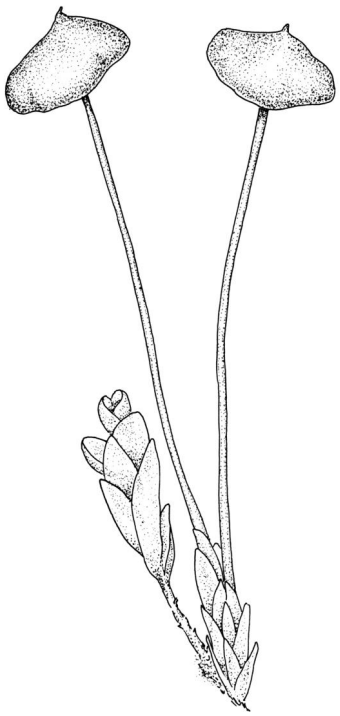
FLORA OF NEW ZEALAND

MOSSES

PLEUROPHASCACEAE



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Cover image: *Pleurophascum ovalifolium*, shoot with capsules. Drawn by Rebecca Wagstaff from *M.J.A. Simpson 8561*, CHR 351331.

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Contents

Introduction

The Pleurophascaceae are a monogeneric family restricted to temperate Australasia. The genus *Pleurophascum* includes three species. The New Zealand representative, *P. ovalifolium*, occurs from the vicinity of Mt Arthur (Nelson L.D.) southwards to Fiordland (Southland L.D.) on the western coast of the South I. The other two *Pleurophascum* species are endemics of Tasmania and Western Australia. Partly because of its unique capsule morphology, the genus is famous in the annals of Australasian bryology. The 19th century Scandinavian bryologist S.O. Lindberg, considered *Pleurophascum* to be “of no less interest to the Muscologist than is *Rafflesia* or *Welwitschia* to the Phanerogamist.” The capsules are exceedingly large, inoperculate, and often brightly coloured. Although the N.Z. taxon was initially described in 1952 as a variety of the Tasmanian *P. grandiglobum*, it has more recently been accorded species rank. *Pleurophascum ovalifolium* has discoid and bright red to orange-red capsules up to 12 mm diameter, in contrast to the globose, dull or brown-orange, and consistently smaller capsules of its Tasmanian congener. Nearly all fruiting material of *P. ovalifolium* is from a restricted area encompassing the vicinity of Westport and Greymouth, the Stockton and Denniston plateaux, and the Paparoa Range. It is a species of wetlands, particularly cushion bogs and pākihi. Only sterile fragments of *Pleurophascum* have been seen from Stewart I. and these suggest that Stewart I. material may be taxonomically distinct from South I. populations.

Pleurophascaceae

Taxonomy: The Pleurophascaceae are a monotypic family, with features of its single Australasian genus described below.

The recognition of this monotypic family is justified by a large number of unique or near-unique morphological features. These include: large, inoperculate capsules, a spore sac attached to the exothecial wall by anastomosing cellular filaments, subterranean and creeping primary stems with scale-like leaves, broadly elliptic to nearly round leaves with very thick-walled and porose cells and no costa. The position of the sex organs can be either terminal or on short lateral branches; secondary (erect) stems are mostly encased in a dense weft of pale, smooth rhizoids.

Brotherus (1924, pp. 155, 219) placed the Pleurophascaceae in its own suborder in the Dicranales, emphasising its ecostate leaves, the lateral placement of its sex organs, and large, spherical, and cleistocarpous capsules with immersed stomata. Vitt (1984, p. 754) placed *Pleurophascum* in a monotypic family Pleurophascaceae Broth., adjacent to the Dicnemonaceae. Both the classification used for the Flora of Australia (McCarthy 2006) and the classification proposed by Goffinet et al. (2009) placed the Pleurophascaceae in the Pottiales, with the large and cosmopolitan family Pottiaceae and the monogeneric families Mitteniaceae and Serpotortellaceae. The Pleurophascaceae are highly distinct morphologically in an Australasian context, and are deserving of familial recognition.

Pleurophascum Lindb., *J. Bot.* 13: 167 (1875)

Type taxon: *Pleurophascum grandiglobum* Lindb.

