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RESEARCH ARTICLE

## Five new additions to the lichenized mycobiota of the Aotearoa / New Zealand archipelago

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**Abstract.** As part of ongoing studies of the lichenized mycobiota of the Aotearoa / New Zealand archipelago we provide formal documentation of the occurrence of *Alyxoria ochrocheila*, *Anisomeridium anisobolobum*, *Fissurina dumastii*, *Porina americana* and *Zwackhia viridis*. Through their formal documentation in peer-reviewed literature these species can now be accepted as new additions to the lichenized mycobiota of that region.

**Keywords:** *Alyxoria ochrocheila*, *Anisomeridium anisobolobum*, *Fissurina dumastii*, *Porina americana*, *Zwackhia viridis*, Aotearoa / New Zealand, lichenized mycobiota, new additions

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### Introduction

The Aotearoa / New Zealand archipelago (268 021 km<sup>2</sup>) is by world standards considered rich in lichens (Galloway, 1985, 2007a, b, 2008), with c. 2026 taxa currently recognized (de Lange et al., 2018). Yet despite two *Flora* treatments (Galloway, 1985, 2007a, b), and two conservation threat listings (de Lange et al., 2012, 2018), it is estimated that perhaps as much as 15% of the taxa are yet to be described or discovered (Galloway, 2007a; de Lange et al., 2018). Although lichens are widely used internationally as bioindicators of pollution and of forest health in general (Rose, 1974, 1976, 1992; Selva, 1994; McCune, 2000; Zedda, 2002), for this use to be effective it is necessary to understand the lichen diversity and composition of the different

vegetation associations being monitored. Recent international studies (e.g. Vondrák et al., 2018) have discussed monitoring techniques and the importance of lichens as bioindicators, but in Aotearoa / New Zealand despite recognition of the ecological importance of lichens (Scott et al., 1997; Ryan, 2002; Porada et al., 2013; Ranft et al., 2018), they are not usually collected and identified for monitoring purposes (de Lange et al., 2012), or if this is attempted, it is incompletely carried out. For example, the Aotearoa / New Zealand Department of Conservation (DOC, 2017) has installed an extensive series of permanent vegetation monitoring plots throughout New Zealand to monitor impacts of global warming and ecosystem health, sampling from these plots macrolichens, but not the crustose taxa (DOC 2017; S. Rowland pers. comm., January 2019). At

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Fig. 1. The Aotearoa / New Zealand archipelago, showing the locations where the lichens reported in this paper were collected

the regional level, the Auckland Council maintain 257 similar permanent plots but do not record lichens at all (Khin, 2013). To remedy this, a project was initiated by Unitec Institute of Technology and Auckland Council (Unitec Institute of Technology Project RE15008) in which a complete inventory of the lichens present within 50 of the 257 Auckland Council permanent vegetation monitoring plots (400 m<sup>2</sup>) was undertaken. These 50 plots encompass the full diversity of indigenous forest vegetation associations within the Auckland region (Fig. 1). To date, we have collected nearly 3000 lichen specimens from these plots, the ongoing analysis of which has uncovered a number of lichen taxa that are either new and required formal description (e.g., *Ocellularia jacinda-aderniae* A.J.Marshall, Blanchon, Lücking et de Lange (Marshall et al., 2019a) or are additions to the New Zealand lichenized mycobiota e.g., *Pertusaria endoxantha* Vain (Marshall, Blanchon, 2017) and five new *Pyrenula* Ach. species records (Marshall et al., 2019b).

Similar studies, albeit in a less-structured way, are being carried out in other regions and on offshore island groups where the lichenized mycobiota is poorly known. For example, five new species of *Buellia* were described from Otago in 2017 (Elix, Knight, 2017; Elix et al., 2017), three new species and five new species records were noted from the Antipodes, Auckland and Campbell islands (Elix, 2018), while a study of collections of lichens from the Kermadec Island group uncovered unexpected lichen diversity, including a new species, *Buellia insularicola* Elix & de Lange and new species records of *Amandinea* M.Choisy ex Scheid. & H.Mayrhofer, *Buellia* De Not., *Pseudocyphellaria* Vain., *Ramalina* Ach. and *Sticta* (Schreb.) Ach. (de Lange, Galloway, 2011; de Lange, Blanchon, 2011; Elix, de Lange, 2017). Similarly, a new species of *Lecanora* Ach., *L. kohu* Printzen, Blanchon, Fryday & de Lange, was described from the Chatham Islands (Printzen et al., 2017).

As part of three wider projects documenting the lichens of the Auckland Region, Chatham Islands and the Kermadec Islands, we intend to publish new discoveries and taxa new to science as a precursor to more comprehensive listings for these areas. Therefore, in this paper we formally add and provide descriptions for five lichen species that are additions to the currently accepted Aotearoa / New Zealand lichenized mycobiota (de Lange et al., 2018).

## Materials and Methods

Lichen specimens were collected from trees within 400 m<sup>2</sup> permanent vegetation plots within the Auckland Region, or opportunistically on the Chatham Islands. Specimens were examined with standard microscopic techniques (Marshall et al., 2019a), with all photographed cross-sections mounted in water. The chemical constituents were studied using thin-layer chromatography (Culberson, 1972; White, James, 1985) using solvent C. Voucher specimens were deposited in the herbarium at Unitec Institute of Technology/Te Pūkenga (UNITEC).

## Results and Discussion

The new records discussed here were discovered in the Auckland Region (Fig.1) at: Dingle Dell (36.858853° S, 174.856314° E, 34 m a.s.l.), an area of indigenous vegetation that had been mostly cleared and then revegetated (Wilcox et al, 2013), an area of coastal regenerating forest dominated by tree ferns close to Hillsborough Cemetery (36.928952° S, 174.753115° E, 45 m a.s.l.), a small remnant of mature totara (*Podocarpus totara* D.Don var. *totara*) forest at Walpole Avenue Reserve (37.015621° S, 174.894990° E, 48 m a.s.l.), Swanson Reserve (36.861178° S, 174.590520° E, 64 m a.s.l.), and Roosevelt Reserve (37.200318° S, 174.915582° E, 102 m a.s.l.). A further species discussed here, *Zwackhia viridis* (Ach.) Poetsch & Schied. whose discovery without a species description was discussed by Marshall & de Lange (2020) is so far only known from collections made from Nikau Bush (43.762325° S, 176.573426° W, 57 m a.s.l.) on Rēkohu / Chatham Island (Fig. 1). All of the records have so far been found at only one or two locations, so further searching is warranted to understand the exact range of these species in Aotearoa / New Zealand.

