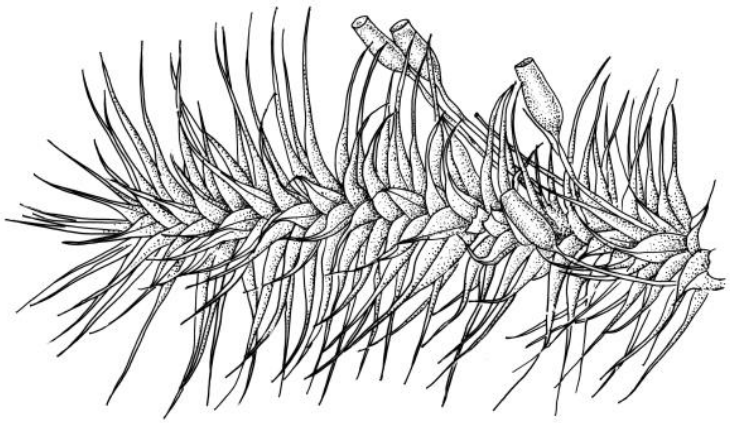
FLORA OF NEW ZEALAND

MOSSES

CYRTOPODACEAE



A.J. FIFE

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nzflora

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Cover image: *Cyrtopus setosus*, portion of shoot with capsules. Drawn by Rebecca Wagstaff from *K.A. Ford D/28*, CHR 513683.

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Contents

Introduction

Cyrtopus setosus is a robust and very handsome epiphyte found in New Zealand forests. It is the only species in the genus and the sole member of the small family Cyrtopodaceae found here. The type of *C. setosus* was collected in 1791 by Archibald Menzies at Dusky Bay, Fiordland, during the Vancouver Expedition. Although it is a relatively common plant in Fiordland and through much of Southland L.D., it occurs most abundantly in *Beilschmiedia tawa* dominated forests on the North I. It most often forms extensive and pendent mats with gracefully curved branches on smooth barked tree trunks; occasionally it occurs on vertical rock faces. Although it has been recorded from mainland Australia, Tasmania, and a few localities in the Pacific, these records of *C. setosus* are inadequately documented and doubtful.

The closest allies of *Cyrtopus setosus* are the two species of the related and predominantly Malesian genus *Bescherellia*. However, in a N.Z. context, *C. setosus* is more likely to be confused with the unrelated epiphyte *Cryptopodium bartramioides*. *Cyrtopus setosus* plants are more compact than those of *Cryptopodium bartramioides*, with shorter, broader, and more abruptly tapered leaves. The marginal teeth in *C. setosus* are single and the laminal cells of its leaf base are dimorphic and subtly striate. Collectively, these features amply serve to differentiate *Cyrtopus setosus* from *Cryptopodium bartramioides.*

Cyrtopodaceae

Elements in the following description are taken from Sastre-De Jesús (1987). The family is assumed to be bigeneric.

Plants robust**,** forming loose tufts on tree trunks or rock, pendent and curving away from the substrate, usually ± yellow-green. **Primary stems** creeping, often eroded, in cross-section with central strand small or absent. **Secondary stems** (stipes) erect or pendent and curving away from the substrate, irregularly branched, dark brown and very stiff. **Leaves of secondary stems and branches** not differentiated, often eroding, erect-appressed, narrowly lanceolate and abruptly tapered from an oblong-obovate base; **margins** plane, singly toothed and often partially bistratose above, entire and unistratose at the base; **laminal cells of the subula** mostly oblong to elliptic, smooth, firm-walled, partially bistratose; **interior cells of the leaf base** linear, thick-walled, ± porose, smooth; **marginal cells of the leaf base** rounded-oblate to rounded-subquadrate in many rows and extending ± to the shoulder, mostly with fine, ± radiate cuticular striations; **alar cells** not differentiated; **costa** rather narrow, percurrent to short excurrent. **Paraphyllia** absent. **Pseudoparaphyllia** foliose.

