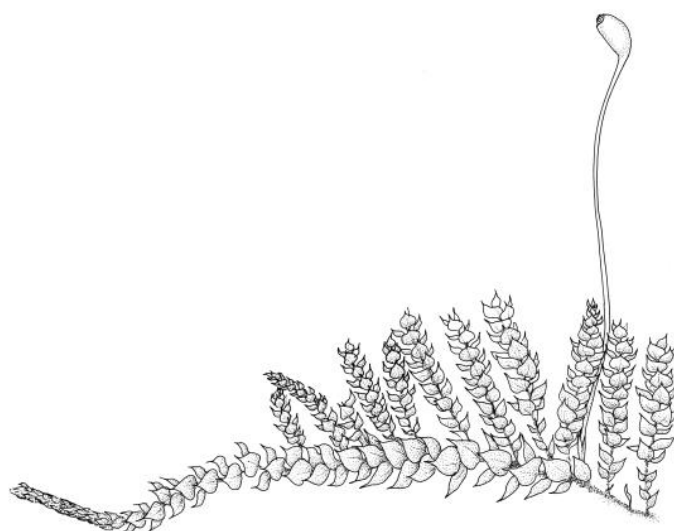




FLORA OF NEW ZEALAND

MOSSES

BRACHYTHECIACEAE



A.J. FIFE

Fascicle 46 – JUNE 2020

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Contents

Introduction.....	1
Typification.....	1
Taxa	
<i>Brachytheciaceae</i>	2
<i>Brachythecium</i> Schimp.	4
<i>Brachythecium albicans</i> (Hedw.) Schimp.	6
<i>Brachythecium campestre</i> (Müll.Hal.) Schimp.	7
<i>Brachythecium fontanum</i> Fife	9
<i>Brachythecium paradoxum</i> (Hook.f. & Wilson) A.Jaeger	9
<i>Brachythecium plumosum</i> (Hedw.) Schimp.	11
<i>Brachythecium rutabulum</i> (Hedw.) Schimp.	12
<i>Brachythecium salebrosum</i> (F.Weber & D.Mohr) Schimp.	13
<i>Brachythecium velutinum</i> (Hedw.) Schimp.	14
<i>Eriodon</i> Mont.	15
<i>Eriodon cylindritheca</i> (Dixon) Dixon & Sainsbury	16
<i>Eurhynchium</i> Schimp.	17
<i>Eurhynchium asperipes</i> (Mitt.) Dixon	19
<i>Eurhynchium praelongum</i> (Hedw.) Schimp.	20
<i>Eurhynchium pulchellum</i> (Hedw.) Jenn.	21
<i>Eurhynchium speciosum</i> (Brid.) Jur.	22
<i>Palamocladium</i> Müll.Hal.	23
<i>Palamocladium leskeoides</i> (Hook.) E.Britton	24
<i>Platyhypnidium</i> M.Fleisch.	25
<i>Platyhypnidium austrinum</i> (Hook.f. & Wilson) M.Fleisch.	26
<i>Pseudoscleropodium</i> (Limpr.) M.Fleisch.	27
<i>Pseudoscleropodium purum</i> (Hedw.) M.Fleisch.	27
<i>Rhynchostegium</i> Schimp.	29
<i>Rhynchostegium laxatum</i> (Mitt.) Paris	30
<i>Rhynchostegium muriculatum</i> (Hook.f. & Wilson) Reichardt	32
<i>Rhynchostegium tenuifolium</i> (Hedw.) Reichardt	33
<i>Scleropodium</i> Schimp.	34
<i>Scleropodium touretii</i> (Brid.) L.F.Koch	35
<i>Scorpiurium</i> Schimp.	36
<i>Scorpiurium cucullatum</i> (Mitt.) Hedenäs	36
References	38
Conventions	42
Acknowledgements	44
Plates	45
Maps	61
Index	63
Image Information	64

Introduction

The Brachytheciaceae are a large family of pleurocarps with a cosmopolitan distribution. Nine genera and 21 species are recognised in New Zealand, although several of the species and at least two of the genera are clearly adventive here. The Brachytheciaceae are placed in the order Hypnobryales (or Hypnales) in all influential 20th century classifications, but there is little consensus concerning the limits of many genera or, indeed, of the family itself. Consequently, both the family and the generic concepts presented here are traditional, and largely conform to concepts employed in recent Australian treatments.

The family representatives are predominantly terrestrial, often robust plants with leaves that have a strong, single costa, and mostly elongate smooth laminal cells. The capsules of the core genus, *Brachythecium*, are relatively stout, asymmetric, and mostly darkly coloured, with thick-walled exothecial cells, darkly coloured double peristomes, and mostly bluntly conic opercula. Scabrose setae occur in many species of *Brachythecium* and elsewhere in the family. Many of the genera placed in the family show these sporophytic features, but in others the capsules can be more elongate, the peristomes reduced in complexity, and opercula variable in form. Many taxa exhibit a marked dimorphism between the stem and branch leaves, and this feature is useful in their identification.

While some members are specific in their habitat requirements, many are “weedy” and catholic in this respect. *Brachythecium*, with several regionally weedy species, is sometimes considered to be among the most difficult of all moss genera to confidently identify, particularly when sporophytes are absent. Not all *Brachythecium* material can be adequately named regionally, and *Rhynchostegium*, while a smaller genus, poses comparable identification difficulties.

Typification

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

***Hypnum huttonii* Hampe ex Beckett, Trans. & Proc. New Zealand Inst. 25: 300 (1893).**

Lectotype (designated here): N.Z., Westland, Greymouth, *W.J. Gulliver s.n.*, CHR 585861!

Brachytheciaceae

Plants delicate to robust, forming loose wefts, compact mats, or erect turves, terrestrial, epiphytic, or epilithic. **Stems** creeping or ascending, loosely and irregularly to densely and pinnately branched, mostly with a central strand, the branches straight or sometimes curved. **Leaves** mostly crowded in several rows, occasionally complanate, those of stems and branches differentiated or not, mostly erect-spreading, less often imbricate or wide-spreading, occasionally secund, ovate to lanceolate and mostly acuminate, rarely broadly ovate and obtuse or rounded at apex, plicate, striolate or smooth, usually denticulate above at margins. **Laminal cells** linear to elongate-hexagonal or elongate-rhomboid, smooth or occasionally prorate, mostly shorter and often porose near insertion; **alar cells** \pm differentiated, often subquadrate, and often forming well-marked groups. **Costa** nearly always single, well developed but mostly ending below the leaf apex, often projecting as a terminal abaxial spine. **Paraphyllia** none. **Pseudoparaphyllia** present or not.

Sexuality various. **Perichaetial** leaves differentiated, sheathing or spreading. **Setae** elongate, often papillose by projecting cell ends; **capsules** inclined to horizontal, rarely erect, mostly asymmetric and relatively short, often broadly ovoid, occasionally ovoid-cylindric or cylindric, usually dark; **stomata** round, restricted to the capsule base; **annulus** differentiated or not; **operculum** bluntly conic to long-rostrate. **Peristome** double, mostly perfect; **exostome teeth** cross-striolate below, mostly dark yellow-brown; **endostome** mostly with a high basal membrane, keeled and perforate segments and well-developed nodose cilia, but sometimes cilia, segments, or membrane reduced. **Calyptra** cucullate, smooth or rarely sparsely hairy. **Spores** small, papillose to nearly smooth.

Taxonomy: The Brachytheciaceae are a large family of cosmopolitan distribution. Hedenäs (2002, quoting Walther 1983) estimated the family to include more than 30 genera and nearly 700 species worldwide; Brotherus (1925, p. 350) recognised 23 genera. Nine genera and 21 species are recognised as part of the N.Z. flora, although two genera and several species are clearly adventive here.

There is little consensus concerning either the family limits or infra-familial generic limits. For these reasons both the family concept and the generic concepts presented here are largely traditional ones. For the most part they conform to concepts employed by Hedenäs (2002) in his treatment of Australian representatives. However, I disagree with Hedenäs in respect to the status of the genus *Eriodon*, which is recognised here as a distinct genus because of its highly distinct peristome. Also, the genus *Palamocladium*, which occurs in N.Z., is not known from Australia.

Confusion can occur between the Brachytheciaceae and the often superficially similar members of the Amblystegiaceae. Buck (1998, p. 234) presented a brief but useful discussion of features he considered distinguished these two families.

The Brachytheciaceae are placed in the order Hypnobryales (Hypnales) in 20th century classification schemes, including the influential treatments of Brotherus (1925), Vitt (1984), and Goffinet et al. (2009).

Ignatov (1999) has examined the morphogenesis of pseudoparaphyllia in members of the Brachytheciaceae and the Meteoraceae and found that the pattern of development in these two families is "unique", and supported Buck's (1994) earlier hypothesis that several elements traditionally placed in the Meteoraceae are better placed within a broadly defined Brachytheciaceae. Ignatov & Huttunen (2002, p. 257) emphasised pseudoparaphyll morphogenesis in a selection of diagnostic characters for the family. According to them, the only morphological features that "consistently characterize(s) members of the Brachytheciaceae and at the same time excluding [sic] members of other families" are: the orientation and angle between the first-formed pseudoparaphyllia and the later-formed pseudoparaphyllia, the presence/absence of papillae above central laminal cell lumina, and the (round) shape of the stomatal pore.

Ignatov & Huttunen (2002) presented a phylogenetic consideration using both molecular and morphological data from the Brachytheciaceae, which largely confirms Buck's (1994) hypothesis. They proposed a new generic and subfamilial classification of the Brachytheciaceae, which treats 41 genera within four subfamilies; but the reliability of both their generic and higher-level (e.g. subfamily) taxonomic classification requires further assessment.

The overview of the family in Australia (Hedenäs 2002) is particularly useful for assessing N.Z. material; useful regional treatments of the family for other geographic areas include those of Buck (1998), Crum & Anderson (1981), Ignatov et al. (1999), Newton (1979), and Smith (2004).

1	Branches julaceous and terete; leaves imbricate, strongly concave, minutely reflexed at apex, and broadly oblong-ovate to nearly cochleariform.....	2
1'	Branches not julaceous (if terete the branch leaves widely spreading); leaves neither imbricate nor minutely reflexed at apex, mostly narrower.....	3
2	Plants loosely interwoven and ascendant; stem leaves mostly 1.5–2.1 × 1.0–1.5 mm; costae ½–¾ the leaf length, lacking a terminal spicule; branches not curved; common and weedy at lower elevations throughout, especially in roughly mown lawns, pastures, and roadside and track verges.....	<i>Pseudoscleropodium</i>
2'	Plants more compact and prostrate; stem leaves smaller, 1.0–1.6 × 0.6–0.8 mm; costae ¾–⅞ the leaf length, mostly with an inconspicuous abaxial terminal spicule; branches mostly distinctly curved; poorly known and documented only from the Wellington Botanical Gardens and Havelock North	<i>Scleropodium</i>
3	Leaves striolate to plicate, especially when dry.....	4
3'	Leaves not plicate, smooth or somewhat striolate when dry (if striolate then apical cells much shorter than mid laminal cells and plants ± aquatic).....	6
4	Dioicous , not known to fruit in N.Z.; plants often pendent; leaves straight, narrowly lanceolate from a subcordate base, 3.0–4.0 mm long; mostly restricted to limestone and marble, occasionally epiphytic, but never aquatic.....	<i>Palamocladium</i>
4'	Autoicous and frequently fruiting; plants not or rarely pendent, forming interwoven mats (if pendent, then plants aquatic); leaves broader (not narrowly lanceolate), nearly always <3.0 mm; on a range of substrates including soil, rotten wood, or bark and rock; sometimes aquatic.....	5
5	Plants aquatic; stem leaves neither differing in shape nor markedly larger than branch leaves, broadly ovate and broadly acute at apex, moderately homomallous, not falcate-secund; well-developed branch leaves mostly 1.0–1.3 mm wide.....	<i>Platyhypnidium</i>
5'	Plants terrestrial or occasionally epiphytic, not aquatic; stem leaves differentiated by shape and larger than branch leaves, ovate-lanceolate, falcate-secund to nearly circinate; well-developed branch leaves <0.5 mm wide.....	<i>Brachythecium</i> pro parte (<i>B. paradoxum</i>)
6	Plants extremely small; stem leaves c. 0.6–0.7 mm, broadly acute or obtuse; alar cells differentiated, quadrate, forming a large group extending nearly to the costa.....	<i>Scorpiurium</i>
6'	Plants larger; stem leaves when well developed >1 mm, acute or acuminate; alar cells variously differentiated but not extending nearly to the costa.....	7
7	Operculum conic or short rostrate.....	<i>Brachythecium</i>
7'	Operculum rostrate or long subulate.....	8
8	Capsules narrowly cylindric; endostome membrane short, with cilia lacking or rudimentary and linear, non-perforate segments; setae smooth, long and slender; usually epiphytic.....	<i>Eriodon</i>
8'	Capsules mostly broadly obovoid to short-cylindric, not narrowly cylindric; endostome membrane tall, with cilia well developed and wider, perforate segments; setae scabrous or smooth; terrestrial or epiphytic.....	9
9	Plants aquatic, robust; branch leaves usually striolate when dry, often ± secund when moist, broadly acute at apex; cells of the leaf apices markedly shorter than mid laminal cells.....	<i>Platyhypnidium</i>
9'	Plants not aquatic, small, moderate or robust in size; branch leaves neither plicate nor secund, acuminate at apex; cells of the leaf apices nearly the same length as mid laminal cells.....	10

10	Stem leaves either markedly decurrent or cordate....	<i>Eurhynchium</i> pro parte
10'	Stem leaves not or weakly decurrent, not cordate.....	11
11	Branch leaves broadly ovate to nearly elliptic; costa of branch leaves stout and nearly uniform in width throughout, mostly $\frac{3}{4}$ – $\frac{7}{8}$ the leaf length; spores mostly 18–21 μm ; northern in distribution....	<i>Eurhynchium</i> pro parte (<i>E. speciosum</i>)
11'	Branch leaves ovate-acuminate, ovate-lanceolate, or broadly ovate and acuminate, not elliptic; costa of branch leaves distinctly tapered, delicate, shorter (mostly $\frac{2}{3}$ the leaf length or less); spores smaller, mostly 12–15 μm ; widespread.....	<i>Rhynchostegium</i>

***Brachythecium* Schimp. in Bruch et al., *Bryol. Eur.* 6, 5 (1853)**

Type taxon: *Brachythecium rivulare* Schimp.

Plants slender to robust, forming loose or compact mats, or erect turves. **Stems** prostrate or ascending, irregularly to subpinnately branched, lacking paraphyllia, in cross-section with a central strand, lacking a hyaloderm (in N.Z. spp.). **Stem** and **branch leaves** usually somewhat differentiated, crowded, erect-spreading, sometimes homomallous to \pm falcate-secund, symmetric, usually little differentiated when dry, narrowly lanceolate to broadly ovate, acute to piliferous, usually plane, not bordered, serrulate or less commonly entire. **Costa** single, unbranched, extending half or more of the leaf, occasionally subpercurrent, with or without a terminal abaxial spine (or teeth). **Upper laminal cells** smooth, firm-walled, elongate, sometimes weakly porose; **basal cells** shorter and usually \pm porose; **alar cells** usually well differentiated, quadrate to inflated.

Sexuality variable. **Perichaetial leaves** mostly acuminate, becoming larger with age and/or with fertilisation, erect or widely squarrose-spreading. **Setae** elongate, straight or flexuose, scabrose or smooth, usually red-brown; **capsules** inclined to horizontal, rarely \pm erect, weakly asymmetric, oblong-ovoid and rather short, or rarely \pm cylindric, only slightly wrinkled when dry; **exothecial cells** variable in shape. **Annulus** usually differentiated; **operculum** conic, blunt or acute, rarely apiculate. **Exostome teeth** yellow-brown to dark brown, cross-striate below, bordered, trabeculate; **endostome** free, with a high basal membrane; **segments** well developed, keeled, perforate; **cilia** variable in number, well developed and nodose to appendiculate, rarely rudimentary. **Calyptra** cucullate, smooth. Spores small, smooth, or finely papillose.

Taxonomy: A large genus estimated to include more than 200 species (Hedenäs 2002). The genus is worldwide in distribution, with species concentrations in eastern Asia and North and South America; relatively few species occur in tropical regions. Eight species are recognised for N.Z.

Brachythecium is a highly diverse genus and it is presented here in a traditional (Brotherean) sense. The genus has often been divided into subgenera and sections, of which four and five, respectively, were treated by Brotherus (1925), but for the most part more recent authors have resisted raising these infra-generic groupings to generic rank. Smith (2004) applied five sections in his treatment of the 15 British species. Crum & Anderson (1981) suggest that the traditional view of *Brachythecium* is given meaning by having “short, asymmetric capsules, reddish peristomes, commonly roughened setae, and single costate, biplicate leaves”.

Hedenäs's (2012) review of the Australian species is founded (with contents virtually unchanged) on an earlier (2002) review, and treats five species occurring in N.Z. It also treats two northern hemisphere species that do not occur in N.Z., as well as the Australian endemic *B. latinervium* Hedenäs. Hedenäs (1996) compared the last to several species, including *B. fontanum* Fife, with which it will likely prove synonymous.

Both Smith's (2004) British flora and Crum & Anderson's (1981) eastern North American flora discuss five species that also occur in N.Z. Despite the modest number of species accepted in the present eFlora, Crum & Anderson's (1981) warning concerning the difficulty of the genus is valid in a N.Z. context and deserves repetition here: “This is one of the most difficult of all moss genera. Bryologists sometimes try too hard to name sterile material, even when the species are widespread and even weedy, as many of the *Brachythecia* are. The differences are often difficult to describe, and no keys work well. On a local-flora basis, sterile scraps can usually be named reasonably well, but there are species that resist taxonomic separation even in good and fertile condition.”

Etymology: The generic name refers to its short capsules (Gr. *brachy-* meaning short and Gr. *theca* meaning capsules).

1	Branch leaf margins entire or nearly so; stems very slender and terete when moist; stem leaves long decurrent, with a large group of small, firm-walled, \pm quadrate alar cells , which extend into a narrow but distinct decurrency (and mostly cohesive to the stripped leaves); very rarely fruiting in N.Z.....	<i>B. albicans</i>
1'	Branch leaf margins mostly serrulate to serrate above, sometimes to base; stems neither slender nor terete (except <i>B. fontanum</i> and sometimes weakly so in <i>B. campestre</i>); stem leaves decurrent or not, with alar cells various, often some \pm inflated, not forming a large group of small quadrate cells (except in <i>B. salebrosum</i> and <i>B. campestre</i> , but there the decurrency is inconspicuous and mostly not stripping with the leaves); sterile or fruiting.....	2
2	Plants fruiting.....	3
2'	Plants sterile (not always identifiable).....	9
3	Setae smooth throughout.....	4
3'	Setae scabrose, at least in upper portions (rarely smooth in <i>B. plumosum</i>).....	5
4	Leaves weakly to moderately concave, ovate-lanceolate, finely acuminate but not piliferous, markedly striolate; alar cells subquadrate and \pm incrassate.....	<i>B. salebrosum</i>
4'	Leaves strongly concave, ovate-oblong, abruptly tapered to a piliferous acumen, weakly or non-striolate; alar cells moderately enlarged.....	<i>B. fontanum</i>
5	Leaves conspicuously plicate.....	6
5'	Leaves striolate or smooth.....	7
6	Branch leaves markedly falcate-secund.....	<i>B. paradoxum</i>
6'	Branch leaves imbricate, erect-spreading, weakly or not secund, not falcate.....	<i>B. campestre</i>
7	Stem leaves more broadly ovate than branch leaves; branch leaves usually 2–3 mm; alar cells oblong, enlarged, those of stem leaves conspicuous and broadly decurrent.....	<i>B. rutabulum</i>
7'	Stem and branch leaves similar in shape; branch leaves less than 2.0 mm; alar cells subquadrate, not enlarged, few or numerous, not decurrent (in <i>B. plumosum</i>) or narrowly decurrent (in <i>B. velutinum</i>).....	8
8	Setae rough throughout; plants silky, with branch leaves \pm falcate-secund; upper costae mostly toothed at back; leaf tips usually somewhat twisted.....	<i>B. velutinum</i>
8'	Setae smooth below, rough above (rarely smooth throughout); plants not silky, with branch leaves imbricate, somewhat secund but not falcate; upper costae not toothed at back (but often with a terminal spine); leaf tips not twisted.....	<i>B. plumosum</i>
9	Stem leaves markedly striolate to plicate.....	10
9'	Stem leaves weakly striolate to smooth.....	11
10	Leaves falcate-secund, those of branches usually <1.5 mm; alar group small and composed of rather irregular cells.....	<i>B. paradoxum</i>
10'	Leaves erect-appressed to spreading, not or only weakly secund, never falcate, those of branches >1.8 mm; alar group moderate to large and composed of more regular, quadrate or subquadrate cells....	<i>B. campestre</i> or <i>B. salebrosum</i> (not distinguishable when sterile)
11	Leaves ovate-oblong, abruptly tapered to a piliferous acumen, strongly concave.....	<i>B. fontanum</i>
11'	Leaves ovate-lanceolate, not abruptly tapered and lacking a piliferous acumen, only moderately concave.....	12

-
- 12** **Stems** and **branch leaves** markedly differentiated; **stem leaves** usually greater than 2.0 mm; **alar cells** inflated, markedly decurrent in stem leaves..... *B. rutabulum*
- 12'** **Stem** and **branch leaves** not differentiated; **stem leaves** rarely exceeding 2.0 mm; **alar cells** not inflated, weakly or not decurrent..... 13
- 13** **Plants** small, not associated with moving water; **branch leaves** <1.5 mm long and <0.4 mm wide, somewhat twisted at apices; **stem leaves** weakly decurrent; **stem** and **branch leaves** ± falcate-secund, especially when dry, often twisted at apices *B. velutinum*
- 13'** **Plants** medium-sized, nearly always occurring near moving water; **branch leaves** usually 1.5–2.0 mm long and 0.6–0.8 mm wide; **stem leaves** not decurrent; **stem** and **branch leaves** neither falcate-secund nor twisted apically when dry..... *B. plumosum*

Excluded Taxa: *Brachythecium cymbifolium* Dixon & Sainsbury is treated here as a synonym of *Scleropodium touretii*.

Brachythecium subpilosum (Hook.f. & Wilson) A.Jaeger, a species based on a South American (Hermite I.) type, was included as a N.Z. species by Fife (1995), without citation of specimens. This report was founded on A.J. Fife 8340 from the St Arnaud Range (Nelson L.D.; CHR 459810). Further study shows this material is better referred to the relatively common *B. salebrosum*, and it is not discussed further here.

Brachythecium subpilosum var. *angustifolium* Allison and *B. allisonii* Fife are nomenclatural synonyms and both are based on material from Flagstaff Hill (Otago L.D., K.W. Allison 5723, CHR 379104). Further study suggests that this material is best referred to *B. campestre*, wherein it is discussed.

Brachythecium subplicatum sensu Sainsbury is considered here to be identical to *B. fontanum* Fife.

***Brachythecium albicans* (Hedw.) Schimp. in Bruch et al., *Bryol. Eur.* 6, 23 (1853)**

≡ *Hypnum albicans* Hedw., *Sp. Musc. Frond.* 251 (1801)

≡ *Chamberlainia albicans* (Hedw.) H.Rob., *Bryologist* 65: 112 (1962)

Lectotype: Europe, no further data, G. (Designated by Hedenäs 2002.) Not seen.

Plants medium-sized, often very slender, soft, yellow- or white-green, usually forming dense turves. **Stems** ascendant, less often creeping, irregularly branched, usually slender and elongate, pale green, to at least 90 mm long (commonly less than 45 mm), terete, in cross-section with a central strand and several layers of thick-walled cortical cells, very sparsely beset below with yellow-brown smooth rhizoids (in fascicles on abaxial side of leaf bases). **Branches** variable, 5–20(–35) mm long, terete or with leaves ± secund. **Stem leaves** imbricate and erect, ovate-lanceolate, slenderly acuminate, plicate both dry and moist, with margins plane throughout or weakly reflexed below, strongly concave, narrowly decurrent, entire or weakly denticulate near apex, (1.8–)2.0–2.6(–2.8) × c. 0.9 mm. **Branch leaves** smaller, c. (0.9–)1.3–1.8 mm, not decurrent, often somewhat secund, weakly plicate, with a smaller alar group. **Costa** (of stem leaves) c. 30–45 wide ($\frac{1}{3}$ above base), extending $\frac{1}{2}$ – $\frac{2}{3}$ the length of the leaf and ending below acumen base, lacking a terminal abaxial spine. **Upper laminal cells** (of stem leaves) smooth, firm-walled, linear, 42–60(–75) × 6–8 µm, gradually becoming shorter and broader near insertion; **alar cells** (of stem leaves) quadrate, short-rectangular, or oblate, firm-walled, forming a large but weakly differentiated group extending into the decurrency, c. 8–15 cells up the margin (excluding the decurrency), and reaching c. $\frac{1}{3}$ to the base of the costa.

Dioicous. **Perichaetial leaves** slenderly lanceolate-acuminate, not or very weakly costate, ± secund.

Perigonia gemmiform, scattered on stems, with bracts broadly ovate-lanceolate, weakly costate, widely spreading at apices, with filiform, 5–6-celled paraphyses and c. 12 antheridia. **Setae** 8–10 mm in N.Z. material, smooth, flexuose, mostly weakly dextrorse above, red-brown; **capsules** inclined, asymmetric, oblong-ovoid, c. 1.5 mm (excluding operculum), red-brown; **exothecial cells** oblate to shortly rectangular. **Operculum** bluntly conic. **Exostome teeth** and **endostome** not clearly seen in N.Z. material. **Spores** c. 12–14 µm.

Illustrations: Plate 1. Crum & Anderson 1981, fig. 509; Hedenäs 2002, fig. 2 d–e; Meagher & Fuhrer 2003, pp. 50–51; Smith 2004, fig. 273, 1–5.

Distribution: NI: N Auckland, S Auckland, Gisborne (Waioeka Gorge), Hawke's Bay, Taranaki, Wellington; SI: Nelson, Marlborough, Canterbury, Otago, Southland.

Adventive. Tasmania*, mainland Australia*. Widespread in the northern hemisphere, including Europe* and North America*.

Habitat: A very weedy species occurring in a wide range of modified habitats. Very often among grasses, often in lawns (either roughly or closely mown), less often in native scrub or open areas in forests, especially at road or track margins; occurring in both dry and moist situations. Sometimes occurring on or adjacent to concrete or even asphalt, in dune slacks, and waste areas. Rarely on tree (*Sophora*, *Salix*) bases and even waterlogged peat. Ranging from near sea level (Mayor I., S. Auckland L.D.) to c. 1100 m (Mt Taranaki, Taranaki L.D.) on the North I. and from sea level (Christchurch) to at least 950 m (near Beaumont in Blue Mountains, Otago L.D.) on the South I. *Breutelia affinis*, *Ceratodon purpureus*, *Eurhynchium praelongum*, *Pseudoscleropodium purum*, *Syntrichia antarctica*, *Thuidiopsis furfurosa*, and *Triquetrella triquetra* are frequently associated moss species.

Notes: An early, and possibly the first N.Z., collection of this species was made by V.D. Zotov in 1931 at Palmerston North (Wellington L.D.). The species is nearly always sterile in N.Z. and the only fruiting N.Z. collection appears to be from Wanaka (Otago L.D., *P. Beveridge* AT-28, WELT M036343).

Recognition: The slender, terete habit and its frequent presence among mown grasses are often sufficient to differentiate this species from its congeners. Slenderly acuminate leaves with entire margins and a large group of decurrent quadrate alar cells are microscopic features providing distinction. Smith (2004, p. 820) succinctly describes this species in Britain as “readily recognized in the field by the pale silky patches and string-like shoots with imbricate plicate leaves”.

Confusion can occur between the present species and some forms of *B. salebrosum*. The present species is dioicous and rarely fruiting, while *B. salebrosum* is autoicous and often fruiting.

Brachythecium albicans is a less branched plant with distinctly terete stems and branches, entire leaves, and a proportionally larger alar group of firm-walled and quadrate, shortly-rectangular or oblate cells. The decurrency usually coheres to the leaf base when leaves are stripped from the stem, in contrast to *B. salebrosum*.

