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RESEARCH ARTICLE

Four new species of Aotearoa | New Zealand *Pyrenula* (*Pyrenulaceae*) segregated from *P. moniliformis*

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Abstract. The lichen genus *Pyrenula* (*Pyrenulaceae*) in Aotearoa | New Zealand was last comprehensively treated by Galloway (2007), who called for further targeted collecting. Since then, additional material, particularly from northern Te Ika-a-Māui | North Island and Rēkohu | Wharekauri | Chatham Island, has led to revised identifications and an improved understanding of species boundaries within the genus. Among the taxa requiring reassessment is *Pyrenula moniliformis*, an enigmatic species known only from the type. The species was recognised in herbarium specimens held in UNITEC from the Tāmaki Makaurau | Auckland Region of Aotearoa | New Zealand. These collections resulted in its rediscovery. Critical study of specimens and others that had been placed within *P. moniliformis* enabled detailed morphological comparisons, particularly of ascospore septation and size, and revealed that *P. moniliformis sensu lato* encompasses multiple taxa. Here, we present a revised circumscription of *P. moniliformis sensu stricto*, and describe four new species: *P. dalmatioides* A.J. Marshall, Blanchon, Aptroot & de Lange, *P. largei* A.J. Marshall, de Lange, Blanchon & Aptroot, *P. quadratolocularis* A.J. Marshall, de Lange, Blanchon & Aptroot, and *P. solomonii* A.J. Marshall, de Lange, Blanchon & Aptroot. For all five species, we provide morphological descriptions, ecological notes, distribution data, conservation assessments and a revised key to the members of *Pyrenula moniliformis* complex.

Keywords: lichen taxonomy, lichenized mycobiota, *Pyrenula*, *Pyrenula moniliformis*, *Pyrenula dalmatioides* sp. nov., *Pyrenula largei* sp. nov., *Pyrenula quadratolocularis* sp. nov., *Pyrenula solomonii* sp. nov., Aotearoa | New Zealand, Rēkohu | Chatham Islands

Introduction

The *Pyrenula* Ach. (*Pyrenulaceae*) of Aotearoa | New Zealand were last given a full treatment by Galloway (2007) who accepted 12 species. Since then there has been, as Galloway had hoped, further assiduous collecting, especially within northern Aotearoa | New Zealand and the Chatham Islands. This has

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led to publications documenting new records and clarifying names used previously (Marshall et al., 2019; Marshall, de Lange, 2025). Inevitably, as our understanding of *Pyrenula* grows, earlier conclusions need revisiting, and Galloway's 2007 assessment is now well out of date. For example, we had previously reported the presence of specimens of *P. leucostoma* Ach., *P. pyrenuloides* (Mont.) R.C. Harris, and *P. subvariolosa* (C. Knight) Aptroot in New Zealand (Marshall et al., 2019), which we now believe are better accommodated in *P. subumbilicata* (C. Knight) Aptroot and *P. ravenelii* (Tuck.) R.C. Harris. Another enigma has been resolving the status of *Pyrenula moniliformis* (C. Knight) Müll. This is the subject of this paper.

Pyrenula moniliformis (C. Knight) Müll. Arg. (Fig. 1), first described by Charles Knight in 1860 within the genus *Verrucaria* Schrad., has been regarded as a somewhat enigmatic species, as it was only known from the type collection. The species was accepted by Galloway (1985, 2007) and Aptroot (2012) though even its placement within *Pyrenula* was questioned on the basis of its unusual ascospores, which have 8 rather than the usual 4 locules and long-fusiform apices (Galloway, 2007). Without further specimens the species seemed destined to remain in obscurity, assessed as 'Data Deficient' in two Aotearoa | New Zealand Lichenized Mycobiota Threat Assessments (de Lange et al., 2012; de Lange et al., 2018).

Over the last 15 or so years the UNITEC Herbarium (herbarium acronyms follow Thiers 2008– onwards) has acquired a range of *Pyrenula* specimens from northern Te Ika-a-Māui | North Island,

Fig. 1. *Pyrenula moniliformis*. A: *P. moniliformis* on the trunk of māhoe (*Melicytus ramiflorus* subsp. *ramiflorus*) at Jagger's Bush, Tāmaki Makaurau | Auckland, Te Ika-a-Māui | North Island, Aotearoa | New Zealand; B: Close-up of the thallus (scale = 2 mm) with ascomata

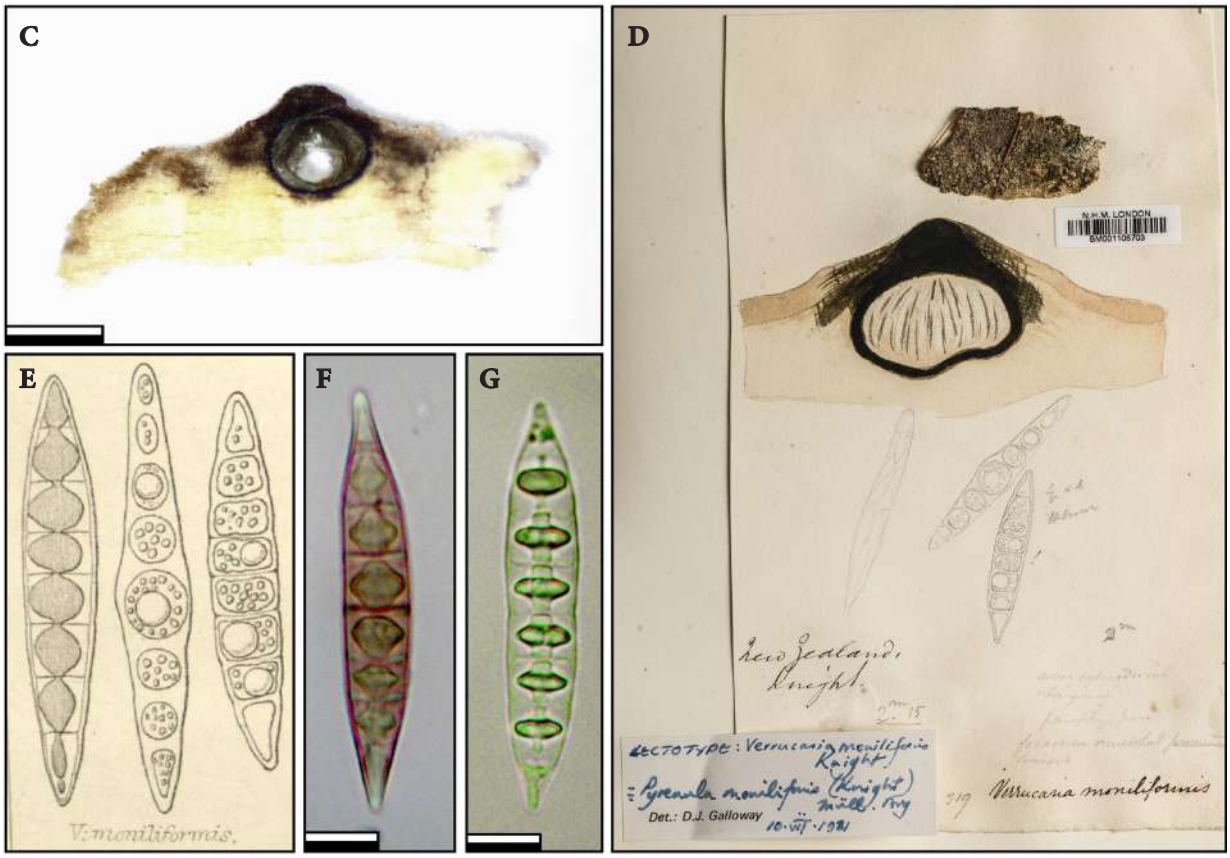

Fig. 1 (Continuation). *Pyrenula moniliformis*. C: Cross-section through ascomatum (scale = 1 mm); D: Charles Knight watercolour of cross-sectioned ascomatum and spores on the holotype (BM); E: Drawings of spores by Knight; F: Mature spore showing brown colouration (scale = 10 µm); G: Immature spore showing distinctive locule shape (scale = 10 µm)

Aotearoa | New Zealand, and Rēkohu | Wharekauri | Chatham Island. These collections matched to an extent the description of *Pyrenula moniliformis* with respect to ascospore characters but are morphologically disparate. The rediscovery of *Pyrenula moniliformis* documented by Marshall, de Lange (2025) in the Auckland Region has however, allowed for a critical reassessment of that species and a revaluation of those UNITEC specimens provisionally placed in that species. This analysis coupled with an investigation of *Pyrenula* collections held in Aotearoa | New Zealand herbaria (AK, CHR, OTA, WELT) confirmed that the variation within *P. moniliformis* s. l. cannot be accommodated within a single entity, so to accommodate this variation we propose a new taxonomy which includes a revised description of *Pyrenula moniliformis* s. str. based on fresh specimens and describe four new species previously assigned by us to *P. moniliformis*: *P. dalmatioides* A.J. Marshall, Blanchon, Aptroot & de Lange, *P. largei* A.J. Marshall, de Lange, Blanchon & Aptroot, *P. quadratolocularis* A.J. Marshall, de Lange, Blanchon & Aptroot, *P. solomonii* A.J. Marshall, de Lange, Blanchon & Aptroot. In addition, the ecology, associations and conservation status of all five species is provided. As these species would currently all key out to *Pyrenula moniliformis* in Galloway (2007) we provide a revised key to that species and those described here.