Dioicous. **Setae** short to elongate; **capsules** exserted, erect and symmetric, oblong to oblong-cylindric; **exothecial cells** firm-walled, not thickened in corners; **stomata** superficial; **annulus** absent; **operculum** obliquely rostrate. **Peristome** double or single; **exostome teeth** 16, yellow-brown, linear-lanceolate, with a straight abaxial median line, baculate-spinose below or throughout; **endostome** present (in N.Z. taxon) or absent. **Calyptra** cucullate, smooth, naked.

Taxonomy: The family Cyrtopodaceae was most recently reviewed bySastre-De Jesús (1987) who considered it to contain two genera, *Cyrtopus* and *Bescherellia*. *Cyrtopus* is monotypic and probably restricted to Australasia, while *Bescherellia* includes two species primarily distributed in Melanesia, Western Polynesia, and eastern Australia. Sastre-De Jesús excluded the New Caledonian *Cyrtopodendron* (placed here by Brotherus 1925) from the family and suggested that this monotypic genus is better placed in the Pterobryaceae (in the general relationship of *Pterobryella*). She emphasised the regularly pinnate branching of the secondary stems of *Cyrtopodendron*, noting that it is unlike the irregular branching of both *Cyrtopus* and *Bescherellia*.

Goffinet et al. (2009) recently placed the genera *Cyrtopus* and *Bescherellia* in the Hypnodendraceae, apparently accepting molecular evidence of a relationship presented by Bell et al. (2007). However, in an Australasian context, the Cyrtopodaceae are highly distinctive by several habitat and morphological features, including their predominantly epiphytic substrate, their pendent and strongly upwardly swept habit, their highly irregular (and non-dendroid) branching, their very long and narrowly lanceolate-acuminate leaves of a uniform shape, and the broad band of differentiated marginal cells at the leaf base. By contrast, members of the Hypnodendraceae are nearly always terrestrial and usually dendroid, lack an upwardly swept habit, have much shorter and less lanceolate (and dimorphic) leaves, and usually lack bands of differentiated marginal cells. The members of the Cyrtopodaceae are readily recognised in the field. Sastre-De Jesús's (1987) family concept is therefore followed here. The family is also maintained in the classification utilised by the *Flora of Australia* vol. 51, based on Goffinet & Buck (2004).

Cyrtopus (Brid.) Hook.f., *Handb. New Zealand Fl.,* 461 (1867)

Type taxon: *Cyrtopus setosus* (Hedw.) Hook.f.

The genus is monotypic, with the features of *Cyrtopus setosus*, described below.

Etymology: The generic name means curved-foot, and is somewhat confusing given that the seta here is straight. The name probably refers to the stems rather than to the seta; the stems are usually curved upwards and away from the often vertical substrate.

Cyrtopus setosus (Hedw.) Hook.f., *Handb. New Zealand Fl.,* 461 (1867)

≡ *Anictangium setosum* Hedw., *Sp. Musc. Frond.,* 43 (1801)
≡ *Neckera setosa* (Hedw.) Hook., *Musci Exot. 1,* 7 (1818)
≡ *Cladomnion setosum* (Hedw.) Wilson, Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II 100 (1854)
Isotype: N.Z.: Dusky Bay, *A. Menzies 88*, BM!

