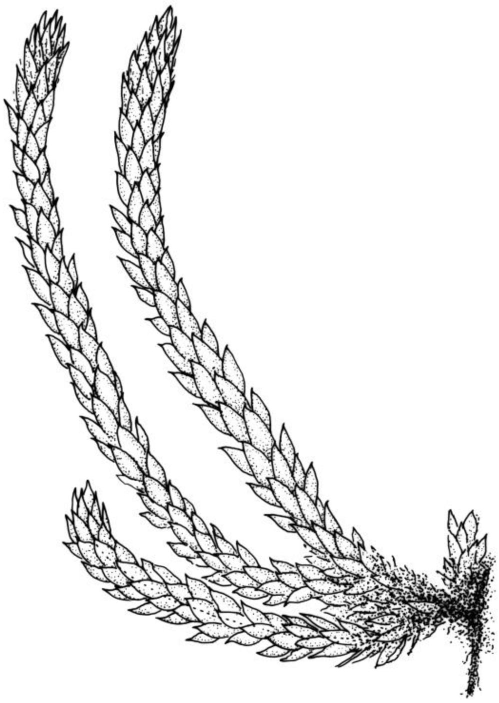
FLORA OF NEW ZEALAND

MOSSES

PTYCHOMNIACEAE



A.J. FIFE

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Introduction

The Ptychomniaceae are a small family of mosses, largely restricted to temperate and cool regions of the southern hemisphere. Members of the family are conspicuous and attractive components of New Zealand forests and grasslands. Our most conspicuous and well-known species, *Ptychomnion aciculare*, occurs primarily on the forest floor; the so-called "pipe-cleaner moss" is one of the few indigenous moss species with a widely used English name. Most other members of the family occur as epiphytes. Pleurocarpous habit, often plicate leaves, strongly ribbed capsules, and long rostrate opercula are features that help to characterise the family. Members range in size from robust plants forming extensive forest floor carpets (as in *Ptychomnion*), to minute plants on twigs usually apparent only to the trained eye (as in *Tetraphidopsis*).

As traditionally circumscribed (by Brotherus), the Ptychomniaceae include seven genera and about 15 species. In this treatment, eight N.Z. species in six genera are assigned to the family. Three of the N.Z. genera, *Cladomnion*, *Dichelodontium*, and *Tetraphidopsis*, are both monotypic and endemic.

Ptychomnion is the most speciose genus in the family and contains between five and eight species, depending on taxonomic interpretation. The relationships (and generic assignments) of our two species of *Hampeella* remain unresolved, while the retention of *Dichelodontium* here is controversial, largely due to interpretation of its peristome structure.

Recent studies using both molecular and morphological characters have potentially enlarged this traditional (Brotherean) view of the family. Two monotypic genera, one a segregate of *Ptychomnion*, have recently been described from temperate South America. A recent proposal to transfer large southern Asian and Malesian genera (*Garovaglia* and allies) to the Ptychomniaceae would make the family more morphologically heterogeneous and difficult to characterise but has little direct significance when considering the N.Z. representatives.

Typification

The following typifications are designated in accordance with the International Code of Nomenclature for Plants, Algae and Fungi.

***Cladomnion* Hook.f. & Wilson in Wilson**
Lectotype species (designated here): *Cladomnion ericoides* (Hook.) Hook.f. & Wilson.

Three species were included in the genus at the time of its description but subsequently (e.g., Brotherus 1925; Dixon 1927; Sainsbury 1955) only *C. ericoides* has been retained in the genus. It is both appropriate and nomenclaturally convenient that this species be considered the lectotype.

***Leucodon nitidus* Hook.f. & Wilson in Wilson, Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II, 99 (1854)**
Lectotype (designated here): N.Z., Bay of Islands, *J.D. Hooker* (herb. Wilson 411), BM 000986857!

Selected by R. Hattaway in March 1980, but apparently not published. The lectotype is sparsely fruiting and accompanied by a series of detailed sketches by Wilson.

***Meteorium pusillum* Hook.f. & Wilson in Wilson, Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II, 101 (1854)**
Lectotype (designated here): N.Z., Wairarapa Valley, W. Colenso 484b, Herb. Wilson, BM 000986878!

***Tetraphidopsis novae-seelandiae* Broth. & Dixon in Dixon, J. Linn. Soc., Bot 40: 451 (1912)**
Lectotype (designated here): N.Z., Kummer's Bush, Mauriceville, 18 Oct. 1909, *W. Gray 54*, Herb. Dixon, BM 000667778!

The lectotype in BM was selected by R. Hattaway in Aug. 1980, but apparently never published; his selection for the lectotype is therefore published here. Mounted on the same sheet (but without a separate BM number) is a second Gray collection made on 24 July 1910, which should be considered a paratype. A specimen in WELT collected by Gray on 10 Nov. 1910 (WELT M001076!) should also be considered a paratype.

Ptychomniaceae

Elements in the following description are translated from Brotherus (1925).

Plants robust or slender, lustrous, forming loose or tight wefts, epiphytic or terrestrial. **Primary and secondary stems** mostly distinct (except in *Ptychomnion*). **Primary stems** creeping, short or long, often either lacking or difficult to observe, rigid and sometimes brittle, mostly leafless. **Secondary stems** usually clustered, ascendant or pendent and curved away from the substrate, often rigid, simple or sparsely branched, mostly lacking rhizoids except for fascicles at the base, in cross-section oval or angular, lacking a central strand, with several layers of thick-walled and often strongly pigmented cortical cells. **Leaves of secondary stems** mostly dense or imbricate, usually in several rows, rarely complanate, lanceolate to broadly oval, mostly symmetric, sometimes decurrent, often plicate, unbordered, mostly toothed above, often recurved or twisted at apex; **mid laminal cells** linear, elliptic, or ± rhombic, thick- or rarely thin-walled (in *Hampeella*), mostly strongly porose, smooth; **cells at insertion** mostly strongly porose and pigmented, often forming a distinct band across the leaf base; **alar cells** variable. **Costae** absent or short and either double or single. **Paraphyllia** absent or present**.** **Gemmae** often present on upper stems; if present filamentous, acicular, or clavate; cells uniseriate with transverse walls.

Dioicous, often with dwarf and epiphyllic male plants. **Perichaetia** on short branches; the inner leaves shouldered and subulate and often (always?) enlarging after fertilisation. **Perigonia** small and bud-like. **Setae** elongate and straight or ± flexuose, smooth; **capsules** erect or curved and ± horizontal, ovoid to cylindric, strongly 8-ribbed; **exothecial cells** firm- or thick-walled; **stomata** few and restricted to extreme base of capsule, superficial; **annulus** absent or present; **operculum** rostrate from a conic base, sometimes longer than the capsule. **Peristome** double or rarely single; **exostome teeth** inserted close to rim, lanceolate, yellow or pale, often furrowed, rarely absent (in *Dichelodontium*); **endostome** arising from a low or high membrane, the segments well developed or rudimentary; **cilia** usually absent (present in *Ptychomnion*). **Calyptra** cucullate, smooth, and elongate. **Spores** one-celled or multicellular (in *Cladomnion*).

Taxonomy: As traditionally circumscribed, the Ptychomniaceae are a small family of seven genera and about 15 species (Brotherus 1925) restricted to the southern hemisphere. Brotherus isolated *Ptychomnion* into a subfamily of its own on the basis of its having curved and strongly ribbed capsules. By Brotherus's concepts, the family has maximum generic diversity in N.Z., with six of seven genera found here, although the recent description of two monotypic genera restricted to South America alters this view. The strongly ribbed capsules, the often plicate leaves, and the long rostrate opercula are features that help to characterise the family.

Most species occur mainly on tree trunks and branches, although *Ptychomnion* is primarily terrestrial in N.Z. The majority of the epiphytic taxa grow on a wide range of host tree species; the host species are not listed for the members of this family.

Temperate South America has a comparable diversity at the genus level, but a greater number of species than N.Z. Buck et al. (2005) raised the section *Ptychomniella* Broth. to generic rank; it is monotypic and restricted to southern South America. Bell et al. (2007) recently described a new genus, *Ombronesus*, with a highly reduced endostome, from the Aysén region of southern Chile. A proposal to shift *Dichelodontium* to the Lepyrodontaceae by Allen (1999), based partly on peristome studies by Magill (1987), is not accepted here. Phylogenetic studies by Bell et al. (2007) show *Dichelodontium* to be nested in a clade with other members of the Ptychomniaceae, and the transfer was not followed by Goffinet et al. (2009).

Recent studies (Buck et al. 2005; Bell et al. 2007), using both molecular and morphological characters, have greatly enlarged this traditional (Brotherean) view of the family. Apart from newly described genera, mentioned above, the most notable change is the proposed transfer of the large, predominantly southern Asian and Malesian genus *Garovaglia*, and the allied genus *Euptychium*, to the Ptychomniaceae from the Pterobryaceae. According to During (1977, p. 9), *Garovaglia* and its allies comprise a “rather distinct, natural group”, the Garovaglioideae, in the Pterobryaceae. *Garovaglia* and its allies differ from N.Z. members of the Ptychomniaceae in many sporophytic features, with short, non-ribbed capsules borne on short setae. They also lack the distinctively long rostrate operculum found in other members of the Ptychomniaceae. These morphological differences mean that the transfer of *Garovaglia* and its allies to the Ptychomniaceae makes the family less cohesive and far more difficult to characterise morphologically.

For the purposes of this Flora, this proposed expansion of the Ptychomniaceae is of little practical significance, as all our taxa are included in the expanded family concept presented by Goffinet et al. (2009). They placed the Ptychomniaceae in its own order, the Ptychomniales, in the general relationship of the Hypnodendrales and the Hookeriales. The furrowed and shouldered exostome teeth of some of the genera occurring in N.Z. make an alliance with the Hookeriales and Hookeriaceae plausible.

Ptychomnion is the largest genus in the family and contains five to eight species, depending on interpretation. Three of the six genera present in N.Z. (*Cladomnion*, *Dichelodontium*, and *Tetraphidopsis*) are monotypic endemics. *Cladomniopsis*, *Ombronesus*, and *Ptychomniella* are each monotypic and restricted to southern South America. A phylogenetic study by Bell et al. (2007) showed *Ptychomniella* to be sister to a clade including all the N.Z. genera, plus *Garovaglia*, and *Euptychium*, but excluding *Hampeella*.

The family as circumscribed here is the most species-rich in N.Z., Patagonia, and Juan Fernandez I., and also occurs on N.Z.'s southern offshore islands (including Macquarie I.), in Tasmania, south-eastern mainland Australia, southern Brazil, Marion and Crozet Is, New Caledonia, Malesia, Polynesia, and probably Sri Lanka and the Philippines.

1 **Leaves** when moist wide-spreading and sometimes squarrose; **capsules** strongly inclined to pendent; **endostomal cilia** present; **setae** mostly >20 mm; **plants** mostly terrestrial .... *Ptychomnion*

1' **Leaves** when moist mostly erect to weakly spreading, never squarrose (but often reflexed apically); **capsules** erect; **endostomal cilia** absent (possibly sometimes rudimentary in *Cladomnion*); **setae** mostly <10 mm; **plants** mostly epiphytic 2

2 **Shoots** moderately to strongly complanate; **exostome teeth** absent (or present in *Hampeella*) 3

2' **Shoots** not or only weakly complanate; **exostome teeth** present 4

3 **Leaves** broadly rounded, strongly concave, and cucullate at apex, <2.0 mm long; **mid laminal cells** vermicular, mostly 42–51 × 3–4 µm; gemmae absent from leaf axils; exostome absent; **endostome** with 16 undivided or forked segments, arising from a basal membrane 3–4 cells and c. 75–100 µm high; widespread on both main islands .... *Dichelodontium nitidum*

3' **Leaves** acute, not cucullate at apex, ≥2.0 mm long; **mid laminal cells** linear-rhombic, mostly 90–120 × 4–5 µm; **gemmae** present in upper leaf axils, acicular, multi-cellular; **exostome** well developed, with furrowed teeth; **endostome** segments arising from a membrane c. ½ the exostome height; very rare, known only from S Auckland L.D. .... *Hampeella pro parte* (*H. pallens*)

4 **Plants** extremely small and slender; **leaves** ≤1.5 mm with a single costa; **secondary (ascendant) stems** when sterile <15 mm, not or scarcely curved, with terminal spherical clusters of filamentous propagulae .... *Tetraphidopsis pusilla*

4' **Plants** larger; **leaves** ≥2.0 mm with costa short and double or absent; **secondary (ascendant) stems** when sterile commonly c. 25–50 mm; mostly curved away from the substrate, lacking terminal clusters of propagulae 5

5 **Leaves** not reflexed at apex, narrowly acute and lacking an apiculus; **paraphyllia** present and sometimes abundant on stems .... *Glyphothecium sciuroides*

5' **Leaves** distinctly reflexed at apex, either obtuse or abruptly apiculate; **paraphyllia** absent from stems 6

6 **Leaves** obtuse, broadly ovate or broadly elliptic, strongly plicate, when well developed l:w c. 2:1; **spores** multicellular .... *Cladomnion ericoides*

6' **Leaves** apiculate, rather narrowly elliptic, not plicate, when well developed l:w c. 3:1; **spores** unicellular .... *Hampeella pro parte* (*H. alaris*)

Cladomnion Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II,* 99 (1854)

≡ *Garovaglia* sect. *Cladomnion* (Hook.f. & Wilson) Mitt., *Trans. & Proc. Roy. Soc. Victoria* 19: 80 (1882)

Type taxon: *Cladomnion ericoides* (Hook.) Hook.f. & Wilson

Taxonomy: Three species were included in the genus at the time of its description but subsequently (e.g., Brotherus 1925; Dixon 1927; Sainsbury 1955) only *C. ericoides* has been retained in the genus. It is both appropriate and nomenclaturally convenient that this species be considered the lectotype.

Cladomnion is a monotypic genus endemic to N.Z. The species description below applies to the genus.

The orthographic variant *Cladomnium* used by Brotherus (1925) is invalid, according to Tropicos (Data seen online, TROPICOS, accessed 14 June 2017).

Etymology: The generic name is derived from Greek roots and means branched moss.

Cladomnion ericoides (Hook.) Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II,* 99 (1854)

≡ *Leskea ericoides* Hook., *Musci Exot. 1,* pl. 28 (1818)
Holotype: N.Z.: Dusky Sound, 1791, *A. Menzies 78*, Herb. Hooker, BM 000986874!

Plants bright green or yellow- to brown-green, robust, forming loose and pendent wefts. **Primary stems** well developed. **Secondary stems** usually ± pendulous, curving upwards at apex, (25–)40–80(–120) mm, sparsely forked or simple, in cross-section oval or round, lacking a central strand. **Shoots** cylindric, not tapered at apices, with smooth, red-brown rhizoids occasionally produced in dense fascicles near apices or at branching points. **Leaves of secondary stems** densely imbricate, erect-spreading, arranged in several well-defined spiral ranks, broadly ovate or broadly elliptic, strongly plicate below and with some plications extending nearly to the leaf apex, clasping and ± auriculate at base, obtuse and strongly reflexed at apex, symmetric and concave, plane and mostly weakly crenulate at upper margins, often weakly toothed at extreme base, c. 3.0–3.2 ×1.5–1.7 mm and c. 2:1; those near the stem apex not differentiated; **mid laminal cells** linear, mostly 30–45 × c. 5–6 µm, strongly porose, smooth, those at apex shorter; **cells at insertion** forming a distinct band across the leaf base; **alar cells** not differentiated. **Costa** absent (illustration here is misleading). **Paraphyllia** absent. **Gemmae** absent.

