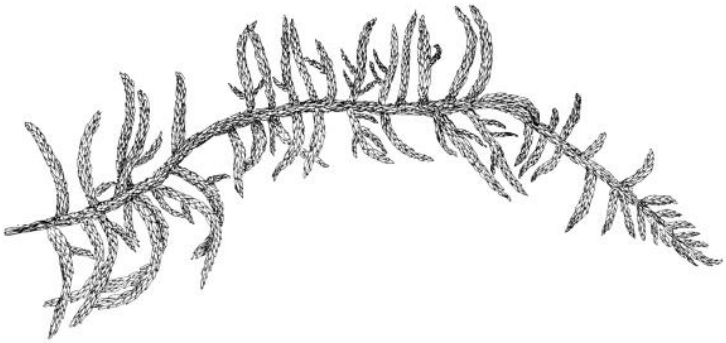
FLORA OF NEW ZEALAND

MOSSES

HYLOCOMIACEAE



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Cover image: *Hylocomium splendens*, habit. Drawn by Rebecca Wagstaff from *B.H. Macmillan 92/62*, CHR 482420.

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Contents

Introduction

The Hylocomiaceae are widely distributed in temperate to cold parts of the northern hemisphere and in some tropical highlands. In addition two genera and three species of Hylocomiaceae have been documented from New Zealand. No sporophytes for any of these dioicous species have been found regionally. *Rhytidiadelphus squarrosus* and *R. triquetrus* are both clearly adventive. The former occurs widely on the west coast of the South Island in roughly-mown areas such as road verges. Nearly all N.Z. material of this species is female but a few male plants have been recorded from the Haast area, suggesting that two introductions of this species probably occurred. *Rhytidiadelphus squarrosus* appears to be actively expanding its range in the South I. and the lack of records from wetter parts of the North I. is surprising. *Rhytidiadelphus triquetrus* is known only from several well-documented collections from St Arnaud in Nelson Lakes N.P. Only male plants of this species have been found there. Attempts have been made to eliminate this potentially invasive species but further survey work is required to determine whether complete eradication has been achieved.

Hylocomium splendens is recorded only from seven high-elevation North I. sites. It is treated here as an indigenous species but several features of its occurrence including a lack of early historical collections, the unisexual (female) nature of its populations, and the otherwise exclusively northern hemisphere distribution of both it and its allies are perplexing. Also perplexing is that this species, one of the most abundant terrestrial species in the boreal coniferous forests of the northern hemisphere, appears to be fully integrated into undisturbed alpine vegetation here.

Hylocomiaceae

Elements in the following family description are taken from Rohrer (1985).

Plants medium-sized to robust, forming loose to compact wefts. **Stems** prostrate, ascendant, or erect, often with ascending-arching innovations, irregularly or pinnately branched, sometimes frondose, usually with a central strand. **Stem and branch leaves** often differentiated, usually serrate to serrulate at margins. **Laminal cells** elongate, prosenchymatous, smooth or prorate, thin- to rather thick-walled, often ± porose; **alar cells** differentiated or not. **Costae** mostly double and strong. **Paraphyllia** present or not. **Pseudoparaphyllia** often present and foliose.

Dioicous. **Perichaetia** restricted to stems. **Perigonia** bud-like and scattered on stems and branches. **Setae** elongate and smooth; **capsules** mostly curved and asymmetric. **Operculum** conic-apiculate or rostrate. **Peristome** double; **exostome teeth** yellow to red-brown, lanceolate, shouldered, and bordered, often reticulate on outer surface; **endostome** with a high basal membrane; segments mostly broad, keeled, and narrowly or broadly perforate; **cilia** mostly present, 1–4. **Calyptra** cucullate and smooth.

Taxonomy: For many decades, there has been little agreement concerning the delimitation of the Hylocomiaceae (grounded by *Hylocomium*) and the related Rhytidiaceae. Several genera, all of them exclusively northern hemisphere in their natural distribution (N.Z. populations of *H. splendens* excepted), have been placed by different authors in both families (and some also in the Hypnaceae). These genera include *Rhytidiadelphus* (which occurs as an adventive in N.Z.), some ecologically important and widely distributed northern hemisphere genera as *Rhytidium*, *Pleurozium*, *Gollania*, and others of more restricted distribution. The Hylocomiaceae were treated by Brotherus (1925) to include seven genera but to exclude *Rhytidiadelphus*, *Rhytidium*, *Pleurozium*, and *Gollania*. Crum & Anderson (1981) treated four genera in the Hylocomiaceae for eastern North America and presented an interesting overview of the problems surrounding its delineation: “We have combined the Hylocomiaceae and the Rhytidiaceae and have taken a conservative view of the genera, in distinct contrast to concepts presented by Fleischer and followed by Brotherus and many more modern authors. The two families, separate or combined, consist of genera anomalous in respect to the Hypnaceae and not clearly related to any other family of the Hypnobryales. The genera defy definition except in relation to one another.” The family was reviewed by Crum’s student J. Rohrer (1985), who recognised 12 genera (including *Rhytidiadelphus*, *Rhytidium*, and *Pleurozium*, but excluding *Gollania*). Goffinet et al. (2009) presented an expanded family concept of 15 genera, some of which were recently described; they also, controversially, included the large genus *Ctenidium* in the Hylocomiaceae.

In this Flora the apparently indigenous *Hylocomium* and the adventive *Rhytidiadelphus* are treated in the Hylocomiaceae, while *Ctenidium* (with only one indigenous species in N.Z.) is retained in the Hypnaceae. The Hylocomiaceae are widely distributed in temperate to cold parts of the northern hemisphere and some tropical highlands.

Two genera and three species (two clearly adventive) are known to occur in N.Z. All three species are known here only by plants of a single sex; no sporophytes for any of the species have been found regionally.