Plants robust**,** on tree trunks or vertical rock, forming loose tufts that are weakly pendent and curved upward away from the substrate, yellow- or brown-green. **Primary stems** creeping, sometimes eroded. **Secondary stems (**stipes), irregularly or subpinnately branched, commonly curving upward

from the substrate, dark brown and very stiff, (15–)60–120(–160) mm, in cross-section with little internal differentiation, lacking a central strand. **Leaves of secondary stems and branches** not differentiated, erect-appressed, somewhat flexuose, and with a few weak to strong longitudinal pleats on each side of the costa when dry, smooth, erect-spreading and sometimes weakly homomallous when moist, abruptly tapered from an oblong-obovate, concave, and non-clasping base to a long, subulate apex, (4–)5–7(–9) × 1.2–1.4 mm; **margins** sharply and singly toothed by projecting cell-ends and partially bistratose in the subula, entire and unistratose in the base; **upper laminal cells** (near base of the subula) mostly oblong to rounded-subquadrate, smooth, mostly 12–21 × 6–9 µm (but a few longer and narrower), partially bistratose; **interior laminal cells of the leaf base** linear, thick-walled, strongly porose, smooth, mostly (60–)75–100 µm long, unistratose; **marginal laminal cells of the leaf base** rounded-oblate to rounded-subquadrate in c. 12–15 rows that extend to the shoulder, thick-walled, lacking pores, with fine, ± radiate cuticular striations or smooth; **extreme basal cells and alar cells** not differentiated; **costa** narrow (c. 60 µm wide near base), percurrent to short excurrent, weakly toothed at back above (the teeth not visible under stereoscope), in cross-section (in leaf base) biconvex, with abaxial and adaxial stereids enclosing a single central layer of guide cells, becoming ± semi-circular in the subula.

Dioicous. **Perichaetia** scattered on secondary stems and branches, the leaves about half the length of vegetative leaves, with marginal cells less differentiated and costa ± filling the subula. **Perigonia** rarely seen, gemmiform, scattered on secondary stems, c. 1.5 mm, the inner bracts yellow, ovate-lanceolate, mostly ecostate, surrounding numerous antheridia and yellow filiform paraphyses. **Setae** straight, smooth, brown, and twisted to the left above, c. 3–4 mm; **capsules** exserted beyond the perichaetial leaves, erect, symmetric, oblong-cylindric, smooth and little altered when dry, brown at maturity, c. 3 mm; **mouth** transverse; **exothecial cells** mostly oblong to ± irregular, firm-walled, not thickened in corners; **stomata** very few and difficult to see at the extreme capsule base; **annulus** absent; **operculum** obliquely rostrate, 1.5–2.0 mm. **Peristome** double; **exostome teeth** yellow-brown, linear-lanceolate, c. 580–750 µm, inwardly circinate when dry, with a straight abaxial median line, baculate-spinose below, with robust adaxial lamellae and usually appearing crenulate at margins; **endostome segments** arising from a very low membrane, straight when dry, nearly the height of the exostome teeth, pale brown, baculate throughout, lacking cilia. **Calyptra** cucullate, smooth, and naked. **Spores** round, 9–11 µm diam., smooth.

Illustrations: Plate 1. Sastre-De Jesús 1987, figs 1 & 3; Brotherus 1925, figs 507a-b, 509. The curvature of the stems and branches is inadequately shown in Plate 1, A and is better shown in Brotherus's fig. 509a.

Distribution: NI: N Auckland, including offshore islands (HC, LB, GB), S Auckland, Gisborne (Hicks Bay, Cape Runaway, near Gisborne), Hawke's Bay (Wairoa, Māhia Peninsula), Taranaki, Wellington (including KA). SI: Nelson, Marlborough (Queen Charlotte Sound, Pelorus Bridge Scenic Reserve), Westland (*s.loc.*), Otago (Lake Wānaka, Catlins), Southland; St.

Apparently Australasian, but the few occurrences outside N.Z. are poorly documented. Scott & Stone (1976, p. 365) recorded it without detail from Queensland and Tasmania, but neither locality was confirmed by Sastre-De Jesús (1987). Dalton et al. (1991) rejected the Tasmanian record. Sastre-De Jesús (1987) recorded one specimen collected by Brass from Normanby Island in Papua New Guinea, and one 19th century (Wilkes Expedition) collection, purportedly from Hawai'i. The latter seems particularly doubtful.