Confusion sometimes also occurs with *Ischyrodon lepturus* (Fabroniaceae), which is a coastal species in N.Z. In the non-coastal *B. albicans* the plants are more ascendant, the stem leaves are clearly decurrent, and the alar cells extend only c. 1/3 to the base of the costa (while in *I. lepturus* the alar cells extend over the adaxial surface of the costa base). Other differences are detailed under *I. lepturus*.

Etymology: The epithet *albicans* means becoming white, and is derived from a polynomial used by a pre-Hedwigian author (probably Dillenius).

***Brachythecium campestre* (Müll.Hal.) Schimp. in Bruch et al., *Bryol. Eur.* 6, 16 (1853)**

≡ *Hypnum rutabulum* var. *campestre* Müll.Hal., *Syn. Musc. Frond.* 2, 368 (1851)

Type: Europe. Not seen.

= *Brachythecium subpilosum* var. *angustifolium* Allison, *Trans. Roy. Soc. New Zealand* 88: 9 (1960)

≡ *Brachythecium allisonii* Fife, *Bryologist* 98: 315 (1995)

Holotype: N.Z., southern base of Flagstaff Hill, Dunedin, *K.W. Allison* 5723, 9 May 1955, CHR 379104! Isotype: BM!

Plants medium-sized, rather soft, yellow-green, forming loose mats. **Stems** apparently ascendant, irregularly branched, yellow- to pale brown, to at least 75 mm long, in cross-section with 3–4 layers of thick-walled cortical cells and a distinct central strand, beset below with brown, smooth rhizoids (in fascicles on abaxial side of leaf bases). **Branches** variable in length, weakly terete. **Stem leaves** erect-spreading to weakly secund, symmetric, strongly plicate (with several pleats extending 3/4 or more the leaf length), scarcely altered when dry, ovate-lanceolate to lanceolate from a weakly auriculate base, evenly tapered to a narrowly acuminate apex, not or irregularly and weakly recurved at margins, weakly concave, not or slightly decurrent (decurrencies not visible under stereoscope), often strongly and sharply serrulate near apex, sometimes serrulate nearly to base, or occasionally entire or nearly so, 2.5–3.3 × 1.0–1.2 mm. **Branch leaves** somewhat smaller, strongly plicate, variably serrulate (mostly strongly and sharply serrulate but sometimes only finely serrulate at apices, with serrulations extending to base, or occasionally entire throughout, often with a few strong teeth at leaf base), often ± twisted at apices, (1.8–)2.1–2.5(3.0) × 0.5–0.8 mm. **Costa** (of branch leaves) c. 25–30 µm wide (1/3 above base), often obscured by plications, extending 2/3–3/4 the length of the leaf, with or without a terminal spine. **Upper laminal cells** (of branch leaves) smooth, firm-walled, linear, 75–120 × 5–8 µm; **basal cells** shorter, wider and porose in c. 3–5 rows, not pigmented; **alar cells**

neither inflated nor pigmented, firm-walled, subquadrate to \pm oblong, forming a moderate-sized but ill-defined group (c. 4–8 cells along margin and reaching c. $\frac{1}{3}$ to costa), sometimes with a few sharp marginal teeth.

Autoicous. Perichaetia scattered on stems, apparently enlarging after fertilisation; **perichaetial leaves** with an oblong base and quickly contracted to an acuminate apex, ecostate, entire, patent above, sheathing the lower seta. **Perigonia** ovoid, scattered on main stems, with ecostate, obovate-cuspidate bracts less than 1 mm long surrounding filiform, 6–7-celled paraphyses and c. 8 antheridia. **Setae** 15–25 mm, scabrose and weakly sinistrorse throughout, yellow-brown; **capsules** inclined to horizontal, asymmetric, oblong-ovoid, c. 1.7–2.0 mm (excluding operculum), pale or dark brown; **exothecial cells** mostly oblong, c. 40 μ m; **annulus** not seen; **operculum** conic. **Exostome teeth** lanceolate; **endostome** with perforate segments and paired or single, nodose **cilia**, mostly c. $\frac{1}{2}$ or more the height of the segments. **Calyptra** cucullate. **Spores** 15–24 μ m, smooth or nearly so.

Illustrations: Plates 1, 2. Crum & Anderson 1981, fig. 515.

Distribution: SI: Canterbury (Craigieburn Range), Otago (Flagstaff Hill in Dunedin, Mt Alfred).

Bipolar but possibly adventive in N.Z. Scattered but widely distributed in the northern hemisphere.

Habitat: Known confidently from only three localities from which the collections are both ample and fertile. The earliest example, from Mt Alfred (CHR 472215A) was collected in Jan. 1892 by W. Bell from “grass crevices of rock” at an elevation of c. 340 m and determined soon afterwards by V.F. Brotherus. The Dunedin material was collected by K.W. Allison (CHR 379104) in 1955 from “on rotten log and on earth” from a “small open space” in a pine plantation at the “southern base” of Flagstaff Hill. The collection was probably made at an elevation of between 400 and 600 m. A second collection, lacking capsules but bearing scabrose setae, was made by K.W. Allison approximately two years after his first from “near the original finding” [at Flagstaff Hill]. He created the name *Brachythecium subpilosum* var. *angustifolium* to accommodate this material. A third collection referred here is from a much higher elevation, c. 1600 m at Mt Olympus in the Craigieburn Range, *B.H. Macmillan* 75/16 (CHR 229620). The leaves here are less strongly toothed (serrulate only in branch leaves but extending more or less to insertion), but otherwise match other N.Z. collections well. Only one detached seta with capsule and one attached but fragmented seta are present, but these are both scabrose. The collection from soil was gathered in a *Chionochloa pallens*–*Celmisia* grassland. One of the Flagstaff collections is mixed with *Calliergonella cuspidata*, *Distichophyllum pulchellum*, and *Ptychomnion aciculare*.

Notes: There are a small number of scant, often sterile, and mostly poorly documented collections in CHR named by various workers as close to or possibly *B. campestre*. None can be named with confidence and they are not discussed further here.

Neither Dixon (1929) nor Sainsbury (1955) discussed this species for N.Z., although Fife (1995) included it as a N.Z. species, without the citation of specimens, while simultaneously creating the name *B. allisonii* for material from Flagstaff Hill.

Crum & Anderson (1981, p. 1050) reviewed the opinions of various American and European workers concerning the status of this species and expressed the view that *B. campestre* is “troublesome and cannot be considered a species of the first rank”. This rather nebulous but succinct view applies to N.Z. material as much as it does to the North American.

This is a confusing taxon in a difficult genus. While, in a regional context, an argument could be made to treat the few ample collections as merely aberrant *B. salebrosum*, to do so would confuse the concept of that species, which has smooth setae. Such an argument would also ignore or counter efforts made by many authors to account for similar collections from other regions. Recognition of *B. campestre* as a rarely collected (or rarely recognised) N.Z. species is the most practical solution available. It is not clear whether this should be considered a native or an adventive species.

Recognition: Ample and fruiting material is required for confident identification. The scabrose setae in *B. campestre* is the most reliable feature to distinguish it from the more common and similar *B. salebrosum*, which has a smooth seta. The larger stem leaves and the sometimes strongly and sharply serrulate nature of both the stem and branch leaves help to corroborate the distinction. The alar group here tends to be smaller and their component cells less quadrate when compared to *B. salebrosum*.

Etymology: The epithet *campestre* refers to plains or flat areas.

***Brachythecium fontanum* Fife, *New Zealand J. Bot.* 28: 126 (1990)**

Holotype: N.Z., Canterbury, valley of Broad Stream, above Cora Lynn Station, 20 Apr. 1989, A.J. Fife 9251, CHR 461262! Isotypes: BA, MICH, NSW, NY, WELT.

Misapplications: *Brachythecium subplicatum sensu* Sainsbury 1955

Plants robust, soft, bright yellowish-green, shiny, stoloniferous, forming loose, emergent turves. **Stems** stoloniferous below, with terminal portions erect-ascendant, simple or irregularly branched and often giving rise to elongate, ascendant branches below, green, to 200 mm long, julaceous, in cross-section with a distinct central strand and with 3–5 layers of thick-walled cortical cells, with rhizoids absent or nearly so. **Branches** variable in length, to 90 mm, terete when moist. **Stem leaves** imbricate, erect-spreading, little altering and weakly striolate when dry, ovate-oblong, abruptly tapered from a rounded apex to a long (525–725 µm), piliferous, denticulate or entire acumen, with margins plane or somewhat inrolled, strongly concave, decurrent, entire below, usually denticulate above and often with a few large teeth just below the base of the acumen, (2.5–)2.8–3.1 × (1.3–)1.5(–1.7) mm (including acumen). **Branch leaves** smaller, to c. 2.5 mm long, but otherwise similar. **Costa** rather weak, c. 30–45 µm wide (1/3 above base), extending 2/3–3/4 the length of the leaf (excluding the acumen), lacking a terminal spine. **Upper laminal cells** smooth, firm-walled, linear, (60–)80–100(–120) × c. 7–8 µm; **basal cells** shorter, broader, and porose; **alar cells** ± oblong, moderately enlarged to form a weakly defined, decurrent, non-auriculate group, with a single row of 6–8 shortly rectangular cells often at alar margins.

Autoicous, with inflorescences scattered on stems. **Perichaetial leaves** oblong to ovate-lanceolate, ecostate, becoming patent above. **Perigonia** gemmiform, c. 1.5 mm long, with bracts ovate-acuminate, ecostate, and erect, enclosing filiform, 4–5-celled paraphyses. **Setae** (14–)18–26 mm, smooth, weakly sinistorse above, red-brown; **capsules** ± horizontal, curved, oblong-obovoid, c. 2.6 mm, dark yellow-brown; **exothecial cells** mostly oblong, (30–)36–45(–51) µm long. **Annulus** not seen; **operculum** short conic. **Exostome teeth** lanceolate; **endostome** with well-developed, nodose, paired **cilia**. **Spores** green, 18–22 µm diam., nearly smooth.

Illustrations: Plate 3. Fife 1990, figs. 1–2.

Distribution: SI: Nelson, Marlborough (Branch River), Canterbury, Westland, Otago, Southland. Endemic. The absence of records of this species from both the North I. and other cool regions of Australasia is surprising. *Brachythecium latinervium* Hedenäs of mainland Australia may prove to be conspecific, but no material of it has been seen.

Habitat: On water-logged muck or floating in pools associated with montane to subalpine springs, seeps, and stream margins. Usually forming emergent loose turves and sometimes also occurring in waterlogged herb/bryophyte mats in waterfall spray zones. Ranging from 530 m (Eyre Mountains, Southland L.D.) to at least 1680 m (Branch River, Marlborough L.D.). *Brachythecium rutabulum*, *Breutelia pendula*, *Cratoneuropsis relaxa*, *Philonotis pyriformis*, and *Marchantia berteriana* are often associated.

Recognition: In a regional context, this is an unmistakable species characterised by ovate-oblong and non-plicate leaves abruptly tapered to a long piliferous apex; its semi-aquatic habitat provides further distinction. It is probably most closely allied to *B. rutabulum*.

Brachythecium fontanum exhibits similarities to *B. subplicatum* (Hampe) A.Jaeger from the Falkland Is, South Georgia, and magellanic regions of South America, but differs from that species by having more weakly differentiated and non-auriculate alar groups and by being more piliferous, as well as by its geographic distribution.

Etymology: The species epithet *fontanum* refers to an association with springs.

***Brachythecium paradoxum* (Hook.f. & Wilson) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1876–1877: 339 (1878)**

≡ *Hypnum paradoxum* Hook.f. & Wilson, *London J. Bot.* 3: 554 (1844)

Lectotype: Hermite Island, Cape Horn, *J.D. Hooker* 169, Herb. Hook., BM 000851301! (Designated by Hedenäs 1996.)

Plants medium-sized, soft to wiry, yellow- to brown-green, forming loosely to densely interwoven mats. **Stems** prostrate, ± pinnately branched, yellow-brown, variable in length, to at least 90 mm long, in cross-section with a central strand and 3–4 layers of thick-walled cortical cells, beset below with

pale brown, smooth rhizoids. **Branches** variable in length, 3–17 mm long, with leaves falcate-secund. **Stem leaves** \pm falcate-secund, symmetric, plicate, with pleats visible under the stereoscope and extending $\frac{2}{3}$ or more the leaf length, scarcely altered when dry, ovate-lanceolate, acuminate, plane or weakly recurved below, not concave, not decurrent, denticulate (sometimes strongly or rarely weakly) above or nearly to insertion, $2.0\text{--}3.0 \times c. 0.5$ mm. **Branch leaves** smaller, $1.0\text{--}1.5(2.0)$ mm long, strongly falcate-secund to nearly circinate, finely to coarsely denticulate above or to insertion, recurved at margins. **Costa** c. $30\text{ }\mu\text{m}$ wide ($\frac{1}{3}$ above base), extending c. $\frac{2}{3}$ the length of the leaf, ending in a stout abaxial spine. **Upper laminal cells** smooth, firm-walled, linear, $60\text{--}105 \times 6\text{--}8\text{ }\mu\text{m}$; **basal cells** shorter in c. 3 rows; **alar cells** thick-walled, irregularly quadrate to short-rectangular, forming a small, poorly defined group.

Autoicous. Perichaetia lateral on stems; **perichaetial leaves** acuminate from an oblong base, ecostate, widely spreading to squarrose above. **Perigonia** gemmiform, c. 1 mm long, scattered on stems, with ecostate, oblong-acuminate bracts and filiform (c. 7-celled) paraphyses. **Setae** 10–22 mm, papillose throughout, weakly sinistrorse, red-brown; **capsules** inclined to horizontal, asymmetric, oblong-ovoid, c. $2.0\text{--}2.8$ mm long (excluding operculum), yellow- to dark brown; **exothecial cells** oblate to shortly rectangular. **Annulus** of 2–3 rows of cells; **operculum** bluntly conic. **Exostome teeth** lanceolate; **endostome** with well-developed, usually paired, and nodose cilia. **Calyptra** c. 2.5 mm long, sometimes finely pilose at base. **Spores** $(12\text{--})15\text{--}21\text{ }\mu\text{m}$, finely papillose.

Illustrations: Plate 4. Brotherus 1925, fig. 688; Malcolm & Malcolm 2003, p. 6; Meagher & Fuhrer 2003, pp. 52–53.

Distribution: NI: S Auckland (Maungapōhatu, several locations near Taupō), Gisborne (Lake Waikaremoana), Hawke's Bay (Titiokura), Taranaki (Mt Egmont), Wellington; SI: Nelson, Marlborough (Inland Kaikōura Range), Canterbury, Westland (Ōtira), Otago, Southland.

Austral. Tasmania*, mainland Australia*, southern South America*, Kerguelen*, Crozet Is*, Marion I.* Reported from southern Africa by Hedenäs (2002), although this report might be based on an earlier record from "Afr. 4" by van der Wijk et al. (1959, p. 216) that was almost certainly founded on records from Kerguelen.

Habitat: This is a versatile species that can occur on soil, rock, duff, rotten wood, or rarely on bark, in a wide range of vegetation types, including *Fuscospora solandri* and broad-leaved forests, mānuka scrub, tussock grasslands, and alpine vegetation. It mostly avoids moist situations and rarely occurs as an epiphyte. It can grow on a variety of rock types, including greywacke, limestone, and basalt. The bulk of records are from the South I. east of the Main Divide, but the species is also particularly common on the higher-elevation limestone/marble in Nelson L.D. Known from 610 (Ōhakune, Wellington L.D.) to at least 1600 m (Wilkes Pool Gorge, Mt Egmont, Taranaki L.D.) on the North I. On the South I. ranging from c. 300 (Mt Thomas, Canterbury L.D.) to at least 2300 m (Inland Kaikōura Range, Marlborough L.D.), although collections from below 600 m are few in number. *Cladomnion ericoides*, *Ditrichum* spp., *Hylocomium splendens*, *Leptotheca gaudichaudii*, *Palamocladium leskeoides*, *Pohlia cruda*, *Rosulabryum billardierei*, and *Tortella knightii* are frequent associates.

Recognition: The species most easily confused with *B. paradoxum* is *B. velutinum*, and some collections from mid elevations on the South I. are troublesome. In *B. paradoxum* the plicate nature of both branch and stem leaves is apparent under the stereoscope and the leaves are generally less strongly serrulate, particularly in their upper portions, and more strongly circinate than the leaves of *B. velutinum*. *Brachythecium paradoxum* is usually a golden or brown-green colour while *B. velutinum* is a yellow- to bright green plant. The branch leaf margins are more obviously recurved in *B. paradoxum* than in *B. velutinum*. The elevational range of the two species overlaps, but *B. paradoxum* is generally a higher-elevation species (c. 300 to at least 2300 m, vs near sea level to c. 700 m on the South I.).

Confusion also occurs with *Sanionia uncinatus* of the Amblystegiaceae. The alar cells of *B. paradoxum* are small and thick-walled, even in the extreme alar angles, while in *S. uncinatus* there are a few thin-walled and inflated cells in the extreme angles. A stem cross-section shows *Brachythecium* to lack a hyaloderm, while *S. uncinatus* has a hyaline cortical layer, with cortical cells that often adhere to stripped-off leaves. Plants of *B. paradoxum* are generally less robust and have leaves that are shorter ($1.0\text{--}1.5$ mm vs generally ≥ 2.0 mm) and more strongly toothed than the leaves of *S. uncinatus*.

Finally, *B. paradoxum* is sometimes confused with *Austrohondaella limata*. The presence of a strong single costa and papillose seta will distinguish *B. paradoxum*. The denticulate margins, differentiated alar cells and generally larger leaves also serve to differentiate the present species.

Etymology: The epithet apparently refers to difficulty that Wilson and Hooker had in separating this species from *Hypnum (Drepanocladus) aduncum*.

***Brachythecium plumosum* (Hedw.) Schimp. in Bruch et al., *Bryol. Eur.* 6, 8 (1853)**

≡ *Hypnum plumosum* Hedw., *Sp. Musc. Frond.* 257 (1801)

Conserved type: Austria, Ost-Steiermark, bei Hartberg, J. Baumgartner, Feb. 1943, S accession number B125673 (Image viewed online, JSTOR Global Plants, accessed 17 May 2018.)

Plants medium-sized, yellow-, brown-, or bright green, forming adherent mats on streamside rocks. **Stems** prostrate, irregularly branched, green, to 30(–45) mm long, in cross-section with a distinct central strand and several layers of thick-walled cortical cells, with scattered tufts of yellow-brown, smooth rhizoids. **Branches** 5–15(–22) mm long. **Stem** and **branch leaves** not differentiated, crowded, homomallous or erect-spreading, symmetric, scarcely altered and smooth or weakly striolate when dry, ovate-lanceolate, acuminate, plane at margins, concave, not or scarcely decurrent, serrulate above or nearly to base, 1.5–2.0 × 0.6–0.8 mm. **Costa** c. 30–40 µm wide near base, to c. ⅔ the leaf length, usually projecting terminally as an inconspicuous abaxial spine. **Upper laminal cells** smooth, firm-walled, vermicular, (50–)60–75(–85) µm long, becoming longer in lower leaf; **basal cells** shorter and ± porose; **alar cells** subquadrate or short oblong, thick-walled, forming a moderately differentiated group that extends c. 8–12 cells up the margin and c. ½ to the costa base in stem leaves (usually smaller in branch leaves).

Autoicous. Perichaetia lateral on main stems; **perichaetial leaves** acuminate from an oblong base, ecostate, widely spreading to squarrose. **Perigonia** gemmiform, c. 1.5 mm long, scattered on main stems, with ecostate, oblong-acuminate bracts and filiform (c. 7-celled) paraphyses. **Setae** 10–18 mm, scabrose above and smooth below, or rarely smooth throughout, c. 210 µm diam., weakly sinistorse, yellow-brown; **capsules** inclined to horizontal, asymmetric, oblong-ovoid, 1.5–2 mm long (excluding operculum), yellow- to dark brown; **exothecial cells** irregular in shape and size. **Annulus** weakly differentiated, of 2–3 cell rows; **operculum** conic, acute or shortly rostrate at apex. **Exostome teeth** lanceolate; **endostome** with cilia well-developed, in groups of 1–3, and appendiculate. **Calyptra** c. 2 mm long. **Spores** c. 12–18 µm, nearly smooth.

Illustrations: Plate 3. Crum & Anderson 1981, fig. 506; Beever et al. 1992, fig. 78 h; Hedenäs 2002, fig. 2 j–k; Smith 2004, fig. 278, 11–15.

Distribution: NI: N Auckland, S Auckland, Gisborne, Hawke's Bay (Kaweka Range) Wellington; SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland, A.

Nearly cosmopolitan.

Habitat: On non-calcareous rocks in stream beds, less commonly at lake margins, occasionally away from moving water, and sometimes on sandy soil, tree bases, logs, or rock faces. Occasionally occurring as an epiphyte in humid subalpine areas. Ranging from near sea level to at least 1280 m (Kaweka Range, Hawke's Bay L.D.) on the North I. and from near sea level (Pelorus Bridge Scenic Reserve, Marlborough L.D.) to at least 1600 m (St Arnaud Range, Nelson L.D.) on the South I.

Recognition: The combination of smooth or only weakly striolate leaves, branch leaves scarcely differentiated in shape from stem leaves, lack of twisted leaf apices, setae that are scabrose above and smooth below, and a strong preference for non-calcareous rocks near moving water generally make this species easily recognisable. This habitat is similar to that of *Sematophyllum jolliffii*, but the ovate-lanceolate and acuminate leaves of *B. plumosum* serve to distinguish it from that species. *Sematophyllum jolliffii* has elliptic and broadly acute leaves. Coloration helps distinguish them in the field, and *S. jolliffii* has cuspidate and moderately flattened branch apices; both species have variably scabrose setae. There is no other species with which *B. plumosum* is likely to be confused.

Etymology: The epithet *plumosum* means feathery, but it does not seem appropriate for the plant; it was derived from a polynomial used by Dillenius.

***Brachythecium rutabulum* (Hedw.) Schimp. in Bruch et al., *Bryol. Eur.* 6, 15 (1853)**

≡ *Hypnum rutabulum* Hedw., *Sp. Musc. Frond.* 276 (1801)

Lectotype: Europe, herb. Hedwig-Schwägrichen, G. (Designated by Hedenäs 2002.) Not seen.

Plants medium-sized or robust, coarse, yellow-green or bright green, forming loose and untidy mats. **Stems** prostrate to ascendant and self-supporting, usually arching, irregularly but much branched, pale green to brown, to at least 80 mm long, in cross-section round or elliptic, with a distinct central strand and 3–4 layers of thick-walled cortical cells, with fascicles of pale brown, smooth rhizoids arising from abaxial side of leaf bases. **Branches** variable in length, commonly 5–20 mm long, with leaves slightly complanate, spreading. **Stem leaves** spreading, symmetric, not or only weakly plicate, scarcely altered when dry, ovate, acuminate, sometimes twisted at apices, plane, scarcely concave, decurrent, serrulate nearly to base, less often only above, with a large alar group, (2.0–)2.5–3 mm × c. 1 mm. **Branch leaves** smaller and narrower, 1.5–2.5 mm, slightly plicate when dry, with a smaller alar group, not or only weakly decurrent. **Costa** c. 30 µm wide ($\frac{1}{3}$ above insertion), extending c. $\frac{1}{2}$ – $\frac{2}{3}$ the length of the leaf, ± evenly tapered throughout, lacking a terminal spine. **Upper laminal cells** smooth, rather thin-walled, linear, c. 100–150 × 9 µm, **basal cells** shorter in 3–5 rows; **alar cells** (of stem leaves) in a large but ill-defined group that extends c. $\frac{2}{3}$ from the margin to the costa and into the decurrency, inflated and rather thin-walled, oblong.

Autoicous or **polygamous**. **Perichaetia** scattered on stems, apparently enlarging after fertilisation; **perichaetial leaves** acuminate from an oblong base, ecostate, erect-spreading to squarrose. **Perigonia** ovoid, scattered on lower portion of stems, with ecostate, ovate, shortly acuminate, sometimes ± spreading bracts and filiform (7–9-celled) paraphyses. **Setae** (15–)20–30(–40) mm, scabrose throughout, weakly sinistrorse throughout, red-brown; **capsules** ± horizontal, asymmetric, curved, oblong-ovoid, c. 2.5–3.0 mm long (excluding operculum), dark yellow-brown; **exothecial cells** ± oblong, (24–)30–60(–75) µm, thick-walled. **Annulus** of 2–3 cell rows, falling with the operculum; **operculum** conic, acute and nearly black at apex. **Exostome teeth** lanceolate; **endostome** with well-developed nodose **cilia** in groups of 2–3. **Calyptra** c. 3 mm long. **Spores** 12–18 µm, finely papillose.

Illustrations: Plate 5. Scott & Stone 1976, pl. 83; Crum & Anderson 1981, fig. 516; Hedenäs 2002, fig. 5 c–d; Meagher & Fuhrer 2003, p. 52–53; Seppelt 2004, fig. 32.

Distribution: NI: N Auckland, including offshore islands (HC, LB, GB), S Auckland, Gisborne, Hawke's Bay, Taranaki (near Ohura, Awakino Scenic Reserve), Wellington; SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland; St; Ch; A; C; M.

More or less bipolar, but with a few scattered tropical localities. Tasmania*, mainland Australia*, North America*, Europe*, Asia. Reported by Crum & Anderson (1981) from Macaronesia, North Africa, Hawai'i, Guatemala.

Habitat: Weedy and occupying a wide range of substrates, including duff, humus, peat, sand, rocks (including limestone and concrete), and rotten logs in a wide range of vegetation types, including southern beech or mixed podocarp forest, exotic plantations, riparian *Salix* forest, scrub, and both native and modified grassland. Often in moist or even waterlogged situations such as seeps or stream/river margins, and shade tolerant. Only rarely epiphytic (and then probably subject to flooding). On the North I. occurring from near sea level to at least 740 m (Erua, Wellington L.D.), and on the South I. occurring from near sea level (several localities) to at least 1675 m (Pisa Range, Otago L.D.) elevation.

Notes: *Brachythecium rutabulum* is both weedy and highly variable, ranging from compact, stunted forms with stems less than 20 mm, to robust, openly branched forms with stems in excess of 80 mm. The latter are more representative. In compact forms, which are usually associated with drier situations, the stem leaves can be quite crowded and their decurrencies less conspicuous than normal. Microscopic features, especially the enlarged and oblong alar cells, however, are diagnostic even in these plants. The distinctly dimorphic, non-plicate leaves, decurrent stem leaves, and well-differentiated alar cells usually create a gestalt that permits recognition of this weedy species despite its variability.

Smith (2004) described this species in Britain as “a fast-growing species, especially of damp woodland in base-rich situations” and considered it to be “rare or absent on acidic nutrient-poor substrates.” Both he and Crum & Anderson (1981) reported a wide range of haploid chromosome numbers from different parts of its wide range.

Brachythecium rutabulum often grows at stream margins and sometimes occurs as an emergent in small, swift streams. Such material invites comparison, if only by virtue of its habitat, to *B. rivulare*, a northern hemisphere species that has been recorded from both Tasmania and mainland Australia (Hedenäs 2002). No N.Z. material is accepted as *B. rivulare*. The aquatic forms noted above have stem and branch leaves serrulate ± to their base, a tendency for leaf apices to become twisted when dry, and generally less strongly differentiated alar cells than those occurring in *B. rivulare*.

Dixon (1929, p. 322) recorded what he termed “*B. rutabulum* var. *robustum* Bryol. Eur.” from the Mt Cook district, citing a collection by J. Murray. Dixon’s record presumably formed the basis of the N.Z. citation for this taxon in van der Wijk et al. (1959). The Murray specimen has not been examined. Dixon’s differentia for this alleged variety (quoted by Sainsbury 1955) do not agree with those given by Limpricht (1903, p. 109). Many infra-specific taxa recognised by earlier workers within *B. rutabulum*, including this one, no longer enjoy wide acceptance (e.g., Corley et al. 1981; Smith 2004) in European literature. For these reasons, plus the variability of *B. rutabulum* in N.Z., the so-called var. *robustum* is not discussed further.

Recognition: Sterile *B. rutabulum* is sometimes confused with *Rhynchostegium tenuifolium*.

Brachythecium rutabulum is a more robust species, with larger leaves (stem leaves c. 2.5–3.0 vs c. 1.6–2.0 long), differentiated alar cells, and decurrent stem leaves. Numerous sporophytic characters, including seta ornamentation and operculum form, also distinguish the two species.