Phyllodioicous. Perichaetia inconspicuous, scattered on secondary stems, apparently lacking paraphyses, with inner leaves c. 1 mm, broadly ovate, acute and non-reflexed at apex, often ± asymmetric; enlarging after fertilisation and becoming broadly elliptic, tubular, and obtuse and clasping the seta for >⅓ of its length. **Male plants** dwarf, epiphytic on leaves of female plants. **Setae** (5–)8–10(–13) mm, red-brown; **capsules** erect, symmetric, cylindric, strongly ribbed, red-brown, 2.5–3.0 mm, with virtually no neck; **exothecial cells** rounded or somewhat polygonal; **annulus** present, persistent, of 3–4 rows of firm-walled cells; **operculum** c. 2.5 mm and rostrate from a conic base, often ± equal the capsule. **Exostome teeth** c. 500–700 µm, not shouldered, furrowed and bordered, transversely striate and finely papillose on outer surface, densely trabeculate but otherwise nearly smooth on inner surface; **endostome** arising from a basal membrane c. 200 µm high, with long, strongly keeled segments nearly the length of the teeth; **cilia** absent. **Calyptra** narrow, enclosing the entire capsule. **Spores** multicellular (to 15-celled or more) and green, extremely variable in shape and size, up to c. 140 × 60 µm.

Illustrations: Plate 1. Hooker 1818, pl. 28; Brotherus 1925, fig. 512 g–n; Sainsbury 1955, pl. 53, fig. 2; Beever et al. 1992, fig. 55; Malcolm & Malcolm 2003, p. 14.

Distribution: NI: N Auckland including offshore islands (LB, GB), S Auckland, Gisborne, Hawke’s Bay (Makatoka, Te Āpiti, Ongaonga), Taranaki, Wellington; SI: Nelson, Marlborough (D’Urville I., Kenepuru, Mt Stokes, Mt Robertson, Pelorus Bridge Scenic Reserve), Westland, Otago (Leith Valley, Pine Hill, near Papatōwai, Humboldt River), Southland; St; Ch; A; Sol.

Endemic.

Habitat: *Cladomnion ericoides* is a frequent forest species in wetter parts of the main islands. It occurs most frequently on twigs and small branches of understorey trees and shrubs, and is a common species in the forest canopy in wet forest. It occurs less frequently on the trunks and larger branches of a wide variety of tree species. The best developed populations are often associated with forest margins. A large number of herbarium collections are from branches fallen from the forest canopy, and these account for the bulk of, if not all, records of it growing on the forest floor. It is extremely catholic in terms of its host species (occurring on at least 15 genera). It occasionally grows on tree bases and stumps. Occasional herbarium records indicate its occurrence on rock (e.g., on lava at 1200 m at Te Mari on Mt Tongariro, Wellington L.D.). On the North I. it ranges from 90 m (Mangamuka Gorge, N Auckland L.D.) to at least 1040 m (Waipunga River, S Auckland L.D.) as an epiphyte and occasionally higher on rock (1200 m on lava at Te Mari Hill, Wellington L.D.). On the South I. it ranges from near sea level (several localities including Madmans Creek, Nelson L.D., and Pourākino River, Southland L.D.) to at least 1070 m (Paparoa Range, Nelson L.D.). Frequent bryophyte associates include *Dicnemon* spp., *Glyphothecium sciuroides*, *Leptostomum* spp., *Mesotus celatus*, *Macromitrium longipes*, *Papillaria flavolimbata*, *Weymouthia cochlearifolia*, *W. mollis*, and *Lepicolea scolopendra*.

Notes: Most of the Hawke's Bay L.D. localities are based on pre-1900 collections (including several collections made in the 1880s by W. Colenso) and the plant has been rarely collected there in recent decades, certainly reflecting deforestation of parts of this L.D. It is a relatively rare plant in Marlborough and Otago L.D. (with many of the Otago collections from the relatively wet hills close to Dunedin). It has not been recorded from Canterbury L.D. It is known from the Auckland Is from only one collection (WELT M003546) made by Colleen Black in 1973.

Cladomnion ericoides is a distinctive and beautiful moss and, once recognised, it is unlikely to be confused with any other species in the N.Z. flora. It is most commonly observed forming pendent mats from branches and twigs. The lustrous, strongly plicate and apically reflexed leaves and the abruptly upwardly swept shoot apices make this species easily recognisable. The description of Beever et al. (1992, p. 114) of the branches of *Cladomnion* as "rope-like" due to the usually regularly spiralled ranks of leaves is apt and calls to mind some of the "funiculate" species of *Macromitrium*.

Both unfertilised perichaetia and dwarf epiphyllic male plants are inconspicuous and often difficult to find. Brotherus (1925, fig. 512, n) illustrated paired endostomal cilia for this species, but these have not been observed, despite numerous dissections. His illustration may be an error and Sainsbury's (1955, p. 341) description of the endostome was probably unduly influenced by Brotherus's illustration. The usual multicellular spores of this species are probably the result of precocious (*in situ*) germination giving rise to an endosporic protonema; a few single-celled spores can usually be observed in dissected capsules.

Recognition: There are few species in the N.Z. flora with which *Cladomnion* could be confused. In the Ptychomniaceae, *Hampeella alaris* has similarly reflexed leaf tips, but *Cladomnion* is quite readily differentiated from it by having much larger and broader leaves that are strongly plicate, by the absence of gemmae, and other features including those of the peristome and spores. *Ptychomnion densifolium* is a more robust plant, growing terrestrially rather than epiphytically, and with the upper half of the leaf (rather than merely the apex) strongly squarrose.

Etymology: Hooker's (1818, pl. 28) protologue gives no hint why he chose the epithet *ericoides* for this species. It presumably alludes to a perceived but superficial resemblance to the genus *Erica*.

Dichelodontium Hook.f. & Wilson ex Broth., *Nat. Pflanzenfam. [Engler & Prantl] 1(3),* 875 (1907)

Type taxon: *Dichelodontium nitidum* (Hook.f. & Wilson) Broth.

Dichelodontium is a monotypic genus endemic to N.Z. The species description applies to the genus.

Taxonomy: *Dichelodontium* is retained in the Ptychomniaceae on the strength of the cladistic trees of Bell et al. (2007) and its placement here by Goffinet et al. (2009).

Magill (1987) discussed at length the nature of the *Dichelodontium* peristome and concluded it is endostomal in nature; he advocated the retention of this monotypic genus in the Ptychomniaceae on the basis of its peristome structure. Citing Magill, Allen (1999) proposed the transfer of *Dichelodontium* to the Lepyrodontaceae, noting the endostomal nature of the peristome, linear to sub-vermicular laminal cells, poorly differentiated alar cells, weak costae, sheathing perichaetia, cucullate calyptrae, and the presence of rhizoid initials in the axils and around branch buds. However, because of the findings of Bell et al. (2007), Allen's proposed transfer is not followed here.

Etymology: According to Meagher (2011) the generic name derives from the Greek roots *dichelos* (two-headed arrow) and *odontos* (toothed), and alludes to the half-split peristome teeth.

Dichelodontium nitidum (Hook.f. & Wilson) Broth., *Nat. Pflanzenfam. [Engler & Prantl] 1(3),* 875 (1907)

≡ *Leucodon nitidus* Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II,* 99 (1854) Lectotype: N.Z., Bay of Islands, *J.D. Hooker* (herb. Wilson 411), BM 000986857! Selected by R. Hattaway in Mar 1980, but apparently not published. The lectotype is sparsely fruiting and accompanied by a series of detailed sketches by Wilson.

Plants soft, yellow-green, strongly lustrous, forming interwoven mats on bark. **Stems** creeping, irregularly branched, mostly pale brown, to at least 35 mm long, in cross-section oval, with 2 layers of thick-walled cortical cells surrounding a parenchymatous core and lacking a central strand, with rhizoids sparse, restricted to branch bases, smooth, and red-brown. **Branches** scarcely differing from stems. **Shoots** slightly flattened, c. 1.5–1.8 mm wide. **Leaves** loosely imbricate and erect-spreading when dry, little altered when moist, becoming more tightly imbricate at shoot apices, erect, weakly ranked, and slightly complanate, symmetric, elliptic and broadly rounded, strongly concave and cucullate at apex, smooth both dry and moist, plane at margins, not decurrent, entire, c. 0.9–1.1(–1.2) × (0.25–)0.3–0.35 mm; **mid and upper laminal cells** vermicular, firm-walled (walls roughly equal to the lumina in width), weakly projecting at upper ends, not porose, mostly 42–51 × 3–4 µm, scarcely differentiated below but with a band of shorter and pigmented cells at insertion; **alar cells** irregular, thick-walled and pale brown, forming a very small group of c. 6–8 cells. **Costa** lacking. **Paraphyllia** lacking. **Gemmae** nil. **Axillary hairs** conspicuous, 3–4 celled, cylindric.

Dioicous. **Perichaetia** scattered on stem and branches, c. 1.5–1.8 mm long, the outer leaves squarrose, the inner leaves longer, tubular, and strongly sheathing the seta base, rounded or broadly obtuse at apex. **Male plants** not dwarfed; **perigonia** scattered, axillary and gemmiform, with few antheridia and no paraphyses. **Seta** 4–8 mm, straight, slightly sinistrorse, pale brown; **capsules** oblong-cylindric, erect or nearly so, weakly curved, with a weakly defined neck, strongly 8-ribbed, 1.5–1.8 mm, red-brown; **exothecial cells** short and weakly polygonal, not thickened at corners; in alternate bands of ± thin and thicker-walled cells; **stomata** superficial, restricted to extreme capsule base; **annulus** lacking; **operculum** rostrate from a conic base, c. ⅔ the urn length. **Exostome** absent; **endostome** yellow-brown or orange, inserted very close to rim, extending c. 270–360 µm beyond rim, arising from a basal membrane 3–4 cells and c. 75–100 µm high; segments 16, undivided or forked nearly to base (with one half sometimes irregularly subdivided), with a median longitudinal line on both surfaces, not keeled, ± smooth or finely papillose. **Calyptra** cucullate, smooth, covering operculum and c. upper half of capsule. **Spores** single-celled, c. 18–33 µm, yellow-brown in mass, coarsely papillose, occasionally germinating in capsule.

Illustrations: Plate 2. Wilson 1854, pl. 87, fig. 4 (as *Leucodon nitidus*); Magill 1987, figs. 1–6, 9; Malcolm & Malcolm 2003, p. 21.

Distribution: NI: N Auckland (Waipoua Forest, Hunua Range), S Auckland (numerous localities), Gisborne (numerous localities, including Waikaremoana area), Hawke's Bay (near Tūtira, Titiokura Hill, near Wairoa, near Mōrere), Taranaki (numerous localities), Wellington (numerous localities); SI: Nelson (Collingwood, Charleston, Punakāiki area), Marlborough (Endeavour Inlet, Pelorus Sound), Westland (numerous localities), Otago (near Dunedin, Papatōwai), Southland (numerous localities).

Endemic.

Habitat: This species occurs most frequently in moister parts of N.Z. Accordingly it is only sparsely recorded from Hawke's Bay, Nelson, and Marlborough L.D. and it is unrecorded from Canterbury and the drier portions of Otago L.D. *Dichelodontium nitidum* occurs on trunks of a wide variety (at least 16 genera) of mostly smooth-barked tree species. Associated bryophyte species include *Calyptopogon mnioides*, *Leptodon smithii*, *Macromitrium* spp., *Orthorrhynchium elegans*, *Tetraphidopsis pusilla*, and *Zygodon hookeri*, as well as *Frullania* spp., *Porella elegantula*, and *Metzgeria hamata*. Ranging to c. 915 m (Mt Taranaki) on the North I. and from near sea level (near Punakāiki) to at least 380 m (Kelly's Creek, Westland L.D.) on the South I.

Notes: Unlike in some genera of the Ptychomniaceae, the primary and secondary stems cannot be differentiated here. The highly lustrous and slightly compressed shoots with elliptic, strongly concave, and apically cucullate leaves are distinctive. The apical leaves are more erect and imbricate than those below, causing the stems/branches to terminate in a compact cluster of leaves, which lends distinction to this species. In some, but not all, collections the terminal leaf cluster is weakly flattened. The erect and ribbed capsules with long-beaked opercula, if present, likewise facilitate recognition of *D. nitidum* in the field. The gametophytic features appear very constant, while some sporophytic characters (including peristome and spore dimensions) vary considerably. Sainsbury's (1955) description indicated a wider range of spore size than that described above.

Recognition: *Dichelodontium nitidum* is most likely to be confused with *Orthorrhynchium elegans*, but the present species has only weakly complanate shoots, while those of *O. elegans* are strongly complanate and the leaves virtually distichous. The leaves of *Dichelodontium* are strongly concave and cucullate, whereas those of *O. elegans* are conduplicate. The sporophytes also differ markedly. Confusion with *Fallaciella gracilis* is also possible, but the latter species is nearly always terrestrial, is less glossy, and has more distinctly acute leaves, as well as alar cell and sporophytic differences.

Etymology: The specific epithet *nitidum* means shiny or polished, and seems apt for this lustrous species.

Glyphothecium Hampe, *Linnaea* 30: 637 (1860)

Type taxon: *Glyphothecium muellerianum* Hampe = *Glyphothecium sciuroides* (Hook.) Hampe

The species description is presented as representative of the genus.

Taxonomy: Hampe (1860) described the genus in a combined generic and species description (*descriptio generic-specifica*) based on the Victorian *G. muellerianum*. Syntype material of *G. muellerianum* has only been seen online (JSTOR Global Plants, accessed 14 June 2014), and it was annotated by R. Hattaway as *G. sciuroides*.

Glyphothecium is probably a genus of two species, although Hattaway (1981) accepted three. In addition to *Glyphothecium sciuroides*, he recognised *G. gracile* (Hampe) Broth. of southern South America and *G. pendulum* Zanten of New Guinea. A detailed description and illustration of *G. gracile* was provided by Kühnemann & Gonçalves Carralves (1975). Enroth (1991) proposed that both *G. pendulum* and the Javanese *G. pangerangense* Fleisch. be considered synonyms of *G. sciuroides*. Very little reliably named material of *Glyphothecium* from outside of Australia and N.Z. has been seen, and the resolution of the species-level taxonomy is outside the ambit of this Flora. The Hampe name is the earliest, and hence any synonym decisions would not affect the name applied to N.Z. material.

Etymology: According to Meagher (2011) the generic name in derived from the Greek roots *glyphos* (engraved) and *thekion* (little vessel, container), and alludes to the strongly ridged capsules.

Glyphothecium sciuroides (Hook.) Hampe, *Linnaea* 30: 637 (1860)

≡ *Leskea sciuroides* Hook., *Musci Exot. 2,* 175 (1819)
≡ *Cladomnion sciuroides* (Hook.) Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II,* 100 (1854)
Holotype: Tasmania, Musci Exot. 2: pl. 175. "In Insula Van Diemen, *D.R. Brown*", herb. Hooker "H. 1973", BM 000667785!

= *Glyphothecium muellerianum* Hampe, *Linnaea* 30: 637 (1860)
Syntype: Australia, "Australia felix, *Dr F. Mueller 63*, 1855", BM 000986867. Seen online on JSTOR Global Plants, accessed 25 Jul. 2017.

Plants rather pale green to brown-green, weakly lustrous, moderately robust, forming loose wefts, usually pendent and curved away from the substrate. **Primary stems** not seen, apparently lacking. **Secondary (ascendant) stems** 17–40(–80) mm, simple or branched by forking, in cross-section oval, with a few smooth, red-brown rhizoids at extreme base. **Shoots** not complanate, strongly curled away from the substrate at their tips. **Leaves of secondary stems** imbricate and erect-spreading when moist, little altered when dry, not complanate, often weakly secund, broadly ovate-lanceolate, gradually tapered to a narrowly acute and usually twisted apex, weakly and rather irregularly plicate (more conspicuously when dry), usually reflexed at mid leaf margins, symmetric, toothed above, mostly c. 2–3 × 0.8–1.1 mm; **mid laminal cells** irregularly rhombic, thick-walled, porose, c. 30–36 × 9 µm; **alar cells** differentiated, irregular in outline, oblate to ± quadrate, porose, compact, forming a small group, which merges gradually above with several rows of obliquely oriented and irregularly elongate cells. **Costa** short, double, and indistinct. **Paraphyllia** present and sometimes abundant, linear, mostly two cells wide at base and 180–400 µm long. **Gemmae** usually numerous among upper leaves, clavate, transversely septate, mostly 5–8-celled and c. 100–150 µm long.