1	**Plants** medium-sized; **stem leaves** erect and overlapping, neither cordate nor clasping at base, <2.0 mm; **branch leaves** strongly differentiated from stem leaves, broadly acute or rounded at apices; **paraphyllia** densely covering stems and branches; known only on North I. and above 1200 m.	*Hylocomium*
1'	**Plants** coarse and robust; **stem leaves** either wide-spreading or squarrose, cordate at base, >2.8 mm; **branch leaves** sometimes narrower but not strongly differentiated from stem leaves, acute at apices; **paraphyllia** absent; known only on South I., from low to mid-elevation sites	*Rhytidiadelphus*

Hylocomium Schimp. in Bruch et al., *Bryol. Eur. 5,* 169 (1852)

Type taxon: *Hylocomium splendens* (Hedw.) Schimp.

A monotypic genus, with the characteristics of *Hylocomium splendens*, described below.

Taxonomy: *Hylocomium* was treated as a monotypic genus by Rohrer (1985). Some 20th century Floras (e.g., Crum & Anderson 1981) treated more species, but these were placed in either

Hylocomiastrum or *Loeskeobryum* Rohrer (1985), whose treatment has been followed in more recent floristic treatments (e.g., Smith 2004).

Etymology: The generic name means “woods-inhabiting."

Hylocomium splendens (Hedw.) Schimp., *Bryol. Eur. 5,* 173 (1852)

≡ *Hypnum splendens* Hedw., *Sp. Musc. Frond.,* 262 (1801)

Type: Europe. Not seen.

Plants medium-sized, yellow- to olive-green, mostly dull or faintly lustrous, forming loose wefts. **Stems** prostrate or ascendant and self-supporting, wiry, red-brown, densely beset with filamentous paraphyllia, commonly 60–120 mm long in N.Z. material, irregularly subpinnate (in N.Z. material), often with scarcely-branched horizontal stolons, in cross-section with several layers of thick-walled cortical cells surrounding a medulla of prosenchymatous cells, lacking a central strand; **rhizoids** lacking (or infrequent *fide* Rohrer); **branches** densely spaced on stems, short, c. 10 mm, simple or branched, distinctly curved (especially near tips), tapered apically and when dry sometimes appearing weakly cuspidate. **Stem** and **branch leaves** differentiated. **Stem leaves** erect and overlapping, oblong-ovate, abruptly narrowed to a short and ± channelled acumen (in N.Z. material), concave, smooth when moist, ± striolate when dry, slightly narrowed and not clasping at base, c. 1.5–1.8 × 0.8–1.1 mm, c. 2:1; **margins** narrowly reflexed near base, plane above, often pinched at the base of the acumen, distantly serrulate or crenulate below, distinctly serrulate at acumen; **mid laminal cells** vermicular, strongly prorate, variably porose, 30–45(–54) × c. 5 µm and 10–13:1, becoming longer and more distinctly porose towards leaf base; **cells at insertion** orange-brown, incrassate, strongly porose, forming a pigmented band across the leaf base; **alar cells** not differentiated or slightly wider than adjacent basal cells. **Costae** double, often ± pigmented, extending ¼–½ the leaf length. **Branch leaves** much smaller, ± elliptic, distinctly narrowed to base, abruptly narrowed to a broad and obtuse apex, c. 0.8–1.0 mm on well-developed primary branches (smaller near branch tips or on secondary branches). **Costae** shorter and sometimes ± absent. **Paraphyllia** abundant on stems and branches, much-branched and filamentous. **Pseudoparaphyllia** not seen.

Dioicous. **Perichaetia** scattered on stems, the leaves ovate-lanceolate, spreading at tips, ecostate, c. 1.5 mm. **Perigonia** and **sporophytes** unknown in N.Z.

Illustrations: Plate 1. Crum & Anderson 1981, fig. 608; Rohrer 1985, fig. 1 a–g, fig. 2a; Noguchi 1987–1994, fig. 531; Smith 2004, fig. 315. The illustration in Sainsbury (1955, pl. 76, fig. 2) gives an inaccurate impression of this species.

Distribution: NI: Gisborne (Mt Hikurangi), Hawke’s Bay (Mt Kaweka, Ruahine Range), Wellington (Mt Ruapehu, Kaimanawa Range, Ōhutu Ridge, Tararua Range). The record from the Kaimanawa Range is based on a sight record from Matt Renner (pers. comm. 18 Jan. 2010).

Bipolar and probably indigenous in N.Z. Widespread in the northern hemisphere.

Habitat: This species is documented from North I. high-altitude and wind-swept locations, where it can be fairly common locally (as at Armstrong Saddle and “north of Tūpari”, both in the northern Ruahine Range). Its apparent absence from South I. is remarkable. Well-documented specimens from “north of Tūpari” (*D. Glenny 4843*, *4849*, & *4851*, WELT) grew on soil “through *Dracophyllum recurvum*” or were associated with *Podocarpus nivalis* in a tussock shrubland with *Chionochloa pallens*. Associated cryptogams recorded by Glenny included: *Racomitrium* sp. (likely *R. pruinosum*), *Cladia aggregata*, *Breutelia pendula, Polytrichum commune, Bartramia papillata, Ptychomnion densifolium,* and *Dicranoloma* sp. (likely *D. robustum*). A very similar range of associates (with the addition of *Hymenophyllum multifidum*, *Celmisia incana*, and *C. spectabilis*) was recorded from a site at 1405 m near Armstrong Saddle in the Ruahine Range (*A.J. Fife & H. Baynes 13064*, CHR 632040). Although there are several post-1932 collections (in CHR, all poorly localised) from the Tararua Range, there appear to be no recent collections from there.

