30193 (CANB—holotype; HO—isotype).

(Fig. 2A)

Thallus smooth to patchily rimose to verruculose, greyish white to cream-white, occasionally highly reduced to ±absent, to 50–200 µm thick, esorediate, forming irregular, diffuse patches to *c.* 2 cm across; medulla inspersed with minute crystals that dissolve in K.

Apothecia 0.3–0.9 mm wide, roundish, superficial, basally constricted; disc whitish to pale pink, epruinose, at first plane, becoming undulate and then convex with age; proper exciple concolorous with the disc or a little paler, entire, becoming inconspicuous to excluded in older, more convex apothecia, in section 40–55 µm thick laterally, pale yellowish brown, composed of radiating, branched and anastomosing hyphae 1.5–2 µm wide with occasional oil vacuoles to 3 µm wide, densely inspersed with minute crystals that dissolve in K and scattered, larger K-insoluble crystals. *Hypothecium* 25–80 µm thick, hyaline, not inspersed. *Hymenium* 40–60 µm thick, hyaline, overlain by pale yellowish brown crystals that dissolve in K. *Paraphyses* 1.5–2 µm wide, with the apices not markedly capitate, hyaline, gradually expanding to 2–3(–4) µm wide. *Asci* 30–45 × 10–16 µm. *Ascospores* ellipsoid, 1(–3)-septate, (9–)10–*11.8*–14(–15) × 4–*4.8*–5.5(–6) µm ($n = 90$), with a thin, distinct wall and septum *c.* 0.3 µm thick.

Pycnidia uncommon, emergent, black and speck-like, 0.07–0.13 mm wide; wall *c.* 20–40 µm thick in section, containing greenish, N+ crimson pigment; conidia globose, 2.5–3 µm diam.

Chemistry. Atranorin and gangaleoidin, sometimes with traces of fatty acids; thallus weakly K+ yellowish, KC−, C−, P−. The thinness of the thallus and low concentration of these compounds can render TLC analyses ambiguous. Traces of usnic acid can occur in the apothecia.

Etymology. The specific epithet alludes to the relatively broad ascospores of the new species when compared to the somewhat morphologically similar *C. griffithii*.

Remarks. This species is superficially similar to *C. griffithii* and, for many years, specimens now recognized as *C. latisporum* were subsumed under that name. However, extensive field observations and detailed anatomical and chemical examination support its recognition as a distinct taxon. Thallus morphology is very similar to that of coastal forms of *C. griffithii* with which it grows, but whereas that species can become scurfy and/or sorediate, the thallus of *C. latisporum* is invariably esorediate and, at most, verruculose. The apothecia of the two species are also similar, but again, whereas those of *C. griffithii* are frequently dark pigmented or piebald, those of the new species are persistently pale pinkish. Furthermore, those of *C. griffithii* tend to remain marginate, but in *C. latisporum* the margin becomes ±excluded or at least reduced and inconspicuous as the apothecia age and become increasingly convex. Anatomical differences between the two species are more clear-cut. The paraphyses of *C. latisporum* are not capitate, but widen gradually and are never pigmented, whereas those of *C. griffithii* are markedly capitate. Finally, the ascospores of the new species, although overlapping somewhat in dimensions, are consistently wider, with a very distinct wall and septum. The chemical difference between the two species is distinct but can be difficult to establish on account of the thin, small thalli and low concentration of the substances. Some of the specimens cited below were too scant for analysis. Gangaleoidin is an uncommon metabolite but it also occurs in *C. verrucosum*, a saxicolous, coastal species with black apothecia. It is observed on developed TLC plates as a pale yellow spot, a little lower than atranorin.

Pycnidia were found only in the type collection and differ from those of *C. griffithii* in the pigment of the wall (aeruginose, N+ crimson, rather than brown, K+ purple-brown) and in the shape of the conidia. The distinction is stark but I am reluctant to overemphasize it until further specimens with pycnidia are found.

Distribution and ecology. The new species is widely scattered along the northern and eastern coast of Tasmania and extends to the southern coast of New South Wales on the Australian mainland. Most collections are from coastal heathland and scrub, where it colonizes the twigs of small shrubs such as *Acacia sophorae* and *Leucopogon parviflorus*. Associated lichens include *Arthothelium endoaurantiacum* Makhija & Patw., *Caloplaca maccarthyi* S. Y. Kondr. *et al.*, *Cliostomum griffithii*,

