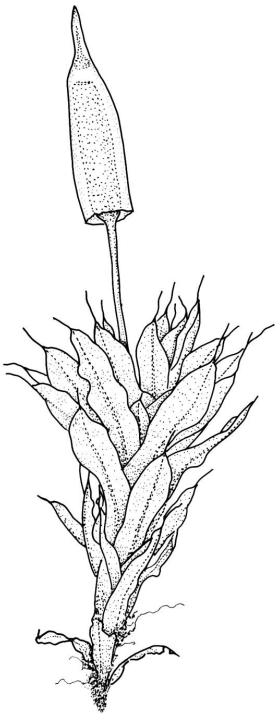
FLORA OF NEW ZEALAND

MOSSES

ENCALYPTACEAE



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Cover image: *Encalypta rhaptocarpa*, habit with capsule. Drawn by Rebecca Wagstaff from *A.J. Fife 10283*, CHR 483503.

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Contents

Introduction

Members of the acrocarpous family Encalyptaceae are often referred to as “extinguisher mosses” or “candle-snuffer-mosses” because of their distinctive and large calyptrae, which are about as long as the setae and completely enclose the developing capsules. Two attractive species, both of which are in the genus *Encalypta* and bipolar in distribution, are documented in N.Z. from calcareous rock and its derived detritus. *Encalypta* is well known for the diversity of its peristome development, but both N.Z. species lack a peristome. Both species are more common on the South I., probably reflecting the greater abundance of calcareous rock on that island. However, it is puzzling that neither species seems to have been collected from the North I. for more than sixty years.

Typification

The following typification is designated in accordance with the International Code of Nomenclature for Plants, Algae and Fungi.

***Encalypta novae-zealandiae* Colenso, Trans. & Proc. New Zealand Inst. 16: 348 (1884).**

Lectotype: N.Z., Pētane, near Napier, *A. Hamilton, s.n.*, 1882, (herb. Colenso 3120), WELT M000325!

Encalyptaceae

Taxonomy: The Encalyptaceae include two genera: *Encalypta* and *Bryobrittonia*. Only *Encalypta* occurs in N.Z. *Bryobrittonia* is a monotypic genus of circumpolar montane-arctic distribution and it is differentiated from *Encalypta* by having smooth upper laminal cells, serrulate leaf margins, and basal laminal cells that lack thickened transverse walls (Horton 1983).

A revision of the family, with emphasis on North American taxa, was supplied by Horton (1982, 1983). She provided (1982, p. 386) an excellent synopsis of the family which is quoted here: "The most distinctive feature of the Encalyptaceae is the long companulate, mitrate calyptra that extends at least to the base of the capsule. Species of Encalyptaceae are predominantly autoicous and populations generally consist of plants covered by a mass of sporophytes. The cylindric capsule is exserted, but the seta is very variable in length. The family is noted for the diversity of peristome-types that characterise the different species, including those that are long and double, shorter and single or completely lacking. Vegetatively, the plants have a pottiaceous appearance. The leaves are broad and oblong with a well-developed, single costa. The upper laminal cells are more-or-less isodiametric, bulging, and, in all except one species, densely papillose. The strikingly differentiated basal cells are considerably larger and oblong with smooth walls, except for one species with the walls papillose on one surface. In most species the transverse walls of the basal cells are thickened and more-or-less intensely coloured".

Encalypta Hedw., *Sp. Musc. Frond.,* 60 (1801)

Type taxon: *Encalypta ciliata* Hedw.

Elements in the following description are taken from Horton (1983).