Hylocomium splendens also occurs below tree-line. At the Ōhutu Ridge in the NW Ruahine Range, Macmillan (1994) found this species to be “locally common” in bogs, boggy stream beds, and clearings associated with *Libocedrus bidwillii* forest; one of her collections (*B.H. Macmillan 92/24*, CHR 482382) was made “on top of [a] limestone slab”. Macmillan (1994) recorded *Hypnum cupressiforme* and *Drepanocladus aduncus* as associates in a “boggy stream bed”. This species also occurs in mountain beech forest on the Sunrise Track (Ruahine Range) where it was gathered from “stony ground, with *Ptychomnion aciculare, Dicranoloma robustum*” (*L.H. Cave 933*, CHR 611358). Ranging from c. 1200 m (Ōhutu Ridge and near Sunrise Hut) to c. 1900 m (Upper Makatote River on Mt Ruapehu).

Notes: No other member of the Hylocomiaceae (or its closely allied families) occurs naturally in the southern hemisphere. The first N.Z. collection of *Hylocomium splendens* was made by *L.B. Moore* in March 1932 on Mt Hikurangi. Only female sex organs have been seen in N.Z. material; these organs are often difficult to locate because of the close spacing of the branches on the stem. Sporophytes are unknown here and rare in other parts of the species' range. The exclusively northern hemisphere distribution of its relatives, the lack of early N.Z. collections, and the unisexual nature of N.Z. populations suggest that this species could possibly be adventive here. Paradoxically, this species appears to be fully integrated into undisturbed vegetation and not to be associated with known adventive species at Armstrong Saddle. Herbarium records also suggest that *H. splendens* occurs in N.Z. only in undisturbed vegetation. The true status of this species in the N.Z. flora cannot be resolved with our present level of knowledge; it is best considered indigenous until further evidence can be brought to bear on the question.

Hylocomium splendens is one of the most abundant terrestrial species in the boreal coniferous forests of the northern hemisphere. In North America it is sometimes termed the "stair-step moss" (Crum & Anderson 1981), because of its production of characteristic annual layers of horizontal branches lying in a single plane.

Material similar to the usual N.Z. subpinnate expression of *H. splendens* occurs in arctic tundra and similarly exposed sites in northern parts of the northern hemisphere. These forms have been given taxonomic recognition under the names *Hylocomium alaskanum* (Lesq. & James) Aust. and *H. splendens* var. *obtusifolium* (Geh.) Paris. Steere (1978) considered *H. alaskanum* "only a stunted physiological-ecological tundra form or ecotype of *Hylocomium splendens* which does not merit nomenclatural recognition at any taxonomic level". Steere's conclusions are echoed by Crum & Anderson (1981, p. 1225). Steere's conclusions regarding northern hemisphere material apply equally to N.Z. populations.

Material collected from below tree-line (e.g., collections from the Ōhutu Ridge by *B.H. Macmillan*, including CHR 482378, 482420 et al.; *A. Knight s.n.*, from near Sunrise Hut, Ruahine Range, CHR 632086) exhibits a slight tendency towards bipinnate branching and for the branches to be crowded on portions of the stem.

Recognition: The morphology of N.Z. material differs markedly from representative northern hemisphere specimens of this species. Our high-elevation material (above c. 1300 m) does not develop the successive annual stem innovations that give most northern hemisphere material a distinctive layered appearance. By contrast, nearly all N.Z. material is subpinnately branched, has broad branch leaf apices, and a bright red stem when fresh. N.Z. material also lacks rugose stem leaf apices and has broader branch leaf apices than the species does in North America (cf. Crum & Anderson 1981). These distinctions led Macmillan (1994) to refer to N.Z. material as "*Hylocomium* aff. *splendens*".

The combination of the densely and subpinnately branched plants, abundant paraphyllia, distinctly curved branches, and dimorphic leaves with double costae and prorate laminal cells make confusion with any other N.Z. species unlikely. Macmillan (1994) aptly described it as growing in "loose, flat patches" with straw-coloured leaves and red stems which give "an underlying pinkish glow to the patch". In habit this species can appear somewhat like a diminutive *Pseudoscleropodium purum*, but the similarity is superficial, and the two are unlikely to be confused.

Etymology: The epithet means "shining" or "brilliant".

Rhytidiadelphus (Limpr.) Warnst., *Krypt.-Fl. Brandenburg, Laubm.*, 917 (1906)

Type taxon: *Rhytidiadelphus squarrosus* (Hedw.) Warnst.

Elements in the following description are taken from Rohrer (1985).

Plants coarse and robust, yellow-brown or green, dull or shiny, forming loose, often extensive and deep wefts. **Stems** creeping and ascendant at tips (decumbent), often quite elongate, irregularly and remotely branched to irregularly pinnate, in cross-section with thick-walled outer cells and a small central strand; branches acute or blunt, often decurved, sometimes with rhizoids near tips. **Stem** and **branch leaves** similar or ± differentiated. **Stem leaves** erect-spreading, squarrose, or falcate-secund, very broadly ovate to ovate-lanceolate, gradually to abruptly acuminate and the acumen sometimes channelled, sometimes cordate and sheathing at base, not decurrent, ± concave below, smooth throughout or plicate in lower half; **margins** plane throughout or narrowly reflexed at base, serrulate in upper ½ or more, serrulate to nearly entire below; **mid laminal cells** narrowly elliptic to linear, smooth or prorate, ± thin-walled, subporose; **cells at insertion** gold-brown, shorter, more incrassate, and

more porose to form a band across the leaf base; **alar cells** weakly to strongly differentiated, typically shorter and wider than the basal cells or enlarged and pale in well-defined groups. **Costae** double, very short to c. ⅔ the leaf length. **Paraphyllia** absent. **Pseudoparaphyllia** broadly ovate to suborbicular (*fide* Rohrer 1985).

