

FLORA OF NEW ZEALAND
MOSSES

MNIACEAE



A.J. FIFE

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Cover image: *Plagiomnium novae-zelandiae*, habit of sterile shoot, moist. Drawn by Rebecca Wagstaff from *B.H. Macmillan 89/104*, CHR 461943.

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Introduction

The family Mniaceae and its allies have received much attention in recent decades from monographers, cytologists, and molecular systematists. Despite this attention, no consensus has arisen concerning the limits of this family; a narrow view is adopted here. The Mniaceae are represented in New Zealand by one widely distributed species, *Plagiomnium novae-zealandiae* Colenso, and one exceedingly poorly documented species known only from two sterile shoots from a high elevation site on Mt Ruapehu. Our widespread species is made distinctive regionally in part by its conspicuous plagiotropic and arching sterile shoots contrasting with erect and fertile shoots, its robust habit, and its large, broadly elliptic, singly costate, bordered leaves, which are strongly contorted when dry.

Plagiomnium novae-zealandiae has been treated by many authors as conspecific with the northern hemisphere *P. rostratum* (Schrad.) T.J.Kop. The latter species is dioicous and lacks leaf decurrencies, while the N.Z. species is consistently synoicous and has clearly decurrent leaves on fertile plants.

Plagiomnium novae-zealandiae is widespread on both main islands, occurring at the margins of streams, rivers, or lakes, as well as in wet sites on the forest floor, ranging from low elevation to nearly 1600 m a.s.l.; all occurrences from above 1000 m are associated with calcareous rocks.

Mniaceae

Elements in the following description are taken from McIntosh (2014).

Plants mostly robust (as in N.Z. species) or sometimes small, rarely dendroid, forming tufts or mats, green or with secondary pigmentation. **Stems** mostly unbranched, erect, arching, or stoloniferous (as in N.Z. species), in cross-section with a well-developed central strand, beset with pigmented, papillose or rarely smooth and often dimorphic rhizoids. **Leaves** mostly crowded near stem apices and more distant below, distributed spirally on the stem but sometimes distichous on sterile shoots, often forming rosettes around terminal gametangia, broad, variable in shape (\pm elliptic in N.Z. species) and mostly rounded apically, usually bordered and toothed, mostly contorted when dry, often \pm decurrent. **Upper laminal cells** mostly rounded-hexagonal, firm- or thin-walled, nearly always smooth, collenchymatous or not, irregularly arranged or sometimes in rows; **marginal cells** mostly differentiated to form a distinct, mostly 1–2 layered border; **alar cells** not differentiated. **Costae** single and strong, ending well below apex to subpercurrent (as in N.Z. species), to excurrent, in cross-section variable in structure. **Gemmae** (including tubers) lacking.

Sexuality variable (dioicous in N.Z. species). **Perichaetia** terminal, usually surrounded by a rosette of leaves. **Perigonia** terminal if present. **Setae** single or multiple, variable in colour, elongate, smooth; **capsules** horizontal to pendent, subglobose to obovoid (in N.Z. species) to cylindrical, mostly with a weakly differentiated neck; **stomata** restricted to neck or distributed on urn, immersed; **annulus** usually differentiated; **operculum** variable. **Peristome** double and well-developed; **exostome teeth** 16, mostly lanceolate-acuminate; **endostome** from a high basal membrane, with well-developed and often perforate segments (rarely fused apically) and nodulose cilia. **Calyptra** cucullate, smooth. **Spores** spherical.

Taxonomy: The family is considered by McIntosh (2014) to consist of 12 genera and 92 species worldwide. It is nearly cosmopolitan but is most diverse in temperate and cooler regions of the northern hemisphere. A single species of the genus *Plagiomnium* is well-documented in N.Z. A second, unidentified species is very poorly known here. The allied genus *Orthomnion* Wilson occurs in tropical Australia.