Materials and Methods

For this study, we examined all *Pyrenula* specimens held in AK, CHR, OTA, UNITEC and WELT. For this analysis we selected specimens corresponding to *Pyrenula moniliformis* s. l. and interloaned these for microscopic analysis at UNITEC. Field work was also conducted at Te Paki (−34.471, 172.764), a range of mānawa | mangrove (*Avicennia marina*

(Forssk.) Vierh. subsp. *australasica* (Walp.) J. Everett (*Acanthaceae* s. l. subfam. *Avicennioideae* Miers, or *Avicenniaceae* Miq. s. str.) swamps from Te Paki south to the Kaipara Harbour (−36.602, 174.349), Mataia Queen Elizabeth II Covenant (−36.493, 174.425), Auckland City, Hunua Range (−37.024, 175.094), and on Rēkohu | Wharekauri | Chatham Island (−43.762, −176.571). Specimens from these locations are cited under the relevant taxon 'representative specimens' listings as well as the distribution maps provided for each taxon in this paper.

At UNITEC specimens were examined with standard microscopic techniques using a Leica S9i and Meiji MT4000H with attached Infinity 1 camera. Microscopic images were taken with material mounted in water and analysed using Infinity Analyze 6.5.5 and Leica Application Suite X 3.8.2.27713. All specimens examined were annotated prior to returning loans.

Taxonomy

Pyrenula moniliformis (C. Knight) Müll. Arg., Bull. Herb. Boissier 2, App. 1: 95 (1894) ≡ *Verrucaria moniliformis* C. Knight, Trans. Linn. Soc. 23: 100 (1860).

Mycobank accession number: 403405

Lectotype: New Zealand. *Sine loco* [probably Auckland], Charles Knight 319 — BM [*fide* Galloway (1985a: 492)].

Notes: The type material (Fig. 1D, E) is assumed to have been collected from Auckland (Galloway, 1985, 2007); on the basis that Charles Knight (1808–1891) was living there when he published a paper on corticolous *Verrucaria* species including "*V. moniliformis*" (Knight, 1860; Galloway, 2013). Charles Knight, an early pioneer of Aotearoa | New Zealand lichenology, collected the more innocuous species from throughout the country. His herbarium contains numerous beautifully presented species, usually with hand-coloured sketches of their internal anatomy, asci and ascospores. However, frustratingly, Knight rarely provided location details on his herbarium specimens, leaving modern users of his herbarium with little choice but to guess locations on the basis of his various places of residence, and publications dated from that time (Galloway, 1985, 2007, 2013; Marshall, de Lange, 2025).

Diagnosis: Distinguished from other species of *Pyrenula* by having apiculate spores which are 5- to 7-septate in the size range 55–68 × 10.0–12.5 µm.

Description (Fig. 1): Corticolous. ***Thallus*** crustose, without pseudocyphellae, cream to pale brown, rugose, often appearing crystalline, usually cracked, corticate, spreading along the substrate in vertical stripes up to 250 mm, 0.4–1.2 mm thick, UV−. ***Prothallus*** not seen. ***Photobiont*** green, trentepohlioid, cells oblong to elongate,12.5–17.5 × 6.25–7.5 µm. ***Ascomata*** solitary, globose, often becoming papilliform at maturity, top half emergent from thallus, black, 1.0–2.3 mm (n = 30) in diameter, ostiole apical to slightly eccentric, often indistinct, 180–220 µm wide, wall carbonised, 65–140 µm thick, K−. ***Hamathecium*** hyaline, not inspersed, IKI−, hamathecium filaments simple or occasionally branched, 0.8–1.2 µm thick. ***Asci*** 8-spored, spores irregularly arranged, cylindrical, 175–225 × 25–35 µm. ***Ascospores*** fusiform, occasionally with apiculate tips, transversely 5–7-septate (mostly 7), cells rounded (resembling a cylinder that is wider at the centre of its axis than the ends) with terminal lumina when present adjacent to the endospore wall, initially hyaline but becoming brown at maturity, 55–68 × 10–12.5 µm (n = 30). ***Pycnidia*** not seen.

Representative Specimens: — AOTEAROA | NEW ZEALAND, TE IKA-A-MĀUI | NORTH ISLAND: Auckland, Titirangi, *A.J. Marshall AJM128*, 12 June 2025, UNITEC14891; Auckland, Meadowbank, Pourewa, *O. Er, C. Reynolds & N. Leddy*, 20 March 2015, UNITEC9328; Auckland, Point Chevalier, Jagger's Bush, *P. de Lange & A.J. Marshall AJM101*, 11 March 2025, UNITEC14865; Auckland, Hunua Ranges, Otau Mountain Road, *A.J. Marshall AJM48AW*, 30 November 2018, UNITEC14006.

Recognition: *Pyrenula moniliformis* differs from other species of *Pyrenula* present in Aotearoa | New Zealand by having 5- to 7-septate ascospores (Fig. 1F, G) that are much larger than those of *P. dalmatioides* A.J. Marshall, Blanchon, de Lange & Aptroot in the range 55–68 × 10.0–12.5 µm rather than 22–30 × 8–10 µm. It differs from *P. largei* by having smaller spores with less septa (70–100 × 10–15 µm for *P. largei* with 10–18 transverse septa), smaller ascomata (up to 3 mm for *P. largei*) and a different thallus appearance (smooth and much darker brown for *P. largei*). From *P. quadratolocularis* it differs by having much more prominent ascomata (Fig. 1B, C), those of *P. quadratolocularis* being flat in appearance, and different spore characters (those of *P. quadratolocularis* are 38–45 × 12–15 µm, curved and with distinctive angular locules). It is closest in spore

morphology to *P. solomonii* although spores are larger (37–52 × 6.0–8.5 µm for *P. solomonii*) with fewer septae (5–7 rather than 7–9). It lacks the characteristic flattened ascomata of *P. solomonii* and the thallus colour is quite different, that of *P. solomonii* appearing pink/orange. Globally, it differs from the Pantropical species *P. sexlocularis* (Nyl.) Müll. Arg. and the Papua New Guinean *P. sexluminata* Aptroot by having spores that are much larger (24–35 µm for these two species), and spores are often 7-septate rather than 5-septate. It also differs by the lack of hymenial IKI reaction (orange for *P. sexlocularis* and blue for *P. sexluminata*). It is distinguished from the Pantropical *P. montagnei* Müll. Arg. by spore size (25–38 × 5–7 µm for *P. montagnei*), thallus colour and the size of the ascomata (0.4–0.6 mm for *P. montagnei*). In the course of collecting specimens in Te Paki ('Broughton's Gully') we encountered an entity whose growth habit and thallus morphology is superficially similar to *Pyrenula moniliformis*. However, collections e.g., *A.J. Marshall 108, P.J. de Lange, C.J. James & E. Kaihe-Wetting*, UNITEC14928, of this were copiously fertile, with 3-septate ascospores, lacked an obvious photobiont, and so is likely a fungus.

Distribution: Endemic to Aotearoa | New Zealand where so far it is known from the Tamaki Makaurau | Auckland, Te Ika-a-Māui | North Island (Fig. 2). However, now that it has been rediscovered (Marshall, de Lange, 2025) it is quite likely to be found outside this region, especially as to date, there have been no targeted surveys for it.

Ecology: So far *Pyrenula moniliformis* appears to be restricted to a single phorophyte, māhoe (*Melicytus ramiflorus* J.R. Forst. & G. Forst subsp. *ramiflorus*) (Marshall, de Lange, 2025), with confirmed specimens collected entirely within the greater Auckland Region (Fig. 6). The lectotype substratum also appears to be mahoe although there are no notes with the specimen to confirm this.

In the locations where it has been collected it is often locally common in shaded situations, and appears to favour early-stage successional forest, in which māhoe is predominant either as canopy or subcanopy. The sole exception to this is a collection from a māhoe tree growing in the subcanopy of a taraire (*Beilschmiedia taraire* (A. Cunn.) Benth. & Hook. f. ex Kirk) / tawa (*Beilschmiedia tawa* A. Cunn.) Benth. & Hook. f. ex Kirk) forest in the Hunua Ranges.

Conservation Status: Marshall, de Lange (2025) expressed a confident view that more locations for *Pyrenula moniliformis* will be found because it is easily recognised in the field (due to its distinctive papilliform ascomata, and apparent restriction to the bark of māhoe), but since then only one new population has been recorded (UNITEC14891). The discovery of an as yet undetermined fungus with very similar macro-morphology, including papilliform fruiting structures (see 'Recognition' above) to *P. moniliformis* suggests that field recognition without follow-up microscopy has the potential to misrepresent the species abundance. Irrespective that the only known phorophyte māhoe is one of the most common indigenous trees of Aotearoa | New Zealand, we feel that the most conservative assessment of 'Data Deficient' *sensu* Rolfe et al. (2022), qualified 'DPR' [Data Poor Recognition], 'DPS' [Data Poor Size] and 'DPT' [Data Poor Trend] applies, because beyond our rediscovery of the species we still have no concept of its abundance, population size and trends. Further, at least for now, the only way to confirm the species presence is to resort to potentially destructive field sampling of specimens that will need to be confirmed by microscopy.