Sterile material of *Eurhynchium speciosum* can also be confused here. *Brachythecium rutabulum* can be distinguished from *E. speciosum* by its more strongly dimorphic leaves, less strongly toothed margins, and the absence of an abaxial costal spicule.

Confusion can also occur with the more wiry, duller, and aquatic *Platyhypnidium austrinum*. Additional distinguishing features are discussed under that species. There appears to be little difficulty in distinguishing *B. rutabulum* from *B. salebrosum* in N.Z.

Etymology: The epithet *rutabulum*, derived from a pre-Hedwigian polynomial, refers to the resemblance of the sporophyte to a fire-shovel or poker.

***Brachythecium salebrosum* (F.Weber & D.Mohr) Schimp. in Bruch et al., Bryol. Eur. 6, 20 (1853)**

≡ *Hypnum salebrosum* F.Weber & D.Mohr, Bot. Taschenb. (Weber) 312 (1807)

Conserved type: Austria, bei Kremsmünster, J.S. Bötsch, 2 Nov 1859, S. (Not seen.)

Plants medium-sized to robust, rather soft, yellow- to bright green, forming loose or sometimes compact mats. **Stems** prostrate to ascendant, irregularly but much branched, green or pale brown, to at least 70 mm long, in cross-section with a distinct central strand and 3–4 layers of thick-walled cortical cells, beset below with brown, smooth rhizoids (in fascicles on abaxial side of leaf bases).

Branches variable in length, not complanate. **Stem leaves** erect to erect-spreading, not secund, symmetric, somewhat to strongly plicate, scarcely altered when dry, ovate-lanceolate, narrowly acuminate, usually recurved in lower half or more on one or both sides, weakly concave, not or slightly decurrent, serrulate above or nearly entire, 2.2–2.5(–3.0) × c. 0.7–1.0 mm. **Branch leaves** smaller, 1.8–2.2(–2.8) × c. 0.4–0.6 mm, usually more strongly serrulate (especially near apex) than stem leaves, but occasionally nearly entire, otherwise not differentiated. **Costa** c. 20–30 µm wide (1/3 above insertion), extending 2/3–3/4 the length of the leaf (incorrectly illustrated here), often obscured by leaf plications, with an abaxial terminal spine present or absent. **Upper laminal cells** smooth, firm-walled, linear, (39–)75–105(–120) × c. 5–7 µm; **basal cells** shorter in c. 3–5 rows; **alar cells** quadrate, subquadrate, or short oblong, strongly differentiated, forming a moderate-sized group extending c. 12 cells up the margin and 1/3–1/2 towards the costa base.

Autoicous. Perichaetia lateral on main stems; **perichaetial leaves** ovate-lanceolate, ecostate, patent above. **Perigonia** narrowly ovoid, scattered (and often numerous?) on main stems, with ecostate, lanceolate bracts less than 1 mm long, and filiform, 5–10-celled paraphyses, enclosing 6 or fewer antheridia. **Setae** variable in length, c. 10–40 mm, smooth, weakly sinistorse below and dextrorse immediately below the capsule, red-brown; **capsules** inclined to horizontal, asymmetric, oblong-ovoid, c. 1.6 mm long (excluding operculum), yellow- to dark brown; **exothelial cells** mostly oblong, to c. 54 µm. **Annulus** not seen; **operculum** bluntly conic. **Exostome teeth** lanceolate; **endostome** detail not seen. **Calyptra** c. 3 mm long. **Spores** c. 12–18(–21) µm, finely papillose.

Illustrations: Plate 2. Crum & Anderson 1981, fig. 510; Hedenäs 2002, fig. 2 f–g; Seppelt 2004, fig. 33.

Distribution: NI: N Auckland (Kaipara Harbour, Bay of Islands), S Auckland, Hawke's Bay (near Wairoa), Taranaki (Waitōtara River), Wellington (Ōhutu Ridge, near Ormondville, Kopuaranga); SI: Nelson, Marlborough, Canterbury, Otago, Westland (Ōtira), Southland (Eyre Mountains); M.

Bipolar; widespread in temperate northern hemisphere regions. Tasmania*, mainland Australia*, North America*, Europe* and reported from Kerguelen, northern Africa, northern and central Asia, and Japan.

Habitat: A weedy species growing a range of mostly disturbed or modified habitats. These include moist soil in waste areas, in drainage ditches, in pastures, and in grazed grassland/ shrubland. This species also occurs on rotten logs and rarely on the lower trunks of willow trees. It seems to favour calcareous or nutrient-enriched habitats in N.Z. One collection has been confirmed from deer antler. On the South I. it ranges from near sea level (Kaikōura Peninsula, Marlborough L.D.) to at least 1670 m (Remarkable Range, Otago L.D.) elevation. Associated moss species include *B. paradoxum*, *B. rutabulum*, *Drepanocladus aduncus* s.l., and *Pseudoscleropodium purum*. Only one fertile specimen of *B. salebrosum* has been confirmed from the North I.

Notes: Hedenäs & Isoviita (1996) proposed a conserved type for the name *Hypnum salebrosum* F.Weber & D.Mohr. in order to preserve the modern application of *B. salebrosum* (F.Weber & D.Mohr) Schimp. for this widespread and well-known species.

Seppelt (2004) briefly considered the merits of the name *B. austrosalebrosum* (Müll.Hal.) Kindb. in his discussion of Macquarie I. collections. He opted to name the Macquarie material as *B. salebrosum*. Hedenäs (2002) also applied *B. salebrosum* to mainland Australia and Tasmanian collections.

Recognition: The medium-sized to robust irregularly branched plants with clearly plicate, erect-spreading leaves (both stem and branch) that are evenly tapered and neither secund nor circinate serve to differentiate this widespread and weedy species. The alar groups are strongly differentiated and composed of \pm quadrate to short oblong cells.

When sterile *B. salebrosum* cannot be confidently distinguished from the apparently much less common *B. campestre*, but when fruiting the smooth setae help to distinguish *B. salebrosum*. *Brachythecium salebrosum* also tends to have less terete stems and branches and less strongly toothed branch leaves.

Occasional confusion between *B. salebrosum* and *B. albicans* can occur. *B. salebrosum* differs by its autoicous sexuality, generally more branched habit and less terete stems and branches, scarcely decurrent and mostly apically denticulate stem leaves, and less regularly quadrate alar cells. The alar group is also smaller in proportion to the leaves than the alar group of *B. albicans*. There appears to be little difficulty distinguishing *B. salebrosum* from *B. rutabulum* in N.Z., in contrast to the situation in some parts of their overlapping ranges.

Larger forms of *B. salebrosum* could be confused with *Palamocladium leskeoides*. The latter species is largely confined to limestone and marble outcrops. *Brachythecium salebrosum* has smaller leaves that are not toothed towards the insertion, and non-clasping leaf bases.

Material of *Ischyrodon lepturus* (Fabroniaceae) is sometimes incorrectly referred to *B. salebrosum*. The *Ischyrodon* is a more compact, darker green, and exclusively coastal plant. *Brachythecium salebrosum* has alar cells that extend $\frac{1}{5}$ – $\frac{1}{2}$ to the costa base, while those of *Ischyrodon* extend over the adaxial surface of the costa base. The upper laminal cells of *B. salebrosum* are generally shorter than those of *Ischyrodon*.

Etymology: The epithet *salebrosum* means rugged or rough, and presumably refers to the frequently untidy growth pattern.

***Brachythecium velutinum* (Hedw.) Schimp. in Bruch et al., *Bryol. Eur.* 6, 9 (1853)**

≡ *Hypnum velutinum* Hedw., *Sp. Musc. Frond.* 272 (1801)

Type: Europe. Not seen.

Plants small, soft, yellow- to bright green, silky, forming loosely interwoven mats. **Stems** prostrate, irregularly to subpinnately branched, pale green, to c. 25(–55) mm long, in cross-section with 3–4 layers of thick-walled cortical cells, beset below with pale brown, smooth rhizoids. **Branches** c. 3–8 mm long, with leaves falcate-secund. **Stem leaves** falcate-secund (especially at stem tips), symmetric, not or only weakly plicate, scarcely altered when dry, narrowly ovate-lanceolate, acuminate and \pm twisted at apex, plane, scarcely concave, weakly decurrent, mostly coarsely and sharply serrulate near tip and serrulations extending to insertion or nearly so, 1.4–2.0 \times 0.3–0.5 mm. **Branch leaves**

smaller, 0.9–1.3(–1.5) × c. 0.3 mm, with a smaller alar group than stem leaves, not decurrent. **Costa** 24–30 µm wide ($\frac{1}{3}$ above base) extending c. $\frac{1}{2}$ the length of the leaf (ending well below the base of acumen), ending in a conspicuous abaxial spine and often toothed abaxially for c. $\frac{1}{3}$ of its length.

Upper laminal cells smooth, firm-walled, linear, c. 56–80(–110) × 5–7 µm; **basal cells** shorter in 3–5 rows; **alar cells** (of stem leaves) poorly delimited, thick-walled, irregularly quadrate to short-rectangular, extending to c. 10 cells up the margin and c. $\frac{1}{2}$ to the costa, not extending into the decurrency.

Autoicous. Perichaetial leaves ovate-lanceolate, ecostate, erect-spreading. **Perigonia** ovoid-gemmiform, scattered on branches, with ecostate, ovate, shortly acuminate bracts and filiform (c. 7-celled) paraphyses. **Setae** c. 9–16 mm, papillose throughout, c. 180 µm diam., weakly sinistorse, red-brown; **capsules** horizontal to pendulous, asymmetric, shortly oblong-ovoid, 1.5–2 mm long (excluding operculum), pale to dark yellowish-brown; **exothecial cells** ± oblong, 30–60 µm.

Annulus of 2–3 rows of cells, falling with the operculum. **Operculum** bluntly conic. **Exostome teeth** lanceolate; **endostome** with well-developed nodose cilia in groups of 2–3. **Calyptra** c. 2 mm long.

Spores 15–19 µm, finely papillose.

Illustrations: Plate 5. Crum & Anderson 1981, fig. 503; Smith 2004, fig. 278, 1–5.

Distribution: SI: Canterbury, Otago, Southland (Te Ānau). Reported from C by Vitt (1974), but this record seems very unlikely, and the voucher specimen has not been seen.

Adventive. Widespread in the northern hemisphere.

Habitat: On soil in dry situations, including grazed areas. Often occurring on tree bases, on vertical soil or rocky banks (including limestone), and under tussocks. Often on bases or lower trunks of willows and sometimes associated with mānuka (*Leptospermum scoparium* s.l.) or matagouri (*Discaria toumatou*). The eventual finding of this species in drier parts of the North I. seems likely. Ranging from near sea level (Kākānui, Otago L.D.) to c. 700 m (Ōtepatōtū Scenic Reserve, Canterbury L.D.). Associated moss species include *Bartramia papillata*, *Encalypta raptocarpa*, *Hypnum cupressiforme*, *Hedwigidium integrifolium*, *Philonotis scabrifolia*, *Syntrichia antarctica*, and *Thuidiopsis furfurosa*.

Notes: Only one specimen collected prior to 1945 has been confirmed; it was collected in the Christchurch Botanical Garden in 1891 (*W. Bell*, CHR 471556). The near absence of early collections, the association of this species with exotic plantations and/or grazed or otherwise modified native vegetation, and a lack of reports from either Tasmania or mainland Australia (Hedenäs 2002) strongly suggest that *B. velutinum* is adventive in N.Z. Its restricted distribution, occurrence at low elevations, and apparent absence from other southern hemisphere regions are consistent with its proposed adventive status.

Recognition: The abaxial costal spine here is generally easily seen and is occasionally so robust as to be visible under high magnification (40–50×) of the stereoscope. The spores of N.Z. material are larger than indicated in the description in some northern hemisphere floras (e.g., Crum & Anderson 1981).

This species can be easily confused with *B. paradoxum*. The two species are usually separable by the smooth or weakly plicate and more strongly toothed leaves of *B. velutinum*. In *B. paradoxum* the plicate and strongly circinate nature of both the branch and stem leaves is apparent under the stereoscope. The multiple abaxial spines at the costa terminus in *B. velutinum* can also be helpful in difficult instances. Also, the leaf margins (especially of the branch leaves) are not recurved in *B. velutinum* but are clearly recurved in *B. paradoxum*. *Brachythecium velutinum* is a yellow- to bright green plant, while *B. paradoxum* is usually a golden or brown-green colour. The two species overlap in their elevational distributions, but *B. velutinum* is not known to occur above 700 m, while *B. paradoxum* occurs mostly at higher elevations.

Etymology: The species epithet, meaning velvety, apparently derives from the Dillenian name ("*Hypnum velutinum capsulis ovatis cernuis*").

***Eriodon* Mont., *Ann. Sci. Nat., Bot. sér. 3, 4: 98* (1845)**

Type taxon: *Eriodon conostomus* Mont.

Taxonomy: *Eriodon* was created by Montagne to accommodate a Chilean species of Brachytheciaceae characterised in part by extremely long (equalling half the capsule length) peristome teeth and a long and finely rostrate operculum. Brotherus (1925) recognised two species of *Eriodon*, both South American. Other species, to a total of nine, have been described in or transferred to the genus. Buck (1981) transferred three species of these nine to other genera (disposed in three

separate families). The single N.Z. species has been treated as a *Rhynchostegium* by Hedenäs (2002), but his proposed placement is not followed here, mainly due to sporophyte morphological differences between the genera.

Buck (1981) characterised the genus as “smallish subcomplanate plants with ovate-lanceolate, unicostate leaves, margins serrulate throughout, linear laminal cells, alar cells differentiated only in the extreme basal angles, an autoicous sexual condition and suberect capsules. The exostome is papillose, with the papillae arranged in horizontal rows at the base of the teeth. The endostome is papillose throughout with a relatively high basal membrane and narrow segments. The operculum is long-rostrate.”

Although it was originally described in *Rhynchostegium*, the peristome of *Eriodon cylindritheca* differs strongly from both other N.Z. species of that genus and from the European type species (*R. confertum* (Dicks.) Schimp.). In *E. cylindritheca* (and the one specimen of *E. conostomus* available for examination), the exostome teeth are pale, linear, bordered below, not shouldered and coarsely papillose-baculate throughout on the outer surface. The papillae are arranged in transverse rows on the lowermost plates. In both species the endostome is papillose-baculate throughout, arises from a basal membrane (which is 200–240 µm high in the type species), and has very long, linear segments. Cilia have not been seen in the type species, but they are also sometimes weakly developed in *E. cylindritheca*.

The description of *E. cylindritheca*, below, is presented here as representative of the genus.

Etymology: According to Meagher (2011) *Eriodon* means “with large teeth” and alludes to the very long peristome teeth.

***Eriodon cylindritheca* (Dixon) Dixon & Sainsbury in Sainsbury, Trans. & Proc. Roy. Soc. New Zealand 75: 186 (1945)**

≡ *Rhynchostegium cylindritheca* Dixon, Bull. Torrey Bot. Club 42: 108 (1915)

Isosyntype: N.Z., Mauriceville, Sept. 1912, W. Gray, WELT M016047!, M000771!

Plants yellow- or bright green, lustrous, forming interwoven mats on bark. **Stems** irregularly branched, to at least 30 mm long, in cross-section with 3–5 layers of thick-walled outer cells and a distinct central strand; **rhizoids** smooth, red-brown, scattered in fascicles on ventral surface of the stem. **Branches** variable in length and often forked, 3–12 mm. **Stem and branch leaves** differing only by size, little altered when dry. **Stem leaves** spreading complanate, ovate-lanceolate and nearly evenly tapered to an acuminate apex, weakly concave, narrowed to the insertion, ± symmetric, plane and denticulate to base, neither decurrent nor striolate, 1.4–1.45 × 0.45–0.6 mm. **Branch leaves** slightly smaller, mostly 1.2–1.4(–1.6) × 0.3–0.5 mm, not otherwise differentiated. **Costa** weak and tapered, mostly extending c. ½ or slightly greater leaf length, lacking an abaxial terminal spine. **Upper laminal cells** linear, smooth or slightly prorate, mostly 57–65(–75) × 4–6 µm; **cells of the acumen** slightly shorter; **basal cells** shorter and thicker-walled; **alar cells** irregular to ± subquadrate, in a small and poorly differentiated group.

Autoicous. Perichaetia scattered on main stem, c. 2–2.5 mm long, sheathing the lower seta, the leaves abruptly acuminate from an oblong base, erect, ecostate. **Perigonia** scattered and usually numerous on fruiting stems, c. 0.8 mm, with filiform paraphyses. **Setae** slender, not twisted, mostly 20–25(–30) mm, red-brown, smooth; **capsules** narrowly cylindric, variable in length, curved, red-brown at maturity (but often green at dehiscence), narrowed below the mouth when dry, inclined to horizontal, 1.6–2.6 mm; **exothecial cells** oblong, firm-walled, not collenchymatous; **stomata** not seen; **annulus** weakly differentiated; **operculum** long rostrate from a conic base, curved, c. 1.2–1.6 mm and c. 0.6–1 × the length of the theca. **Exostome teeth** pale yellow, usually reflexed at base and circinate when dry, linear, bordered but not shouldered, coarsely papillose-baculate throughout on the outer surface, the papillae mostly transversely aligned on the lowermost plates, weakly trabeculate on inner surface, c. 500–550 µm; **endostome** from a low (c. 120 µm) membrane, with segments linear, nearly the height of the teeth, and **cilia** either absent or poorly developed. **Calyptra** cucullate and smooth. **Spores** 15–21 µm, green, rather coarsely insulate.

Illustrations: Plate 6. Sainsbury 1955, pl. 73, fig. 1; Buck 1981, figs 8–13.

Distribution: K; NI: N Auckland (Waipoua), S Auckland, Gisborne, Hawke’s Bay (Dannevirke), Taranaki (near Dawson Falls, Pōtaemā Swamp Track), Wellington; SI: Nelson, Westland, Otago (Mossy Falls, Chaslands), Southland; St.

Australasian. Reported from mainland Australia (N.S.W.) by both Dixon (1929) and Hedenäs (2002), apparently on the basis of a single collection.

Habitat: Epiphytic and usually on twigs, small branches or trunks of small diameter; also occurring on fallen logs and usually close to streams. Rarely on shaded rock. Occurring on a wide range of host species, including *Aristotelia serrata*, *Coprosma grandifolia*, *C. rotundifolia*, *Fuchsia excorticata*, *Hoheria glabrata*, *H. sexstylosa*, *Melicytus ramiflorus*, *Metrosideros diffusa*, *Muehlenbeckia australis*, *Myrsine divaricata*, *Ripogonum scandens*, *Salix* sp., *Sambucus nigra*, *Schefflera digitata*, *Urtica ferox*, and *Weinmannia sylvicola*. Occurring with *Calyptopogon mnioides*, *Cryphaea tenella*, *Neckera pennata*, *Rhaphidorrhynchium amoenum*, *Sauloma tenella*, and *Weymouthia cochlearifolia*. The presence of the relatively rare *Daltonia splachnoides* in many herbarium collections is noteworthy. Occurring from near sea level (Fox River, Nelson L.D.) to at least 480 m (Lake Rotoroa, Nelson L.D.) on the South I. and to c. 1070 m (Mt Manuoha, Gisborne L.D.) on the North I. On the South I. this species appears to be absent from Marlborough and Canterbury L.D. as well as drier parts of Otago L.D. On the North I. the only confirmed Hawke's Bay material is an 1887 Colenso collection from Dannevirke.

Notes: More precise collection data than recorded on WELT M016047 (an isosyntype) of Dixon's basionym are given in the protologue. The protologue records the date of collection as 26 Sept. 1912 and cites what appears to be a *W. Gray* collection number (145). WELT M016047 has a Sainsbury herbarium number (9398) and was sent to Sainsbury by Dixon. Apart from one poorly documented and sterile isosyntype in CHR, none of the other syntypes cited by Dixon appear to be represented in N.Z. herbaria. For this reason, a duplicate of *W. Gray* 145, if present in the Dixon herbarium, would be the preferred choice as a lectotype. Hedenäs (2002) cited an apparent duplicate of *W. Gray* 145 in H-Brotherus as a syntype.

Hedenäs (2002) placed the Australian *Helicodontiadelphus australiensis* Dixon [J. Bot. 74: 5, 1936] into synonymy here, based on type material collected by R. Collie in N.S.W. Material collected by Collie was also cited by Dixon (1929, p. 329) in his discussion of this species.

There is some confusion about the species relationships and consequent nomenclature in *Eriodon*. Based on examination of a single ample specimen of the generitype, *E. conostomus* (Dusén 372, CHR 585851), I agree with Buck's (1981) suggestion that *E. conostomus* and *E. cylindritheca* are not conspecific.

Buck (1981) referred the Andean *E. radicalis* Spruce ex A. Jaeger to the genus *Entodontopsis*. However, an isotype from Ecuador (Musci Amazonici et Andini no. 1401; CHR 414932) is clearly an *Eriodon*, and if this material were collected in N.Z. it would be almost certainly referred to *E. cylindritheca*. The peristome teeth are c. 600 µm long and the spores mostly 16–20 µm and coarsely ornamented. The alar cells in the Ecuadorian collection are scarcely differentiated rather than forming a large group of subquadrate cells as illustrated by Buck (1981, fig. 15). The species-level taxonomy of *Eriodon* requires further study beyond the scope of this eFlora.

Recognition: Regionally, fertile material of *E. cylindritheca*, because of the distinctive narrowly cylindric capsule, very long and slender operculum, and distinctive peristome, is unlikely to be confused with other species. However, sterile material, which is fortunately uncommon, could easily be confused with *Rhynchostegium muriculatum*. *Eriodon cylindritheca* has branches that are decidedly more complanate, and stem leaf mid to upper laminal cells generally shorter (57–75 µm vs mostly 75–90 µm) than those of *R. muriculatum*.

Etymology: The epithet *cylindritheca* refers to the narrow and terete form of the capsule.

***Eurhynchium* Schimp. in Bruch et al., *Bryol. Eur.* 5, 217 (1854)**

Type taxon: *Eurhynchium longirostre* Schimp.

Plants small to robust, dark, bright, or yellow-green, dull or lustrous, forming wefts or mats. **Stems** creeping or ascendant, irregularly or pinnately branched, with ascendant branches, in cross-section with a strong central strand, with scattered fascicles of smooth, brown rhizoids on ventral surface.

Stem and branch leaves mostly differentiated in form, occasionally only by size. **Stem leaves** spreading, often widely so, sometimes appressed at base, not complanate, broadly ovate to broadly triangular from a broad insertion, serrulate ± throughout, usually decurrent, ± concave and often plicate, plane at margins; **costa** stout and usually little tapered, with or without a terminal abaxial spine. **Branch leaves** smaller than stem leaves, erect to erect-spreading, complanate or not, mostly ovate to ovate-lanceolate, gradually or abruptly acute, ± concave, not or weakly decurrent, variably plicate, serrate or serrulate throughout; **upper laminal cells** ± linear, smooth, ± thick-walled, eporose, those at leaf apex usually much shorter; **alar cells** not or weakly differentiated; **costa** stout and usually little tapered, usually projecting as one (or few) terminal abaxial spine. **Paraphyllia** rare (none in N.Z. species). **Pseudoparaphyllia** present, foliose.

Dioicous or less often autoicous. Perichaetial leaves wide-spreading to squarrose, costate or not. **Setae** elongate, slender or stout, scabrose throughout or less often smooth; **capsules** inclined or horizontal, asymmetric, ovoid-cylindric or short cylindric, dark; **exothecial cells** oblong, firm- or thick-walled, not or weakly collenchymatous; **stomata** present; **annulus** well developed; **operculum** long-rostrate from a conic base. **Exostome teeth** red-brown below, shouldered, bordered, cross-striate or cross-striolate below on outer surface, pale and papillose above; **endostome** well developed, with a high basal membrane; segments nearly the length to the teeth, keeled, perforate or gaping; **cilia** present, mostly nodose. **Calyptra** cucullate, smooth.

Taxonomy: There is little consensus concerning either the generic limits or the number of species in *Eurhynchium*. The genera *Kindbergia* Ochyra [= *Stokesiella* H. Rob., hom. illeg.], *Oxyrrhynchium* (Schimp.) Warnst., are variously treated as synonyms or as generic segregates (cf. Smith 2004; Fife 1995) of *Eurhynchium*. These genera are not accepted here, and the clarification of the limits of *Eurhynchium* are outside the ambit of this eFlora. The broad view of the genus conforms with the concepts presented by Buck (1998, p. 245) for the West Indies and Hedenäs (2002) for Australia. The latter author considered *Eurhynchium* to encompass 65–70 species.

Among the Brachytheciaceae, *Eurhynchium* is characterised by having short cells at the mostly broad apex of the branch leaves, branch leaf costa terminating in an abaxial spine, and a long-rostrate operculum. Stem and branch leaves are generally strongly differentiated, but this is not the case in *E. asperipes*. Buck (1998, p. 245) considers that the very stout and relatively untapered costa of the branch leaves gives further definition to the genus, but this is not a feature of the two indigenous N.Z. species, suggesting that further study may be warranted.

The species treated as *Kindbergia praelonga* (Hedw.) Ochyra in Fife (1995) is accepted here as a *Eurhynchium*.

Etymology: The generic name means well or finely beaked and alludes to the long, slender beak of the operculum (Meagher, 2011).

- | | |
|----|---|
| 1 | Stem and branch leaves differing by size only; branch leaf apices pointed toward the branch apex and nearly parallel to the branch axis when moist, often twisted when dry; plants suggestive of a miniature <i>Ptychomnion aciculare</i> <i>E. asperipes</i> |
| 1' | Stem and branch leaves differing by shape and size; branch leaf apices neither parallel to the branch axis when moist nor twisted when dry; plants not suggestive of a miniature <i>Ptychomnion aciculare</i> 2 |
| 2 | Stem leaves strongly decurrent; dioicous ; very common and weedy throughout N.Z..... <i>E. praelongum</i> |
| 2' | Stem leaves not or weakly decurrent; phyllodioicous , autoicous , or synoicous ; less common and mostly in northern regions (but <i>E. pulchellum</i> known only from Somes I., Wellington L.D.) 3 |
| 3 | Branch leaves complanate, c. 1.4 × 0.6 mm; branches ± uniform in length, giving the plants a neat appearance; mid laminal cells of stem leaves linear, mostly 120–165 × c. 6 µm; autoicous or synoicous ; setae finely papillose throughout (usually not visible under hand-lens); northern N.Z..... <i>E. speciosum</i> |
| 3' | Branch leaves not or only weakly complanate, spreading, c. 0.8–0.9 × 0.3–0.4 mm; branches uneven in length; mid laminal cells of stem leaves shorter, mostly 30–45 × 6–9 µm; reportedly phyllodioicous ; setae smooth, even under low objective of compound scope; known from Somes I., Wellington L.D..... <i>E. pulchellum</i> |

Excluded Taxa: *Eurhynchium cucullatum* (Mitt.) I.G.Stone & G.A.M.Scott [J. Bryol. 7: 605, 1973] is treated here in the genus *Scorpiurium*, q.v.

Eurhynchium muriculatum (Hook.f. & Wilson) A.Jaeger, [Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 35, 1878] is treated here in the genus *Rhynchostegium*, q.v.

Eurhynchium novae-zealandiae (Dixon) Fife [Bryologist 98: 315, 1995] is treated here as a synonym of *Rhynchostegium muriculatum*, q.v.

Eurhynchium remotifolium (Grev.) A.Jaeger was reported from three N.Z. localities by Hooker (1867, as *Hypnum remotifolium*). This name is based on a South American type and is sometimes (e.g.,

Streimann & Curnow 1989) considered as a synonym of *E. asperipes*. Hedenäs (1996) excluded it from the Australian flora and commented on perceived differences between the two species. *Eurhynchium remotifolium* is not discussed further.

***Eurhynchium asperipes* (Mitt.) Dixon, J. Bot. 65: 9 (1927)**

≡ *Hypnum asperipes* Mitt. in Wilson, *Bot. Antarct. Voy. III. (Fl. Tasman.) Part II*, 209 (1859)

Holotype: Tasmania, Cheshunt, Archer, NY-Mitten 267966!

Plants yellow-green, lustrous, ascendant, very neat in appearance, forming dense wefts.

