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RESEARCH ARTICLE

## A revision of the *Coenogonium luteum* (*Coenogoniaceae*) complex in Aotearoa | New Zealand, with new records and new species, and a note on *C. tomentosum*

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**Abstract.** *Coenogonium* (lichenized *Ascomycota*: *Coenogoniaceae*) was last treated in Aotearoa | New Zealand by Galloway (2007), who accepted nine species, with a further species subsequently described, bringing the total to 10 species. Since this treatment, mounting evidence has indicated that *Coenogonium luteum* (Dicks.) Kalb & Lücking may constitute a species complex in New Zealand collections, highlighting the need for a comprehensive taxonomic re-evaluation. Specimens of *C. luteum* were examined from multiple New Zealand herbaria, with a focus on those from Auckland War Memorial Museum (AK), University of Otago (OTA) and Unitec (UNITEC). The results of this indicated that collections of *C. luteum* sensu lato included multiple taxa. Here, we present a revised circumscription of *C. luteum* for New Zealand material, report two new records for Aotearoa, *C. australiense* Kantvilas & Lücking and *C. pineti* (Ach.) Lücking & Lumbsch, and describe two new species: *C. hepatiphilum* C.J. James sp. nov. and *C. goniocystosum* C.J. James sp. nov. For all five species, we provide morphological descriptions, ecological notes, distribution data, conservation assessments and a revised key to *Coenogonium* in Aotearoa. In addition, we synonymize *C. pertenuae* (Stirt.) Kalb & Lücking with *C. luteum* and *C. tomentosum* Müll. Arg. with *C. implexum* Nyl.

**Keywords:** Aotearoa | New Zealand, *Coenogonium*, lichen taxonomy, lichenized mycobiota, new species, new synonyms

### Introduction

*Coenogonium* Ehrenb. (lichenized *Ascomycota*: *Coenogoniaceae*) is a large genus consisting of upward of 130 species, with a subcosmopolitan global

distribution (Rivas Plata et al., 2006; Ferraro, Michlig, 2013; de Oliveira et al., 2023; Adhikari et al., 2024). Characterized by biatorine (rarely zeorine) yellow to orange or brown apothecia with paraplectenchymatous excipulum, 1-septate or rarely

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non-septate ascospores, and a trentepohlioid photobiont; species in the genus can be crustose to filamentous and occur on various substrates: bark, bryophytes, leaves, rocks and soil (Rivas Plata et al., 2006; Ferraro, Michlig, 2013). *Coenogonium* has been in the focus of several recent phylogenetic studies, resulting in the addition of new taxa (de Oliveira et al., 2023; Malíček et al., 2023; Adhikari et al., 2024), rapidly raising the genus as one of the most species-rich genera of lichenized fungi (Lücking et al., 2017; Kantvilas et al., 2018).

In the most recent revision of *Coenogonium* for Aotearoa | New Zealand (hereafter Aotearoa), Galloway (2007) accepted nine species, with the later addition of an isidiate species, *C. fruticulosum* L. Ludw. (Ludwig, 2014), increasing the total to 10 species. The variable and widespread species, *Coenogonium luteum* (Dicks.) Kalb & Lücking, is now thought to be a species complex. In Australia, *C. australiense* Kantvilas & Lücking has been segregated and described from the complex, with more thought to be likely (Kantvilas et al., 2018). For Aotearoa, use of the key in Galloway (2007) results in any crustose specimens with large yellow to yellow-orange apothecia being identified as *C. luteum* sensu Galloway (2007), despite morphological differences being present. Hence, revision of the species complex (and genus) was necessary and the following recent revisions of this genus in Tasmania (Kantvilas et al., 2018; Kantvilas, 2024) sparked our investigation into the *C. luteum* sensu lato of Aotearoa taxa, as well as an update of the other members of the genus that were accepted by Galloway (2007) (James, 2024).

In this article, we present a revision of the Aotearoa members of the *C. luteum* complex, including a refined description of *C. luteum* for Aotearoa material, two new records for Aotearoa, *C. australiense* and *C. pineti* (Schrad. ex Ach.) Lücking & Lumbsch, and two new species: *C. hepatiphilum* C.J. James sp. nov. and *C. gonicystosum* C.J. James sp. nov. For each species, we provide descriptions, ecology, and suggest a conservation status using the New Zealand Threat Classification System (Rolfe et al., 2022). The focus on the genus also revealed taxa that merit synonymization. In this article, we synonymize the following species: *C. pertenuae* (Stirt.) Kalb & Lücking (treated as a synonym of *C. luteum* already in Kantvilas et al., 2018), and *C. tomentosum* Müll. Arg. (designated here as a synonym of *C. implexum* Nyl.). Finally, we provide a revised key to the genus *Coenogonium* in Aotearoa.

## Materials and Methods

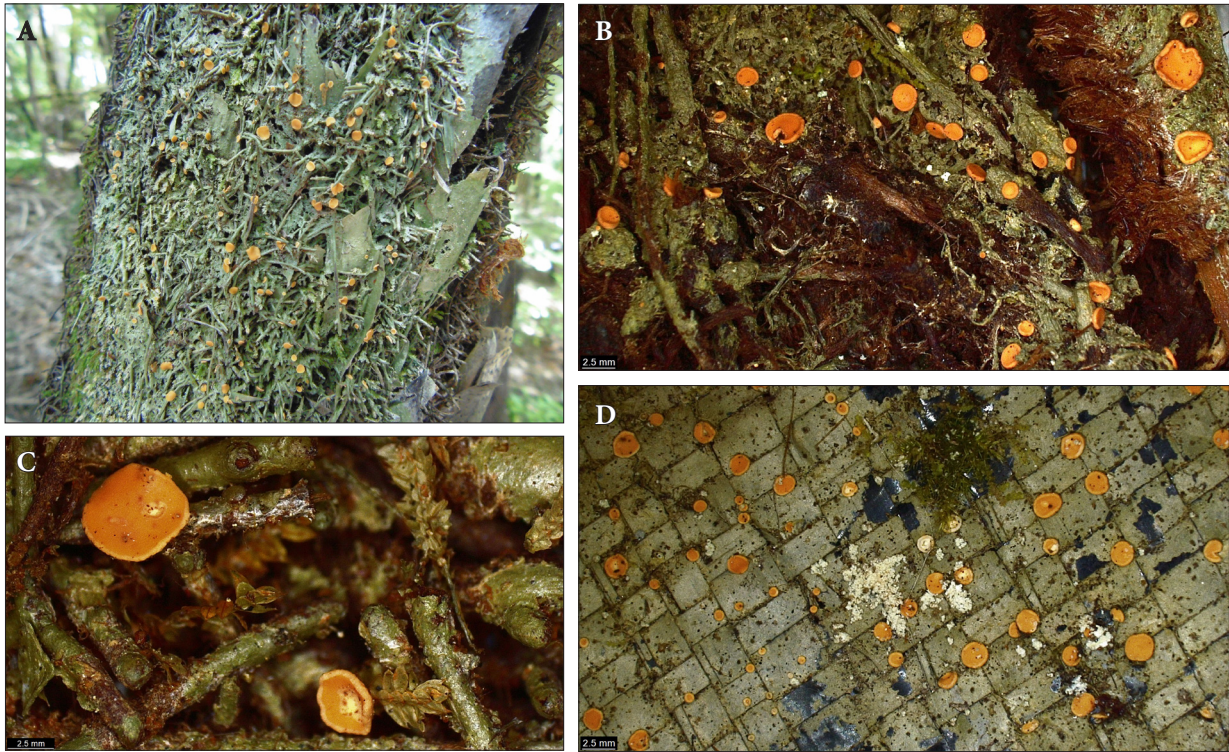
Specimens of *Coenogonium luteum* sensu lato (including those listed under synonyms and previously applied names) and undetermined collections within the genus were examined from the herbaria AK, OTA and UNITEC (herbarium acronyms follow Thiers, 2008–onwards). Opportunistic sampling was also conducted in Whangārei: Whangārei Heads (−36.850, 174.571); the Auckland Region: Hunua Ranges (−37.024, 175.094), Rangitoto Island (−36.784, 174.863), Schnapper Rock (−36.752, 174.690), Waitākere Ranges (−36.864, 174.490); Central Otago: Herbert Forest (−45.251, 170.757), Trotters Gorge (−45.405, 170.777); and Rēkohu | Wharekauri | Chatham Island (−43.762, −176.571). The specimens are cited in the ‘representative specimens’ listings, as well as the distribution maps created using ArcGIS v3.6.1 provided for each taxon in this article. Specimens were examined with standard microscopic techniques and photographs of morphological features acquired using a Leica S9i Leica Application Suite X 3.8.2.27713. In this article, the microscopic images used may inadvertently exaggerate or provide unreliable colour interpretation from the collected specimens. Therefore, for colour reference refer to the descriptions. For each taxon, we also suggest a Threat Classification status following the New Zealand Threat Classification system (Rolfe et al., 2022) based on information gathered from collections and preserved specimens, which we hope will contribute to the eventual threat listing following on from de Lange et al. (2018).