Plants acrocarpous, medium-sized, green to olive-green, often with yellow-brown or red-brown overtones. **Stems** variable in length, to 50 mm (rarely more), more or less branched, in cross-section with or without a distinct central strand. **Leaves** mostly oblong to lingulate, rather abruptly narrowed above to a broadly acute or obtuse apex, muticous, mucronate, apiculate, or with a long hair-point, much contorted and usually inrolled when dry, erect-spreading to reflexed when moist, broadly V-shaped in cross-section; **margins** crenulate or entire, plane or recurved below; **upper laminal cells** unistratose, short-oblong or rounded-quadrate, bulging, densely pluripapillose; **cells of lower lamina** elongate-oblong, smooth, extending upwards to 1/3 or more of the leaf length, with thin longitudinal walls and thickened and mostly pigmented transverse walls (especially near base of costa); **cells of the lower margin** often narrower and more elongate to form a moderately defined border; **alar cells** not differentiated. **Costa** stout, ending well below leaf apex to excurrent, mostly prominent abaxially, in cross-section with 2–3 central layers of large and often thick-walled cells, a distinct abaxial stereid band (mostly of 2–3 cell layers) and a single adaxial layer of green, papillose cells. **Gemmae** absent in N.Z. taxa (rarely present and axillary in non-N.Z. species).

Gonioautoicous (in N.Z. species) or rarely dioicous. **Perichaetia** terminal, the leaves not or weakly differentiated, often overtopped by innovations. **Perigonia** mostly immediately below the perichaetia. **Setae** rather short, straight or flexuose, variable twisted; **capsules**, erect, exserted, narrowly cylindric, with a weakly defined neck, smooth, weakly striate, or furrowed, ± constricted at mouth when dry, with a small and poorly defined neck; **exothecial cells** variably oblong, thin-walled; **stomata** superficial to indistinctly immersed, restricted to capsule base or scattered on urn; **annulus** mostly absent, sometimes differentiated; **operculum** conic-rostrate, short to very elongate. **Peristome** extremely variable, often nil. **Spores** highly variable, spherical or reniform, often with distinct proximal and distal surfaces and often ± trilete. **Calyptra** narrowly long-mitrate, completely enclosing the capsule, usually weakly lobed at base, in N.Z. species c. 4.5–6 mm.

Notes: Horton (1983) considered *Encalypta* to comprise 19 species, many of which are predominantly or exclusively distributed in the colder parts of the northern hemisphere. Fewer species occur at higher elevations in the tropics and in temperate to cold parts of the southern hemisphere. Two species are known from N.Z.

The extraordinarily variable nature of the peristome in *Encalypta*, a group otherwise so “naturally cohesive” (Horton, 1982, p. 368), has long attracted attention from bryologists. Horton discussed this variability from an historical perspective. Ironically, both the N.Z. species are gymnostomous. She also pointed out (Horton, 1982, 1983) that the peristome variation is paralleled by a high level of spore morphology variation, which she illustrated in detail using SEM micrographs.

Horton (1983) also discussed the presence of populations in North America that appeared to show intermediates between *E. vulgaris* and *E. rhaptocarpa*, but resisted reducing these two taxa to infraspecific rank. The two taxa seem clearly differentiated in N.Z., although our material of *E. rhaptocarpa* appears to be consistently gymnostomous, unlike populations in some other parts of its range.

The commonly produced and disproportionately large calyptrae and gymnostomous capsules, together with the unbordered and entire leaves of both N.Z. *Encalypta* species, should preclude confusion with members of the Pottiaceae. Of the most likely confused species, *Hennediella macrophylla* and *H. arenae* have relatively large and ± campanulate calyptrae but their leaves are bordered above, and denticulate at the apex. Both species of *Hennediella* lack the pigmented and thickened transverse walls in the basal cells that characterise all *Encalypta* spp.

Sterile material of either *Encalypta* species could possibly be confused in N.Z. with *Syntrichia antarctica* or *S. anderssonii*. However, sterile material of *Encalypta* is very rarely collected. The calyptrae and distinctly thickened transverse walls in the interior basal cells of all *Encalypta* species again distinguish the genus. In both our *Encalypta* spp. the margins are plane or nearly so and the basal marginal cells lack chlorophyll; in *Syntrichia* spp. the margins are generally narrowly recurved and the basal marginal cells are pigmented.

Etymology: The generic name alludes to the very large and long-mitrate calyptra that completely encloses the mature capsules; the nature of the calyptra also gives this genus their common and descriptive name “extinguisher mosses”.