Pyrenula dalmatioides A.J. Marshall, Blanchon, de Lange & Aptroot sp. nov.

Mycobank accession number: 860250

Type: AOTEAROA | NEW ZEALAND, TE IKA-A-MĀUI | NORTH ISLAND. North Island, Northland, Oruaiti River, Mangōnui, 35.0120392°S, 173.5607300°E, 0 m, *A.J. Marshall (AJM102) & H.E. Marshall*, 17 January 2025. On bark of *Avicennia marina* subsp. *australasica* (*holotype* UNITEC14835, *isotype* AK).

Diagnosis: Distinguished from other species of *Pyrenula* by the apiculate spores which are 5- to 7-septate and 22–30 × 8–10 µm.

Description (Fig. 3): Corticolous. ***Thallus*** crustose, without pseudocyphellae, white to cream, minutely roughened (often appearing crystalline), ecorticate, spreading along the substrate up to 200 mm, 65–165 µm thick, UV–. ***Prothallus*** often present between neighbouring thalli although not seen where thallus edge meets the substrate, black, 250–650 µm wide. ***Photobiont*** green, trentepohlioid, cells oblong to elongate, 10.0–17.5 × 7.5 µm. ***Ascomata*** mainly solitary, occasionally clustered in groups of up to 5, subglobose with top half emergent from thallus, black, 0.46–0.75 mm (n = 30) in diameter, slightly less tall than wide, ostiole apical, often indistinct, 65–80 µm wide,

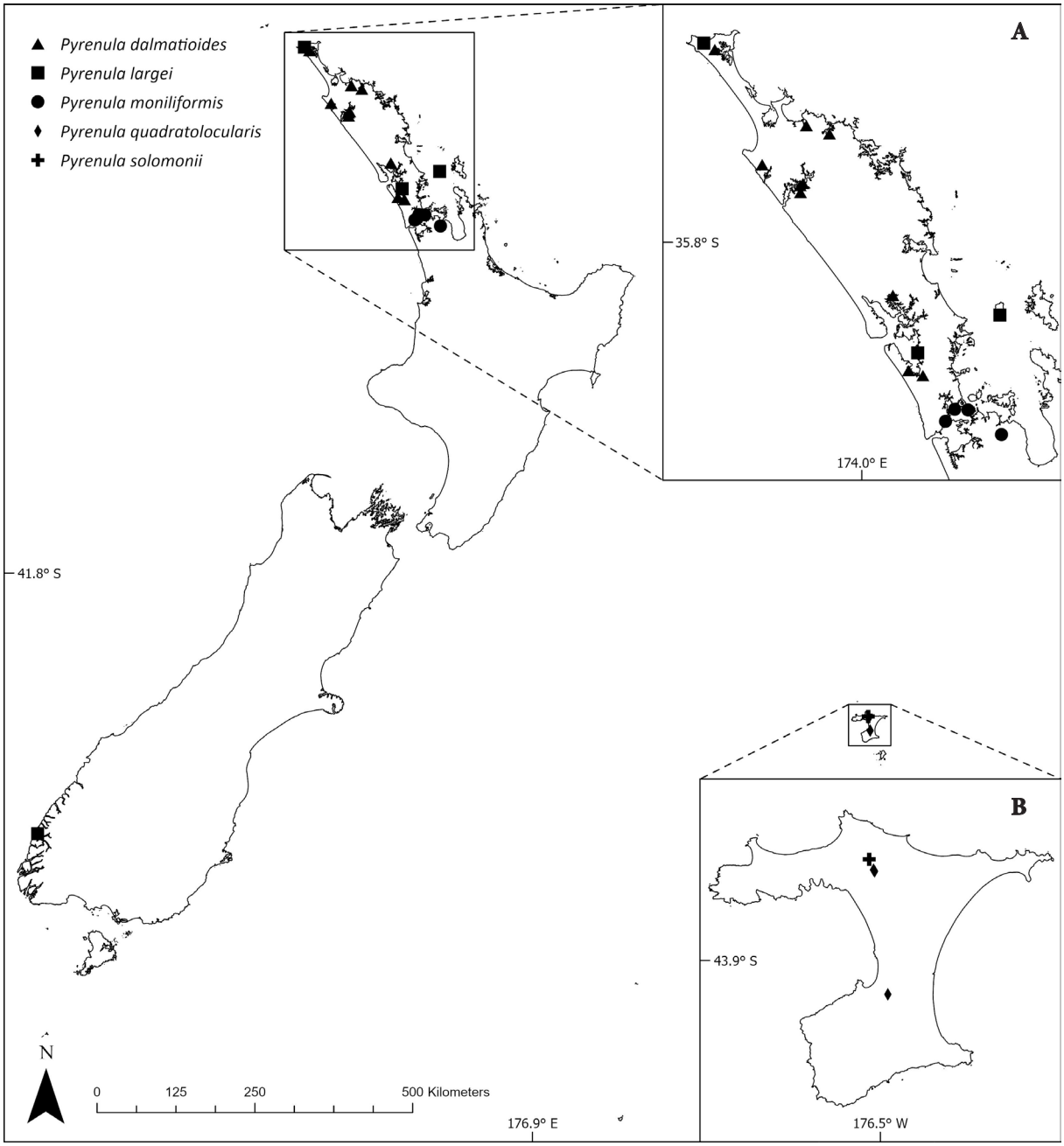

Fig. 2. Map showing the distributions of the taxa discussed. A: locations in Te Hiku-o-te Ika | Far North, Te Tai Tokerau | Northland; B: locations on Rēkohu | Wharekauri | Chatham Island — the largest island in the Chathams group

wall carbonised, 80–120 µm thick, K–. ***Hamathecium*** hyaline, not inspersed, IKI–, hamathecium filaments simple, 1.0–1.5 µm thick. ***Asci*** 8-spored, spores irregularly arranged, cylindrical to clavate, 45–80 × 15–22 µm. ***Ascospores*** fusiform-citriform, often with apiculate tips, transversely 5–7-septate, cells rounded with terminal lumina when present adjacent to the endospore wall, initially hyaline but becoming brown at maturity, 22–30 × 8–10 µm (n = 30). ***Pycnidia*** common, black, punctiform, 200–250 µm. ***Conidia*** filiform, curved, 12–19 × 1.0–1.5 µm (n = 30)