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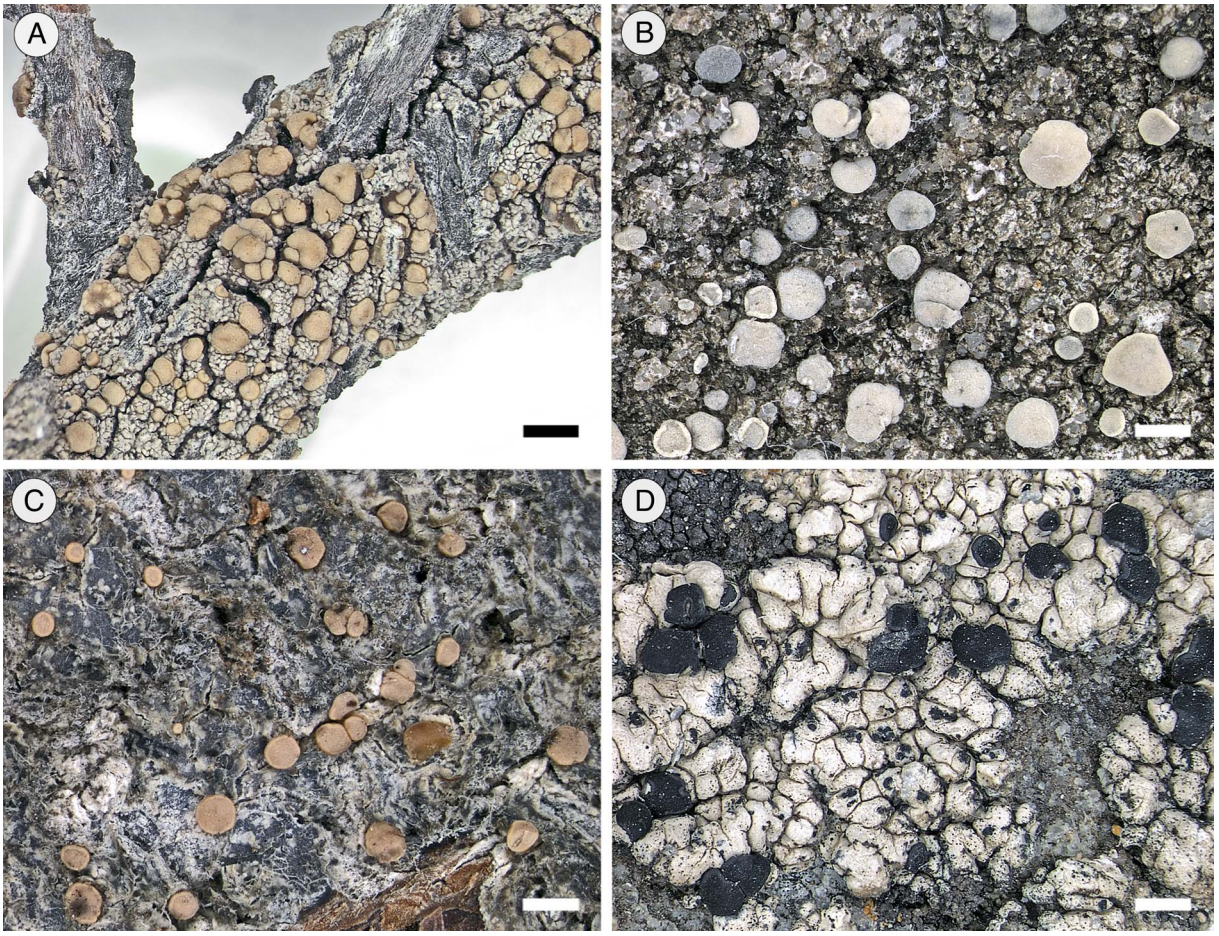

Figure 2. Morphology of Australian *Cliostomum* species. A, *C. latisporum* (note the unpigmented, immarginate apothecia). B, *C. litorale*. C, *C. praepallidum*. D, *C. verrucosum*. Scales = 1 mm. In colour online.

Lecanora flavopallida Stirt. and species of *Amandinea* and *Buellia*. It has also been found in *Melaleuca ericifolia*-dominated swampy coastal woodland and, in New South Wales, in mangrove vegetation where it grew on the twigs of *Avicennia*.

Specimens examined. **Australia:** *Tasmania*: Rocky Cape, Burgess Cove, 40°52′S, 145°30′E, sea level, 1999, *G. Kantvilas* 296/99 (HO); end of Robbins Island Track, 40°45′S, 144°53′E, sea level, 1999, *G. Kantvilas* 262/99 (HO); Cape Portland, Musselroe Bay Conservation Area, 'Abalone Rocks', 40°47′26″S, 148°06′08″E, 3 m, 2018, *G. Kantvilas* 389/18 (HO); King Island, Lavinia State Reserve, Nine Mile Beach, 39°42′12″S 144°06'17″E, 20 m, 2023, *G. Kantvilas* 360/23 (HO). *New South Wales*: Cullendulla Creek Nature Reserve, 3 km NE of Batemans Bay, 32°42′04″S, 150°11′56″E, 1 m, 2008, *J. A. Elix* 45654 (CANB).