Dioicous. Perichaetia scattered, appearing lateral on secondary stems, the inner leaves shouldered and tapered to a slender acumen, clasping the seta base. **Male plants** not dwarfed, with numerous scattered gemmiform and brown **perigonia**. **Seta** c. 5 mm; **capsules** erect and symmetric, ellipsoid, ribbed; **exothecial cells** rounded; **stomata** few, best seen in green capsules; **annulus** lacking; **operculum** c. ½ length of the capsule. **Exostome teeth** c. 360 µm, neither furrowed nor shouldered, unbordered, cross-striate below on abaxial surface, nearly smooth above; trabeculate but otherwise smooth on the adaxial surface; **endostome** arising from a pale membrane c. ½ the exostome height, with rudimentary **segments**. **Calyptra** cucullate, smooth. **Spores** single-celled, 15–18 (rarely –30) µm, papillose.

Illustrations: Plate 3. Hooker 1819–1820, pl. 175; Hattaway 1981, figs 1, 4–5, 7; Malcolm & Malcolm 2003, p. 30; Milne & Klazenga 2012, unnumbered fig. and photos; Seppelt et al. 2013, pl. 7.

Distribution: NI: N Auckland (Puketi Forest, Waipoua Forest, Titirangi) including offshore islands (LB), S Auckland, Gisborne (numerous localities, including Lake Waikaremoana area), Hawke's Bay, Taranaki, Wellington; SI: Nelson, Marlborough, Canterbury (numerous localities, all above c. 700 m elevation), Westland, Otago (localities mostly in eastern Otago), Southland.

Austral. Tasmania*, mainland Australia*, Argentina*. Reported from Chile by Hattaway (1981) and from P.N.G., several other Malesian islands, and elsewhere by Enroth (1991) and others. However, there is no consensus regarding the relationship of Australasian (N.Z., Tasmanian, and mainland Australian) populations of *Glyphothecium* to populations in Malesia (including P.N.G.) and Asia. Consequently, all published records from those regions are regarded here as inconclusive.

Habitat: Mostly epiphytic on trunks and large branches, less often on stumps or boulders, and rarely on twigs. Occurring on a wide variety of woody species belonging to at least 16 genera. Commonly associated mosses include *Cladomnion ericoides*, *Dicnemon* spp., *Hampeella alaris*, *Macromitrium longipes*, *Mesotus celatus*, and *Weymouthia cochlearifolia*. Ranging from low elevations (c. 80 m at Otūmangu Landing on the Whanganui River, Wellington L.D.) to at least 1070 m (Mt Taranaki, Taranaki L.D.) on the North I. and from near sea level (at several localities including the Punakāiki River, Nelson L.D. and Pelorus Bridge Scenic Reserve, Marlborough L.D.) to >1100 m (St Arnaud Range, Nelson L.D.) on the South I. All Canterbury L.D. records are from elevations of >700 m, although there are several lowland records from Marlborough L.D., *Glyphothecium* is very frequent throughout Southland L.D. (>20 separate collections in CHR), making the absence of records from Stewart I. seem anomalous.

Notes: Spore characters are particularly difficult to observe in *G. sciuroides*. The measurements in the description are taken from spores in capsules with fallen opercula. Spores are often very few in number in such herbarium specimens. Some spores up to 30 µm diam. have been seen, and these correspond to the size Fleischer (quoted by Sainsbury 1955) mentioned for Javanese *Glyphothecium*. In addition to normally developed papillose spores, occasional thin-walled and collapsed spores occur. One instance has been seen (*E.S. West*, 24 Sep. 1938, WELT M003045) of gametophyte shoots emergent from capsules, apparently as the result of *in situ* germination.

The circumscription of this species and its consequent distribution outside of N.Z., Tasmania, and mainland Australia require clarification. The type locality is Tasmania, while the type locality of the synonym *G. muellerianum* is Victorian. Hattaway (1981) recorded it from Chile and western Argentina and indicated that it sometimes co-occurs there with *G. gracile* (Hampe) Broth. Two Patagonian specimens collected by P. Dusén (from Puerto Blest on Lago Nahuel Huapi in western Argentina, WELT M033715!, and Insula Guaitecas in Chile, WELT M033716!) have been confirmed as belonging to *G. sciuroides*.

Enroth (1991) recorded *G. sciuroides* from several high elevation localities in New Guinea, from whence van Zanten (1964) described *G. pendulum*. I am not convinced that the single New Guinean specimen I have examined is conspecific with N.Z. or Tasmanian material of *G. sciuroides*, but note that Enroth briefly discussed (citing an unpublished revision by Hattaway) the considerable variability of *G. sciuroides* on that island. Material of the Javanese *G. pangerangense* Fleisch. has not been studied.

According to Hattaway (1981), the South American *G. gracile* (Hampe) Broth. differs from the present species by having rectangular to linear alar cells, while he considered the alar cells of *G. sciuroides* to be quadrate to oblate. No reliably named material of *G. gracile* has been available for comparison; the absence of this species in N.Z. herbaria is difficult to explain.

There are discrepancies between the collection information in the protologue and that on the holotype in the BM. "D.R. Brown", given in the protologue, presumably refers to Robert Brown of Australian fame. The holotype does not bear the collector's name, but bears a collection number: "8, *L. sciuroides*, Van Diemen's Island" in Robert Brown's script as well as a clear reference to Hooker's (1819–1820) Musci Exotici pl. 175 (probably in the same script). The holotype is also labelled as Herbarium Hooker "H.1973". The two mounted stems comprising the holotype were illustrated in the protologue. There are other Tasmanian species published in the Musci Exotici (e.g. *Bartramia affinis*, *Splachnum octoblepharum*) that are cited as collected by either "D.R. Brown" or by "D. Brown".

Recognition: *Glyphothecium sciuroides* is unlikely to be confused with other members of the Ptychomniaceae in N.Z. *Hampeella alaris* differs by being a more delicate and glossy plant, with distinctly reflexed leaf apices.

More compact forms of *G. sciuroides* bear considerable superficial similarity to *Crosbya straminea* and confusion does sometimes occur, especially in sterile material. *Glyphothecium sciuroides* has weak and double costae and unbordered leaves, in contrast to the strong single costa and distinct leaf border in *C. straminea*. The wider (mostly c. 1 mm) and less secund leaves of the *Glyphothecium* contrast with the narrower (mostly c. 0.5 mm) and distinctly secund leaves of the *Crosbya*. *Glyphothecium* stems bear paraphyllia, while those of *Crosbya* do not. Both species frequently bear capsules and then the ribbed capsules of *Glyphothecium* contrast with the smooth capsules of *Crosbya*.

Etymology: The epithet *sciuroides* means squirrel-like and refers to the distinctive aspect of *Glyphothecium* shoots. The shoot tips usually curve upward and away from the substrate in a manner suggestive of the curvature of a squirrel's tail.

Hampeella Müll.Hal., *Bot. Zentralbl.* 7: 348 (1881)

Type taxon: *Hampeella kurzii* Müll.Hal. = *Hampeella pallens* (Sande Lac.) M.Fleisch.

Plants pale green, slender to moderately robust. **Primary stems** weak. **Secondary stems** (shoots) arising in tufts, ascendant, simple or sparsely branched, weakly complanate or ± julaceous, with rhizoids restricted to base, in cross-section oval. **Leaves of secondary shoots** imbricate, complanate or erect-spreading and ± julaceous, asymmetrically lanceolate and acute or symmetric, elliptic, and abruptly acute, serrulate above or nearly entire, neither decurrent nor plicate; **mid laminal cells** linear-rhombic, firm- or ± thin-walled, not or slightly porose. **Costa** absent or very short (<⅕ of leaf length), double, and indistinct. **Paraphyllia** absent. **Gemmae** acicular and multi-septate, arising in tufts from short rhizoid-like structures in leaf axils.

Dioicous. **Perichaetia** scattered on secondary shoots, the leaves expanding after fertilisation and clasping the seta base. **Perigonia** bud-like, on well-developed ♂ shoots (seen only in *H. alaris*). **Capsules** erect, symmetric, ellipsoid-cylindric, strongly ribbed; **exothecial cells** rounded and ± polygonal; **stomata** few at capsule base; **annulus** weakly developed; **operculum** rostrate from a conic base. **Peristome** double; **exostome teeth** bordered, cross-striate on outer surface, densely trabeculate but otherwise nearly smooth on inner surface; **endostome** from a pale membrane c. half the exostome height; **segments** smooth, nearly the height of the teeth. **Calyptra** not seen. **Spores** single celled.

Taxonomy: The genus is circumscribed here based on the type species (which is a taxonomic synonym of *H. pallens* (Sande Lac.) Fleisch.) and *H. alaris*; material of neither *H. leptodictyon* from Mindinao nor *H. concavifolia* Hattaway & D.H. Norris from Queensland (Hattaway & Norris 2008) has been seen. This is a small genus of two to four species. Milne & Klazenga (2012) accepted three species for Australia.

The Australasian *H. alaris* differs from *H. pallens* in many gametophytic features, enumerated below. *Hampeella alaris* is retained in the present genus as a taxonomic convenience rather than from conviction. The tendency for the upper shoots of *H. alaris* to become complanate, similar gemmae form, and sporophyte morphology (excepting exostome teeth form) argue for the species' continued placement in *Hampeella*. Also, W.R. Buck (pers. comm., March 2002) informed me that molecular data suggest that the two species are closely allied.

Etymology: The genus is named after the German botanist and apothecary Georg Ernst Ludwig Hampe (1795–1880), who wrote extensively (usually as E. Hampe) about mosses of South America and Australasia.

1 **Leaves** asymmetric, flat except for a single inrolled lower margin, not reflexed apically, arranged in 4 rows and strongly complanate throughout; **leaf cells at insertion** weakly pigmented but scarcely forming a distinct band at leaf base; **brood bodies** mostly of 12–18 cells and 400–650 µm long; **exostome teeth** with a well-developed median furrow; **plants** known only from S Auckland L.D. .... *H. pallens*

1' **Leaves** symmetric, concave, erect-spreading, reflexed apically (at least in leaves at the lower portion of the stems), and arranged in several weakly defined spiral ranks on lower stem (often weakly complanate near stem apex); **leaf cells at insertion** pigmented to form a distinct band across the leaf base; **brood bodies** mostly of 20–25 cells and mostly 750–1200 µm long (rarely shorter); **exostome teeth** lacking a distinct median furrow; **plants** widespread on both main islands .... *H. alaris*

Hampeella alaris (Dixon & Sainsbury) Sainsbury, *Rev. Bryol. Lichénol., n.s.* 20: 95 (1951)

≡ *Glyphothecium alare* Dixon & Sainsbury, *J. Bot.* 71: 246 (1933)
Holotype: N.Z., Maruia Springs, Nelson, April 1931, *J.H. McMahon*, Herb. Dixon, BM 000667782! Isotype: CHR 558926!

= *Hampeella pallens* var. *symmetrica* Sainsbury, *Rev. Bryol. Lichénol., n.s.* 20: 95 (1951)
≡ *Hampeella alaris* var. *symmetrica* (Sainsbury) J.Milne & Klazenga, *Austral. Mosses Online* 31: 2 (2012)
Holotype: N.Z., South Auckland, between Lake Rotoehu and Bay of Plenty coast, *K.W. Allison 2052*, WELT M003017! Isotype: CHR 547286!

The species description below deliberately repeats information in the generic description, reflecting my persistent doubts about a close relationship between these two species.

Plants pale yellow-green, lustrous, rather slender, forming loose wefts, usually weakly curled upwards. **Primary stems** weak and creeping or sometimes apparently absent. **Secondary shoots** arising in tufts, variable in length, c. 20–35 mm, simple or sparsely forked, ± julaceous (not complanate) below, tapered to a slender and weakly complanate apex, with **stems** in cross-section oval, lacking a central strand, with several layers of thick-walled, pigmented cortical cells, and with a few smooth red-brown rhizoids at base. **Leaves** of secondary shoots imbricate, erect-spreading, arranged in several weakly defined spiral ranks, elliptic and rather abruptly tapered to an acute, reflexed, and untwisted mucro, concave and with margins strongly inrolled above, smooth, symmetric, entire except for a few apical denticulations, c. 1.3–1.5 × 0.4 mm; those near stem apex nearly always more lanceolate, markedly less concave, and not reflexed at apex; **mid laminal cells** linear-rhombic, ± thin-walled, smooth, usually slightly porose, c. 60–90 × 4–5 µm; **cells at insertion** irregular, thick-walled, porose, pigmented, forming a ± distinct band across the leaf base; **alar cells** forming a small, well-defined group of c. 7–10 irregularly quadrate, thick-walled, and somewhat enlarged (c. 15–21 µm in greater dimension) cells. **Costa** short and double, indistinct, or lacking. **Paraphyllia** apparently absent (see below). **Gemmae** abundant or sparse among upper leaf axils, acicular and uniseriate, mostly 20–25 cells and 750–1200 µm long, arising from tufts of short rhizoid-like structures.

Dioicous. Perichaetia on short branches, scattered and appearing lateral on secondary shoots, inner leaves broadly ovate, acute, not shouldered, apparently enlarging after fertilisation and clasping the seta for up to half its length. **Perigonia** bud-like, scattered on well developed ♂ shoots. **Setae** 3–5(–6) mm, flexuose; **capsules** erect, symmetric, strongly sulcate when dry, c. 2.5 mm; **exothecial cells** firm-walled, rounded or somewhat polygonal; **stomata** few at extreme capsule base; **annulus** weakly developed, composed of 1(?) row of thin-walled cells; **operculum** as per genus, c. ½ the length of the capsule. **Exostome teeth** yellow, broadly lanceolate, not shouldered, c. 330 µm long, bordered, inserted just below the rim, with a ± zig-zag divisural line, not furrowed, transversely finely striate below on outer surface, densely trabeculate but otherwise nearly smooth on inner surface; **endostome** arising from a basal membrane c. ½ the height of the teeth, with nearly colourless and smooth segments extending c. ⅞ the height of the teeth and no cilia. **Calyptra** not seen, probably cucullate and smooth. **Spores** extremely variable, round or elliptic, green, papillose, mostly 12–45 µm, but often appearing collapsed in dried material and sometimes larger.

Illustrations: Plate 4. Sainsbury 1955, pl. 54, fig. 2; Malcolm & Malcolm 2003, p. 32; Milne & Klazenga 2012, unnumbered fig. and photos; Seppelt et al. 2013, pl. 8.

Distribution: NI: S Auckland, Gisborne, Taranaki, Wellington (Mt Tongariro, Ruapehu, Tararua Range). SI: Nelson, Marlborough (Mt Stokes, Pelorus Bridge Scenic Reserve), Canterbury, Westland, Otago, Southland; St.

Australasian. Tasmania*. Reported from Victoria by Vollebergh (1986) and by Milne & Klazenga (2012).

Habitat: In forest and usually on small branches and twigs of a wide range of woody plant species, less often on trunks. Host plants include at least 11 different woody genera. Commonly associated mosses include *Cladomnion ericoides*, *Crosbya straminea*, *Glyphothecium sciuroides*, *Leptostomum inclinans*, *Macromitrium longipes*, and *Weymouthia mollis*. Ranging from c. 215 (Mayor I., S Auckland L.D.) to at least 1070 m (Panekiri Range, Gisborne L.D.) on the North I. and from c. 30 (Lyell Creek, Nelson L.D. to 1050 m on the South I).