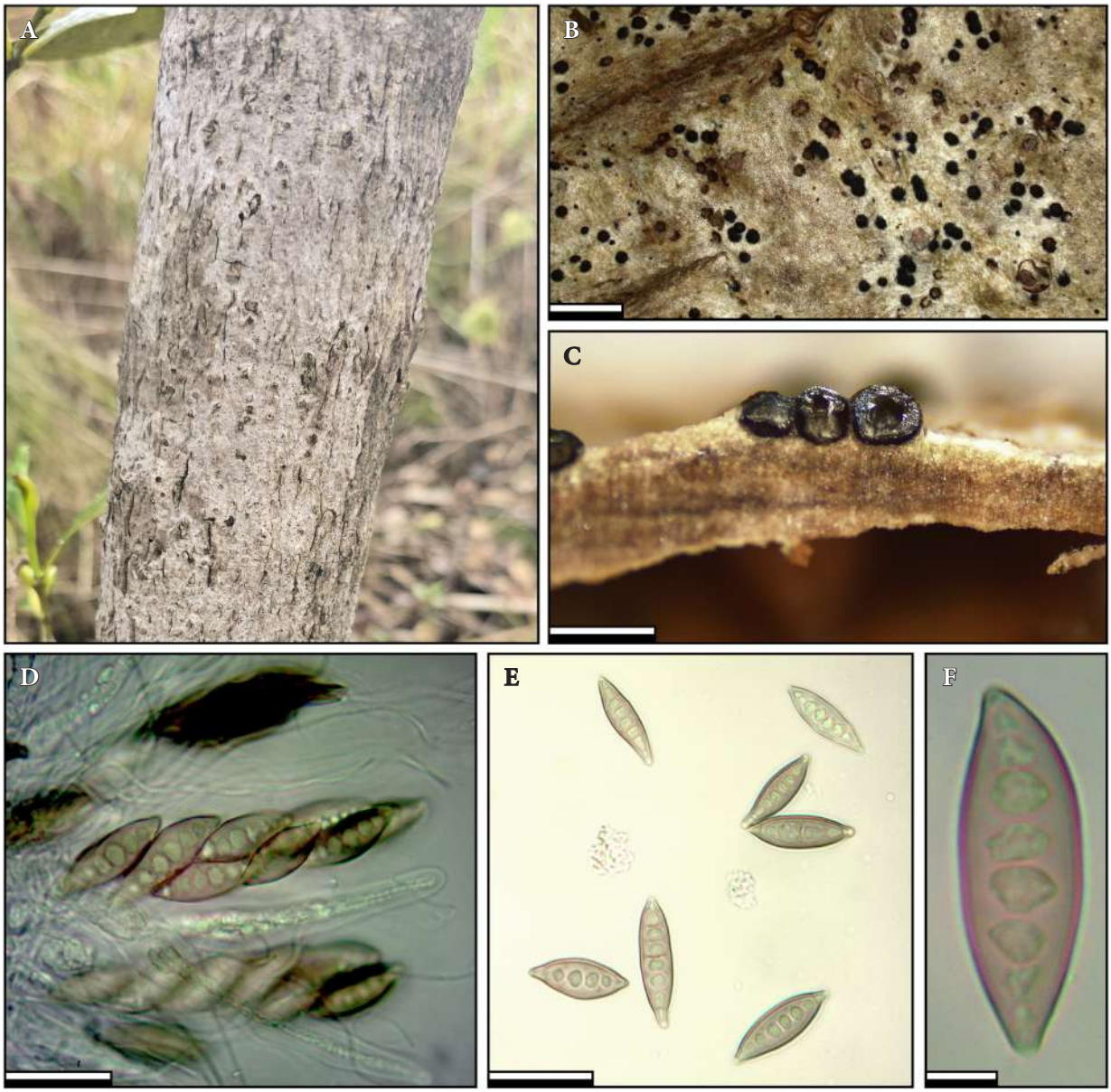

Fig. 3. *Pyrenula dalmatioides.* A: *P. dalmatioides* growing on the trunk of mānawa | mangrove (*Avicennia marina* subsp. *australasica*) at the type locality (Mangōnui, Oruaiti River, Te Tai Tokerau / Northland, Te Ika-ā-Māui / North Island, Aotearoa / New Zealand); B: Close-up of the thallus (scale = 2 mm); C: Cross-section through ascomata (scale = 500 µm); D: Spores in ascus (scale = 20 µm); E: Spores showing variation (scale = 20 µm); F: Spore (scale = 5 µm)

Representative Specimens (of 15 seen): AOTEAROA | NEW ZEALAND, TE IKA-A-MĀUI | NORTH ISLAND, Northland, Kaeo, *P.J. de Lange, C.J. James & A.J. Marshall AJM112*, 17 March 2025, UNITEC14850; Northland, Rawene, *P.J. de Lange, C.J. James & A.J. Marshall AJM123*, 17 March 2025; Auckland; Northland, North Kaipara, Paparoa, *O. Er & C. Reynolds*, 10 February, UNITEC6431.

Recognition: *Pyrenula dalmatioides* differs from all other *Pyrenula* presently recognised in Aotearoa | New Zealand by having 5- to 7-septate ascospores (Fig. 3D–F) in the size range 22–30 × 8–10 µm, a white thallus (Fig. 3A), and by its northern distribution and restriction to coastal mānawa | mangrove habitats. All other novel *Pyrenula* species discussed in this paper have larger ascospores that are

Fig. 4. *Pyrenula largei*. A: *P. largei* growing on the trunk of tanekaha (*Phyllocladus trichomanoides*) at the type locality (Mataia QEII Covenant, Kaipara, Te Ika-a-Māui | North Island, Aotearoa | New Zealand); B: Close-up of the thallus (scale = 3 mm); C: Cross-section through ascomatum (scale = 1 mm); D: Spores in ascus (scale = 20 µm); E: Spores showing variation (scale = 40 µm); F: Spore (scale = 20 µm)

not citriform (see descriptions) and thalli which are not white in appearance. The thallus morphology is similar to that of *P. microcarpa* Müll. Arg., a species with which in the field it is easily confused. However, *P. microcarpa* has 3-septate ascospores rather than 5–7-septate. From a global perspective, *P. dalmatioides* is distinguished from both *P. sexlocularis* and *P. sexluminata* by the lack of hymenial IKI reaction (orange for *P. sexlocularis* and blue for *P. sexluminata*) and the ecorticate thallus (Schumm, Aptroot, 2022). It also differs from both species by having lemon-shaped (citriform) spores with apiculate tips which are less broad (8–10 rather than 10–15 µm). From the South African species *P. wilmsiana* Müll. Arg. it differs by its thallus colouration (not olivaceous), 5–7-septate ascospores rather

than 5-septate, and which are not uniseriately arranged in the ascus.

Distribution: Presumed endemic to Aotearoa | New Zealand where so far it is known from Te Hiku-o-te-Ika | Far North south to Tāmaki Makaurau | Auckland, Te Ika-a-Māui | North Island (Fig. 2) in mānawa | mangrove swamps.

Ecology: *Pyrenula dalmatioides* is so far known only from two phorophytes; mānawa | mangroves (*Avicennia marina* subsp. *australasica*) and two collections from ngaio (*Myoporum laetum* G. Forst.), both in the immediate vicinity of mānawa forests. It appears to have a distinctly coastal ecology and has not been collected from other vegetation associations. It displays a similar habit to that of the recently described *Lithothelium kiritea* A.J. Marshall, Aptroot, de Lange & Blanchon (Marshall et al., 2024) insofar as it is an early coloniser species and is most common on young adult mānawa | mangrove or isolated trees where it is often the only species present. As the forest ages, other lichen species begin to colonise the bark and *Pyrenula dalmatioides* is displaced.

Conservation Status: *Pyrenula dalmatioides* despite its recognition here as a new species within a notoriously difficult genus to identify, is fortunately so specific in its habitat requirements that it is relatively easy to recognise in the field. The only species with which it could be readily confused, *P. microcarpa*, has so far not been recorded within the same habitat. Although it is not inconceivable that *P. microcarpa* could grow on mānawa, it appears so far that *P. dalmatioides* is the usual white *Pyrenula* on this host. This means that we are more confident of providing a definitive conservation assessment. The species appears to be abundant and secure throughout its range. Its only known habitat, mānawa | mangrove ecosystems are widespread (c. 26,000 ha, Spalding et al., 2010) and ironically increasing their extent as a consequence of ongoing sedimentation of harbours caused by past deforestation of the catchment and from erosion of exposed ground as a consequence of intensive dairy farming and urbanisation (de Lange, de Lange, 1994; de Satgé, 2021). While there has been some loss of mānawa | mangrove ecosystems through deliberate clearance from some harbours (de Satgé, 2021), this has been minimal, and so far has had no obvious impact on the places where *Pyrenula dalmatioides* has been found. Nevertheless, *P. dalmatioides* has not been found in every mānawa | mangrove ecosystem, but our field work has found it in some of the key mānawa | mangrove areas of Te Tai Tokerau | Northland. Accordingly, using the New Zealand Threat Classification System (Rolfe et al., 2022) we assess *Pyrenula dalmatioides* as 'At Risk | Uncommon' (UnCn1 [Naturally small population that is forecast to increase > 10% over the longer of the next 10 years or three generations (maximum 100 years) (UNCn1)], Criterion 'I'[The total area of occupancy is 10 000–100 000 ha (100–1000 km^2)], qualified 'DPR' [Data Poor Recognition], 'DPS' [Data Poor Size] and 'DPT' [Data Poor Trend] because we lack this data making our assessment on our judgement of populations in the field, their security and what is happening to their preferred habitat. Finally, the species should also be marked 'RR' [Range Restricted] due to its apparent phorophyte preference.

Etymology: The species epithet refers to the similarity of the thallus to the patterning on the coat of a Dalmatian dog, a breed of dog originating from historic Dalmatia (now modern-day Croatia) whose coat is white with numerous black spots (see: https://en.wikipedia.org/wiki/Dalmatian_dog). It also honours early Dalmatian settlers who began to emigrate to Aotearoa | New Zealand in waves starting during the 1890s and intensifying during periods of civil unrest and war in the Balkans between 1900 and 1930, and again in the 1990s (see https://teara.govt.nz/en/dalmatians). The initial sites of settlement were in Te Tai Tokerau | Northland of Te Ika-a-Māui | North Island to dig kauri (*Agathis australis* (D. Don) Lindl.) gum from peat bogs that often abut the mānawa | mangrove swamps frequented by *Pyrenula dalmatioides*.

Pyrenula largei A.J. Marshall, de Lange, Blanchon & Aptroot sp. nov.

Mycobank accession number: 860251

Type: AOTEAROA | NEW ZEALAND, TE IKA-A-MĀUI | NORTH ISLAND. North Island, Northland, Auckland, Glorit, Mataia, Mataia QEII Covenant, 36.4932365°S, 174.4248199°E, 30 m, *A.J. Marshall (AJM127) & P.J. de Lange,* 11 December 2024. On bark of *Phyllocladus trichomanoides* (*holotype* UNITEC14864, *isotype* AK).

Diagnosis: Distinguished from other species of *Pyrenula* by the 10–18-transversely septate ascospores (rarely submuriform in overmature spores); these 70–100 × 10–15 µm, and ascomata up to 3 mm in diameter.

