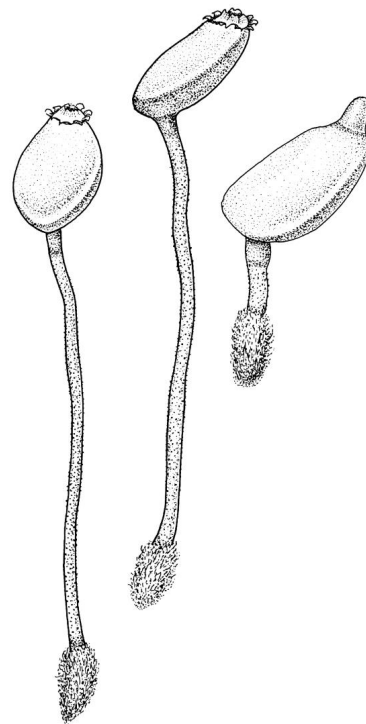


FLORA OF NEW ZEALAND
MOSSES

BUXBAUMIACEAE



A.J. FIFE

Fascicle 6 – JUNE 2014

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Cover image: *Buxbaumia aphylla*, habits with capsules. Drawn by Rebecca Wagstaff from A.J. Fife 7323, CHR 406488 and K.W. Allison 634, CHR 532687.

Contents

- Introduction..... 1
- Taxa
 - Buxbaumiaceae* 2
 - Buxbaumia* Hedw. 2
 - Buxbaumia aphylla* Hedw. 2
 - Buxbaumia novae-zelandiae* Dixon 3
- References 5
- Conventions 6
- Acknowledgements 8
- Plates 9
- Maps 10
- Index 12
- Image Information 13

Introduction

The Buxbaumiaceae are monogeneric, with *Buxbaumia* including about 10 species distributed mostly in temperate regions. One endemic and one apparently bipolar species are known from N.Z. The capsules are extremely large (up to 9 mm in one species) and persist for more than one year. Despite their large size, they are remarkably difficult to see in the field and may not even be recognised as belonging to a moss. The capsules are almost certainly sometimes overlooked by even skilled collectors. Non-fruiting material is rarely, if ever, collected. The vegetative leaves of all species are minute and probably contribute little to the nutrition of the developing sporophyte.

Buxbaumiaceae

Notes: The Buxbaumiaceae are monotypic and no family description is provided here. The plants typically grow on soil or rotten wood and have persistent and well-developed protonemata. The gametophores are highly reduced and reportedly surround a single male or female sex organ. The setae are very stout and often papillose. The capsules are very large, perennial, ± obovoid, and dorsiventrally flattened. The peristome is double, with an exostome composed of rows of nematodontous teeth. The endostome is a pleated cone usually exceeding the exostome in height. The family is placed in its own subclass and order in the class Bryopsida by Goffinet et al. (2009).

***Buxbaumia* Hedw., *Sp. Musc. Frond.*, 166 (1801)**

Type taxon: *Buxbaumia aphylla* Hedw.

Plants solitary or gregarious, on soil. **Stems** minute, rarely observed unless fertile, arising from ± persistent and pale protonemata. **Leaves** minute, persistent at base of the setae, brown, lingulate, lanceolate, or irregular, toothed or ciliate. **Mid laminal cells** ± oblong. **Costa** absent.

Reportedly dioicous. Female plants minute, reportedly with a single archegonium. **Male plants** minute, reportedly of a single bract-like leaf enclosing one antheridium, not seen in N.Z. material. **Setae** stout, smooth or papillose, swollen at base and surrounded by few or numerous persistent leaves; **capsules** very large, remaining green until nearly fully mature, asymmetric at base, inclined or erect, obovoid, uniformly convex or flattened on upper surface, with a small and inconspicuous neck; **stomata** in a single row at the base of the neck, superficial or immersed; **exothelial cells** often exfoliating; **operculum** high-conic. **Peristome** double; **exostome** nematodontous, of 1–4 rows of irregular (sometimes rudimentary) teeth, smooth or papillose; **endostome** a pale, pleated cone, usually exceeding the exostome in height. **Calyptra** cucullate, naked, covering only the operculum.

Notes: A genus of c. 10 species distributed mostly in temperate regions. Two species occur in N.Z.