This species is uncommon in the eastern, drier portions of the South I. R. Seppelt (pers. comm., 13 March 2002) informs me that it is restricted to wetter and more western portions of Tasmania.

Notes: When occurring on small branches this species grows as irregular rosettes of ± erect and usually curved secondary shoots c. 20–35 mm in height. The axillary gemmae can be very abundant amongst the upper leaves and can occasionally be seen with a hand-lens. When leaves are stripped from the stem, uniseriate and filamentous hairs (in addition to the brood bodies) are usually visible associated with the leaf base. These are mostly c. 200 µm and 5–6 cells long. They are interpreted here as axillary hairs rather than as paraphyllia. What appear to be lanceolate pseudoparaphyllia, c. 100 µm long and 2 cells wide at base are present at the base of perichaetia, but these have not been observed at the base of vegetative branches. I am, like Sainsbury (1955, p. 345), uncertain concerning the size and morphology of the spores, and in most fruiting collections have been unable to satisfactorily observe them. In at least one herbarium collection (*W. Martin 13 Feb.1951* ex Doubtful Sd., CHR 558927) the spores are distinctly dimorphic within a single capsule, with some 39–54 µm and others c. 21–24 µm and somewhat collapsed. It is unclear whether such dimorphic spores are the normal condition in this species or whether the smaller spores are merely undeveloped in this material.

Aberrant material has been collected at Marawaiwai Scenic Reserve (near Ōpōtiki, Gisborne L.D.) by *P. Beveridge LU-43* (WELT M040630). This material has leaves on the lower stem portions arranged in spiral ranks and with weakly reflexed apical mucros. There is a small group of rounded-subquadrate alar cells present, forming a small decurrency. The axillary gemmae here are mostly 400–640 µm and 15–22 cells long. These are shorter (in overall length) than usual for the gemmae of *H. alaris* and scarcely overlapping in terms of the cell number. While in some respects the Marawaiwai material is suggestive of *H. pallens*, it has been referred to *H. alaris*. Beveridge's Marawaiwai collection compares very well to type material of the previously synonymised *Hampeella pallens* var*. symmetrica* Sainsbury.

All the material of *H. alaris* appears to be dioicous, Sainsbury's (1955, p. 345) observation that the sexuality is "apparently variable" notwithstanding.

The generic placement of this species is problematic. When it was originally described in *Glyphothecium*, Dixon & Sainsbury (1933) expressed reservations concerning its belonging in that genus. The lack of paraphyllia, the acicular nature of the brood bodies, the thin-walled, scarcely porose and ± rhombic laminal cells, the strongly defined alar group of enlarged but thick-walled cells, the absence of oblique cells above the alar group, the lack of leaf plications, and the presence of well-developed endostomal segments all argue strongly against its retention in *Glyphothecium*.

Dixon & Sainsbury (1933) also suggested that this species might be allied to *Clastobryum*, a small genus of East Asian distribution in the Sematophyllaceae. The apiculate and reflexed nature of the vegetative leaves in *Hampeella alaris* argue against its placement in that genus while such leaf apices are found elsewhere, both in the Ptychomniaceae (e.g., *Cladomnion*) and in the Sematophyllaceae. The erect, symmetric and ribbed capsules, the epiphytic habitat, the presence of weakly developed primary stems giving rise to tufts of upwardly curved secondary shoots, and the presence of a band of thick-walled and strongly porose cells at the base of the leaves are all features that argue in favour of retention in Ptychomniaceae.

In 1951 Sainsbury transferred *G. alare* to an expanded *Hampeella*. In his enumeration of the species' outstanding gametophytic features Sainsbury noted the polymorphic and non-plicate nature of the vegetative leaves ("which in the main part of the stem are oblong-oval, very concave, cucullate and cuspidate, with the apex strongly recurved, but which in the upper part of the stem become much narrower, less concave, not cucullate, gradually acuminate and bluntly pointed"), filamentous axillary brood bodies, the absence of paraphyllia, linear-rhomboid, weakly porose laminal cells, and large, incrassate, and coloured alar cells.

Sainsbury's (1951) placement of this species in *Hampeella* is followed here with reservations. Scott & Stone (1976, p. 362) have expressed similar doubts, without citing their reasons. The most notable differences between the two N.Z. species of *Hampeella* are found in the exostome teeth. These lack a distinct abaxial furrow (and associated shoulder) in *H. alaris*, while those of *H. pallens* have a well-developed median adaxial furrow and are shouldered. Furrowed exostome teeth are widespread in the Ptychomniaceae. Also, the leaves on the lower stems of *H. alaris* are symmetric, apiculate, strongly concave, arranged in weakly defined spiral ranks, and reflexed at the apex, whereas those of *H. pallens* are asymmetric, non-apiculate, nearly flat (except at the extreme basal margin), and not reflexed at the apex. Further study of *H. alaris* may show it to deserve a new genus of its own.

Hampeella pallens var. *symmetrica* Sainsbury is treated here as a synonym (and unworthy of segregation at any taxonomic level) of *H. alaris*. The recognition of Sainsbury's var. *symmetrica* as a variety within *H. alaris*, as has been proposed by Milne & Klazenga (2012), is not accepted here.

Recognition: Confusion sometimes occurs between *H. alaris* and *Sauloma tenella* due to both having similarly shaped leaves with reflexed apices. *Hampeella alaris* invariably has an erect habit, while the paler *S. tenella* sometimes forms prostrate or even pendent mats. The leaves of *H. alaris* lack the longitudinal pleat that occurs in *Sauloma*. The upper laminal cells in the present species are c. 60–90 × 4–5 µm, while those in *S. tenella* are mostly 75–135 × 12–15 µm.

Etymology: The species epithet *alaris* refers to the well-defined group of irregularly quadrate and thick-walled alar cells.

Hampeella pallens (Sande Lac.) M.Fleisch., *Musci Buitenzorg 3,* 664 (1908)

≡ *Cladomnion pallens* Sande Lac., *Sp. Nov. Musci Ind.* 12 (1872)
Lectotype: Java, *Junghuhn s.n.*, FH (Cited by Enroth 1991.) Not seen.

The species description below deliberately repeats information in the generic description, reflecting my persistent doubts about a close relationship between these two species.

Plants yellow- or pale green, strongly lustrous, moderately robust, forming upright tufts. **Primary stems** weak, apparently forming thin and creeping mats. **Secondary stems** (shoots) in tufts, c. 8–23 mm, simple or branched, curved, strongly complanate, tapered to a pointed tip, with stems oval in cross-section, lacking a central strand, with several layers of thick-walled, pigmented cortical cells, and with a rather dense mat of ± smooth brown rhizoids at base. **Leaves** of secondary shoots arranged in 4 rows, strongly complanate, imbricate, not decurrent, asymmetrically lanceolate, tapered to an acute apex, not plicate, flat, margins strongly incurved at extreme base at one side but otherwise plane, serrulate in upper third, mostly c. 2.0–2.5 × 0.5–0.7 mm, becoming smaller towards shoot apices, sometimes with leaves of branches narrower (c. 0.3 mm wide) and nearly symmetric; **mid laminal cells** linear-rhombic, thin-walled, not porose, smooth, mostly 90–105(–120) × 4–5 µm, becoming shorter but not otherwise differentiated towards apices; **cells at insertion** shorter, thicker-walled, not porose, weakly pigmented but scarcely forming a distinct band; **alar cells** weakly differentiated, a few ± quadrate and thick-walled in extreme angles. **Costa** absent or very short (<⅕ of leaf), double, and indistinct. **Paraphyllia** absent. **Gemmae** present among upper leaf axils, acicular, uniseriate, mostly 12–18 cells and 400–650 µm long, arising in tufts of c. 30–50 from short rhizoid-like structures.

Probably dioicous. Perichaetia scattered on secondary shoots, the leaves apparently expanding greatly after fertilisation, the inner leaves ovate-lanceolate, c. 1.2 mm, clasping the seta base. **Male plants** and **perigonia** not seen. **Setae** 6–8 mm; **capsules** erect, symmetric, ellipsoid-cylindric, strongly 8-ribbed when dry, c. 2 mm; **exothecial cells** firm-walled, rounded, and ± thickened at corners; **stomata** few at extreme capsule base; **annulus** differentiated, of c. 3 rows of inflated cells, persistent; **operculum** as per genus, c. ½ to nearly equal the length of the capsule. **Exostome teeth** yellow-brown, lanceolate but ± shouldered above, c. 380 µm, bordered, inserted near the mouth, cross-striate and furrowed c. ⅞ to apex on outer surface, densely trabeculate but otherwise nearly smooth on inner surface; **endostome** with a pale membrane c. ½ the height of the teeth, segments smooth, nearly the height of the teeth. **Calyptra** not seen, probably cucullate and smooth. **Spores** ellipsoid or round, mostly 24–30 µm, finely papillose.

Illustrations: Plate 5. Brotherus 1925, fig. 510; Sainsbury 1955, pl. 54, fig. 3; Enroth 1991, fig. 1, a–f.; Milne & Klazenga 2012, unnumbered fig.

Distribution: NI: S Auckland (between Lake Rotoehu and coast, Wairere Stream in Kaimāī Range, Mayor I.).

Anomalous. Reported from New Guinea (both P.N.G. & West Irian) and Taiwan by Enroth 1991) and from mainland Australia (Qld, N.S.W., and Vic.) by Milne & Klazenga (2012).

Habitat: Documented as growing on *Ripogonum* and *Rubus* stems, on small branches and twigs of unspecified trees, and on a fallen dead branch in tawa/kāmahi/tāwari forest. Apparently from c. 180–400 m elevation.

This is one of N.Z.'s rarest and most poorly documented moss species. Five K.W. Allison collections made between December 1940 and March 1943 are from the area between Lake Rotoehu and the Bay of Plenty coast. Most of Allison's collections were made from *Ripogonum* and lawyer (presumably *Rubus cissoides*) stems at c. 180 m elevation and appear to come from moist gullies. One collection (*K.W. Allison 644,* CHR 547290B, WELT M003012) is better documented than the others and came from "lawyer vines of about 1 inch diameter [in a] broad bush gully, open underneath". Another collection (*K.W. Allison 645*, CHR 486029; WELT M003013) bears slightly more detailed locality data than the others and was collected at "northern part of bush on Hannon's Road". The region north of Lake Rotoehu is presently largely occupied by exotic pine plantations and it is unclear if *H. pallens* survives in this area.

More recent collections from the Kaimāī Range (*M. Skinner s.n.*, CHR 352758) and Mayor I. (*P. de Lange 10375*, AK 330304) extend the known range of this rare species westward and northward but all known localities remain in S Auckland L.D. This species is given a Nationally Critical ranking, with the modifiers of Data Poor and Range Restricted in the 2014 iteration of the Conservation Status of N.Z. (Rolfe et al. 2016).

Notes: Scott & Stone (1976, p. 361), describe the shoots as curving "outwards and upwards like hooks". I have been unable to locate perigonia and doubt Sainsbury's (1955p. 344) statement that *H. pallens* is autoicous. Brotherus (1925, p. 103) states the genus *Hampeella* to be dioicous, and Enroth (1991) stated unequivocally that this species is dioicous in P.N.G. He described perigonia from there, and also briefly described the habitat and substrate of this species in P.N.G.

When leaves of this species are removed, a few stem cells often adhere to the leaf base, giving the incorrect impression of decurrencies. It is difficult to make consistent observations on spores in herbarium material. Although in most of the capsules examined (e.g., in *K.W. Allison 2055* and *2054*) the spores are as described above, in one capsule of *K.W. Allison 2055* the spores appear to be dimorphic, with many spores smaller and apparently collapsed.

Material has been seen (*K.W. Allison 644*, CHR 547290A & B) in which the leaves of some upper branches are decidedly more symmetric and narrower (c. 0.3 mm wide) than the leaves of the lower shoots. At least one duplicate of *K.W. Allison 644* (WELT M003012), as well as other collections from the same locality, were annotated by R. Hattaway (who wrote a Ph.D. dissertation on this family) in 1980 as *H. pallens* var. *symmetrica*, but these specimens fall within the normal range of variability of *H. pallens*. The status of *H. pallens* var. *symmetrica*, has been further confused by the fact that both Sainsbury and Hattaway (in herb.; see also Sainsbury 1951) erroneously annotated material of both representative *H. pallens* and *H. alaris* as *H. pallens* var. *symmetrica*. The holotype of var. *symmetrica* (*K.W. Allison 2052*, WELT M003017) is, however, clearly referable to *H. alaris*. The var. *symmetrica* is neither accepted nor discussed further here.

The peristome of *H. pallens* is strongly suggestive of species in the Daltoniaceae.

Etymology: The specific epithet *pallens* means becoming pale.

Ptychomnion (Hook.f. & Wilson) Mitt., *J. Linn. Soc., Bot.* 12: 536 (1869)

≡ *Hypnum* sect. *Ptychomnion* Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II,* 110 (1854)

Type taxon: *Ptychomnion aciculare* (Brid.) Mitt.

Plants bright green, yellow- or brown-green, robust or rarely slender, forming rather loose wefts, mostly on humus or duff. **Primary and secondary stems** not differentiated, creeping and stiff, irregularly and usually much branched, ascendant, in cross-section as for family. **Leaves** imbricate or widely spaced, mostly widely spreading, sometimes squarrose, appearing thin, with a broadly elliptic or oblong base, usually abruptly contracted to a rather broad, toothed, and often twisted acumen, occasionally uniformly tapered, variably plicate, little altered when dry; **mid laminal cells** linear-oblong, thick-walled and porose; **cells at insertion** forming a pigmented band across the leaf base;

alar cells forming a small and weakly defined group. **Costae** short, double, often indistinct. **Paraphyllia** absent. **Gemmae** absent.

Dioicous, mostly **phyllodioicous. Perichaetia** scattered on ♀ stems, inconspicuous, apparently lacking paraphyses, with inner leaves symmetric, sheathing, broadly oblong-obovate, abruptly tapered to an acumen, which is usually c. ⅓ the total leaf length and with outer leaves often strongly reflexed, enlarging after fertilisation. **Male plants** usually dwarf and epiphyllic on ♀ plants, occasionally well developed and with scattered gemmiform perigonia. **Setae** elongate (mostly >20 mm), slender, straight or weakly flexuose, dark red to nearly black in N.Z. species; **capsules** strongly inclined to pendent, ± cylindric, red-brown, with a weakly developed neck; **exothecial cells** oblong; **annulus** obscure; **operculum** with a very long and slender rostrum, ± ½ to equal the capsule. **Exostome teeth** weakly shouldered, furrowed and bordered, transversely striate below on outer surface, often baculate near apex, densely trabeculate but otherwise nearly smooth on inner surface; **endostome** arising from a high basal membrane, with segments well developed and perforate or nearly lacking, and with variably developed **cilia**. **Calyptra** enclosing the entire capsule. **Spores** single-celled, smooth, small.

Notes: Ptychomnion is a genus of fewer than eight species, restricted to cool and warm temperate regions of the southern hemisphere. It was isolated in the Ptychomniaceae into a monotypic subfamily Ptychomnioideae by Brotherus (1925) on the basis of large stature, erect-squarrose leaves, longer setae, horizontal and curved capsules, and well-developed peristomes (all relative to the genera placed together in the subfamily Cladomnioideae). The N.Z. representatives are predominantly terrestrial.

One species traditionally placed in *Ptychomnion*, *P. ptychocarpum* (Schwägr.) Mitt., a slender and epiphytic South American species, has been segregated recently into the monotypic genus *Ptychomniella* (Broth.) W.R. Buck, C.J. Cox, A.J. Shaw & Goffinet.

Etymology: The generic name means pleated moss, and refers to the plications or pleats variably developed in the leaves.