1 **Setae** 3–5 mm; **capsules** ± furrowed, with prominent ribs when mature and dry; **well-developed leaves** short to long hair-pointed (rarely muticous when less developed); **costae** mostly red-brown, smooth abaxially .... *E. rhaptocarpa*

1' **Setae** 4–5(–10) mm; **capsules** weakly striate-wrinkled, lacking prominent ribs when mature and dry; **well-developed leaves** muticous; **costae** dull brown to dull yellow, with the ends of abaxial cells projecting ..... *E. vulgaris*

Encalypta rhaptocarpa Schwägr., *Sp. Musc. Frond. Suppl. 1(1),* 56 (1811)

Type: Austria. Not seen.

Plants dull, red-brown. **Stems** to c. 8 mm in N.Z. material, mostly branched. **Leaves** oblong-lanceolate, rather abruptly narrowed above to an acute apex, with a short or long hair-point, mostly spiralled around the stem when dry, not markedly inrolled, erect-spreading when moist, entire, in cross-section U-shaped or weakly-keeled and with margins plane, 2.0–3.5 × 1 mm; **upper laminal cells** short-oblong or subquadrate, bulging, each with several (mostly 4–6) c-shaped papillae, mostly 12–21 × 12–15 µm, becoming ± oblate in a few rows near the margins, grading into the cells of the lower lamina; **cells of lower lamina** elongate-oblong, smooth, with thin longitudinal walls and strongly thickened, yellow-orange transverse walls (especially near base of costa); **cells of the lower margin** lacking thickened transverse walls, forming a border 5–6 cells wide that fades at the junction with the papillose laminal cells. **Costa** stout and prominent abaxially, red-brown or less commonly yellow-brown, mostly short- to long-excurrent (rarely percurrent) to form a concolourous or apically pale hair-point, lustrous when dry, smooth abaxially, in cross-section with 1–2 layers of guide cells, 1 layer of papillose adaxial cells (not differing from adjacent laminal cells), and a large abaxial stereid band.

Gonioautoicous. **Perichaetia** with leaves scarcely differentiated, often overtopped by innovations. **Perigonia** located immediately below perichaetia. **Setae** 3–5 mm, red-brown or orange, smooth, straight, not twisted; **capsules** as per genus, longitudinally furrowed when dry, gold-brown, red at mouth, 2.5–3.2 mm; **exothecial cells** mostly elongate-oblong, in alternating bands of thick- and thinner-walled cells; **stomata** superficial, apparently scattered in lower urn (occurring to c. ⅓ above base); **annulus** lacking; **operculum** narrowly long-rostrate from a conic base, straight, c. 1.5 mm, often falling with the calyptra. **Peristome** nil in N.Z. material. **Spores** reniform, coarsely bullate-insulate on distal surface, with individual insulae 5–6 µm across, proximal surface indistinctly trilete, c. 38 µm diam. **Calyptra** narrowly long-mitrate, completely enclosing the capsule, not lobed at base, weakly scabrous near tip, c. 5 mm long.

Illustrations: Plate 1. Horton 1983, figs. 171–177; Horton 1994, fig. 314; Ochyra et al. 2008, fig. 45; Smith 2004, fig. 162, 11–14.

Distribution: NI: Wellington (Ruahine Range); SI: Nelson (Arthur Range, Owen Range), Canterbury (Broken River), Southland (Takahē Valley); Ch (Pitt I.). The sole collection from the "northwestern Ruahine Ra." is a poorly documented one made by A.P. Druce in 1948.

Bipolar. Widespread in North America, northern Europe and parts of Asia (Horton 1983). Smith (2004) and Hoe (1974) recorded it from Hawaii. Ochyra et al. (2008) recorded it from Patagonia, the Antarctica Peninsula, and the South Orkney Is.