Stems densely and subpinnately branched, terete. **Branches** mostly c. 5–12 mm, terete. **Stem** and **branch leaves** contorted, usually incurved above, weakly plicate and often ± twisted when dry, wide-spreading and with the apices usually nearly parallel to the stem/branch when moist, differing only by size. **Stem leaves** very broadly ovate-cordate, moderately concave, strongly narrowed to insertion, abruptly and finely acuminate, not or only weakly plicate, weakly decurrent, c. 1.8–2.2 × c. 1.2 mm, sharply serrulate nearly to base; **mid laminal cells** linear-rhombic, firm-walled, smooth or very weakly prorate at upper end, mostly 60–85 × c. 9 µm; **cells of the acumen** scarcely shorter, the terminal cell c. 60–65 µm; **alar cells** not differentiated. **Branch leaves** smaller, mostly (0.8–)1.2–1.5 × (0.5–)0.72–1.0 mm, otherwise not differentiated. **Costa** mostly single, extending c. ½ the leaf length (including the acumen), tapered above, ending in an abaxial spine; sometimes forked at base and shorter in some stem leaves.

Autoicous, but perigonia often difficult to locate. **Perichaetia** scattered on main stem, the leaves apparently ecostate, widely spreading. **Perigonia** scattered on stem, c. 1 mm, leaves widely spreading, ecostate and nearly entire, with filiform paraphyses. **Setae** rather stout, flexuose, 10–17(–25) mm, red-brown, coarsely and densely papillose throughout; **capsules** curved and asymmetric, short oblong-cylindric, narrowed below mouth when dry, strongly inclined to horizontal, (1.6–)1.8–2.5 mm; **exothecial cells** rounded-oblong, thick-walled, sometimes weakly thickened in corners; **stomata** few, restricted to capsule base; **annulus** present; **operculum** long rostrate, ± equal the capsule in length. **Exostome teeth** yellow-brown, lanceolate and shouldered, weakly bordered, transversely striate on the outer surface, trabeculate on the inner surface, c. 500 µm long; **endostome** from a high membrane, with segments perforate or gaping and nearly the height of teeth; **cilia** 2–3, well-developed and nodose. **Calyptra** cucullate and smooth. **Spores** 11–15 µm, green, smooth.

Illustrations: Plate 7. Wilson 1859, pl. 176, fig. 4; Beever et al. 1992, fig. 78 i; Hedenäs 2002, fig. 7 f; Malcolm & Malcolm 2003, p. 28.

Distribution: NI: N Auckland (Te Whau, Bay of Islands, Kepa Bush Reserve), S Auckland, Gisborne (Lake Waikaremoana), Hawke's Bay, Taranaki (Mt Taranaki, near Uruti), Wellington (Ōhakune, Oroua Valley, Tararua Range, Trentham); SI: Nelson, Marlborough, Canterbury, Westland (Ōtira, Lake Kaniere, Fox Glacier), Otago, Southland.

Australasian. Tasmania* Reported from Victoria by Hedenäs (2002) and from N.S.W. and Queensland by Scott & Stone (1976, p. 427).

Habitat: On a range of terrestrial substrates including humus, damp gravel, and rotten logs in a variety of forest and scrub types, including southern beech forest, on tree bases, soil over rock (greywacke, basalt, limestone, concrete, magnesite); very occasionally as an epiphyte. On the North I. from near sea level (Kepa Bush Reserve) to 1070 m (Mt Taranaki), and on the South I. from near sea level to c. 1220 m (Mt Owen, Nelson L.D.). Common associates of this highly adaptable species include *Achrophyllum dentatum*, *Atrichum androgynum*, *Brachythecium paradoxum*, *B. rutabulum*, *Ditrichum difficile*, *Eurhynchium praelongum*, *Fissidens taxifolius*, *Leptotheca gaudichaudii*, *Pyrrobryum bifarium*, *Rhynchostegium muriculatum*, and *R. laxatum*.

Recognition: The leaves here have their apices pointed toward the branch apex and nearly parallel to the stem when moist; their abruptly narrowed apex and cordate base combine to give this species a highly distinctive facies. *Eurhynchium asperipes* is an extremely handsome moss that bears a strong resemblance when fresh to a miniature *Ptychomnion aciculare*. Size alone, and the clearly brachytheciaceous capsules, preclude any possibility of confusion. The autoicous sexuality and the relatively delicate costae of the branch leaves make this species anomalous in *Eurhynchium*.

This species bears considerable superficial resemblance to, and occupies similar habitats to, *Ctenidium pubescens*, but the present species is generally a coarser and less feathery plant. The single costa and papillose seta in the present species are clearly visible with a hand-lens and are among several features that readily distinguish the two.

Etymology: The epithet means rough and presumably refers to the roughened seta.

***Eurhynchium praelongum* (Hedw.) Schimp. in Bruch et al., *Bryol. Eur.* 5, 224 (1854)**

≡ *Hypnum praelongum* Hedw., *Sp. Musc. Frond.* 258 (1801)

≡ *Oxyrrhynchium praelongum* (Hedw.) Warnst., *Krypt.-Fl. Brandenburg, Laubm.* 781 (1905)

≡ *Stokesiella praelonga* (Hedw.) H. Rob., *Bryologist* 70: 39 (1967)

≡ *Kindbergia praelonga* (Hedw.) Ochyra, *Lindbergia* 8: 54 (1982)

Type: Europe. Not seen.

Plants medium-sized, bright green or yellow- or brown-green, forming rather rough and irregular wefts, often on acidic, wet soil. **Stems** creeping, irregularly branching, elongate, commonly 40–100(–130 mm) long. **Branches** ascendant, often rigid, simple or more often irregularly branched, variable in length. **Stem leaves** rather distant, widely spreading to squarrose, abruptly acuminate from a broadly ovate-cordate base, plane and sharply serrulate at margins, strongly decurrent, plicate when dry, mostly (1.1–)1.3–1.5 × 0.8–0.95 mm (excluding the decurrencies); **costa** tapered, ending near base of the acumen, apparently lacking a terminal spine; **mid laminal cells** linear-rhomboid, firm-walled, smooth, mostly 36–60 × c. 6 µm, becoming shorter, thicker-walled, and porose near insertion; **cells of the acumen** not differentiated; **alar cells** inflated and often clear, forming a large but poorly-defined, intra-marginal group, which nearly fills the auricle and grades into the oblong cells of the decurrency. **Branch leaves** strongly differentiated, not or scarcely complanate, ovate-lanceolate, often weakly acuminate, narrowed and symmetric at base, mostly 0.7–1.0 × 0.35–0.4 mm; **alar cells** differentiated and subquadrate; **costa** extending c. ¾ the leaf length, stout and nearly uniform in width throughout (poorly illustrated in fig. e), with a terminal abaxial spine. **Paraphyllia** lacking in N.Z. material.

Dioicous. **Perichaetia** rather inconspicuous and scattered on stems, c. 1.5 mm long, the inner leaves strongly squarrose and ecostate, surrounding c. 12–15 archegonia and numerous filiform and hyaline paraphyses. **Perigonia** scattered on main stems and branches, c. 1.5 mm long, the bracts erect, narrowly ovate-acuminate or lanceolate, surrounding c. 6 antheridia. **Setae** slender and elongate, strongly sinistorse, c. 25 µm, red-brown, finely papillose throughout (not visible under hand-lens); **capsules** short, oblong-cylindric, narrowed below mouth when dry, ± horizontal, c. 2.0 mm; **exothecial cells** mostly rounded-oblong, thick-walled, scarcely thickened in corners; **stomata** not seen; **operculum** ± equal the capsule. **Exostome teeth** as for genus, c. 500 µm; **endostome** as for genus; **cilia** 2–3 (apparently variable within a single capsule). **Spores** 10–15 µm, smooth.

Illustrations: Plate 8. Crum & Anderson 1981, fig. 528 (as *Stokesiella praelonga*); Meagher & Fuhrer 2003, p. 59; Smith 2004, fig. 286, 1–6 (as *Kindbergia praelonga*).

Distribution: NI: N Auckland including offshore islands (GB, LB, Waiheke), S Auckland, Hawke's Bay (near Wairoa, Waihou), Wellington; SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland; St; Ch.

Adventive. Mainland Australia* and widespread in the northern hemisphere. Reported from Tasmania by both Dalton et al. (1991) and Hedenäs (2002), and from "northern South America" by Hedenäs (2002).

There are numerous records from N Auckland, S Auckland and throughout Wellington L.D. on the North I., but few from outside these Land Districts. Further documentation of occurrences from the central and eastern portions of the North I. is desirable. It is possible that the apparently bicentric North I. distribution may reflect the history of introduction and subsequent range expansion of this undoubtedly adventive species. Sainsbury (1955, p. 448) suggested that it was less common on the North I. than on the South I., and this discrepancy continues to be reflected in the relative numbers of recent collections.

Habitat: An extremely weedy species, widespread in a range of disturbed sites, including lawns, fallow areas, soil and gravel areas at margins of tracks, fallen logs, etc. Often penetrating into native forest, but there usually restricted to track and stream margins. Forming wefts of several metres square under favourable conditions. In lawns (where it is considered an undesirable weed species) and similar habitats it is often most conspicuous and lush during winter months in damp, acidic sites. On the North I. documented from near sea level to c. 760 m (southern Tararua Range, Wellington L.D.) and on the South I. to at least 430 m (Banks Peninsula, Canterbury L.D.).

Notes: Sainsbury (1955, p. 448) suggested that a fragmentary collection from Taranaki L.D. might be referable to the "var. *stokesii* Brid." No effort has been made here to differentiate the "var. *praelongum*" from the "var. *stokesii*", which are differentiated in some European floras mainly on the basis of branching patterns, the presence or absence of paraphyllia, and the length:width ratio of the branch leaves. There is a tendency for these taxa (sometimes differentiated at the specific level) not to

be recognised in modern floras (cf. Crum & Anderson 1981; Smith 2004). While paraphyllia are sometimes reported as present in British material (Smith 2004), none have been seen in N.Z. collections. Hedenäs (2002) made no effort to apply these varietal names to Australian material.

There are few early records of *E. praelongum* from N.Z. The French botanist E. Raoul (1846, cited by Macmillan 1998), recorded the species (as *Hypnum praelongum*) from Akaroa, Canterbury L.D., and this appears to be the only 19th century record. There are no collections in the Beckett herbarium (at CHR), which strongly suggests this species was absent or very rare in the eastern South I. in the late 19th century, when Beckett was actively collecting. There is a 1927 collection from Diamond Harbour, Canterbury L.D. (Mrs. J. Meiklejohn) in BM that is cited by Dixon (1929), and 1928 collections from Christchurch (Meiklejohn) and Marlborough (McMahon). The earliest North I. records appear to be a 1929 collection (G.O.K. Sainsbury 1032, CHR 578302) from near Wairoa and 1931 collections (e.g. V.D. Zotov s.n., CHR 2751A) from Palmerston North, Wellington L.D. The paucity of early collections and the weedy habitats occupied by this species leave little doubt that it is adventive in N.Z.

In N.Z. fruiting populations of *E. praelongum* are very rare.

Etymology: The epithet "referring to very long, trailing plants, derives from Dillenius's designation as *Hypnum repens, triangularibus parvis foliis, praelongum*" (Crum & Anderson 1981, p. 1077).

***Eurhynchium pulchellum* (Hedw.) Jenn., *Man. Mosses W. Pennsylvania* 350 (1913)**

≡ *Hypnum pulchellum* Hedw., *Sp. Musc. Frond.* 265 (1801)

Type: Europe. Not seen.

Plants yellow-green, lustrous, forming interwoven mats on soil. **Stems** to c. 25 mm long, densely and irregularly branched, not terete. **Branches** mostly short and simple, 5–7(–10) mm, not or weakly complanate in N.Z. material. **Stem leaves** broadly ovate and acute, narrowed to insertion but not cordate, nearly flat, neither plicate nor decurrent, coarsely serrulate throughout, with a stout costa that lacks a terminal spine, c. 1 mm × 0.5 mm; **mid laminal cells** narrowly rhombic, firm-walled, smooth, mostly 30–45 × 6–9 µm; **cells at apex** shorter; **alar cells** differentiated, forming a medium-sized group, subquadrate to short oblong-rectangular, merging gradually with laminal cells. **Branch leaves** differentiated, spreading, smaller and more narrowly ovate, ± evenly tapered to an acute apex, with a stout costa only weakly tapering above and ending with a prominent abaxial spine, coarsely serrulate throughout, not or very weakly complanate, mostly 0.8–0.9 × 0.3–0.4 mm; **mid laminal cells** as per stem leaves, the cells at leaf apex markedly shorter and more rhombic; **alar cells** moderately differentiated, those at extreme corners ± oblong-rectangular and firm-walled.

Reportedly phyllocladous. **Perichaetia** scattered on stems, with perichaetial leaves ecostate and widely spreading. **Perigonia** not seen in N.Z. material. **Setae** elongate, smooth. **Operculum** long-rostrate (only one seen in N.Z. material).

Illustrations: Plate 9. Crum & Anderson 1981, fig. 524; Buck 1998, pl. 96, figs 11–18.

Distribution: NI: Wellington (Somes I.). Known from a single N.Z. collection.

Presumably adventive. Widespread in the northern hemisphere.

Habitat: The sole collection was from track-side soil in coastal scrub of *Corynocarpus laevigatus* at 30 m elev. The restriction of this rather characterless (at least in the field) species to a single locality in Wellington Harbour seems unlikely, and further collections from other areas might reasonably be expected.

Notes: The branch leaf alar cells here are more elongate and oblong than those of the northern hemisphere herbarium specimens available for comparison, but compare well to Buck's (1998) illustrations. The species is highly variable in Europe, and numerous variants have been proposed; no attempt has been made to assign the N.Z. collection to any variants.

Etymology: The epithet *pulchellum* means pretty; it seems a curious name for such a non-descript plant.

***Eurhynchium speciosum* (Brid.) Jur., Verh. K. K. Zool.-Bot. Ges. Wien 13: 500 (1863)**

≡ *Hypnum speciosum* Brid., *Muscol. Recent. Suppl.* 2, 105 (1812)

≡ *Oxyrrhynchium speciosum* (Brid.) Warnst., *Krypt.-Fl. Brandenburg, Laubm.* 786 (1905)

Type: Europe. Not seen.

= *Hypnum trachypelma* Müll.Hal., *Bot. Zeitung (Berlin)* 15: 780 (1857)

Lectotype: N.Z., Kermadec Islands, Sunday Island, over the mountain, July 1854, *Milne* 91, NY-Mitten! (Designated by Beever et al., 1996.)

= *Eurhynchium ellipticifolium* Dixon & Sainsbury in Sainsbury, *Trans. & Proc. Roy. Soc. New Zealand* 75: 184 (1945)

Isotypes: N.Z., between Lake Rotoehu & the coast, Bay of Plenty, 11 Aug. 1943, K.W. Allison 667, (herb. Sainsbury 983) WELT M005722!, CHR 570079!

Plants medium-sized, yellow- or dirty-green, lustrous, forming rather rough and irregular wefts. **Stems** creeping, irregularly to subpinnately branched, short or elongate (to >100 mm long); **branches** ascendant, simple or sparsely branched, mostly 6–12 mm. **Stem leaves** rather distant, spreading, broadly ovate, abruptly tapered to a short and sometimes twisted acumen, sharply serrulate throughout, weakly decurrent, scarcely concave, not plicate, 1.5–1.8 × 0.65–1.0 mm; **costa** tapered, extending c. $\frac{3}{4}$ the leaf length, lacking a terminal spine; **mid laminal cells** linear, firm-walled, weakly prorate at upper end, mostly 120–165 × c. 6 µm, becoming shorter and broader at insertion; **cells of the acumen** not differentiated; **alar cells** scarcely differentiated, forming weak decurrencies. **Branch leaves** differentiated, complanate, broadly ovate to nearly elliptic, acute or broadly acuminate, weakly asymmetric at base, c. 1.4 × 0.6 mm; **costa** extending c. $\frac{3}{4}$ to $\frac{7}{8}$ the leaf length, nearly uniform in width throughout, with a conspicuous terminal abaxial spine.

Autoicous or synoicous. **Perichaetia** scattered on stems, with leaves squarrose from a sheathing base, ecostate. **Perigonia**, scattered if present, with wide-spreading bracts and filiform paraphyses. **Setae** slender and elongate, 15–22 mm, red-brown, finely papillose throughout (usually not visible under hand-lens); **capsules** oblong-cylindric, narrowed below mouth when dry, ± horizontal, c. 2.0 mm; **exothecial cells** mostly rounded-oblong, thick-walled, very weakly thickened in corners; **stomata** few at capsule base; **annulus** and **operculum** not seen. **Exostome teeth** as for genus, c. 500 µm; **endostome** as for genus, **cilia** paired. **Spores** 18–21 µm, smooth.

Illustrations: Plate 10. Smith 2004, fig. 287, 1–4 (as *Oxyrrhynchium speciosum*).

Distribution: K; NI: N Auckland, S Auckland. SI: Westland? (see notes below)

Probably adventive. Largely confined to Europe but reported from Iran, Saudi Arabia, China and Macaronesia by Smith (2004). Jessica Beever (pers. comm., 3 May 2019) considers this species to be “quite common” in N Auckland L.D. The tentative Westland record is from the “Lake Brunner shore” and collected by M.F. Sinclair in 1970. The small sterile fragment I have seen of this collection appears to be correctly determined and bears a note by K.W. Allison that he had seen one sporophyte with a “sparsely and lowly papillose” seta. The occurrence of this species on the South I. requires confirmation.

Habitat: Occurring on Kermadec Islands from sea level to c. 150 m; on the North I. from near sea level to 450 m (Whirinaki Forest, S Auckland L.D.). On Raoul I. (Kermadecs) this species is often collected in a variety of mostly modified vegetation types, including underneath Mysore thorn (*Caesalpinia decapetala*); it is often associated with *Racopilum cuspidigerum* var. *convolutaceum*. The majority of the North I. collections are from either damp hollows or damp sites adjacent to streams and probably subject to periodic flooding. There is little constancy in associated vegetation types; they include native forest (with kahikatea, taraire, etc.), mixed bracken and *Phormium*, and adventive grasses. The indicated substrates were soil and rotten logs.

Notes: Beever et al. (1996) discussed the typification of the synonymous *Hypnum trachypelma* Müll.Hal. Material reported by Sykes (1977) from the Kermadecs as *Rhynchostegiella vitiensis* Dixon [Proc. Linn. Soc. New South Wales 55: 300, 1930] was tentatively referred to *E. speciosum* by Beever et al. (1996). There are three sterile specimens in herb. J.E. Beever from N Auckland L.D. that have branch leaves more lanceolate and plicate when dry than the other N.Z. material.

The relationship between the present species and the widely distributed northern hemisphere *E. hians* (Hedw.) Sande Lac. [Ann. Mus. Bot. Lugduno-Batavi 2: 299, 1866] is unclear and beyond the scope of this eFlora treatment. All fruiting N.Z. material is either synoicous or autoicous (or polyoicous?) and thus conforms with the sexuality of *E. speciosum* given in European floras (cf. Limpricht 1903; Smith 2004). There are, however, several sterile N.Z. collections that are probably

dioicous (which is the sexual state of *E. hians* in central Europe, *vide* Limpricht 1903) and eastern North America (*vide* Crum & Anderson 1981). I can find no other morphological differences between the limited North American material of *E. hians* studied (including *S. Rapp* 61, CHR 649698) and confirmed NZ material of *E. speciosum*.

No comparison has been made of *E. speciosum* to *E. laevisetum* Geh. of eastern Australia. Apart from alleged differences in sexuality, the dioicous *E. laevisetum* is distinguished from the present species by Hedenäs (2002) by a series of overlapping quantitative characters that are not fully convincing.

Etymology: The epithet *speciosum* means "striking" or "worth looking at".

***Palamocladium* Müll.Hal., *Flora* 82: 465 (1896)**

≡ *Pleuropus* Griff., *Calcutta J. Nat. Hist.* 2: 473 (1842) nom. illeg.

Type taxon: *Pleuropus fenestratus* Griff. = *Palamocladium leskeoides* (Hook.) E. Britton

Plants medium-sized to robust, forming loose green, yellow-, brown- or pink-green mats, or pendent, rigid and glossy when dry. **Stems** elongate and creeping, with numerous bundles of rhizoids, fastigiately or subpinnately branched, in cross-section with a strong central strand and 2–4 layers of thick-walled cortical cells. **Branches** short or elongate, ascending or pendent. **Stem and branch leaves** not differentiated, crowded, erect-spreading, often secund, little differentiated when dry, gradually lanceolate from an ovate base, strongly plicate, with margins plane above and recurved below, serrate above, serrulate below, not decurrent. **Costa** unbranched and ending below the leaf apex. **Upper laminal cells** smooth, thin- or firm-walled, oblong-linear to flexuose-linear, porose, becoming shorter and more porose near leaf base; **alar cells** ± quadrate in rather large groups.

Dioicous. **Perichaetial leaves** elongate, abruptly or gradually subulate. **Setae** elongate, reddish, thin, smooth; **capsules** erect, symmetric, cylindric, smooth; **exothecial cells** variable in shape, mostly rectangular; **annulus** differentiated; **operculum** rostrate from a conic base. **Exostome teeth** cross-striolate or smooth below and papillose above, ± trabeculate; **endostome** free, yellowish, with a high basal membrane; segments rather irregular and keeled, perforate or not; **cilia** rudimentary or absent. **Calyptra** cucullate, smooth. **Spores** small, finely papillose.

Taxonomy: A small genus of three species of wide but scattered distribution in tropical and temperate regions. One species occurs in N.Z. Representatives of *Palamocladium* were first recorded here by Bartlett (1984). Hofmann designated the Indian *Pleuropus fenestratus* Griff., a heterotypic synonym of *Palamocladium leskeoides*, as the lectotype of *Palamocladium*.

The genus was monographed by Hofmann (1997), who noted that the three species (which do not overlap geographically) cannot be confidently distinguished in the absence of sporophytes. She did not, however, express reservation about her assignment of N.Z. material to *P. leskeoides*, which is the most widespread of the three species. According to her discussion and key, *P. leskeoides* is mostly reliably distinguished from its congeners by an absence of perforations in the endostome segments, the presence of cross-striolations or striations on the lower parts of exostome teeth, and the number of short exothecial cells present at the capsule mouth. She reported all three species of *Palamocladium* to be dioicous, and to produce both normal-sized and dwarf male plants.

The relationship between *Palamocladium* and *Homalothecium* Schimp. is controversial, and some authors (e.g., Robinson 1962) have submerged *Palamocladium* into the latter genus. Hofmann (1997, 1998) is the most recent monographer of both these genera and her decision to retain *Palamocladium* is followed here. The characters used traditionally (*vide* Brotherus 1925) to differentiate the genera *Palamocladium* and *Homalothecium* include the ornamentation of the setae, the degree of leaf margin serration, capsule symmetry, and the density of rhizoids. Modern regional Floras that treat the two genera as distinct include Crum & Anderson 1981, Noguchi 1991, and Lai et al. 1991. The separation of the two genera appears to be well supported in the phylogenetic analysis of Ignatov & Huttunen (2002, fig. 2).

Etymology: The generic name *Palamocladium* refers to a supposedly palmate branching pattern.

***Palamocladium leskeoides* (Hook.) E.Britton, *Bull. Torrey Bot. Club* 40: 673 (1914)**

≡ *Hookeria leskeoides* Hook., *Musci Exot.* 1, 55 (1818)

Isotype: Ecuador, *Humboldt & Bonpland*, E 00908996. Annotated by Hofmann 1997. Image seen online, JSTOR Global Plants, accessed 5 June 2018.

= *Isothecium nilgheriense* Mont., *Ann. Sci. Nat., Bot. sér.* 2, 17: 246 (1842)

≡ *Palamocladium nilgheriense* (Mont.) Müll.Hal., *Flora* 82: 465 (1896)

Type: India. Not seen.

= *Hypnum macrostegium* Sull. & Lesq., *Proc. Amer. Acad. Arts* 4: 280 (1859)

≡ *Palamocladium macrostegium* (Sull. & Lesq.) Z.Iwats. & Takaki in Iwatsuki, *J. Hattori Bot. Lab.* 29: 58 (1966)

Type: Japan. Not seen.

= *Astrodonium sericeum* A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1875–1876: 213 (1877)

≡ *Palamocladium sericeum* (A.Jaeger) Müll.Hal., *Flora* 82: 465 (1896)

Syntype: South Africa, Zitzikama, *Breutel*, BM 00087887. Annotated by Hofmann 1997. Image seen online, JSTOR Global Plants, accessed 5 June 2018.

Plants robust, rather wiry, golden to pale yellow- or pink-green, forming rather dense, often pendent mats. **Stems** creeping or pendent, branching irregular and ± fastigiate, 40–70(–100) mm long; rhizoids in very sparse fascicles, smooth and red-brown. **Branches** variable in length (but producing a smooth and even mat), c. 5–40 mm. **Stems** and **branch leaves** not differentiated, moderately homomallous (especially near branch tips), erect-spreading, straight, crowded, symmetric, strongly plicate for $\frac{2}{3}$ or more of their length, weakly twisted at apex but otherwise not altered when dry, narrowly lanceolate from a subcordate base, plane at margins above, weakly reflexed at base, concave below, serrate or strongly serrulate above, less so towards base, 3.0–4.0 × c. 1.0 mm. **Costa** concolorous, c. 30–36 µm wide ($\frac{1}{3}$ above base), gradually tapered and becoming faint above, c. $\frac{3}{4}$ length of leaf (in N.Z. material), lacking an abaxial terminal spine. **Upper laminal cells** weakly prorate at upper end, firm-walled and porose, linear-flexuose, (33–)42–60(–81) × 3–6 µm, several rows shorter, broader, and strongly porose at insertion; **alar cells** forming a well-differentiated opaque group, ± quadrate.

Perichaetia with outer leaves scarcely differentiated from vegetative, the inner shorter (1.5–2.0 mm), either narrowly subulate or broadly acute from an oblong base, not plicate, ecostate, widely spreading.

Male plants and **sporophytes** not seen in N.Z. material.

Illustrations: Plate 11. Hofmann 1997, figs 3 & 7.

Distribution: NI: S Auckland (Piopio, Tawarau, Waitomo, Upper Awaroa River); SI: Nelson (Burnett Range, Devils Boots, Grove Reserve, Tākaka; Mt Arthur Range, Cobb Valley, Garibaldi Range, Ōpārara Range, Tiropahī River, Mt Owen Range), Marlborough (Leatham River).

Anomalous. South Africa*, southern Asia*. Recorded from North, Central, and South America, South and eastern Africa, southern and eastern Asia into Malesia by Hofmann (1997), who also provided a more detailed description that included sporophyte details.

Habitat: On shaded, mesic to rather dry outcrops of limestone and marble, in forest (mostly southern beech dominated forest on the South I.) but extending into the alpine zone in sheltered rock crevices. Rarely epiphytic in N.Z. Specimens from epiphytic habitats have been seen from Bulmer Creek in the Mt Owen Range (on *Brachyglottis hectorii* and *Olearia paniculata*) and the Ōpārara Valley (on *Melicytus ramiflorus*). Recorded only in lowland situations (below 520 m) on the North I. On the South I. ranging from near sea level (Tākaka) to at least 1320 m (Mt Arthur Range). Associated mosses include *Brachythecium paradoxum*, *Camptochaete deflexa*, *Cyathophorum bulbosum*, *Lembophyllum divulsum*, *Leptodon smithii*, *Sauloma tenella*, *Seligeria cardotii*, and *Weymouthia cochlearifolia*.

While scattered in its N.Z. distribution, where it occurs *P. leskeoides* can be abundant and conspicuous. On an isolated outcrop of Cambrian “Summit Limestone” on the floor of the Cobb Valley (850 m elevation) it is abundant and forms pure, ± pendent mats of at least 0.3 m diameter.

Notes: Three names have been previously applied to N.Z. material of *Palamocladium*:

P. macrostegium (Sull. & Lesq.) Iwats. & Takaki and *P. nilgheriense* (Mont.) Müll.Hal. were recorded by Bartlett (1984), and the name *P. sericeum* (A.Jaeger) Müll.Hal. was subsequently used by Fife (1995). Hofmann (1997) has placed all three of these names in the synonymy of *P. leskeoides* (Hook.) E.Britton, and her synonymy is accepted here.

