

Lepidozia nanophylla* (Lepidoziaceae: Marchantiophyta) a new species from New Zealand segregated from *Lepidozia microphylla

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Abstract

Lepidozia nanophylla is proposed as a new species for plants previously confused with *Lepidozia microphylla* on account of their highly reduced scale-like leaves and bipinnate shoot systems. *Lepidozia nanophylla* is readily distinguished from *L. microphylla* by leaf characters, the primary shoot leaves of *L. nanophylla* are weakly bisbifid lobed, have lobes two cells broad at the base, and the disc cell surfaces are smooth; whereas in *L. microphylla* leaves on primary shoots are asymmetrical with the dorsal lobe the largest and the ventral the smallest, the lobes are 4 or 5 cells broad at the base, and the disc cell surfaces are faintly striolate-papillose. Despite outward similarity to *L. microphylla*, *L. nanophylla* is more closely related to *Lepidozia spinosissima*. *Lepidozia microphylla* and *L. nanophylla* exhibit a degree of ecological differentiation, though this appears to be incomplete. *Lepidozia nanophylla* is often found growing as an epiphyte on the trunks and large branches of trees, especially in low-stature podocarp dominated forest on poorly drained sites, and in short scrub and the interior of well-lit forest. However, *L. nanophylla* may grow as a terrestrial in well-lit situations. *Lepidozia microphylla* is usually a terrestrial species occupying moist depressions on the forest floor, but in wet forests it may occur on the bases of tree trunks. *Lepidozia nanophylla* may be more localised in occurrence than *L. microphylla* and is currently known from scattered localities from South Westland in the South Island to Warawara Forest in the north of the North Island.

Introduction

Twenty-four of the world's 80 or so species of *Lepidozia* (Dumort.) Dumort. occur in New Zealand (Engel and Glenney 2008), and that relatively high representation of species diversity captures most of the morphological diversity expressed by the genus at a global level. The result is that New Zealand's *Lepidozia* are conspicuous elements of all moist environments, from sea level to above the alpine zone, and are characterised as much by their morphological and ecological diversity, as by their beauty. *Lepidozia* species have been described as ecological generalists, many occur on humus of forest floors, or on decaying logs, also on rocks and in cliff crevices, while a few are epiphytic, and those usually on tree fern trunks (Schuster 2000).

Four of the six subgenera recognised by Schuster (2000) occur in New Zealand. These subgenera, which accommodate morphologically disparate elements, do not wholly correspond with the main lineages within *Lepidozia* recovered by Cooper et al. (2012). The infrageneric classification remains in a state requiring further study, and the circumscription of taxa between genus and species awaits further investigation and refinement.

In contrast, the circumscription of species, in New Zealand at least, is well-resolved and stable. The genus *Lepidozia* was revised for New Zealand by Engel and Schuster

Renner MAM (2025) *Lepidozia nanophylla* (Lepidoziaceae: Marchantiophyta) a new species from New Zealand segregated from *Lepidozia microphylla*. *Telopea* 29: 189–196.
[doi:10.7751/telopea20368](https://doi.org/10.7751/telopea20368)

Received: 16 November 2024
Accepted: 21 May 2025
Published: 11 June 2025

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(2001) and this revision remains current (Engel and Glenn 2008) with the exception of the addition of *Lepidozia bragginsiana* E.D.Cooper & M.A.M.Renner by Cooper and Renner (2014), which is included in the species count above. *Lepidozia bragginsiana* was described for the ‘poorly-developed’ plants of *Lepidozia pendulina* (Hook.) Lindenb. mentioned by Engel and Glenn (2008). That new species proposal was supported, in part, by molecular evidence demonstrating that individuals of the two morphotypes were, though related, divergent to a degree suggesting they belonged to different species (Cooper and Renner 2014). Another interesting result relevant to species circumscription from Cooper et al. (2012) was the resolution of *L. spinosissima* (Hook.f. & Taylor) Mitt. nested among two accessions of *Lepidozia microphylla* (Hook.) Lindenb. so rendering *L. microphylla* paraphyletic.

Re-examination of specimens and subsequent fieldwork in New Zealand over the course of the past decade has confirmed two ecologically distinct morphotypes are present within *Lepidozia microphylla* as circumscribed by Engel and Glenn (2008), both of which are represented in the phylogeny of Cooper et al. (2012). One of these morphotypes is a large, yellow-green plant that grows erect from microsites on the forest floor, where it forms tall, intricately and openly branched, turfs. This corresponds with the type of *Jungermannia microphylla* Hook., gathered at ‘Dusky Bay’, and is widespread in the cool hyper-humid forests of the wetter western side of New Zealand (Engel and Glenn 2008).