Plants yellow- or brown-green, ± comose, sometimes hoary, forming loose turves or cushions. **Primary stems** creeping and subterranean, with minute, scale-like leaves. **Secondary stems** erect, branching laterally or by innovation, usually julaceous, in cross-section with a small central strand and weakly differentiated cortical cells. **Leaves** crowded at stem apices, broadly elliptic to nearly cochleariform, variably shaped at apices, concave, appressed or erect-spreading, decurrent or not, not bordered; **margins** erect or narrowly recurved, entire or toothed; **mid laminal cells** oblong or oblong-hexagonal, very thick-walled and highly porose; **basal cells** elongate and porose; **alar cells** weakly differentiated, usually shorter and wider than adjacent laminal cells. **Costa** absent.

Dioicous. **Perichaetia** on short lateral branches arising from the secondary stems (in N.Z. species), or terminating secondary stems, mostly enlarging after fertilisation. **Perigonia** gemmiform, scattered, lateral on secondary stems (in N.Z. species) or terminal. **Setae** erect, smooth, elongate (in N.Z. species) or very short; **capsules** very large, discoid, globose, or obovoid, inoperculate, bluntly rostrate or rounded at apex; **spore sac** ± globose, attached to the exothecial wall by anastomosing cellular filaments; **columella** present; **stomata** present or absent at capsule base. **Calyptra** cucullate, ± split at base, dark brown, enclosing only the apical rostrum at capsule maturity, often enclosing a second hyaline membrane (like an internal mitrate calyptra). **Spores** large, smooth.

Taxonomy: A genus of three Australasian species, all with restricted distributions. The two species occurring outside N.Z. are a Tasmanian endemic (*P. grandiglobum*) and a Western Australian endemic (*P. occidentale*).

Its unique morphology has made this genus famous in the annals of Australasian botany; Lindberg (1875) considered *Pleurophascum* to be “of no less interest to the Muscologist than is *Rafflesia* or *Welwitschia* to the Phanerogamist.”

Fife & Dalton (2005) reviewed the genus.

Pleurophascum ovalifolium Fife & P.J.Dalton, *New Zealand J. Bot.* 43: 877 (2005)

≡ *Pleurophascum grandiglobum* var. *decurrens* Sainsbury, *Rev. Bryol. Lichenol., n.s.* 21: 216 (1952)
Holotype: N.Z., Westland, Ōkārito, 13 Dec. 1949, *J.H. Ardley s.n.*, WELT M004850b! Isotype: CHR 513138! Discrepancies between the collection data cited in the protologue and those attached to the holotype and isotypes specimens are discussed by Fife & Dalton (2005).

Plants strongly julaceous, with dark brown, creeping, and subterranean primary stems. **Secondary stems** to c. 40(–60) mm in sterile material, usually <20 mm when fertile, variably sheathed by a weft of pale, smooth rhizoids (originating from outer cortical cells) with oblique end walls. **Leaves** broadly elliptic to nearly cochleariform, rounded and non-reflexed at apices, mostly 2.0–3.2(–3.5) × 1.4–1.8(–2.0) mm, strongly concave, mostly loosely imbricate both moist and dry, sometimes erect-spreading in robust sterile plants, often funiculate in sinistrorse ranks on sterile shoots, narrowly and

obscurely decurrent; **margins** erect throughout or weakly and narrowly reflexed near base; **mid laminal cells** mostly oblong but somewhat variable in shape, very thick-walled and highly porose, strongly opaque, mostly c. 45–72 × 15–18 µm, becoming shorter and broadly rhombic to subquadrate near leaf apex; **basal cells** long-rectangular to long-hexagonal, to c. 150 µm, thick-walled and porose; **marginal cells** regularly oblong in a few rows; **alar cells** shorter and wider than adjacent laminal cells, sometimes weakly auriculate; **cells of decurrencies** ± quadrate, usually not stripping off with leaves.

Perichaetia before fertilisation c. 1.5–2.0 mm long, with leaves widely spreading and surrounding several archegonia and filiform paraphyses, following fertilisation expanding to c. 7 mm long, with leaves broadly oblong-elliptic, obtuse, to 4.5 mm, not or very weakly reflexed at apex, sheathing the lowermost 2–3 mm of seta. **Perigonia** sessile, scattered and lateral on secondary stems, gemmiform, with very broadly ovate, obtuse, and highly concave bracts c. 0.8 mm long enclosing the numerous antheridia and no paraphyses. **Setae** 10–35 mm, pale yellow; **capsules** globose when immature, becoming discoid at maturity (3.5–)6–12 mm diameter × c. 3 mm, bluntly rostrate (rostrum 0.6–0.9 mm, rarely swollen apically) at apex, bright red-orange when fresh, fading to pale or dirty yellow with age; **spore sac** as per genus. **Calyptra** as per genus. **Spores** oval, ± smooth, 33–45 µm.