## New Lichen Records

*Alyxoria ochrocheila* (Nyl.) Ertz & Tehler *Fungal Diversity* 49 (1): 50. 2011.

(≡ *Opegrapha atra* f. *ochrocheila* (Nyl.) Leight., = *Opegrapha atricolor* Stirt., ≡ *Opegrapha ochrocheila* Nyl., = *Opegrapha rubescens* Sandst., = *Opegrapha wainioi* Zahlbr.)

**Description (Fig. 2).** Thallus effuse, spreading, very thin or immersed, inconspicuous, smooth or cracked, whitish, white-grey rarely tinged brownish or olive-green, lacking a prothallus. Ascomata 0.6–2.5 × 0.18–0.25 mm, 0.06–0.1 mm high, sessile, simple or branched, straight to flexuose, sometimes irregularly gnarled, sinuous or rarely stellate, scattered or contiguous; exciple and sometimes the disc encrusted with a bright orange/red-orange pruina of unknown composition, K+ magenta, rarely totally absent; disc a slit, occasionally widening to a broad disc with a thin margin; epihymenium red-brown; hymenium 45–60 µm tall, faint I+ blue in upper part, strongly I+ red in lower part; subhymenium I+ pale blue. Hypothecium pale brown, 15–25 µm tall, I+ blue; paraphysoids to 1.5 µm. Asci claviform, 45–55 × 10–15 µm. Ascospores 12.5–15(–20) × 3–5 µm, clavate, one of the median cells enlarged, 3-septate. Pycnidia and conidia so far not observed in Aotearoa / New Zealand material.

**Chemistry:** Thallus C–, K+/- purple (pruina), KC–, P–, UV–.

**Specimen seen.** Aotearoa / New Zealand, Te Ika a Māui / North Island, Tāmaki Makarau / Auckland, Hillsborough, Hillsborough Rd, Hillsborough Cemetery, A.J. Marshall (AM22L) & S. Graham, 2 Oct 2016, UNITEC 9476.

**General geographical distribution:** Europe (e.g., Belgium, France, United Kingdom, Ireland, Poland), North America (United States of America), Africa (Angola, Gabon, Rwanda), Asia (Papua New Guinea, Philippines) (Cannon et al., 2021; Ertz, 2008; Nash et al., 2007).

**Notes:** In the field *Alyxoria* has a superficial resemblance to species of *Opegrapha* with a white thallus, distinctive black lirellae and three-septate ascospores. However, none of the members of *Opegrapha* currently recognised in the New Zealand lichenized mycobiota (Galloway, 2007; de Lange et al., 2018) possess the striking orange pruina (Fig. 2) that turn deep purple when spot-tested with potassium hydroxide solution. However, the species is regularly found lacking pruina (e.g. in Europe), so collections of *A. ochrocheila* may be present in herbarium collections

