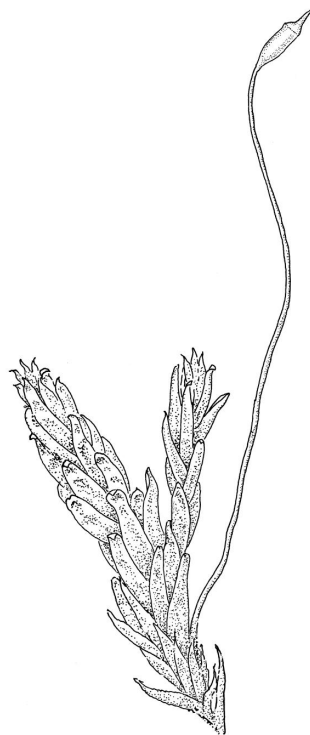


FLORA OF NEW ZEALAND
MOSSES

SAULOMATACEAE



A.J. FIFE

Fascicle 33 – APRIL 2017

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Cover image: *Sauloma tenella*, habit with capsule, moist. Drawn by Rebecca Wagstaff from A.J. Fife 6754, CHR 405820.

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Introduction

The Saulomataceae are a small southern hemisphere family centred on *Sauloma*, of which the type *S. tenella* occurs in New Zealand. *Sauloma* has traditionally been placed in the Hookeriaceae, but was recently segregated from that large family using predominantly molecular data. It is a small genus of fewer than five species occurring in Australasia and South America. In N.Z. *S. tenella* is widely distributed and forms very pale mats on rotten wood, rock, soil banks, and trees in damp situations. It is characterised by its white-green coloration, its mostly oblong and obtuse leaves with strongly reflexed apices, its costae double and very weak or lacking, and its smooth, linear-rhomboidal, and porose laminal cells. The plants bear axillary, multicellular fusiform gemmae. The capsules have strongly collenchymatous exothecial cells, furrowed and cross-striate exostome teeth, and an endostome with a high basal membrane, well-developed perforate segments, and lacking cilia. Two other genera, both monotypic and restricted to Chile, and assigned to the family by some authors, are discussed briefly. A previously recognised species, *S. macrospora*, is placed in synonymy.

Saulomataceae

Taxonomy: The core genus of this small family, *Sauloma*, was traditionally (Brotherus 1925) placed in a broadly defined Hookeriaceae, a group which has received a great deal of systematic attention and modification in recent years. The Saulomataceae were initially described by Buck et al. (2005) using both molecular data derived from four DNA regions and morphological data. The molecular data they present provides convincing support for the recognition of an evolutionary clade containing *Sauloma* and the monotypic Chilean genus *Ancistrodes* Hampe as the sister group to a larger clade corresponding to the Daltoniaceae, Pilotrichaceae, Schimperobryaceae, and a highly reduced Hookeriaceae, collectively. The Saulomataceae were retained by Goffinet et al. (2009) to accommodate *Sauloma*, *Ancistrodes*, and another Chilean monotypic genus, *Vesiculariopsis* Broth.

Because of the considerable morphological differences between *Sauloma*, *Ancistrodes*, and *Vesiculariopsis*, as well as limited or nil available specimens for the last two genera, no family description is presented here. A family description is provided by Buck et al. (2005) for interested users; brief notes on *Ancistrodes* and *Vesiculariopsis* are provided here for context.