Habitat: This species occurs on a wide range of flowering tree species including *Beilschmiedia tawa*, *B. tarairi*, *B. tawaroa*, *Dysoxylum spectabile*, *Knightia excelsa*, *Laurelia novae-zelandiae*, *Melicytus ramiflorus*, and *Weinmannia racemosa*, as well as *Agathis australis*, *Dacrydium cupressinum*, *Dacrycarpus dacrydioides*, and *Prumnopitys ferruginea*. It appears to be most abundant in *Beilschmiedia tawa* dominated forests on smooth-barked trees. It most often forms extensive mats (to at least 2 × 0.5 m) on tree trunks, but occasionally occurs on vertical rock faces. This species is most common in the northern portion of the North I., but it is also relatively common in Wellington and Southland L.D. The relatively few collections seen from the eastern North I. (Gisborne and Hawke's Bay L.D.) are sterile and stunted. No collections have been seen from Canterbury L.D., or inland parts of Otago L.D. There are very few records from Marlborough L.D., and from Westland L.D. it is known from a single unlocalised collection by T. Kirk (WELT M003392). *Cyrtopus setosus* very often co-occurs with *Orthorrhynchium elegans*; other associates include *Camptochaete* spp., *Cladomnion ericoides*, *Leptostomum inclinans*, *Lopidium concinnum*, *Weymouthia cochlearifolia*, and *Plagiochila* spp. On North I. from 60 m (Logues Bush, N Auckland L.D.) to at least 550 m (Mt Wainui, Wellington L.D.); on South I. from near sea level to c. 220 m (Ōpārara Valley, Nelson L.D.), but there is a single W. Martin collection from Lake Rotoiti (Nelson L.D., CHR 308309) which presumably came from a site at more than 620 m a.s.l.

Notes: Given the frequency with which *C. setosus* fruits, perigonia are surprisingly rarely found in herbarium material. Perigonia can sometimes be located by searching for leaves which are more concave basally than adjacent vegetative leaves.

Recognition: *Cyrtopus setosus* is most likely and often confused with *Cryptopodium bartramioides*. *Cyrtopus setosus* is a more compact plant with shorter, broader (c. 5–7 × 1.2–1.4 mm vs c. 8–12 × 0.7–0.9 mm), and more abruptly tapered leaves. The marginal teeth in *C. setosus* are single and the abaxial costal surface weakly toothed (both are difficult to observe under a hand-lens). By contrast, the marginal and costal teeth of *Cryptopodium bartramioides* are paired and readily seen with a hand-lens. In *C. setosus* the laminal cells of the leaf base are dimorphic and have cuticular striations (observable under the compound microscope; not illustrated in Plate 1), while in *Cryptopodium bartramioides* the cells of the leaf base are uniformly short-rectangular and smooth. In *C. setosus* the setae are 3–4 mm and the capsules exserted beyond the perichaetial leaves (but only weakly exserted beyond the longer vegetative leaves), while in *Cryptopodium bartramioides* the setae are shorter and the capsules immersed among non-differentiated perichaetial leaves. The two plants also differ by their peristome structure and usually occur on different host species.

Confusion may also occur with *Echinodium hispidum*, but in that species the leaves are dark green and somewhat falcate secund, with capsules well exserted on longer and curved setae.