Hofmann (1997) cited N.Z. specimens of *P. leskeoides* among the specimens she verified “in which the costa ends well below the leaf apex”; my observations, based on a larger suite of N.Z. collections, conform to hers. New Zealand material differs from Indian material available for study by having more distinctly porose mid laminal cells, and more robust and less curved branches. Hofmann’s (1997) description suggests that N.Z. material is at the upper end of leaf size range for the species.

Recognition: The overall appearance of *P. leskeoides*, with plants of a pink or golden hue forming neat and usually pendent mats over limestone, long (3–4 mm), narrowly lanceolate, ± cordate, and plicate leaves, makes it one of the most readily recognisable species of the Brachytheciaceae in N.Z. Confusion in the field could occur with forms of *Echinodium hispidum*. When *E. hispidum* grows on limestone it can assume a pinkish cast not dissimilar to that of *Palamocladium*. However, the overall appearance of *Palamocladium* is much softer, the leaves narrowly lanceolate (vs abruptly narrowed from an ovate base to a stout subula in *E. hispidum*), the costae narrower and the leaf cells of a much different shape and length (linear-flexuose and mostly 42–60 µm long in *Palamocladium*).

Etymology: The species epithet means appearing like a *Leskea*, and refers to the erect capsules in the present species and in species of *Leskea*.

***Platyhypnidium* M.Fleisch., *Musci Buitenzorg* 1536 (1923)**

Type taxon: *Platyhypnidium muelleri* (A.Jaeger) M.Fleisch.

The following generic description draws on Buck (1998) and Hedenäs (2002).

Plants medium-sized to robust, variable in colour, ± lustrous, forming mats on damp or irrigated rock, sometimes floating. **Stems** variably branched, in cross-section with several layers of thick-walled cells surrounding thin-walled cells and a distinct central strand. **Stem** and **branch leaves** not differentiated except by size, erect to erect-spreading, sometimes homomallous or weakly secund, often contorted or striolate when dry, broadly ovate to oblong-ovate, acute to broadly obtuse, weakly concave, not decurrent, margins plane, denticulate in upper half or to base; **mid laminal cells** linear or long-hexagonal, smooth or weakly prorate, thin- or firm-walled, not porose; **apical cells** and **upper marginal cells** shorter and more rhombic; **alar cells** mostly differentiated and enlarged (but scarcely so in N.Z. species). **Costa** single, rather slender and tapered to apex, with or without a terminal abaxial spine. **Paraphyllia** lacking. **Pseudoparaphyllia** foliose.

Autoicous. Perichaetia scattered on stems, often inconspicuous. **Setae** elongate, smooth or rarely scabrose (as in N.Z. species), mostly flexuose, orange- to red-brown or dark brown; **capsules** curved and asymmetric, broadly obovoid to short-cylindric, inclined to horizontal; **exothecial cells** subquadrate to short-rectangular to oblong, thin- or thick-walled, sometimes ± collenchymatous; **stomata** few at capsule base, round-pored; **annulus** differentiated or not; **operculum** rostrate from a conic base. **Peristome** perfect; **exostome teeth** dark yellow-brown; **endostomal cilia** short or well-developed, usually nodose. **Calyptra** cucullate & smooth. **Spores** smooth or finely papillose.

Taxonomy: In modern floras *Platyhypnidium* is often included within a broadly defined *Rhynchostegium* (e.g., McFarland 1994). Although a relatively broad concept of *Rhynchostegium* is presented here, the aquatic habitat and the consistently broader and non-acuminate leaves with rhombic apical cells seem sufficient reason for retention of the two genera. Historically, *Platyhypnidium* has often been confounded with the southern hemisphere amblystegiaceous genus *Hygrohypnum*.

Platyhypnidium “was described to include 17 species” (Buck 1998, p. 248) and occurs primarily in temperate and high-elevation tropical regions.

Ignatov et al. (1999, p. 60) summarised the nomenclatural confusion surrounding the name *Platyhypnidium*. He supported Buck’s (1998) selection of the Javan *P. muelleri* as the generic type, noting that the Javan *P. muelleri* was the only species discussed in detail by Fleischer (1923). The recognition of *P. muelleri* (A.Jaeger) M.Fleisch. as the generic type helps clarify the application of this generic name. However, this typification is not accepted in Tropicos (data seen online, TROPICOS, accessed 19 June 2018) where the generic type is designated as the northern hemisphere *P. rusciforme* M.Fleisch. (usually considered a synonym of *P. riparioides* (Hedw.) Dixon). The nomenclatural issues surrounding *Platyhypnidium* and its included species are considerable and exceed the ambit of this eFlora.

North American authors (e.g. Crum & Anderson 1981) have often included species of *Platyhypnidium* (e.g., *P. riparioides*) in a broadly defined *Eurhynchium*. I agree with Buck 1998 that *Platyhypnidium* is given meaning by its aquatic habitat, non-differentiated stem, and branch leaves with broad apices, and by relatively slender and tapered costae. The concept of *Platyhypnidium* presented here conforms to those presented in recent revisions of the

Brachytheciaceae for Australia (Hedenäs 2002) and the Huon Peninsula of P.N.G. (Ignatov et al. 1999).

Platyhypnidium austrinum, the only species of the genus in N.Z., is unusual in the genus by having scabrose setae. However, other brachytheciaceous genera have species with smooth and scabrous setae, and this difference is not sufficient reason to exclude *P. austrinum* from the present genus.

Platyhypnidium aquaticum (A.Jaeger) M.Fleisch. is a species of tropical affinities that has been recorded from N.S.W. by Hedenäs (2012). According to his key, it has more obtuse leaves than the N.Z. species, and smooth setae.

Etymology: According to Meagher (2011), the name *Platyhypnum* derives from Greek *platys* (flat, wide) and *hypnon* (moss) and alludes to a prostrate and spreading habit. *Platyhypnum* was illegitimate at the time of Loeske's publication of it, and Fleischer (1923) consequently substituted the new generic name *Platyhypnidium*.

***Platyhypnidium austrinum* (Hook.f. & Wilson) M.Fleisch., Musci Buitenzorg 1537 (1923)**

≡ *Hypnum austrinum* Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II*, 108 (1854)

≡ *Eurhynchium austrinum* (Hook.f. & Wilson) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1876–1877: 356 (1878)

≡ *Oxyrrhynchium austrinum* (Hook.f. & Wilson) Broth., *Nat. Pflanzenfam. [Engler & Prantl]* 1(3), 1155 (1909)

Lectotype: N.Z., Wellington, 1850, *Lyll 104*, BM-Wilson. (Designated by Hedenäs, 1996).
Not seen.

Plants medium-sized to robust, yellow- or dark or bright green, weakly lustrous, forming interwoven and sometimes ± pendent mats on irrigated rock. **Shoots** subjulaceous when fresh. **Stems** rigid (at least below), irregularly branched, commonly c. 40 mm long, in cross-section with several layers of thick-walled cells surrounding thin-walled cells and a distinct central strand; **branches** variable in length, scarcely narrowed at apex. **Stem** and **branch leaves** not differentiated, broadly ovate, narrowed to the insertion, broadly acute to rounded, weakly homomallous to secund, often eroded, weakly concave and ± striolate when dry, weakly complanate, more concave and variably striolate when moist, not decurrent, c. 1.8–2.1(–2.3) × 1.0–1.3 mm, denticulate in upper half; **mid laminal cells** linear, mostly (60–)75–87(–115) × c. 6 µm, smooth or very weakly prorate, firm-walled, non-porose; **apical cells** usually shorter and more rhombic; **basal cells** (including **alar cells**) shorter and broader than laminal cells, not forming a distinct group. **Costa** extending c. $\frac{2}{3}$ the leaf length, strongly tapered, becoming thin and obscure above, lacking a terminal spine.

Autoicous. Perichaetia scattered, c. 2 mm long, the inner leaves spreading, acuminate from an oblong-ovate base, ecostate. **Perigonia** scattered, c. 0.6–1.0 mm long. **Setae** flexuose, weakly dextrorse above, c. 13–16 mm, orange- to dark brown, coarsely and densely papillose throughout (visible under hand-lens); **capsules** curved and asymmetric, broadly obovoid, narrowed below mouth when dry, inclined to nearly horizontal, becoming very dark with age, c. 2 mm; **exothecial cells** mostly oblong, unevenly thick-walled, sometimes appearing weakly collenchymatous; **stomata** few at capsule base; **annulus** not differentiated; **operculum** rostrate from a conic base, c. $\frac{2}{3}$ the length of urn.

Exostome teeth dark yellow-brown, lanceolate and shouldered, bordered, transversely striate on the outer surface, strongly trabeculate on inner surface, c. 550 µm; **endostome** from a high membrane, with segments perforate and nearly the height of teeth; **cilia** single or paired, nodose. **Calyptra** cucullate, smooth. **Spores** c. 15–19 µm, green, smooth or nearly so.

Illustrations: Plate 12. Hedenäs 2002, fig. 11 a–b; Seppelt 2004, fig. 34. Seppelt's illustration shows a plant with much more acuminate leaves than representative N.Z. material.

Distribution: NI: N Auckland including offshore islands (GB), S Auckland, Gisborne (Waioeka Gorge, Oronui Stream), Hawke's Bay (Te Pohue), Taranaki (near Dawson Falls Hostel, Te Maire Scenic Reserve), Wellington, including offshore islands (KA); SI: Nelson, Marlborough, Canterbury, Westland (Jackson Bay), Otago, Southland; St; Ch; A; C. Reported from M by both Hedenäs (2002) and Seppelt (2004).

Australasian. Tasmania*, mainland Australia (N.S.W.*, Vic.*, A.C.T.*).

Habitat: On rocks in swift streams and in splash zones; either submerged or emergent, and in favourable situations forming mats of several square metres in extent. Collections of this species often bear a dense periphyton of diatoms and sometimes have leaves tattered. Occurring on a wide variety of rock types, including limestone, sandstone, basalt, and granite. The occurrence of this species in a

small polluted stream at Charming Creek, Nelson L.D. (A.J. Fife 10450, CHR 515187) suggests this species can tolerate acidic coal-mining effluent. On the North I. from near sea level (North Cape, N Auckland L.D. and Kapiti I., Wellington L.D.) to at least 600 m (Ōhākune, Wellington L.D.), but a W. Martin collection from “near Dawson Falls Hostel” suggests occurrence to at least 800 m elevation. On the South I. from near sea level (Fox River, Nelson L.D. to c. 900 m (Broad Stream, Canterbury L.D.). Frequently associated aquatic species include *Cratoneuropsis relaxa*, *Fissidens rigidulus*, *Schistidium rivulare*, *Thamnobryum pandum*, and *Tridontium tasmanicum*.

Notes: The unpublished name *Hypnum helmsianum* was applied by Karl Müller (*in herb.*) to material of this species collected by Beckett from Waimate (T.W.N. Beckett 152, CHR 585855).

Recognition: Confusion might be possible with *Brachythecium rutabulum*. However, compared to *B. rutabulum*, the present species is a duller plant, with more wiry stems and undifferentiated stem and branch leaves. None of the leaves in *Platyhypnidium austrinum* are decurrent, and the alar cells are more compact. There are fairly reliable habitat differences as *B. rutabulum* does not occur in swiftly flowing water.

Etymology: The species epithet *austrinum* means southern or of the southern hemisphere.

***Pseudoscleropodium* (Limpr.) M.Fleisch., *Musci Buitenzorg* 1542 (1923)**

≡ *Scleropodium* sect. *Pseudoscleropodium* Limpr., *Laubm. Deutschland* 3, 142 (1896) – as Pseudo-Scleropodium

Type taxon: *Pseudoscleropodium purum* (Hedw.) M.Fleisch.

Taxonomy: A monotypic genus with the features of the type species, described below.

While Brotherus (1925) placed *Pseudoscleropodium* in the Entodontaceae, modern treatments (Crum & Anderson 1981; Goffinet et al. 2009) place this genus in the Brachytheciaceae.

Etymology: The generic name references the predominantly northern hemisphere genus *Scleropodium*.

***Pseudoscleropodium purum* (Hedw.) M.Fleisch., *Musci Buitenzorg* 1542 (1923)**

≡ *Hypnum purum* Hedw., *Sp. Musc. Frond.* 253 (1801)

≡ *Scleropodium purum* (Hedw.) Limpr., *Laubm. Deutschland* 3, 147 (1896)

≡ *Brachythecium purum* (Hedw.) Dixon, *Stud. Handb. Brit. Mosses* 410 (1896)

Lectotype: Europe, no further locality data, G. (Designated by Hedenäs 1996). Not seen.

Plants robust, lustrous, forming loosely interwoven mats, yellow- or white-green. **Stems** mostly ascendant, (40–)60–100(–150) mm long, pinnately or subpinnately branched, tumid and julaceous, lacking paraphyllia, in cross-section with several layers of thick-walled cortical cells surrounding thinner-walled cells and a small central strand, beset with scattered fascicles of red-brown and smooth rhizoids. **Stems** and **branch leaves** differentiated only by size. **Stem leaves** loosely erect, imbricate, broadly oblong-ovate to nearly cochleariform, abruptly tapered to an apiculate and reflexed apex, strongly concave, often weakly plicate when dry, denticulate above, plane at margins, not decurrent, mostly c. 1.5–2.1 × (0.8–)1.0–1.5(–1.8) mm. **Branches** variable in length, mostly 8–15 mm, often cuspidate at apex. **Branch leaves** mostly 1.3–1.5 × c. 0.8 mm, weakly to markedly reflexed at apex. **Costa** slender, unbranched, extending $\frac{1}{2}$ – $\frac{2}{3}$ the leaf length, terminal spine apparently absent. **Upper laminal cells** linear-vermiculate, firm-walled, weakly prorate at upper or both ends, not porose, mostly 65–85 × c. 4 µm, becoming shorter towards leaf apex; **basal cells** shorter, thick-walled and porose in several rows; **alar cells** thick-walled, subquadrate to short-irregular, forming a small and poorly defined concave group. **Axillary hairs** 7–11 cells long, with pigmented basal cells.

Dioicous. **Perichaetia** inconspicuous, gemmiform, scattered on main stem; **perichaetial leaves** spreading, ovate-lanceolate, ± entire, ecostate, c. 1.4 mm, surrounding c. 12 archegonia and numerous filiform paraphyses. **Perigonia** not seen. **Setae** c. 20–30 mm, smooth, sinistrorse; **capsules** inclined, short-cylindric, c. 2.0 mm, dark brown; **exothecial cells** irregular, incrassate.

Exostome teeth dark, transversely striate below, strongly trabeculate; **endostome** detail not seen in N.Z. material. **Spores** c. 15 µm.

Illustrations: Plate 13. Crum & Anderson 1981, fig. 529; Buck 1998, pl. 92, 1–9; Smith 2004, fig. 279; Seppelt et al. 2011, fig. 3.

Distribution: NI: N Auckland, S Auckland, Gisborne (near Ōpōtiki, Raukokore River), Hawke's Bay (Havelock North, Wakarara), Wellington; SI: Nelson, Marlborough, Canterbury (McLeans I., Hororātā), Westland, Otago (near Palmerston, Dunedin area, Tahakopa, Thisbe Stream), Southland (Hamilton Burn, near Borland Lodge, Pourākino River); St; Ch (including Pitt I.).

Adventive. Buck (1998) gave the world distribution of this species as “maritime Canada, coastal Pacific Northwest [America], Argentina, Chile, numerous Atlantic islands, Réunion, Japan, Sri Lanka, New Zealand, [and] Jamaica.” Also occurring in Tasmania*, south-eastern mainland Australia*, and Hawai'i. Buck considered it to be “presumably native to Europe but now widespread due to introduction, often with nursery stock.” It is sometimes employed as mulch on pot plants in the N.Z. horticultural trade, which no doubt facilitates its spread regionally.

Habitat: Mainly in roughly mown lawns, pastures, and roadside and track verges. Also occurring in *Pinus radiata* plantations, gaps in native forest, disturbed sites in subalpine scrub (as at Mt Fyffe, Marlborough L.D.), and in native *Kunzea ericoides* scrub (as at Kaikōura, Marlborough L.D.). *Thuidiopsis furfurosa* and *Hypnum cupressiforme* are frequent associates. On the North I. from near sea level to at least 820 m (National Park, Wellington L.D.), but apparently uncommon above c. 600 m; on the South I. mostly from low elevations but extending to c. 1000 m (Mt Fyffe, Marlborough L.D.).

Notes: Sporophytes are extremely rare in N.Z. (and throughout the species' range), as reflected in the partial description above. Only two intact capsules (from Kaikōura, Marlborough L.D., *J. Lewinsky* 1095, CHR 348580) and a few fragmentary capsules in material from Havelock North have been seen. A more detailed description of the sporophyte can be found in Buck (1998, p. 235). Perichaetia are quite inconspicuous and seem to be infrequent in N.Z. material.

Crum & Anderson (1981, p. 1078) refer to *P. purum* as “a robust moss with softly julaceous stems and branches and broad, concave leaves, rounded-obtuse and abruptly apiculate at the tip.” According to Dixon (1896, p. 410), in Britain this species is “frequently employed by anglers for scouring worms.”

Sainsbury (1955, p. 451) reported *P. purum* from a suburb of Auckland and from Nelson. The former is based on two 1930 collections from the neighbourhood of Mt Eden by L.B. Moore. Several collections were made by K.W. Allison in the Dunedin area in 1951–52.

It is probable that the spread of this moss, particularly on the South I., has been both recent and rapid. In 1976 John Linzey wrote to K.W. Allison (notes preserved in CHR 433091) that *P. purum* is “extremely widespread in the Auckland Province. I have found it near Whangarei & all over the Coromandel. It is very common sight throughout the Waitakere Ranges among grass on forest edges & forest opening. I have never found fruit & [sic] not found in S Is.” Subsequently Lewinsky & Bartlett (1982) recorded it from in excess of 30 localities, including seven on the South I. They suggested that the species seemed “to be spreading vigorously in New Zealand at the moment” and concluded that it should be considered an introduction. They also recorded sporophytes from Marlborough material, which they believed were the first capsules found in the southern hemisphere.

Although the type of *P. purum* Hedw. has not been seen, there are images on JSTOR Global Plants (accessed 11 June 2018) of three specimens in the Linnaean Herbarium (LINN). Hedwig's protologue referenced both Linnaean and Dillenian polynomials. The JSTOR images of the fruiting material in the Linnaean are easily recognisable as representative *P. purum*.

Recognition: The combination of its weedy habitat, its usually robust size with tumid, julaceous and subpinnately branched stems, and its imbricate, broadly oblong-ovate leaves, which are abruptly tapered to an apiculate and reflexed apex, make *P. purum* an easily recognised plant.

Confusion is most likely with the poorly known (in N.Z.) *Scleropodium touretii*, and features that distinguish the two species are discussed under that species.

Pseudoscleropodium could also be confused with *Calliergonella cuspidata*, but that species has non-julaceous stems, non-reflexed leaf apices, mostly ecostate leaves with distinctly inflated alar cells, and it generally grows in wetter sites. Confusion with *Acrocladium chlamydophyllum* seems less likely; that species is more irregularly branched and has nearly cochleariform, broadly rounded, and non-reflexed stem leaves with porose laminal cells. *Acrocladium chlamydophyllum* is also autoicous and frequently fruits.

Etymology: The epithet *purum* means pure or clean, apparently referring to the clean appearance of this handsome moss.

***Rhynchostegium* Schimp. in Bruch et al., *Bryol. Eur.* 5, 197 (1852)**

Type taxon: *Rhynchostegium confertum* (Dicks.) Schimp.

Plants small to ± robust, yellow- to dark green, lustrous, forming interwoven mats, mostly on soil or rotten wood. **Stems** prostrate and creeping, irregularly to subpinnately branched, in cross-section with thick-walled outer cells surrounding large, thin-walled cells and usually with a distinct central strand (apparently absent in *R. muriculatum*), with fascicles of smooth, brown rhizoids on ventral surface.

Branches prostrate or ascending. **Stem** and **branch leaves** differing by size only, or by both size and shape. **Stem leaves** broadly ovate to ovate-lanceolate, usually abruptly tapered to an acumen, usually narrowed to base and occasionally ± cordate, wide-spreading or erect-spreading, variably complanate, not plicate (but sometimes striolate, especially when dry), serrulate or denticulate above or to base; **mid laminal cells** linear-rhombic or linear, smooth, thin- or firm-walled, not porose; **alar cells** not differentiated or poorly so and ± quadrate. **Costa** single, tapered, mostly ending beyond mid leaf, with or without a terminal abaxial spine. **Branch leaves** usually differing only by their smaller size but sometimes more abruptly acuminate than stem leaves. **Pseudoparaphyllia** present and foliose.

Gemmae nil.

Autoicous. Perichaetia scattered on stems (sometimes also on branches), with leaves ecostate, erect or (reportedly) sometimes spreading from an erect base. **Setae** elongate and slender, flexuose or nearly straight, smooth; **capsules** short oblong-cylindric to long-cylindric, inclined to horizontal, curved and asymmetric, narrowed below the mouth when dry; **exothecial cells** oblong to quadrate, ± collenchymatous in the N.Z. species; **stomata** restricted to extreme base of capsule, round-pored; **annulus** differentiated; **operculum** long-rostrate from a conic base, often ± equal the theca. **Peristome** perfect; **exostome teeth** yellow-brown, lanceolate and shouldered, bordered, transversely striate (in N.Z. species) or sometimes striolate on the outer surface, trabeculate on inner surface; **endostome** with a low or high basal membrane and perforate or gaping segments, which are nearly the height of the teeth; **cilia** in groups of 1–3, mostly well developed and nodose. **Calyptra** cucullate and smooth. **Spores** smooth or nearly so in N.Z. species.

Taxonomy: The concept of *Rhynchostegium* presented here is narrower than that presented for Australia by Hedenäs (2002), who termed it a “highly artificial genus”. He included *R. cylindritheca* Dixon, which is here treated as an *Eriodon* (for reasons detailed under that genus). However, I agree with his assessment that the Australasian species previously assigned to *Rhynchostegiella* (as *R. muriculata*) is better included here. Hedenäs (2002) treated (including *Eriodon cylindritheca*) six species for Australia, all of which also occur in N.Z.

According to Ignatov et al. (1999), *Rhynchostegium* “includes species with long-beaked opercula, usually ovate-lanceolate leaves and a rather weak costa that is not toothed abaxially. Many species of *Rhynchostegium* have pale, somewhat transparent leaves and show a tendency to have capsules that are disproportionately small relative to the gametophytes. Their endostome is somewhat reduced, with the low basal membrane having narrow, unperforated segments and short cilia.” However, the species recognised here do not fully comply with this characterisation.

Poorly developed plants and those growing in marginal habitats are very difficult to name with confidence. While sporophytic characters are highly diagnostic, gametophytic characters are both less constant and less convincing, and a significant fraction of sterile collections cannot be confidently determined. Scott & Stone’s (1976, p. 431) suggestion that a “thorough revision [of *Rhynchostegium*] is needed” remains true more than 30 years after it was written. It is unlikely that a revision based solely on morphological features will greatly clarify the relationships between the Australasian species.

Both the distribution and the size of this large and taxonomically troublesome genus are difficult to summarise. Brotherus (1925) considered it to include 130 species, mostly distributed in temperate and subtropical regions. Three N.Z. species are recognised here.

- 1 **Branch leaves** mostly ≤ 0.4 mm wide and branches distinctly complanate; **capsules** narrowly cylindric; **exostome teeth** pale; **endostome** with cilia either absent or poorly developed and with linear, non-perforate segments; **operculum** very slender and elongate-rostrate, c. 1.2–1.6 mm..... *Eriodon cylindritheca*
- 1' **Branch leaves** mostly > 0.4 mm wide or if narrower then branches not distinctly complanate; **capsules** oblong-cylindric; **exostome teeth** yellow-brown; **endostome** with well-developed and nodose cilia and with non-linear, perforate segments; **operculum** long rostrate from a conic base, c. 1 mm2
- 2 **Costa of branch leaves** often ending in a terminal spine; **stems** short, usually less than 20 mm; **setae** scabrose..... *R. muriculatum*
- 2' **Costa of branch leaves** usually lacking a terminal spine; **stems** usually greater than 20 mm; **setae** smooth.....3
- 3 **Shoots** (both stems and branches) distinctly complanate; **branch leaves** not striolate, distinctly lustrous when dry (suggestive of a *Plagiothecium*), 0.65–0.8 mm wide; **stem leaf mid laminal cells** mostly 90–135 μm ; **operculum** \pm equal the theca..... *R. tenuifolium*
- 3' **Shoots** (both stems and branches) not complanate; **branch leaves** striolate and only weakly lustrous when dry, 0.4–0.55(–0.65) mm wide; **stem leaf mid laminal cells** mostly 54–90 μm ; **operculum** distinctly shorter than the theca *R. laxatum*

Excluded Taxa: *Rhynchostegium fragilicuspis* Dixon [Bull. New Zealand Inst. 3(6): 329, 1929]. Dixon was uncertain about the generic placement of this species at the time of its description, and placed it in *Rhynchostegium* “provisionally” following an opinion from Brotherus. The type collection by W. Gray is from Great Barrier I. I have seen only a minute isotype (WELT M005809) and very much doubt that it belongs here. Several features, including the entire margins and differentiated alar cells, suggest that it might belong to the Amblystegiaceae. It is not in my opinion nameable and it is not considered further here.

***Rhynchostegium laxatum* (Mitt.) Paris, Index. Bryol. 1131 (1898)**

as “luxatum”

\equiv *Hypnum laxatum* Mitt., *Hooker's J. Bot. Kew Gard. Misc.* 8: 264 (1856)

Lectotype: Victoria, Gipps Land, *Dr. Mueller 120*, NY-Mitten 267964! (Designated by Hedenäs, 1996)

$=$ *Hypnum elusum* Mitt. in Hooker, *Handb. New Zealand Fl.* 478 (1867)

Holotype: N.Z., Otago, N.E. Valley, 1862, *Hector*, NY-Mitten 267968!

$=$ *Rhynchostegium peracuminatum* Dixon & Sainsbury in Sainsbury, *Trans. & Proc. Roy. Soc. New Zealand* 75: 185 (1945)

Isotype: N.Z., on damp log, Ohakune, 20 Aug. 1926, *R. Mundy s.n.*, (herb. Sainsbury 728a), WELT M005804! CHR 570188A!, 570188B!

Plants small to medium-sized, yellow-green or occasionally bright green, weakly lustrous. **Stems** irregularly to subpinnately branched, c. 20–50 mm long, decumbent, in cross-section with 3–5 layers of thick-walled outer cells and a distinct central strand. **Branches** ascendant and short (mostly 6–8 mm). **Stem and branch leaves** differentiated by shape, when dry \pm striolate and erect, erect-spreading and not or weakly striolate when moist. **Stem leaves** broadly ovate to oblong-ovate, abruptly tapered to a narrowly acuminate or filiform apex (acumen mostly 0.45–0.6 mm and up to c. 0.4 the total leaf length), weakly concave, narrowed to the insertion, erect to spreading, weakly decurrent, 1.4–1.9 \times 0.6–1.0 mm (including acumen), entire or denticulate above; **mid laminal cells** linear-rhombic, smooth, firm-walled, mostly 54–90 \times 7–9 μm ; **cells of the acumen** not differentiated; **cells at insertion** shorter, thicker-walled and porose in several rows; **alar cells** slightly inflated or subquadrate in a poorly differentiated group. **Branch leaves** ovate-acuminate, the acumen usually narrow and \pm piliferous, mostly 1.2–1.6(–1.8) \times 0.4–0.55(–0.65) mm, erect-spreading when moist, erect and striolate when dry; **mid laminal cells** linear-rhombic, firm-walled, mostly 45–60(–90) \times 7–9 μm , becoming longer in lower leaf and shorter and broader at insertion; **alar**

cells subquadrate and mostly weakly inflated, forming a medium-sized but poorly defined group. **Costa** variable in length, single or rarely slightly forked, ($\frac{1}{3}$ –) $\frac{1}{2}$ – $\frac{2}{3}$ the leaf length, terminal spine lacking or rarely rudimentary.