Cliostomum litorale Kantvilas sp. nov.

MycoBank No.: MB 850547

Unique to the genus *Cliostomum* in containing confluentic acid in addition to atranorin, and further characterized by the esorediate thallus, the relatively large, usually pale pinkish apothecia, 0.6–1.5 mm wide, the non-capitate paraphyses, and the 1(–2)-septate ascospores, 9–13 × 4–6 µm.

Type: Australia, Tasmania, Frogmore Peninsula, Midway Point, 42°47′S, 147°31′E, 2 m, on littoral sandstone, 28 June 2017, *G. Kantvilas* 132/17 (HO—holotype).

(Fig. 2B)

Thallus rimose areolate to rather granular, pale yellowish grey to beige-grey, sometimes abraded and then whitish, forming irregular, diffuse patches to *c.* 10 cm wide; individual areoles and granules 0.15–1.5 mm wide and to 0.3–0.6 mm thick, irregular in outline, plane to markedly convex, contiguous and fused together or rather dispersed and separated by deep cracks; prothallus usually lacking, occasionally effuse, bluish grey and visible at the periphery of the thallus; medulla white, densely inspersed with minute crystals that partially dissolve in K.

Apothecia 0.6–1.5 mm wide, roundish, superficial, basally constricted; disc usually pale pink, epruinose, occasionally becoming discoloured smoky blue-grey, rarely blackened, plane to undulate to convex, sometimes markedly so; proper exciple concolorous with and a little higher than the disc, persistent, entire to flexuose, sometimes quite deeply lobed, in section 50–80 µm thick laterally, hyaline to pale yellowish brown, composed of radiating, short-celled, branched hyphae *c.* 2 µm wide, with frequent oil vacuoles to 5 µm wide, densely inspersed with minute crystals that dissolve in K as well as clusters of insoluble crystals. *Hypothecium* (40–) 70–100 µm thick, hyaline, not inspersed. *Hymenium* 45–65 µm

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thick, hyaline, overlain and inspersed in the upper part with minute crystals that dissolve fleetingly yellowish in K, in darkened apothecia with a bluish green, N+ crimson pigment. *Paraphyses* (1.5–)2 µm wide, with the apices unpigmented, not capitate, sometimes slightly enlarged to 2.5 µm wide. *Asci* (35–)40–50 × 12–18 µm. *Ascospores* ellipsoid, 1(–2)-septate, 9–*10.6*–13 × 4–*4.9*–6 µm ($n = 75$), when mature with a distinct wall *c.* 0.3 µm thick.

Pycnidia soon emergent, black, 0.25–0.4 mm wide, with the wall 30–40 µm thick in section, greenish black, intensifying greenish in K, N+ crimson; conidia oblong-ellipsoid, 4–5 × 1.5–2 µm.

Chemistry. Atranorin and confluentic acid; thallus weakly K+ yellowish, KC−, C−, P−.

Etymology. The specific epithet alludes to the coastal distribution of the new species.

Remarks. The combination of a rather coarse, areolate to granular thallus, relatively large, pale pink, biatorine apothecia, *Biatora*-type asci and 1-septate, hyaline ascospores, together with the saxicolous, coastal habitat render this species very easily recognizable, and there are no known, potentially confusing species in the temperate Australian biota. Amongst the known species of *Cliostomum*, the presence of confluentic acid is unique. Although most species of *Cliostomum* are corticolous or lignicolous, there are several saxicolous taxa. The sorediate *C. subtenerum* Coppins & Fryday and the esorediate *C. tenerum* (Nyl.) Coppins & Ekman both contain atranorin, stictic acid and zeorin (Ekman 1997; Fryday & Coppins 2012). The chemistry of *C. albidum* Fryday, from the Falkland Islands, has not been analyzed but the reported P+ orange-red reaction (Fryday 2019) indicates that it is different from the new species. Also from the Falkland Islands, *C. falklandicum* Fryday & Coppins contains atranorin only (Fryday & Øvstedal 2012), whereas *C. longisporum* Fryday is distinguished best by its ascospores that are 15–23 µm long (Fryday 2019). Finally, *C. namibicum* V. Wirth & Kalb differs by its long conidia (9–12 × 0.8–1.2 µm) and by containing usnic acid (Wirth & Kalb 2011). Australian saxicolous taxa include *C. saxatile*, which differs by its small, black apothecia and by the presence of lecanoric acid. A further saxicolous species, *C. verrucosum*, which also occurs in littoral habitats, has black apothecia with greenish, N+ crimson pigments and contains gangaleoidin or lecideoidin in addition to atranorin.

All collections of the new species are very uniform in morphology and anatomy. Pycnidia are relatively uncommon, and are most frequent in thalli where apothecia are few. Ascospores are almost invariably 1-septate, and a second septum is at best developed near the spore apex and then only weakly.