Description (Fig. 4): Corticolous. ***Thallus*** crustose, without pseudocyphellae, grey-brown to umber, smooth to minutely rugose, corticate, in semi-circular to irregular bands and patches on the photobiont

substratum; these up to 50 mm in diameter, 125–170 µm thick, UV–. ***Prothallus*** indistinct. Photobiont green, trentepohlioid, cells oblong to elongate, cells 20–28 × 7.5–8 µm. ***Ascomata*** prominent, mainly solitary but occasionally in groups of 2–4, hemispherical, occasionally with a flattened top, black, 1.2–2.9 mm (*n* = 30) in diameter, ostiole white, apical to slightly eccentric, prominent, 150–270 µm wide, wall carbonised, 140–225 µm thick, K–. ***Hamathecium*** hyaline, not inspersed, IKI–, hamathecium filaments simple, 1.0–1.5 µm thick. ***Asci*** 8-spored, spores irregularly arranged, cylindrical to clavate 150–180 × 30–40 µm. ***Ascospores*** fusiform-musiform, often with apiculate tips, with 10–18 transverse septa and occasionally 1 longitudinal septum in central cells, cells rounded to angular, initially hyaline but becoming brown at maturity, 70–100 × 10–15 µm (*n* = 30). ***Pycnidia*** and ***Conidia*** not seen.

Specimens seen: — AOTEAROA | NEW ZEALAND, TE IKA-A-MĀUI | NORTH ISLAND: Te Hiku-o-te-Ika | Northland, Ngāti Kuri, Te Paki, Tahae | Radar Bush, *P.J. de Lange 15833*, 3 April 2024, UNITEC14836; Auckland, Glorit, Mataia, *A. McKenzie & D. Bennett*, 11 May 2018, UNITEC10176; Hauturu-o-Toi | Little Barrier Island, *B.W. Hayward*, August 1981, AK224897. TE WAIPOUNAMU | SOUTH ISLAND: Ka Tū-Waewae-o-Tū | Secretary Island, *[J.] Murray*, February 1959, OTA 67696.

Recognition: *Pyrenula largei* differs from other species of *Pyrenula* present in Aotearoa | New Zealand by having 10- to 18-septate ascospores (Fig. 4D–F) that are the largest in this group, being 70–100 × 10–15 µm. All other novel *Pyrenula* species discussed in this paper have smaller ascospores and fewer septae (see descriptions) and thalli which lack the shiny brown appearance of *P. largei* (Fig. 4B). Ascomata are the largest in the group averaging 2.1 mm in diameter, usually with a prominent pale ostiole (Fig. 3B, C). Without microscopy it could be confused with *Pyrenula ravenelii* with which it often grows and has a similar thallus colour, ascomata size and habitat preference but very different spores — those of *P. ravenelii* being muriform and in the size range 45–70 × 18–28 µm. Keying out at couplet 62 of the world *Pyrenula* key (Schumm, Aptroot, 2022), it differs from *P. cylindrica* Kashiw. by having spores which are larger (70–100 × 10–15 µm rather than 45–60 × 4–6 µm), and from *P. clavatispora* Common & Aptroot by having much larger ascomata (1.2–2.9 mm rather than 0.3–0.5 mm) and a lack of IKI reaction in the hamathecium.

Distribution: Presumed endemic to Aotearoa | New Zealand where so far it is known from Te Paki, Te Hiku-o-te-Ika | Far North, Te-Ika-a-Māui | North Island south to Ka Tū-Waewae-o-Tū | Secretary Island, Murihiku | Southland, Te Waipounamu | South Island (Fig. 2).

Ecology: In the Te Ika-a-Māui | North Island part of its range *Pyrenula largei* is best known from kauri forest associations where it seems to exclusively inhabit the bark of tānekaha (*Phyllocladus trichomanoides* D. Don) (Fig. 4A) a common coniferous associate of kauri. On Hauturu-o-Toi | Little Barrier Island, the species was found in a mixed collection of *Pyrenula* collected from *Myrsine* L. (probably *M. australis* (A. Rich.) Allan) in "kanuka" (*Kunzea robusta* de Lange & Toelken) forest. It is not known what phorophyte it was collected from on Ka Tū-Waewae-o-Tū | Secretary Island, an island well out of the range of tānekaha and kauri but not *Myrsine*. That island has a lowland forest dominated by *Nothofagus* Blume and Podocarp trees, with the montane portion covered in southern rātā (*Metrosideros umbellata* Cav.) and kāmahi (*Pterophylla racemosa* (L. f.) Pillon & H.C. Hopkins) forest associations.

In the northern part of its range, where we have collected *Pyrenula largei*, it can be locally common, though in the field it is easily confused with *P. ravenelii* (see above), with confident determinations requiring microscopy. Irrespective, at Mataia QEII Covenant for example, *Pyrenula largei*, was usually found in association with *Pyrenula ravenelii*, *Ocellularia jacinda-arderniae* A.J. Marshall, Blanchon, Lücking & de Lange, *Thelotrema lepadinum* (Ach.) Ach., *Fissurina* Fée spp., and *Pertusaria* DC. spp. (see: https://inaturalist.nz/observations/254844328). At Mataia it was noted that *Pyrenula largei* occupied a narrow band within regenerating kauri forest; namely sites more influenced by and/or exposed to coastal weather. Above that band *P. ravenelii* dominated. At Te Paki, the species was part of a generic *Pyrenula* sampling from dense kauri forest, noting that all of Te Paki weather is in effect maritime.

Conservation Status: Using the New Zealand Threat Classification System (Rolfe et al., 2022), *Pyrenula largei* best qualifies as 'Data Deficient' qualified 'DPR' [Data Poor Recognition], 'DPS' [Data Poor Size] and 'DPT' [Data Poor Trend] because we have no concept of this species abundance and trends, and without resorting to potentially destructive field sampling for microscopy as field

recognition is, thus far anyway, impossible. Further, our best understanding of this species ecology is based on our field work in kauri forest associations in which it was first recognised by us as potentially distinct. The discovery of herbarium specimens on different phorophytes spanning the range of the two main islands of Aotearoa | New Zealand, increases our uncertainty, especially with respect to potential threats the species may face.

Etymology: *Pyrenula largei* is named in honour of the Aotearoa | New Zealand botanist Dr. Mark Large FLS (31 March 1959 –) (Fig. 5), who specialised in pteridology. Mark started his academic career at Oxford as Royal Society Endeavour Fellow, then continued teaching botany at Massey University of New Zealand | Te Kunenga ki Pūrehuroa in 1993, before moving to what is now Unitec originally as Head of Department, then in a senior role (Associate Professor) and teaching Earth Sciences, Botany and Science Philosophy (2002–2024). During his career Mark supervised and examined a range of dissertations, including M.Sc. and PhD, and was an examiner or supervisor of two of the authors on this article, Andrew Marshall and Dan Blanchon. Mark's contributions to global botanical sciences and indeed the history of science have been remarkable. He is fondly remembered by his past students and graduates for his unique, dry humour and engaging lecturing style that helped encouraged many students to follow a career in botany and taxonomy.

Pyrenula quadratolocularis A.J Marshall, de Lange, Blanchon & Aptroot sp. nov.

Mycobank accession number: 860252

Type: AOTEAROA | NEW ZEALAND, RĒKOHU | WHAREKAURI | CHATHAM ISLAND: Te Whanga, Pana | Blind Jim's, 43.779172°S, 176.557417°W, 15 m, *P. J de Lange (CH4637)*, 30 January 2025. On bark of *Coprosma chathamica* (*holotype* UNITEC14830, *isotype* AK).

Diagnosis: *Pyrenula quadratolocularis* is distinguished from other species of *Pyrenula* by the combination of aggregated ascomata, partially immersed in thallus, and ascospores that are curved, with square locules in the size range 38–45 × 12–15 µm.

Description (Fig. 6): Corticolous. ***Thallus*** crustose, without pseudocyphellae, grey-white (fresh) fading to light brown to tan on storage, smooth to minutely rugose (often appearing crystalline), ecorticate (occasionally corticate), in patches along the substrate up to 40 mm in diameter, 350–650 µm thick, UV–. ***Prothallus*** black, 200–1000 µm wide. ***Photobiont*** green, trentepohlioid, cells oblong to elongate, 20–22 × 9–10 µm. ***Ascomata*** usually confluent but occasionally solitary, flattened, partially immersed in the thallus, black, 1.2–2.1 mm (n = 30) in diameter, ostiole apical, often indistinct, 180–230 µm wide, wall carbonised, appearing cellular in cross-section, 50–150 µm thick, K–. ***Hamathecium*** hyaline, not inspersed, IKI–, hamathecium filaments simple, 1.0–1.5 µm thick. ***Asci*** 8-spored, spores irregularly arranged, cylindrical to clavate 50–100 × 15–20 µm. ***Ascospores*** usually curved, mostly submuriform but occasionally transversely septate, often constricted at septa, especially at maturity, fusiform, 7–9 × 0–3-septate, cells angular, oblong to square, brown, 38–50 × 5.5–8.0 µm (n = 30). ***Pycnidia*** common, black, punctiform, 300–580 µm. ***Conidia*** ellipsoid, 3.5–4.9 × 1.4–2.0 µm (n = 30).