The other morphotype is a smaller, bronze or brown-green plant that typically forms loose wefts from the trunks and larger branches of trees, often in short forests dominated by *Lepidothamnium* Phil. and other podocarps on poorly drained and waterlogged soils (Figure 1), but also in kauri forest and low scrub. This epiphytic morphotype is more localised in occurrence, but it may grow sympatrically with *Lepidozia microphylla* Lindb., and with *Lepidozia spinosissima*. No name has been applied to this predominantly epiphytic morphotype, the only heterotypic synonym of *Lepidozia microphylla*, *Lepidozia multipinna* Steph., was applied to a specimen of the terrestrial morphotype collected by Dall, and is correctly treated as a synonym of *Lepidozia microphylla*. Therefore, in this paper a new species is proposed to accommodate the hypothesis that the often epiphytic morphotype represents a distinct species (Fitzhugh 2005), as supported by the morphological and molecular phylogenetic evidence gathered to date.

Methods

This description is based on herbarium specimens held at AK, and on field observations of the species made by the author between 2001 and 2024. Layout of the description and terminology follow Engel and Schuster (2001) and Engel and Glenn (2008). Material was rehydrated for manipulation including slide mounting of shoot systems, dissection of leaves, underleaves, bracts, and other parts; and sectioning of stems and perianths. Illustrations were composed with the aid of a Leitz Wetzlar camera-lucida attached to a Leica Laborlux S compound microscope, which were then inked and shaded freehand.

Taxonomic Treatment

***Lepidozia nanophylla* M.A.M.Renner, sp. nov.**

Type: New Zealand: North Island: Coromandel Peninsula, Mt Rowe on north side of Kauaeranga Valley, 37°02′04″S 175°40′22″E, 740 m, 19 Mar 2024, M.A.M. Renner 9787 (holotype: AK; isotypes: CANB, CHR, F, G, NSW, WELT).

Plants forming intricate space-filling wefts on tree trunks and lower branches, bronze-green or brown-green in life, sometimes with a hint of orange. Shoot systems regularly pinnately branched in young sectors, irregularly bipinnate in older shoot sectors, to around 60 mm long. Stems of primary shoots 750–1000 µm diameter with 17–20 rows of cortical cells on primary shoots, free external wall thickened, internal walls with thickened, more pronounced near trigones, trigones bulging; medulla cells in around 30 rows, smaller in diameter than cortical cells, with large nodular trigones coalescent across medial cell walls. Vegetative branching from the lateral merophyte by *Frullania*-type branching on both sides of shoot, with ventral branching by intercalary *Bazzania*-type from the underleaf axil; in response to shoot tip damage lateral intercalary branches are produced from the axil of leaves in response to shoot tip damage, these situated in the middle of the leaf axil; sexual branches produced by ventral-intercalary *Bazzania*-type branches. *Frullania*-type branch half leaf bifid, disc 5 or 6 cell tiers high, lobes 2 cells wide at base, 4 cells long, two cells wide for two tiers, one cell wide for two cells, apical cell thick-walled, squat, narrowly transversely conical; first branch underleaf displaced, situated at lateral base of branch and appearing attached to parent stem; quadrifid at the base of secondary shoots, trifid at the base of tertiary shoots. Leaf insertion not attaining the dorsal stem midline, leaving half a cell on either side of the midline leaf-free. Leaves on primary shoots more or less symmetrically bisbifid; to 550 µm long and 500 µm wide, four-lobed, medial sinus deeper by around half a cell length, with the two middle lobes slightly longer than the dorsal and ventral lobes, leaf disc 4 or 5 cell tiers tall, and lobes 2 or 3 cells wide at base, medial lobes biseriate for three or four cell tiers, then uniseriate for two cell tiers, dorsal and ventral lobes biseriate for two or three cell tiers, then uniseriate for two cell tiers; leaves on secondary shoots four-lobed, typically asymmetrical with the lobes decreasing in stature from dorsal to ventral, or with all lobes equal, slightly smaller than leaves on primary shoots, to 350 µm long and wide. Leaf cells rounded-quadrate, arranged in rows, walls moderately thickened and with pronounced concave trigones at cell angles, discrete medial thickenings rare, marginal wall slightly thicker than medial walls; lobe cells slightly smaller otherwise as for disc cells; disc cell surfaces smooth, lobe cell surfaces smooth to asperulate. Primary shoot underleaves each inserted on five or six rows of ventral cortical cells, insertion straight and transverse. Underleaves on primary shoots four-lobed, weakly bisbifid, symmetrical, middle lobes usually longest, lobes two cells wide at base, two cells wide for two to four cell tiers tall, and uniseriate for two to two four cells, lobes fragmented and dislocated in older shoot sectors; disc four cells tall, eight to ten cells wide, inserted on seven or eight rows of ventral cortical cells. Underleaf disc cells rounded-quadrate, arranged in rows, walls moderately thickened and with pronounced concave trigones at cell angles, discrete medial wall thickenings rare; lobe cells slightly smaller otherwise same as disc cells; cell surfaces smooth. Secondary shoot underleaves four-lobed, weakly

bisbifid to asymmetrically lobed, inserted on four or five rows of ventral cortical cells. Asexual reproduction absent.