Distribution and ecology. This species is known only from south-eastern Tasmania where almost all records are from sheltered underhangs on coastal, coarse-grained Tertiary sandstone. The littoral zone in Tasmania is typically very lichen-rich with respect to both species diversity and biomass. Yet the microhabitat colonized by the new species tends to be remarkably devoid of lichens, supporting, at most, depauperate thalli of the common taxa which dominate more exposed sites, for example, *Buellia* spp., *Caloplaca kilcundaensis* S. Y. Kondr. & Kärnefelt, *Lecanora dispersa* (Pers.) Sommerf. and *Cliostomum verrucosum*.

Specimens examined. **Australia:** *Tasmania*: type locality, 2017, *G. Kantvilas* 127/17 (HO); Spring Bay Bill, 'Cresponea Cliffs', 42°33′S, 147°56′E, 5 m, 2021, *G. Kantvilas* 12/21 (HO); Randalls Bay, south-western headland, 43°15′S, 147°07′E, 3 m, 2021, *G. Kantvilas* 185/21 (HO); Alum Cliffs, Kingston, 42°58′S, 147° 20′E, 35 m, 2022, *G. Kantvilas* 330/22 (HO).

Cliostomum praepallidum (Müll. Arg.) Kantvilas & Fryday

Lichenologist **42**, 542 (2010).—*Patellaria praepallida* Müll. Arg., *Miss. Sc. Cap Horn, Lich.*, 166 (1888).

(Fig. 2C)

Thallus effuse, smooth, continuous or patchy, sometimes very thin and inapparent, pale grey, to cream-grey, 30–80 µm thick, forming diffuse patches rarely more than *c.* 20 mm wide; medulla not inspersed.

Apothecia 0.3–1 mm diam., roundish, superficial, basally constricted; disc pale pink to pale orange, rather waxy and glossy, epruinose, plane at first, becoming convex with age, at length sometimes multi-divided and with clusters of regenerating apothecia; proper exciple concolorous with the disc or a little paler, slightly inrolled when young, usually becoming excluded with age, in section 40–90(–120) µm thick laterally, hyaline to pale yellowish brown, composed of radiating, short-celled, branched and anastomosing, highly gelatinized hyphae 1–1.5 µm wide, densely inspersed with minute crystals that dissolve in K. *Hypothecium* 50–130 µm thick, hyaline to pale yellowish, not inspersed. *Hymenium* 60–70 µm thick, hyaline, overlain and inspersed in the upper part by minute, pale yellow-brown crystals that dissolve fleetingly yellowish in K. *Paraphyses* 1.5–2 µm wide, with the apices hyaline, to 2–5 µm wide. *Asci* 35–50 × 10–18 µm. *Ascospores* ellipsoid, (11–)12–*14.3*–18 × (5–)6–*7.3*–9 µm ($n = 120$), invariably 1-septate, polarilocular, with the septum 3–5 µm thick and the narrow, connecting channel clearly evident.

Pycnidia not observed.

Chemistry. Atranorin, roccellic acid and norcaperatic acid (major compounds); thallus weakly K+ yellowish, KC−, C−, P−.

Remarks. A detailed discussion of this species is provided by Kantvilas & Fryday (2010). Its relatively large, polarilocular ascospores, a feature shared with the Scottish, epiphytic *C. coppinsii* Fryday & Kantvilas, suggest that it occupies a rather peripheral position within the genus. However, for the present, chemical and anatomical characters relating to the apothecium and the ascus make *Cliostomum* the 'genus of best fit'. *Cliostomum praepallidum* is relatively easily distinguished in the Tasmanian biota, although confirmation of its identity invariably requires anatomical examination of apothecial sections in order to observe the diagnostic crystals, asci and ascospores. Although superficially similar to *C. griffithii*, which is chemically identical, its apothecia are never dark pigmented and remain orange-pink throughout development. Furthermore, these two species are not known to co-occur.

Distribution and ecology. In Tasmania, this species occurs on twigs and young branches in cool temperate rainforest, wet eucalypt forest, scrub and wet heathland, where it is part of a rich assemblage of chiefly crustose lichens (see Kantvilas & Fryday 2010). It is also known from southern South America.

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Selected specimens examined. **Australia:** *Tasmania*: Lake Esperance, 43°14′S, 146°46′E, 980 m, 1963, *P. James* (BM, HO); Mt Sprent, 42°47′S, 145°58′E, 850 m, 1987, *G. Kantvilas* 132/87A (E, HO); Bluff River Gorge, 42°33′S, 147°41′E, 200 m, 2017, *G. Kantvilas* 372/17 (HO); Mt Wedge, 42°51′S, 146°18′E, 1145 m, 2107, *G. Kantvilas* 156/17 (HO); Lake Skinner Track, 42°57′S, 146°41′E, 910 m, 2021, *G. Kantvilas* 136/21 (HO).