The classification of the Mniaceae and its allied families has been the object of much attention in recent years, but no consensus concerning the familial limits has been achieved. Brotherus (1924) considered the family to consist of seven genera. His concept of the genus *Mnium* Hedw. was very broad and several assemblages, sometimes recognised by Brotherus as sections, have been subsequently segregated and raised to the generic level.

A very broad concept of the Mniaceae was advocated by Goffinet et al. (2009). In their concept, several genera traditionally placed in the Bryaceae (*Pohlia*, *Epipterygium*, and *Mielichhoferia*, as well as *Schizymenium*) were included in the Mniaceae, largely on the basis of molecular data published by Cox & Hedderson (2003). However, the inclusion of these genera in a family centred around *Mnium* Hedw. resulted in a morphologically extremely heterogeneous and unsatisfactory assemblage, and their concept is therefore not followed here.

The circumscription of the Mniaceae for the Australian flora that was employed by Wyatt & Ramsay (2012) excluded the four genera cited in the previous paragraph, and is accepted here. Their concept of the family was, in turn, influenced by Shaw's placement of these same genera in their own family, the Mielichhoferiaceae, in the Flora of North America (Shaw 2014, as outlined in an earlier online version by Shaw). Wyatt & Ramsay's concept of the Mniaceae thus accords with the concept of that family employed by McIntosh (2014) for North America, although the North American representatives are far more diverse. According to Wyatt & Ramsay (2012) the removal of *Pohlia*, *Epipterygium*, *Mielichhoferia*, and *Schizymenium* from the Mniaceae accounts for recent molecular evidence from "nuclear, chloroplast, and mitochondrial genomes [that] suggests that a broad Mniaceae clade may have separated early into two diverging lineages, the families Mielichhoferiaceae and Mniaceae."

Koponen has published extensively over many years on the classification of the Mniaceae in its traditional sense and he also erected the genus *Plagiomnium*. Koponen's (1968) initial generic revision of the Mniaceae stressed, among other morphological features, stem branching patterns, stem anatomy, rhizoid morphology and topography, leaf areolation, border and costal anatomy, and the presence or absence of secondary pigments.

At a later date, Koponen (1988) suggested that *Plagiomnium*, *Orthomnion*, and *Pseudobryum* (Kindb.) T.J.Kop. be isolated into their own family (Plagiomniaceae), and that some genera traditionally placed in the Rhizogoniaceae might be better placed in a reduced Mniaceae, together with *Mnium* s.s. Koponen's (1988) proposals are not followed here.

***Plagiomnium* T.J.Kop., *Ann. Bot. Fenn.* 5: 145 (1968)**

Type taxon: *Plagiomnium cuspidatum* (Hedw.) T.J.Kop.

Plants mostly robust, usually with plagiotropic, arching vegetative shoots and erect, fertile shoots, lacking secondary pigments in the gametophytes. **Stems** with a central strand. **Leaves of fertile shoots** spirally arranged and with a terminal rosette, variable in shape, mostly decurrent, with a unistratose border and singly-toothed; **upper laminal cells** rounded-hexagonal, firm-walled, sometimes arranged in rows, collenchymatous or not, porose or not. **Leaves of arching shoots** in two rows, mostly not decurrent. **Costa of all leaves** strong, ending near or at the apex, lacking teeth abaxially, with an adaxial stereid band.

Dioicous or rarely **synoicous** (as in N.Z. species). **Perichaetia** and **perigonia** (if present) terminal and conspicuous, surrounded by a rosette of leaves. **Setae** single or multiple, erect and elongate; **capsules** inclined to nutant, ovoid or obovoid; **operculum** conic, rostrate or not; **peristome** well-developed.

Taxonomy: According to Koponen (1981), *Plagiomnium* is a cosmopolitan genus of 24 species. Only *P. novae-zealandiae* is well documented in N.Z. and south-eastern Australia, although another possible N.Z. representative is discussed below, under “excluded species”.

New Zealand material of *Plagiomnium* (or *Mnium* s.l.) was treated by some regional authors, including Dixon (1926) and Scott & Stone (1976), as conspecific with the widespread northern hemisphere *P. rostratum* (Schrad.) T.J.Kop. This species is dioicous and is considered by Koponen (1982, p. 83) to be “invariable enough in North America and Europe to be regarded as a monophyletic taxon”.