The nomenclatural type of *Ancistrodes* is *Hookeria ancistrodes* Mont. (a heterotypic synonym of *Duseniella genuflexa* Müll.Hal.). The typification and confusing nomenclature of this genus were clarified by Crosby (1976) and the accepted name of its one species is *Ancistrodes genuflexa* (Müll.Hal.) Crosby; the genus is described and illustrated as *Duseniella genuflexa* in the Meteoriaceae by Brotherus (1925, fig. 553). Morphologically *Ancistrodes* is sufficiently distinct from *Sauloma* to make its placement in a single family questionable, and it is retained in the Meteoriaceae in some recent online classifications such as the Catalogue of Life (accessed 6 Oct. 2016), and in TROPICOS (accessed 2 Feb. 2017). Material collected by Dusén (CHR 641703) has unbordered leaves abruptly tapered from an oblong base to a long acumen that is crooked apically and bears reflexed, hook-like teeth. The upper laminal cells are firm-walled, ellipsoid, rounded apically, and non-porose (in sharp contrast to those of *Sauloma tenella*), and weak double costae are present. The stems here are more branched than in *S. tenella*, and the plant apparently grew pendent from tree trunks. The exothecial cells are firm-walled, mostly quadrate to oblong and weakly collenchymatous. The peristome appears to be accurately portrayed by Brotherus (fig. 553, as *Duseniella genuflexa*) and the calyptra is mitrate.

No material of *Vesiculariopsis spirifolium* (Dusén) Broth. has been available for study. Brotherus (1925, fig. 624) illustrated this species (as *V. spiripes* (Dusén) Broth.) in his treatment of the Leucomiaceae. The illustration shows unbordered ovate-lanceolate leaves borne on much-branched shoots. *Vesiculariopsis* is not included in the analyses presented by Buck et al. (2005), and their reasons for placing it in the Saulomataceae are not provided.

***Sauloma* (Hook.f. & Wilson) Mitt., J. Proc. Linn. Soc., Bot. Suppl. 1–2: 116 (1859)**

≡ *Hookeria* sect. *Sauloma* Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II* 122 (1854)

Type taxon: *Sauloma tenella* (Hook.f. & Wilson) Mitt.

Plants medium-sized, soft, white- or yellow-green, not iridescent, forming rather dense erect or less often pendent mats. **Stems** sparsely branched, mostly weakly erect. **Leaves** symmetric, uniform in size throughout shoot, erect-spreading when moist, oblong to ovate-lanceolate, mostly obtuse and strongly reflexed at apex, very weakly bordered, mostly entire. **Costae** absent or very weak and double. **Upper laminal cells** smooth, linear-rhomboid, porose. **Gemmae** fusiform and axillary.

Dioicous. **Perichaetial leaves** differ from vegetative leaves only by size. **Setae** lateral, straight, smooth, mostly red-brown; **capsules** inclined to horizontal, symmetric, ovoid or elongate-ovoid, papillose when mature and dry; **operculum** high-conic. **Peristome teeth** brownish-yellow, linear-lanceolate, furrowed, densely and finely cross-striate, with high lamellae and laterally projecting trabeculae; **endostome** yellowish, finely papillose, with a moderately high basal membrane; segments well developed, perforate; **cilia** absent. **Calyptra** mitrate, naked. **Spores** 1-celled, variable in size.

Taxonomy: A genus of fewer than 5 species, occurring in Australasia and South America. According to Streimann (2000) the genus also occurs in south-east Asia and east Africa. The type species occurs in N.Z.

Matteri (1972) has reviewed the occurrence of the genus in southern South America, from whence only *S. tenella* is known. Streimann (2000) likewise considered that only *S. tenella* occurred in

Tasmania and mainland Australia. Dixon (1927, p. 279) included *Sauloma* in his key to the genera of Hookeriaceae, but inexplicably failed to discuss the genus further.

Buck (1987) placed the monotypic Bolivian genus *Pulvinella* in synonymy here, while rejecting Crosby's (1974) earlier placement of *Achrohypnella* Herzog (a monotypic and poorly known Chilean genus) in synonymy. *Achrohypnella* and *Sauloma* are retained as separate genera by Matteri (1972), presumably at least partly due to their difference in sexuality.

Etymology: The generic name is derived from *saulos* (Greek: soft) and "presumably alludes to the soft, delicate appearance of *Sauloma tenella*" (Meagher 2011).