Sterile material is rarely, if ever, collected. The relatively large capsules, borne on stout setae, persist for more than one year. The vegetative leaves of all species are minute and probably contribute little to the nutrition of the developing sporophyte. The Australian species of *Buxbaumia* were discussed by Stone (1983) and her notes included observations on N.Z. species.

Etymology: The genus was named for the German botanist, J.C. Buxbaum who, according to Crum & Anderson (1981, p. 1236), discovered the type species in 1712 near the mouth of the Volga River.

- | | | |
|----|--|---------------------------|
| 1 | Setae distinctly papillose; capsules strongly inclined or horizontal, 3–5 mm, broadly obovate with the upper surface nearly plane and surrounded by a distinctly raised border; mouth surrounded by flaps of exfoliating exothelial cells | <i>B. aphylla</i> |
| 1' | Setae smooth; capsules erect, 6–9 mm, narrowly obovate and uniformly convex; mouth not surrounded by exfoliating exothelial cells | <i>B. novae-zelandiae</i> |

***Buxbaumia aphylla* Hedw., *Sp. Musc. Frond.*, 166 (1801)**

Type: Europe. Not seen.

Plants mostly gregarious, arising from persistent and pale protonemata. **Leaves** sparse (occasionally not observable) at base of setae, lingulate or highly irregular in outline and irregularly toothed or long ciliate. **Mid laminal cells** mostly oblong-hexagonal, c. 30–39 × 15 µm.

Setae red, 1.5–18 mm, coarsely or rarely finely papillose (prorate) throughout, swollen at base and usually with a felt of protonemata and persistent leaves; **capsules** 3–5 mm, inclined to horizontal, red- or yellow-brown at maturity, broadly obovate in outline, plane or nearly so on upper surface, convex on lower surface, the surfaces separated by a distinct, raised, and often dark red border, tapering to a narrow, ± transverse mouth which at maturity is surrounded by irregular and reflexed flaps of exfoliating exothelial cells, with a small and weakly swollen neck; **exothelial cells** ± hexagonal, firm-walled, mostly 40–50 µm; **stomata** deeply immersed, 1- or 2-celled; **operculum** c. 0.8 mm high, conic, rounded at apex. **Exostome teeth** variable in number, dark brown, each tooth irregular to triangular, composed of 2–3 layers of parallel bundles of intact cells, smooth or nearly so. **Calyptra** c. 1 mm. **Spores** c. 5–7(–12) µm, smooth.

Illustrations: Plate 1.

Distribution: NI: N Auckland (Waitakere Ranges), S Auckland (Pārāwera, Rotorua-Taupō-Kaingaroa area); SI: Nelson (Abel Tasman N.P.), Canterbury (Lewis Pass, Arthur's Pass, Hawdon River), Westland (Pegleg Creek), Otago (Waitātī, Flagstaff Hill, Berwick, Paradise).

Bipolar. Tasmania*, mainland Australia (Qld)*, widespread but local in northern hemisphere.

Habitat: On soil on alluvial terraces, rock, logs or stumps, usually in relatively open vegetation such as scrub or low mānuka forest, occasionally in subalpine grasslands and also in plantations of pine and larch (*Larix decidua*). The base, lower trunks and rotten stumps of larch provided the habitat for a number of collections from the Kaingaroa Plains in S Auckland L.D. Once collected from damp sandstone. Frequently associated bryophytes include *Campylopus introflexus*, *Ceratodon purpureus*, *Dicranoweisia antarctica*, *Notoligotrichum australe*, *Leptotheca gaudichaudii*, and *Lepidozia* spp., while associated lichens include the genera *Cladia*, *Cladonia*, *Peltigera*, and *Psoroma*. On NI from 100–550 m; on SI from near sea level to c. 1100 m.

Notes: Fruiting *Buxbaumia aphylla* has been collected from NI in all seasons, while from SI it has been collected mainly in late winter to spring. Crum & Anderson (1981, p. 1236) indicated that in eastern North America the “capsules mature over the winter” and shed spores in the spring. Hancock & Brassard (1974) suggest that in Newfoundland, Canada, the gametophytes may persist for two to several years and give rise to annual crops of sporophytes.

Etymology: The species epithet means without leaves.

***Buxbaumia novae-zelandiae* Dixon, *Bull. New Zealand Inst.* 3: 369 (1929)**

Isotypes: N.Z., Ātiamuri, *K.W. Allison 1*, CHR 509135!, WELT M12505!