Habitat: Occurring mostly in cracks in massive limestone and marble outcrops and boulders and on derived soil detritus. In the Takahē Valley it is a common species for more than 200 m along the base of a limestone bluff at the eastern end of Lake Orbell. The Pitt I. (Hākepa Hill) collection (*P. de Lange* & *P.B. Heenan* CH2246, CHR 604653) was growing "threaded through *Lolium perenne* and *Hymenophyllum multifidum*" on soil derived from trachyte (a feldspar-rich intrusive rock often associated with basalt). At Hākepa Hill the trachyte has weathered to form "pseudo-karst" topography that included well-developed dolines and blind valleys. *Encalypta rhaptocarpa* is frequently associated with *Brachythecium paradoxum*, *Bryoerythrophyllum recurvirostrum*, *Camptochaete aciphylla*, *Distichium capillaceum*, *Encalypta vulgaris*, *Lepyrodon australis*, *L. lagurus*, *Philonotis scabrifolia*, *Plagiobryum novae-seelandiae*, and *Syntrichia serrata*. On SI ranging from c. 790 (Takahē Valley) to at least 1800 m (Mt Owen) elevation. The Pitt I. collection was from c. 220 m.

Recognition: Apart from pottiaceous taxa mentioned in the generic discussion, confusion is likely only with the more common *E. vulgaris*, which can be segregated by the features in the key.

Etymology: The epithet means striped fruit.

Encalypta vulgaris Hedw., *Sp. Musc. Frond.,* 60 (1801)

Lectotype: designated by Horton (1983) as published plate. Not seen

= *Encalypta novae-zealandiae* Colenso, *Trans. & Proc. New Zealand Inst.* 16: 348 (1884)
Lectotype: N.Z., Pētane, near Napier, *A. Hamilton, s.n.*, 1882, (herb. Colenso 3120), WELT M000325! Isolectotype: CHR 604608! Paratype: WELT M000326!

Plants dull brown-green to dark yellow-green. **Stems** mostly 5–10(–20) mm. **Leaves** oblong to lingulate, rather abruptly narrowed above to a broadly acute and muticous apex, inrolled when dry, erect-spreading when moist, broadly V-shaped in cross-section, with margins crenulate and papillose above, plane or weakly recurved, 3.0–3.5 × 0.9–1.0 mm; **upper laminal cells** short-oblong or rounded-quadrate, bulging, each with 2–4 tall and mostly branched papillae, mostly 12–15 × 10–12 µm, becoming shorter and ± oblate near margins, grading into the cells of the lower lamina; **cells of lower lamina** elongate-oblong, smooth, mostly 45–75 µm, with thin longitudinal walls and thickened and yellow-orange transverse walls (especially near base of costa); **cells of the lower margin** narrower and more elongate, forming a border 5–6 cells wide and fading at the junction with the papillose laminal cells. **Costa** stout and prominent abaxially, dull brown to dull yellow, ± lustrous in dry material, subpercurrent, with cell ends weakly or strongly projecting abaxially above, in cross-section semi-circular on abaxial surface, with a single layer of guide cells, 2 layers of large adaxial cells (including the papillose cells on adaxial surface), and a large abaxial stereid band.

Gonioautoicous. **Perichaetia** with leaves scarcely differentiated, often overtopped by innovations. **Perigonia** located immediately below perichaetia, c. 1 mm, the bracts ovate and obtuse, surrounding few antheridia and filiform paraphyses. **Setae** 4–5(–10) mm, yellow, smooth, straight, not twisted; **capsules** as per genus, weakly striate-wrinkled when dry, gold-brown, weakly constricted and red at mouth, 2.6–3.0 × c. 0.75 mm; **exothecial cells** short- to elongate-oblong, thin-walled; **stomata** few, superficial, apparently scattered in lower urn (occurring to c. ¼ above base); **annulus** lacking; **operculum** narrowly long-rostrate from a conic base, straight, 0.9–1.0(–1.3) mm. **Peristome** nil. **Spores** ± reniform, coarsely bullate-insulate on distal surface, often with a weak trilete scar, often persisting as tetrads in N.Z. material, 27–39 µm. **Calyptra** long-mitrate, completely enclosing the capsule, weakly lobed at base, weakly scabrose or smooth near tip, 4.5–6 mm.

Illustrations: Plate 1. Scott & Stone 1976, pl. 41; Horton 1994, fig 315; Smith 2004, fig. 162, 7–10; Seppelt et al. 2013, pl. 5.