Koponen has argued (1982, p. 83) that the synoicous inflorescence found in N.Z. material, together with the decurrent leaf bases (“in fertile plants at least”), clearly distinguish it from the widespread northern hemisphere *P. rostratum*. Koponen proposed three scenarios to explain the evolution of the synoicous *P. novae-zealandiae* in the “certainly monophyletic” *Plagiomnium* sect. *Rostrata* (Kindb.) T.J.Kop. He noted that the 10 species in the section all possess rostrate opercula and stomata that are dispersed throughout the capsule, and considered these to be absent in other sections of *Plagiomnium*.

Excluded Taxa: *Mnium pseudorhynchophorum* Broth. Type material of this name is present in the Paris herbarium (PC 0132767) and is viewable on JSTOR (accessed 8 March 2018). It was collected by T.W.N. Beckett 502 at Waimate, Canterbury L.D., and annotated by Koponen as *P. novae-zealandiae* (Colenso) T.J.Kop. It is unusual for Beckett not to have retained in his personal herbarium a portion of a collection that he sent to overseas authorities. This name is not considered further.

The name *Mnium rhynchophorum* Hook. was applied to N.Z. material by J.D. Hooker (1867) and, with a variation of citation, by Dixon (1926). It is a pantropical species and is not considered further here.

Plagiomnium cf. *cuspidatum* (Hedw.) T.J.Kop. Two sterile shoots of highly aberrant *Plagiomnium* have been segregated from *Hylocomium splendens* gathered by Peter de Lange at a high-elevation site at the Upper Makatote River, Mt Ruapehu. This material differs from representative *P. novae-zealandiae* in several morphological features, as outlined below. It has sterile shoots c. 25 mm in length; leaves elliptic, 3–4 × 1.5 mm, *very strongly decurrent*, bordered throughout (c. 3 cells wide at mid leaf), and *sharply and singly toothed to base*. The mid laminal cells are mostly *oblong, firm-walled, slightly thickened at corners* and c. 18–21 × 12 µm; there is a slight hint of arrangement in rows, and they are slightly more compact near the margins. The costa *mostly shortly excurrent to form a short cusp*. This combination of characters suggests that a second N.Z. species of *Plagiomnium* is to hand, but using such sparse and asexual material specific assignment is very difficult. The high-elevation collection site is more than 1000 m higher than any other North I. collection of *Plagiomnium*, although it is only about 300 m higher than the highest South I. records of *P. novae-zealandiae*. Using the key characters employed by Smith (2004), the Upper Makatote River material approaches in many ways his concept of *P. cuspidatum*. However, the distribution of marginal teeth (extending to the leaf insertion) agrees more with Smith’s fig. 207 than with his description. Additional high-elevation collections may clarify the identity of the Upper Makatote River material. It is filed, for convenience, as *P. cf. cuspidatum* (Hedw.) T.J.Kop., CHR 587434.

***Plagiomnium novae-zealandiae* (Colenso) T.J.Kop., *Ann. Bot. Fenn.*
14: 6 (1977)**

≡ *Mnium novae-zealandiae* Colenso, *Trans. & Proc. New Zealand Inst.* 18: 225 (1886)

Lectotype: N.Z., Glenross, County of Hawke's Bay, 1885, *Mr. D.P. Balfour*, WELT M 000414!
(Designated by Koponen 1983.)

= *Mnium xanthocarpum* Colenso, *Trans. & Proc. New Zealand Inst.* 20: 238 (1888)

Holotype: N.Z., wet shaded forest near Norsewood, County of Waipawa, 1886, *W. Colenso*,
WELT M 000415!

