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Pannaria pyxinoides comb. nov., an overlooked
lichen species from northern New Zealand

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lichen species from northern New Zealand**

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Abstract: The name *Psoroma pyxinoides*, which has been considered to be a synonym of *Pannaria sphinctrina*, is shown here to represent a distinct species, differing from *P. sphinctrina* by thallus characters and in spore and pycnidium morphology. Those characters indicate a relationship with *Pannaria allorhiza*. Like the latter species, *P. pyxinoides* is endemic to northern New Zealand, and is at present known from 11 localities.

Introduction

Tripartite foliose *Pannaria* species are especially adapted to austral forests. Their biodiversity is far from completely known, particularly in New Zealand, which seems to be the centre of speciation. When Elvebakk & Elix (2017) described two new species, they also presented the highly diverse secondary chemistry of the group, and accepted 24 species. Most of those species had been accommodated in *Psoroma* prior to the studies by Jørgensen (2001) and Elvebakk & Galloway (2003).

Psoroma pyxinoides Nyl. is a name given to a species that has been treated as a synonym of *Pannaria sphinctrina* Mont. ex Tuck. in all recent studies, e.g. by Jørgensen (2003) and Galloway (2007). It was described from New Zealand by Nylander (1888), with the brief specimen information “Corticola (Kn.)” The label information on the lectotype *C. Knight 62* (H-NYL 30804) is “Nova Zelandia, 1867”. Galloway (1985) made the lectotypification, and stated that its location was probably Wellington.

When the present author studied herbarium material of the *Pannaria sphinctrina* complex, some collections were found to deviate by having thin and strongly adnate lobes, and their colour was much paler than the dark chestnut-brown characteristic of old specimens of *P. sphinctrina*. The lectotype of *Psoroma pyxinoides* proved to have the same appearance, illustrating that the epithet had been aptly chosen, in that the habit of the type specimen resembles a *Pyxine* species in overall appearance, except for the pale brown apothecial discs and the presence of cephalodia.

Our revisions have now defined the *P. sphinctrina* complex as one primarily apotheciate species, *P. sphinctrina* itself, another rare, deviating and apparently extinct, fertile Chilean species (Elvebakk 2012), and four new species characterized by the presence of various types of vegetative propagules (Elvebakk 2013). The aim of the present study was to investigate whether *Psoroma pyxinoides* could be maintained as a synonym of *Pannaria sphinctrina*, whether it should be accommodated as a further primarily apotheciate member of this complex, or if it has other affinities. Because the old description is incomplete (although it included the key phrase “subcrustaceo-adnato”), a new description is provided here.

Material and methods

This paper is based on material from the herbaria AK, B, H-NYL, TROM, W and WELT. In total, 15 collections of *Pannaria pyxinoides* from 11 localities were found and examined, and most analyzed by TLC. In microscope sections, iodine reactions were tested by adding IKI to mounts pretreated with KOH. Perispore structures were studied in water mounts and restricted to spores liberated from their asci, and detailed drawings of a total of 50 spores were made and included with the specimens. Thin-layer chromatography of acetone extracts followed standardized procedures and used solvents A and C (Orange *et al.* 2010). Nomenclature of ascospore structures follows Nordin (1997). The localities cited are indicated within the present political boundaries of New Zealand.

Pannaria pyxinoides (Nyl.) Elvebakk, comb. nov.
Mycobank number: **MB 824968**

Figs 1–4

Basionym: *Psoroma pyxinoides* Nyl., *Lich. Nov. Zel.*: 53 (1888). Type: New Zealand, *sine loco* (probably Wellington). *C. Knight 62*, H-NYL 30804, lectotype!; lectotypified by Galloway 1985: 482; W 1919-12621, isolectotype!