## Taxonomy

***Coenogonium luteum*** (Dicks.) Kalb & Lücking, Bot. Jahrb. Syst. 122 (1): 32 (2000) ≡ *Lichen luteus* Dicks., Fasc. Plant. Crypt. Brit. 1: 11 (1785) ≡ *Dimerella lutea* (Dicks.) Trevis., Rend. Reale Inst. Lombardo Sci. 13: 66(1880); type not seen.  
= *Coenogonium pertenuae* (Stirt.) Kalb & Lücking, syn. nov., Fungal Diversity 23: 297 (2006) ≡ *Baeomyces pertenuis* Stirt., Trans. Glasgow Soc. Field Naturalists 1: 17 (1873); type not seen (BM — isotype)

**Mycobank accession number:** 458099

**Note.** *Coenogonium pertenuae* was treated as a synonym of *C. luteum* by Galloway (2007) and reinstated by Rivas Plata et al. (2006) on account of longer and wider ascospores. Kantvilas et al. (2018) examined the isotype of *C. pertenuae* (in BM), and



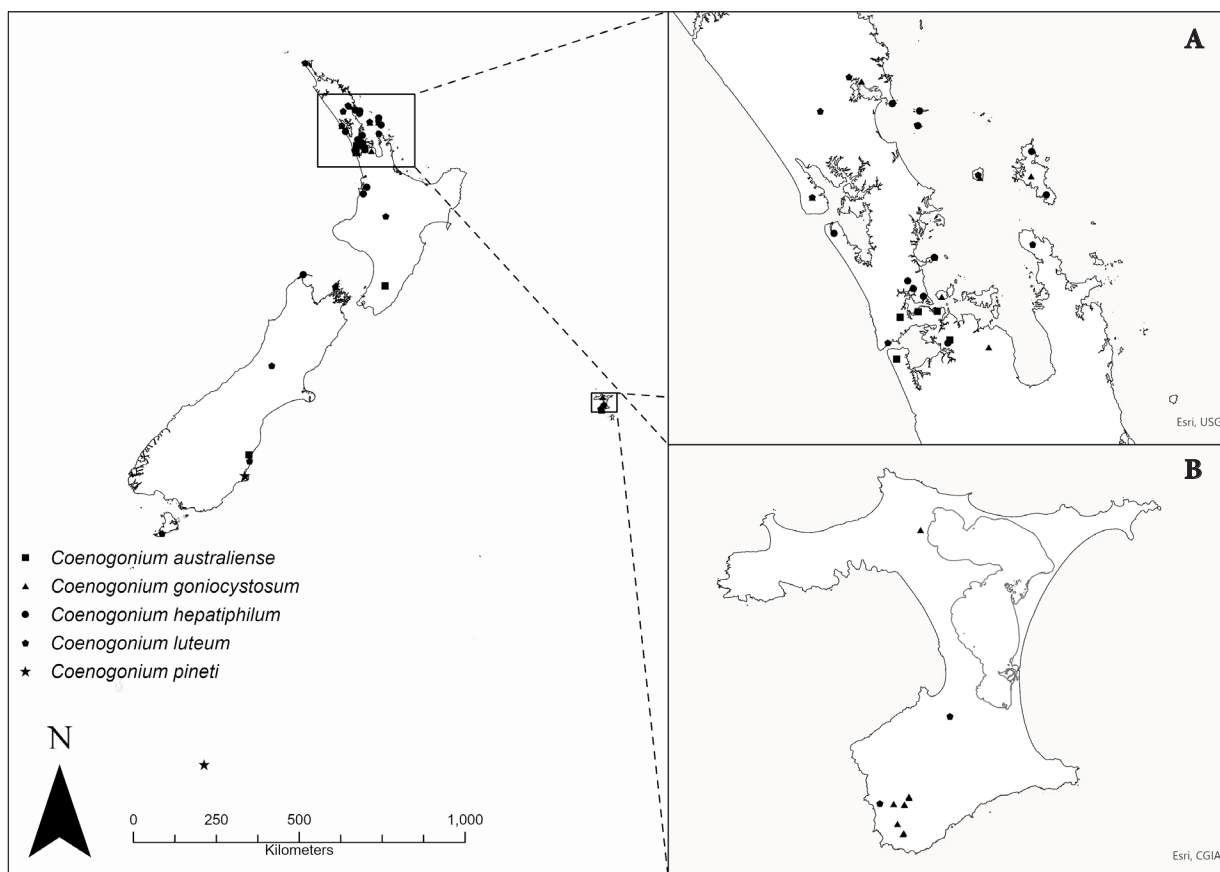
**Fig. 1.** *Coenogonium luteum*. A: Habit of *C. luteum*, growing on the trunk of *Alsophila dealbata*, Waitākere, Tāmaki Makaurau | Auckland, Aotearoa | New Zealand. Photo: Campbell James (iNaturalist: 247582165); B, C: Close up of thallus and apothecia, growing on the trunk of *Alsophila dealbata*, Waitākere, Tāmaki Makaurau | Auckland, Aotearoa | New Zealand (UNITEC15298); D: Thallus and apothecia of *C. luteum* growing on exposed plastic weed mat, Schnapper Rock, Albany (UNITEC14467)

found that it had uniseriate ascospores, with measurements of  $9\text{--}11 \times 2\text{--}3 \mu\text{m}$ . The habitat on a tree fern trunk, along with anatomy, led Kantvilas et al. (2018) to suggest that *C. pertenuis* is a poorly developed specimen of *C. luteum*. Here, we officially re-synonymize the name.

**Description (Fig. 1).** Corticolous (mostly on the caudex of tree-ferns in the genera *Alsophila* R. Br., *Dicksonia* L'Hér and *Sphaeropteris* Wall). **Thallus** crustose, ecorticate, dull grey to grey-green when dry, green to brown-green when wet, to  $50 \mu\text{m}$  thick, smooth to rarely unevenly verrucose, thin, varnish-like, continuous or forming irregular, undelimited patches to c. 20 cm wide that encrust the substratum. **Prothallus** absent. **Photobiont** green, cells subglobose to oblong,  $7\text{--}16 \times 7\text{--}12 \mu\text{m}$ . **Apothecia** sessile,  $0.7\text{--}2.5\text{--}(3.0) \text{mm}$  wide, when young: disc plane, orange, margin occasionally in rolled, cream to concolorous with disc, when mature: disc plane to subconvex, deep orange, margin often undulating and creating an irregular shape,

concolorous with disc or slightly paler. **Proper excipulum**  $100\text{--}150 \mu\text{m}$  thick basally,  $50\text{--}100 \mu\text{m}$  thick laterally. **Hypothecium** hyaline,  $40\text{--}75 \mu\text{m}$  thick. **Hymenium** hyaline,  $50\text{--}75 \mu\text{m}$  thick. **Paraphyses**  $1.0\text{--}1.5 \mu\text{m}$  thick, apices swollen to  $3\text{--}5 \mu\text{m}$  thick. **Asci** cylindrical,  $55\text{--}65 \times 4\text{--}6 \mu\text{m}$ . **Ascospores** uniseriate, narrowly ellipsoidal, 1-septate,  $7\text{--}11 \times 2\text{--}4 \mu\text{m}$ . **Pycnidia** not seen.