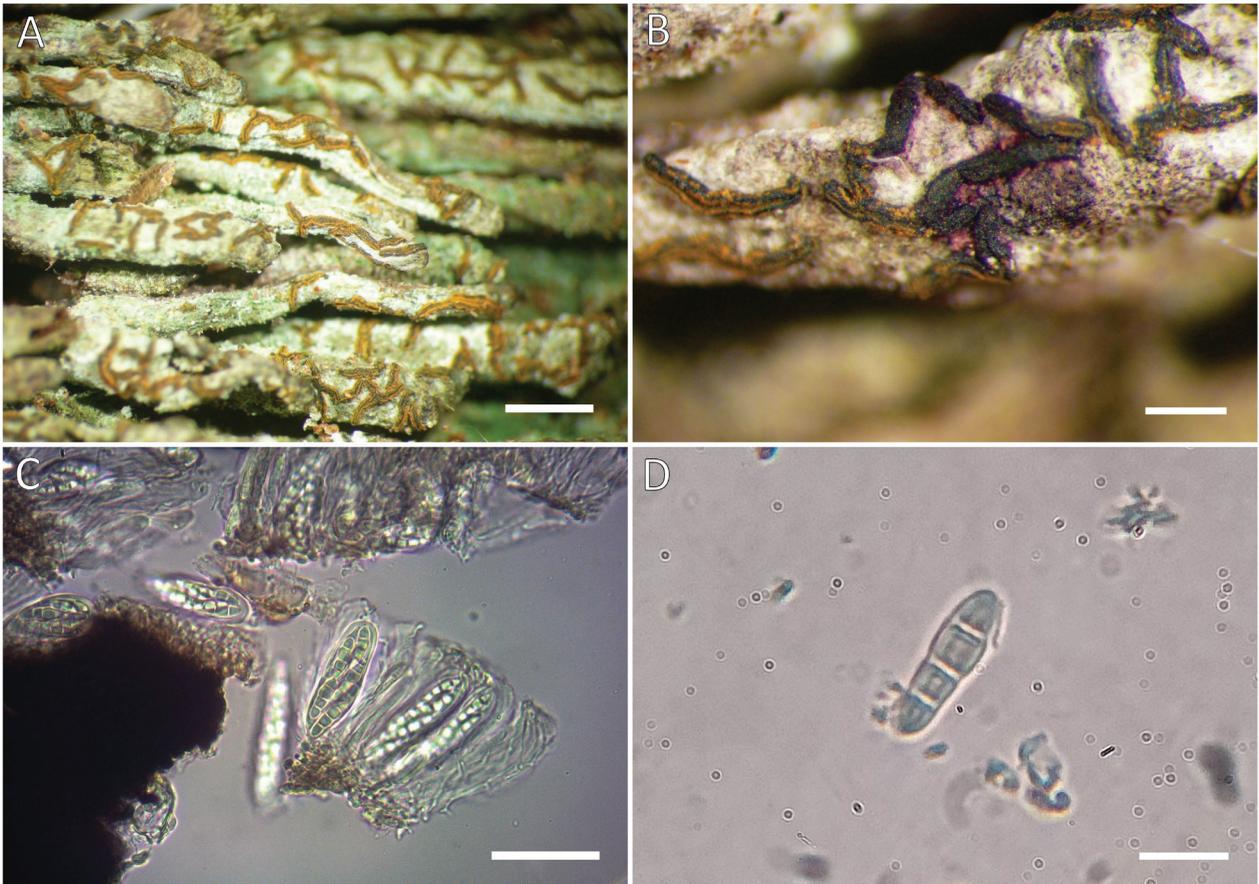


Fig. 2. *Alyxoria ochrocheila*. A: thallus of *Alyxoria ochrocheila* with vibrant orange pruina on lirellae, scale = 1.5 mm; B: close-up of lirellae showing K<sup>+</sup> purple reaction of orange pruina, scale = 0.5 mm; C: 8-spored asci, scale = 40 µm; D: ascospore of *Alyxoria ochrocheila*, with one of the median cells wider than others, scale = 10 µm (images from UNITEC 9476: A.J. Marshall)

incorrectly identified as *Opegrapha* (Ertz, pers. comm., May 2022; Cannon et al., 2021).

*Alyxoria ochrocheila* has a subcosmopolitan distribution (Cannon et al., 2021; Ertz, 2008; Nash et al., 2007) but so far it has only been collected from one location in Aotearoa / New Zealand. This lack of collection is surprising given the striking orange pruina which are most unusual for members of the *Arthoniales* present in Aotearoa / New Zealand [*Coniocarpon cinnabarinum* DC. (*Arthoniaceae*) also has orange pruina but has not been collected within the fifty plots performed within our study]. *Coniocarpon* is best distinguished from *Alyxoria* by the short ascomata with lack of carbonization in the walls and by the 4–7-septate rather than 3-septate ascospores which are wider (5–8 µm c.f., 3–5 µm in *Alyxoria ochrocheila*), longer (20–26(–30) µm c.f. 12.5–15(–20) µm in *A. ochrocheila*) and clavate with an enlarged upper cell (macrocephalic).

The *Alyxoria* specimen was collected from the trunk of a *Cyathea dealbata* (G.Forst.) Sw. tree fern in a regenerating urban forest fragment in West Auckland. Other species growing alongside included *Lepraria ulrikii* Grewe, Barcenas-Peña, R. Diaz & Lumbsch, *Chrysothrix xanthina* (Vain.) Kalb and *Coenogonium luteum* (Dicks.) Kalb & Lücking.

During surveys of Auckland vegetation plots, a sterile white crust similar to *Alyxoria* can often be observed on the lower caudex of mature tree ferns (*Cyathea* Sm. spp.), particularly *Cyathea dealbata*. Possibly this crust is *Alyxoria*, irrespective, careful scrutiny of *Cyathea* is now needed to find further specimens of this species. To that end a further survey of the area where the specimen was collected to find more fertile material and ascertain population size was unsuccessful; further survey of indigenous forest remnants along the same stretch of coastline would be worthwhile.