Dioicous. **Perichaetia** restricted to main stems, scattered, with leaves sheathing and squarrose-recurved above. **Setae** elongate, red-brown, smooth; **capsules** asymmetric, ± horizontal, ovoid to ellipsoid, smooth or furrowed when dry; **exothecial cells** isodiametric or short-rectangular; **stomata** superficial, restricted to capsule base; **annulus** differentiated; **operculum** conic, apiculate. **Exostome teeth** red-brown, lanceolate, shouldered, bordered; **endostome** yellow-brown, arising from membrane ⅓–½ the height of the teeth, with well-developed keeled and perforate **segments** and variably developed **cilia**. **Calyptra** cucullate, smooth.

Taxonomy: A northern hemisphere genus of four species (Rohrer 1985). The species occurring in N.Z. are both clearly adventive.

Etymology: The generic name alludes to a relationship to the widespread and monotypic northern hemisphere *Rhytidium*.

1	**Stem leaves** squarrose, distinctly sheathing the stem, not plicate, gradually tapered to a channelled acumen, c. 2.8–3.5 mm long; **laminal cells** prorate, weakly projecting on abaxial surface but not spinose; **plants** in N.Z. mostly female	*R. squarrosus*
1'	**Stem leaves** wide-spreading, not sheathing the stem, plicate, gradually tapered to a non-channelled apex, c. 4.0–4.8 mm long; **laminal cells** strongly prorate-spinose on abaxial surface; **plants** in N.Z. male only.	*R. triquetrus*

Rhytidiadelphus squarrosus (Hedw.) Warnst., *Krypt.-Fl. Brandenburg, Laubm.,* 918 (1906)

≡ *Hypnum squarrosum* Hedw., *Sp. Musc. Frond.,* 281 (1801)
Type: Europe. Not seen.

Plants fairly robust, yellow- or bright-green, shiny, forming extensive wefts. **Stems** commonly 50–80(–150) mm, orange, mostly obscured by the sheathing leaves, irregularly branched, ascendant; branches tapered and acute, decurved. **Stem** and **branch leaves** differentiated. **Stem leaves** sheathing, strongly squarrose, broadly ovate-lanceolate, concave and smooth below both moist and dry, gradually tapered to a channelled acumen, scarcely cordate at base, serrulate to base or nearly so, c. 2.8–3.5 × 1.1–1.5 mm; **mid laminal cells** elliptic-linear, prorate (upper cell ends weakly projecting on abaxial surface), scarcely porose, mostly 45–66 × 6–7 µm, becoming longer and more or less porose towards leaf base; **alar cells** slightly inflated, not or weakly porose, forming a large but rather poorly delimited elliptic group. **Branch leaves** narrower and more lanceolate. **Costae** c. ¼ the leaf length. **Pseudoparaphyllia** not seen.

Perichaetia scattered on main stems, the inner leaves narrowly acuminate and squarrose. **Perigonia** and **sporophytes** not seen.

Illustrations: Plate 2. Brotherus 1925, fig. 762; Crum & Anderson 1981, fig. 602; Smith 2004, fig. 312.

Distribution: SI: Nelson, Canterbury (near Arthur's Pass Village), Westland, Otago (Makarora, Dunedin area, Catlins River), Southland (Milford Sound.); St; Ch (Pitt I.).

Adventive. Tasmania*. Widespread in the northern hemisphere.

Habitat: Restricted to disturbed and roughly-mown areas such as road verges, picnic sites, campgrounds, and golf courses. It is a very common species on the west coast of the South I. from at least the Denniston area south to Milford Sound and is known in the Dunedin area. P.J. Dalton and C. Brooker (pers. comm., 29 Jan. 2007) made an unsuccessful effort to locate additional sites in southern Otago and eastern Southland L.D. in Jan. 2007. However, J. Beever (pers. comm., 30 April 2014) collected it at the Catlins River (in southern Otago) in Jan. 2014. It often occurs abundantly in disturbed, moist, and strongly insolated sites and its spread is almost certainly encouraged by mowing. The apparent absence of this species from wetter parts of the North I. is curious and its eventual collection there is to be expected. Ranging from near sea level to c. 580 m (at Denniston Plateau, Nelson L.D.). Frequent associates include *Eurhynchium praelongum*, *Thuidium furfurosum*, and *Calliergonella cuspidata*.

The initial report of *R. squarrosus* in N.Z. was made by Child & Allison (1975) from a clayey slope in a golf course fairway where it occupied an area c. 50 m in diameter.

I have seen no male plants or sporophytes in N.Z. material; however P. Dalton (pers. comm., 12 Sept. 2007) informs me that male plants occur in the Haast (Westland L.D.) area. He has also seen male plants from Tasmania. This suggests that at least two introductions may have been made of this species on South I. A large fraction of collections are from road verges. The species appears to be actively expanding its range in the South I. at the time of writing.

Recognition: *Rhytidiadelphus squarrosus* is likely to be confused only with *Ptychomnion densifolium*, but can be differentiated from that species by its non-twisted leaf apices, the presence of a large but weakly delimited elliptic group of slightly inflated alar cells, and the near or total absence of pores in its mid laminal cell walls. Additionally *R. squarrosus* is a less compact and more branched species occurring in lowland disturbed habitats, in contrast to the mostly high elevation *P. densifolium*. Confusion with the widespread and mostly subaquatic *Cratoneuropsis relaxa* seems less likely; some distinguishing features are discussed under that species.

Etymology: The epithet refers to the squarrose nature of the stem leaves.

Rhytidiadelphus triquetrus (Hedw.) Warnst., *Krypt.-Fl. Brandenburg, Laubm.,* 920 (1906)

≡ *Hypnum triquetrum* Hedw., *Sp. Musc. Frond.,* 256 (1801)
Type: Europe. Not seen.