Dioicous. Androecia on abbreviated ventral-intercalary branches, arising from the axils of underleaves on primary and secondary shoots; weakly cernuous, loosely spicate, bearing up to six pairs of contiguous to imbricate bracts; bracts bilobed, divided from $1/4$ – $1/3$ length, lobes triangular, narrowing to a short projecting uniseriate apex comprising two or three cells; disc inflated, lobes orientated on planes at nearly right angles to each other due to the inflation of the bract disc; cell walls thin, hyaline, with indistinct medial wall thickenings and weakly bulging trigones; underleaves bilobed; antheridia one or, more usually, two per bract. Gynoecia on abbreviated ventral-intercalary branches, arising from the axils of underleaves on primary and secondary shoots. Gynoecial branches with three series of bracts; bracts of innermost series half the length of the perianth, weakly bisbifid, deeply divided to 0.4, lobes lacinate, four or five cells wide at base, tapering to lobes two or one cell wide toward the apex, uniseriate portion one to 12 cells long, sinuous and kinked, marginal cells with walls projecting at cell junctions, disc margins with one to four accessory uniseriate spines three to twelve cells long. Marginal cells narrow rectangular, four times longer than wide, walls thickened, either evenly or thicker toward the middle of the wall, trigones concave; medial cells rectangular two to three times longer than wide, walls evenly thickened, medial thickenings rare, transverse walls sometimes thicker than longitudinal walls. Bract underleaves with lacinate lobes, as for bracts. Perianths c. 5 mm long, cylindrical, terete below, obscurely trigonous above, mouth lacinate, cells long-rectangular, three to four cells longer than wide. Cells of upper perianth thick-walled, trigones bulging, long rectangular, progressively shorter and thinner walled to a medial band of quadrate to short rectangular cells, then lengthening toward the perianth base where cells are long rectangular, a mixture of lengths up to five times longer than wide, cell walls thickening from middle to base, through a zone of cells having pronounced medial thickenings immediately below the medial quadrate cells. Capsule ellipsoid, valves 3 stratose (Figs 2, 3).

Diagnostic characters: *Lepidozia nanophylla* is immediately distinguished from all other New Zealand *Lepidozia* by the combination of wiry, bronze- to yellow-brown, three-dimensional shoot systems that are regularly pinnately branched in young sectors and irregularly bipinnately branched in older sectors, and scale-like, weakly bisbifid, leaves on the primary shoots whose lobes are two cells broad at the base.

Recognition: *Lepidozia nanophylla* has been confused with *L. microphylla* on account of its small scale-like leaves and bipinnately branched shoot systems. However, *L. nanophylla* differs from *L. microphylla* in several characters, such that differentiation is straight forward (Fig. 4; Table 1). In *L. nanophylla* the leaves on primary shoots are weakly bisbifid, meaning the leaves are nearly symmetrical either side of a line drawn lengthwise that passes through the apex of the medial sinus. The two middle lobes are the same size, and slightly larger in stature than the dorsal and ventral most lobes, which are also more or less the same size. Each of the lobes are two cells broad at their base, and the disc cell surfaces are smooth. In *L. microphylla* leaves on primary shoots are asymmetric, the lobes progressively decrease in stature from top to bottom, so that the dorsal lobe is the largest and the ventral lobe the smallest.



Figure 1. Interior of the podocarp-dominated forest in which *Lepidozia nanophylla* grows on Mt Rowe in the southern Coromandel Range, showing the dense ground layer dominated by *Gahnia procera* that results from the sparse overhead canopy and resulting high light at ground level. Many of the habitats throughout New Zealand in which *Lepidozia nanophylla* grows are characterised by similar understorey composition and density.

The lobes are 4 or 5 cells broad at the base, and the disc cell surface is faintly striolate-papillose. Plant colour in life can also usefully distinguish the two species in most cases, where *L. nanophylla* is a bronze or yellow-brown colour, sometimes with a touch of orange, *L. microphylla* is a clear green or yellow-green more typical of most *Lepidozia* species, especially when growing in moist depressions on the forest floor. Stem anatomy also distinguishes *L. microphylla* from *L. nanophylla*. Stems on primary shoots of *L. microphylla* are large and succulent, they have 70–100 rows of cortical cells, and medullary cells whose walls are unthickened except for small concave trigones at cell angles. Primary shoot stems of *Lepidozia nanophylla* are wiry, with 25–35 rows of cortical cells, and medullary cell walls that are heavily thickened by large nodular trigones that are confluent across all medial walls. Microsite and growth habit can also differentiate the two species, *L. nanophylla* forms wefts of horizontal to pendulous shoots whose apex is ascendant and is often epiphytic on tree trunks and branches; whereas *L. microphylla* forms tall turfs of erect shoots on damp microsites on the forest floor and is usually terrestrial. However, *L. nanophylla* may grow on soil in terrestrial microsites, and *L. microphylla* may grow on the bases of tree trunks, so microsite of occurrence is indicative only, not diagnostic.