Fig. 5. Adjunct Professor, Dr Mark Large FLS (image: provided by Mark Large)

Specimens seen: — AOTEAROA | NEW ZEALAND, RĒKOHU | WHAREKAURI | CHATHAM ISLAND: Te Whanga, Pana | Blind Jim's, *P.J. de Lange CH4130*, 27 June 2021, UNITEC12907; Te Whanga, Pana | Blind Jim's near Cattle Point, *P.J. de Lange CH4643*, 26 August 2025, UNITEC15024;

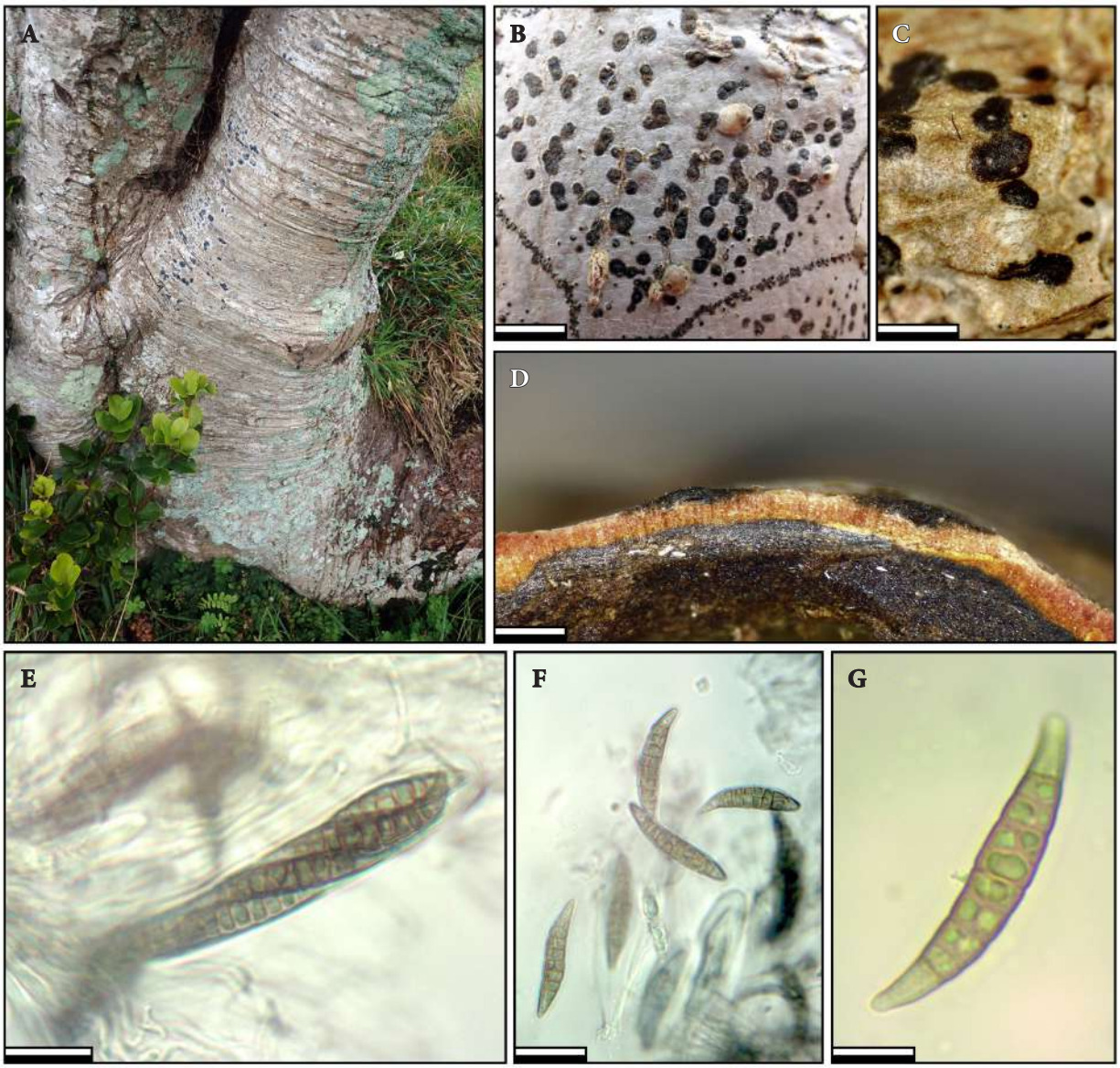

Fig. 6. *Pyrenula quadratolocularis*. A: *P. quadratolocularis* growing on the trunk of karamū hikoa (*Coprosma chathamica*) at the type locality (Pana | Blind Jim's, Te Whanga, Rēkohu | Wharekauri | Chatham Island, Chatham Islands); B: Close-up of the thallus in fresh state (scale = 3 mm); C: Close-up of the thallus after storage (scale = 2 mm); D: Cross–section through ascomata (scale = 500 µm); E: Spores in ascus (scale = 20 µm); F: Spores showing variation (scale = 25 µm); G: Spore (scale = 10 µm)

Lake Huro, Te Awatea, *P.J. de Lange CH4638 & C.J. James*, 3 February 2025, UNITEC14831; Lake Huro, Te Awatea, *P.J. de Lange CH4642 & C.J. James*, 3 February 2025, UNITEC15000.

Recognition: *Pyrenula quadratolocularis*, remarkably for an Aotearoa | New Zealand *Pyrenula*, is easily recognised in the field on account of the (when fresh) grey-white (Fig. 6A) thallus (fading to light brown or tan on storage: see Fig. 6C), delineated by a black prothallus (Fig. 6B), and by the black, confluent, semi-immersed (so appearing 'flat') ascomata (Fig. 6B–D, see also: https://inaturalist.nz/observations/262065399). Spore size is similar to that of *P. solomonii*, but spores are usually curved, submuriform and have distinctive square/rectangular locules (Fig. 6E–G), a character lacking in *P. solomonii* that has