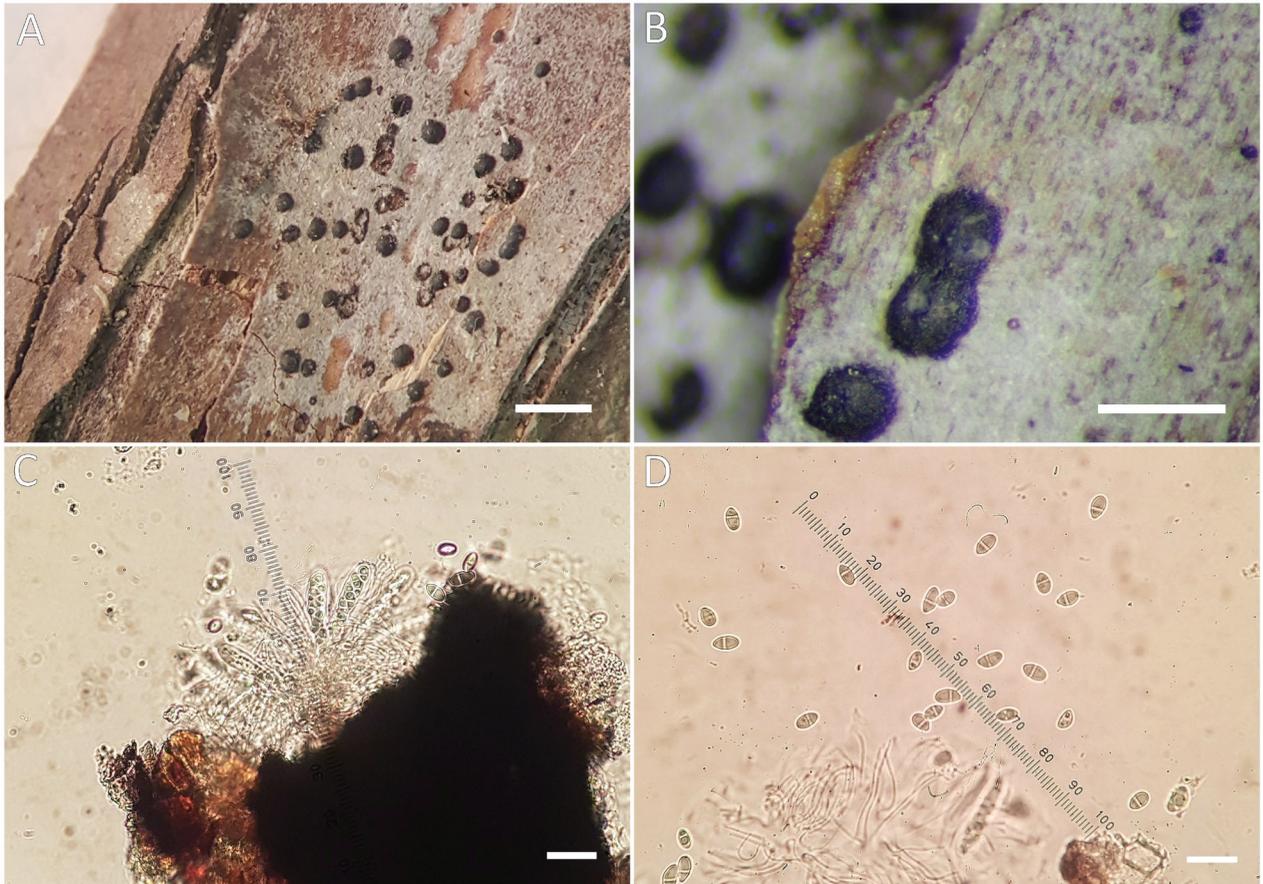


Fig. 3. *Anisomeridium anislobum*. A: thallus of *Anisomeridium anislobum*, scale = 2 mm; B: close up of perithecia, scale = 1 mm; C: close up of perithecia, scale = 1 mm; D: asci, scale = 30  $\mu$ m; E: ascospores with one locule distinctly bigger than the other, scale = 30  $\mu$ m (images from UNITEC 10576: A.J. Marshall)

***Anisomeridium anislobum* (Müll. Arg.) Aptroot, Bibliotheca Lichenologica 57: 21. 1995.**

( $\equiv$  *Arthopyrenia anisloba* Müll. Arg.,  $\equiv$  *Ditremis anisloba* (Müll. Arg.) R.C. Harris).

**Description (Fig. 3).** Thallus whitish to grey, UV–, smooth-varnished, possibly appearing white-maculate (original description). Ascomata perithecioid, black, matt, mostly solitary or occasionally aggregated, 0.25–0.5 mm in diameter, ostiole apical or slightly off-centre and often inconspicuous, dimidiate (outer wall only covering upper half); paraphyses thread-like, entangled, connected and branched, asci clavate, c. 50–75  $\times$  18–25  $\mu$ m, with a thick wall, spores 8 per ascus, irregularly uniseriate, smooth, straight, cuneiform-obovoid, 1-septate with the lower cell smaller and the upper one larger, with rounded ends, often constricted at septum (12.5–)15–20  $\times$  7.5–10  $\mu$ m.

**Chemistry:** Thallus K–, C–, KC–, PD–, UV–, TLC, no lichen products detected.

**Specimen seen:** Aotearoa / New Zealand, Te Ika a Māui / North Island, Tāmaki Makarau / Auckland, St Heliers, Dingle Dell Reserve, A. J. Marshall 32BE & J. Anderson, 13 Sep 2016, UNITEC 10576.

**General geographical distribution:** Pantropical (Aptroot et al., 1994; Aptroot et al., 2022; Harris, 1990).

**Notes:** *Anisomeridium anislobum* differs from *A. subatomarium* (C.Knight) R.C.Harris by having larger perithecia that are not immersed in the substratum (0.2 mm for *A. subatomarium* whereas the perithecia varied from 0.25 to 0.5 mm in the material examined). It differs from *A. biforme* (Borrer) R.C.Harris as its spores have a distinctly sub-median septum (Fig. 3). Spores are uniseriate to irregularly arranged in the ascus, with distinctly rounded ends, lacking the apical ‘complex dimple’ (Galloway, 2007) of *Acrocordia gemmata* (Ach.) A.Massal. *Anisomeridium anislobum* also differs from *A. subbiforme* (C.Knight) R.C.Harris, as the spores are a different shape and are not biseriate in the ascus as suggested by Galloway (2007).

*Anisomeridium anislobum* is widely distributed in the tropics and subtropics (Aptroot et al., 1994, 2022; Harris, 1990), but has so far only been collected from the one location from Aotearoa / New Zealand. That specimen (UNITEC 10576) was found growing on nikau (*Rhopalostylis sapida* H.Wendl. & Drude) in Dingle Dell Reserve, Auckland an urban indigenous forest enhanced by deliberate plantings (Esson, 1960; Wilcox et al., 2013). Other lichen species present on the same host species are diverse, but the most commonly encountered include *Mazosia phyllosema* (Nyl.) Zahlbr., *Opegrapha agelaeoides* Nyl. and *Arthonia peraffinis* Nyl. Considering the vegetation history of Dingle Dell, a habitat derived from regenerating coastal forest and deliberate plantings, it is intriguing that, aside from the *Anisomeridium*, the same location had three species of *Pyrenula* new to Aotearoa / New Zealand (Marshall et al., 2019). This is not what one would expect for lichen diversity, as typically only natural indigenous vegetation would support unusual lichen taxa (Galloway, 2008). Dingle Dell should be studied further to understand the occurrence of this unexpected diversity. Being surrounded by urban development it is uncertain whether some of the species occurrences are as a result of recent introductions, or, more likely, whether they indicate a level of forest continuity in the area overlooked by Wilcox et al. (2013), who documented the vegetation history of Dingle Dell. We further assume that the lack of previous records probably also reflects that the crustose lichens of Aotearoa / New Zealand are still very poorly collected and studied by lichenologists (de Lange et al., 2012).

*Fissurina dumastii* Fée, *Essai Crypt. Écorc.* 45. 1825 (≡ *Graphis dumastii* (Fée) Spreng., = *Graphis glauca* Müll.Arg., = *Fissurina glauca* (Müll.Arg.) Staiger.)

**Description (Fig. 4).** Thallus green, thin, smooth, glossy. Ascomata inconspicuous, rare to abundant, immersed, indicated by a thin line between the two thin lips, sometimes slightly open, somewhat raised and paler than the thallus, straight, curved or sinuous, often branched, 1–3 mm long, 0.05–0.15 mm wide. Proper exciple absent. Hymenium 100–125 µm thick. Ascospores overlapping-uniseriate, ellipsoid to clavate, 4-locular, 16–20 × 8–10 µm, I–.