Cliostomum saxatile Kantvilas sp. nov.

MycoBank No.: MB 850548

A saxicolous species distinguished from all others in the genus by containing lecanoric acid in addition to atranorin, and further characterized by the esorediate thallus, dark brown to black apothecia, 0.3–0.5 mm wide and pigmented with Laurocerasi-brown, the capitate paraphyses, and 1-septate ascospores, 7–14 × 3–5 µm.

Type: Australia, Tasmania, The Gnomon, 41°11′S, 146°02′E, 475 m, on vertical, sheltered rock faces in wet sclerophyll forest, 25 May 1991, *G. Kantvilas* 237/91 (HO—holotype; M—isotype).

(Fig. 3B)

Thallus granular areolate, whitish, forming diffuse, wide-spreading patches; individual areoles to 0.3 mm wide and to *c.* 0.2 mm thick, irregular in outline, plane to convex, sometimes a little gnarled, contiguous or rather dispersed over a very thin, wispy, whitish prothallus; medulla white, inspersed with minute crystals that dissolve in K.

Apothecia 0.3–0.5 mm wide, round, superficial, basally constricted; disc dark brown to black, epruinose, plane, rarely becoming convex; proper exciple concolorous with and ±level with the disc, rarely a little paler, persistent, entire, in section 40–60 µm thick laterally, hyaline to pale yellowish brown within, dark purple-brown, K+ intensifying at the upper, outer edge, composed of radiating, short-celled, branched hyphae 2–2.5 µm wide, with occasional oil vacuoles to 4 µm wide and with the outermost, pigmented cells to 5 µm wide, inspersed with minute crystals that dissolve in K, sometimes also with clusters of insoluble crystals. *Hypothecium* 70–80 µm thick, hyaline, K+ faint yellowish, not inspersed. *Hymenium* 40–50 µm thick, hyaline, overlain by a purple-brown, K+ intensifying epithecium 5–10 µm thick and inspersed in the upper part with minute crystals that dissolve in K. *Paraphyses* 1.5–2 µm wide, with the apices markedly capitate, 4–6.5 µm wide, externally purple-brown. *Asci* 32–42 × 10–14 µm. *Ascospores* ellipsoid to fusiform, thin-walled, (0–)1-septate, (7–)7.5–*9.4*–12(–14) × 3–*3.7*–4(–5) µm (*n* = 75).

Pycnidia emergent, black, 0.2–0.4 mm wide, with the wall often rather gnarled, 30–60 µm thick, in section purple-brown, intensifying purplish in K; conidia oblong-ellipsoid, 3.5–5 × 1.5–2 µm.

Chemistry. Atranorin and lecanoric acid; thallus weakly K+ yellowish, KC+ fleeting pink, C+ fleeting pink, P−.

Etymology. The specific epithet refers to the habitat of the new species.

Remarks. Comparative diagnostic features of the other saxicolous species of *Cliostomum* are discussed under *C. litorale* (see above) and are not repeated here. Superficially, with its small Laurocerasi-brown pigmented apothecia and capitate paraphyses, *C. saxatile* most closely resembles the chiefly corticolous *C. griffithii*, but the presence of lecanoric acid is unique and has never been reported previously for the genus. In addition, the ascospores of *C. saxatile* are marginally shorter than those of *C. griffithii*.

Distribution and ecology. The new species is known only from the type collection, from vertical, deeply sheltered crevices of a large crag of highly siliceous, Ordovician conglomerate in wet sclerophyll forest. It has not been sighted since, despite more than three decades of lichen investigations in Tasmania. Its