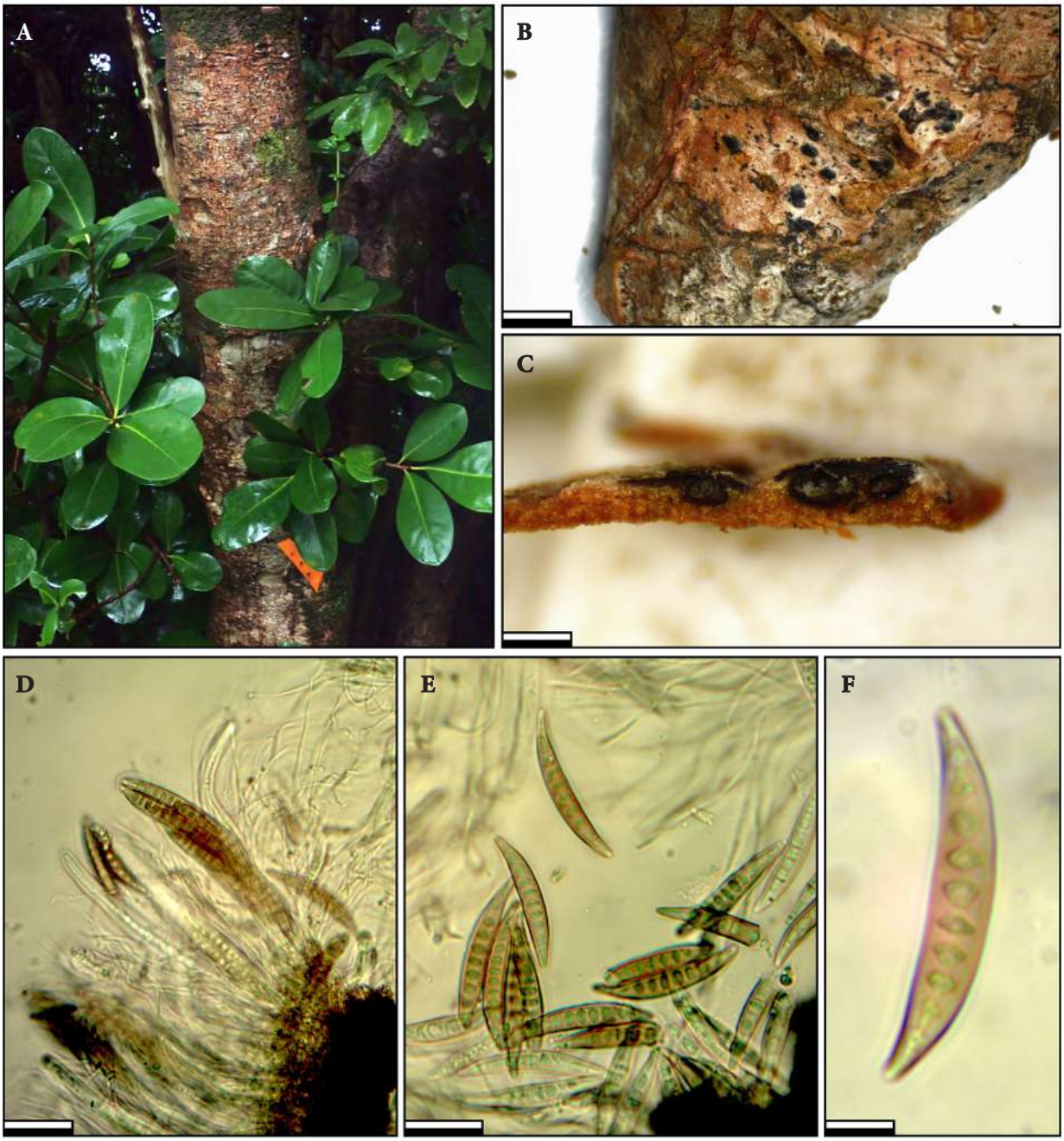

Fig. 7. *Pyrenula solomonii* at the type locality (Nikau Bush Conservation Area, Pana | Blind Jim's, Te Whanga, Rēkohu | Wharekauri | Chatham Island, Chatham Islands). A: *P. solomonii* growing on the trunk of karamū hikoa (*Coprosma chathamica*) tree surrounded by kopi (*Corynocarpus laevigatus*); B: Close-up of the thallus (scale = 2.5 mm); C: Cross-section through ascomata (scale = 1 mm); D: Spores in ascus (scale = 20 µm); E: Spores showing variation (scale = 20 µm); F: Spore (scale = 10 µm)

a locule shape much more like other species of *Pyrenula* (Fig. 7). These spore characteristics are unique for *Pyrenula*, at least for those taxa recognised from Aotearoa | New Zealand. It is described here within *Pyrenula* although further investigation is warranted to explore this (see comments by Galloway, 2007).

From *P. largei* it differs by having smaller ascospores (70–100 × 10–15 µm for *P. largei*) and smaller, much less prominent ascomata (hemispherical rather than flattened for *P. largei*). *Pyrenula dalmatioides* has smaller ascospores (22–30 × 8–10 µm) and those of *P. moniliformis* are larger (55–68 × 10.0–12.5 µm), and both these taxa lack the distinctive locule shape discussed above. *Pyrenula quadratolocularis* differs from the similarly submuriform *P. subumbilicata* by having curved ascospores that are far more pointed at the tips, and lacks the yellow thallus colour and prominent fused ostioles.

Distribution: Presumed endemic to the Chatham Islands, Aotearoa | New Zealand (Fig. 2).

Ecology: In the two locations in which *Pyrenula quadratolocularis* has been found, it is locally common on exposed, often isolated trees or 'stands' of trees; remnants of a formerly contiguous swamp / fen forest and/or shoreline forest that once occupied the frequently flooded margins of Te Whanga and Lake Huro. In these habitats it has been found on two phorophytes, karamū hikoa (*Coprosma chathamica* Cockayne) and tapatapa (*C. propinqua* A. Cunn. var. *martinii* W.R.B. Oliv.). The *Pyrenula* seems to be strongly photophilous, only colonising the most exposed portions of the trunks (Fig. 6A) of these phorophytes and eschewing those shaded portions or areas of denser branching. In these sites, the *Pyrenula* is commonly found associating with another *Pyrenula*, possibly endemic to the islands, *P.* aff. *microcarpa*, *Lecanora kohu* Printzen, Fryday, Blanchon & de Lange, *Physcia adscendens* H. Oliver, *P. poncinsii* Hue and *Ramalina canariensis* J. Steiner.

Conservation Status: *Pyrenula quadratolocularis* has been collected from two sites on Rekohu | Wharekauri | Chatham Island (Pana | Blind Jim's, on the shores of Te Whanga, and from Te Awatea, on the southeastern shoreline of Lake Huro). At both sites it was locally common, on exposed trees of karamū hikoa and tapatapa — remnants from former swamp and shoreline forest. On these phorophytes, especially on the exposed portions of their trunks it can be the dominant lichen. Whilst encouraging these host trees are in reality under extreme stress due to the loss of surrounding forest cover, resulting in their exposure, and some of the trees on which it was found in June 2021 have since toppled in the strong winds typical of the Chatham Islands.

Aside from its ease of field identification, *Pyrenula quadratolocularis* has not yet been surveyed for in all potential habitat. Nevertheless it has been opportunistically looked for in a range of sites around Rēkohu | Wharekauri | Chatham Island, and as yet no further locations have been discovered.

The New Zealand Threat Classification System (Rolfe et al. 2022) requires that assessors try to avoid assessing taxa as 'Data Deficient' if sufficient data exists to place taxa in a more definitive conservation category, such is possible for *Pyrenula quadratolocularis*. In the two locations in where it has been found, as there is no data available on the number of individuals but there is for area of occupancy, and, as was done for *Lecanora kohu* by de Lange (2021), longevity of phorophyte as a proxy for population trend of the lichen.

At Pana | Blind Jim's the *Pyrenula* occupies an area of c. 1 ha, where in June 2021 it was found on 11 karamū hikoa. Of those phorophytes, three were in ill–thrift during an inspection in late January 2025, and one tree had collapsed and was dying.

At Te Awatea, *Pyrenula quadratolocularis* was only seen in the unfenced, cattle-pugged, exposed and seriously degraded fen between the swamp forest of the reserve and farmland. Although locally common on eight karamū hikoa and three tapatapa in an area of c. 1 ha, none of the trees seen were in good condition, many had partially hollowed out, rotted trunks, and others were 'unstable' in the peat due to wind 'rock' and cattle rubbing themselves on the exposed trunks.

Using area as an estimate of population, *Pyrenula quadratolocularis* has a known area of occupancy of c. 2 ha, with both subpopulations (Pana | Blind Jim's and Te Awatea) of roughly equal size. The decline rate of the phorophyte 'hosts' can be estimated from the loss of trees at Pana | Blind Jim's, where four of the original 11 trees had collapsed and were either in ill-thrift or dying — a loss of 36% over four years. This data places the *Pyrenula* in 'Threatened / Nationally Endangered' (NEu3h) ['Small population that is forecast to decline 10–50% over the longer of the next 10 years or three generations (maximum 100 years)'… 'classified as Nationally Endangered when evidence indicates that it will experience a decline of 10–50% over the longer of the next 10 years or three generations (maximum 100 years) and meets one of the following size criteria… 'the total area of occupancy is 1–10 ha (0.01–0.1 km^2) (h)'] (Rolfe et al., 2022: 26). To this assessment the qualifiers 'DPS' [Data Poor Size] and 'DPT' [Data Poor Trend] cannot be added as we have no quantitative data for this conservation

assessment. Other suitable qualifiers suggested here are 'IE' [Island Endemic], 'PF' [Population Fragmentation] because the species is currently believed endemic to the Chatham Islands, and the only known sites are smaller fragments of a formerly contiguous swamp forest / fen system stretching along the shoreline of Te Whanga and Lake Huro.

Etymology: The species epithet *quadratolocularis* refers to the square nature of the spore locules when viewed under the microscope.

Pyrenula solomonii A.J. Marshall, de Lange, Blanchon & Aptroot sp. nov.

Mycobank accession number: 860253

Type: AOTEAROA | NEW ZEALAND, RĒKOHU | WHAREKAURI | CHATHAM ISLAND, Nikau Bush Conservation Area, 43.762203°S, 176.570593°W, 41 m, *P. J de Lange (CH4129)*, 27 June 2021. On bark of *Coprosma chathamica* (*holotype* UNITEC12906, *isotype* AK).

Diagnosis: *Pyrenula solomonii* is distinguished from other species of *Pyrenula* by the pinkish thallus, flattened ascomata largely immersed in the substratum and 7–10 transversely septate ascospores, 37–52 × 6–8.5 µm.

Description (Fig. 7): Corticolous. ***Thallus*** crustose, without pseudocyphellae, pink to pink-grey when fresh, turning beige/orange to pale pink on storage, surface minutely rugose, corticate, in irregular patches up to 30 mm in diameter, 120–280 µm thick, UV–. ***Prothallus*** black, 150–500 µm wide. ***Photobiont*** green, trentepohlioid cells oblong to elongate cells 15.0–17.5 × 7.5 µm. ***Ascomata*** solitary to crowded, flattened, black, 0.5–1.4 mm (n = 30) in diameter, partially immersed in the thallus, ostiole apical, often indistinct, 80–140 µm wide, wall carbonised, 80–300 µm thick, K–. ***Hamathecium*** hyaline, not inspersed, IKI–, hamathecium filaments simple, 0.8–1.3 µm thick. ***Asci*** 8-spored, spores irregularly arranged, cylindrical to clavate, 55–85 × 12–18 µm. ***Ascospores*** fusiform-musiform, 7–9-septate, cells angular with terminal lumina adjacent to the endospore wall, initially hyaline but becoming brown at maturity, 37–52 × 6.0–8.5 µm (n = 30). ***Pycnidia*** common, black, punctiform, 180–340 µm. ***Conidia*** filiform, straight-curved, 12–20 × 0.8–1.4 µm (n = 30).