**Representative specimens (out of 84).** TE IKA-A-MĀUI | NORTH ISLAND: Whangarei, Coronation Reserve, *P. Bell-Butler s.n.*, 1 April 2020, UNITEC11652; Northland, Tangihua Forest, *A.E. Wright 11674*, 29 August 1991, AK204565; Haururu-o-Toi | Little Barrier Island, *B.W. Hayward*, August 1981, AK175109; North Kaipara, Tapu Bush, *A.E. Wright 11616*, 25 May 1991, AK202429; Auckland, Schnapper Rock, *C.J. James s.n.*, 4 June 2024, UNITEC14467; Auckland, Schnapper Rock, *C.J. James s.n.*, 1 September 2024, UNITEC14468; Auckland, Kohimarama, *D.J. Blanchon s.n. & N. Leddy*, 13 April 2015, UNITEC7154; Waitākere



**Fig. 2.** Map showing the distribution of the representative specimens of taxa discussed. A: locations in Te Tai Tokerau | Northland, Tikapa Moana | Hauraki Gulf, Tāmaki Makaurau | Auckland; B: Rēkohu | Wharekauri | Chatham Island

Ranges, Mount Donald McLean, *G.C. Hayward & B.W. Hayward s.n.*, 1977, AK161835; Coromandel, Mount Moehau, *B.W. Hayward H39.70*, August 1974, AK154523; Taumarānui, Kuratau, *J.K. Bartlett s.n.*, 10 July 1981, AK193282. TE WAIPOUNAMU | SOUTH ISLAND: Marlborough Sounds, Rangitoto ki te Tonga | D'Urville Island, *B.W. Hayward & G.C. Hayward s.n.*, 4 January 1998, AK209354; Canterbury, Arthurs Pass, *A.E. Wright 9313*, 5 November 1989, AK187405; Trotter's Gorge, Central Otago, *T. Aldridge s.n.*, 31 October 2025, UNITEC15123. AOTEAROA | NEW ZEALAND, RAKIURA | STEWART ISLAND: Port Pegasus, Islet Cove, *B.W. Hayward s.n.*, 3 February 1989, AK187063. CHATHAM ISLANDS, RĒKOHU | WHAREKAURI | CHATHAM ISLAND: Kopi Bush, *C.J. James s.n.*, 12 February 2024, UNITEC14276.

**Recognition.** *Coenogonium luteum* is a cosmopolitan species that in Aotearoa was treated in a broad sense by Galloway (2007). Here, *C. luteum*

can be distinguished from other *Coenogonium* species in Aotearoa by the often thin, varnish-like thallus, larger dark orange apothecia (0.5–3.5 mm) that become undulate and irregular in shape, and ascospores smaller than 11 µm in length. *Coenogonium australiense* is the most similar species, but it can be distinguished from *C. luteum* by its slightly thicker hymenium (60–100 µm compared with 50–75 µm), a thinner basal exciple (60–110 µm compared with 100–150 µm) and larger ascospores (often longer than 12 µm). In Aotearoa, this species is usually found on tree fern trunks, as opposed to *C. australiense* which is found on a range of bark substrates.

**Distribution.** Indigenous to Aotearoa, where it is known from Te Ika-A-Māui | North, Te Wai-pounamu | South, and Chatham Islands (Fig. 2). It is also known from mainland Australia and Tasmania (Kantvilas et al., 2018), Asia, Europe, and North and South America (Cannon et al., 2021).

**Ecology.** In Aotearoa, it is mostly found on trunks of the tree fern, ponga (*Alsophila dealbata* (G. Forst.) Corda), occasionally on wheki (*Dicksonia squarrosa* (G. Forst.) Sw.), or at the base of rawirinui (*Kunzea robusta* de Lange & Toelken), forming large patches covering often the shaded side of the trunk. It has been found on tree ferns in suburban areas and one collection from exposed woven weed mat in a native forest in Albany (Fig. 1D, UNITEC14467). Where *C. luteum* is found, it is locally common, often in shaded to partly shaded areas. In Tasmania, the species is known also to grow on shaded rocks (Kantvilas et al., 2018).

**Conservation status.** Prior to the separation of species here, *Coenogonium luteum* was assessed in the broad sense as “Not Threatened” and “Secure Overseas” by de Lange et al. (2018), a threat status we suggest be maintained.

***Coenogonium australiense*** Kantvilas & Lücking, Lichenologist 50 (5): 575 (2018)

**Mycobank accession number:** 827258

**Type:** Tasmania, Little Fisher River,  $-41^{\circ}45'$ ,  $146^{\circ}20'$  on *Nothofagus cunninghamii* (Hook.) Oerst. in rainforest, 880 m, October 1984, G. Kantvilas 691/84; type not seen (*holotype* HO, *isotypes* B, F)

**Description (Fig. 3).** Corticolous. **Thallus** crustose, ecorticate grey-green when dry, dark green to brown-green when moist, 50 to 150  $\mu\text{m}$  thick, smooth to verrucose, often reduced forming continuous or irregular patches to c. 10cm wide. **Prothallus** absent. **Photobiont** green, globose to oblong,  $7-18 \times 7-14 \mu\text{m}$ . **Apothecia** sessile, 0.5–2.5 mm in diam., when young: disc convex, pale orange, margin, slightly involute, cream, when mature: disc slightly convex to plane, pale orange, margin persistent, cream or rarely concolorous with disc. **Proper excipulum** 60–110  $\mu\text{m}$  basally, 50–80  $\mu\text{m}$  laterally. **Hypothecium** hyaline, 40–80  $\mu\text{m}$ . **Hymenium** hyaline, 60–100  $\mu\text{m}$ . **Paraphyses** 1.0–1.5  $\mu\text{m}$  thick, with apices 3–5  $\mu\text{m}$  thick. **Asci** cylindrical, 50–70  $\times$  5–8  $\mu\text{m}$ . **Ascospores** 8 per ascus, uniseriate, narrowly ellipsoidal to fusiform, 1-septate, occasionally constricted at septum, 8–14  $\times$  2.5–5.9  $\mu\text{m}$ . **Pycnidia** not seen in material from Aotearoa, described from Australian material as immersed, visible as minute, somewhat paler swellings in the upper surface of the thallus. **Conidia** not seen, described as ellipsoid, 3–5  $\times$  1–3  $\mu\text{m}$ .

**Representative specimens.** TE IKA-A-MÄUI | NORTH ISLAND: Manukau Heads, Awhitu, P.J. de Lange 14616, M. Prasad, & P. Bell-Butler, 22



**Fig. 3.** *Coenogonium australiense*. A: Habit of *C. australiense* growing on *Myrsine australis* on Swallow Track, Herbert Forest, Otago, Te Waipounamu | South Island, Aotearoa | New Zealand. Photo: Liadan Dickie, 02.11.2025 (UNITEC15121) (iNaturalist: <https://www.inaturalist.org/observations/324437150>); B: Close up image of thallus and apothecia, after drying (UNITEC15121); C: Close up of apothecium (UNITEC15121)

January 2020, UNITEC11428; Kohimarama, Kepa Bush, A.J. Marshall s.n., D.J. Blanchon, & C. Reynolds, 20 March 2015, UNITEC7259; Auckland, Henderson, Opanuku Stream, P.J. de Lange s.n. & D.J. Blanchon, 24 March 2017, UNITEC9103; Auckland, Western Springs, M. Ford s.n., 20 July

2019, UNITEC10907; Auckland, Manurewa, Botanic Gardens, *H. Nessia s.n.* & *W.F. Kooperberg*, 30 March 2012, UNITEC5216. TE WAIPOUNAMU | SOUTH ISLAND: Herbert Forest, Otago, *C. James s.n.* & *L. Dickie*, 2 November 2025, UNITEC15121.