**Chemistry:** Thallus K–, C–, KC–, PD–, UV–, TLC, no lichen products detected.

**Specimens seen:** Aotearoa / New Zealand, Te Ika a Māui / North Island, Tāmaki Makarau / Auckland. Manurewa, Walpole Avenue Reserve, *A. J. Marshall*

38AB & *D.J. Blanchon*, 2 Oct 2017, UNITEC 12873; Manurewa, Walpole Avenue Reserve, *A.J. Marshall & P.J. de Lange*, 8 Apr 2022, UNITEC 13369; Manurewa, Orford Park, *A.J. Marshall & P.J. de Lange*, 8 Apr 2022, UNITEC 13368.

**General geographical distribution:** Pantropical (Archer, 2009; Joshi et al., 2013).

**Notes:** Within the New Zealand lichenised mycobiota, *Fissurina dumastii* resembles *F. insidiosa* C.Knight & Mitt. in having no demonstrable chemistry and pale lirellae. However, *Fissurina dumastii* lacks the black prothallus of *F. insidiosa*, has less conspicuous and shorter lirellae (thickened in *F. insidiosa*) that are more often branched, and a mainly continuous thallus (less fissured and lacking the shallow verrucae characteristic of *F. insidiosa*) (Fig. 4). Within the material examined the abundance and density of lirellae varied (Fig. 4) and the small, inconspicuous nature of the lirellae, combined with low light, made it difficult to distinguish this species in the field from other lichens, notably *Porina exocha* (Nyl.) P.M.McCarthy on the same tree without a 10× hand lens. The taxonomy of *F. dumastii* is not settled; the type has weakly amyloid ascospores and apically spinulose paraphyses, but most other records show inamyloid ascospores and smooth paraphyses.

*Fissurina dumastii* is pantropical in distribution, and has previously been recorded from Australia, Indonesia, India, Thailand, Vietnam, the Solomon Islands, Brazil, Bolivia, Colombia, and the southeastern United States of America, among other countries (Archer 2009; Joshi et al., 2013). In New Zealand, the species was first collected by us in 2017, growing on the bark of kahikatea (*Dacrydium dacrydioides* (A.Rich) de Laub.) at Walpole Avenue Reserve in Manurewa, Auckland. A return to the site found more material on this host, and also a small population growing on rewarewa (*Knightia excelsa* R.Br.), another hard-barked tree, and a search of another nearby reserve (Orford Park) found another population on kahikatea. Both reserves are characterised by tall totara (*Podocarpus totara* var. *totara*) and kahikatea, with *Fissurina dumastii* growing close to the base of these phorophytes, and on their exposed roots in low-light conditions. Lichen diversity at these sites was not high, probably due to the low light levels, sparse understorey (caused by human traffic), their small size and the fact that they are surrounded by residential houses. Associated lichens also suggest that these forest remnants are heavily disturbed, as they are species typical of urban vegetation, and exotic planted trees e.g., *Graphis anfractuosa*, (Eschw.) Eschw., *Opegrapha*