Illustrations: Plate 1. Malcolm & Malcolm 2003, p. 52 (as *P. grandiglobum* var. *decurrens*); Fife & Dalton 2005, fig. 2, B–E; Malcolm & Malcolm 2006, p. 31, 83, 84, 202, 237, 246.

Distribution: SI: Nelson, Canterbury (Bealey Glacier Track), Westland, Southland (Lake Hankinson, Percy Saddle). The bulk of the known localities are in Nelson and Westland L.D. Nearly all collections with sporophytes are from a restricted area encompassing the general vicinity of Westport and Greymouth, the Stockton and Denniston plateaux, and the Paparoa Range. A paucity of collections from south of the latitude of Ōkārito (c. 43°15' S) may be a collection artefact. Material of uncertain identity from St is discussed below.

Endemic.

Habitat: At pool margins in cushion bogs, pākihi (a nutrient-depleted swamp with highly podsolised hard-pan soils), and on sandstone pavements (as on Denniston Plateau, Nelson L.D.); also in wet sites in subalpine scrub and red tussock grassland including associated flushes. Occasionally submerged. Frequently associated mosses include *Breutelia elongata*, *Campylopus introflexus*, *Dicranoloma robustum*, *Ptychomnion aciculare*, *Rhacocarpus purpurascens*, *Sphagnum cristatum* and *S. falcatulum*, while associated hepatics include *Anastrophyllum schismoides*, *Isotachis* spp., *Kurzia helophila*, *Riccardia australis*, *Temnoma pulchellum*, and *Trichocolea mollissima.* Pākihi sites where it occurs are usually characterised by scattered small trees of manuka (*Leptospermum scoparium*). *P. ovalifolium* frequently (as on Denniston Plateau) grows in close proximity to the restiad *Empodisma minus*, the sedge *Schoenus pauciflorus,* the ferns *Gleichenia* spp., and sundews (especially *Drosera spathulata*). Other often associated vascular plants include *Donatia novae-zelandiae*, *Euphrasia disperma*, *Schizaea australis*, and *Utricularia monanthos*. Ranging from c. 50 (near Westport) to 1430 m (Cobb Valley, both in Nelson L.D.) and known only from west of, or very close to, the main divide on the South I.

Notes: Many collections from the Denniston Plateau-Stockton Plateau-Westport vicinity in Nelson L.D. are fertile, whereas capsules from outside this general vicinity are less common. Capsules mature in spring to late summer. The globose immature capsule becomes strongly flattened, discoid, and bright red-orange to scarlet with maturity (see Fife & Dalton 2005, fig. 2). The spore sac in a mature capsule of 6 mm diameter is c. 2.2 mm diameter (in *M.J.A. Simpson 8561*, CHR 351331); the spore sac is attached to the exothecial wall by anastomosing cellular filaments. Plants with mature capsules are completely unmistakeable and, when fruiting, this is arguably the most striking moss in the N.Z. flora. The strongly julaceous shoots and ± cochleariform, ecostate leaves and very thick and strongly porose laminal cell walls are also highly characteristic.

The means by which the spores are released from the globose capsules are unknown, although in mature material the exothecial wall sometimes disintegrates, possibly following mechanical disruption, and peels away from the still intact spore sac. Developing sporophytes probably require more than a single growing season to fully mature. In the wet sites where *Pleurophascum ovalifolium* characteristically occurs, the large air spaces within the capsule might facilitate dispersal by water. No internal spore germination has been observed.

Repeated efforts to find perigonia in fruiting specimens have failed. The pale, nearly white, filaments that often sheath the secondary stems arise from outer cortical cells of the stem and have oblique end walls; they are interpreted here as rhizoids rather than fungal hyphae.

Sainsbury (1952) originally described this taxon as a variety of the Tasmanian *P. grandiglobum* but subsequently (1955, p. 141) suggested that it “may well prove to be entitled to specific rank”. In *P. grandiglobum*, the upper leaves of fertile plants have reflexed or narrowly recurved upper margins

and strongly reflexed apices. Capsules in *P. grandiglobum* are consistently globose and dull brown-orange or grey-brown at maturity and have an apical rostrum that is shorter (0.2–0.35 mm) than that of *P. ovalifolium*. Other features distinguishing between the two species are detailed by Fife & Dalton (2005).