**Recognition.** Of the species discussed in this article, *C. australiense* is most similar to *C. luteum*, from which it is readily distinguished by the thicker often verrucose thallus, smaller apothecia that remain plane (0.5–2.5 mm compared with 0.5–3.5 mm becoming undulate in *C. luteum*), slightly thicker hymenium (60–100 µm compared with 50–75 µm), thinner basal exciple (60–110 µm compared with 100–150 µm) and larger ascospores (8–14 × 2.5–5.0 µm compared with 7–11 × 2–4 µm). Galloway (2007) included spore measurements of 6–14 × 2–4 µm for *C. luteum*, and Kantvilas et al. (2018) indicate the likelihood that those specimens with the smaller spore measurements might be better accommodated in *C. australiense*.

**Distribution.** This species has been collected from the western portion of the Auckland Region and the Wairarapa Region of Te Ika-a-Māui | North Island, with a further collection from central Otago, Te Waipounamu | South Island (Fig. 2). We suspect that this pattern is an artifact of collector interests and residences rather than a natural pattern. *Coenogonium australiense* is also known from Tasmania and South Australia (Kantvilas et al., 2018).

**Ecology.** This species has been recorded from a greater diversity of phorophytes than *C. luteum*, these include the bark of manawa / mangrove (*Avicennia marina* subsp. *australasica* (Walp.) J. Everett), mapou (*Myrsine australis* (A. Rich.) Allan), rawirinui, rohutu (*Lophomyrtus obcordata* (Raoul) Burret), titoki (*Alectryon excelsus* Gaertn. subsp. *excelsus*), and totara (*Podocarpus totara* G. Benn. ex D. Don var. *totara*).

In Tasmania, *C. australiense* is known from a variety of habitats, including cool temperate rainforest and drier areas of sclerophyllous vegetation (Kantvilas et al., 2018). It has also been collected as saxicolous from sheltered dolerite boulders, in dry eucalypt forest (Kantvilas et al., 2018), but in Aotearoa it has only been recorded as corticolous.

**Conservation status.** As few collections have been identified as this species in Aotearoa, we suggest it could be regarded as a “Data Deficient” species. As it is described and well known from Tasmania and Southern Australia (Kantvilas et al., 2018), we also suggest the status of “Secure Overseas”.

*Coenogonium goniocystosum* C.J. James sp. nov.

**Mycobank accession number:** 863462

**Holotype:** NEW ZEALAND. Chatham Islands, Rēkohu | Wharekauri | Chatham Island, Southern Tablelands, track to Lake Rangatapu, Waipuru Valley Headwaters, –44.107560, –176.599290, 259 m a.s.l., *P.J. de Lange CH4647* & *D. Boyle*, 26 December 2025. Abundant on *Hymenophyllum demissum* (G. Forst.) Sw. growing on forest floor, on logs, rocks and on the lower trunks of trees in dense tarahinau (*Dracophyllum arboreum* Cockayne), mataira (*Myrsine chathamica* F. Muell.) with karamu hiooa (*Coprosma chathamica* Cockayne) and hoho (*Pseudopanax chathamicus* Kirk) forest. [iNaturalist NZ Species Identification Number: [332319696](https://www.inaturalist.org/observations/332319696) (<https://www.inaturalist.org/observations/332319696>)]. UNITEC15158, isotype AK.

**Diagnosis.** Distinguished from other species of *Coenogonium* by the thallus, composed of goniocysts, apothecia that are convex at maturity and spores that measure 10–15 × 4–5 µm.

**Description (Fig. 4).** Foliicolous / corticolous. **Thallus** thin, grey, granular to dust-like when dry, dark grey-green gelatinous when wet, continuous spreading to c. 5cm, consisting of abundant and evenly dispersed globose goniocysts over the hypothallus. **Hypothallus** grey, 50–150 µm thick, hyphae 1.0–2.5 µm wide. **Goniocysts** evenly scattered in close-set aggregates, 15–70(–100) µm diam., outer fungal cells paraplectenchymous, 2–5 µm wide. **Photobiont** green, cells globose, 2.5–10(–15) diam. **Apothecia** sessile, 0.5–1.0–1.8 mm, when young; disc convex, orange, margin often in rolled, cream to pale orange, when mature; disc convex, orange, margin decurved beneath disc, often becoming irregular in shape, cream. **Proper excipulum** 50–100 µm thick basally, 50–90 µm thick laterally. **Hypothecium** hyaline, 50–75µm. **Hymenium** hyaline, 75–100 µm. **Paraphyses** unbranched, colourless, 1.0–2.5 µm wide, apices swollen to 3–5 µm. **Asci** cylindrical, 40–75 × 7.5–12.5 µm. **Ascospores** 8 per ascus, uniseriate, ellipsoidal, 1-septate, sometimes indistinctly septate, 10–15 × 4–5 µm. **Pycnidia** not seen.

**Representative specimens.** TE IKA-A-MĀUI | NORTH ISLAND: Mangonui, Herekino, *J.K. Bartlett*, 1975–1985, AK199555; Whangarei, Onerahi, *J.K. Bartlett s.n.*, 21 July 1981, AK193283; North Kaipara, Tapu Bush, *A.E. Wright 11574*, 23 May 1991, AK202392; Te Hauturu-o-Toi | Little Barrier Island, *B.W. Hayward s.n.*, May 1990, AK247957; Aotea | Great Barrier Island, *B.W. Hayward s.n.*,

January 1984, AK178105; Aotea | Great Barrier Island, *B.W. Hayward* 35, May 1990, AK247960; Auckland, Rangitoto Island, *C.J. James s.n.*, 23 May 2024, UNITEC 14466; Auckland, Hunua Ranges, *A.J. Marshall s.n.*, 21 October 2024, UNITEC 14979. CHATHAM ISLANDS, RĒKOHU | WHAREKAURI | CHATHAM ISLAND: Nikau Bush, *P.J. de Lange CH4653*, 29 January 2026, UNITEC15165; Tuku Nature Reserve, Tuku-a-Tamatea, *P.J. de Lange CH3039*, 10 February 2019, UNITEC11475; Tuku Nature Reserve, Timihonga Catchment, *P.J. de Lange CH4644* & *D. Boyle*, 26 December 2025, UNITEC15155; Tuku Nature Reserve, Timihonga Catchment, *P.J. de Lange CH4646* & *D. Boyle*, 26 December 2025, UNITEC15156; Tuku Nature Reserve, Igloo Track, *P.J. de Lange CH4648* & *D. Boyle*, 6 January 2026, UNITEC15159; Tuku Nature Reserve, Igloo Track, *P.J. de Lange CH4649*, 6 January 2026, UNITEC15160; Tuku Nature Reserve, Tuku-a-tamatea River, *P.J. de Lange CH4649* & *D. Boyle*, 6 January 2026, UNITEC15161; Tuku Nature Reserve, Tuku-a-tamatea River, *P.J. de Lange CH4651* & *D. Boyle*, 6 January 2026, UNITEC15162; Tuku Nature Reserve, Tuku-a-tamatea River, *P.J. de Lange CH4652* & *D. Boyle*, 6 January 2026, UNITEC15163; Southern Tablelands, Waipurua Valley, *P.J. de Lange CH4646* *D. Boyle*, 26 December 2025, UNITEC15157.