Plants mostly solitary, arising from inconspicuous protonemata. **Leaves** numerous at base of setae, mostly 600–750 µm, lanceolate, weakly toothed or crenulate at margins. **Mid laminal cells** variable in size, 27–66 × 12–15 µm.

Setae red, c. 13–24 mm, to c. 350 µm diam., smooth, surrounded at base by numerous persistent leaves; **capsules** 6–9 mm (including neck), nearly erect, green at maturity, narrowly obovate, convex on all surfaces and lacking a border between the upper and lower surfaces, tapered to a narrow, ± transverse, and clearly delimited mouth (not surrounded by flaps of exfoliating exothecial cells), with a small and weakly swollen neck; **exothecial cells** irregular in outline, firm-walled, not exfoliating; **stomata** superficial, 2-celled; **operculum** c. 0.8–1.0 mm high, rounded at apex. **Exostome teeth** scarcely exceeding the mouth; **endostome** sometimes fragmenting to form numerous parallel filaments. **Spores** 9.5–12 µm, finely papillose.

Illustrations: Plate 1.

Distribution: NI: N Auckland, including offshore islands (GB), S Auckland (Pārāwera, Rotorua-Taupō-Kaingaroa area, Pongakawa), Gisborne (Te Wera Reserve), Hawke's Bay (Wairoa), Wellington (Te Maire Scenic Reserve, Whanganui River, Francis Stream); SI: Nelson (Abel Tasman N.P.), Westland (Barrytown).

Endemic or possibly Australasian.

Habitat: Growing mostly on shaded rock (greywacke, granite, volcanics, or papa) or occasionally on gravel, in open or forest situations. Mostly as isolated plants in mixed bryophyte mats. On NI from c. 50 to 610 m; on SI known only from 2–3 collections from below c. 250 m.

Notes: The exostome in this species is extremely short and difficult to observe; like Sainsbury (1955, p. 27), I am unable to confirm the number of rows of exostome teeth present. I have, however, had little difficulty (unlike Sainsbury 1955, p. 27) determining that the stomata in N.Z. material are superficial. Both these features were used by Brotherus (1925, p. 488) to define intrageneric taxa in *Buxbaumia*.

Stone (1983) compared the N.S.W. type of *B. coleryae* to two specimens of *B. novae-zelandiae*. She reached the tentative conclusion that *B. coleryae* should be recognised as distinct, largely on characters of the operculum (form of the apex, cell size, and overall size) and a slight difference in the degree of immersion of the stomata. The type material of *B. coleryae* has not been seen but, considering the variability of *B. novae-zelandiae*, the distinguishing features that she cited are unconvincing, e.g., the opercula in N.Z. range from 0.8 to 1.0 mm and are generally rounded apically. I have found the mid operculum cell dimensions in N.Z. material to agree with Stone's measurements, but doubt that these differences, and her observations on the stomata, are sufficient reason to retain the Australian species as distinct. Phytogeographically, too, it seems likely that *B. coleryae*, recorded from N.S.W. and Qld, is conspecific with the N.Z. species.

Stone (1983) also discussed and illustrated the morphology of the foot region of *B. novae-zelandiae* in considerable detail.

The holotype of *Buxbaumia tasmanica* Mitt. is a single capsule (NY-Mitten!) collected by Archer from Cheshunt, Tasmania. *Buxbaumia novae-zelandiae* has entirely smooth setae whereas the seta of Mitten's type has obscure papillae. Stone (1983, p. 548) apparently did not see type material and she (quoting Mitten 1860 and Dixon 1929) downplayed the papillae, despite their being visible under the stereoscope. The seta in Mitten's type is 8.5 mm and the capsule (exclusive of the conic operculum) is 6 mm long. I have been unable to see leaves in Mitten's type, which he described as sparsely ciliate ("foliis parvis ciliatis"). I agree with Dixon (1929, p. 369) that *B. tasmanica* is not conspecific with *B. novae-zelandiae*.

Etymology: The epithet *novae-zelandiae* refers to the provenance of the type specimen.