Two sterile fragments of *Pleurophascum* have been seen from Stewart I. (*D. Glenny 9330b* from Magog, Fraser Peaks area, CHR 571408 and *C.D. Meurk & H.D. Wilson s.n*., 5 Mar. 1980, from near South Cape, CHR 574228). In both collections leaves with weakly mucronate leaf apices and slightly recurved upper margins occur, raising the possibility that Stewart I. populations might differ from South I. populations. The collection of well-developed material from Stewart I. is required to clarify the status of these populations.

Etymology: The species epithet refers to the oval form of the vegetative leaves. This epithet was adopted since the leaf decurrency referenced in Sainsbury's varietal epithet is obscure and difficult to observe.

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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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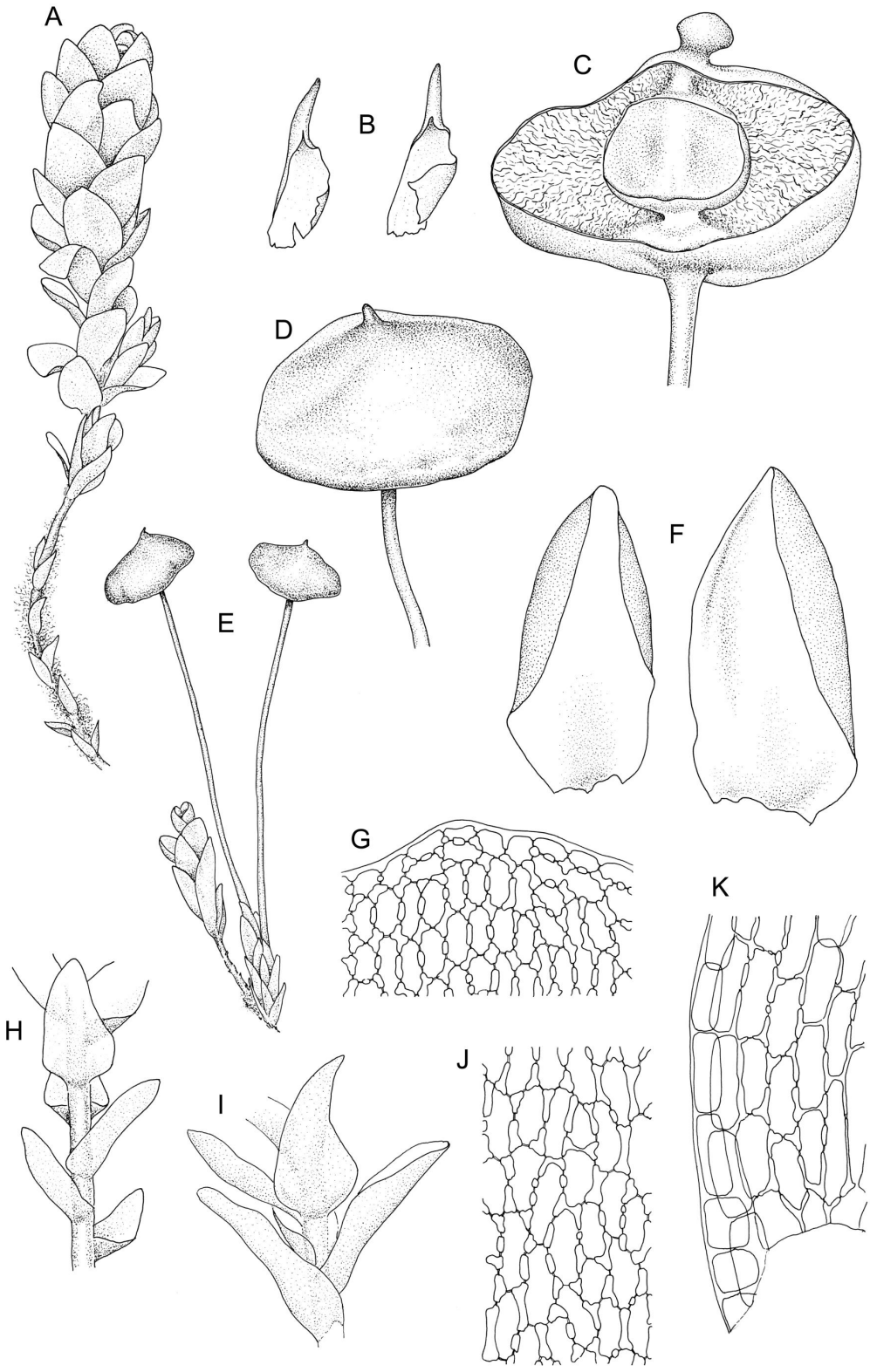
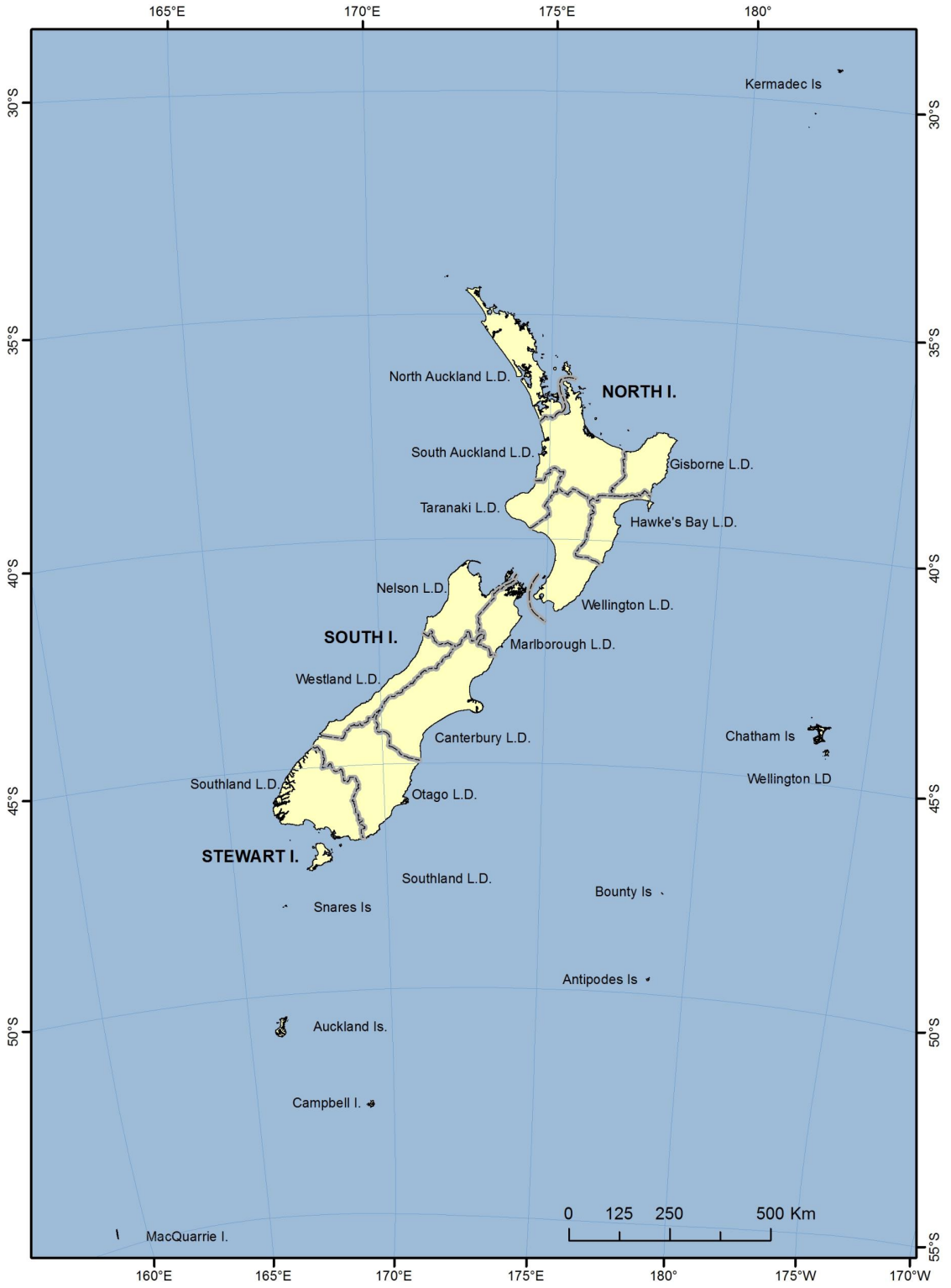
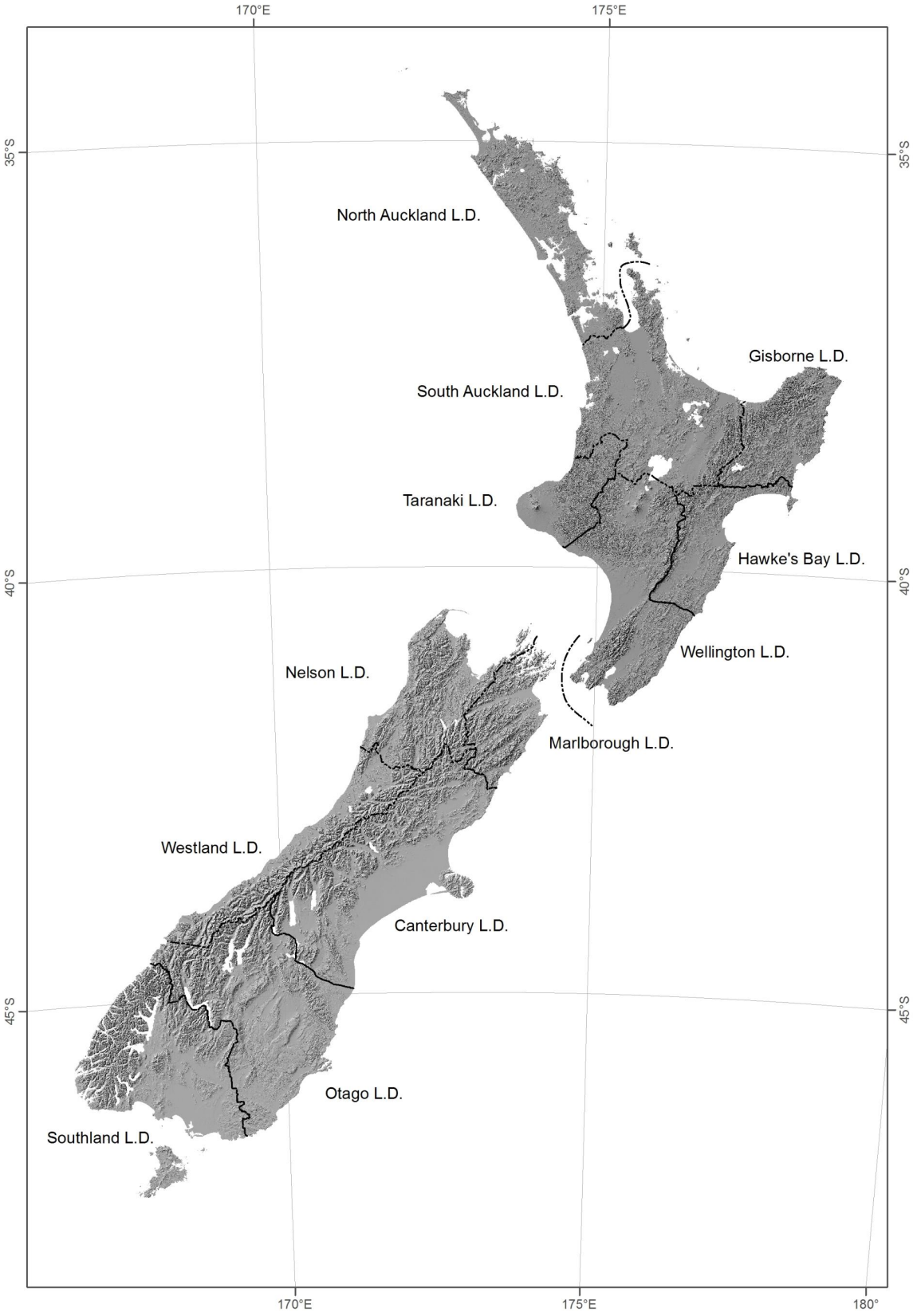


Plate 1: ***Pleurophascum*. A–K: *P. ovalifolium***. A, sterile shoot. B, calyptrae. C, section of mature capsule. D, capsule, dry. E, shoot with capsules. F, leaves. G, leaf apex. H–I, shoot details. J, upper laminal cells. K, alar cells. A–F, H–K drawn from *M.J.A. Simpson 8561*, CHR 351331; G drawn from isotype of *Pleurophascum grandiglobum* var. *decurrens*, *J.H. Ardley s.n.*, Dec. 1949, CHR 513138.



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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