**Recognition.** In Aotearoa, *C. gonicystosum* is easily distinguished by the thallus, which is comprised of gonicysts, evident when the thallus is hydrated and viewed under a 10× hand lens. Globally, no other species in *Coenogonium* are known to possess gonicysts. Other distinguishing features include the convex mature apothecia, a thick hymenium (75–100 µm) and large 0–1-septate ascospores (10–15 × 4–5 µm), though independently these overlap with other species.

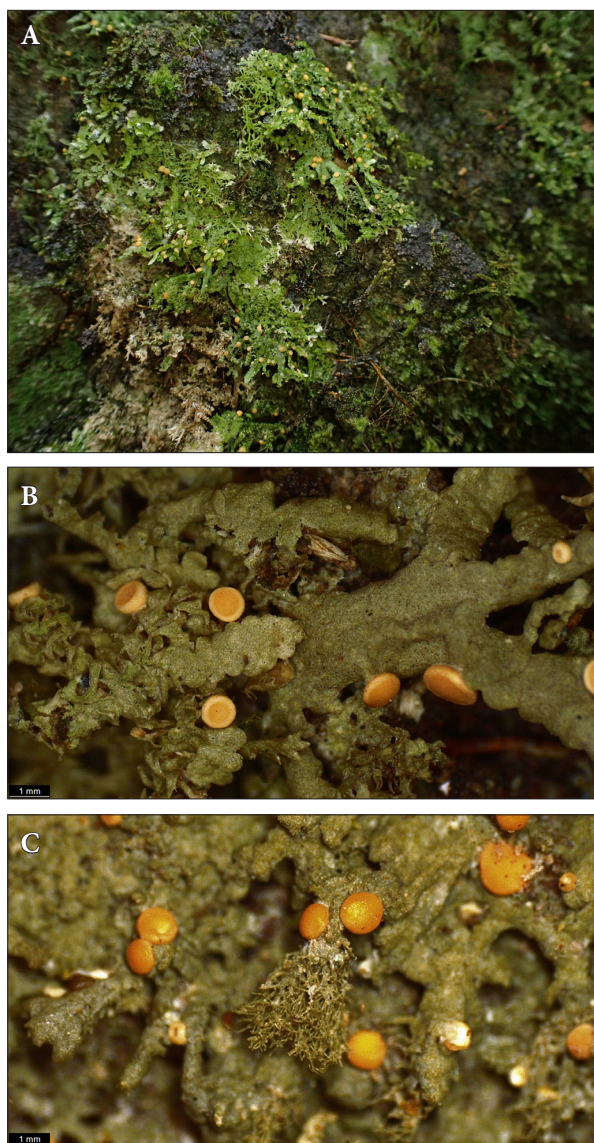
**Distribution.** Possibly endemic to Aotearoa | New Zealand. *Coenogonium gonicystosum* is known from the greater Auckland Region, Te Ika-a-Māui | North Island and from Rēkohu | Chatham Island in the Chatham Islands (Fig. 2). There is also a credible iNaturalist record (<https://inaturalist.nz/observations/236447393>) of this species growing on the fronds of *Hymenophyllum demissum* on Rakiura | Stewart Island. This pattern suggests this species is wide ranging and that it will undoubtedly in time be found throughout the Aotearoa Archipelago.

**Ecology.** *Coenogonium gonicystosum* is mostly known from shaded sites where it is foliicolous on



**Fig. 4.** *Coenogonium gonicystosum*. A: Habit of *C. gonicystosum* type specimen growing on *Hymenophyllum demissum* in dense tarahinau (*Dracophyllum arboreum*), at the type locality Waipurua Valley Headwaters, Southern Tablelands, Rēkohu | Chatham Island. Photo: Peter de Lange (UNITEC15158) (iNaturalist: <https://www.inaturalist.org/observations/332319696>); B: Close up of thallus and mature apothecia, showing granular thallus made of gonicysts, collected from *Kunzea robusta* Hunua Ranges, Tāmaki Makaurau | Auckland, Aotearoa | New Zealand (UNITEC14980); C: Close up of thallus and apothecia, individual gonicysts evident (UNITEC14980)

six species of filmy fern (*Hymenophyllaceae*): irirangi (*Hymenophyllum demissum*), matua mauku (*H.*



**Fig. 5.** *Coenogonium hepatiphilum*. A: Habit of *C. hepatiphilum*, growing over leafy liverworts on a shaded boulder, Peach Cove, Whangarei Heads, Te Ika-A-Mauī | North Island, Aotearoa | New Zealand. Photo: Marley Ford, 15.07.2024 (UNITEC14470) (iNaturalist: <https://www.inaturalist.org/observations/229420370>); B: Close up of thallus and apothecia (UNITEC14470); C: Close up of thallus developing into caespitose filaments

*dilatatum* (G. Forst.) Sw.), *H. flabellatum* Labill., *konehu* (*H. nephrophyllum* Ebihara & K. Iwats.) and *H. multifidum* (G. Forst.) Sw. There is also a single collection from bark of rawirinui (*Kunzea robusta*) (Hunua Range: UNITEC 14979), suggesting that it should be looked for on other substrates. Judged by

herbarium evidence and field work on the Chatham Islands, the preferred phorophyte is irirangi but this *Coenogonium* is a species which would be very easily overlooked if growing on other substrates such as bark.

**Conservation status.** Since its recognition by the senior author, specific searches for this species have found it to be locally common, e.g., on the Chatham Islands. The species has been found misidentified as *C. luteum* in Aotearoa | New Zealand herbaria and iNaturalist NZ (<https://inaturalist.nz>). Accordingly, we suggest that *Coenogonium goniocystosum* is probably best considered as “Not Threatened” but qualified as “DPR”, [Data Poor Recognition], “DPS” [Data Poor Population Size] and “DPT” [Data Poor Trend] as the species is not easily recognised when colonising bark, and we have no qualitative data on the population sizes and trends beyond that the species is found in a range of secure sites spanning the country.

**Etymology.** The epithet “*goniocystosum*” refers to the distinctive thallus of this species, consisting of goniocysts that become obvious when hydrated and observed under a microscope.

***Coenogonium hepatiphilum*** C.J. James sp. nov.

**Mycobank accession number:** 863463

**Holotype:** NEW ZEALAND. North Island, Northland, Auckland, Glorit, Mataia QEII, -36.491999, 174.425846, *P.J. de Lange 15846*. 20 September 2025, East of Kauri Track, on root mat of taraire (*Beilschmiedia tarairi* (A. Cunn.) Benth. & Hook.f. ex Kirk) in stream bed (UNITEC15109).

**Diagnosis:** Distinguished from other species of *Coenogonium* by the bryophilous / corticolous habit, an occasional white prothallus, a crustose thallus developing into pilose filaments, convex apothecia, and ascospores that measure  $12\text{--}18 \times 2\text{--}5 \mu\text{m}$ .

**Description (Fig. 5).** Bryophilous / corticolous, mostly found growing directly on bryophytes (mosses and leafy liverworts), also covering the associated non-bryophilous substratum: bark or rock, occasionally found directly on bark. **Thallus** crustose, ecorticate, grey-green when dry, green, gelatinous when moist,  $90\text{--}150 \mu\text{m}$  thick, continuous, spreading to c. 10 cm patches, encrusting and reflecting the texture of the substratum, apices of the thallus occasionally developing into pilose filaments, to 5 mm long,  $7\text{--}10 \mu\text{m}$  wide, rarely branched. **Prothallus** occasionally present, as a  $150\text{--}300 \mu\text{m}$  wide white byssoid extension of

fungal hyphae to the edge of the thallus. **Photobiont** green, filamentous, 5–15 µm wide. **Apothecia** sessile, 0.8–2.0 mm, when young: disc plane, pale yellow-orange, reduced, margin rarely inrolled, cream, when mature: disc plane to convex, pale yellow-orange to orange, margin often decurved beneath disc, cream, rarely concolorous with disc. **Proper excipulum** 100–200 µm basally, 50–125 µm laterally. **Hypothecium** hyaline, 60–200 µm. **Hymenium** hyaline, 70–130 µm. **Paraphyses** unbranched, colourless, 1.0–2.5 µm wide, apices swollen to 2–5 µm. **Asci** cylindrical, 60–90 × 7–10 µm. **Ascospores** 8 per ascus, uniseriate or biseriate, ellipsoid, 1-septate, 12–18 × 2–5 µm. **Pycnidia** not seen.