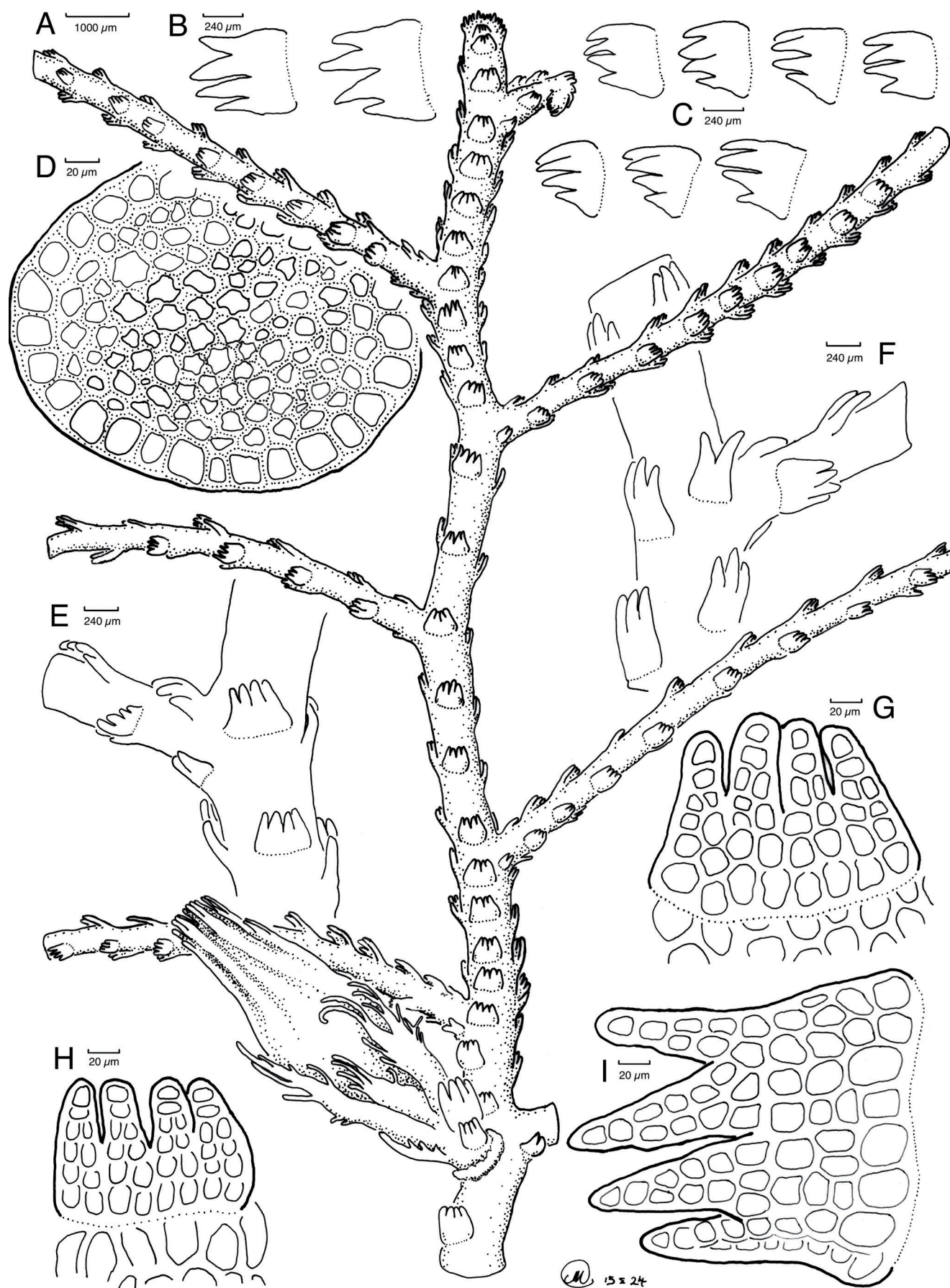


Figure 2. *Lepidozia nanophylla* M.A.M.Renner. A: Female shoot system with perianth-bearing gynoecium at base. B: Outlines of two leaves from primary shoots showing symmetry and bisbifid lobing. C: Outlines of seven leaves from secondary shoots showing mild asymmetry and bisbifid lobing. D: Cross section of stem from primary shoot. E: *Frullania*-type branch from primary shoot in ventral view. F: *Frullania*-type branch from primary shoot in dorsal view. G: Detail of underleaf from primary shoot showing symmetry and bisbifid lobing, the medial division being slightly deeper than the lateral two. H: Detail of underleaf from secondary shoot. I: Detail of leaf from primary shoot, again showing symmetry and bisbifid lobing. All from the holotype, Renner 9787 (AK).