Etymology: The epithet "*setosum*" refers to the narrowly subulate or setose nature of the vegetative 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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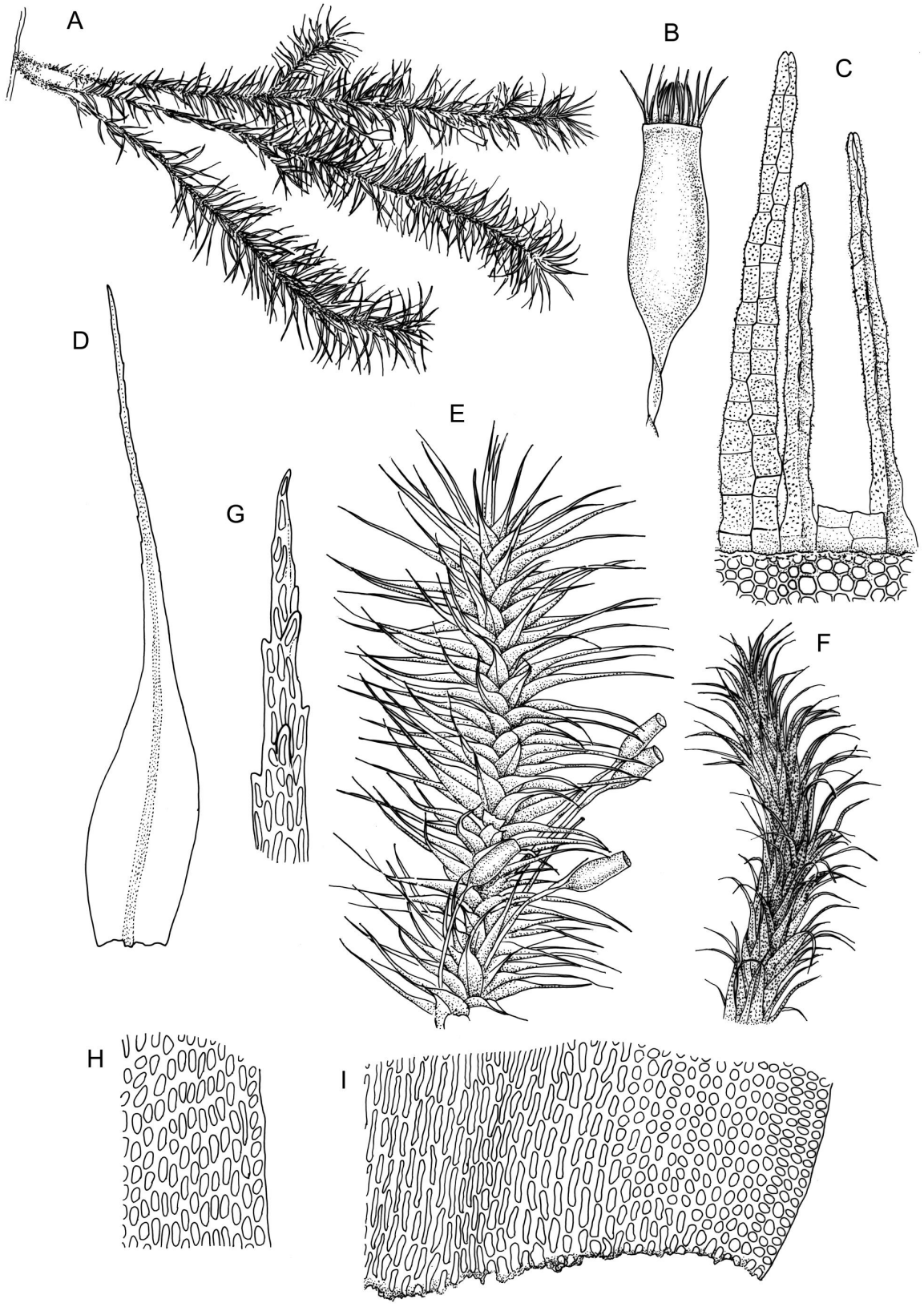