Distribution: NI: Hawke's Bay, Wellington (Taihape, Ruahine Range); SI: Nelson (Arthur Range, Owen Range), Marlborough, Canterbury, Otago.

Bipolar or anomalous. Although there are numerous collections from Hawke's Bay L.D., I have seen none more recent than 1948. However, there is no reason to believe this species would not still occur there. Tasmania*, mainland Australia*, widespread in northern hemisphere. Recorded from New Guinea and Africa by Smith (2004).

Habitat: On cation-rich and calcareous rock and derived soil. Growing on limestone, greywacke, basalt, schist, sandstone, and rarely on concrete. A large number of collections from throughout Otago (mostly by W. Martin) indicate it to be widespread throughout the eastern parts of this L.D. and suggest that it is common in drier tussock and shrubland. Herbarium records also include such habitats (from Otago L.D.) as a “sandy bank at lakeside” (Lake Wānaka, *J.T. Linzey 334*, CHR 613290) and “damp rock faces” (Glendhu Bluff, Lake Wānaka, *P. Child, s.n.*, CHR 422932).

The elevational range on NI is poorly documented. Occurring at 1200–1300 m (at Ōhutu Ridge, Ruahine Range) and apparently at much lower elevations in the Hawke’s Bay region. On SI it ranges from c. 60 m (near Berwick, Otago L.D.) to at least 1650 m (Mt Arthur, Nelson L.D.) and possibly to as high as c. 2400 m (Inland Kaikōura Range, Marlborough L.D.). In addition to *Encalypta rhaptocarpa*, common associates include *Bryoerythrophyllum recurvirostrum*, *Didymodon torquatus*, *Distichium capillaceum*, *Syntrichia anderssonii*, *S. antarctica*, *S. serrata*, and *Weissia controversa*, as well as (less commonly) such species as *Ceratodon purpureus*, *Fissidens megalotis*, and *Grimmia pulvinata*. The last three species seem to co-occur with *E. vulgaris* when it grows on basalt or greywacke.

Notes: When dry the plants have a dull, ± brown-green colour. The lingulate leaves are strongly inrolled at their apices and the stout, dull brown, and weakly lustrous costae are prominent abaxially. In larger plants the leaves can be weakly spirally twisted around the stem as well as inrolled. If collected in a sterile condition the presence of the thickened and pigmented transverse walls of the basal cells, together with the nature of the leaf apex, permit placement. However, because of its gonioautoicous (perigonia on small branches immediately below the perichaetium) sexuality, this species is nearly always collected with capsules.

N.Z. material only rarely has setae exceeding 5-7 mm. One aberrant collection (from Avon Valley, Marlborough) has a few sporophytes with setae c. 10 mm. The setae in this collection slightly exceed the range given by Horton (1994) for this species in Mexico.

Some emphasis was given by early authors to the purportedly smooth apex of the calyptra in N.Z. material (see Dixon 1926, p. 153); this feature was part of the reason that Colenso described *E. novae-zealandiae*. However, both smooth and finely scabrose calyptrae occur throughout the N.Z. range of this species and both can sometimes be observed in single collections (e.g., *G. Brownlie 625*, Porter River, Canterbury, CHR 427843). Diana Horton (*in herb.* CHR) confirmed N.Z. material as *E. vulgaris* and I agree with Dixon (1926) that little purpose would be served by taxonomic segregation of Australasian material from northern hemisphere material. Dixon (1926) also discussed the variability of the vegetative leaf apices in N.Z. material.

The Tasmanian names *E. australis* Mitt. and *E. tasmanica* Müll.Hal. & Hampe have been applied to N.Z. material. Dixon (1926) placed both these names in the synonymy of *E. vulgaris* and there is no reason to question his decisions here. Dalton et al. (1991) endorsed the synonymy of *E. australis* Mitt., but did not comment on *E. tasmanica*.

Etymology: The epithet means common, and is coincidentally apt in a N.Z. context, as this species is the more frequently found species here.