Misapplications: *Mnium longirostrum sensu* Sainsbury 1955

Mnium rostratum sensu Scott & Stone 1976

Plants mostly robust, bright to dark green, usually with plagiotropic and arching vegetative shoots, with leaves strongly contorted when dry. **Stems** pale brown, angular in cross-section, with thick-walled cortical cells and a well-developed central strand, beset below with red-brown and nearly smooth rhizoids, those of erect fertile shoots to c. 30 mm, those of sterile arching shoots to at least 80 mm. **Leaves of fertile shoots** broadly elliptic, undulate, strongly contorted when dry, often ± retuse and weakly mucronate at apex, bordered from insertion to apex by elongate cells, weakly and bluntly toothed from c. mid leaf or nearly entire, decurrent, mostly 5.5–7.0 × 3–4 mm. **Leaves of arching shoots** in two rows, as fertile shoots but smaller (especially near the stem base), lacking decurrencies. **Mid laminal cells** (in leaves of fertile shoots) not arranged in ranks, rounded-hexagonal, firm-walled, very slightly thickened at corners, mostly 30–45 × 21–30 µm, becoming more compact near leaf apex and more oblong and larger towards insertion; **cells of the border** elongate, thick-walled, in a single layer, and forming a border 3–4 cells and c. 45–60 µm wide at mid leaf. **Costa** stout, dilated towards insertion, fading just below apex, sometimes appearing to fuse with a very weak mucro, in cross-section rounded on both surfaces, with numerous large central cells surrounded on both sides by smaller, firm-walled cells and with a small adaxial stereid group, cells elongate in adaxial surface view.

Synoicus. Perichaetia terminal, conspicuous, surrounded by a whorl of wide-spreading leaves and reduced inner leaves, surrounding large numbers of archegonia, antheridia, and filiform 6–10-celled hyaline paraphyses. **Setae** single or multiple (–4) per perichaetium, yellow- or pale red-brown, erect and elongate, mostly 22–27(–40) mm; **capsules** inclined, horizontal, or weakly nutant, obovoid with a scarcely differentiated neck, pale brown with a red-brown rim, 3.0–4.0 mm long; **exothecial cells** irregular; **stomata** distributed on urn, immersed, sparse and difficult to observe; **annulus** apparently not differentiated; **operculum** rostrate from a conic base, c. ½ the length of capsule. **Exostome teeth** yellow-brown, finely papillose throughout (on outer surface), not bordered, lacking marginal trabeculae, with a zig-zag line on outer surface, strongly trabeculate and apparently otherwise smooth on inner surface; **endostome** with a high basal membrane, perforate segments, and 2–4 well-developed nodose or appendiculate **cilia**. **Calyptra** cucullate. **Spores** mostly 24–30 µm, pale brown, thin-walled and often collapsed in dried material.

Illustrations: Plate 1. Sainsbury 1955, pl. 42, fig. 1 (as *Mnium longirostrum*); Koponen 1983, figs 1–4; Beaver et al. 1992, fig. 44; Malcolm & Malcolm 2003, p. 50.

Distribution: NI: N Auckland, S Auckland, Gisborne, Hawke's Bay, Wellington; SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland (Fiordland N.P.). No material from Taranaki L.D., Stewart I., or any of the southern offshore (subantarctic) islands has been confirmed. The lack of Taranaki L.D. records is likely a collection artefact.

Australasian. Mainland Australia* (Reported from Queensland, N.S.W., and Victoria by Wyatt & Ramsay 2012). Dalton et al. (1991) rejected the record of this species from Tasmania.

Habitat: Usually at the margins of streams, rivers, or lakes, but often in wet sites on forest floors. Nearly always in sites that are irrigated or subject to flooding, and sometimes collected from areas of standing water; occasionally on prostrate logs or epiphytic. It can grow in alpine regions in sheltered sites, such as dolines on Mt Arthur (Nelson L.D.); all occurrences from above 1000 m are associated with calcareous rocks. Wyatt & Ramsay (2012) consider this species to be primarily high elevation (above 1000 m) and calcicolous in Australia, but the species is more catholic in its habitat preferences in NZ. *Achrophyllum dentatum*, *Brachythecium plumosum*, *Fissidens rigidulus*, *Pohlia cruda*, *Racopilum strumiferum*, *Thuidium laevigatum*, and *Tridontium tasmanicum* are frequently associated species.