1	**Leaves** wide-spreading to weakly squarrose, with basal plications indistinct or absent, those at shoot apices more crowded than those below; **secondary stems** usually clearly visible between leaves	*P. aciculare*
1'	**Leaves** strongly squarrose, with several well-defined plications extending from base to ¼–⅓ their length, those at shoot apices not more crowded than below; **secondary stems** hidden throughout by closely imbricate and sheathing leaves	*P. densifolium*

Ptychomnion aciculare (Brid.) Mitt., *J. Linn. Soc., Bot.* 12: 536 (1869)

≡ *Hypnum aciculare* Brid., 158, tab. 5, fig. 2 (1801)

Type: Tasmania, “terra Van Diemen”, *de Labillardière*. Presumably in B. Not seen. Isotype: PC0131732, image seen online, JSTOR Global Plants, accessed 1 Aug. 2017.

Plants bright green, yellow-, or brown-green, lustrous, usually robust but quite variable in size, usually neat, occasionally rough and shaggy in appearance. **Secondary stems** ascendant, c. 30–120 mm, variably branched, stiff, red-brown, usually visible between leaves when dry except at shoot apices where obscured by imbricate leaves, in cross-section with many layers of thick-walled cortical cells and lacking a central strand. **Leaves** widely spreading, rather widely spaced in lower stems, much more closely spaced near stem apices, thin and chartaceous, little altered when dry, broadly ovate to broadly elliptic below, tapered to a narrowed insertion, abruptly contracted above to a broad, strongly toothed, and twisted acumen, not or indistinctly plicate, usually with an indistinct border in lower ½ of leaf of several rows of slightly enlarged cells, c. 3.0–4.5(–5.0) × 1.2–2.0 mm when well developed; **mid laminal cells** thick-walled and porose, mostly c. 35–50 µm, becoming longer towards insertion; **cells at insertion** shorter and pigmented in a band, those in alar angles irregular and thick-walled, forming small and weakly defined groups. **Costae** usually indistinct, double. **Paraphyllia** and **gemmae** absent.

Phyllodioicous in all but rare instances. **Perichaetia** scattered on ♀ stems, with inner leaves broadly oblong-obovate and abruptly tapered to an acumen, which is usually c. ⅓ the total leaf length, the outer leaves reflexed. **Male plants** usually dwarf and epiphyllic, occasionally well developed and with multiple scattered perigonia. **Setae** as per genus; **capsules** as per genus, c. 3.5–4.5 mm; **annulus** of several cell rows and persisting at capsule mouth, usually obscure or eroded; **operculum** with a very long and slender rostrum, ± equal the capsule. **Exostome teeth** yellow-brown, weakly shouldered above, furrowed, striate below (to top of the furrow) on outer surface, baculate at apex; **endostome** with cilia in pairs and 3s, well developed, appendiculate. **Spores** as per genus, 10–12 µm.

Illustrations: Plate 6. Beever et al. 1992, fig. 56; Brotherus 1925, fig. 514; Kühnemann & Gonçalves Carralves 1975, Pls. VI–VII; Malcolm & Malcolm 2003, p. 56; Milne & Klazenga 2012, unnumbered fig. and photos; Seppelt et al. 2013, pl. 23.

Distribution: NI: N Auckland, including offshore islands (TK, PK, HC, LB), S Auckland, Gisborne, Hawke's Bay, Taranaki, Wellington; SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland; St; Ch; Sol; Sn; A; Ant, C. No material has been seen from M, and Seppelt (2004) concluded that this species does not occur there.

Predominantly austral but extending north to Malesia and Pacific Is. Tasmania*, mainland Australia (N.S.W.* Vic*), Lord Howe*, Argentina*, Chile*, Tahiti*, Fiji*, Borneo*. Milne & Klazenga (2012) recorded it from the state of South Australia and Belleden Ker in Queensland. Reported from Samoa, Hawai'i, and New Caledonia by Kühnemann & Gonçalves Carralves (1975) and from the Marquesas Is. and from Rapa I. (Whittier 1976, p. 231). Whittier specifically questioned the occurrence of this species in Hawai'i.

Notes: This is one of N.Z.'s most widespread and frequent moss species, and it is one of few indigenous moss species with a well-established common name: the apt "pipe-cleaner moss". *Ptychomnion aciculare* forms dense and often extensive wefts on humus and duff in a variety of forest types, but is best developed and most abundant in forest dominated by one or more species of southern beech, *Kunzea spp*., or *Leptospermum scoparium*. It is often a prominent ground cover species in these forest types. Also occurring, sometimes abundantly, in *Agathis australis* or *Weinmannia* spp. dominated forests and in podocarp or podocarp/broadleaved forests. In addition to its occurrence on the forest floor, *P. aciculare* occurs commonly on stumps and rotten logs and epiphytically, as well as in grasslands and under exotic tree species. Ranging from near sea level to at least 1070 m (Ruahine Range, Hawke's Bay L.D.) on the North I. and to c. 1120 m (Paparoa Range, Nelson L.D.) on the South I.

This distinctive and attractive species is extremely variable in stature, ranging from plants only c. 15–20 mm to c. 120 or more mm long. The usually yellow-green colour, broadly ovate, abruptly narrowed, and chartaceous leaves with their twisted and toothed apices, together with the strong tendency for the leaves to be more crowded at the branch apices, make this one of the most readily recognised mosses in N.Z. The red-brown stem is wiry and nearly always visible between the lower leaves of the stem, thus readily differentiating this species from its sole N.Z. congener. Scott & Stone (1976, p. 360), writing on the Australian flora, refer to it as "perhaps the most unmistakable moss in the entire flora; there is nothing like it".

Ptychomnion aciculare is consistently dioicous, with the ♂ plants usually greatly reduced in size and epiphyllic on leaves of the robust female plants. Occasionally the dwarf male plants can be observed with a hand-lens in the field, and are most likely seen in abundantly fruiting populations. However, the degree of ♂ plant development varies, suggesting developmental inhibition by growth substances produced by ♀ plants. Perigonia have been seen on well-developed ♂ shoots in material from N Auckland L.D., Stewart I., and Chatham I.

The degree of endostomal development is likewise variable. The majority of populations have well-developed and perforate segments and two to three appendiculate cilia. However, material has been seen with segments lacking and rudimentary cilia.

Etymology: The specific epithet means stiff or pointed, like a needle, in reference to the stiff and acuminate leaf apices.

Ptychomnion densifolium (Brid.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1877–1878: 353 (1879)

≡ *Hypnum densifolium* Brid., *Muscol. Recent. Suppl. 2,* 204 (1812)
Type: Tristan d'Acunha, 1806, *Du Petit-Thouars*, BM!

Plants yellow- to brown-green, lustrous, variable in size, forming wefts that are compact and neat in appearance. **Secondary stems** ascendant, usually c. 40–70(–100) mm, mostly branched by forking, stiff, red-brown, not visible between leaves either fresh or dry, in cross-section with many layers of thick-walled cortical cells and lacking a central strand. **Leaves** squarrose and strongly imbricate throughout, thin and chartaceous, only slightly more squarrose when dry, oblong below, scarcely narrowed to insertion, abruptly tapered to a rather short (c. 0.8–1.0 mm), toothed and twisted acumen, with several basal plicae extending from the base to ⅓ the leaf length, mostly c. 3.5–4.2 × 1.5–2.0 mm when well developed; **mid laminal cells** thick-walled and porose, mostly c. 45–57 µm, becoming longer towards insertion; **cells at insertion** shorter and pigmented in a band, those in alar angles forming a small, weakly defined group. **Costae** usually indistinct, double. **Paraphyllia** and **gemmae** absent.

Phyllodioicous. Perichaetia scattered on secondary stems, the inner leaves oblong-obovate, abruptly acuminate, sheathing, the outer leaves widely spreading. **Male plants** dwarf and epiphyllic on female plants. **Setae** as per genus, to at least 25 mm; **capsules** c. 3.5 mm, strongly curved; **operculum** with a very long and slender rostrum, ± equal the capsule; **annulus** and **peristome** details not seen in N.Z. material. Only immature **spores** seen in N.Z. material.

Illustrations: Plate 7. Tangney & Fife 1997, figs 1–2, 5–6; Kühnemann & Gonçalves Carralves 1975, Pl. I, fig. 1, Pls. X–XI; Seppelt 2004, fig. 94.

Distribution: NI: Wellington (Ruahine Range, Tararua Range). SI: Nelson (numerous collections from Cobb Valley and Mt Peel vicinity, Matiri Range, Mt Priestly), Canterbury (Broad Stream, Worryline Stream), Westland (numerous localities), Southland (Gertrude Valley, Longwood Range), St, A, C. Recorded from many localities on M by Seppelt (2004).

Austral. Argentina*, Tristan d'Acunha*. Reported from Chile by Kühnemann & Gonçalves Carralves (1975).

Habitat: Mainly occurring at insolated sites (e.g. grassy banks, ledges) in subalpine or alpine grassland or mixed grassland scrub, often with *Chionochloa pallens* and various species of *Olearia* and *Dracophyllum* present and often on humus over rock. Less often in dense subalpine scrub or light gaps in southern beech forest.

On the North I. known only from a few localities between 1140–1400 m elevation. On the South I. occurring from (800–)1000–1400 m elevations, with most occurrences below c. 1000 m associated with watercourses. On Stewart I. this species descends to sea level and is apparently tolerant of some salt spray. Associated bryophyte species often include *Breutelia pendula*, *B. robusta*, *Pleurophascum ovalifolium*, *Pyrrhobryum mnioide* subsp. *contortum*, *Lepidolaena hodgsoniae*, and *Trichocolea* spp. In the Gertrude Valley it is very common in *Chionochloa pallens*–*Dracophyllum*–*Olearia* grassland/scrub and occurs only between c. 950 and 1050 m. Both Vitt (1979) and Colin Meurk (pers. comm.) indicate that *P. densifolium* is usually associated with *Bulbinella rossii* (*Chrysobactron*) on Campbell I.

Notes: The earliest record of *P. densifolium* from N.Z. is that from Campbell I. by Vitt (1974).

Tangney & Fife (1997) discussed early N.Z. records and noted minor differences between the N.Z. populations and the Tristan d'Acunha type.

I know nothing of the Chilean *P. densifolium* var. *gracile* Cardot & Broth., but in N.Z. *P. densifolium* is quite variable in size. Most populations have shoots c. 4–5 mm wide, but robust plants with shoots c. 6–7 mm wide are frequently seen. There appears to be a tendency for more northern populations to be more robust. The robust populations appear to be representative of the species in other respects and are unworthy of taxonomic recognition.

Recognition: *Ptychomnion densifolium* is a very attractive species made distinctive by its formation of compact, neat, turf-like colonies and its strongly squarrose and imbricate leaves, which completely mask the stem in both fresh and dry material. Capsules are rare in N.Z. In the Ptychomniaceae, *P. densifolium* could be confused only with its congener, *P. aciculare*, but it is nearly always readily distinguished by the characters given in the key. Confusion is more likely to occur with the adventive *Rhytidiadelphus squarrosus*. *Ptychomnion densifolium* can be distinguished from *R. squarrosus* by its neater, less branched, and more compact habit, its porose laminal cells, its poorly differentiated alar cells, and its occurrence in undisturbed vegetation at higher elevations.

Etymology: The epithet *densifolium* is an obvious reference to the closely spaced and imbricate leaves.

Tetraphidopsis Broth. & Dixon in Dixon, *J. Linn. Soc., Bot.* 40: 451 (1912)

Type taxon: *Tetraphidopsis novae-seelandiae* Broth. & Dixon = *Tetraphidopsis pusilla* (Hook.f. & Wilson) Dixon

Taxonomy: Tetraphidopsis is a monotypic genus with the features of the type species, discussed below.

Tetraphidopsis exhibits morphological features that are anomalous in the Ptychomniaceae, including a single costa and a short, rostrate operculum. The peristome teeth are not furrowed. Its affinities to the other members of the family would be best considered in a world-scale review, perhaps using molecular characters.

Etymology: The generic name alludes to a resemblance to the northern hemisphere genus *Tetraphis*. According to Brotherus & Dixon (in Dixon 1912) the terminal cluster of gemmae of this plant "is enclosed in bracts resembling those of *Tetraphis* but smaller".

Tetraphidopsis pusilla (Hook.f. & Wilson) Dixon, *J. Bot.* 51: 245 (1913)

≡ *Meteorium pusillum* Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II,* 101 (1854)
Lectotype: N.Z., Wairarapa Valley, W. Colenso 484b, Herb. Wilson, BM 000986878!

= *Tetraphidopsis novae-seelandiae* Broth. & Dixon in Dixon, *J. Linn. Soc., Bot.* 40: 451 (1912)
Lectotype: N.Z., Kummer's Bush, Mauriceville, 18 Oct. 1909, *W. Gray 54*, Herb. Dixon, BM 000667778! The lectotype in BM was selected by R. Hattaway in Aug. 1980, but apparently never published; his selection for the lectotype is therefore published here. Mounted on the same sheet (but without a separate BM number) is a second Gray collection made on 24 July 1910, which should be considered a paratype. A specimen in WELT collected by Gray on 10 Nov. 1910 (WELT M001076!) should also be considered a paratype.

Plants yellow- or brown-green, very small and slender, usually on twigs or small branches. **Primary stems** not seen, apparently lacking. **Secondary stems** red-brown and clustered, variably branched but often simple (branches, if present, arising in leaf axils), mostly 3–15(–40) mm, with smooth, red-brown rhizoids restricted to base of the stem or to branch bases, in cross-section lacking a central strand. **Leaves** in several rows, not complanate, spreading at c. 45 (when moist), erect-appressed when dry, not secund, lanceolate, acute (sometimes narrowly acute), neither twisted nor reflexed at apex, smooth, narrowly recurved or plane at margins, entire or weakly crenulate above, mostly (0.8–)1.0–1.2(–1.5) × 0.25–0.35 mm but usually smaller on lower stem; **mid laminal cells** elongate-rhombic, not porose, mostly 27–39 × 7–9 µm, with cytoplasm retracted from cell walls in dried material; **cells at insertion** shorter and weakly pigmented; **alar cells** short-rectangular to ± quadrate, numerous but merging gradually with interior cells and not forming a distinct group; **cells at basal margins** usually not pigmented. **Costae** single, ill-defined, usually c. ¼ the leaf length, occasionally longer. **Paraphyllia** absent. **Pseudoparaphyllia** present, foliose. **Gemmae** usually present, clavate, mostly 4–6 cells and 90–105 µm long, aggregated in dense, ± ovoid clusters (clusters c. 0.25–1.0 mm long) and borne at the apex of terminal flagelliferous shoots.

Apparently dioicous. Perichaetia scattered and appearing lateral, in leaf axils on secondary shoots, the inner leaves ovate-lanceolate and ecostate, expanding after fertilisation (to c. 1.8 mm) and clasping the seta base. **Male plants** not dwarfed, with numerous scattered or sometimes terminal gemmiform and yellow-brown perigonia. **Setae** c. 3 mm, straight, pale; **capsules** erect, symmetric, ellipsoid, c. 1 mm; **exothecial cells** ± irregular, mostly rounded and short oblong; **annulus** not seen; **operculum** short rostrate, much shorter than the capsule. **Peristome** double; **exostome teeth** c. 275–300 µm, weakly shouldered, neither furrowed nor bordered, transversely striate below, finely baculate above on the outer surface, trabeculate but otherwise smooth on the inner surface; **endostome** lacking a basal membrane and **cilia**, the **segments** c. ⅔ the height of the teeth, straight or sometimes appendiculate. **Calyptra** cucullate. **Spores** single-celled, dimorphic, the larger variable in size, often ovoid, c. 30–45 µm in greater dimension, papillose.

Illustrations: Plate 8. Dixon 1912, pl. 21, figs 25–41 (as *T. novae-seelandiae*); Sainsbury 1955, pl. 52; Malcolm & Malcolm 2003, p. 65.