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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
<i>hom. illeg.</i>	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
<i>nom. cons.</i>	conserved name (<i>nomen conservandum</i>)
<i>nom. dub.</i>	name of doubtful application (<i>nomen dubium</i>)
<i>nom. illeg.</i>	name contrary to the rules of nomenclature (<i>nomen illegitimum</i>)
<i>nom. inval.</i>	invalid name (<i>nomen invalidum</i>)
<i>nom. nud.</i>	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
x	times
>	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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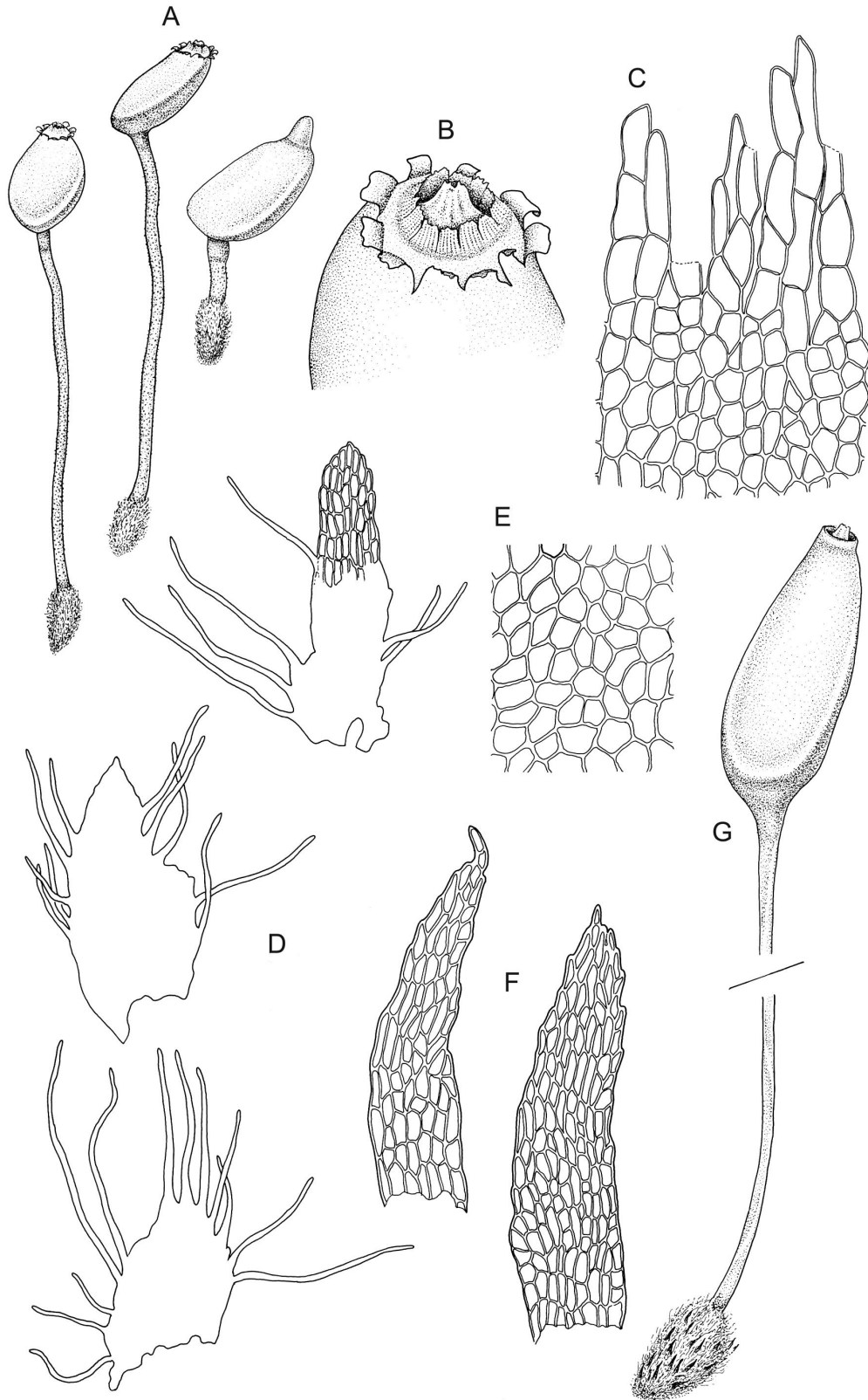
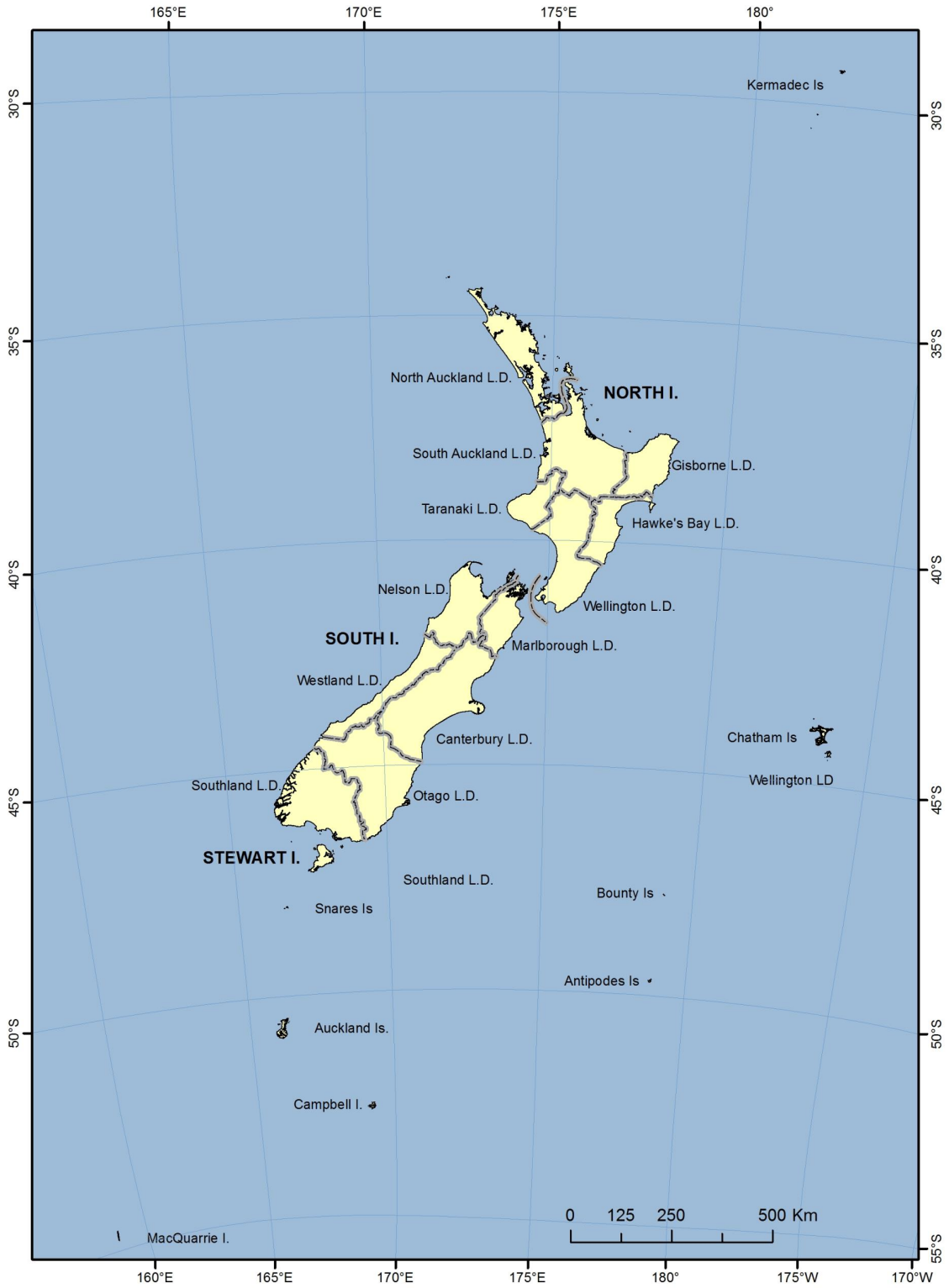
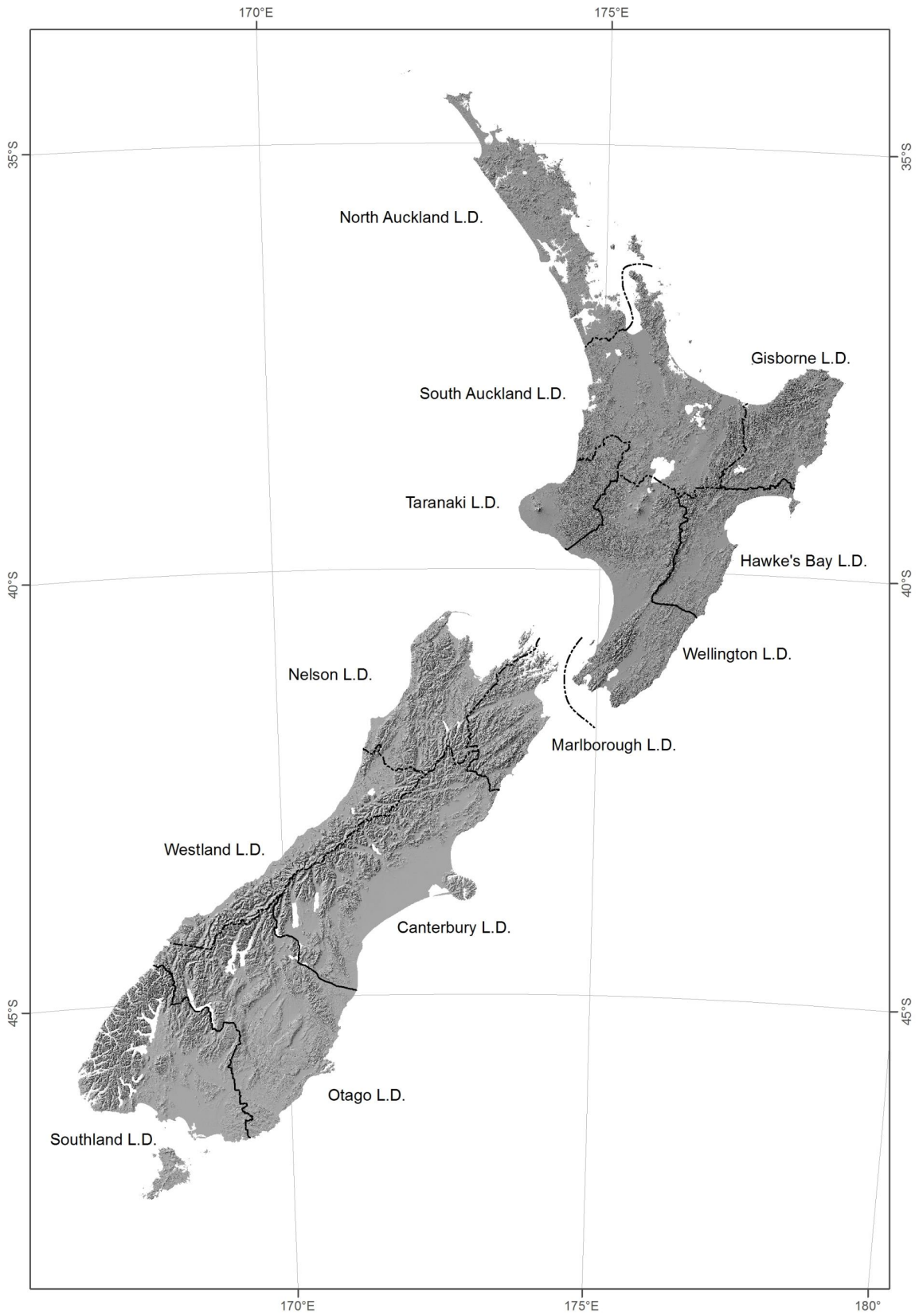


Plate 1: *Buxbaumia*. A–E: *B. aphylla*. A, habits with capsules. B, capsule mouth with exfoliating exothecial cells. C, exostome teeth. D, three leaves. E, exothecial cells. **F–G: *B. novae-zelandiae*.** F, two leaves. G, habit with capsule. *B. aphylla* drawn from A.J. Fife 7323, CHR 406488 and K.W. Allison 634, CHR 532687. *B. novae-zelandiae* drawn from E. Lüring s.n., 12 Nov. 1995, CHR 532688.



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

Index

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

Buxbaumia Hedw. 1, **2**, 3

Buxbaumia aphylla Hedw. **2**

Buxbaumia novae-zelandiae Dixon **3**

Buxbaumiaceae 1, **2**

Image Information

Image
Plate 1
Map 1
Map 2

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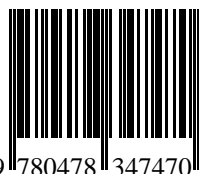
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