Thallus foliose, corticolous, forming adnate rosettes 2–7 cm diam. *Lobes* 100–150 µm thick, 0.5–1 mm wide and up to 15 mm long, convex to flat, margins entire; monopodially to subdichotomously or irregularly and often weakly branched, resulting in lobes with parallel orientation, coalescing centrally where thin and adnate secondary lobules frequently develop. *Upper surface* smooth, weakly glossy, uneven in older parts; when alive, pale greyish green when dry, lettuce-green when moist, turning pale ochraceous or weakly brownish after long-term storage. *Upper cortex* 20–30 µm thick, plectenchymatous, lumina 5–8 µm wide, walls 1.5–2 µm thick. *Photobiont layer* 20–30 µm thick, of either cf. *Myrmecia* or cf. *Trebouxia* cells, globose to subglobose, 2–6 µm diam. *Medulla* lax, 60–80 µm thick, pale brown-pigmented on the exposed, ecorticate and erhizinate lower part. Hypothallus/prothallus not observed. *Cephalodia* common, pulvinate to placodioid, 0.5–2 mm diam.; cyanobiont *Nostoc*, cells deep green, globose to irregularly ellipsoid, 3–7 µm diam., organized within glomerules, without visible chain structures. *Apothecia* common, substipitate, 1–2.5 mm diam.; disc pale reddish brown, mostly flat, without concentric rings or thalline granules; thalline excipulum c. 0.2 mm wide, finely striate-crenulate with striae 0.1–0.15 mm broad. *Epithecium* pale brown, 20–30 µm thick; hymenium c. 90–100 µm thick, IKI+ deep blue; hypothecium pale brown, 50–60 µm thick. *Asci* clavate, 70–80 × 15 µm, no IKI+ internal structures seen, with 8 ascospores. *Ascospores* entire, regularly ellipsoid to ovoid, ends broadly obtuse, short- to elongate-ellipsoid, 12–15 × 6–9 µm; *perispores* seen as a few scattered low verrucae on some spores, and without apical extensions, but mostly not visible apart from very small verrucae, 0.5–1 µm wide on immature spores. *Pycnidia* common in some specimens, elevated and verrucose, 0.1–0.25 × 0.1–0.25 µm, ostiole brown, spermatia bacilliform, 2.5 × 0.5 µm. *Chemistry*: containing vicanicin.

Remarks

The species differs from *Pannaria sphinctrina* in having more adnate and thinner lobes, which are often more parallel-oriented, and by verrucose pycnidia and smaller spores. Perispores are usually not visible on mature spores, although sometimes a few low verrucae are present, and the large apical extensions characteristic of *P. sphinctrina* are always absent. Immature spores have verrucae, but they are much smaller than those observed in *P. sphinctrina*. Old herbarium specimens do not become dark chestnut-brown in colour as do those of *P. sphinctrina*.

ADDITIONAL SPECIMENS STUDIED:

Auckland Region: • Great Barrier Island, 2 km E of Port Fitzroy, 6–700 m southwards from Aotea Road along the Coopers Castle Track, 36°09'45"S, 175°22'45"E, 280 m alt., on trunk of *Syzygium maire*, A. Elvebakk 16:066; 16:069, 21.ii.2016 (TROM); • Ruahine summit, 36°20'S, 175°31'E, 395–400 m alt., on bark, semi-open forest, B.W. Hayward, 4–10.i.1984 (AK 182668); • Tryphena, Needles Track, 36°17'S, 175°29'E, 170–190 m alt., semi-open forest, B.W. Hayward, i.1984 (AK 178239); • Little Barrier (Hauturu) Island (36°11'57"S, 175°04'53"E), B.W. Hayward, viii.1984 (AK 175465), B.W. Hayward 9.v.1990 (AK 247025); • ridge north of Te Hue Stream, Track 5, 36°11'S, 175°04'E, 300 m alt., on bark of kauri in mature forest, A.E. Wright 10064, 10.v.1990 (AK 193519); • Hauraki Gulf, Awaroa Stream, J.E. Braggins 84/155b, 4.xi.1985 (AK 280149). *Waikato Region*: • Coromandel Ecological Region, Colville Ecological District, Mount Maungatawhiri, near Whitianga, 36°47'S, 175°44'E, 240 m alt., on bark in bush, B.W. & G.C. Hayward H44.230, viii.1974 (AK 154596). *Northland Region*: • Hokianga Co., Waipoua State Forest, Ohae headwaters, 35°37'S, 173°29'E, 250 m alt., mixed forest, B.W. & G.C. Hayward, 6.i.1987 (AK 181577); • 1 km N

of Mitimiti, on banks of Taikarawa Stream, Warawara Forest, 35°25'20"N, 173°16'20" E, along river and on banks, on fallen tree, *P.J. Brownsey*, 26.iv.1990 (W L-3197); ● *W.A. Nelson*, 26.iv.1991 (W L-3188); ● Okahu, Herekino Forest, end of Lerner Road, 1 km past quarry, track to Okahu Stream, 35°10'S, 173°16'E, 80 m alt., forest of nikau, kohekohe, kahikatea, taraire, puriri; on nikau near stream edge, *W.A. Nelson* 28.iv.1990 (W L-3171).