Distribution: NI: N Auckland, S Auckland, Gisborne (Hopuruahine River, Mt Whakapunake), Taranaki, Wellington; SI: Nelson, Marlborough, Canterbury (Banks Peninsula, Raincliff, Arthur's Pass) Westland, Otago (Mt Watkin, Dunedin vicinity, south-eastern coast), Southland; St. Scott & Stone (1976) recorded it from Vic., mainland Australia, and according to P. Dalton (pers. comm., April 2006) it has been collected near the Thomson River in that state.

Habitat: Mostly on twigs and small branches, much less often on tree trunks. Most commonly at forest and stream margins in moist environments. Occurring on at least 13 genera of woody dicots, as well as *Cordyline* and *Ripogonum*. Frequently associated bryophyte species include: *Calyptopogon mnioides*, *Crosbya straminea*, *Cryphaea* spp., *Daltonia splachnoides*, *Ephemeropsis trentepohlioides*, *Neckera pennata*, *Papillaria flexicaulis*, various Orthotrichaceae, as well as *Dendroceros validus*, *Metzgeria hamata* and various leafy hepatics. Occurring from near sea level to c. 760 m (near Tangiwai, Wellington L.D.).

Notes: The majority of populations of this minute species are sterile, with shoots <15 mm high, and bear a characteristic terminal ovoid to spherical cluster of gemmae. A short portion of the shoot immediately below the gemmae usually bears reduced leaves (i.e. is flagelliferous) but is otherwise suggestive of the gemmae clusters seen in the well-known but unrelated northern hemisphere species *Aulacomnium androgynum*.

Capsules are relatively rare (as Sainsbury correctly noted) and plants with capsules only rarely found. Fruiting shoots, when found, are frequently elongate (from c. 15–40 mm) and much branched. The original Colenso collection is fruiting, and Hooker & Wilson's protologue of *Meteorium pusillum* reflects this. Spores are apparently dimorphic. The larger and presumably viable spores are variable in size and are mixed with smaller (mostly c. 12–15 µm) spores that are perhaps non-viable. However, the presumption that the smaller spores are not viable needs experimental confirmation, as does the possibility that the different-sized spores may germinate to form male and female plants.

Sainsbury's (1955) suggestion that *T. pusilla* is "very rare in the South [Island]" is not correct, although it is certainly more frequent in wetter parts of this island. Nearly all Canterbury L.D. collections are from the Banks Peninsula and localities near the Main Divide. All collections (excepting one from Mt Watkin) from Otago L.D. are from relatively damp localities in the vicinity of Dunedin and along the south-eastern Otago coast. Numerous records are known from Westland L.D.

Recognition: The minute size, the terminal clusters ("capitula") of gemmae and the preference for small branches and twigs as a substrate make this species virtually unmistakeable in a N.Z. context.

Etymology: The specific epithet *pusilla* means very small and is certainly appropriate for this species.

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Conventions

Abbreviations and Latin terms

Abbreviations	**Meaning**
A	Auckland Islands
A.C.T.	Australian Capital Territory
aff.	allied to (*affinis*)
agg.	aggregate
Ant	Antipodes Islands
a.s.l.	above sea level
auct.	of authors (*auctorum*)
B	Bounty Islands
C	Campbell Island
c.	about (*circa*)
cf.	compare with, possibly the species named (*confer*)
c.fr.	with fruit (*cum fructibus*)
Ch	Chatham Islands
comb. nov.	new combination (*combinatio nova*)
D’U	D’Urville Island
et al.	and others (*et alia*)
et seq.	and following pages (*et sequentia*)
ex	from
fasc.	fascicle
fide	according to
GB	Great Barrier Island
HC	Hen and Chicken Islands
Herb.	Herbarium
hom. illeg.	illegitimate homonym
I.	Island
ibid.	in the same place (*ibidem*)
incl.	including
in herb.	in herbarium (*in herbario*)
in litt.	in a letter (*in litteris*)
inter alia	among other things (*inter alia*)
Is	Islands
K	Kermadec Islands
KA	Kapiti Island
LB	Little Barrier Island
L.D.	Land District or Districts
leg.	collected by (*legit*)
loc. cit.	in the same place (*loco citato*)
l:w	length:width ratio
M	Macquarie Island
Mt	Mount
nec	nor
NI	North Island
no.	number
nom. cons.	conserved name (*nomen conservandum*)
nom. dub.	name of doubtful application (*nomen dubium*)
nom. illeg.	name contrary to the rules of nomenclature (*nomen illegitimum*)
nom. inval.	invalid name (*nomen invalidum*)
nom. nud.	name published without a description (*nomen nudum*)
non	not
N.P.	National Park
N.S.W.	New South Wales
N.T.	Northern Territory (Australia)
N.Z.	New Zealand
op. cit.	in the work cited (*opere citato*)
pers. comm.	personal communication

PK	Poor Knights Islands
P.N.G.	Papua New Guinea
pro parte	in part
Qld	Queensland
q.v.	which see (*quod vide*)
RT	Rangitoto Island
S.A.	South Australia
s.coll.	without collector (*sine collectore*)
s.d.	without date (*sine die*)
sect.	section
SEM	scanning electron microscope/microsopy
sensu	in the taxonomic sense of
SI	South Island
sic	as written
s.l.	in a broad taxonomic sense (*sensu lato*)
s.loc.	without location (*sine locus*)
Sn	Snares Islands
s.n.	without a collection number (*sine numero*)
Sol	Solander Island
sp.	species (singular)
spp.	species (plural)
s.s.	in a narrow taxonomic sense (*sensu stricto*)
St	Stewart Island
stat. nov.	new status (*status novus*)
subg.	subgenus
subsect.	subsection
subsp.	subspecies (singular)
subspp.	subspecies (plural)
Tas.	Tasmania
TK	Three Kings Islands
U.S.A.	United States of America
var.	variety
vars	varieties
Vic.	Victoria
viz.	that is to say (*videlicet*)
vs	versus
W.A.	Western Australia

Symbols

Symbol	**Meaning**
µm	micrometre
♂	male
♀	female
±	more or less, somewhat
×	times; dimensions connected by × refer to length times width
>	greater than
<	less than
≥	greater than or equal to
≤	less than or equal to
=	heterotypic synonym of the preceding name
≡	homotypic synonym of the preceding name
!	confirmed by the author
*	in distribution statements, indicates non-N.Z. localities from which material has been confirmed by the author

Technical terms conform to Malcolm, B.; Malcolm, N. 2006: *Mosses and other Bryophytes: an Illustrated Glossary*. Edition 2. Micro-Optics Press, Nelson.

Abbreviations for Herbaria follow the standard abbreviations listed in *Index Herbariorum*.

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A.J. Fife

Manaaki Whenua – Landcare Research, PO Box 69040, Lincoln 7640, New Zealand

FifeA@landcareresearch.co.nz

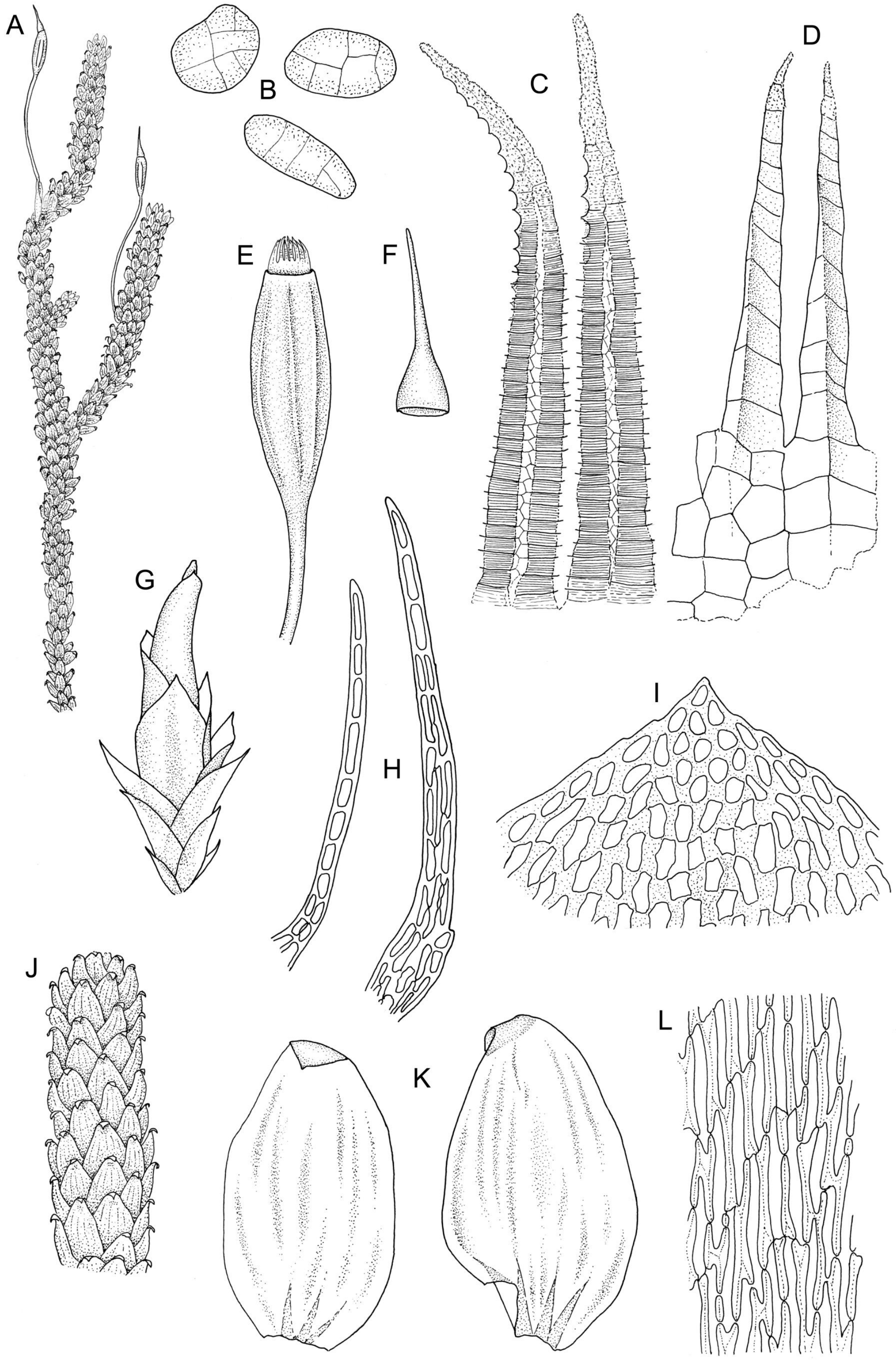


Plate 1: ***Cladomnion*. A–L: *C. ericoides***. A, habit with capsules, moist. B, three spores. C, exostome teeth, outer surface. D, endostome. E, capsule, moist. F, operculum. G, perichaetium. H, paraphyllia. I, leaf apex. J, portion of shoot, dry. K, leaves. L, mid laminal cells. Drawn from *P. Child s.n.*, 5 Mar. 1972, CHR 422333, and *D. Glenny s.n.*, 27 Nov. 1985, CHR 438494.

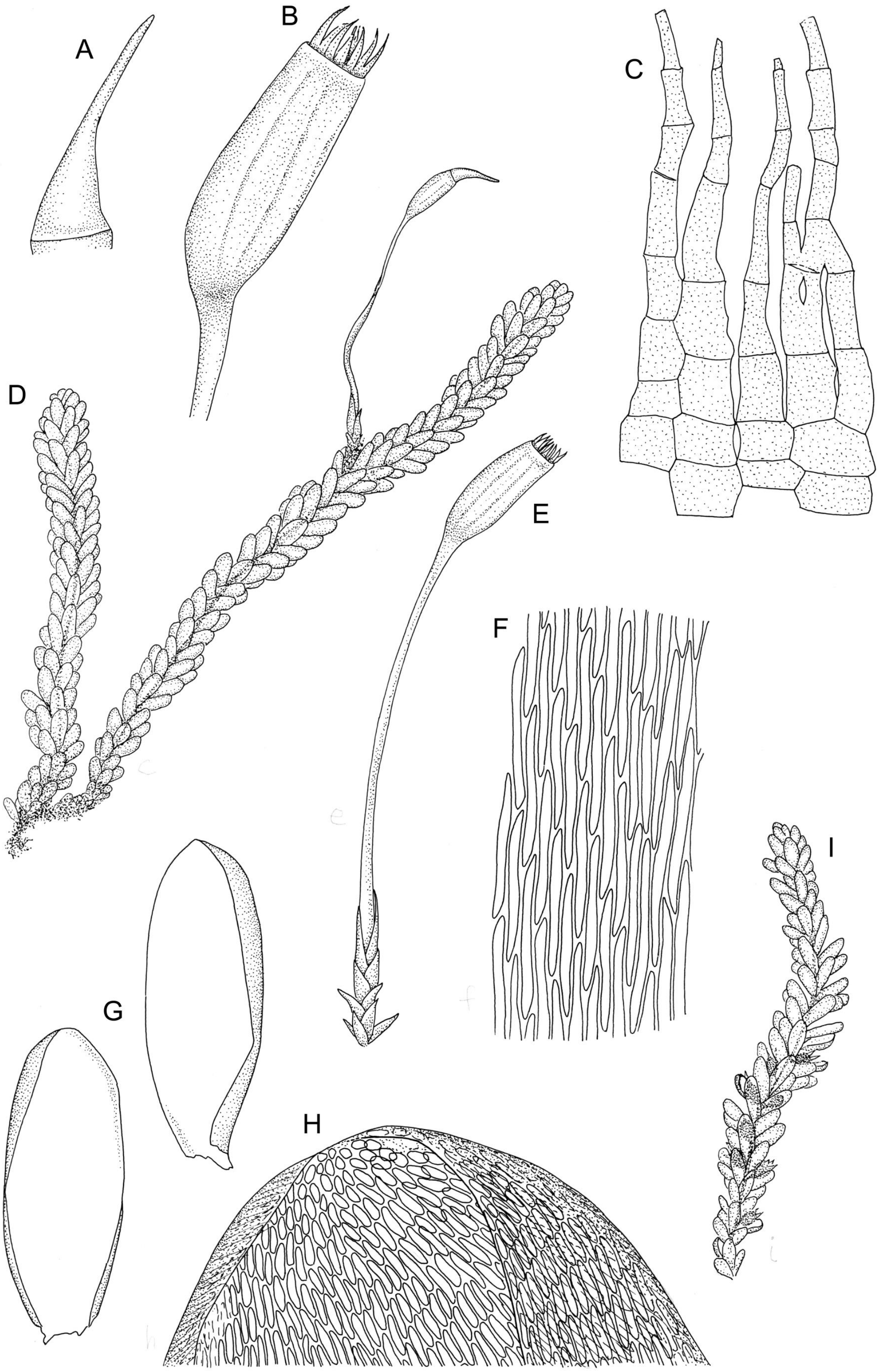


Plate 2: ***Dichelodontium*****. A–I:** ***D. nitidum***. A, operculum. B, capsule, moist. C, peristome detail. D, habit with capsule, moist. E, perichaetium with capsule, moist. F, mid laminal cells. G, leaves. H, leaf apex. I, ♂ branch. Drawn from *K.W. Allison 2607*, CHR 532689, and *K.W. Allison 72*, CHR 532690A.