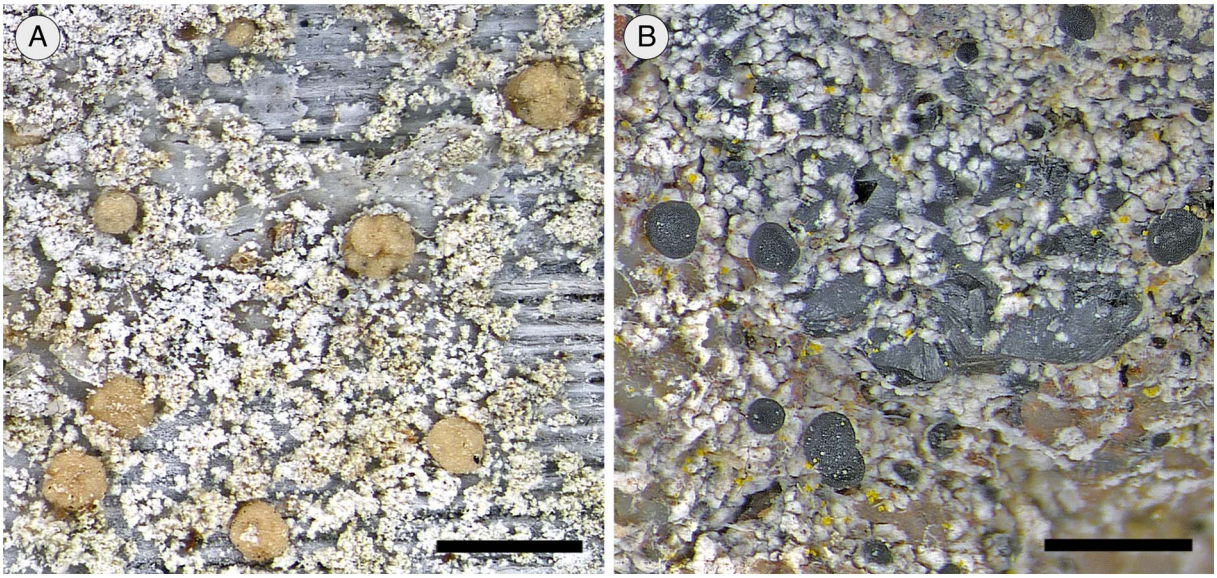

Figure 3. Morphology of Australian *Cliostomum* species. A, *C. vezdae*, showing the sorediate thallus, yellowish pink apothecia and tiny, black pycnidia. B, *C. saxatile*, with black apothecia and black, emergent pycnidia. Scales = 1 mm. Images: Jean Jarman. In colour online.

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occurrence in a highly sheltered microhabitat is not unusual for species of *Cliostomum*.

Cliostomum verrucosum (Müll. Arg.) Kantvilas comb. nov.

MycoBank No.: MB 850549

Patellaria verrucosa Müll. Arg., *Bull. Herb. Boissier* **4**, 94 (1896).—*Catillaria verrucosa* (Müll. Arg.) Zahlbr., *Cat. Lich. Univ.* **4**, 84 (1926).—*Tylothallia verrucosa* (Müll. Arg.) Kantvilas, *Australas. Lichenol.* **74**, 13 (2014); type: Victoria, Sandringham, on maritime rock at high water mark, 1893, *Rev. F. R. M. Wilson* 1743 (G—holotype!).

Catillaria rimosa (Müll. Arg.) Zahlbr., *Cat. Lich. Univers.* **4**, 69 (1926).—*Patellaria rimosa* Müll. Arg., *Bull. Herb. Boissier* **1**, 48 (1893) nom. illegit; type: Victoria, Lorne, on sandstone, 1892, *Rev. F. R. M. Wilson* 1402 (G—holotype!).

Tylothallia pahiensis (Zahlbr.) Hertel & H. Kilias, *in* H. Hertel, *Mitt. Bot. Staatssamml. München* **19**, 446 (1983).—*Lecidea pahiensis* Zahlbr., *Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr.* **104**, 303 (1941); type: New Zealand, South I., Southland, Foveaux Strait, Pahia Point, on granitic coastal rocks, viii.1935, *J. S. Thomson* T2242 (W—holotype; BM—isotype!); for location of additional isotypes, see Galloway (2007).

Catillaria brisbanensis Räsänen, *Arch. Soc. Zool. Bot. Fenn. Vanamo* **3**, 182 (1949); type: Australia, South Queensland, Brisbane, Hellend, ad saxa silicata, 1890, *F. R. M. Wilson* (H—holotype!).

(Fig. 2D)

Thallus rimose-areolate to verruculose, sometimes rather lumpy, esorediate, whitish grey to pale greenish grey, rarely rather pale brownish grey, to 1.5 mm thick, forming extensive irregular patches; prothallus marginal, black to bluish black; medulla white, inspersed with minute crystals that partially dissolve in K.

Apothecia 0.4–1.2(–1.7) mm wide, roundish, superficial, basally constricted; disc black, plane to undulate, sometimes becoming convex, epruinose or occasionally lightly greyish pruinose; proper exciple concolorous with the disc or pale greyish or brownish at the outer edge, persistent except in the oldest, most convex apothecia, in section 40–110 µm thick laterally, bluish green at the outer edge, hyaline within, densely inspersed with clusters of large and small crystals, the former rod-shaped, *c.* 2–3 µm long, pale brown and insoluble in K, the latter hyaline, minute and soon dissolving in K. *Hypothecium* 60–120 µm thick, sometimes becoming massive, hyaline, not inspersed. *Hymenium* 50–65 µm thick, not inspersed, hyaline or with a faint yellowish or pinkish tinge, overlain by a greenish black, K −, N+ crimson epithecial layer. *Paraphyses* 1–2 µm thick, with apices 3–4 µm wide, coated with blue-green pigment. *Asci* 40–50 × 11–17 µm. *Ascospores* ellipsoid, (0–)1-septate, (8–)8.5–*10.3*–12.5(–16) × 4–*4.9*–5.5(–6) µm ($n = 60$).