Plants robust and coarse, bright-green, ± dull, forming loose and shaggy wefts. **Stems** c. 100 mm or more in N.Z. material, orange-brown, clearly visible between leaves, irregularly branched, ascendant; **branches** mostly tapered and decurved at tips. **Stem** and **branch leaves** differentiated. **Stems leaves** not sheathing, wide-spreading, broadly ovate-lanceolate, auriculate and clasping at base, scarcely concave, distinctly plicate moist or dry, ± rugose when dry, gradually tapered to a non-channelled and nearly flat acumen, cordate and clasping at base, serrulate to base or nearly so, c. 4.0–4.8 × c. 2 mm; **mid laminal cells** oblong-linear, strongly prorate-spinose (upper cell ends projecting on abaxial surface, most conspicuously at plications), distinctly porose, mostly c. 40–50 × 6–7 µm, becoming longer but otherwise differing little towards leaf base; **alar cells** scarcely differentiated, porose. **Branch leaves** narrower and more lanceolate. **Costae** c. ⅔ the leaf length. **Pseudoparaphyllia** not seen.

Perigonia gemmiform, yellow, scattered on main stems. **Perichaetia** and **sporophytes** not known from N.Z.

Illustrations: Plate 3. Crum & Anderson 1981, figs 604–605; Noguchi 1987–1994, fig. 522; Smith 2004, fig. 311, 5–7.

Distribution: SI: Nelson (St Arnaud).

Adventive. Adventive also in Tasmania. Widespread in the northern hemisphere.

Habitat: Known from several well-documented collections from one restricted locality at St Arnaud (c. 640 m elevation) in Nelson Lakes N.P. There it grows on duff beneath 4–6 m high scrub of manuka (*Leptospermum scoparium*), forming nearly pure wefts of up to one square metre that are invading adjacent mats of *Acrocladium chlamydophyllum*, *Ptychomnion aciculare*, and *Thuidium furfurosum*. Its pattern of growth at St Arnaud suggests that it might be capable of invading undisturbed scrub and montane forest and its presence is therefore a source of particular management concern. Work by the Department of Conservation to eradicate it at St Arnaud is on-going. Considerable success has been achieved by raking and burning the larger colonies and by subsequent application of iron sulphate solutions to remaining plants, but further survey work is required to determine whether complete eradication has been achieved (S. Wotherspoon, pers. comm., 27 May 2014). *Rhytidiadelphus triquetrus* has not been found at any other N.Z. locality.

Notes: This is a dioicous species and only male plants have been found in N.Z.

This species is an abundant and widespread forest floor moss in boreal parts of North America and Europe. This coarse moss is sometimes given the apt common name “shaggy moss” in North America. Its rough and shaggy appearance makes it very distinct from any indigenous N.Z. forest species. The initial collection and recognition of this species at St Arnaud was by Jean Espie and Jim Crawford in 1997. It very likely arrived there on camping equipment brought from overseas.

Etymology: The species epithet means three-angled and according to Crum & Anderson (1981, p. 1218) refers to the triangular shape of the leaves.

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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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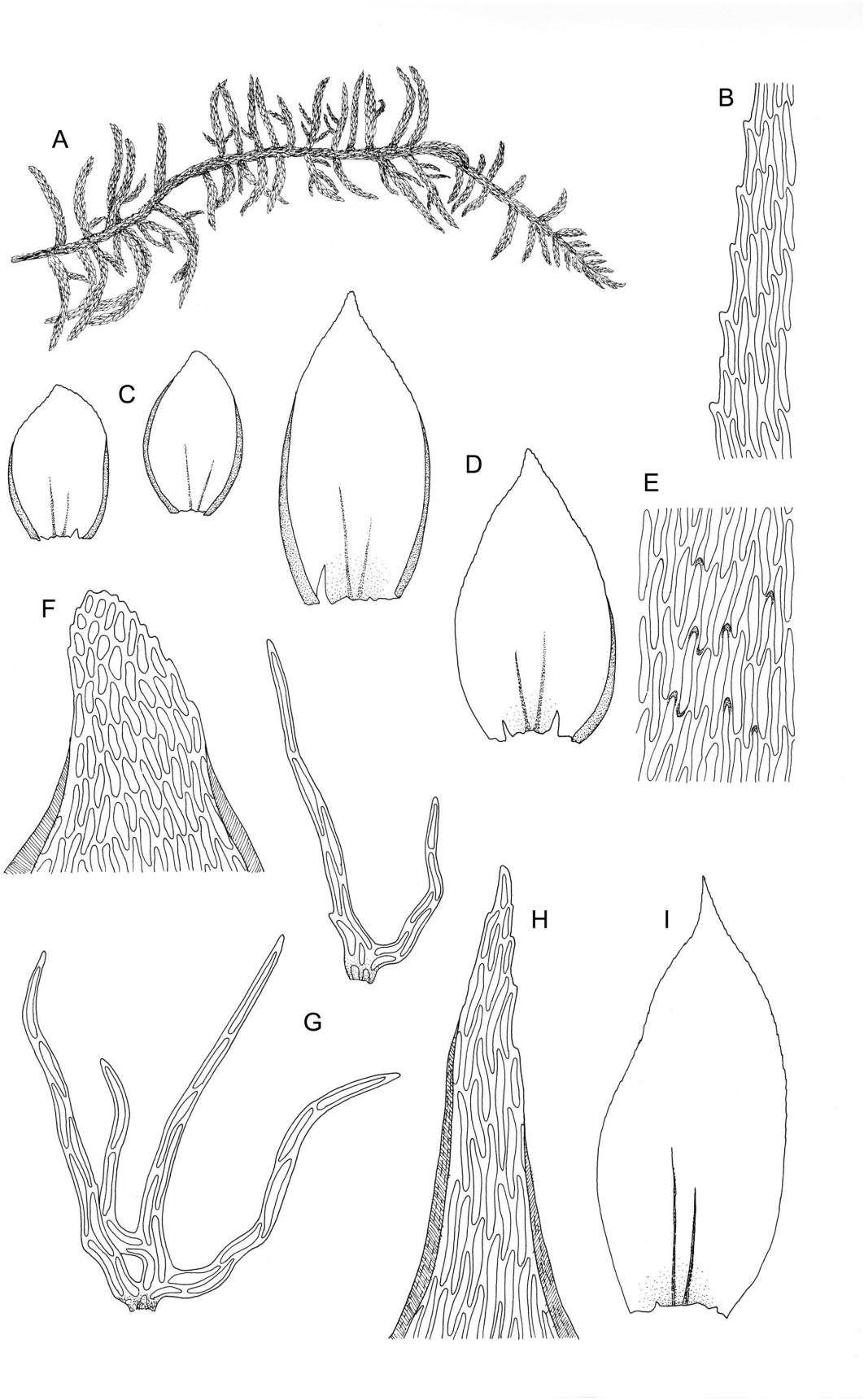