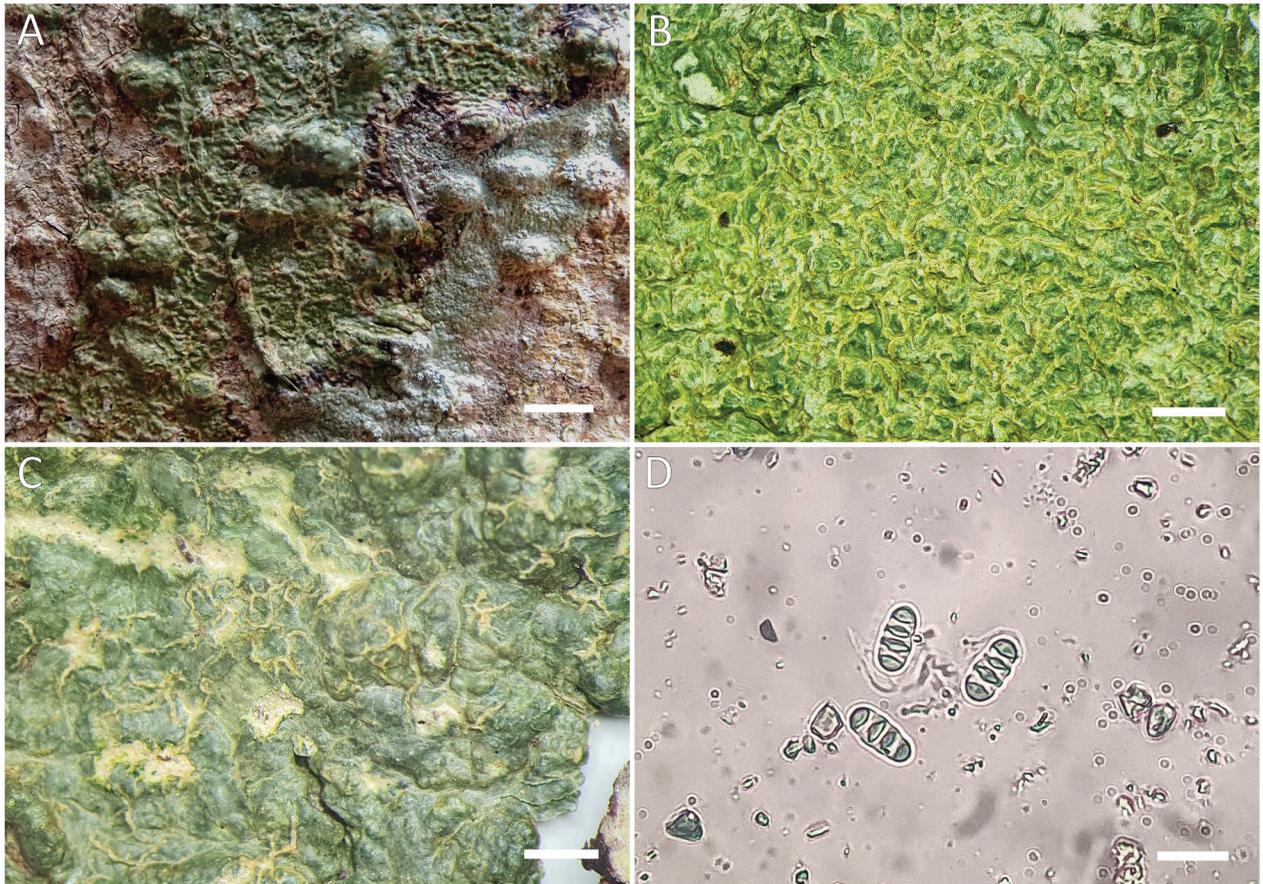


Fig. 4. *Fissurina dumastii*. A: habitus of *Fissurina dumastii* on kahikatea (*Dacrycarpus dacrydioides*) at Walpole Reserve, Manurewa, scale = 1.5 mm (image: P.J. de Lange); B: specimen of *Fissurina dumastii* on kahikatea, lirellae extremely crowded, scale = 1.5 mm; C: specimen of *Fissurina dumastii* from rewarewa (*Knightsia excelsa*), the lirellae more sparse on the thallus, scale = 1.5 mm; D: ascospores, scale = 20  $\mu$ m (images from UNITEC 12870, 12873: A.J. Marshall B–D)

*agelaeoides* Nyl., *Porina exocha*, *Dirinaria applanata* (Fée) D.D.Awasthi, *Parmotrema reticulatum* (Taylor) M.Choisy and *Chrysothrix xanthina*.

***Porina americana*** Fée. *Essai Crypt. Exot. (Paris)* 1: 83. 1825.

( $\equiv$  *Pertusaria americana* (Fée) Mont.,  $\equiv$  *Porophora americana* (Fée) Spreng.)

**Description (Fig. 5).** Thallus epiphloeodal, continuous to richly rimose, pale grey-brown, pale yellow-brown or pale greyish green, matt to slightly glossy, smooth to verruculose, (20–)40–60(–100)  $\mu$ m thick, corticate, occasionally with simple or branched isidioid outgrowths; prothallus not apparent. Algae *Trentepohlia*; cells 7–14  $\times$  7–12  $\mu$ m. Perithecial verrucae hemispherical to subglobose, 0.50–0.75 mm diam.; wall containing a layer of colourless crystals; apex concolorous with the thallus to medium brown; ostiole inconspicuous or in a shallow depression. Involucrellum

apical to dimidiate or extending to exciple base level, yellow-brown to orange-brown, becoming more visible when wet. Centrum 0.25–0.45 mm wide. Exciple 15–25  $\mu$ m thick, pale yellow-brown. Asci elongate-cylindrical, 200–220  $\times$  45–55  $\mu$ m. Ascospores mostly straight or occasionally slightly curved, fusiform to broadly fusiform, (9–)11–12 septate, (85–)100–120  $\times$  20–25(–28)  $\mu$ m including perispore. perispore distinct, 4–6  $\mu$ m thick. Pycnidia not seen.

**Chemistry:** No lichen products detected.

**Specimens seen:** Aotearoa / New Zealand, Te Ika a Māui / North Island, Tāmaki Makarau / Auckland. Swanson, Swanson Scenic Reserve, A.J. Marshall 34BV & J. Anderson, 13 Oct 2016, UNITEC 12871; Swanson, Swanson Scenic Reserve, A.J. Marshall 34G & J. Anderson, 13 Oct 2016, UNITEC 12870; Pukekohe, Roosevelt Reserve, A.J. Marshall 35J & J. Anderson, 17 Oct 2016, UNITEC 12872.