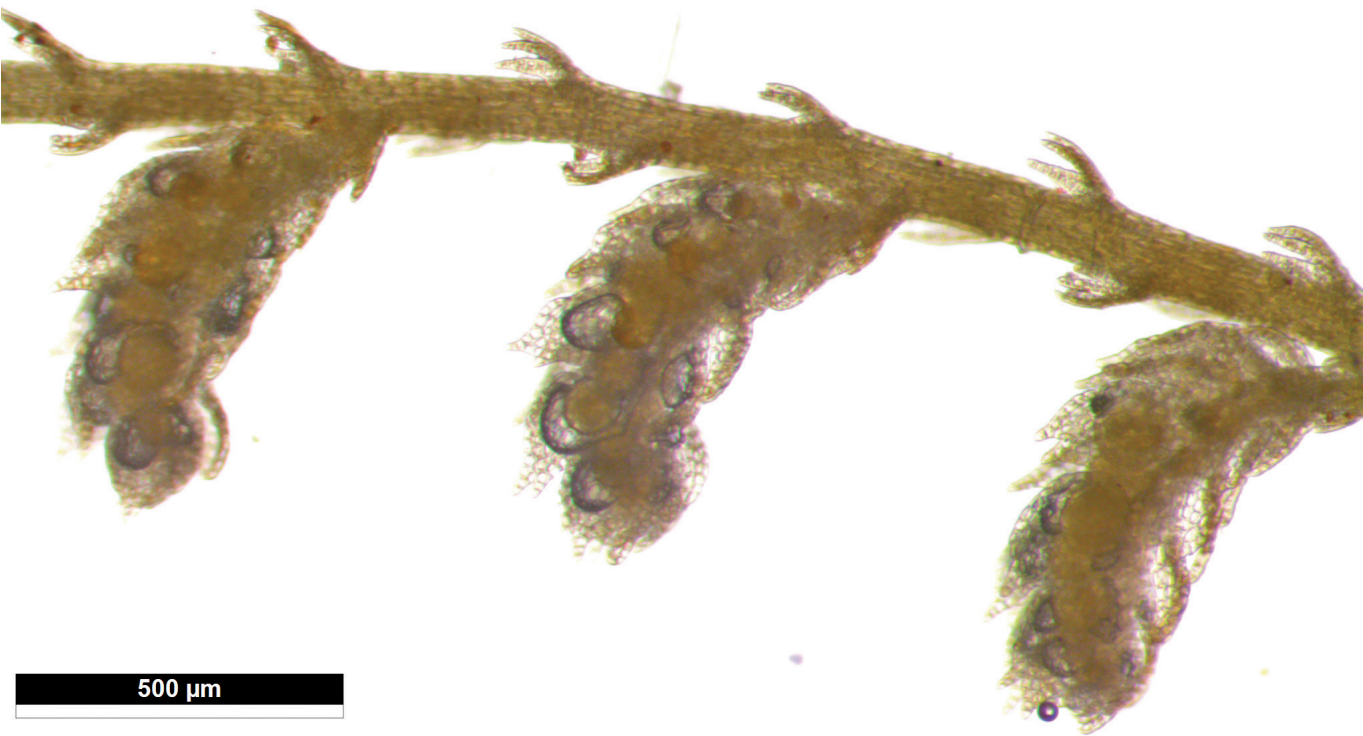


Figure 3. *Lepidozia nanophylla* M.A.M.Renner, short spicate male branches issuing from a secondary shoot by ventral intercalary branching, with usually two antheridia in the lateral bracts only. From *Glenny 10021* (NSW).

Table 1. Comparison of characters useful for differentiating *Lepidozia nanophylla* from *L. microphylla* and *L. spinosissima*.

	<i>Lepidozia microphylla</i>	<i>Lepidozia nanophylla</i>	<i>Lepidozia spinosissima</i>
Leaf lobing	asymmetrical	weakly asymmetrical to bisbifid	weakly asymmetrical to bisbifid
Leaf division	0.4–0.5 ×	0.4–0.5 ×	0.6–0.9 ×
Leaf lobe width at base	4 or 5 cells	2(3) cells	4–8 cells
Leaf disc cell surfaces	striolate papillose	smooth	smooth
Underleaf disc width	10–13 cells	8(9) cells	12–15 cells
Underleaf lobe length	3 cells	4–6 cells	15–20 cells
Stem medulla cell walls	small concave trigones	coarse nodular confluent trigones	coarse nodular confluent trigones

Many of the characters that distinguish *L. nanophylla* from *L. microphylla* will also separate *L. nanophylla* from *L. spinosissima*. The leaves provide a ready source of diagnostic discriminating characters in that *L. nanophylla* never has the conspicuous, spinose leaves that are characteristic of *L. spinosissima*. The leaf lobes of *L. nanophylla* are a mere two cells broad at their base, while those of *L. spinosissima* are 6–10 cells broad. The uniseriate row at the apex of each lobe differs in length, usually two but up to four cells long in *L. nanophylla* and six to ten cells long in *L. spinosissima*. Where *Lepidozia nanophylla* and *L. spinosissima* grow sympatrically *L. nanophylla* grows on tree trunks and branches, and *L. spinosissima* grows on the forest floor.