Pycnidia abundant, visible as black specks; wall 10-20 µm thick in section, brown, unchanged in K, sometimes with additional greenish, N+ crimson pigment at the ostiole; conidia 3–3.5 × 1.5–2 µm.

Chemistry. Atranorin, ±either lecideoidin or gangaleoidin; thallus weakly K+ yellowish, KC−, C−, P−.

Remarks. The transfer of this common species from *Tylothallia* to *Cliostomum* is discussed above in the introductory paragraphs. All its salient features, notably the presence of crystals in the exciple, the *Biatora*-type asci, simple, capitate paraphyses and 1-septate hyaline ascospores, support its inclusion there. The status of the remaining species of *Tylothallia* (*T. biformigera*) awaits further study although this taxon has branched and anastomosing paraphyses. In the field and in the absence of anatomical examination, *C. verrucosum* could be confused with *Lecanora austrooceanica* Hertel & Leuckert (hyaline, simple ascospores) and species of *Amandinea* (brown, 1-septate ascospores) which occur in the same habitat, although these lichens tend to be considerably less common and have a duller grey thallus. Additional descriptive data are provided by Galloway (1985, 2007) and Kantvilas (2014).

This species has an extensive synonymy to which is now added *Catillaria brisbanensis*. Annotations on this type specimen (in H) by Harald Kilias (in 1983) indicate that he already recognized this species as belonging to the genus *Tylothallia*.

Distribution and ecology. This species is locally abundant and widespread on siliceous, coastal rocks, ranging from Tasmania, along the southern Australian coast and northwards to at least south-eastern Queensland; it is also known from New Zealand. This conspicuous species is the major contributor to the white coloration of littoral lichen mosaics, contrasting sharply with the yellowish or orange *Caloplaca* species, yellow *Lecanora subcoarctata* (C. Knight) Hertel and blackish or dark brown *Catillaria austrolittoralis* Kantvilas & van den Boom, *Rinodina blastidiata* Matzer & H. Mayrhofer and *Verrucaria* species with which it grows.

Selected specimens examined. **Australia:** *Tasmania*: Don Heads, 41°10′S, 146°20′E, 1963, *G. C. Bratt* 978 & *J. A. Cashin* (HO); Penguin, 1968, *W. A. Weber* & *D. McVean* L-49696 (COLO, HO); Sleepy Bay, 42°08′S, 148°19′E, sea level, 1984, *G. Kantvilas* 129/84 & *P. James* (BM, HO); Swansea, 42°07′S, 148°04′E, 1–5 m, 1996, *H. Mayrhofer* 13380 (GZU, HO); Lion Rock, 43°36′S, 146°49′E, 1 m, 2013, *G. Kantvilas* 35/13 (HO); Flinders Island, The Dock, 39°48′S, 147°52′E, 1 m, 2014, *G. Kantvilas* 289/14 (HO); Stony Head Training Area, eastern end of Maitland Bay, 40°59′S, 147°01′E, 2 m, 2021, *G. Kantvilas* 176/21 (HO). *South Australia, Kangaroo Island*: Kona, Antechamber Bay, 35°47′S, 138°05′E, 2008, *G. Kantvilas* 334/08 (AD, HO); W of Windmill Bay, 35°51′S, 138°07′E, 40 m, 2012, *G. Kantvilas* 504/12 (AD, HO). *Victoria*: Phillip Island, Barrys Beach, 38°31′S, 146°12′E, 6 m, 1966, *G. C. Bratt* 3574 & *R. C. Weeks* (HO). *New South Wales*: Baragoot Point, 36°24′S, 150°05′E, 1978, *J. A. Elix* 4583 & *G. Rambold* (HO) (distributed as *H. Hertel: Lecideaceae Exsiccatae* 140); Boulder Bay, Bournda National Park, 36°44′51″S, 149°58′53″E, 20 m, 2012, *L. H. Cave* 1797 (HO).

Cliostomum vezdae Kantvilas & Elix

Biblioth. Lichenol. **58**, 208 (1995); type: Australia, Tasmania, Weindorfers Forest, 41°38′S, 145°56′E, on trunk of *Richea pandanifolia* in rainforest, 920 m, 1988, *G. Kantvilas* 30/88 (HO—holotype!; E—isotype!).

(Fig. 3A)

Thallus ±entirely farinose sorediate, greyish white with a faint yellowish tinge, to *c.* 150 µm thick but usually much thinner, forming irregular, diffuse, thinly dispersed patches to 15 cm or more in width; individual soredia 20–50 µm wide.