Excluded Taxa: *Hypnum amiantum* Stirt. in Paris is a nom. nud. Material so-named is in the Buchanan Herbarium (WELT M005831) and is *S. tenella*. Its exact provenance is obscure.

Plagiothecium helvolum Müll.Hal. in Paris is a nom. nud. based on *R. Helms* 12 (CHR 573778), probably from near Greymouth. The Helms collection is *S. tenella*.

***Sauloma tenella* (Hook.f. & Wilson) Mitt., J. Proc. Linn. Soc., Bot. 4: 89 (1859)**

≡ *Hookeria tenella* Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II* 122 (1854)
Type: N.Z.: Banks Peninsula, *D. Lyall s.n.*, March 1850, NY-Mitten!

= *Sauloma macrospora* Sainsbury, *Rev. Bryol. Lichénol., n.s.* 18: 113 (1949)
Holotype: N.Z.: Ohakune, *R. Mundy s.n.*, 30 July 1926, ("Herb. Sainsbury no. 882"), WELT M005792! Isotypes: CHR 466230!, NY!

Plants medium-sized, soft, pale white-green or gold-brown, usually erect, sometimes prostrate or pendent, forming mats. **Stems** to 60 mm, weakly erect and self-supporting, delicate, pale, becoming yellow- or red-brown in lower portions, in cross section composed of nearly uniform parenchyma cells, with weakly differentiated cortical cells and no central strand; **rhizoids** restricted to basal part of stem, sparse, smooth, and pale. **Shoots** not complanate, c. 2 mm wide. **Leaves** closely inserted in several ranks, erect-spreading when moist, constricted and appearing narrower and homomalous when dry, oblong to ovate-lanceolate, rounded, broadly obtuse, acute, to weakly acuminate and mostly reflexed at apex, concave, entire or nearly so, (1.5–)1.8–2.3 × 0.6–0.9 mm. **Costa** absent or very weak and double, occasionally reaching to mid leaf. **Upper laminal cells** linear-rhomboid to fusiform, smooth, thin-walled, porose, 75–135(–165) × 12–15(–18) μm and 5–8:1, becoming longer (to c. 180 μm) in lower lamina and shorter and somewhat wider at insertion; **alar cells** oblong and weakly inflated to form a moderate-sized but ill-defined group. **Gemmae** borne on elongate filaments in leaf axils, fusiform, with 3–5 transverse walls, c. 120 μm long.

Dioicous. Perichaetia lateral or at base of stems; perichaetial leaves smaller than vegetative, oblong-ovate, c. 1.0 mm long. **Perigonia** terminal, with rather large, broadly ovate, strongly concave gold-brown bracts enclosing c. 20 antheridia with biseriate stalks (c. 100–120 μm long) and filiform 4–5-celled paraphyses. **Setae** (4–)6–12 mm, in cross-section with a cortical layer of 2–3 layers of thick-walled cells, lacking a central strand; **capsules** ovoid, from an ill-defined neck, (0.8–)1.0–1.8(–2.0) mm, constricted below the mouth and warty when mature and dry, pale brown; **exothecial cells** mostly rounded-quadrate, strongly collenchymatous. **Operculum** high-conic, 0.5–1.0 mm long. **Peristome teeth** c. 425 μm long, otherwise as per genus; **endostome** with perforate segments equal to the teeth in length, appearing longer than the exostome when dry. **Calyptra** mitrate, c. 1.0–2.0 mm long, somewhat lacerate but not fimbriate at base, naked, very pale, covering the operculum and c. upper 1/3 of the capsule. **Spores** extremely variable in size, 10–48(–54) μm diam., green, nearly smooth, often germinating in capsule.

Illustrations: Plate 1. Brotherus 1925, fig. 598, F–K; Streimann 2000, fig. 19.