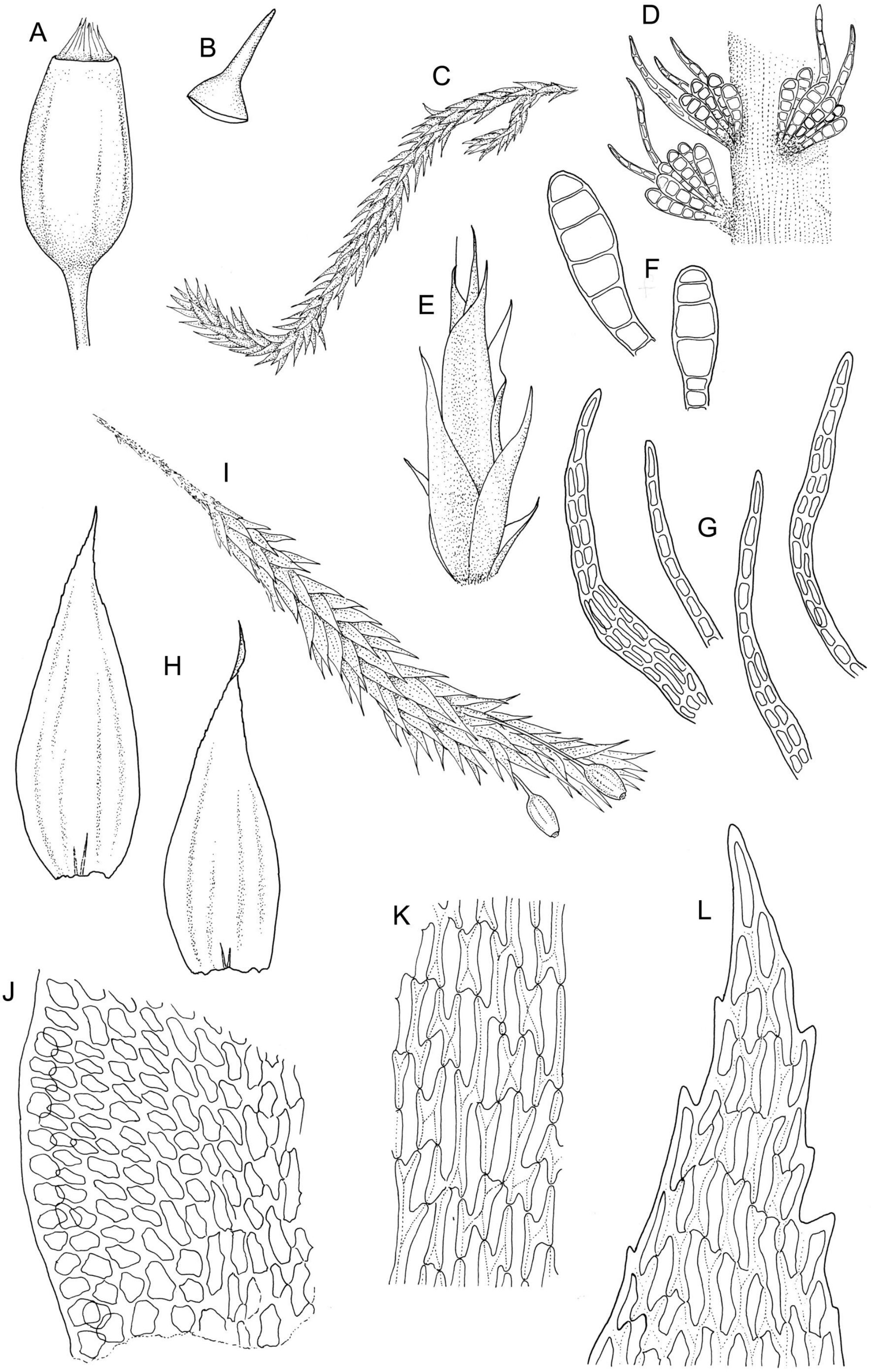


Plate 3: ***Glyphothecium*****. A–L:** ***G. sciuroides***. A, capsule. B, operculum. C, habit, dry. D, gemmae and paraphyllia attached to branch, with paraphyllia. E, perichaetium. F, gemmae. G, paraphyllia. H, leaves. I, habit with capsules. J, alar cells. K, mid laminal cells. L, leaf apex. Drawn from *K.W. Allison 6941*, CHR 532691.

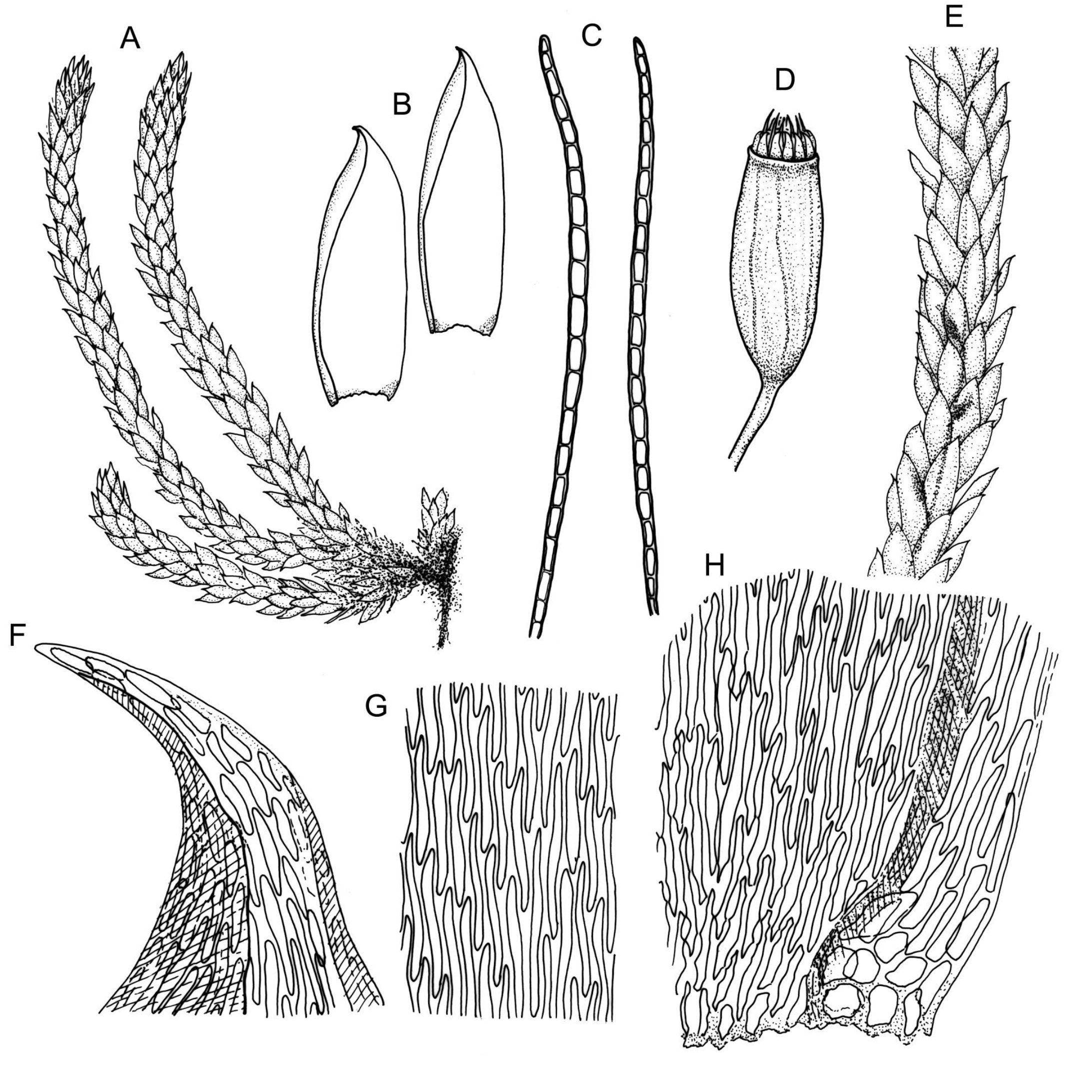


Plate 4: ***Hampeella*****. A–H:** ***H. alaris***. A, habit. B, leaves. C, gemmae. D, capsule, dry. E, portion of shoot. F, leaf apex. G, mid laminal cells. H, alar cells. A–C, E–H drawn from *A.J. Fife 6614*, CHR 405723; D drawn from *A.J. Fife 6547*, CHR 405705.

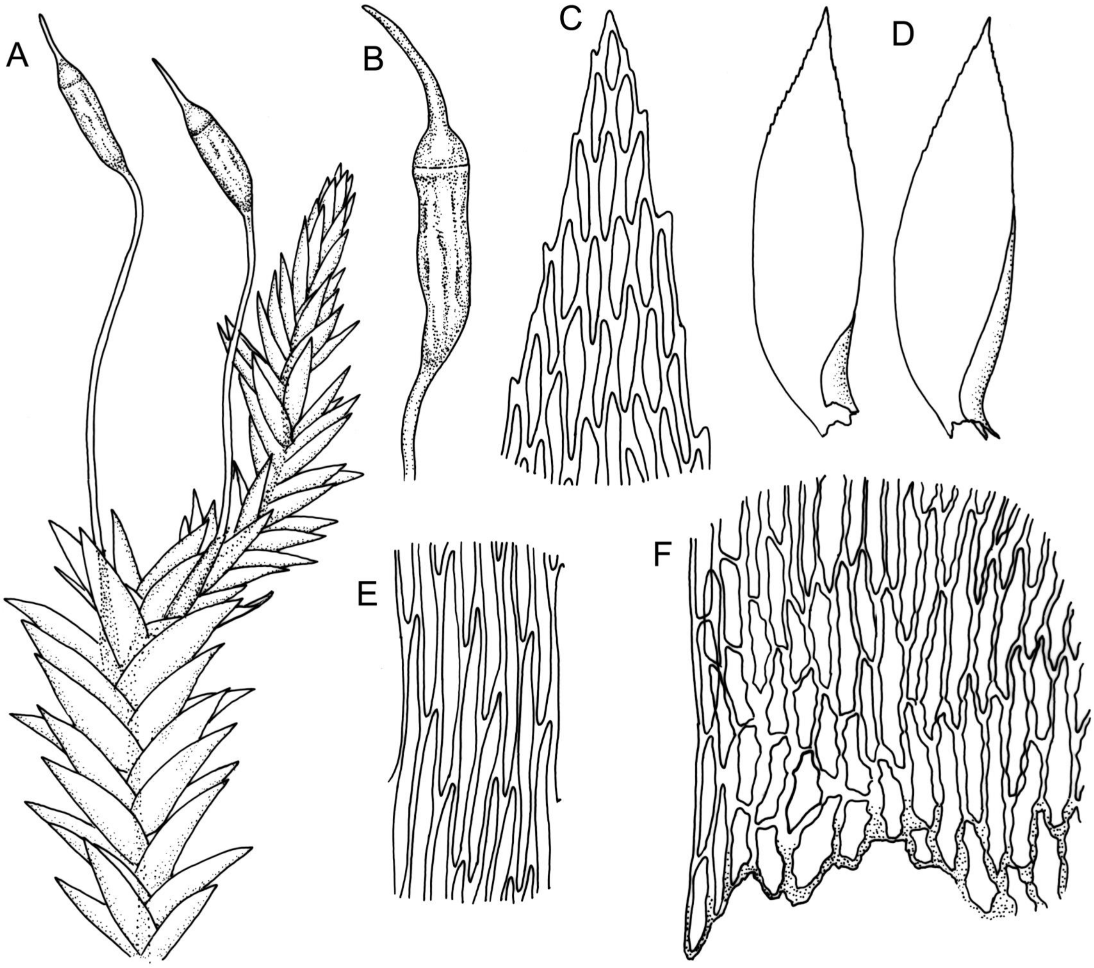


Plate 5: ***Hampeella*. A–F: *H. pallens***. A, habit with capsules. B, capsule, dry. C, leaf apex. D, leaves. E, mid laminal cells. F, alar cells. Drawn from *K.W. Allison 2054*, CHR 486028.

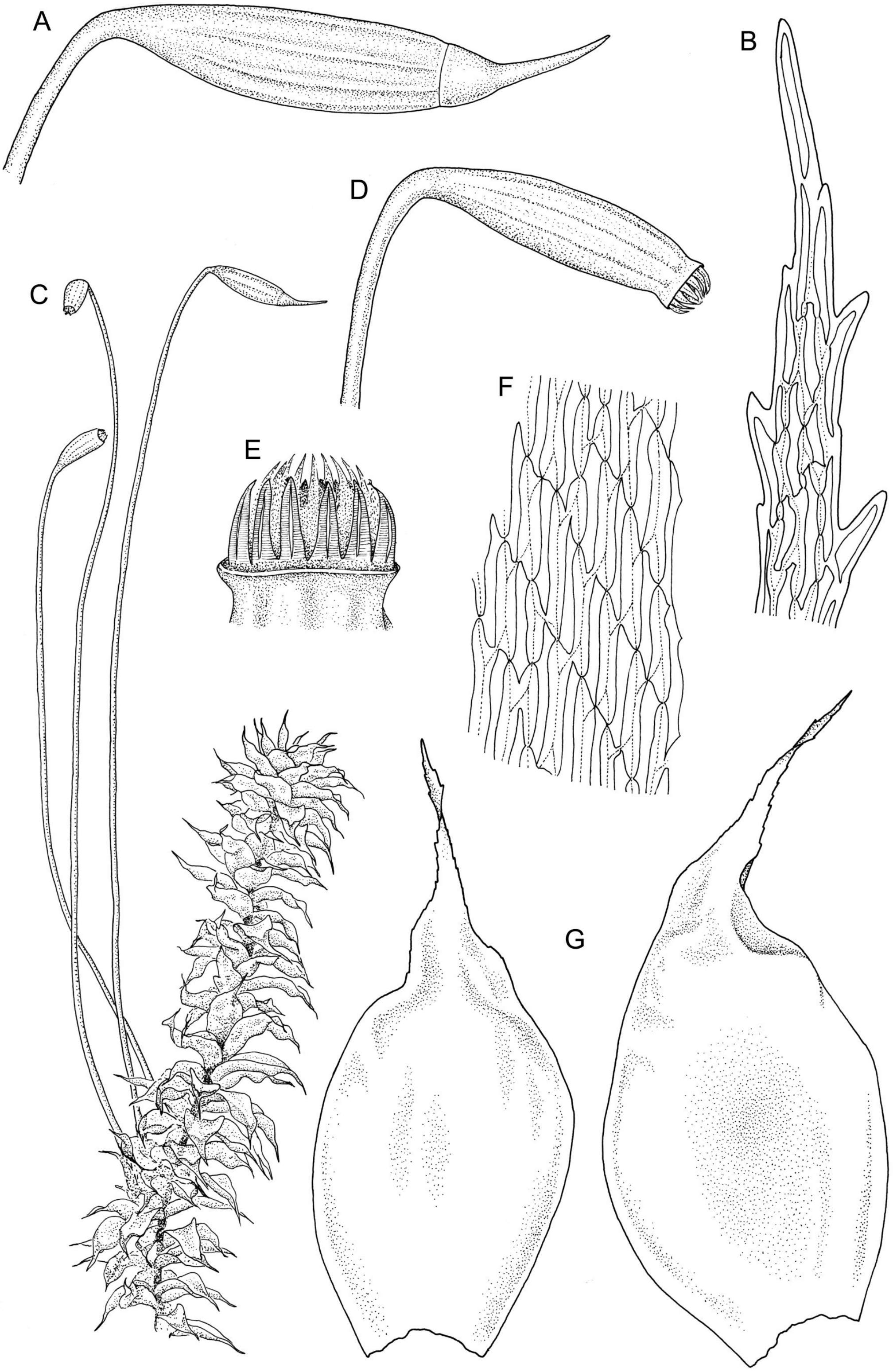


Plate 6: ***Ptychomnion*. A–G: *P. aciculare***. A, capsule with operculum, moist. B, leaf apex. C, habit. D, capsule, moist. E, peristome. F, mid laminal cells. G, leaves. Drawn from *P. Child s.n.*, 5 Mar. 1972, CHR 412908.