Notes: Notwithstanding the outward similarity between *Lepidozia nanophylla* and *L. microphylla* imparted by their reduced scale-like leaves and bipinnate shoot systems, *L. nanophylla* is more closely related to *L. spinosissima* (Cooper et al. 2012), and this relationship is reflected in several characters shared by this latter pair of species. Both have smooth leaf cell surfaces, in contrast to the faintly striolate papillose leaf surfaces of *L. microphylla*. Both have bisbifid leaves, rather than asymmetrically divided leaves. And both have strongly thickened medullar cell walls in the stem.

Lepidozia nanophylla produces intercalary branches from all three merophyte rows in response to damage to the shoot apex. These intercalary branches are produced from the middle of the leaf or underleaf axil, so correspond with *Bazzania*-type branches on the ventral merophyte and *Lophozia*-type branches on the lateral merophyte, in the sense of Schuster (1966). *Bazzania*-type branches are the primary mode of ventral branching in this species to produce both vegetative branches and sexual branches in undamaged shoots. *Lophozia*-type branching, and indeed lateral-intercalary branching of any kind, appears confined to the vicinity of damaged shoot apices, and does not contribute to shoot architecture anywhere else.

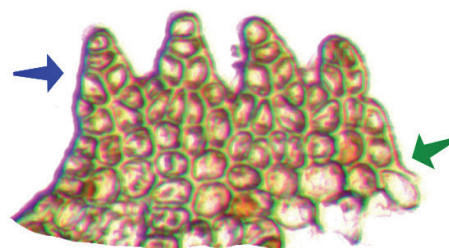
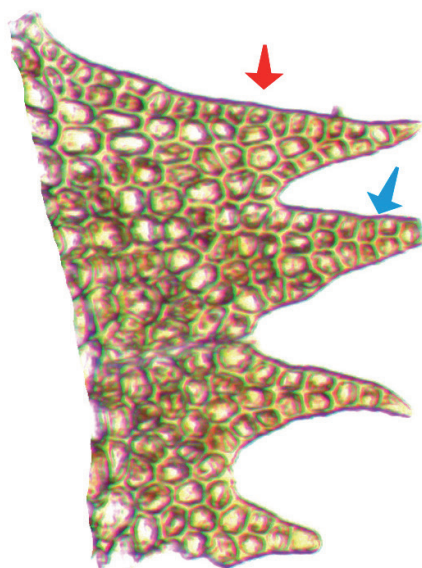
In the key to *Lepidozia* species presented by Engel & Glenny (2008) *L. nanophylla* will progress to either *L. microphylla* if couplet 1b is followed because the shoot systems are interpreted as regularly bipinnate or the widely spaced and vertically orientated leaves are emphasised; or to *L. procera* if couplet 1a is followed when the shoot systems are interpreted as having only sporadically produced secondary branches, and the leaf spacing character is disregarded.

Primary shoot

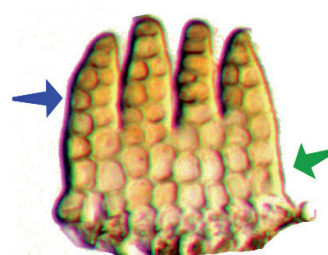
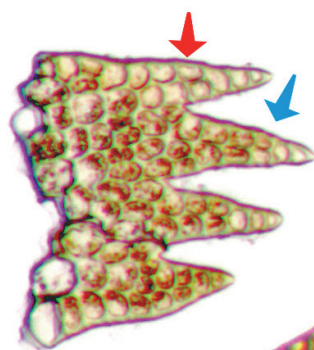
Leaves

Underleaves

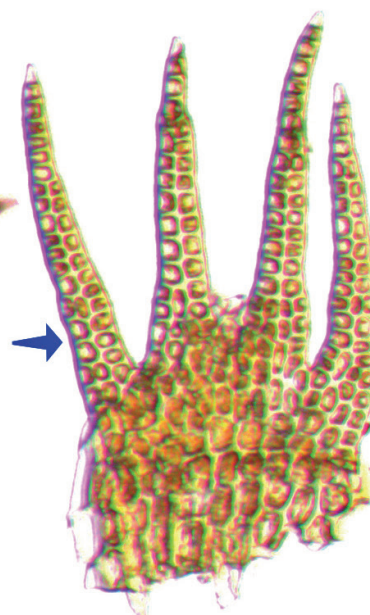
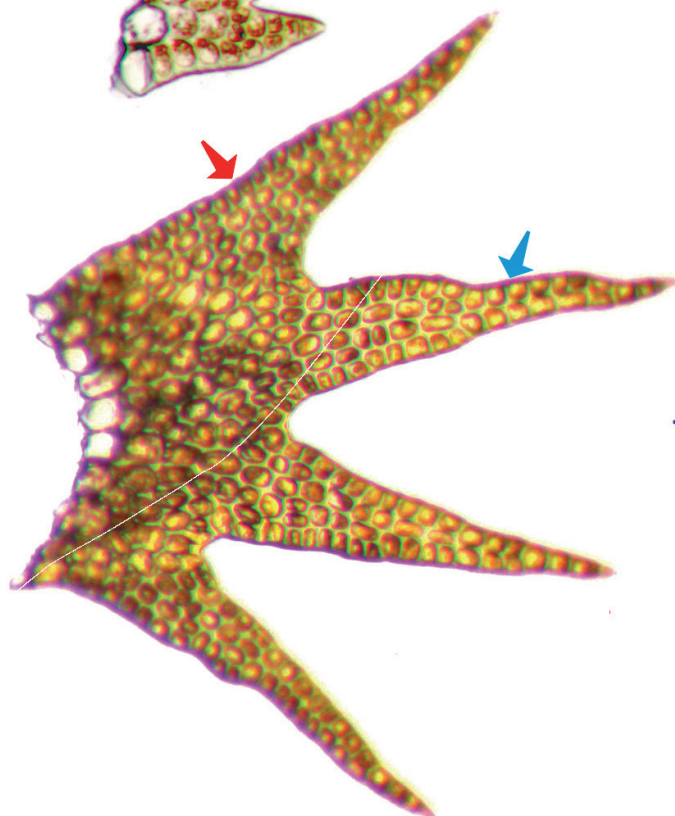
L. microphylla