Distribution: NI: N Auckland (Ōmahuta State Forest), S Auckland (Kaimai Range, Rotorua–Taupō region), Gisborne (Te Tiki, Ruakituri River), Hawke's Bay (Dannevirke), Taranaki (Dawson Falls), Wellington (Mt Ruapehu, Wanganui, Mt Bruce, Carterton, Eastbourne); SI: Nelson, Marlborough (Mt Richmond State Forest, Molesworth), Canterbury, Westland (Ōtira, Franz Josef, Robinsons Creek), Otago (Hunter Valley, Pine Hill, Paradise), Southland; St (Port Pegasus).

Austral. Tasmania*, Argentina*. Reported from mainland Australia (including one locality in WA) and Chile by Streimann (2000).

Habitat: Extremely catholic in regard to substrate, *S. tenella* grows on stumps/logs and on rock (including limestone, sandstone, scoria, and greywacke) in damp situations. It is often in seeps and

occurs rarely on sheltered earth banks and as an epiphyte. As an epiphyte it can occur on trunks, branches, and small twigs, the last mostly in hyper-moist subalpine situations. *Fuscospora solandri* s.l. is the most frequently recorded host plant, but *S. tenella* also occurs on other genera, including *Hoheria*, *Cyathodes*, *Coprosma*, *Fuchsia*, and *Dacrycarpus*. It is primarily a forest species, but extends above the tree-line in protected situations. *Sauloma tenella* appears to be a rare species north of c. 37° 30' S (the approximate latitude of Huntly, S Auckland L.D.). Occurring from low elevations to at least c. 1200 m (Dawson Falls) and probably to c. 1800 m on the North I., and from 40 (Bullock Creek, Nelson L.D.) to c. 1500 m (Culliford Hill, Nelson L.D.) on the South I.

Notes: *Sauloma tenella* is a highly variable species with respect to both gametophytic and sporophytic characters. The plants are most commonly self-supporting and mat-forming. The mats can assume a horizontal or even pendent stance, especially on the sides of logs or in seeps. The nature of the leaf apices, ranging from rounded to acute and from erect to strongly reflexed, varies markedly even within a single population. Collections occur in which stems with reflexed leaf apices and erect leaf apices are present in roughly equal numbers (e.g., *K.W. Allison 7164* from Lewis Pass, CHR 491641; *G.B. Huang 451* from Broad Stream, Canterbury L.D., CHR 462976). Some collections have both reflexed and obtuse leaf apices and erect and acute leaf apices (e.g., *G. Brownlie 137* from Arthur's Pass, CHR 427989, and *A.J. Fife 6754* from Cass, Canterbury L.D., CHR 405820). The type collection of *S. macrospora* provides an example of a population in which leaf apices are predominantly erect and acute, but with a few leaves with reflexed apices. Populations also occur in which the majority of stems have acute leaves with weakly reflexed apices. The variation of the vegetative leaves seems to be continuous and, although strongly reflexed leaf apices seem to be more common on the South I., a similar range of variability occurs throughout the two main islands. The type of *S. tenella* has erect, acute to weakly acuminate leaf apices and recurved upper leaf margins; it lacks mature capsules.

In addition to gametophytic characters, capsule length and spore dimension vary greatly. Sainsbury (1949; 1955) suggested that larger capsules (i.e., those greater than 1.5 mm) are correlated with subacute or obtuse, reflexed leaf apices. My observations do not support this contention. Material from Temple Basin in Arthur's Pass (e.g., *A.J. Fife 7373*, CHR 406583) with predominantly reflexed and obtuse leaf apices has capsules 0.8–1.0 mm. These capsule lengths correspond to the dimensions that Sainsbury (1955) accepted for *S. tenella*. Material in which all leaves are acute to acuminate, but in which some capsules greatly exceed the dimensions described by Sainsbury (1955) for *S. tenella*, also occurs (e.g., *K.W. Allison 3255* from Rangitāiki, S Auckland L.D., CHR 466226). Even the type of *S. macrospora* poses problems using the leaf and capsule characters utilised by Sainsbury to separate the two alleged species of *Sauloma*. In the type, capsules range in length from 0.8 to 1.8 mm and the majority of stems have erect leaf apices, but some leaves are markedly reflexed.