Paratype: — AOTEAROA | NEW ZEALAND, RĒKOHU | WHAREKAURI | CHATHAM ISLAND: Nikau Bush Conservation Area, *P.J. de Lange CH4105*, 21 September 2019, UNITEC12866.

Recognition: *Pyrenula solomonii* is most similar in its thallus morphology to *P. quadratolocularis*, having somewhat flattened ascomata (Fig. 7C), although it differs in the thallus colour being pinkish rather than grey-white/brown (Fig. 7A, B) and having different spore morphology (see recognition section for *P. quadratolocularis* above). Spore morphology is closest to *P. moniliformis* (Fig. 1F, G), from which it differs by having more septa (7–9 rather than 5–7; Fig. 7D–F) and smaller ascospores (37–52 × 6.0–8.5 µm rather than 55–68 × 10.0–12.5 µm), and *P. largei* from which it differs by having less septa (10–18 for *P. largei*) and smaller spores (70–100 × 10–15 µm for *P. largei*). Differences with internationally recognised taxa are discussed in the recognition sections above.

Distribution: Presumed endemic to the Chatham Islands, Aotearoa | New Zealand.

Ecology: *Pyrenula solomonii* is only known from three collections (the holotype, isotype and an earlier collection) made from the same phorophyte, a solitary karamū hikoa (Fig. 7A) at the type locality Nikau Bush Conservation Area, so little can be said about its ecological preferences and associated species. When it was discovered in September 2019, it was considered common on that tree but it was not seen elsewhere. Since then the adjacent forest canopy of mostly kopi (*Corynocarpus laevigatus* J.R. Forst. & G. Forst.) has thickened around the karamū hikoa, shading it such that it is now in ill-thrift, possibly even terminal decline. At the time of discovery *Pyrenula solomonii* was noted growing with an undetermined species of *Arthonia* Ach.

Conservation Status: Using the New Zealand Threat Classification System (Rolfe et al., 2022), *Pyrenula solomonii* could either be assessed as 'Data Deficient' or 'Threatened | Nationally Critical'. As noted above, the default preference for threat assessments using this classification system is to pick a more definitive category wherever possible (Rolfe et al., 2022: 23) 'Expert panels should use Data Deficient only when there is extreme uncertainty about the abundance and population trend of an organism, i.e. the possible categories it truly occupies cover most or all of the range from Nationally Critical to Not Threatened'. In this case, whilst *Pyrenula solomonii* is certainly cryptic, its pinkish colouration does help distinguish it from other lichens on potential 'host' trees, and there have been dedicated surveys for it in Nikau Bush Conservation Area (between 2020 and 2025) by Peter de Lange, and opportunistic surveys

Fig. 8. Māui Solomon LLB *Canterb.* (image provided by Māui Solomon)

elsewhere on Rēkohu | Wharekauri | Chatham Island so far failing to disclose further specimens. Therefore, we think it appropriate to recommend a conservation assessment of 'Threatened | Nationally Critical' (NCn1a,g) ['Very small population (natural, unnatural or population state unknown) regardless of the trend (NCn1, NCn2, NCu1, NCu2, NCu3, NCu4, NCu5, NCu6, NCx1, NCx2)'…' The total population size is fewer than 250 mature individuals (a), The total area of occupancy is less than 1 ha (0.01 km^2) (g)'] due to the small area of occupancy <1 ha [one tree], an estimated population size of 30 'individuals'(excepting that delineation of an individual in this species is difficult due to the growth habit) in 2019 down to three 'individuals' in 2025 (decline rate of 90% in seven years). To this assessment we suggest adding the qualifiers 'DPR' [Data Poor Recognition], 'IE' [Island Endemic], and 'OL' [One Location].

Etymology: Named in honour of Māui Solomon (6 September 1960 —) (Fig. 8), a resident of Rēkohu, who is a barrister (graduate of the University of Canterbury law school) and indigenous rights activist, mediator and negotiator. Māui was born in Te Muka, Te Waipounamu | South Island. His Moriori hokopapa (descent) is through Tame Horomona Rehe (also known as 'Tommy Solomon') (7 May 1884 — 19 March 1933) his grandfather, often referred to as 'the last full-blooded Moriori', as well Ngāi Tahu and Pakeha [European]. Māui was instrumental in achieving legal recognition for Moriori as a distinct people from Māori, the revival of their language (Ta Re) and culture, the building of Kopinga Marae, and the Moriori Claims Settlement Act 2021. He has been chair of the Moriori Hokotehi Trust Board and is current chair of the Moriori Imi Settlement Trust. Aside from being a passionate and committed advocate for Moriori, Māui is a keen conservationist and together with his hunau [family] has been restoring the korowai [cloak] of indigenous vegetation at Manukau, east of Ouenga | Owenga, on land that was granted by Native Land Court to Moriori (3% of the island) in the 1870s.

Revised key to *Pyrenula moniliformis* and segregates

1. Ascospores under 70 µm long. . . . . 2.

– Thallus brown, corticate, ascospores 70–100 × 10–15 µm . . . . . .*Pyrenula largei*

2. Ascospores greater than 35 µm long . . . . . 3.

– Thallus white-cream, ascospores 22–30 × 8–10 µm . . . . . *Pyrenula dalmatioides*

3. Ascospores transversely septate . . . . . 4.

– Ascospores curved, submuriform with square/rectangular locules, 38–45 × 12–15 µm. . . . . *Pyrenula quadratolocularis*

4. Ascomata flattened, ascospores 7–9-septate, 37–52 × 6.0–8.5 µm . . . . . *Pyrenula solomonii*

– Ascomata erumpent, ascospores 5–7-septate, 55–68 × 10.0–12.5 µm . . . . . *Pyrenula moniliformis*

Acknowledgments

The authors would like to thank the staff of the herbaria throughout Aotearoa | New Zealand who assisted with viewings of collections of the genus including Auckland War Memorial Museum (AK), Museum of New Zealand Te Papa Tongarewa (WELT), Manaaki Whenua — Landcare Research (CHR) and University of Otago (OTA). We thank Mark Carine (BM) for use of the image reproduced in Figure 1D, which is reproduced under a Creative Commons Attribution CC BY licence and is © copyright The Trustees of the Natural History Museum, London. Mark Large and Māui Solomon provided Figures 5 and 8, respectively. We thank Ngāti Kuri, notably Sheridan Waitai, and the taiao team who assisted with survey in Te Hiku-o-te-Ika | Far North of Aotearoa | New Zealand and allowed our disclosure of specimens collected within their rohe, also the Adshead family for permission to survey at

the Mataia QEII Covenant. Cameron Kilgour assisted with many collections, and the first author's immediate family permitted forays to collect while on holiday, with special thanks to Harriet and Kevin Marshall who joined on several muddy trips into the mangroves to survey and collect. We appreciate the reviewers of the submitted manuscript for their comprehensive and helpful comments.

ETHICS DECLARATION

The authors declare no conflict of interest.

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Чотири нові види роду *Pyrenula* (*Pyrenulaceae*)
з Аотеароа | Нової Зеландії, виділені з *P. moniliformis*

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Реферат. Лишайники роду *Pyrenula* (*Pyrenulaceae*) в Аотеароа | Новій Зеландії востаннє детально вивчав Галловей (Galloway, 2007), який закликав до подальшого планомірного збору зразків. Зібрані відтоді додаткові матеріали, зокрема з північної частини Північного острова та архіпелагу Чатем, призвели до критичного перегляду раніше ідентифікованих зборів і до кращого розуміння обсягу виду в межах цього роду. Серед таксонів, що потребували перегляду, був загадковий вид *Pyrenula moniliformis*, відомий лише з типового місцезростання. Цей вид віднайшли у колекціях гербарію UNITEC з регіону Окленд у Новій Зеландії. Віднайдення виду і критичне вивчення цих та інших зразків, які включали до складу *P. moniliformis*, дозволили провести детальне морфологічне порівняння, зокрема перегородок і розміру аскоспор, і встановити, що *P. moniliformis sensu lato* насправді містить декілька таксонів. У статті ми подаємо уточнений опис *P. moniliformis sensu stricto*, а також описуємо чотири нові види: *P. dalmatioides* A.J. Marshall, Blanchon, Aptroot & de Lange, *P. largei* A.J. Marshall, de Lange, Blanchon & Aptroot, *P. quadratolocularis* A.J. Marshall, de Lange, Blanchon & Aptroot, і *P. solomonii* A.J. Marshall, de Lange, Blanchon & Aptroot. Для цих п'яти видів наведено морфологічні описи, екологічні особливості, поширення та оцінка природоохоронного статусу, а також ключ для визначення представників комплексу *Pyrenula moniliformis*.

Keywords: Аотеароа | Нова Зеландія, архіпелаг Чатем, ліхенізована мікобіота, таксономія лишайників, *Pyrenula*, *Pyrenula moniliformis*, *Pyrenula dalmatioides* sp. nov., *Pyrenula largei* sp. nov., *Pyrenula quadratolocularis* sp. nov., *Pyrenula solomonii* sp. nov.