L. nanophylla



L. spinosissima



200 μ m

Figure 4. Representative *primary* shoot leaves and underleaves from *Lepidozia nanophylla*, *L. microphylla* and *L. spinosissima* indicating characters useful for differentiating species with arrows, including width of leaf lobe at base (red arrow), leaf lobe length (light blue arrow), underleaf lobe length (dark blue arrow) and the width of the underleaf disc (green arrow). From *Glenny 10021*, *Engel 21086*, and *Engel 21789* (all NSW).

The differences between *Lepidozia microphylla* and *L. nanophylla* are described above. *Lepidozia nanophylla* differs from *L. procera* by the widely remote, weakly bisbifid leaves on primary shoots; whereas *Lepidozia procera* on primary shoots has contiguous to weakly imbricate asymmetric leaves whose lobes are unequally divided, the dorsal sinus being shallowest and the ventral sinus being deepest.

Because the shoot architecture character is somewhat ambiguous as far as *Lepidozia nanophylla* is concerned, couplets for the inclusion of this species into the flora *Lepidozia* key for both leads in couplet 1 are presented below.

- 11a(a) Leaves on primary shoots remote to contiguous to weakly imbricate, ventrally secund, asymmetrically lobed, dorsal sinus shallowest and ventral sinus deepest; leaf disc 17–26 cells high at dorsal sinus..... *Lepidozia procera*
- 11a(b) Leaves on primary shoots widely remote, transversely orientated, weakly bisbifid, dorsal sinus equal to ventral sinus and medial sinus deeper by around half a cell length; leaf disc four or five cells high at dorsal sinus..... *Lepidozia nanophylla*
- 21a(a) Leaves on primary shoots asymmetrically lobed with the dorsal lobe largest and ventral lobe smallest, lobes 4 or 5 cells broad at their base; disc cell surface faintly striolate-papillose. Stems of primary shoots thick, succulent, around 24–40 cells across in transverse section, with 70–100 rows of cortical cells, medullar cells with small concave trigones *Lepidozia microphylla*
- 21a(b) Leaves on primary shoots weakly bisbifid with the two medial lobes slightly larger than the dorsal and ventral, lobes two, occasionally three, cells broad at the base; disc cell surface smooth. Stems of primary shoots wiry, around 15 cells across in transverse section, with 25–35 cells across in transverse section, medullar cells with coarse, nodular, confluent trigones..... *Lepidozia nanophylla*

In *Lepidozia*, leaf shape exhibits complex patterns of variation. Leaves on primary shoots may differ in size and shape from leaves on secondary shoots, which is true of *L. microphylla*, *L. nanophylla* and *L. spinosissima*.

Terminology describing shoot architecture is not standardised. Engel and Schuster (2001) use ‘stem’ to refer to primary shoots, ‘primary branches’ to refer to secondary shoots, and ‘secondary branches’ to refer to tertiary shoots. This nomenclature is functional but lacks absolute specificity and consistency in its communication of shoot order. I regard the need for specificity as critical, so use a naming convention wherein shoots are referred to by order. However, this comes with the disadvantage that my ‘primary shoots’ are not the same as the ‘primary branches’ of other authors.

Etymology: From Latin, *nanophylla* (tiny leaf), referring to the leaves which are even smaller than those of *Lepidozia microphylla*.