Perichaetia c. 2.0 mm long, the inner leaves acuminate from an oblong base and erect. **Perigonia** scattered on stems and branches, c. 0.6–0.8 mm, paraphyses not seen. **Setae** flexuose, sinistorse, 12–15 mm, red-brown, smooth; **capsules** oblong-cylindric, red-brown, constricted below the mouth when dry, 1.4–1.8 mm; **exothecial cells** oblong, firm-walled, distinctly or weakly collenchymatous; **annulus** adhering to the operculum; **operculum** c. 1 mm, curved and distinctly shorter than the theca. **Exostome teeth** as genus, c. 450 μ m; **endostomal segments** perforate, **cilia** single or paired, nodose. **Spores** 13–15 μ m, green.

Illustrations: Plate 14.

Distribution: NI: N Auckland, S Auckland, Gisborne, Hawke's Bay, Taranaki, Wellington; SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland; St; Ch; Sol; Sn; A. Reported from C by Vitt (1974).

Australasian. Tasmania*, mainland Australia*. Hedenäs (2002) has detailed the occurrence of this species in Australia.

Habitat: Mostly on soil, rotten logs, and tree bases, but also occurring on rock (especially basalt and limestone) and epiphytic on a variety of trees and shrubs, including *Coprosma grandifolia*, *Hoheria* sp., *Melicytus ramiflorus*, *Metrosideros excelsa*, and *Myoporum laetum*. Occurring in a range of indigenous forest, shrubland, and grassland types. Also occurring in disturbed habitats, and either under, or epiphytic on, a range of exotic trees (including *Eucalyptus*, *Pinus*, *Populus*, *Quercus*, *Salix*, and *Sambucus*), including those in plantations. On the North I. ranging from near sea level (near Foxton, Wellington L.D.) to at least 900 m (near Blyth Track, Wellington L.D.), and on the South I. to c. 1230 m (Mt Mytton, Nelson L.D.). Relatively few records are from above 1000 m, and these all come from limestone or marble ledges in Nelson L.D.

Occurring with a wide range of terrestrial, epilithic and epiphytic species, including *Alleniella hymenodonta*, *Eurhynchium asperipes*, *Orthorrhynchium elegans*, *Racopilum strumiferum*, *Rhaphidorrhynchium amoenum*, *Rhynchostegium muriculatum*, *R. tenuifolium*, and *Weymouthia cochlearifolia*. Mixtures of *Rhynchostegium* spp. are common and often confusing.

Notes: Representative material of *R. laxatum* is easily recognisable. The distinctly striolate (when dry) and non-complanate branch leaves, which are abruptly and usually narrowly acuminate, give this species a distinctive facies. Given its autoicous sexuality, at least some sporophytes are usually observable; the smooth seta and relatively short operculum help to differentiate this species from its congeners. Differences in habit are as reliable as the length of laminal cells to differentiate the present species from *R. tenuifolium*, despite considerable variability related to habitat conditions.

In the lectotype specimen of this species the upper laminal cells (in branch leaves) are mostly 54–75 μ m long; mid to lower laminal cells have similar dimensions, and the leaves are mostly c. 1.2 mm long. These measurements are all near the lower end of the continuous variation for the species.

Although well-developed and representative material is easily recognised, this is a highly variable species and not all material can be named with confidence.

After initial uncertainty, I concur with Sainsbury (1955, p. 443) that *R. peracuminatum* Dixon & Sainsbury is referable here. The type specimen (three isotypes seen) has branch leaves at the upper end of continuous variation for this species (to c. 1.8 × 0.5 mm) and the specimen is brighter yellow and more lustrous than usual for *R. laxatum*; most mid laminal cells (branch leaves) are c. 75–90 μ m long and the dry leaves are striolate. Like Sainsbury, I consider these specimens to represent an extreme form of *R. laxatum*.

Recognition: Many herbarium specimens of *R. muriculatum* are misnamed as *R. laxatum*. When sterile, the most useful character for distinguishing the two species is the width of the stem leaves, which are c. 0.6–1.0 mm wide in *R. laxatum* and mostly 0.4–0.5 wide in *R. muriculatum*. The smooth setae of *R. laxatum* will readily distinguish fertile material.

Etymology: The epithet *laxatum* means wide or loose. It was used by Mitten in his protologue in reference to the relatively wide laminal cells in the present species compared to the European *R. confertum*.

***Rhynchostegium muriculatum* (Hook.f. & Wilson) Reichardt in Fenzl, *Reise Novara* 1, 191 (1870)**

≡ *Hypnum muriculatum* Hook.f. & Wilson in Wilson, *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II*, 108 (1854)

≡ *Eurhynchium muriculatum* (Hook.f. & Wilson) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1876–1877: 351 (1878)

≡ *Rhynchostegiella muriculata* (Hook.f. & Wilson) Broth., *Nat. Pflanzenfam. [Engler & Prantl]* 1(3), 1161 (1909)

Type: N.Z. Not seen.

= *Rhynchostegiella novae-zealandiae* Dixon, *Bull. New Zealand Inst.* 3: 370 (1929)

≡ *Eurhynchium novae-zealandiae* (Dixon) Fife, *Bryologist* 98: 315 (1995)

Isotypes: N.Z., Marlborough, 1928, *J.H. McMahon s.n.*, CHR 4745!, CHR 570080!; WELT M020226!

Plants yellow- to dark green, lustrous. **Stems** irregularly branched, mostly weakly complanate, commonly to c. 20 mm long, in cross-section with central strand apparently absent. **Branches** mostly c. 5–12 mm, variably complanate (often more complanate in lower segments and scarcely at all near apices; occasionally markedly complanate). **Stem** and **branch leaves** differing only by size, not plicate, spreading when moist, little altered when dry. **Stem leaves** ovate-lanceolate and ± abruptly acuminate, weakly concave, weakly narrowed to the insertion, ± symmetric, neither plicate nor decurrent, (1.1–)1.2–1.5 × 0.4–0.5 mm, finely denticulate nearly to base; **mid laminal cells** linear-rhombic, mostly (45–)75–90 × c. 6–7 µm and 9–15: 1; **cells of the acumen** scarcely shorter; cells at insertion shorter, thicker-walled and porose in several rows; **alar cells** subquadrate in a small and poorly differentiated group. **Branch leaves** slightly smaller (c. 1.1–1.4 × 0.30–0.55 mm). **Costa** single, distinctly tapered, extending ½ or more of the leaf length (often to c. ¾ the leaf length and less tapered in stem leaves), often with a terminal abaxial spine.

Autoicous. Perichaetia c. 2 mm long, the leaves erect. **Perigonia** scattered and usually numerous on fruiting stems, c. 0.6–0.8 mm, nearly black, with filiform paraphyses. **Setae** flexuose, not twisted, (5)8–15 mm, red-brown, finely and densely papillose throughout (papillae scarcely visible under a hand-lens); **capsules** short oblong-cylindric, weakly curved, dark brown at maturity, c. 2.0 mm; **exothecial cells** oblong, firm-walled, distinctly or weakly collenchymatous; **operculum** c. 1.5 mm, curved, distinctly shorter than the theca. **Exostome teeth** as per genus, c. 450–500 µm; **endostome** as per genus, with widely perforate **segments** and paired or single nodose **cilia**. **Spores** 13–15 µm, green.

Illustrations: Plate 7. Wilson 1854, pl. 89, fig. 3; Hedenäs 2002, fig. 11 e.

Distribution: NI: N Auckland, including offshore islands (TK, PK, HC, GB), S Auckland, Gisborne, Hawke's Bay, Wellington; SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland; St. Australasian. Tasmania*, mainland Australia*. Reported from Norfolk I. by Streimann (2002).

Habitat: On wood or bark of both standing trunks and logs in varying stages of decay; on bark of living trees of a wide range of species (including *Aristotelia serrata*, *Carpodetus serratus*, *Dacrycarpus dacrydioides*, *Fuchsia excorticata*, *Veronica elliptica*, *Melicytus ramiflorus*, *Myoporum laetum*, *Pseudopanax* sp., *Salix* sp., and *Schefflera digitata*, as well as tree-ferns). Also occurring on rock (breccia, basalt, mudstone, greywacke, and granite) or soil, and in both instances often associated with stream beds. Occurring in a wide range of lowland forest and scrub vegetation. On both the North I. and the South I. ranging near sea level to c. 760 m (Tangiwhai, Wellington L.D.). Associated with a wide range of bryophytes including *Alleniella hymenodonta*, *Calyptopogon mnioides*, *Camptochaete pulvinata*, *Cryphaea* spp., *Dichelodontium nitidum*, *Pyrrhobryum bifarium*, *Racopilum convolutaceum*, *Rhynchostegium laxatum*, *R. tenuifolium*, *Sauloma tenella*, *Thuidiopsis sparsa*, *Metzgeria* spp., and *Chiloscyphus muricatus*.

Notes: This is a morphologically variable species. The width and shape of the leaves, the length of the mid laminal cells, the strength of leaf margin toothing, and the degree of flattening of the shoot (both stems and branches) all vary markedly here. Like Scott & Stone (1976, p. 426), I find that a terminal costal spine is often present in this species and strongly doubt Sainsbury's (1955, p. 436) statement that the nerve here is "never ending in a dorsal spicule". However, the observational difference may in part be a function of intra-specific variability. The usually present costal spine is often most easily observed when an intact branch is observed under the compound microscope. Forms with broader leaves occur that, if sterile, cannot be differentiated from *R. laxatum*. In difficult material the shorter stems and lack of leaf striolations in the present species can allow at least tentative

determinations. Occasionally material of *R. muriculatum* is seen in which the laminal cells are quite short (c. 45–60 µm). Molecular investigations might cast some light on the nature of the intra-specific variation. For the present, however, it is advisable to take a wide view of this species.

The type material of *R. novae-zealandiae* Dixon is very attenuate, but exhibits no morphological differences (including the degree of differentiation of alar cells) to justify its segregation. The presence of *Catagonium nitens* mixed with one isotype suggests its collection from a very sheltered and shaded site.

Only one sterile specimen from Norfolk I. has been examined, and its identity is not certain. It has well-developed stem and branch leaves that are shorter (c. 0.8–1.2 mm), more ovate, and broader at the apex than representative N.Z. *R. muriculatum*. However, Streimann's (2002, p. 12) description suggests that at least some Norfolk I. material is correctly referred to this species.

Recognition: Sporophytically, the finely scabrose setae and the collenchymatous exothecial cells are distinctive, and, fortunately, collections devoid of sporophytes are relatively uncommon. Differentiation from *Eriodon cylindritheca* (q.v.) is not always possible when fruit are lacking.

When sterile (or when admixtures occur) this species can be very difficult to differentiate from other species of *Rhynchostegium* and *Eriodon cylindritheca*. *Rhynchostegium muriculatum* and *R. laxatum* have laminal cells of similar length, but *R. muriculatum* generally has narrower stem leaves (c. 0.4–0.5 mm wide) than does *R. laxatum* (c. 0.6–1.0 mm), but this may not consistently distinguish some collections. *Rhynchostegium muriculatum* has branches that are not or only weakly complanate and mid laminal cells that are generally longer (75–90 µm) in contrast to the decidedly complanate branches and shorter stem leaf mid laminal cells (57–75 µm) of *Eriodon*.

When fruiting, the scabrose setae (vs smooth in *R. laxatum* and *R. tenuifolium*) and the shorter and stouter operculum with a distinctly conic base (vs a slender operculum, which is more or less the length of the theca in *R. laxatum* and *R. tenuifolium*) will distinguish *R. muriculatum* from its N.Z. congeners. However, largely because the papillae in *R. muriculatum* are low and inconspicuous under the hand-lens or stereo microscope, some herbarium specimens are misnamed as *R. laxatum*.

Rhynchostegium muriculatum is also sometimes confused with *Amblystegium serpens* but differs subtly in habit due to the ± complanate set of the leaves in the present species. When fruiting, the scabrose setae, dark brown capsules with collenchymatous exothecial cells, distinctly brown-coloured exostome teeth, and rostrate operculum contrast sharply with the smooth setae, pale brown capsules with non-collenchymatous exothecial cells, pale exostome teeth, and conic operculum of the *Amblystegium*. The longer (c. 9–15:1) mid laminal cells and weakly differentiated alar group of *R. muriculatum* also contrast with the shorter (c. 3–5:1 and c. 24–30 µm long) mid laminal cells and more strongly differentiated alar group of the *Amblystegium*.

Etymology: The epithet *muriculatum* means minutely rough and refers to the minute papillae of the setae (which are often difficult to see with a hand-lens).

***Rhynchostegium tenuifolium* (Hedw.) Reichardt in Fenzl, *Reise Novara* 1, 191 (1870)**

≡ *Hypnum tenuifolium* Hedw., *Sp. Musc. Frond.* 283 (1801)

Neotype: Australia, Victoria. (Designated by Hedenäs, 1996.) Not seen.

= *Hypnum huttonii* Hampe ex Beckett, *Trans. & Proc. New Zealand Inst.* 25: 300 (1893)

Lectotype: N.Z., Westland, Greymouth, *W.J. Gulliver s.n.*, CHR 585861!

Plants medium-sized, bright or pale green, lustrous when dry. **Stems** irregularly or subpinnately branched, from <40–100 mm or more, not or weakly complanate. **Branches** ascendant and variably complanate. **Stem and branch leaves** differing only by size, not striolate when moist or dry. **Stem leaves** broadly ovate, abruptly and shortly acuminate, asymmetric at base, spreading, not complanate, mostly (1.6–)1.8–2.0 × c. 1.0 mm, narrowed and ± cordate at base, plane at margins, margins sharply denticulate nearly to base; **mid laminal cells** linear, 90–120(–135) × 6–9 µm, becoming shorter and broader near base; **cells of the acumen** not differentiated but somewhat shorter; **cells at insertion** shorter, thicker-walled and porose in several rows; **alar cells** not differentiated. **Branch leaves** smaller and more complanate than stem leaves but not otherwise differentiated, mostly 1.5–1.6(–1.8) × 0.65–0.8 mm. **Costa** rapidly tapered, not forked, extending c. ½–¾(–¾) to apex, lacking or rarely with a terminal abaxial spine.

Perichaetia c. 2.0 mm long, the inner leaves acuminate from an oblong base, erect or weakly spreading. **Perigonia** scattered on stems & branches, c. 0.8 mm, with filiform paraphyses. **Seta** nearly straight, smooth, red-brown, c. 15–20 mm; **capsules** oblong-cylindric, red-brown, constricted below

the mouth when dry, 1.6–2.0 mm; **exothecial cells** mostly oblong, firm-walled, weakly collenchymatous; **annulus** not clearly seen; **operculum** ± equal the theca. **Exostome teeth** as per genus, finely transversely striate on the outer surface, c. 450 µm; **endostome** as per genus, with perforate segments and single or paired, nodose cilia. **Spores** 12–14 µm.

Illustrations: Plate 14. Beever et al. 1992, fig. 78 a–e; Hedenäs 2002, fig. 11 c–d; Malcolm & Malcolm 2003, p. 59; Meagher & Fuhrer 2003, p. 79.

Distribution: K; NI: N Auckland including offshore islands (TK, PK, HC, LB, GB), S Auckland, Gisborne, Hawke's Bay, Taranaki (Lake Rotokare, New Plymouth, Stratford), Wellington; SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland; St; Ch; Sol; C.

Austral. Tasmania*, mainland Australia*. Reported from South America by Scott & Stone (1976, p. 430) and others.

Habitat: On decaying wood, exposed roots, tree trunks, and sometimes branches of a wide range of native and introduced tree species, including tree ferns. Also terrestrial on humus, duff, or soil and sometimes growing on thin soil over rock (breccia, granite, greywacke, limestone). On the North I. occurring from sea level (many localities) to at least 780 m (Erua, Wellington L.D.). On the South I. ranging from near sea level (many localities) to at least 735 m (Banks Peninsula).

In keeping with its varied habitats, *R. tenuifolium* can associate with a large number of moss taxa, including *Achrophyllum* spp., *Calomnion complanatum*, *Calyptrochaeta flexicollis*, *Hypopterygium* sp., *Hypnum cupressiforme*, *Lembophyllum divulsum*, *Racopilum convolutaceum*, *Rhaphidorrhynchium amoenum*, *Rhizogonium distichum*, *Thuidiopsis furfurosa*, and *Wijkia extenuata*.

Notes: The typification of *Hypnum huttonii* Beckett poses some difficulty. Although three of the four specimens cited by Beckett (1893, p. 300) are present in the Beckett herbarium, they include two species of *Rhynchostegium* as well as *Eriodon cylindritheca*. The lectotype selected above conforms with both Beckett's diagnosis and with Dixon's (1929, p. 328) placement of this name in the synonymy of *R. tenuifolium*.

Recognition: When well developed, the lustrous, non-striolate, and complanate plants facilitate recognition of *R. tenuifolium*. Sporophytes are frequently present in this autoicous species, and the presence of the asymmetric oblong-cylindric capsules with long-rostrate opercula is useful in its recognition. However, less well-developed material can be confused with *R. laxatum*; mixtures of the two species are frequent and can be confusing.

Sterile *Brachythecium rutabulum* is sometimes confused with *R. tenuifolium*. *Rhynchostegium tenuifolium* is a less robust plant with smaller leaves (stem leaves 1.6–2.0 vs 2.5–3.0 mm), in which the branches are distinctly complanate. The most easily observed gametophytic difference, however, is the absence of differentiated stem leaf decurrencies in *R. tenuifolium*. Numerous sporophytic characters also distinguish the two species, but confusion is far less likely when fruit is present.

Etymology: The epithet *tenuifolium* means thin-leaved.

***Scleropodium* Schimp. in Bruch et al., *Bryol. Eur.* 6, 27 (1853)**

Type taxon: *Scleropodium illecebrum* Schimp.

Taxonomy: *Scleropodium* is a genus of fewer than 10 species that is distributed in North America, Europe, and Asia; its centre of diversity seems to be western North America, where “all six of the well-recognised taxa are found” (*fide* Seppelt et al. 2011). A single, very poorly documented species occurs in N.Z., where it is surely adventive.

Only a species description is given below. It draws on a collection by P. Beveridge as well as a published description by Seppelt et al. (2011). Generic descriptions can be found in several modern regional floras, including those of Lawton (1971) and Smith (2004).

Etymology: The generic name means hard-footed; its significance is unclear.

***Scleropodium touretii* (Brid.) L.F.Koch, *Rev. Bryol. Lichénol.*, n.s. 18: 177 (1949)**

≡ *Hypnum touretii* Brid., *Muscol. Recent. Suppl.* 2, 185 (1812)

Type: France. Not seen.

= *Brachythecium cymbifolium* Dixon & Sainsbury, *J. Bot.* 71: 249 (1933)

Holotype: N.Z., Hawke's Bay, Havelock North, June 1930, *E.A. Hodgson s.n.*, ("Sainsbury no. 613") BM-Dixon! Isotypes: CHR 573787! WELT M005752!

Plants medium-sized, yellow-green, forming compact mats on insolated soil banks. **Stems** prostrate, irregularly but much branched, green- or pale brown, to at least 50 mm, strongly curved both wet and dry, in cross-section with a distinct central strand and several layers of thick-walled cortical cells, densely beset below with fascicles of brown, smooth rhizoids. **Branches** ± uniform in length, mostly 6–10 mm, strongly curved, terete, ± cuspidate at tips. **Stem** and **branch leaves** similar, broadly ovate, acute or apiculate and very weakly reflexed at apex, narrowed at insertion, strongly concave, not striolate, slightly spreading when moist, erect and imbricate when dry, with margins erect, weakly and bluntly denticulate (especially at apex) or nearly entire, 1.0–1.6 × 0.6–0.8 mm in N.Z. material. **Costa** stout but ill-defined, c. 50–60 µm near base, tapered to terminus, rarely weakly spurred, extending c. $\frac{3}{4}$ – $\frac{7}{8}$ the leaf length, mostly with an inconspicuous abaxial terminal spicule. **Upper laminal cells** linear-vermicular, rounded at ends, smooth, firm-walled, not porose, 45–60(–75) × 4–5 µm, becoming much shorter at leaf apex; **basal cells** shorter and broader in several rows, not or moderately porose; **alar cells** moderately differentiated to form a medium-sized, ± auriculate group, subquadrate to short-rectangular, firm-walled, sometimes with a few larger and inflated cells, extending less than 10 cells up the margin and about halfway to the base of the costa. **Axillary hairs** difficult to observe, few, 2–4 cells long, lacking pigmented basal cells.

Reportedly dioicous. **Perichaetia** scattered on stems, c. 1.2 mm, with ecostate, ovate-acuminate leaves. Neither **perigonia** nor **capsules** seen in N.Z. material.

Illustrations: Plate 15. Hedenäs 2002, fig. 7 a–c (as *S. australe*); Smith 2004, fig. 280, 5–8; Seppelt et al. 2011, fig. 1. Smith's figure shows stem and branch leaves that are more differentiated than seen in N.Z. material.

Distribution: NI: Hawke's Bay (Havelock North), Wellington (Wellington Botanical Gardens).

Adventive. Tasmania*. Reported from Britain, Mediterranean and western Europe, western North America, as well as Cyprus, China, Macaronesia, and North Africa by Smith (2004). Lawton (1971) detailed the distribution in western North America; she considered the species to have two varieties there.

Notes: This species was first recognised in N.Z. by Peter Beveridge, who collected it in 2008 from an insolated soil bank beside the William Wakefield Way, and at other localities, in the Wellington Botanical Garden.

Beveridge subsequently identified his Wellington Botanical Garden collections using the elegant illustration and detailed discussion by Seppelt et al. (2011) of its Tasmanian occurrence.

An earlier collection by E.A. Hodgson at Havelock North in 1930 was described as *Brachythecium cymbifolium* Dixon & Sainsbury (1933). It is troublesome that the protologue of this species includes a description of the sporophyte while the type specimen is sterile. Examination of material in Sainsbury's herbarium shows that the sporophyte description was derived from a fertile topotype (*E.A. Hodgson s.n.*, July 1931, WELT M005753).

Recognition: The strongly curved branches (mostly more curved than shown in Plate 15) and more compact and prostrate habit distinguish *S. touretii* from the much more widespread, loosely interwoven, and ascendant *Pseudoscleropodium purum*. The stem leaves here are smaller (1.0–1.6 × 0.6–0.8 mm vs c. 1.5–2.1 × 1.0–1.5 mm); the costae are longer ($\frac{3}{4}$ – $\frac{7}{8}$ the leaf length and mostly with an inconspicuous abaxial terminal spicule) relative to the leaf length than those of *P. purum* ($\frac{1}{2}$ – $\frac{2}{3}$ the leaf length, with a terminal spine apparently absent). The leaf apiculi here are very slightly reflexed compared to the often markedly reflexed apiculi of *P. purum*.

According to Seppelt et al. (2011) and others, *Scleropodium touretii* has fewer and fewer-celled axillary hairs than *P. purum*. Axillary hairs, while difficult to demonstrate, are most easily located attached to branch leaf scars following removal of the leaves and staining. In the Wellington Botanical Garden material they conform to Seppelt's illustration and description.

Etymology: The specific epithet probably honours the collector (“La Tourette”) of the French type. There is some variation in its spelling in modern floras; the spelling in *Tropicos* (data seen online, TROPICOS, accessed 18 June 2018) and Seppelt et al. (2011) is followed here.

***Scorpiurium* Schimp., *Syn. Musc. Eur.*, ed. 2, 855 (1876)**

Type taxon: *Scorpiurium rivale* Schimp. = *Scorpiurium deflexifolium* (Solms) M.Fleisch. & Loeske

Plants small or minute, dull, with creeping primary stems and ascendant secondary stems.

Secondary stems fastigiatly or subpinnately branched, mostly less than 15 mm long, in cross-section round or oval, with several (c. 5) layers of thick-walled outer cells and a central strand;

rhizoids smooth, brown, scattered in sparse fascicles on ventral surface of stems; **branches** short, curved when dry. **Primary stem leaves and branch leaves** differentiated. **Primary stem leaves** erect when dry, \pm spreading when moist, ovate-triangular and abruptly tapered to a narrow acumen, denticulate or entire. **Secondary stem and branch leaves** erect when dry, loosely spreading and concave to subtubulose when moist, ovate-lanceolate to elliptic-ovate, acute or obtuse, neither complanate nor decurrent, denticulate; **upper and mid laminal cells** rhombic to linear-rhombic, firm-walled and smooth, eporose; **alar cells** differentiated, quadrate or subquadrate, firm-walled, forming a large but ill-defined group extending nearly to the costa base and far up the basal margin; **costa** single, ending $\frac{2}{3}$ or more the leaf length, stout or tapered, smooth or ending in abaxial spine. **Axillary hairs** reportedly present (not seen).

Autoicous. **Perichaetia** and **perigonia** scattered on stem and branches. **Setae** weakly papillose throughout (visible only under compound microscope), or smooth above; **capsule** obovoid, inclined.

Exostome teeth yellow-brown, transversely striate below; **endostome** present, basal membrane reportedly weak. **Calyptra** cucullate and smooth.

Taxonomy: *Scorpiurium* is a genus of fewer than five species distributed in western and southern Europe, western Asia, Macaronesia, and Australasia. It is traditionally distinguished from *Eurhynchium* and allied genera by having “large alar groups that extend far up along the stem and branch leaf margins and which consist of numerous shortly oblate to rectangular cells, and by the branches tending to be curved when dry” (Hedenäs 1996).

The placement of one Australasian species in *Scorpiurium* follows Hedenäs (1996, 2002). The Australasian *S. cucullatum* differs from the European *S. circinatum* in several ways, including (1) broader, more elliptic branch leaves, which are broadly acute or obtuse apically and more strongly concave, even subtubulose, when dry; and (2) shorter, less stout, and more tapered costae. Very limited sporophytic material of either species has been available for comparison. Future investigations may alter our view of the generic affinities of this species.

***Scorpiurium cucullatum* (Mitt.) Hedenäs, *Nova Hedwigia* 62: 452 (1996)**

≡ *Hypnum cucullatum* Mitt., *Hooker's J. Bot. Kew Gard. Misc.* 8: 264 (1856)

≡ *Rhynchostegium cucullatum* (Mitt.) Mitt., *Trans. & Proc. Roy. Soc. Victoria* 19: 88 (1882)

≡ *Rhynchostegiella cucullata* (Mitt.) Paris, *Coll. Nom. Broth.* 28 (1909)

≡ *Eurhynchium cucullatum* (Mitt.) I.G.Stone & G.A.M.Scott, *J. Bryol.* 7: 605 (1973)

Holotype: Australia, Victoria, Dargo, 18(?)5, *F. Mueller* 10, NY 267967!

Plants small, very pale or dirty green, dull, prostrate or with branches weakly ascendant and curved, forming densely interwoven mats. **Primary stems** creeping. **Secondary stems** mostly c. 10–15(–20) mm long, fastigiatly or subpinnately branched, in cross-section oval, with several (c. 5) layers of thick-walled outer cells and a distinct central strand; **rhizoids** smooth, brown, very sparse, scattered in fascicles on ventral surface of stems. **Stem and branch leaves** differentiated. **Stem leaves** not clearly seen in N.Z. material. **Branch leaves** erect and subtubulose when dry, loosely spreading and concave when moist, elliptic-ovate, widest at or near mid leaf, broadly acute, obtuse, or rounded (usually variable on one plant), mostly $0.6\text{--}0.8\text{--}(0.9) \times c. 0.35\text{--}0.4$ mm, neither decurrent nor plicate, bluntly denticulate in upper one-fourth or slightly more; **upper laminal cells** (beyond costa) and cells near margins rhombic, firm-walled and smooth, $21\text{--}30 \times c. 9$ μm ; **mid laminal cells** more elongate, (c. $35\text{--}45$ μm); **alar cells** quadrate or subquadrate, firm-walled, forming a very large but ill-defined group extending nearly to the costa and upwards on the margin for c. $150\text{--}225$ μm and c. $15\text{--}20$ cells. **Costa** c. 30 μm wide near base, tapered, sometimes weakly spurred above, extending c. $\frac{2}{3}$ to apex, apparently without a terminal spine.

Sexuality as per genus. **Perigonia** scattered, c. 0.6 mm. **Setae** stout, 4–5 mm, yellow-brown, weakly flexuose, weakly papillose throughout (visible only under compound microscope), or smooth above; **capsule** obovoid, weakly inclined, yellow-brown at maturity, not narrowed at mouth, c. 1.1×0.65 mm; **exothecial cells** oblong, firm-walled, not thickened at corners; **stomata** few at capsule base; **annulus** and **operculum** not seen. **Exostome teeth** yellow-brown, broadly lanceolate, mostly blunt at apex, apparently bordered, transversely striate below, trabeculate on inner surface, c. 210–240 μm ; **endostome** present; **segments** nearly the height of the teeth and narrowly perforate, arising from a high membrane; **cilia** apparently absent. **Calyptra** not seen. **Spores** mostly 20–24 μm , not smooth (surface details not seen).