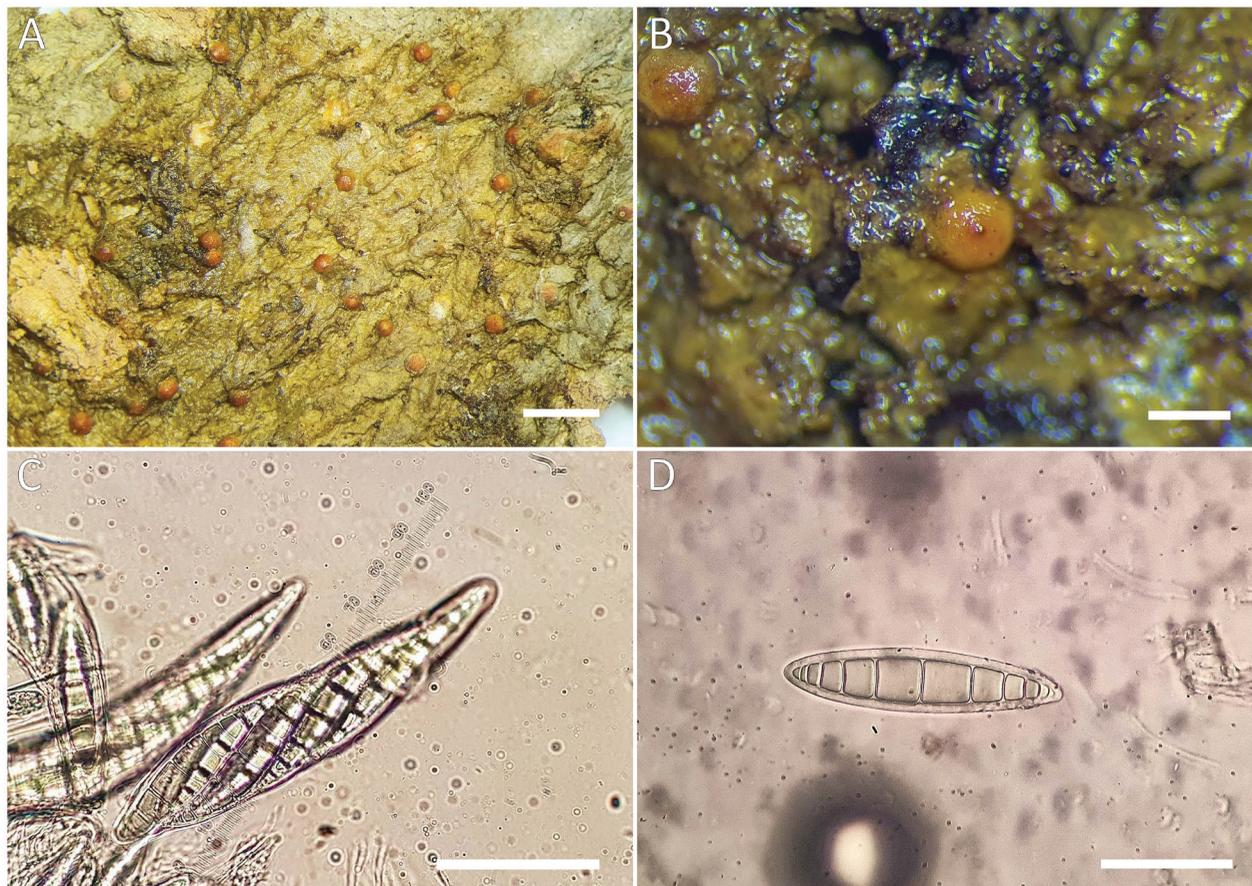


Fig. 5. *Porina americana*. A: thallus of *Porina americana* in wet state with perithecia very noticeable. When dry they are often inconspicuous, scale = 3 mm; B: close-up of perithecium, scale = 1 mm; C: spores in ascus, scale = 100  $\mu$ m; D: ascospore, scale = 35  $\mu$ m (images from UNITEC 12871: A.J. Marshall)

**General geographical distribution:** Pantropical (Rincón-Espita, 2013; Vinayaka et al., 2011).

**Notes:** The species is also known from Colombia, India, Sri Lanka and Thailand (Rincón-Espita, 2013; Vinayaka et al., 2011).

*Porina americana* superficially fits the description of *P. nucula* Ach. (Galloway, 2007) in thallus morphology, but differs in having larger ascospores with a greater number of septae. Spores are strongly halonate as with *P. nucula*, the walls of the perispore being up to 6 microns (Fig. 5).

Future molecular work would ascertain whether this is the same species described by Fée or if there is something different in New Zealand, given that the ascospores appear to be larger than in the description of this species given by Upreti (1994), the ascospores of which were up to maximum of 100  $\mu$ m.

Within New Zealand, this species was found at two sites, c. 90 km apart. The plot at Swanson Scenic Reserve is dominated by large titoki (*Alectryon excelsus* Gaertn. subsp. *excelsus*) and rewarewa (*Knightia excelsa*), and the collections themselves came from rewarewa and mahoe (*Melicytus ramiflorus* J.R.Forst. & G.Forst. subsp. *ramiflorus*). At Roosevill Reserve the plot was dominated by large kohekohe (*Didymocheton spectabilis* (G.Forst.) Mabb, & Holzmeyer) and the collection was corticolous on pukatea (*Laurelia novae-zelandiae* A.Cunn.). At both plots there is a dense canopy causing heavy shade in the understorey where the specimens were collected. Other species occurring in the vicinity include *Mazosia phyllosema* (Nyl.) Zahlbr., *Phyllopsora furfuracea* (Pers.) Zahlbr., and *Coenogonium implexum* Nyl.