**Representative specimens.** TE IKA-A-MĀUI | NORTH ISLAND: Whangarei, Peach Cove, C.J. James s.n. & M.Ford, 14 July 2024, UNITEC14470; Northland, Taranga | Hen Island, A.E. Wright 10829, 29 December 1990, AK201104; Northland, Lady Alice Island, B.W. Hayward 514, January 1982, AK246878; Aotea | Great Barrier Island, Tryphena B.W. Hayward, January 1984, AK178104; Aotea | Great Barrier Island, Rangiwheake Bay, B.W. Hayward s.n., 5 November 1984, AK178106; Rodney, Coatesville, A.E. Wright 7336, 3 November 1985, AK171666; South Kaipara, Woodhill Forest, D.B. Rogan 458, 15 July 2000, AK248697; Whangaparaoa, Shakespear, P.J. de Lange s.n. & C.J. James, 18 October 2024, UNITEC15108; Auckland, Schnapper Rock, C.J. James s.n., 20 June 2024, UNITEC15107; Auckland, North Cote, Smith's Bush, BioBlitz (s.col.), 5 April 2008, UNITEC3970; Auckland, Manurewa, W.F. Kooperberg s.n., 31 March 2012, UNITEC5217; Waitomo, Marakopa Falls, A.E. Wright 9142, 29 October 1989, AK187087; Otorohanga, Te Kauri Scenic Reserve, A.E. Wright 9074, 27 October 1989, AK187074; TE WAIPOUNAMU | SOUTH ISLAND: Nelson, Wharariki, P.J. de Lange 14835 & T.J.P. de Lange, 30 November 2019, UNITEC12199; Nelson, Wharariki, P.J. de Lange 14817 & T.J.P. de Lange, 30 November 2019, UNITEC12181.

**Recognition.** *Coenogonium hepatiphilum* is easily distinguished from the other species discussed in this article, identified by the bryophilous (mainly hepaticolous) habit, the white prothallus, filamentous algae as the photobiont, thallus occasionally filamentous, large (0.8–2.0 mm) apothecia that are often convex when mature, and the large ascospores (12–18 × 2–5 µm). *Coenogonium zonatum* (Müll. Arg.) Kalb & Lücking is the only other species in

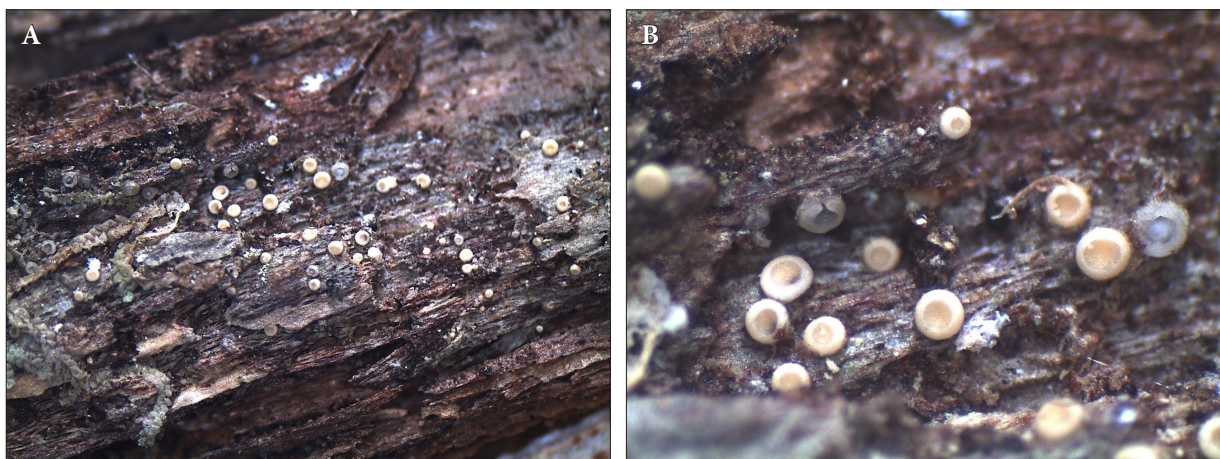
Aotearoa with a white marginal prothallus (Galloway, 2007), distinguished from *C. hepatiphilum* by its foliicolous habit, smaller apothecia (0.25–0.5 mm) and smaller ascospores (6–12 × 2.5–4.5 µm). The Australian species, *C. bryophilum* Kalb & Aptroot, has a similar habit in overgrowing bryophytes, though differs with having a strictly crustose thallus lacking a prothallus, and smaller spores (7–10 × 2–3 µm) (Kalb, Aptroot, 2018). *Coenogonium epiphyllum* Vain has a thallus that resembles this species (mainly crustose, developing algal filaments), aside from its tropical distribution can be distinguished by its foliicolous habit and significantly small spores (5–7 × 1.8–2.5 µm) (Kalb et al., 2016).

**Distribution.** Possibly endemic to Aotearoa. Currently known from Te Ika-a-Māui | North Island (Whangarei, Auckland Region, Hauraki Gulf), to the northwest of the Te Waipounamu | South Island, at Wharariki (Fig. 2). Again, this pattern is likely an artifact of collector interests and location rather than a natural pattern.

**Ecology.** *Coenogonium hepatiphilum* has been collected on *Porella amoena* (Colenso) Martin, *Spruceanthus olivaceus* (Hook.f. & Taylor) X.Q. Shi, R.L. Zhu & Gradst., *Radula Dumort* sp. and other leafy liverworts; taxa that are themselves epiphytic on substrates such as kahikatea (*Dacrycarpus dacrydioides* (A. Rich.) de Laub.), kiekie (*Freycinetia banksii* A. Cunn.), mapou (*Myrsine australis* (A. Rich.) Allan), porokaiwhiri (*Hedycarya arborea* J.R. Forst. & G. Forst.), taraire and rock. The thallus often spreads to cover surrounding bryophytes, substratum, and in one case the lichen *Pseudocyphellaria dissimilis* (Nyl.) D.J. Galloway & P. James. Commonly associated mosses include *Camptochaete pulvinata* (Hook.f. & Wils.) Jaeg., *Echinodiopsis hispida* (Hook.f. & Wilson) S. Olsson, Enroth & D. Quandt and *Thuidiopsis sparsa* (Hook.f. & Wilson) Broth. Often this species is collected in heavy or partial shade, likely reflecting the habit of the bryophytes, though collections from forest located in urban Albany (Auckland) suggest this species is not restricted to areas of dense native vegetation.

**Conservation status.** The species has a wide distribution spanning the North and South Islands, but it is sparse in the localities where it is known. Hence, we suggest this species could be treated as “At Risk - Naturally Uncommon”.

**Etymology.** The epithet “*hepatiphilum*” refers to this species’ habit of mainly growing over leafy liverworts (see above).



**Fig. 6.** *Coenogonium pineti*. A: Close up of thallus and apothecia of *C. pineti*, collected from bark of rawirinui, Orokonui Ecosanctuary, Te Waipounamu | South Island (OTA62069); B: Close up of thallus and apothecia (OTA62069)

*Coenogonium pineti* (Schrad. ex Ach.) Lücking & Lumbsch, *Mycologia* 96: 290 (2004)  $\equiv$  *Lecidea pineti* Schrad. ex Ach., *Lichenogr. Univ.*: 195 (1810)  $\equiv$  *Dimerella pineti* (Schrad. ex Ach.) Vězda, *Lich. Sel. Exsicc.* 52: 1279 (1976); (!BM000500426 — lectotype) type not handled, image seen.