Illustrations: Plate 16. Scott & Stone 1976, pl. 79; Hedenäs 2002, fig. 2 a–c.

Distribution: NI: N Auckland (Kawakawa), Wellington (Upper Kaumingi Stream); SI: Marlborough (Rai Valley).

Australasian. Tasmania*, mainland Australia (Victoria)*. Recorded from Queensland and N.S.W. by both Scott & Stone (1976) and Hedenäs (2002).

Habitat: One of the most poorly documented species in the N.Z. moss flora. The Kawakawa collection was recorded by Bartlett (1984, as *Eurhynchium*), and this appears to be the only N.Z. published record. This collection is ample and sparsely fruiting; it came from “base of willows on silt (from flooding)”. Bartlett (1984) recorded some nine associated moss taxa, of which *Cyrtodon dilatatus* was the most abundant. Both the Rai Valley collection (from “Browns Road Swamp” and collected by J.K. Bartlett) and the Upper Kaumingi Stream collection (on Te Kanuka Farm Station, collected by P.J. de Lange) also came from silt-covered willow bases. The former was associated with *Hennediella serrulata* and the latter with *Amblystegium serpens*. The habitat for the documented collections is very similar to the “typical habitat” of the species in Australia, as described by Scott & Stone (1976, p. 428).

The original Rai Valley collection was made in 1979 but an attempt to relocate this species there in October 2004 was unsuccessful; the silt-covered tree (willow) trunks occupied by this species are possibly an ephemeral habitat at any one site.

Recognition: The diagnosis of Hedenäs (2002) in his Australian Brachytheciaceae treatment applies equally well to N.Z. material: “*Scorpiurium cucullatum* is easily separated from other Australian species of the Brachytheciaceae by its small size, its large alar groups that extend far up along the leaf margins and consisting of numerous shortly oblate to rectangular cells, and by the strongly inrolled leaf margins when dry.” The very pale coloration is helpful in the recognition of this species.

Because of the curvature of the dry branches and its epiphytic habit, this species could possibly be confused with *Leptodon smithii*, and in particular with those forms producing microphyllous branches. The secondary stem and branch leaves of *S. cucullatum* are narrower in relation to their width than the branch leaves of well-developed *L. smithii*. However, with microphyllous forms of *Leptodon*, difficulties may be greater. The mid laminal cells are longer and more distinctly rhombic in *Scorpiurium* than in *Leptodon* (c. 35–45 μm vs <15 μm). Paraphyllia are lacking in *Scorpiurium*, while the distinctive strap-shaped paraphyllia of *Leptodon smithii* are present even in microphyllous forms. The host tree species, pale coloration, autoicous sexuality, and numerous sporophyte characters of *Scorpiurium* will also help differentiate it from *Leptodon*.

Etymology: The epithet *cucullatum* refers to the form of the leaf apex; the subtubulose leaves (and hence the cucullate appearance of some leaves) is more apparent in dry material.

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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)
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 (<i>videlicet</i>)
vs	versus
W.A.	Western Australia
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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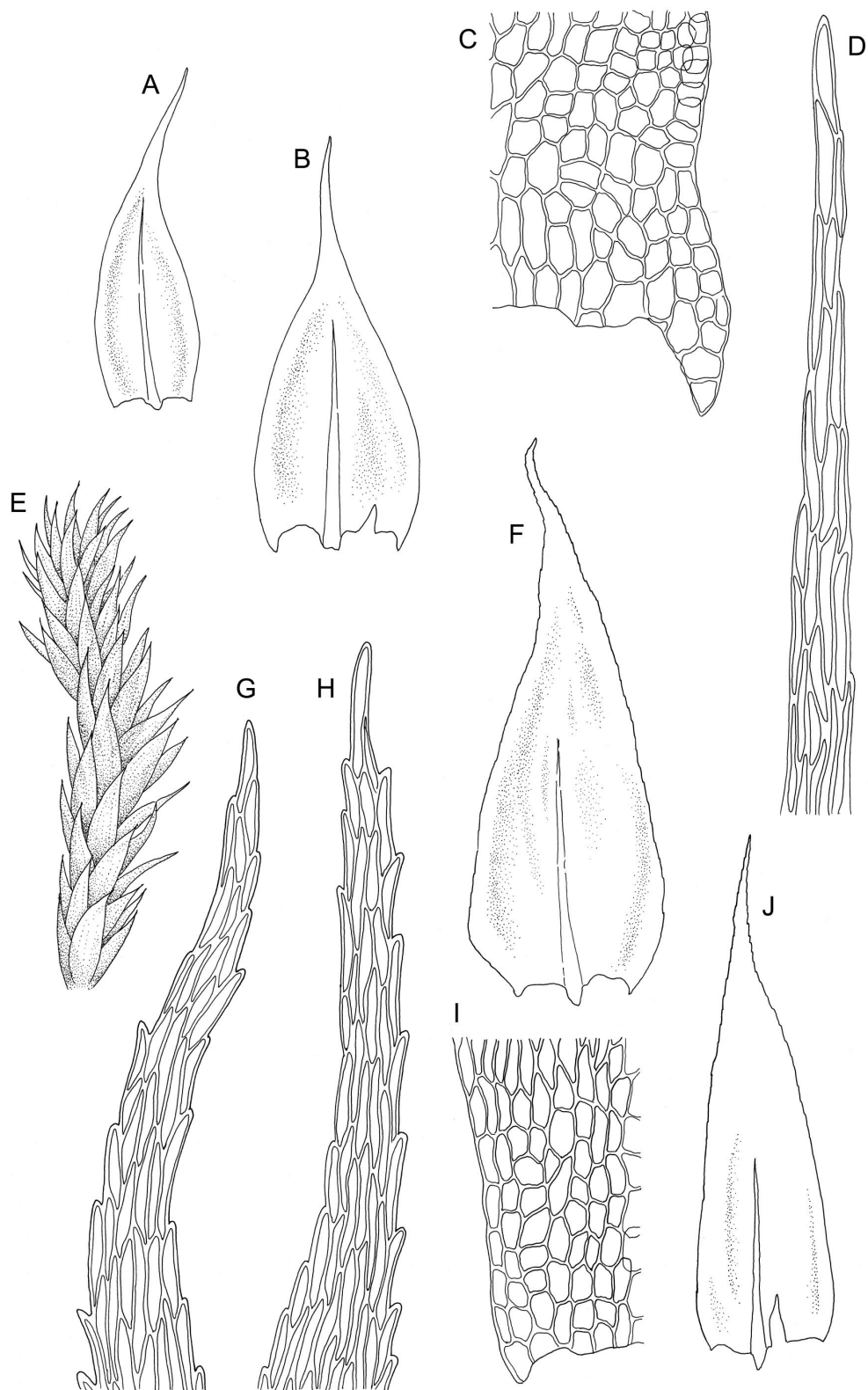


Plate 1: *Brachythecium*. A–D: *B. albicans*. A, branch leaf. B, stem leaf. C, alar cells of stem leaf. D, leaf apex. E–J: *B. campestre*. E, portion of shoot. F, stem leaf. G, stem leaf apex. H, branch leaf apex. I, alar cells of stem leaf. J, branch leaf. *B. albicans* drawn from A.J. Fife 10083, CHR 496115. *B. campestre* drawn from W. Bell s.n., Jan. 1892, CHR 472215A.

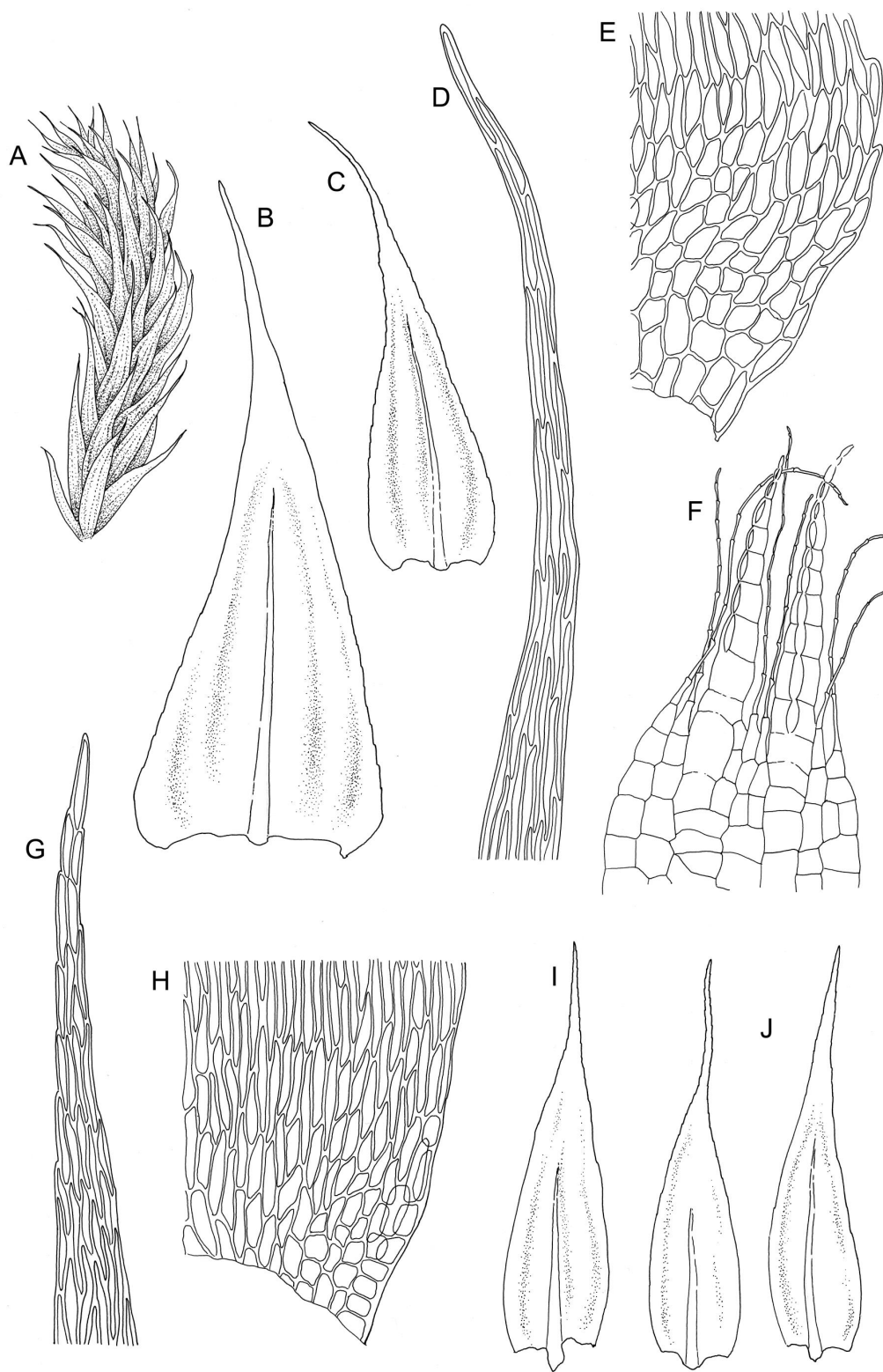


Plate 2: *Brachythecium*. A–F: *B. campestre*. A, portion of shoot. B, stem leaf. C, branch leaf. D, stem leaf apex. E, alar cells of stem leaf. F, endostome detail. **G–J: *B. salebrosum*.** G, stem leaf apex. H, alar cells of stem leaf. I, stem leaf. J, branch leaves. *B. campestre* drawn from K.W. Allison 5723, CHR 379104. *B. salebrosum* drawn from T.W.N. Beckett 393, CHR 472214.

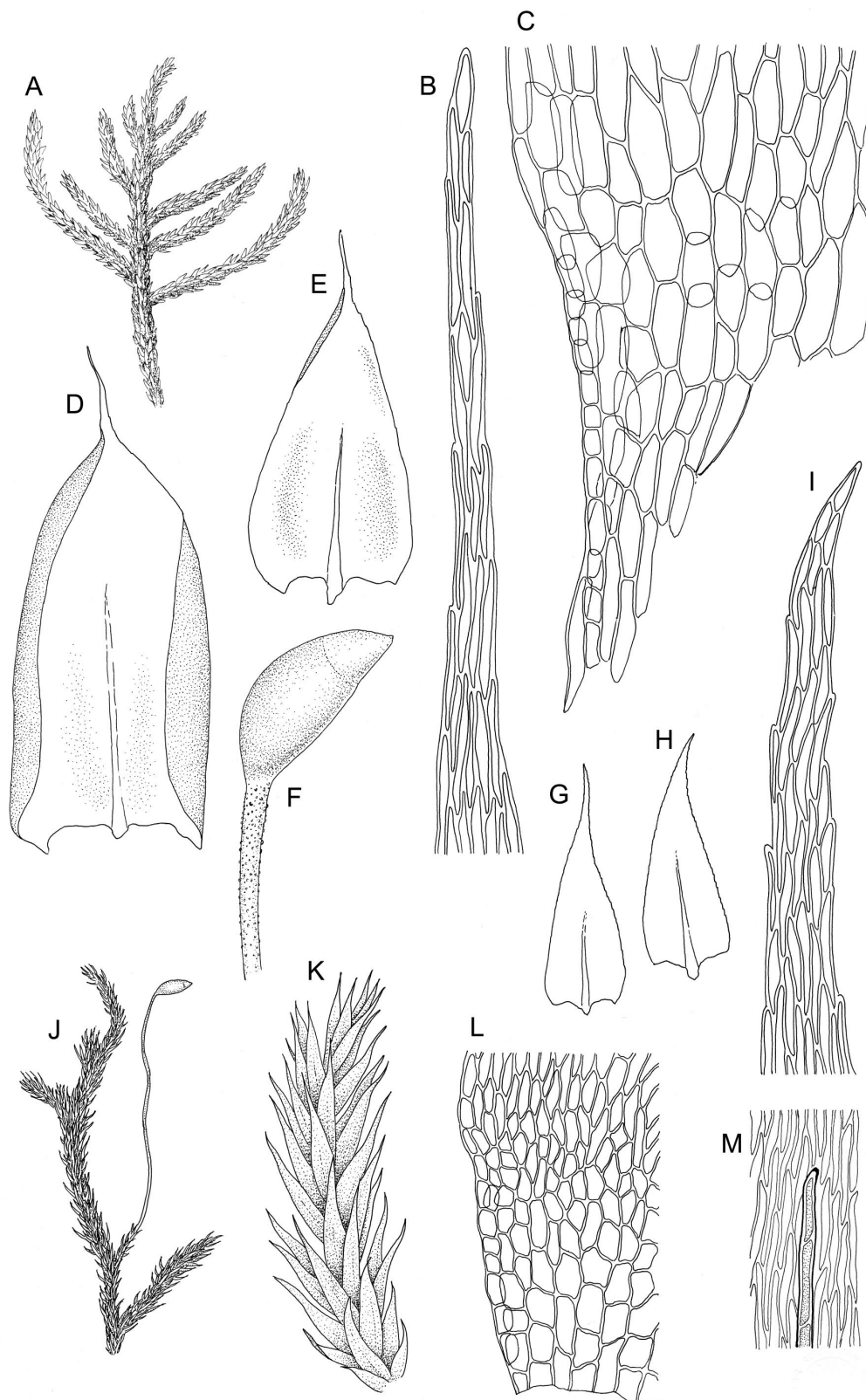


Plate 3: *Brachythecium*. A–E: *B. fontanum*. A, habit. B, stem leaf apex. C, alar cells of stem leaf. D, stem leaf. E, branch leaf. **F–M: *B. plumosum*.** F, capsule and upper seta. G, branch leaf. H, stem leaf. I, leaf apex. J, habit with capsule. K, branch detail. L, alar cells. M, abaxial costal spine. *B. fontanum* drawn from holotype, A.J. Fife 9251, CHR 461262. *B. plumosum* drawn from A.J. Fife 6593, CHR 405566.

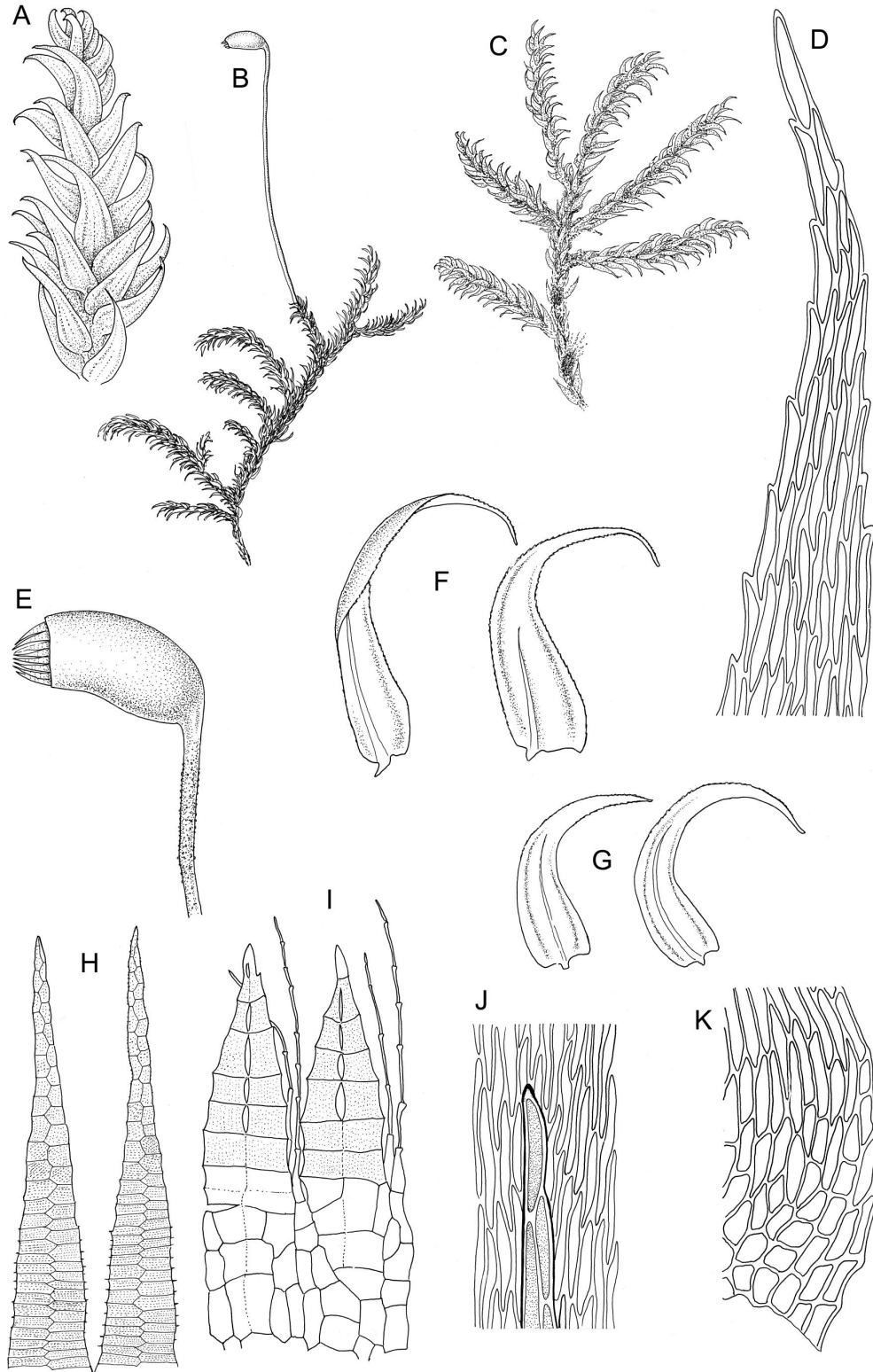


Plate 4: *Brachythecium*. A–K: *B. paradoxum*. A, branch detail. B, habit with capsule. C, habit of sterile plant. D, stem leaf apex. E, capsule and upper seta. F, stem leaves. G, branch leaves. H, exostome teeth outer surface. I, endostome. J, abaxial costal spine of stem leaf. K, alar cells of stem leaf. Drawn from *J. Lewinsky 74-500*, CHR 240407.

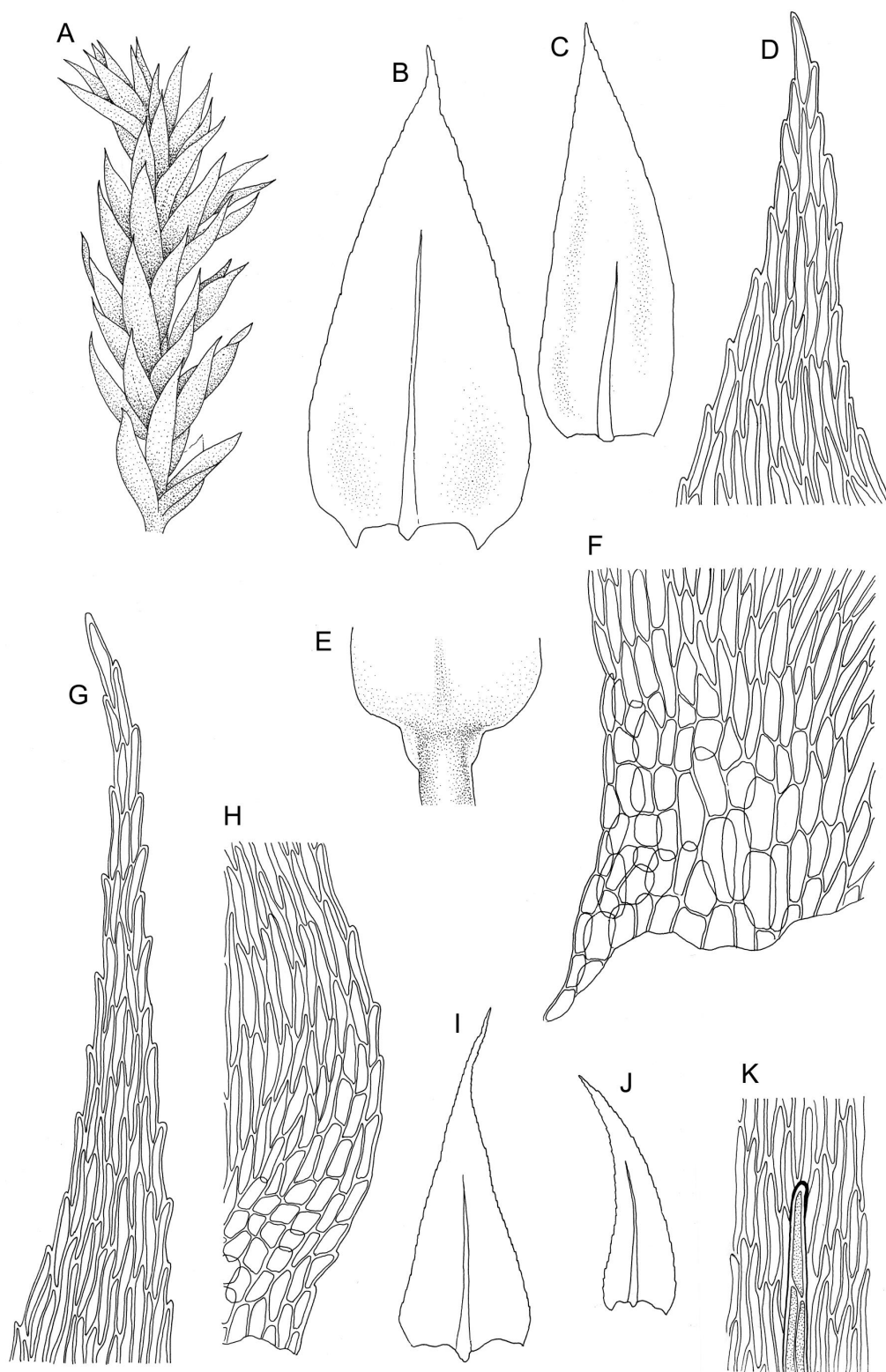


Plate 5: *Brachythecium*. A–F: *B. rutabulum*. A, branch detail. B, stem leaf. C, branch leaf. D, stem leaf apex. E, stem leaf insertion. F, alar cells of stem leaf. **G–K: *B. velutinum*.** G, stem leaf apex. H, alar cells of stem leaf. I, stem leaf. J, branch leaf. K, abaxial costal spine. *B. rutabulum* drawn from B.H. Macmillan 87/58, CHR 413402. *B. velutinum* drawn from K.W. Allison 4660, CHR 477815.

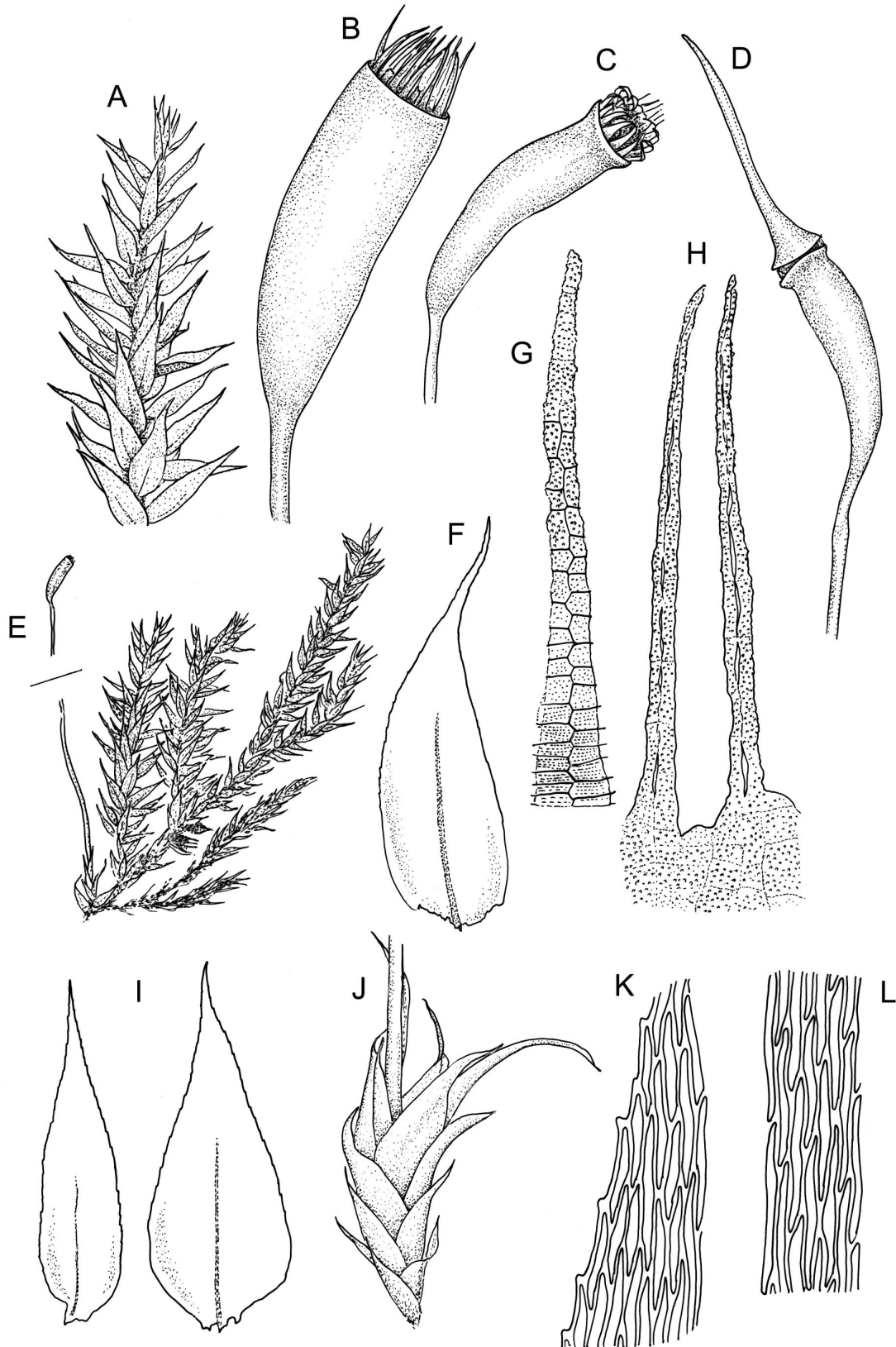


Plate 6: *Eriodon*. A–L: *E. cylindritheca*. A, branch detail. B, capsule, moist. C, capsule, dry. D, capsule with operculum, dry. E, habit with capsule, dry. F, stem leaf. G, peristome tooth, outer surface. H, endostome detail. I, branch leaves. J, perichaetium. K, upper laminal cells, adjacent to margin of branch leaf. L, upper laminal cells of branch leaf. Drawn from *B.H. Macmillan 87/4*, CHR 413377.