On the North I. ranging from 10 m (Wairarapa Lake Shore Scenic Reserve, Wellington L.D.) to at least 750 m (Lake Waikaremoana, Gisborne L.D. and Mt Tongariro, Wellington L.D.). On the South I. from 10 m (near mouth of Wanganui River, Westland L.D.) to nearly 1600 m (Mt Arthur, Nelson L.D.)

Notes: The collection site of the lectotype of *Mnium novae-zealandiae* Colenso, given in the protologue as “Glenross”, is probably the Glenross Homestead, located some 10 km SW of Pongaroa in Hawke’s Bay L.D.

The protologue of *Mnium xanthocarpum* Colenso cites only a single collection as type material, and thus Koponen’s (1983, p. 101) citing of the collection in WELT as a syntype is superfluous. Apparently duplicates of this collection were sent by Colenso to both Kew and to F.M. Reader, but only material in WELT has been seen.

Mnium novae-seelandiae Müll.Hal. is a *nom. nud.* Original material of *M. novae-seelandiae* Müll.Hal. was collected by R. Helms at Greymouth, but it does not appear to be present in any N.Z. herbarium. The original material (NY 01186706) can be viewed on JSTOR (accessed 8 March 2018) and has been annotated by T. Koponen.

Koponen (1982) indicated that *P. novae-zealandiae* closely resembles the South African *P. rhynchophorum* var. *reidii* within the section of *Plagiomnium* (sect. *Rostrata* (Kindb.) T.J. Kop.) to which these taxa are both assigned.

Recognition: *Plagiomnium novae-zealandiae* is regionally most likely to be confused with *Achrophyllum dentatum*, a species that often grows in the same habitats. Both these species have strongly contorted leaves when dry, and both can assume a dark, nearly black coloration. When the plants are moist, confusion is less likely.

Etymology: The specific epithet refers to the N.Z. provenance of the type collection. The epithet used by Sainsbury (1955), *longirostrum*, refers to the form of the operculum.