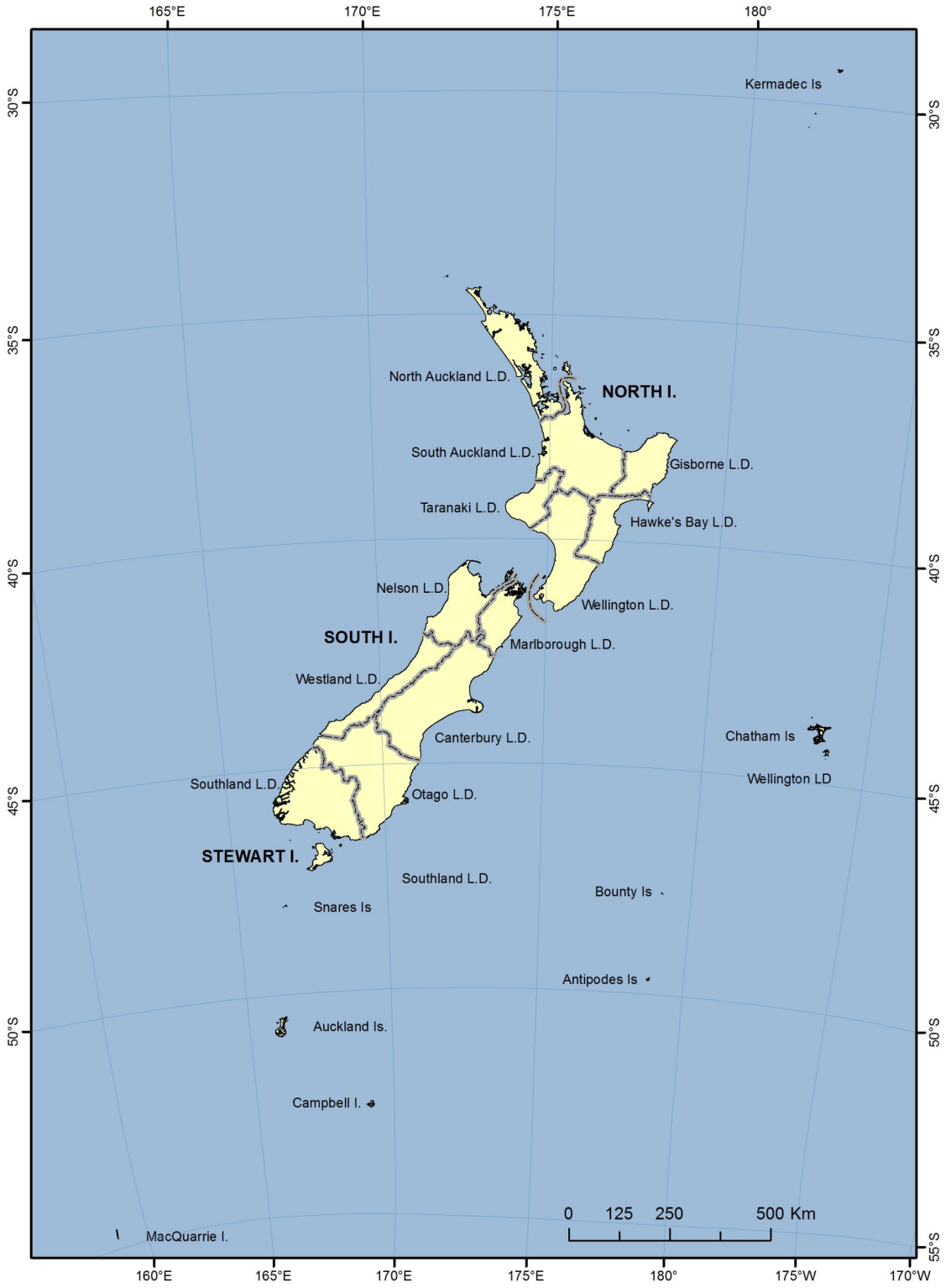
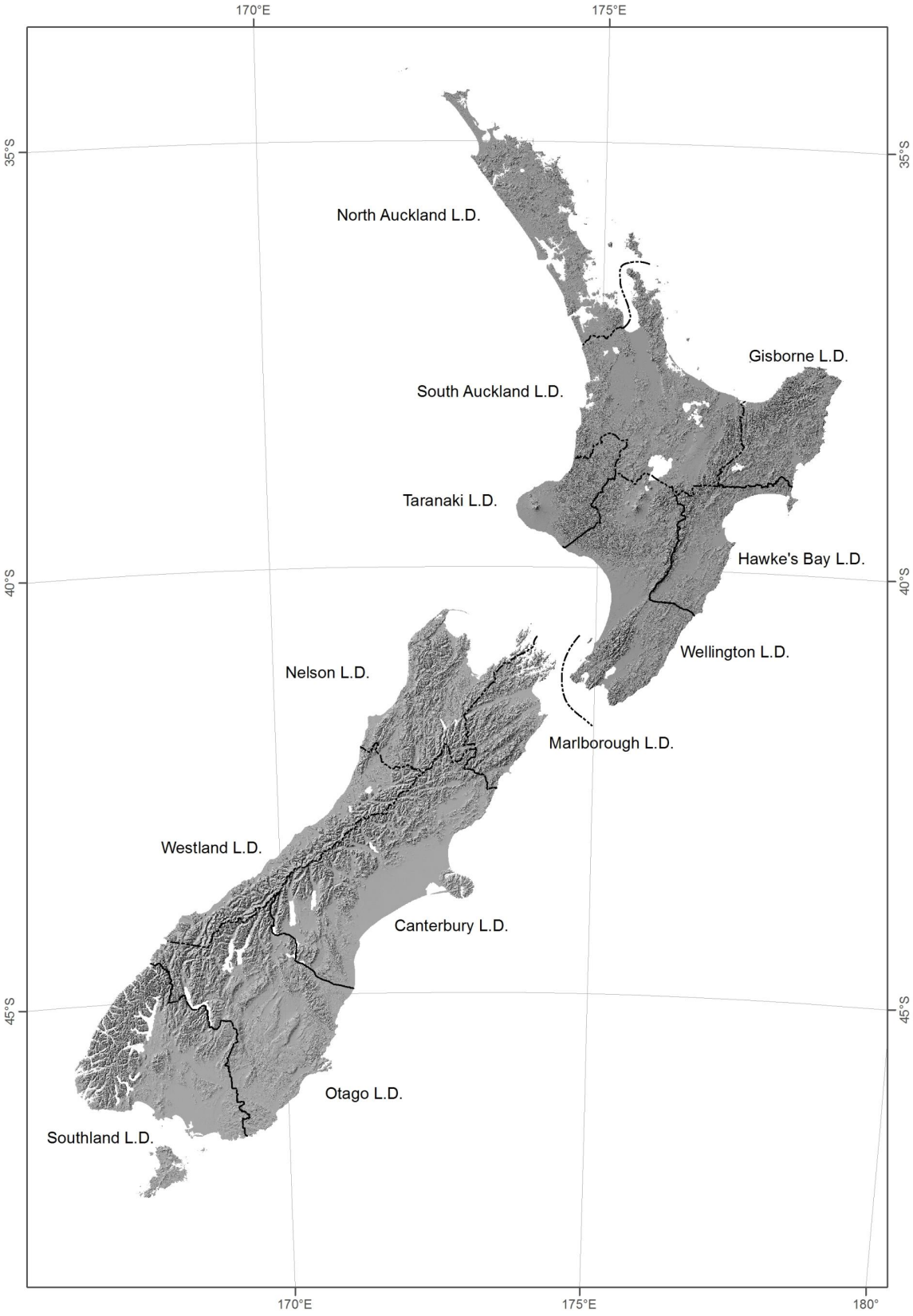


Plate 1: ***Cyrtopus*. A–I: *C. setosus***. A, habit. B, capsule. C, peristome detail. D, leaf. E, portion of shoot with capsules. F, portion of shoot, dry. G, leaf apex. H, upper laminal cells adjacent to margin. I, lower laminal cells from costa to margin. Drawn from *K.A. Ford D/28*, CHR 513683.



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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