Spore dimensions vary more than suggested by Sainsbury (1955), who gave spore diameters of 12–14 µm and 20–32 µm for *S. tenella* and *S. macrospora*, respectively. Only a minority of herbarium specimens have mature spores. Spore dimensions range continuously from c. 10 to 54 µm, with extreme variability even within single populations. Spore dimensions do not appear to correlate with gametophytic characters. In two specimens (*A.J. Fife 8696* from Cobb Valley, Nelson L.D., CHR 460812, and *J.E. Beever 36-05a* from Mt Ruapehu, CHR 406712) with extremely large spores (30–48 µm in both cases), a large percentage have germinated within the dehiscent capsules, and protonemal filaments have emerged. Small numbers of germinated spores have also been observed in other collections. This suggests that spore dimension variability may be a function of maturity/germination state and casts further doubt upon the taxonomic value of *S. macrospora*.

Sainsbury (1955) suggested that axillary gemmae occur exclusively or primarily in populations with larger spores and reflexed leaf apices. In my experience the presence of gemmae does not correlate with spore size or leaf apex reflexion. *K.W. Allison 3255* from Rangitāiki is an example of a collection with both erect, acute leaf apices and axillary gemmae. Likewise the distinctions that Sainsbury drew using endostome segment perforations and laminal cell dimensions cannot be supported.

Sauloma presents a bewildering degree of variation. However, none of the characters proposed by Sainsbury (1955) for segregating *S. macrospora* from *S. tenella* stand up to scrutiny. Interestingly, the holotype of *S. macrospora* bears the following notation by Dixon (in Sainsbury's hand): "I feel doubtful therefore whether it [the type of *S. macrospora*] is more than a form or variety of *tenella*... I have seen no intermediate forms except Brotherus' figure! But I hesitate to call it a n. sp." My own observations support Dixon's opinion, and it is best to take a broad view of *S. tenella*.

Recognition: Sterile plants of *S. tenella* could be confused with *Hampeella alaris*, but the former is a paler plant with larger leaves lacking inrolled margins. The larger upper laminal cells (mostly 75–135 × 12–15 µm in *S. tenella* vs 60–90 × 4–5 µm in *H. alaris*), the very different alar cells, and the dimension and number of cells of the gemmae (c. 120 µm and 4–6-celled vs c. 1000 µm and 20–25-celled in

H. alaris) distinguish these two species. They also differ by many sporophytic features. Streimann (2000) suggested that *S. tenella* could be confused with some species of *Sematophyllum* (possibly bleached material?), but this seems unlikely in a N.Z. context.

Etymology: The epithet *tenella* means delicate. The unaccepted epithet *macrospora* refers to the spore size.