Conclusions

The characters cited above clearly show that *P. pyxinooides* is a distinct species and not conspecific with *P. sphinctrina*, even though the two species have the same major secondary chemistry. Most collections in the *P. sphinctrina* complex have perispores with tall and c. 2.5 µm wide verrucae, frequently in addition to larger nodulose apical extensions. The verrucae of *P. pyxinooides* are much smaller, 0.5–1 µm, and are absent when spores mature. The size and shape of the spores are actually more similar to *P. allorhiza* (Nyl.) Elvebakk & Galloway and *P. araneosa* (C.Bab.) Hue, both now being studied by the present author.

Pycnidia have been little studied in the Pannariaceae, and have been overlooked in my previous studies of the *P. sphinctrina* complex. However, they are distinct and verrucose with dark ostioles in some of the collections of *P. pyxinooides*. As such they show a strong resemblance to the large pycnidia present in *P. allorhiza*, to be described in a forthcoming paper.

Whereas all of these species are deep lettuce-green when observed moist in the field, the colour of old herbarium collections of *P. pyxinooides* is pale, ochraceous-brown, rather than deep chestnut-brown like species in the *P. sphinctrina* group. The reasons for these colours are not well understood; however, Elvebakk (2007) suggested that they derive from compounds released after the death of the chlorobionts. Interestingly, the cells of the chlorobionts of *P. pyxinooides*, *P. allorhiza* and *P. araneosa* are all much smaller than those in other species of tripartite foliose *Pannaria* species. Most cells are smaller than 5 µm wide, both in strains determined as cf. *Myrmecia* here, and in a contrasting collection where the shape of the chloroplasts indicates it belongs to *Trebouxia*. Perhaps the chlorobionts have narrow climatic demands that contribute to the northern New Zealand distributions of these lichens.

Most of the specimens studied here are from Little and Great Barrier Islands. In addition, there is a collection from the Coromandel Peninsula, and the species is known from the Herekino, Waipoua and Warawara forests in northern parts of Northland. If the lectotype really originates from the Wellington area, that would be the southernmost locality known for the species. In cases where ecological information is available, it shows that *P. pyxinooides* occurs in forests from 170 to 400 m altitude. Our present knowledge indicates that it is a northern New Zealand endemic. It was found in only a single site during the present author's field work on Great Barrier Island, and only in the highest locality visited, so it might be more common at slightly higher altitudes. The Knight collection made in 1867 and published by Nylander (1888) is the only reliable report of the species made previously. Zahlbruckner (1941) reported an Allison collection of *P. pyxinooides* from 500 m on the Volcanic Plateau, but that collection could not be located.

A molecular study of the northern tripartite, foliose *Pannaria* species might confirm the relationships proposed here based on morphological and anatomical characters. In the meantime, *P. pyxinooides* is considered to be a relative of *P. allorhiza* and not *P. sphinctrina*.

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Fig. 1. The holotype of *Psoroma pyxinoides*.



Fig. 3. *Pannaria pyxinoides*. The 5-cm-wide specimen *Elvebakk 16-069* photographed in the field on Great Barrier Island, together with *P. allorhiza* (*Elvebakk 16:068*) to the right.



Fig. 2. *Pannaria pyxinoides*. The specimen *Wright 10064*. Scale bar = 10 mm.

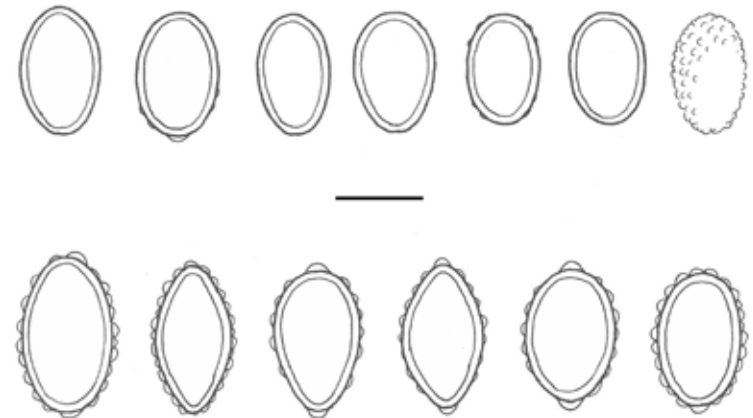


Fig. 4. Ascospores of *P. pyxinoides* (above, an immature spore to the far right) compared with *P. sphinctrina* (below). Scale bar = 10 μ m.