**Mycobank accession number:** 488113

**Description (Fig. 6).** Corticolous. **Thallus** crustose, ecorticate, pale grey green when dry, dark green, often inconspicuous when wet, smooth, thin, to 30  $\mu\text{m}$  thick, forming irregular patches to c. 5 cm, in material seen mostly absent. **Prothallus** absent. **Photobiont** green, cells oblong to subglobose, 10–20  $\times$  7–12  $\mu\text{m}$ . **Apothecia** sessile, 0.2–0.4 mm wide, when young: disc plane light yellow-pink to pale flesh coloured margin in rolled, white to cream, when mature: disc plane to subconcave, light yellow-pink to pale flesh coloured, plane, margin white to cream, often in rolled. **Proper excipulum** 40–70  $\mu\text{m}$  thick basally, 30–60  $\mu\text{m}$  thick laterally. **Hypothecium** hyaline, 20–60  $\mu\text{m}$  thick. **Hymenium** hyaline, 70–100  $\mu\text{m}$  thick; asci 60–75  $\times$  5–7  $\mu\text{m}$ . **Paraphyses** 1.0–1.5  $\mu\text{m}$  thick, with apices swollen to 2–4  $\mu\text{m}$  thick. **Asci** narrowly cylindrical, 45–70  $\times$  5–7  $\mu\text{m}$ . **Ascospores** uniseriate, fusiform to ellipsoidal, 1-septate, rarely indistinct, 8–12  $\times$  3–5  $\mu\text{m}$ . **Pycnidia** not seen in material from Aotearoa, exceedingly rare in Tasmanian specimens (Kantvilas et al., 2018), visible as minute, pale swellings in the upper surface of the thallus. **Conidia** not seen, described as simple, oblong, mostly slightly constricted in the centre, 3–5  $\times$  1–2  $\mu\text{m}$ .

**Representative specimens.** TE WAIPOUNAMU | SOUTH ISLAND: Orokonui Ecosanctuary, Dunedin, *J. Steel s.n.*, 27 August 2011, OTA62069. MOTU IHUPUKU | CAMPBELL ISLAND: Mt Beeman, *s.col.*, October 1958, OTA52936.

**Recognition.** *Coenogonium pineti* is readily distinguished from the other species discussed here by its minute (0.2–0.5 mm diam.) pink apothecia. Compared with other taxa in Aotearoa, *C. pineti* is most similar to *C. lutescens* (Vězda & Malcolm) Malcolm, as both have similar small apothecia, though *C. pineti* can be differentiated from *C. lutescens* by the distinctly pink-orange apothecia (compared with yellow), and slightly larger ascospores (9–14  $\times$  3.0–4.5  $\mu\text{m}$  compared with 7–11  $\times$  2.7–4.5  $\mu\text{m}$ ) that are strictly uniseriate (as opposed to strictly biseriata) in the ascus.

Kantvilas et al. (2018) state that Tasmanian material of *C. pineti* often has larger spores than European material, though it lacks any other morphological characters to separate it as a distinct species. Moreover, several collections of *C. pineti* from Aotearoa are of another undescribed taxon (Kantvilas et al., 2018), indicating that further collection of this species' variation is needed in Aotearoa.

**Distribution.** Indigenous to Aotearoa: currently known from Aotearoa herbaria from two collections made from Dunedin, Te Waipounamu | South Island and Motu Ihupuku | Campbell Island (Fig. 2). We are also aware of a specimen of *C. pineti* (L031247) held in Uppsala University, Museum of Evolution Herbarium (UPS), collected from black beech (*Nothofagus solandri* (Hook.f.) Oerst.) in a southern-beech

(*Nothofagus* Blume) forest, Waimakariri, Canterbury (Te Waipounamu | South Island) by L. Tibell in 1980 (Myrdal, 2025). Though this specimen has not been viewed by the authors of this article, it is likely to be *C. pineti*. It is unlikely that this species is as uncommon as these records imply. Rather we suspect that it has been overlooked because it is inconspicuous. *Coenogonium pineti* was described from Europe, and is widespread in the Northern Hemisphere (India: Adhikari et al., 2025; China: Wu et al., 2018) and the Southern Hemisphere: South America (Brazil: de Oliveira Lima et al., 2023), and recorded from south-eastern Australia and Tasmania (Kantvilas et al., 2018).

**Ecology.** The Dunedin specimen is said to have been collected from rawirinui, growing with *Chiloscyphus muricatus* (Lehm.) J.J. Engel & R.M. Schust. in a damp understorey. There is no ecological information associated with the Motu Ihupuku | Campbell Island specimen. In Tasmania *Coenogonium pineti* is reported from trunks of old *Nothofagus* trees (Kantvilas et al., 2018), the same habitat as reported for the Tibell specimen from Canterbury. Deliberate searching of *Nothofagus* trees in Aotearoa could be illuminating.

**Conservation status.** We suggest *C. pineti* could be designated “Data Deficient” as it is known from few collections in Aotearoa. To this we suggest adding the qualifier as “Secure Overseas”.

***Coenogonium implexum*** Nyl., Ann. Sci. Nat. Bot., sér. 4, 16: 92 (1862), Australia, Victoria, ‘*supra cortices et muscos*’, Dr. Müller [F.J.H. von Mueller]: type not seen (H-NYL22093 -holotype; S, MEL -isotypes)

**Mycobank accession number:** 371312

**Remarks.** *Coenogonium implexum* sensu Galloway (2007) is a common species throughout Aotearoa (North, South and Chatham Islands) growing on a range of bark substrates. It is easily recognized by the felt-like thallus, comprised of pannose filaments, producing scattered orange-yellow apothecia, with ascospores  $7\text{--}12 \times 2\text{--}4 \mu\text{m}$ . Based on morphological variability observed, it is likely that there are more taxa in Aotearoa that currently sit within the broad sense of this species, some with differing filamental thallus shape (pannose compared with prostrate, see Rivas Plata et al. (2006) for examples) or longer spores (to  $15 \mu\text{m}$  long). Further collections are needed to fully understand the variation and the potential to segregate other taxa.

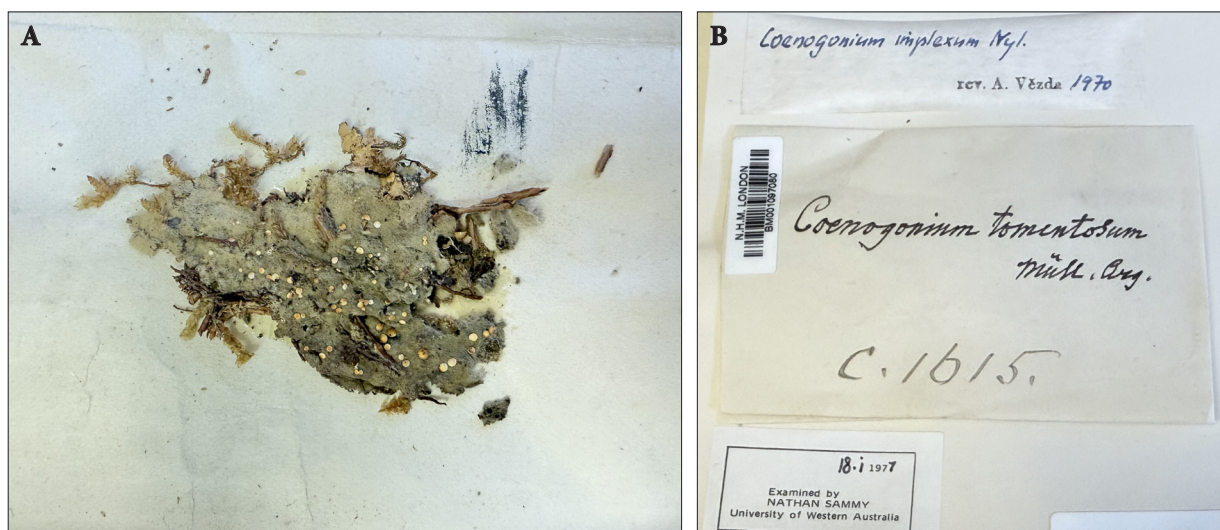
= ***Coenogonium tomentosum*** Müll. Arg., syn. nov. (Fig. 7), J. Linn. Soc. Bot., 32:206 (1896); type: New Zealand, on bark, Colenso C.1615, (!BM001097080-type). However, St. George (2009) noted that Colenso 1615 was in reference to a “large grass” Colenso had collected, with no date and no location.