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Apothecia 0.25–0.6 mm wide, roundish, superficial and nestled amongst the soredia; disc pale yellowish to pinkish grey, rarely discoloured bluish grey, usually slightly pruinose, plane to undulate, becoming convex and at length convoluted; proper exciple concolorous with the disc or a little paler, persistent in young apothecia but becoming excluded in older, convex ones, entire, in section 30–60 µm thick laterally, pale yellowish brown and inspersed with minute crystals that dissolve yellowish in K, later becoming reflexed and excluded, composed of highly gelatinized, radiating, branched hyphae *c.* 2.5 µm wide. *Hypothecium* 50–60(–150) µm thick, hyaline, not inspersed. *Hymenium* 40–60 µm thick, hyaline, inspersed in the upper part and overlain by yellow-brown crystals that dissolve yellow in K; occasionally with patchy blue-green, N+ crimson pigment. *Paraphyses* 0.8–1.5 µm wide, with the apices unpigmented, rounded or tapered, sometimes a little expanded to 2–2.5 µm wide. *Asci* 30–55 × 12–18 µm. *Ascospores* ellipsoid-oblong, almost invariably 1-septate, 8–*10.1*–12(–14.5) × 3–*4.1*–5 µm ($n = 65$), with a distinct wall and septum when mature.

Pycnidia superficial, rare, visible as minute, black specks *c.* 0.1 mm wide; wall brown, K± purplish brown; conidia fusiform to bacilliform, 4–5 × 1.5–2 µm.

Chemistry. Atranorin and fumarprotocetraric acid (major compounds), sometimes with traces of additional fatty acids (usually caperatic or roccellic acids); thallus weakly K+ yellowish, KC−, C−, P+ orange-red.

Remarks. Ekman (1997) synonymized *Cliostomum vezdae* with the widespread Northern Hemisphere species *C. flavidulum* Hafellner & Kalb, chiefly because of the superficial similarities in their sorediate thalli and their identical secondary chemistry. On further consideration and study, however, the two taxa are better treated as distinct, with *C. flavidulum* differing by having a continuous, initially areolate thallus, frequently delimited by a whitish to blue-black prothallus, and which is intensely sulphur yellow when fresh, as well as by having immersed, unpigmented pycnidia (Ekman 1997, personal communication 2023). In contrast, *C. vezdae* is sorediate from the outset, very pale yellowish at all stages of development, lacks a prothallus and has dark-pigmented pycnidia.

There are several other sorediate species of the genus, but none have the same chemical composition as *C. vezdae*. In the Northern Hemisphere, the corticolous species *C. leprosum* (Räsänen) Holien & Tønsberg has a whitish grey thallus containing atranorin and caperatic acid (Ekman 1997), *C. haematommatis* (Keisll.) D. Hawksw. *et al.* has a pale bluish grey thallus and contains atranorin and an unknown substance (Hawksworth *et al.* 2006), *C. spribillei* Goward & Tønsberg has a yellowish green thallus containing usnic acid (Tønsberg & Goward 2016), and *C. subtenerum* Coppins & Fryday is saxicolous and contains atranorin, stictic acid and zeorin (Fryday & Coppins 2012). In the Falkland Islands, *C. violascens* (Müll. Arg.) Fryday is sorediate and contains apothecial Melaena-red pigment (Fryday 2019). The widespread *C. griffithii*, which occurs in Tasmania and is sometimes sympatric with *C. flavidulum*, can be occasionally and patchily granular sorediate but contains atranorin and roccellic acid in the thallus and Laurocerasi-brown pigment in darkened apothecia.

Distribution and ecology. This species appears to be rare in Tasmania, where it is restricted to cool temperate rainforest, especially at higher elevations. Like several other species of *Cliostomum*, it favours sheltered, drier microhabitats. The dead retained leaves and inclined trunks of the rosette tree heath *Richea pandanifolia* appear to offer a preferred microhabitat, where it occurs together with the far more common *C. griffithii*. Associated lichens in this habitat are listed under that species.

Specimens examined. **Australia:** *Tasmania*: Yarlington Tier, 42° 32′S, 147°18′E, 620 m, 1987, *G. Kantvilas* 90/87 (BM, HO); Anthony Road, 41°50′S, 145°38′E, 600 m, 1991, *G. Kantvilas* 448/91 (HO); track to Woolleys Tarn, 42°55′S, 146°40′E, 950 m, 2004, *G. Kantvilas* 222/04 (HO); Lake Skinner Track, 42°57′S, 146°41′E, 850 m, 2020, *G. Kantvilas* 33/20 (HO); Scotts Peak Road, *c.* 1.1 km S of Frodshams Pass, 42°49′S, 146°23′E, 550 m, 2023, *G. Kantvilas* 246/23 (HO).

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