Distribution and ecology: *Lepidozia nanophylla* is endemic to New Zealand, where it is known from the North, South, and Chatham Islands, from Warawara forest in the north to Cascade River in the south. In Northland, Auckland, Waikato, and Bay of Plenty, *Lepidozia nanophylla* occurs in mature and successional kauri (*Agathis australis*) forests and low wind-swept towai (*Pterophylla sylvicola*) forests on elevated ridgelines and high

peaks. Throughout the rest of New Zealand *L. nanophylla* occurs in short-stature podocarp dominated forests on poorly drained sites, especially those dominated by *Lepidothamnus intermedius*, and in manuka-dominated scrub on ultramafic till. *Lepidozia nanophylla* is usually an epiphyte on tree trunks and branches, in well-lit microsites typically within 2 metres of the ground but occasionally higher, and may be a dominant component of trunk epiphyte bryophyte communities, as at Mt Rowe in the Coromandel Range. Hosts include *Agathis australis*, *Lepidothamnus intermedius*, *Leptospermum scoparium*, *Leucopogon fasciculata*, and *Pterophylla sylvicola*. *Lepidozia nanophylla* may also grow terrestrially, in well-lit situations in scrub or along the sides of tracks and ditches. At Omahuta forest in Northland, it grew as a low turf on the well-lit sides of a ditch, and at Cascade River, Westland, formed extensive patches on leaf litter within a scrub of *Dracophyllum* and *Leptospermum*, on ultramafic soils. *Lepidozia nanophylla* grows with obligate and facultative epiphytic bryophytes including *Acromastigum cavifolium*, *A. marginatum*, *Brevianthus flavus* subsp. *crenulatus*, *Clandarium xiphophyllum*, *Dendromastgophora flagellifera*, *Hypnum cupressiforme*, and *Lepicolea attenuata*.

Specimens examined: NEW ZEALAND. NORTH ISLAND. Warawara State Forest, 35°22'58"S, 173°17'29"E, 460 m, 31 Oct 1977, J.E. Braggins s.n. (AK 335846); Western Northland Ecological Region, Maungataniwha Ecological District, Omahuta State Forest, look track around kauri sanctuary, 35°14'38"S, 173°37'43"E, 320 m, 21 Nov 2008, J.E. Braggins 08/214 & E.A. Brown (AK 362897); Western Northland Ecological Region, Maungataniwha Ecological District, Omahuta Kauri Sanctuary, 35°15'S, 173°38'E, 260 m, 8 Feb 1995, J.E. Braggins 95/087B (AK 255066); Little Barrier Island, Mount Archeria (Hauturu), 36°12'S, 175°05'E, c. 2300 ft, 10 Jul 1939, R.E.N. Matthews (AK 18714, AK 18715); Little Barrier Island, Hauturu summit, 36°12'S, 175°5'E, 13 Jun 1984, J.E. Braggins 84/171e (AK 313245); Coromandel Ecological Region, Thames Ecological District, ridge NW of Mt Rowe, 37°2'16"S, 175°40'19"E, 720 m, 26 Jun 2007, M.A.M. Renner 2835 (AK 300171); Egmont Ecological Region and District, Mt Taranaki, Pembroke Road, Potaemae Track, c. 1.9 km from park entrance, 39°19'S, 174°9'E, 660 m, 15 Sep 1999, J.E. Braggins 99/265 (AK 254385). SOUTH ISLAND. Olivine Ecological Region, Cascade Ecological District, ultramafic zone near Martyr River, between Martyr Saddle and end of Jacksons River, 44°7'S, 168°33'E, 140 m, 7 Dec 2000, J.E. Braggins s.n. (AK 287172); Westland National Park, Lake Gault track, 43°26'S, 169°58'E, 17 Feb 2007, D.S. Glenn 10021 (NSW746970); Olivine Ecological Region, Cascade Ecological District, Jackson River Road, at Monkey Puzzle Gorge, 44°7'S, 168°33'E, 140 m, 2 May 2003, J.E. Braggins 03/320A (AK 360340). CHATHAM ISLANDS. Chatham (Rekohu) Island, Southern Tablelands, track to Lake Rakeinui, upper tributary of the Tuku-a-Tamatea River, 44°5'S, 176°35'W, 270 m, 12 Jan 2006, P.J. de Lange CH729 (AK 299296).

Lepidozia microphylla (Hook.) Lindenb.

NEW ZEALAND. NORTH ISLAND. North Auckland Province, SE corner of Waipoua Forest, just N of Tutamoe, 35°38'S, 173°38'E, 540 m, 9 Feb 1995, J.J. Engel 21086 (NSW 2001262).

Lepidozia spinosissima (Hook.f. & Taylor) Mitt.

NEW ZEALAND. SOUTH ISLAND. Westland Province, Cascade Road, Cascade ultramafic moraine, W of Martyr Saddle, 44°9'S, 168°36'E, 35 m, 27 Feb 1995, J.J. Engel 21789 (NSW 2001290).

Acknowledgements

The author thanks Yumiko Baba and Dhahara Ranatunga for their kind assistance at Auckland Museum where this work was completed, Cameron Kilgour and Peter de Lange for their interest, John Braggins for studious documentation of New Zealand's liverwort flora over many decades, and David Glenny for comments that improved the manuscript. Collections by MR were made under Research and Collection Authorisation Approval 9731-FLO.

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