Plate 1: ***Hylocomium*. A–I: *H. splendens***. A, habit. B, mid laminal cells at margin. C, branch leaves. D, stem leaves. E, mid laminal cells. F, apex of stem leaf. G, paraphyllia. H, apex of stem leaf. I, stem leaf. A–G drawn from *B.H. Macmillan 92/62*, CHR 482420; H–I drawn from *B.H. Macmillan 92/620*, CHR 482378.

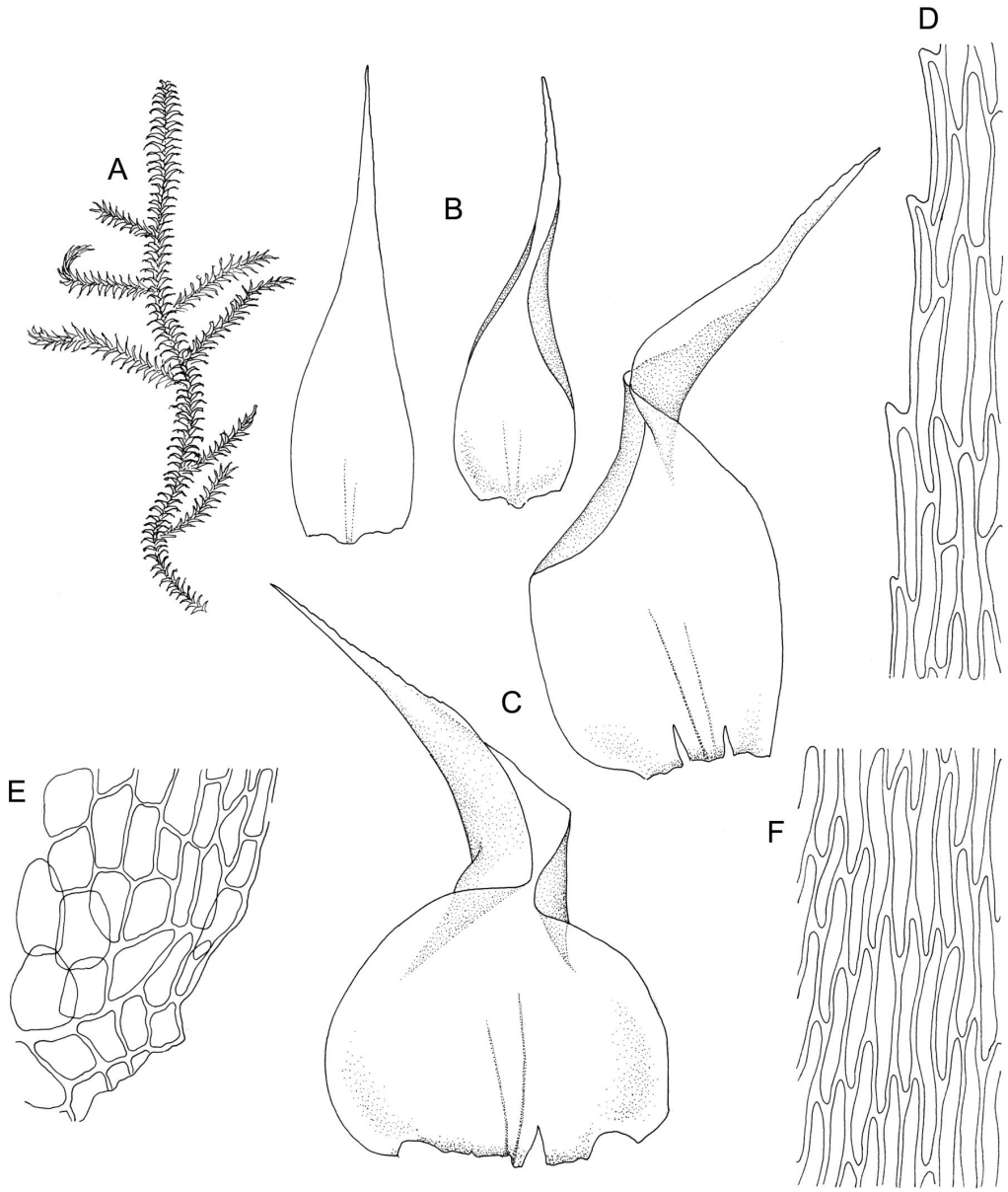


Plate 2: ***Rhytidiadelphus*. A–F: *R. squarrosus***. A, habit, dry. B, branch leaves. C, stem leaves. D, mid laminal cells at margin. E, alar cells. F, lower laminal cells. Drawn from *B.H. Macmillan 90/6*, CHR 456466.