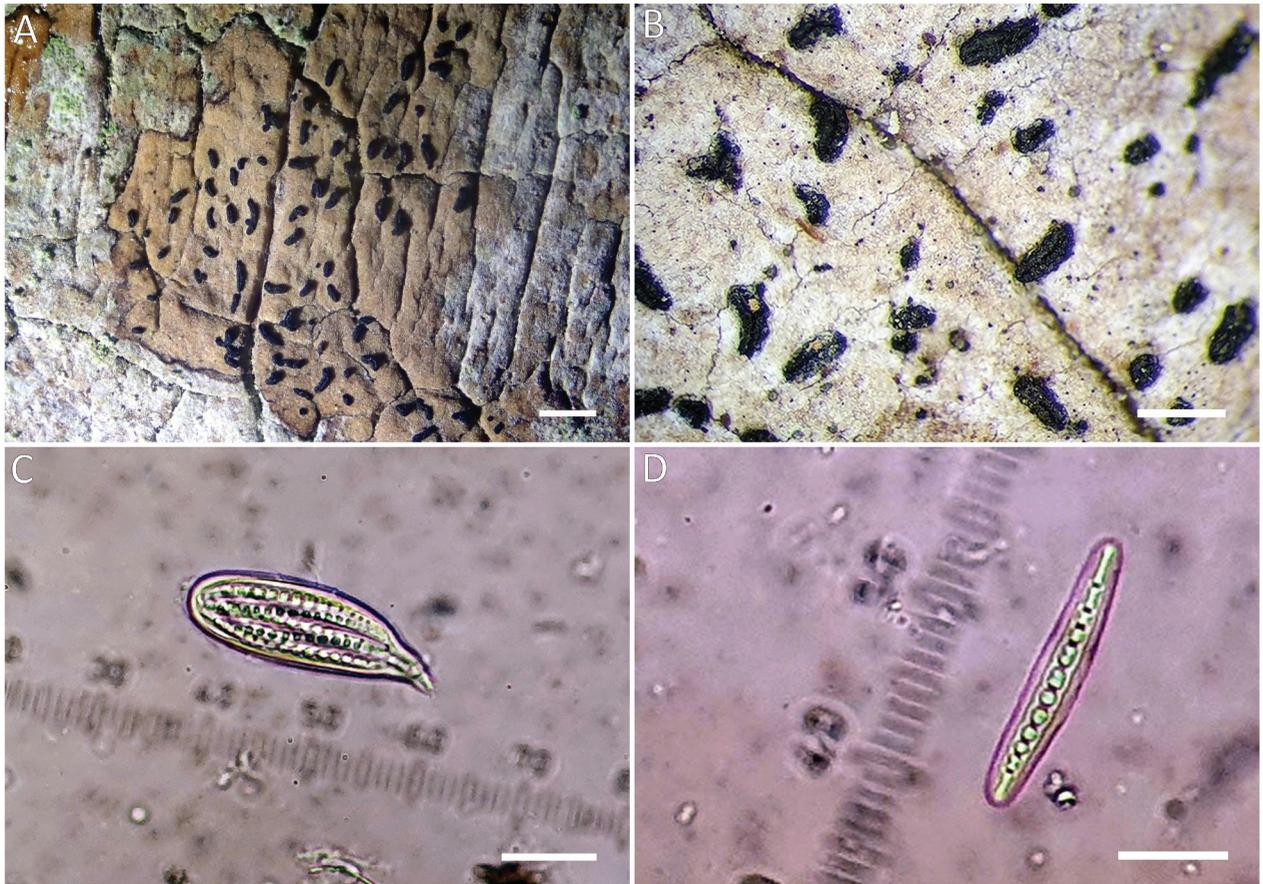


Fig. 6. *Zwackhia viridis*. A: thallus of *Zwackhia viridis* on nikau (*Rhopalostylis sapida*) at Nikau Bush Conservation Area, Rēkohu / Chatham Island, scale = 5 mm; B: close-up of lirellae, scale = 2 mm; C: 8-spored ascus, scale = 35 µm; D: ascospore, terminal cells usually longer than others, scale = 15 µm (images from UNITEC 12163: P.J. de Lange (A–B), A.J. Marshall (C–D))

***Zwackhia viridis*** (Pers. ex Ach.) Poetsch and Schied.  
(≡ *Graphis viridis* (Ach.) Branth, & Rostr., ≡ *Graphis involuta* Wallr., ≡ *Opegrapha viridis* (Ach.) Nyl.)

**Description (Fig. 6).** Thallus inconspicuous to thin, continuous to finely cracked, smooth, pale brown, pale grey, greenish grey, brownish grey or green, matt. Prothallus occasionally present, dark brown, 0.1–0.2 mm wide. Ascomata scattered more or less evenly over the thallus, rarely grouped by 2–4, lirelliform, simple or rarely with 1–2 short to long branches, sessile, black, straight or curved, rarely slightly flexuose, 0.2–1.2 × 0.15–0.3 mm; hymenial disk a slit, not pruinose. Excipulum dark brown, K+ olivaceous (Atra-brown), continuous below the hymenium, 25–50 µm wide laterally, 15–80 µm wide at base. Hypothecium pale brown, 5–20 µm tall, K+ olivaceous, I+ red. Hymenium hyaline, not interspersed with oil droplets, I+ red, 75–120 µm tall; hymenial gel K/I+ blue. Paraphysoids

branched, anastomosing, 1.0–1.5 µm wide, not distinctly enlarged at the apex. Epiphytenium pale brown, I+ red. Asci clavate to ellipsoid, 8-spored, 55–70 × 16–22 µm, with a distinct K/I+ apical blue ring. Ascospores fusiform, hyaline, straight or rarely slightly curved, 10–15(–17)-septate, not constricted at the septa, median cells ± as long as wide in the mature ascospores, terminal locules elongated, 30.0–42.5 × 4.5–7.5 µm, perispore 1.5–2.5 µm wide, hyaline, becoming evenly brown when over-matured. Pycnidia and conidia so far not observed in NZ material.

**Chemistry:** Thallus K–, C–, KC–, PD–, UV–; TLC: no lichen products detected.

**Specimens seen:** Aotearoa / New Zealand, Rēkohu / Chatham Island, Nikau Bush Conservation Area, P.J. de Lange CH3071, 21 Sep 2021, UNITEC 12163; P.J. de Lange CH4119, 27 Jun 2021, UNITEC 12890.

**General geographical distribution:** Cosmopolitan (Ertz, 2008).

**Notes:** Cosmopolitan in distribution (Ertz, 2008), the species has been recorded in Europe, the Americas, Asia, Africa and Oceania.

The thallus of *Zwackia viridis* when fresh often has a greenish tinge – see <https://inaturalist.nz/observations/87944115>. In dry specimens the thallus is whitish, chartaceous and furnished with small, black, almost consistently solitary lirellae (Fig. 6). As with most opegraphoid species, *Zwackia viridis* is best recognised by the spores which are unlike other species currently recognised in the Aotearoa / New Zealand Lichen Flora where they were all treated as *Opegrapha* by Galloway (2007). From these, *Zwackia viridis* is readily distinguished by the spores which have a greater number of septae and longer length (Fig. 6).

As described by Marshall & de Lange (2020) *Zwackia viridis* has so far only been recorded from the trunks of nikau (*Rhopalostylis sapida*), where it co-habits with *Megalaria maculosa* (Stirt.) D.J.Galloway, *Pyrenula nitidula* (Bres.) R.C.Harris and *Usnea* cf. *oncodes* Stirt. Opportunistic surveys elsewhere on the Chatham Islands group has thus far not located further specimens, and it is absent from other lichen collections held in New Zealand herbaria from those islands. Nevertheless, considering its global distribution, as suggested by Marshall & de Lange (2020) it is unlikely that *Zwackia viridis* is not present in the main islands of Aotearoa / New Zealand. They suggested that it is more likely that it has been collected and remains as yet unrecognised in herbaria holdings from those islands, or it has yet to be found there. Lirellate crustose lichens, including *Graphidales* and *Arthoniales*, are as a rule poorly represented in the herbaria of Aotearoa / New Zealand (UNITEC is a notable exception).

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## Ethics Declaration

The authors declare no conflict of interest.

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**Реферат.** Під час досліджень ліхенізованої мікобіоти архіпелагу Нова Зеландія виявлено види *Alyxoria ochrocheila*, *Anisomeridium anisolobum*, *Fissurina dumastii*, *Porina americana* та *Zwackhia viridis*. Внаслідок аналізу відповідних публікацій ці види запропоновані як нові доповнення до ліхенізованої мікобіоти цього регіону.

**Ключові слова:** *Alyxoria ochrocheila*, *Anisomeridium anisolobum*, *Fissurina dumastii*, *Porina americana*, *Zwackhia viridis*, ліхенізована мікобіота, Нова Зеландія, нові знахідки