**Mycobank accession number:** 383152

**Notes.** These collections were made between 1847 and 1848, “nr. Patea”, referring to the Mokai Patea Range, of the west Ruahine Ranges (St. George, 2009). Colenso walked these ranges between 1847 and 1852, likely collecting what would later be the type of *C. subtorulosum* Müll. Arg. (C.1614) and *C. tomentosum* Müll. Arg. (Müller, 1896). Galloway (1985) synonymized *C. subtorulosum* with *C. implexum*, apparently overlooking the type of *C. tomentosum*. *Coenogonium tomentosum* was described with a dense tomentose [pannose], filamental thallus, with orange apothecia  $0.25\text{--}1.0 \text{ mm}$  in diameter, and 8 ascospores per ascus, ascospores 1-septate, fusiform,  $10\text{--}11 \times 2.5 \mu\text{m}$  (Müller, 1896): these measurements overlapping with the description of *C. implexum* (Galloway, 1985, 2007; Kantvilas et al., 2018). The holotype of *C. tomentosum* was later identified as *C. implexum* by A. Vězda in 1970 (Fig. 7) but no formal synonymization was made; hence, we officially synonymize the name here.

### Aotearoa *Coenogonium*

Following the revision of the *C. luteum* complex above, *Coenogonium* in Aotearoa is now represented by 12 species. Nonetheless, the genus needs a full revision, especially of those taxa that remain relatively little-known (*C. lutescens* and *C. rubrifuscum* (Vězda & Malcolm) Malcolm). These species were stated as only known from the type locality by Galloway (2007). While further collections have been made for *C. lutescens*, expanding the taxon’s range to Australia whilst broadening the species description (Kantvilas et al., 2018), *C. rubrifuscum* remains poorly known. Furthermore, species discussed here, especially *C. australiense* and *C. pineti* (see above), will likely require further revision in Aotearoa. We recommend further targeted collections of the genus in Aotearoa paired with a comprehensive morphological and molecular phylogenetic study, to fully understand species limits.



**Fig. 7.** *Coenogonium tomentosum* (synonymized here with *C. implexum*). A: Type specimen of *C. tomentosum* (now a synonym of *C. implexum*), C.1615 BM001097080, Natural History Museum (BM). Photo: Muhammad Usman, 09.09.2025; B: Determination slip of the type specimen of *C. tomentosum* C.1615 BM001097080, Natural History Museum (BM), identified as *C. implexum* in 1970 by the late Antonín Vězda (1920–2008)

#### Key to *Coenogonium* in Aotearoa | New Zealand (adapted from Galloway, 2007)

1. Thallus wholly filamental, isidiate, or possessing goniocysts; not appearing crustose . . . . . 2.
  - Thallus wholly or partly crustose (may sometimes develop filaments), patchy or inconspicuous . . . 4.
2. Thallus felt-like, consisting of pannose filaments . . . . . *C. implexum*
  - Thallus isidiate or possessing goniocysts . . . . . 3.
3. Thallus isidiate . . . . . *C. fruticulosum*
  - Thallus possessing goniocysts . . . . . *C. goniocystosum*
4. Thallus foliicolous, never corticolous . . . . . 5.
  - Thallus corticolous or bryophyllous, never foliicolous . . . . . 9.
5. Apothecia epiphyllous . . . . . 6.
  - Apothecia hypophyllous, rarely epiphyllous . . . . . 8.
6. Thallus without a marginal prothallus . . . . . 7.
  - Thalli with a prominent, thick, white, marginal prothallus; apothecia 0.25–0.5 mm diam., brick-red; hymenium 45–65  $\mu\text{m}$  tall; ascospores 6–12  $\times$  2.5–4.0(4.5)  $\mu\text{m}$  . . . . . *C. zonatum*
7. Apothecia 0.2–0.28 mm diam., brick-red; hymenium 60–70  $\mu\text{m}$  tall; ascospores 6–9  $\times$  1.8–2.0  $\mu\text{m}$  . . . . . *C. fuscescens*
  - Apothecia 0.5–0.7 mm diam.; pale yellow-brown; hymenium to 45  $\mu\text{m}$  tall; ascospores 6.5–7.5  $\times$  1.8–2.0  $\mu\text{m}$  . . . . . *C. queenslandicum*
8. Thalli with pale-yellow, tubular pycnidia . . . . . *C. flavum*
  - Thalli without pycnidia . . . . . *C. fallaciosum*
9. Ascospores often longer than 14  $\mu\text{m}$ ; thallus bryophyllous . . . . . *C. hepaticophilum*
  - Ascospores less than 14  $\mu\text{m}$  long; thallus corticolous . . . . . 10.
10. Apothecia less than 0.5 mm in diam., pale yellow pink, pink, to flesh coloured, not orange . . . *C. pineti*
  - Apothecia over 0.5 mm in diam., often up to 3 mm, yellow to orange, never pale yellow pink . . . . 11.
11. Apothecia 0.5–2.5 mm in diam., yellow-orange, margins never undulating, disc persistently plane; basal exciple 60–110  $\mu\text{m}$  tall; ascospores 8–14  $\times$  2.5–5.0  $\mu\text{m}$  . . . . . *C. australiense*
  - Apothecia 0.7–3 mm in diam., orange, margins undulating at maturity, disc becoming convex to plane; basal exciple 100–200  $\mu\text{m}$  tall; ascospores 7–11  $\times$  2–4  $\mu\text{m}$  . . . . . *C. luteum*

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## ETHICS DECLARATION

The authors declare no conflict of interest.

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**Перегляд комплексу видів *Coenogonium luteum* (*Coenogoniaceae*) у Новій Зеландії: нові види, нові знахідки й нотатки щодо *C. tomentosum***

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**Реферат.** Рід *Coenogonium* (ліхенізовані *Ascomycota Coenogoniaceae*) в Аотеароа | Новій Зеландії востаннє детально вивчав Галлоуей у 2007 р., який визнавав дев'ять видів; разом із ще одним описаним згодом видом їхня загальна кількість складала 10 видів. З початком нашого дослідження було виявлено багато доказів на користь того, що *Coenogonium luteum* є насправді комплексом видів у Новій Зеландії, і це зумовило необхідність проведення нашого таксономічного перегляду. Було досліджено зразки *C. luteum sensu lato* у колекціях багатьох новозеландських гербаріїв, головним чином, в Оклендському військово-історичному музеї (АК), Університеті Отаго (ОТА) та УніТеку (UNITEC). Результати цього дослідження показали, що зразки *C. luteum sensu lato* включають декілька таксонів. Тут ми подаємо уточнений опис *C. luteum* для новозеландських зразків, повідомляємо про дві нові знахідки для Аотеароа — *C. australiense* та *C. pineti*, а також описуємо два нові види — *C. hepatiphilum* C.J. James sp. nov. і *C. goniocystosum* C.J. James sp. nov. Для всіх п'яти видів подано морфологічні описи, екологічні особливості, дані про поширення, оцінки природоохоронного статусу, а також оновлений ключ для визначення видів роду *Coenogonium* в Аотеароа. Крім того, запропоновано синонімізувати *C. pertenuis* з *C. luteum* і *C. tomentosum* з *C. implexum*.

**Ключові слова:** *Coenogonium*, Аотеароа | Нова Зеландія, ліхенізована мікобіота, нові види, нові синоніми, таксономія лишайників