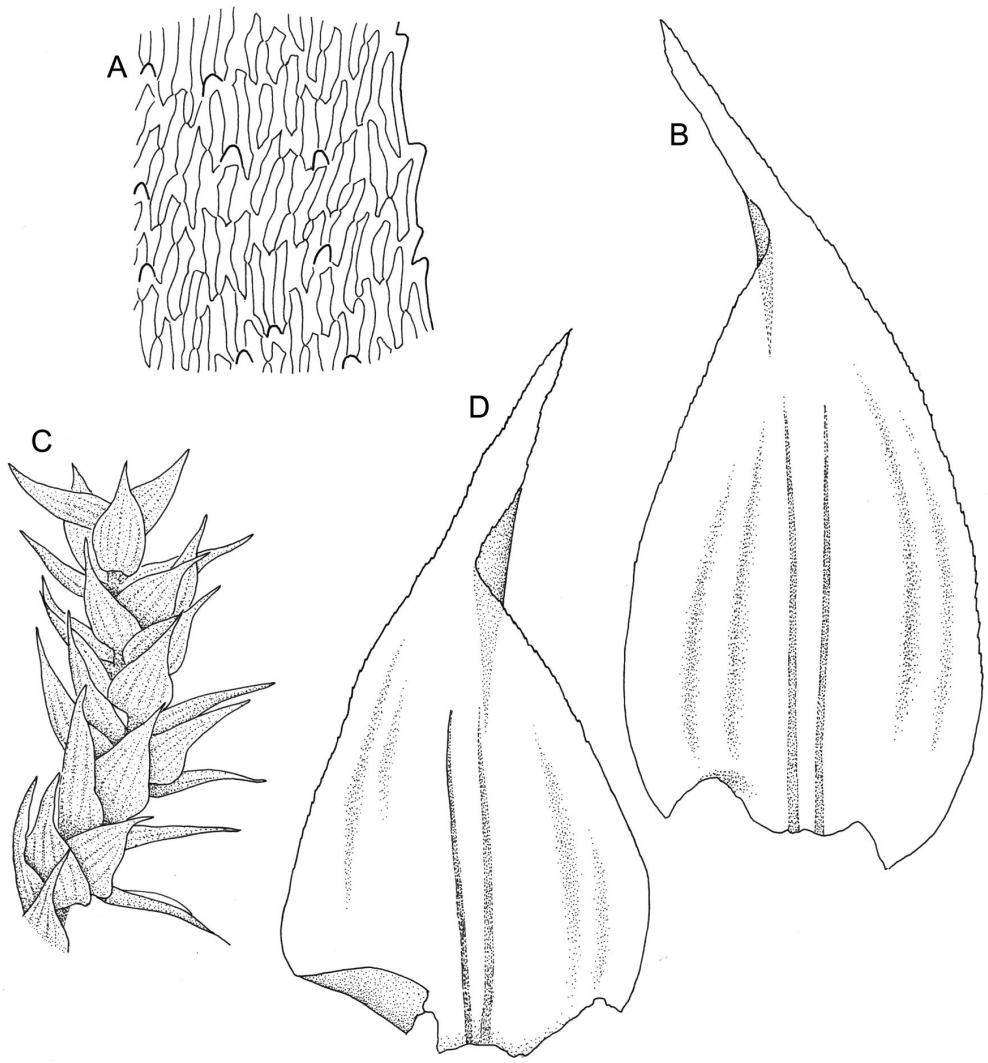
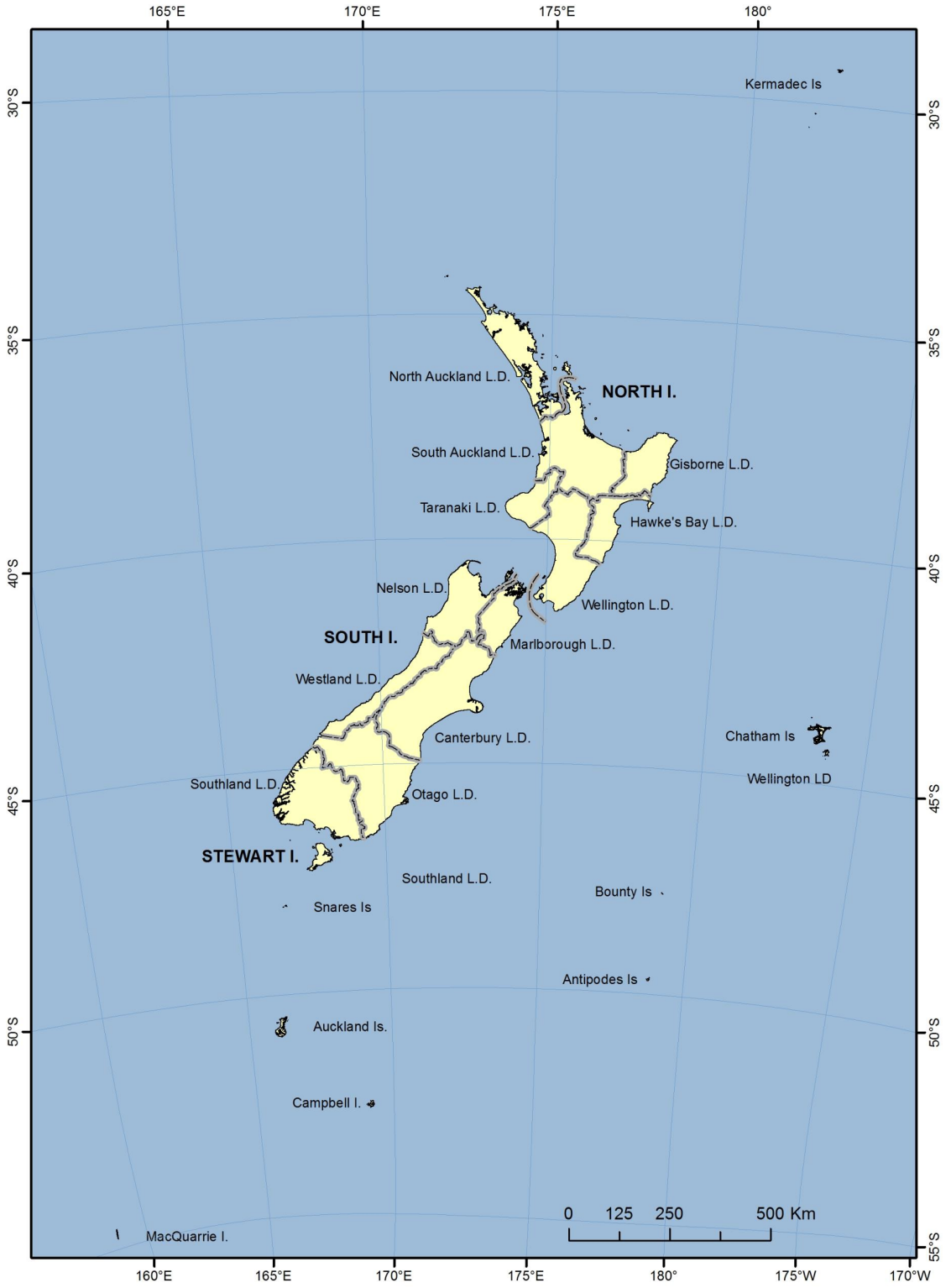
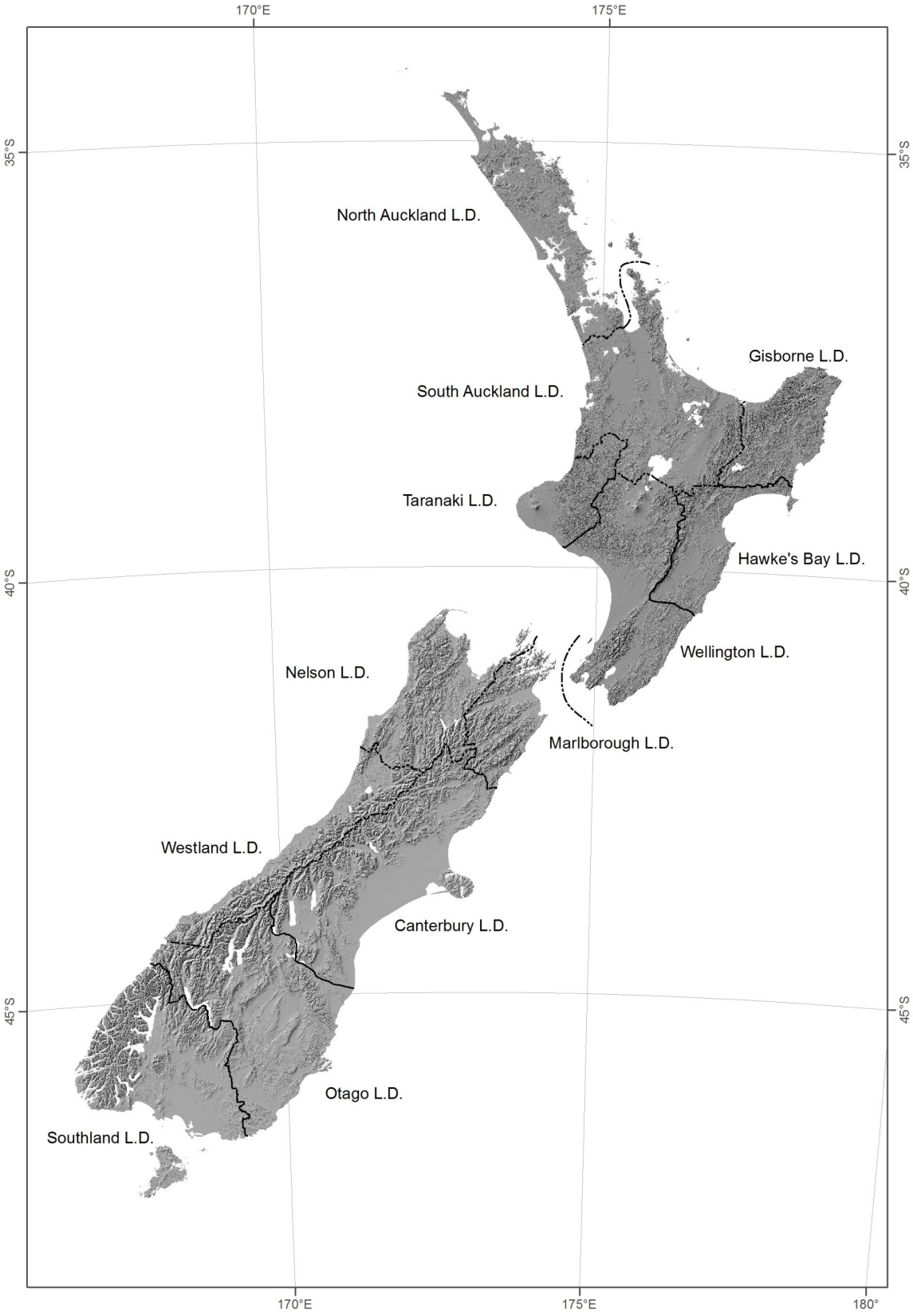


Plate 3: ***Rhytidiadelphus*. A–D: *R. triquetrus***. A, mid laminal cells at margin of stem leaf. B, stem leaf. C, portion of stem. D, branch leaf. Drawn from *J. Espie 60.015*, CHR 513545.



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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