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Conventions

Abbreviations and Latin terms

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

PK	Poor Knights Islands
P.N.G.	Papua New Guinea
<i>pro parte</i>	in part
Qld	Queensland
q.v.	which see (<i>quod vide</i>)
RT	Rangitoto Island
S.A.	South Australia
<i>s.coll.</i>	without collector (<i>sine collectore</i>)
<i>s.d.</i>	without date (<i>sine die</i>)
sect.	section
SEM	scanning electron microscope/microscopy
<i>sensu</i>	in the taxonomic sense of
SI	South Island
<i>sic</i>	as written
<i>s.l.</i>	in a broad taxonomic sense (<i>sensu lato</i>)
<i>s.loc.</i>	without location (<i>sine locus</i>)
Sn	Snares Islands
<i>s.n.</i>	without a collection number (<i>sine numero</i>)
Sol	Solander Island
sp.	species (singular)
spp.	species (plural)
<i>s.s.</i>	in a narrow taxonomic sense (<i>sensu stricto</i>)
St	Stewart Island
<i>stat. nov.</i>	new status (<i>status novus</i>)
subg.	subgenus
subsect.	subsection
subsp.	subspecies (singular)
subsp.	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 (<i>videlicet</i>)
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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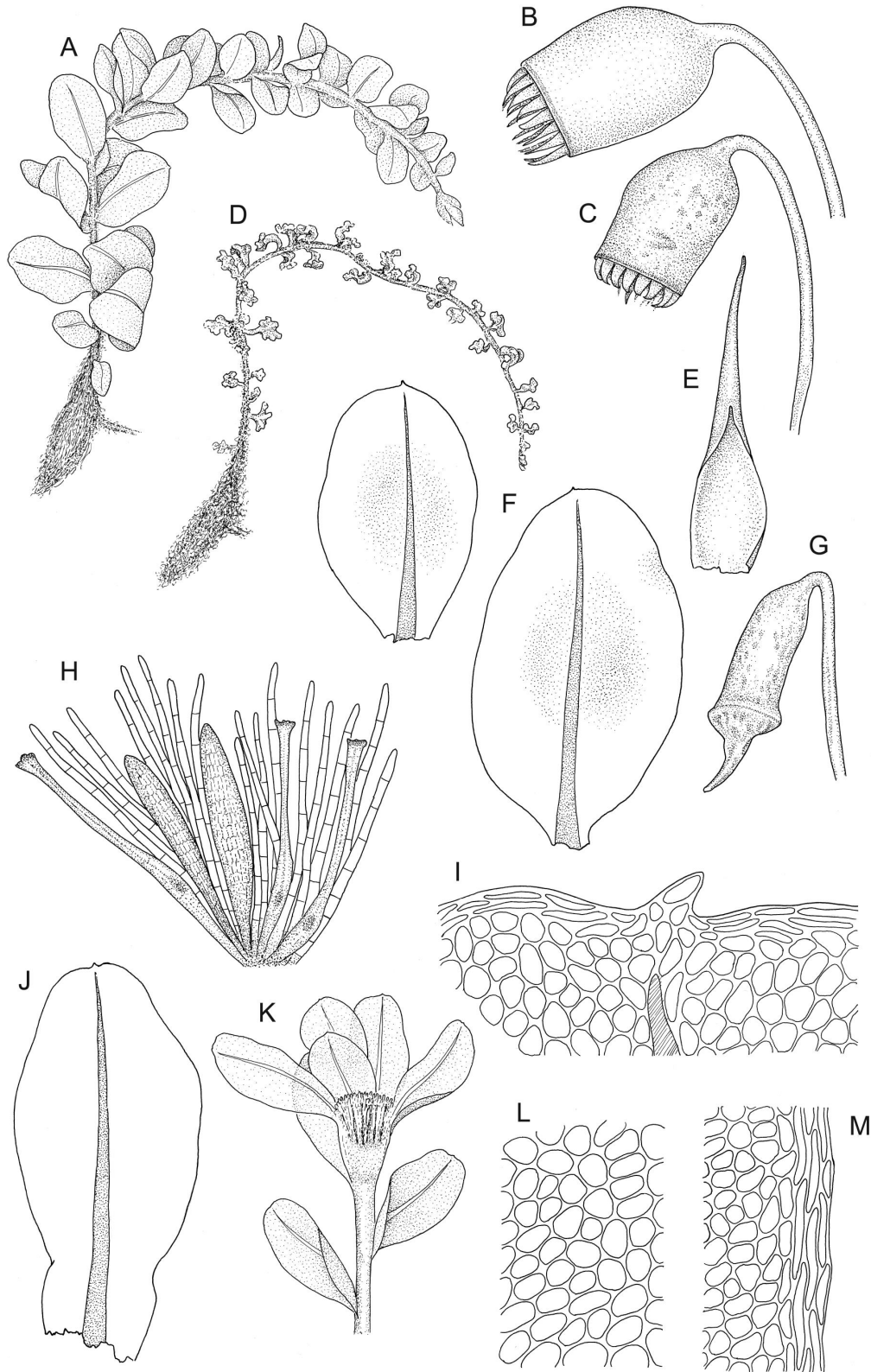
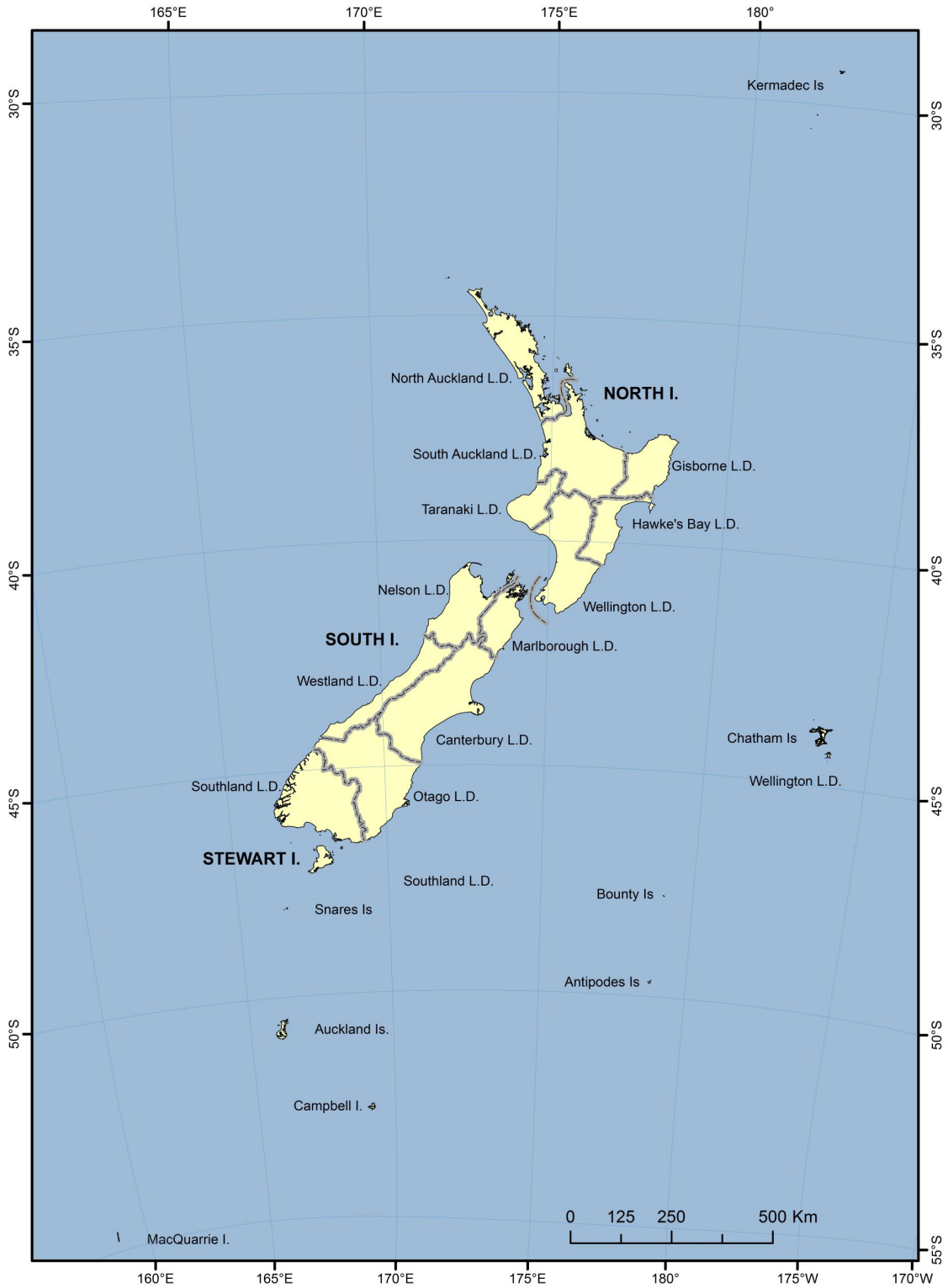
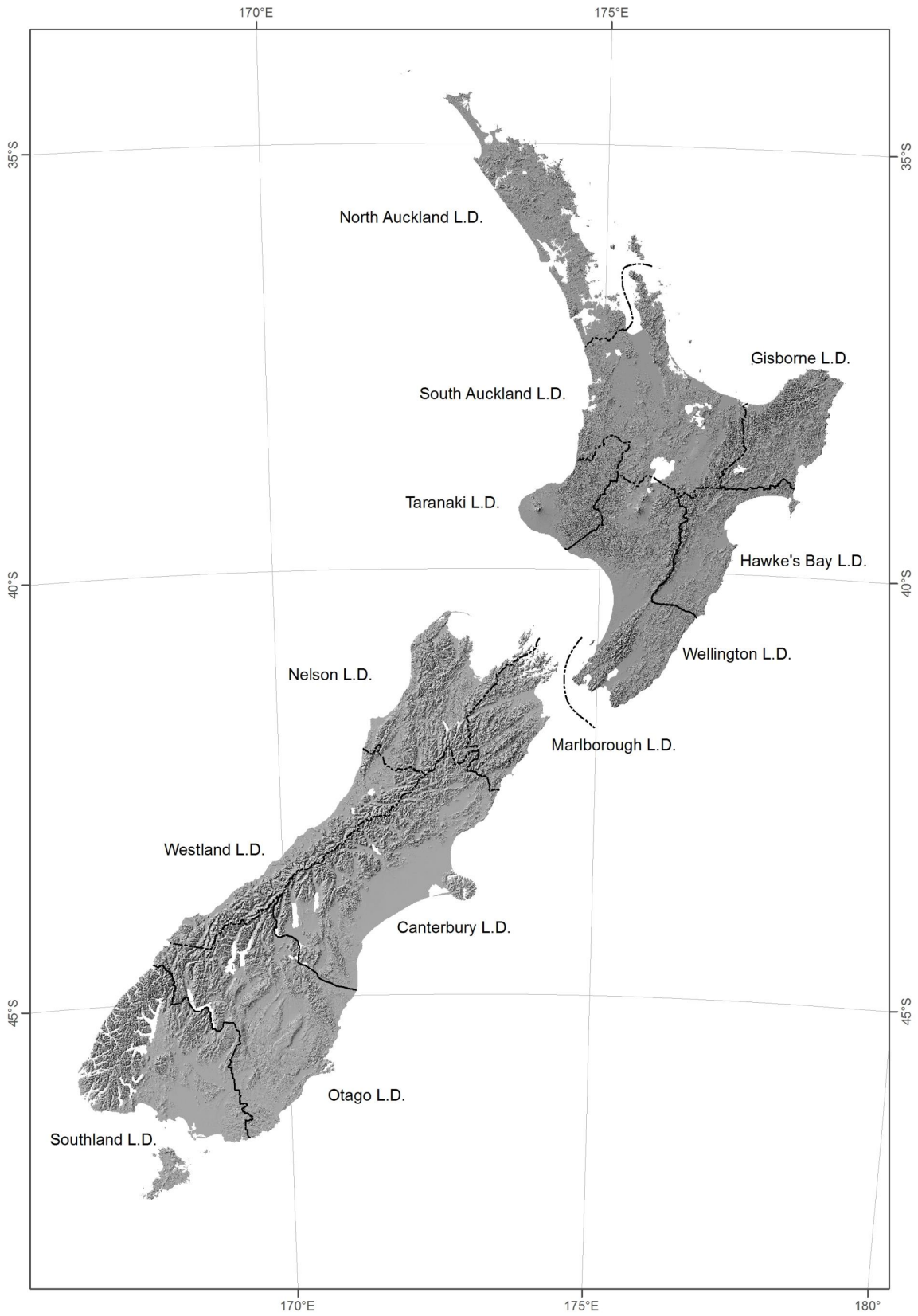


Plate 1: *Plagiomnium*. A–M: *P. novae-zelandiae*. A, habit of sterile shoot, moist. B, capsule, moist. C, capsule, dry. D, habit of sterile shoot, dry. E, calyptra. F, vegetative leaves. G, capsule with operculum, dry. H, detail of antheridia, archegonia and paraphyses. I, leaf apex. J, perichaetial leaf. K, perichaetial shoot. L, upper laminal cells. M, mid laminal cells adjacent to margin. A, D, F, H–M drawn from *B.H. Macmillan 89/104*, CHR 461943; B–C drawn from *K.W. Allison 3019*, CHR 578251; E, G drawn from *J. Lewinsky 74-224*, CHR 240235.



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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and *italic* for synonyms.

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T.J.Kop. 1, 3, **4**

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