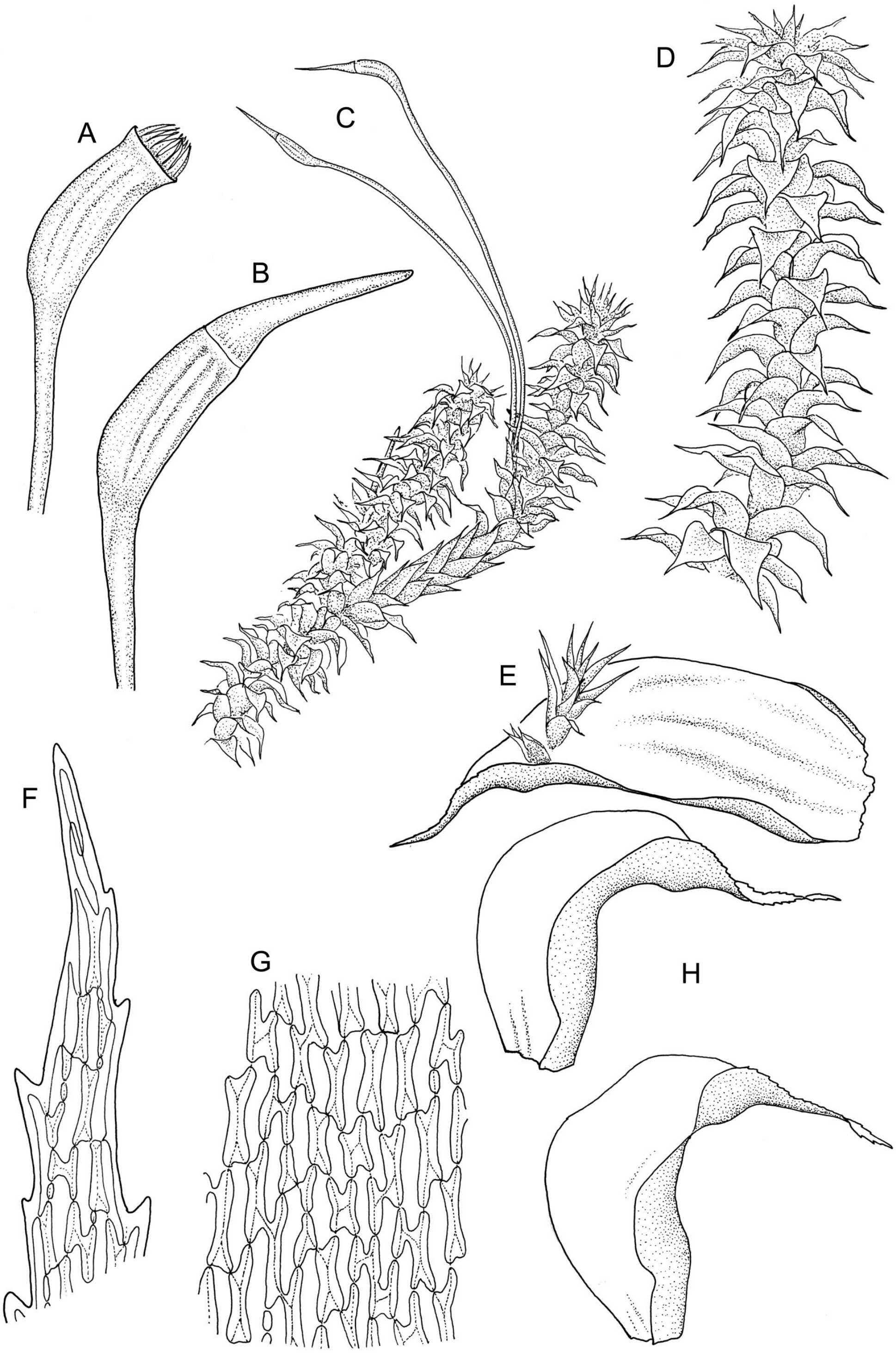


Plate 7: ***Ptychomnion*. A–H: *P. densifolium***. A, capsule, moist. B, capsule with operculum, moist. C, habit. D, shoot (branch). E, leaf with dwarf male plants. F, leaf apex. G, mid laminal cells. H, leaves. A–C, E drawn from *K.W. Allison 6845*, CHR 454699; D, F–H drawn from *A.J. Fife 5959*, CHR 438934.

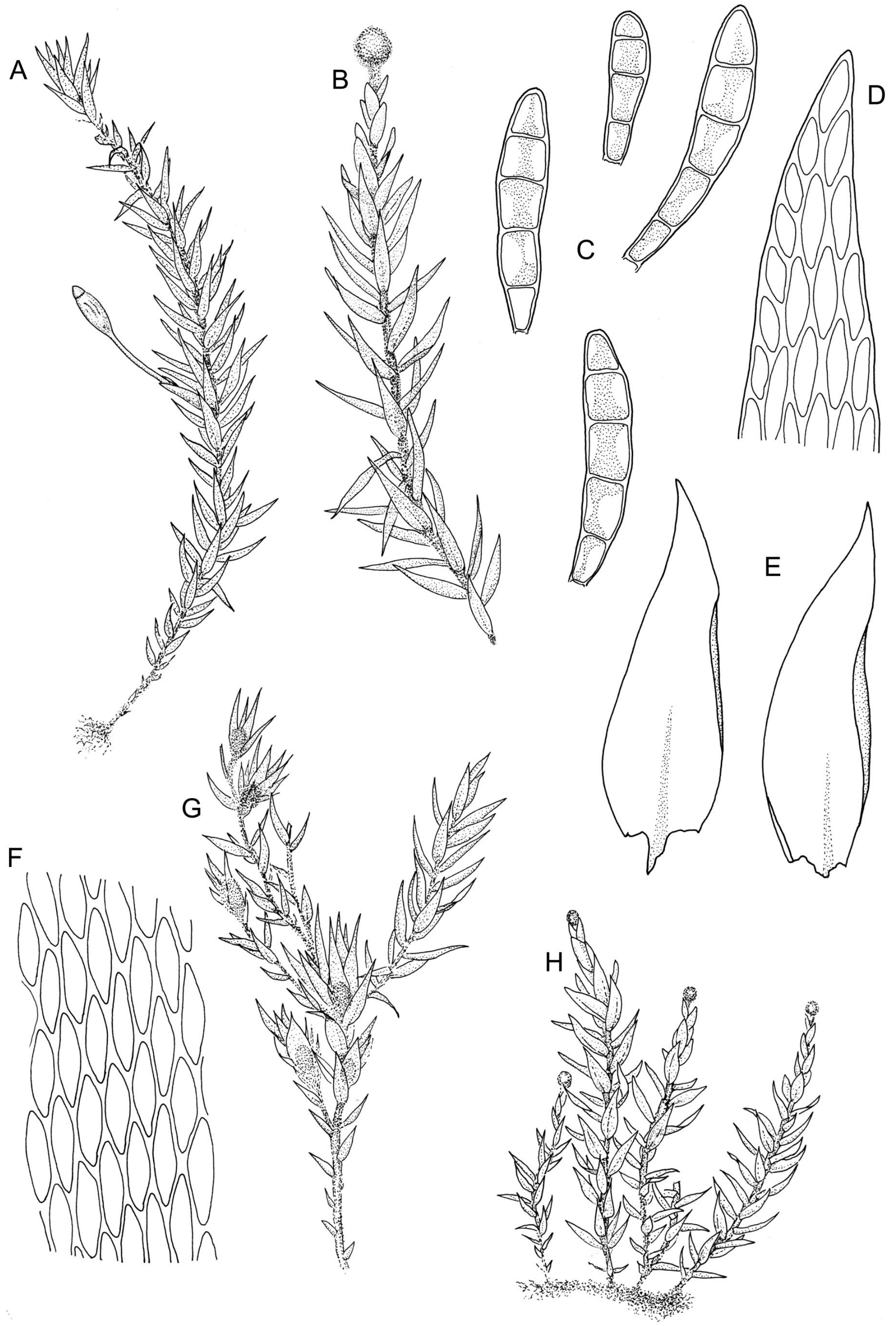
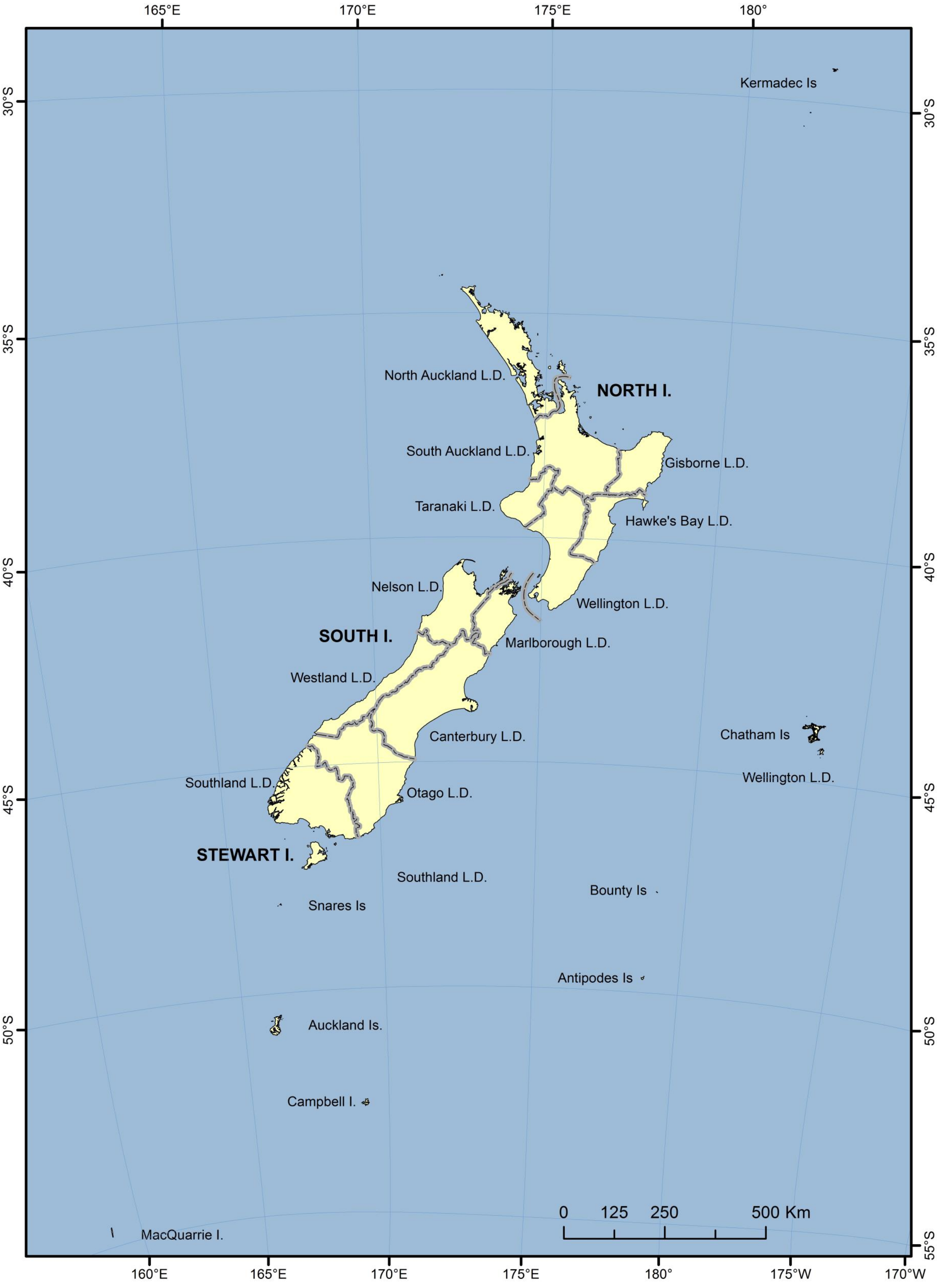
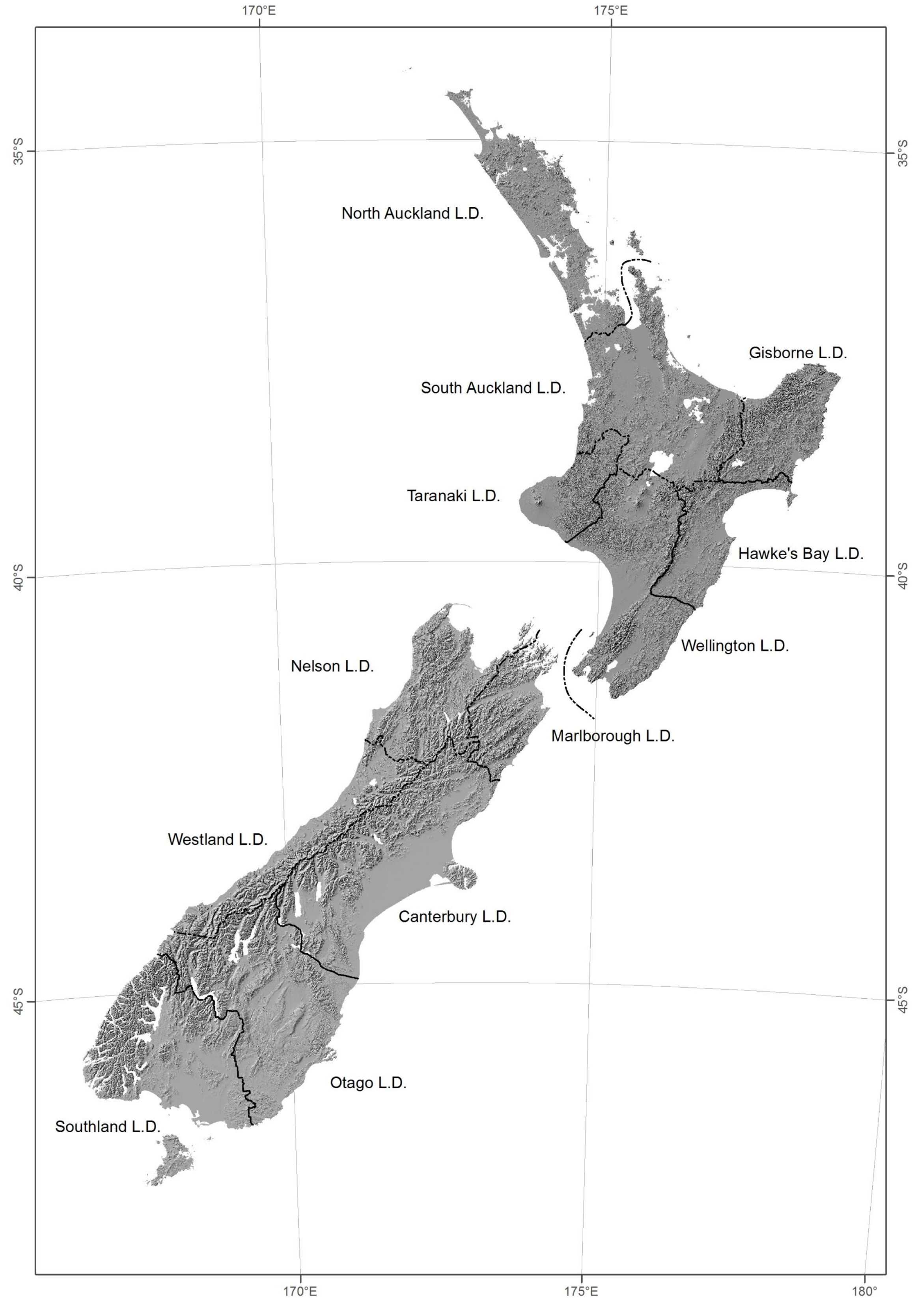


Plate 8: ***Tetraphidopsis*. A–H: *T. pusilla***. A, habit with capsule. B, shoot bearing gemmae. C, gemmae. D, leaf apex. E, leaves. F, upper laminal cells. G, male plant showing perigonia. H, clump of plants bearing gemmae. A, G drawn from *A.J. Fife 9314*, CHR 477164; B–F, H drawn from *B.H. Macmillan 89/205*, CHR 456443.



Map 1: Map of New Zealand and offshore islands showing Land District boundaries



Map 2: Map of main islands of New Zealand showing Land District boundaries

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Page numbers are in **bold** for the main entry, and *italic* for synonyms.

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