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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
>	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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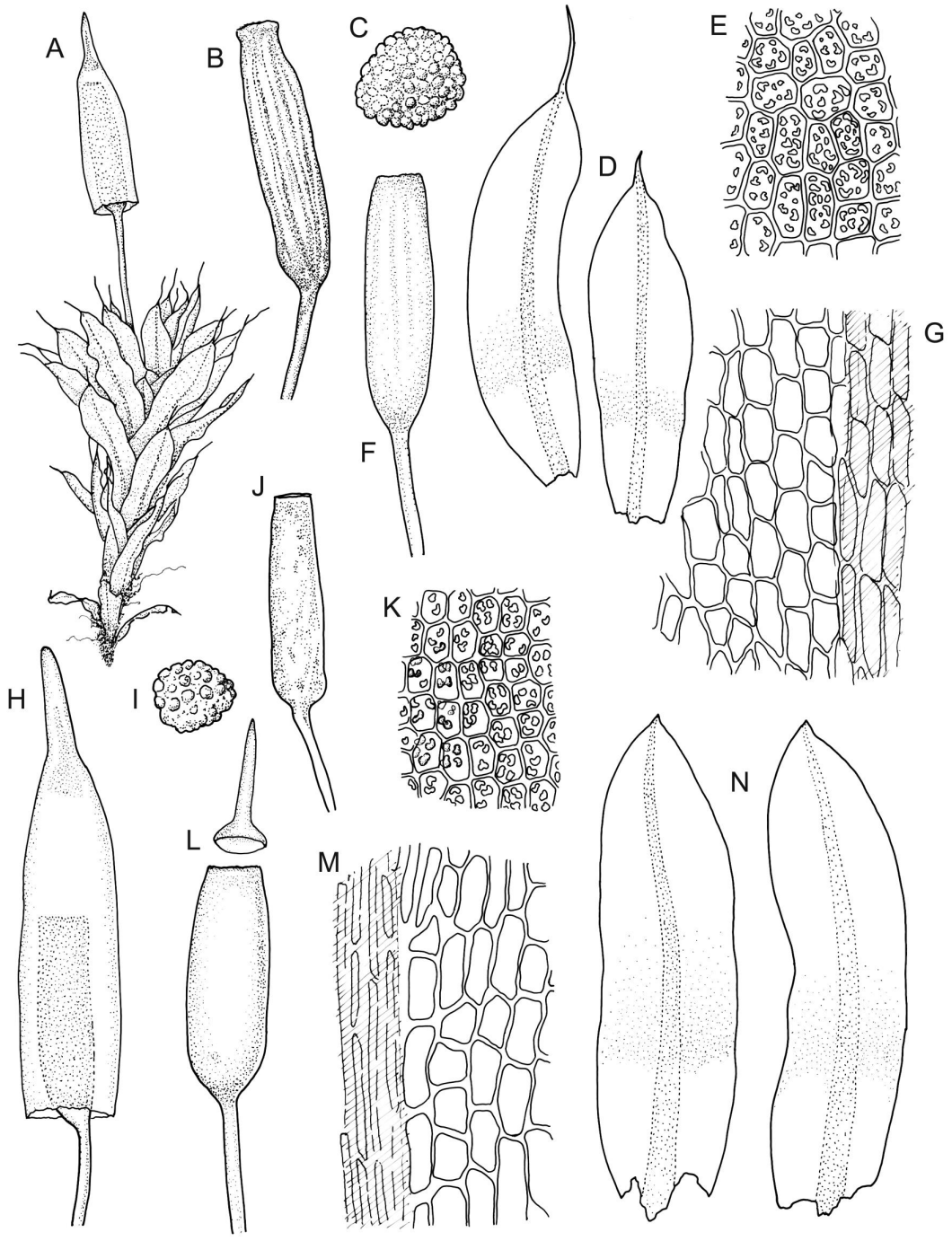
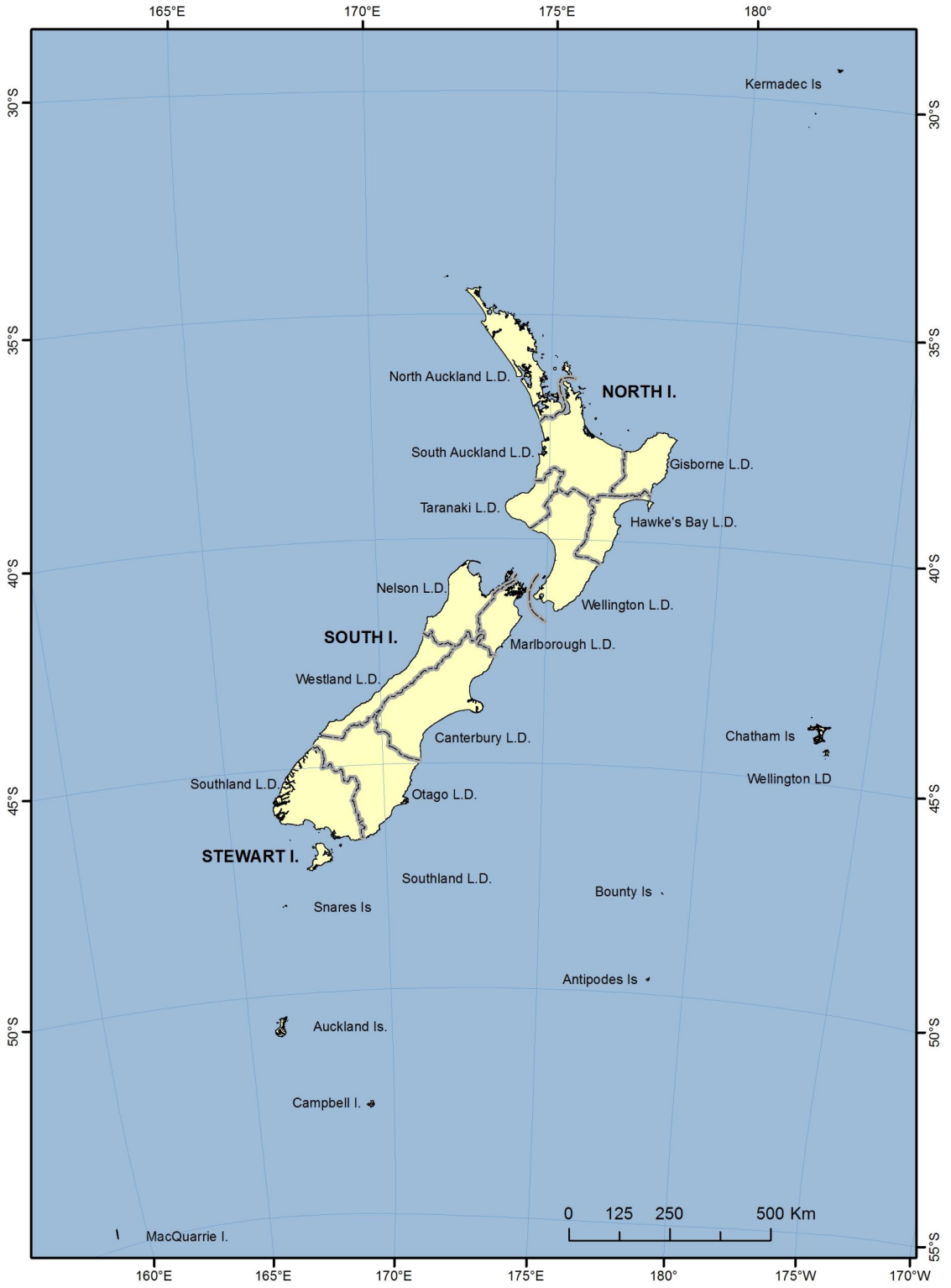