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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)
sub spp.	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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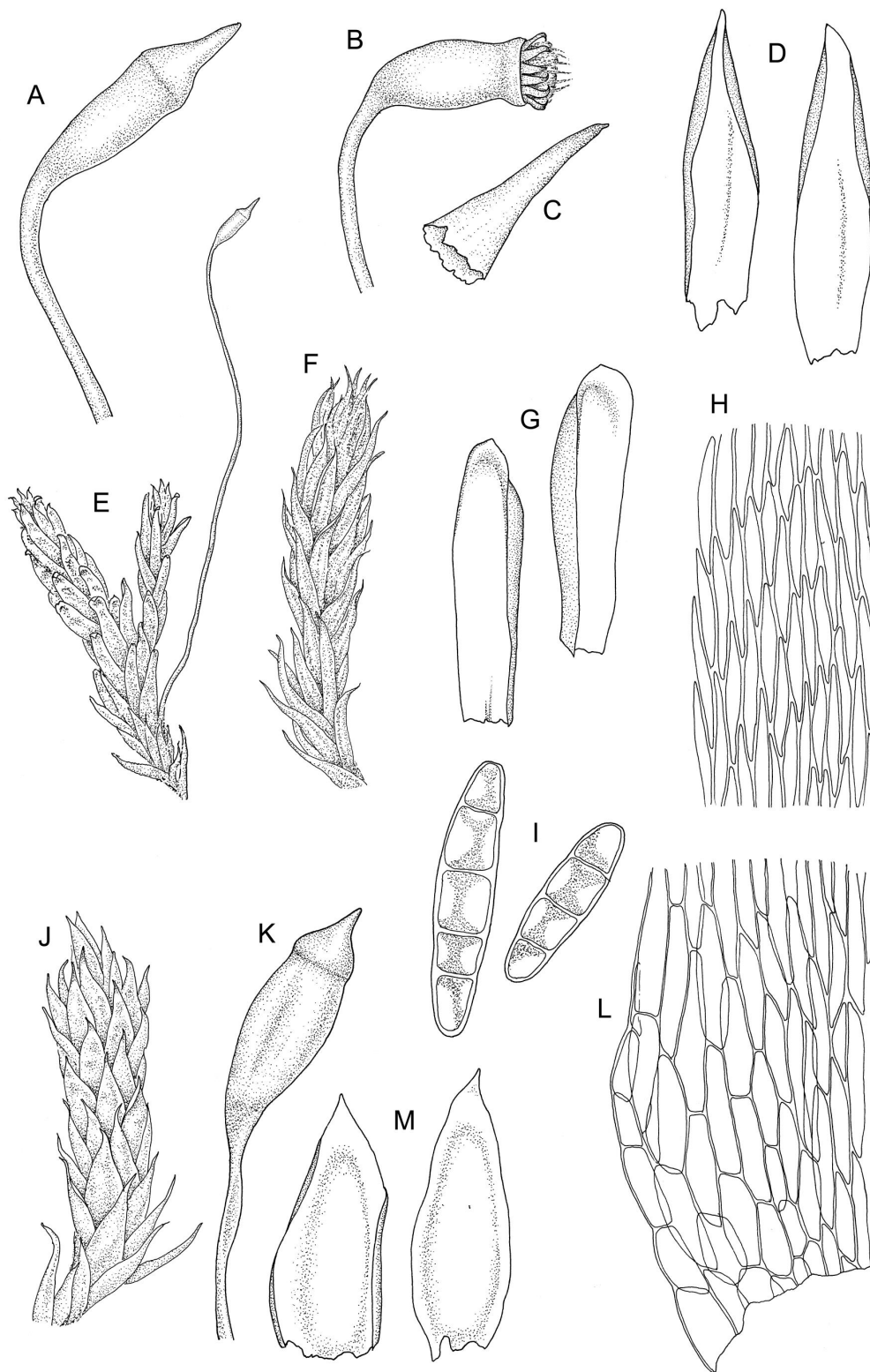
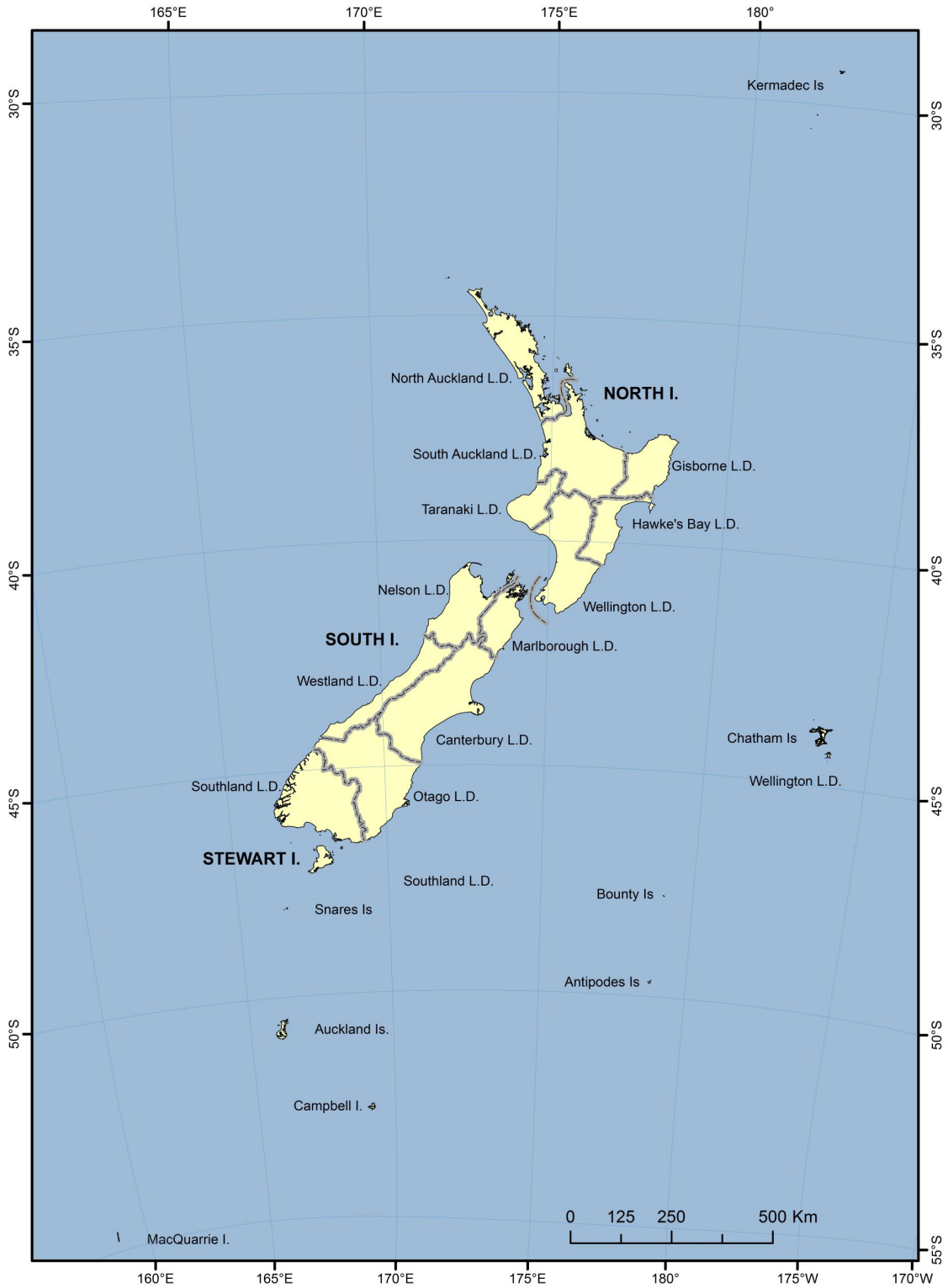
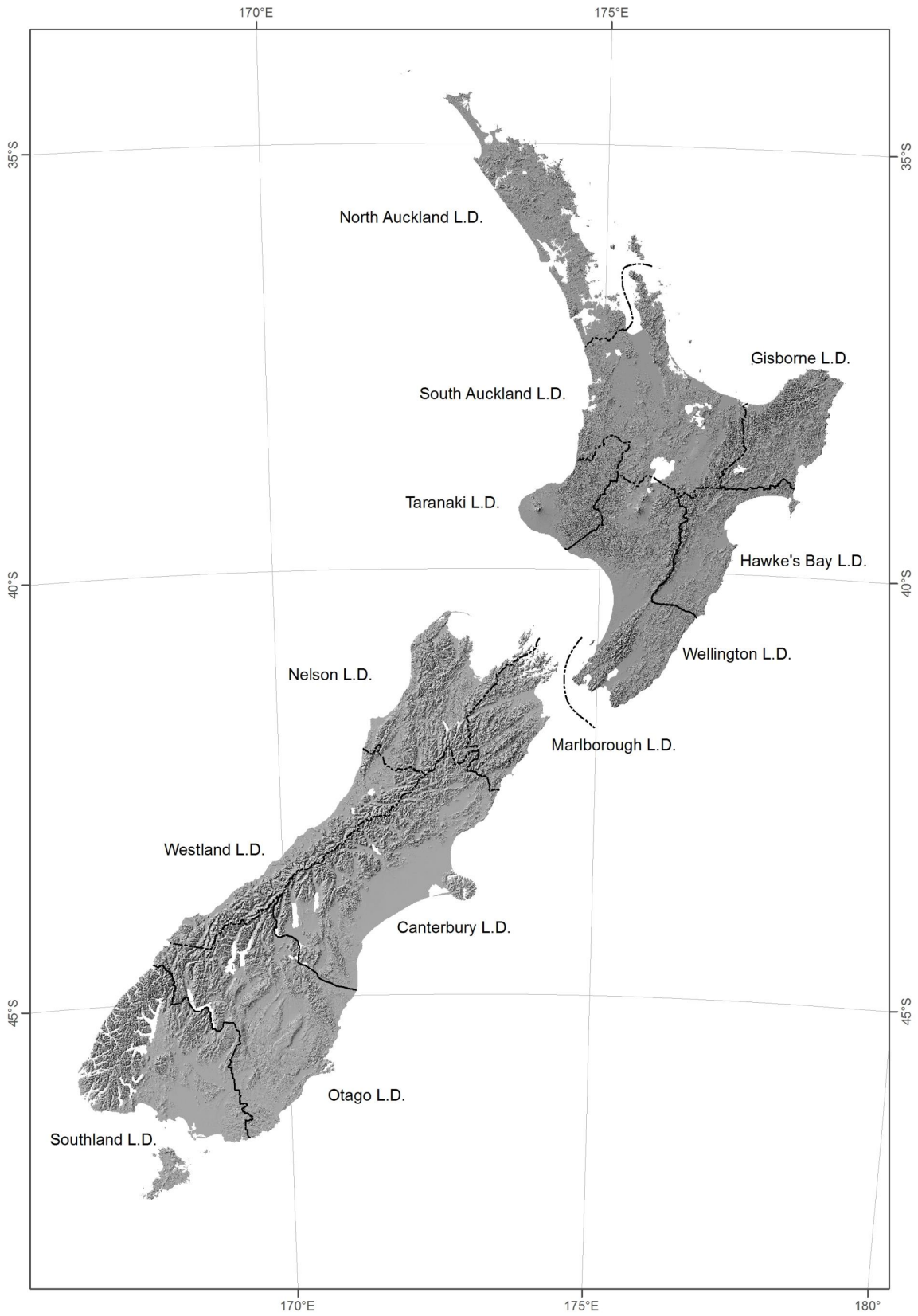


Plate 1: *Sauloma*. A–M: *S. tenella*. A–B, capsules, moist. C, calyptra. D, leaves with broadly acute apices. E, habit with capsule, moist. F, portion of shoot, dry. G, leaves with obtuse apices. H, upper laminal cells. I, gemmae. J, portion of shoot, moist. K, capsule, dry. L, alar cells. M, leaves with acute apices. A, C–I, L drawn from A.J. Fife 6754, CHR 405820; B drawn from A.J. Fife 4768, CHR 103696; J–K, M drawn from isotype of *Sauloma macrospora* Sainsbury, R. Mundy s.n., 30 July 1926, CHR 466230.



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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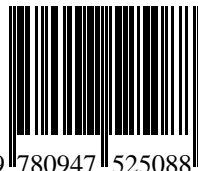
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