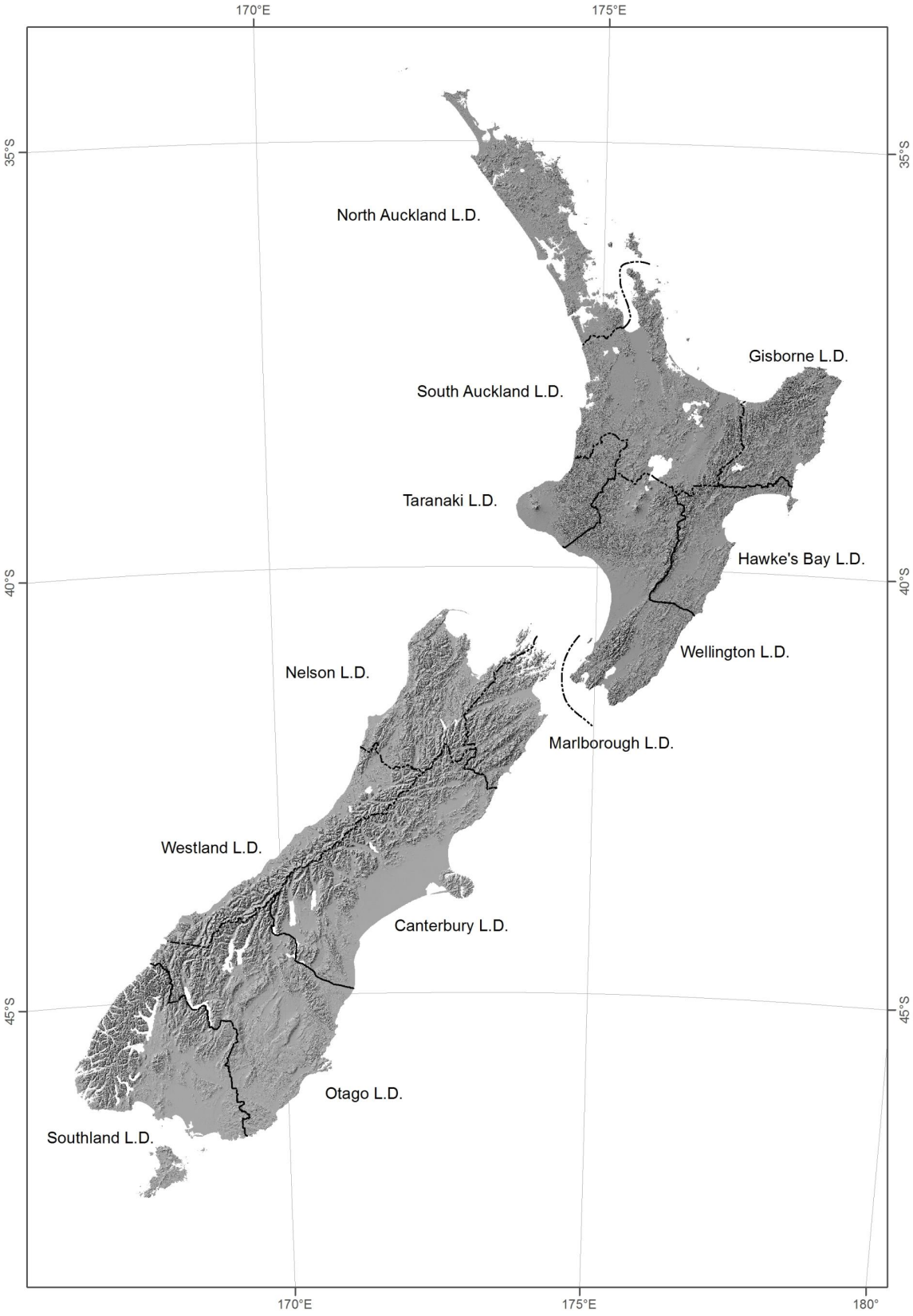


Plate 1: ***Encalypta*. A–G: *E. rhaptocarpa***. A, habit with capsule. B, capsule, dry. C, spore. D, leaves. E, upper laminal cells. F, capsule. G, lower laminal cells adjacent to costa. **H–N: *E. vulgaris***. H, capsule with calyptra. I, spore. J, capsule, dry. K, upper laminal cells. L, capsule with operculum. M, lower laminal cells adjacent to costa. N, leaves. *E. rhaptocarpa* drawn from *A.J. Fife 10283*, CHR 483503. *E. vulgaris* drawn from *B.H. Macmillan 92/70*, CHR 482423.



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.

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