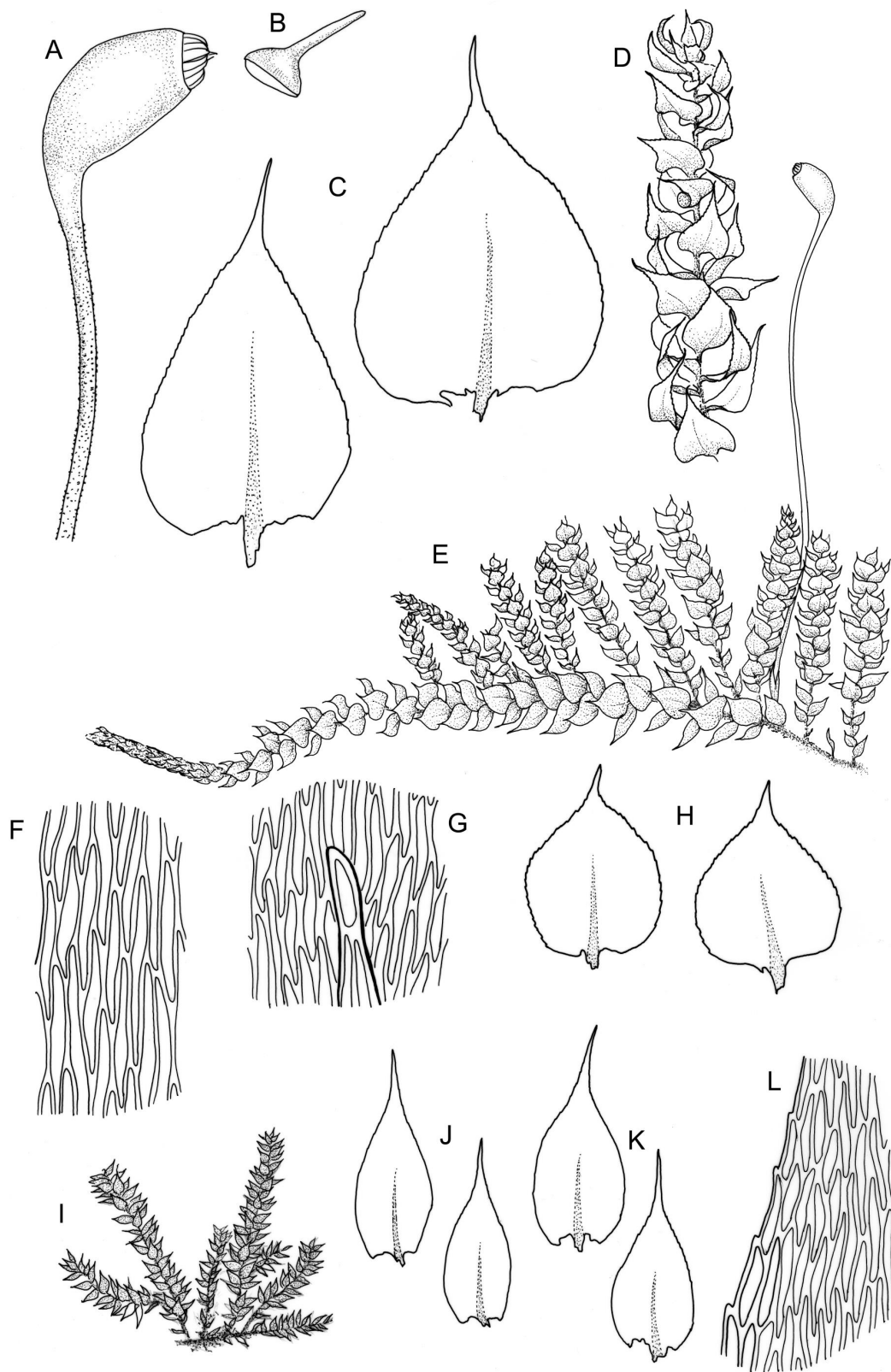


Plate 7: *Eurhynchium* and *Rhynchostegium*. A–H: *E. asperipes*. A, capsule and upper seta, moist. B, operculum. C, stem leaves. D, branch detail, dry. E, habit with capsule, moist. F, mid laminal cells of stem leaf. G, abaxial costal spine of stem leaf. H, branch leaves. I–L: *R. muriculatum*. I, habit. J, branch leaves. K, stem leaves. L, upper laminal cells adjacent to margin of stem leaf. *Eurhynchium asperipes* drawn from A.J. Fife 6828, CHR 449024. *Rhynchostegium muriculatum* drawn from A.J. Fife 7919, CHR 106584.

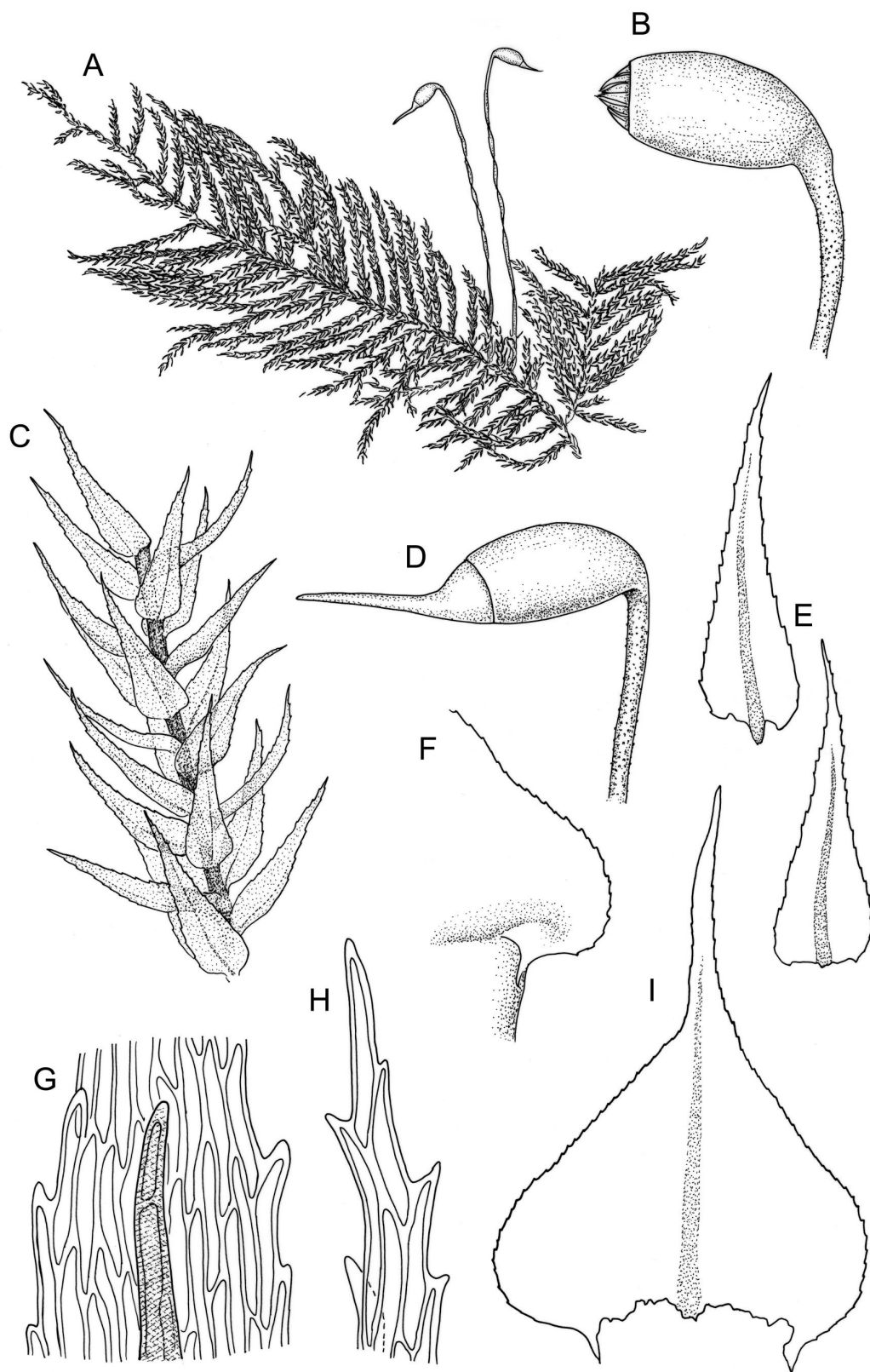


Plate 8: *Eurhynchium*. A–I: *E. praelongum*. A. habit with capsules. B. capsule and upper seta, moist. C. branch detail. D. capsule with operculum. E. branch leaves. F. stem leaf insertion. G. abaxial costal spine of branch leaf. H. branch leaf apex. I. stem leaf. Drawn from *J. Child* 6659, CHR 429182.

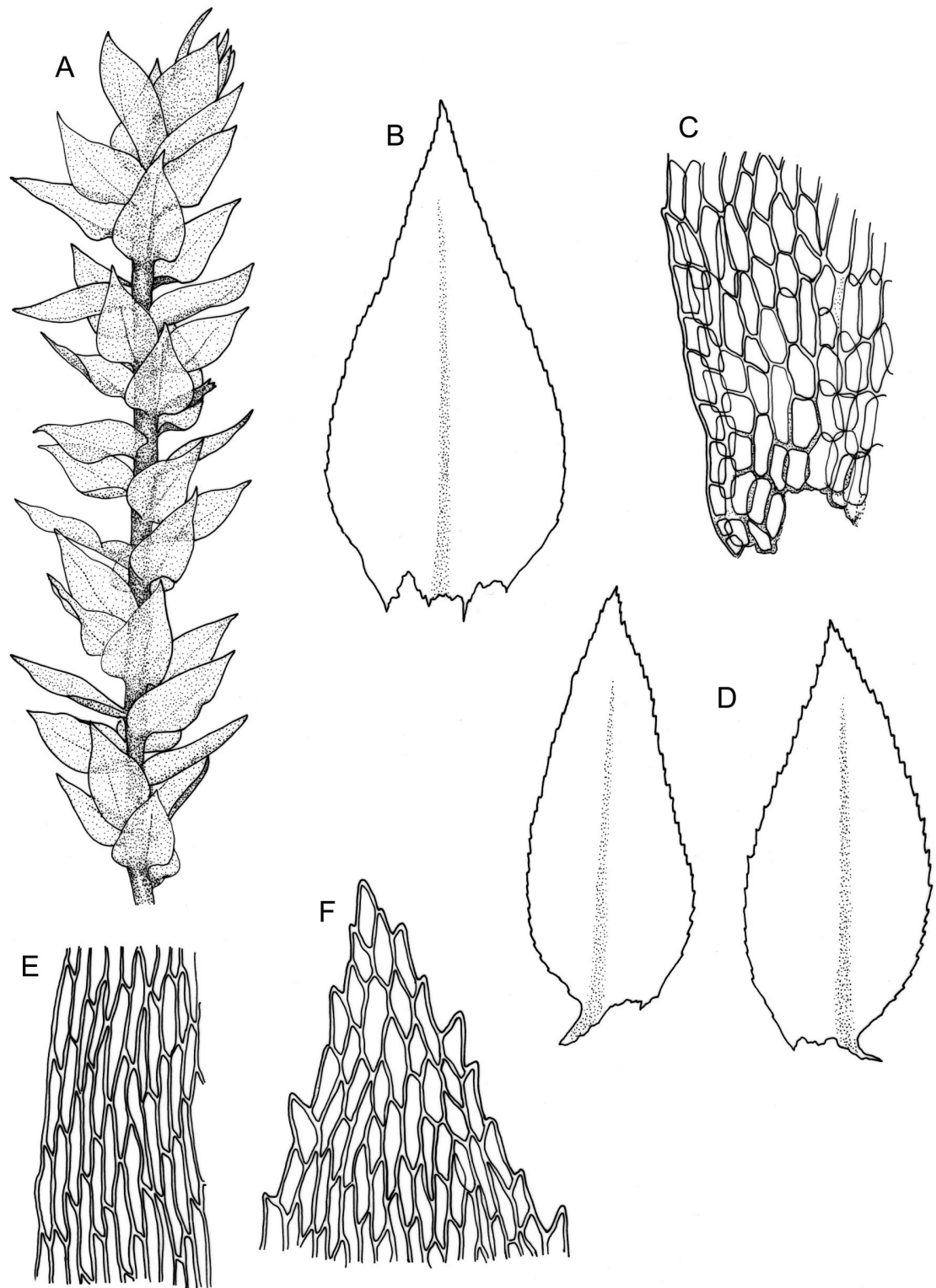


Plate 9: *Eurhynchium*. A–F: *E. pulchellum*. A, branch detail. B, stem leaf. C, alar cells of stem leaf. D, branch leaves. E, mid laminal cells adjacent to margin of stem leaf. F, leaf apex. Drawn from *P.J. Brownsey s.n.*, 5 Feb. 1997, WELT M0032083.

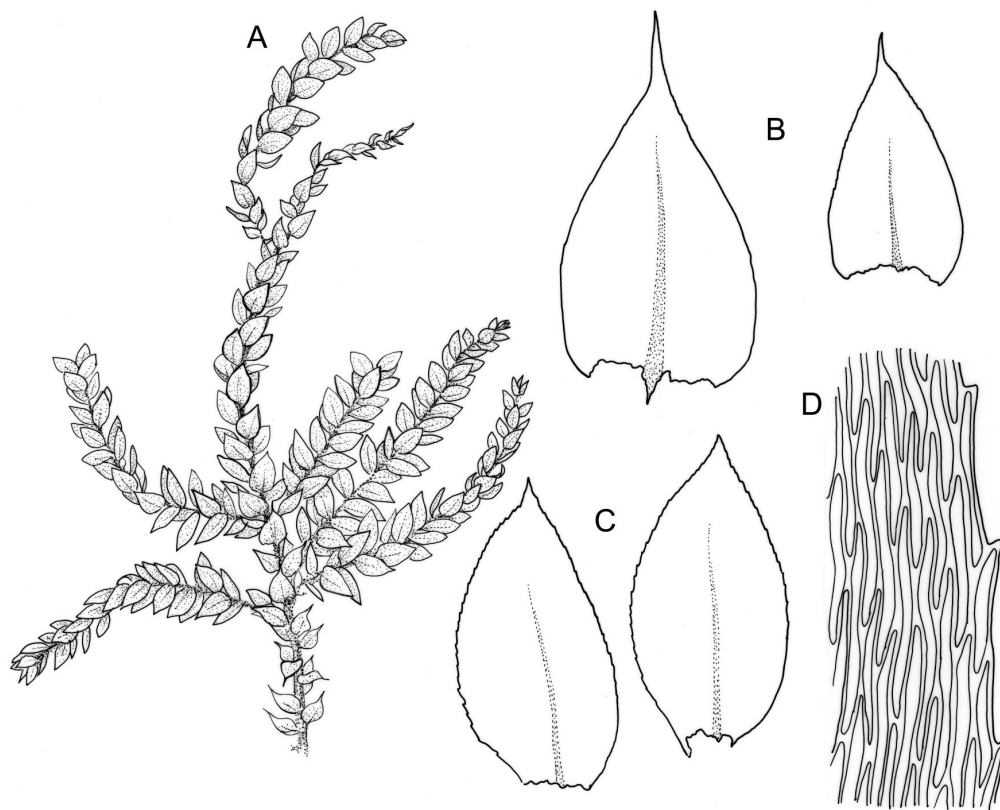


Plate 10: *Eurhynchium*. A–D: *E. speciosum*. A, habit. B, stem leaves. C, branch leaves. D, mid laminal cells, adjacent to margin of stem leaf. Drawn from J.E. Beever 34-66, CHR 406969.

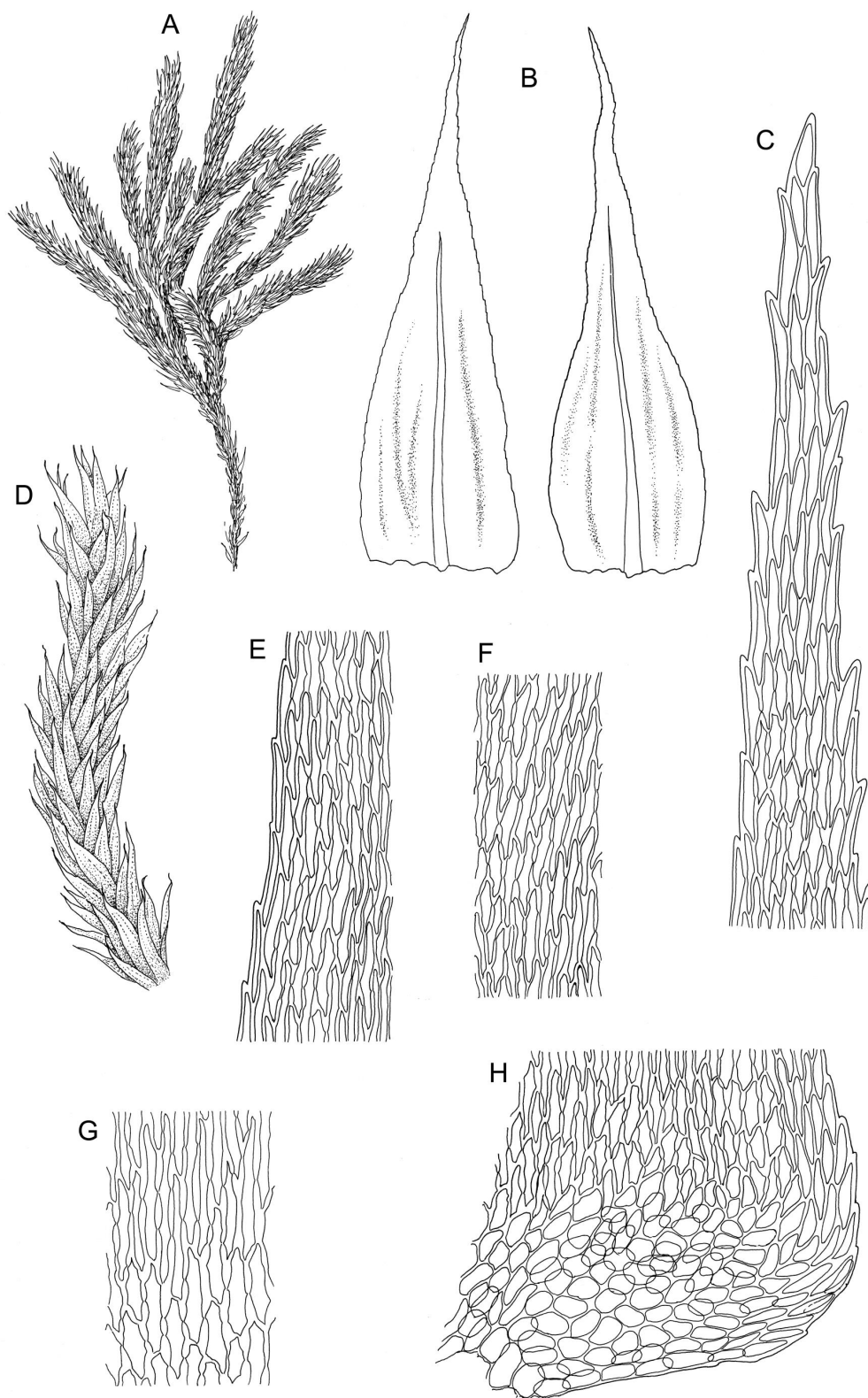


Plate 11: *Palamocladium*. A–H: *P. leskeoides*. A, habit. B, branch leaves. C, apex of branch leaf. D, branch detail. E, mid laminal cells adjacent to margin of branch leaf. F, mid laminal cells of branch leaf. G, basal laminal cells. H, alar cells of branch leaf. Drawn from A.J. Fife 8590, CHR 461008.

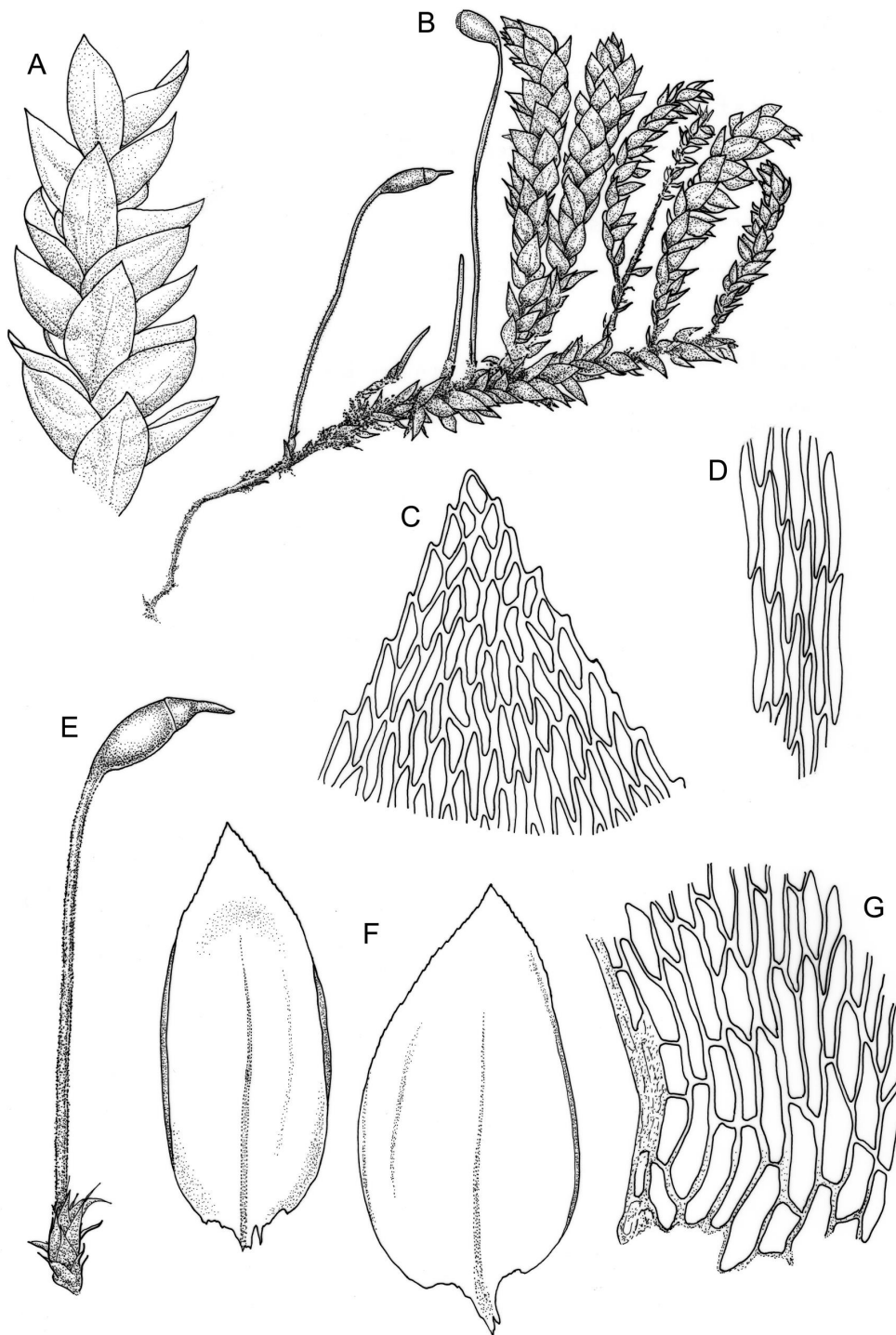


Plate 12: *Platyhypnidium*. A–G: *P. austrinum*. A, branch detail. B, habit with capsules. C, leaf apex. D, mid laminal cells of branch leaf. E, perichaetium with capsule. F, branch leaves. G, alar cells of branch leaf. Drawn from *B.H. Macmillan 72/1073*, CHR 164806.

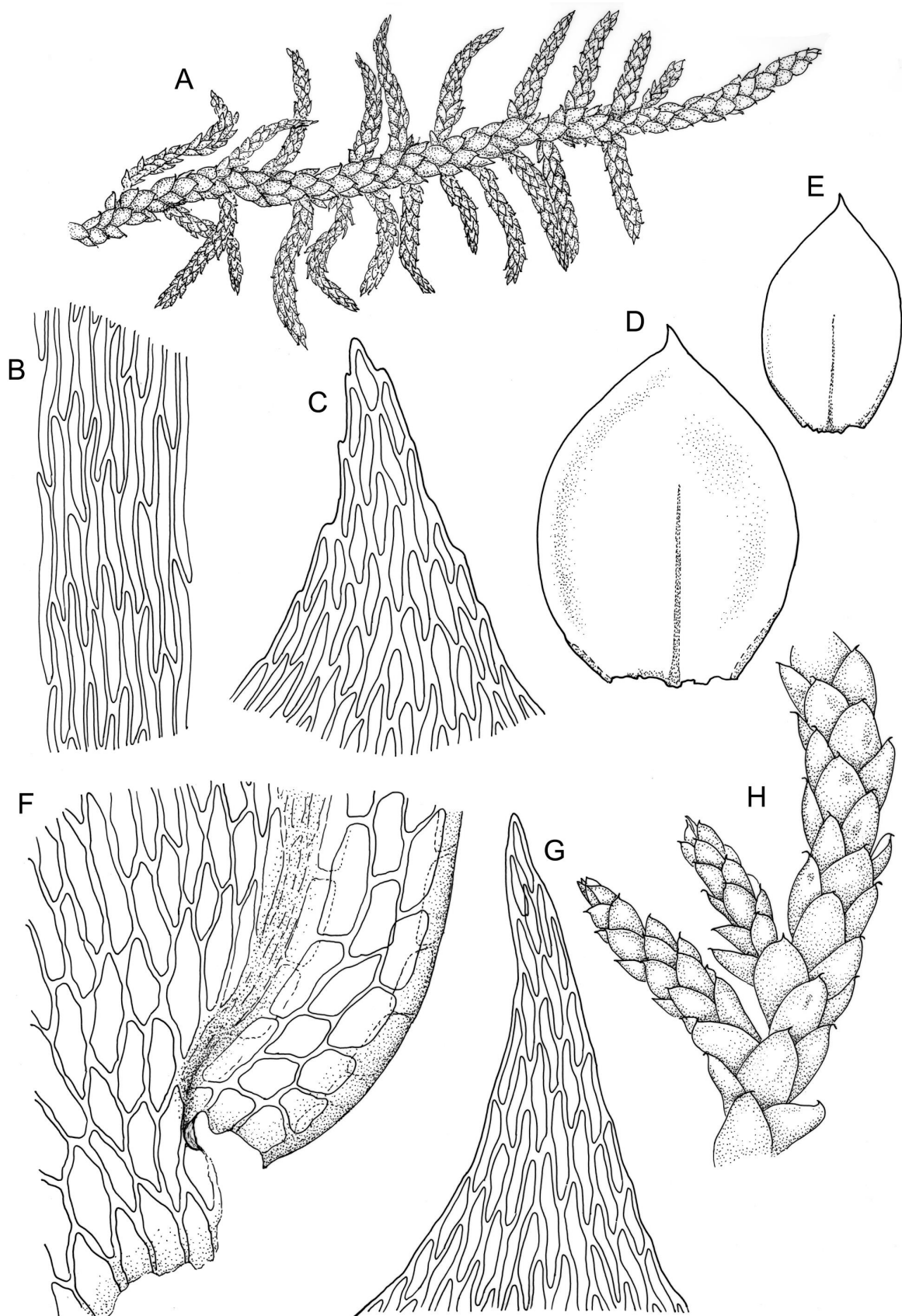


Plate 13: *Pseudoscleropodium*. A–H: *P. purum*. A, habit. B, upper laminal cells of stem leaf. C, apex of branch leaf. D, stem leaf. E, branch leaf. F, alar cells of branch leaf. G, apex of stem leaf. H, shoot detail. Drawn from A.J. Fife 9663, CHR 477633.

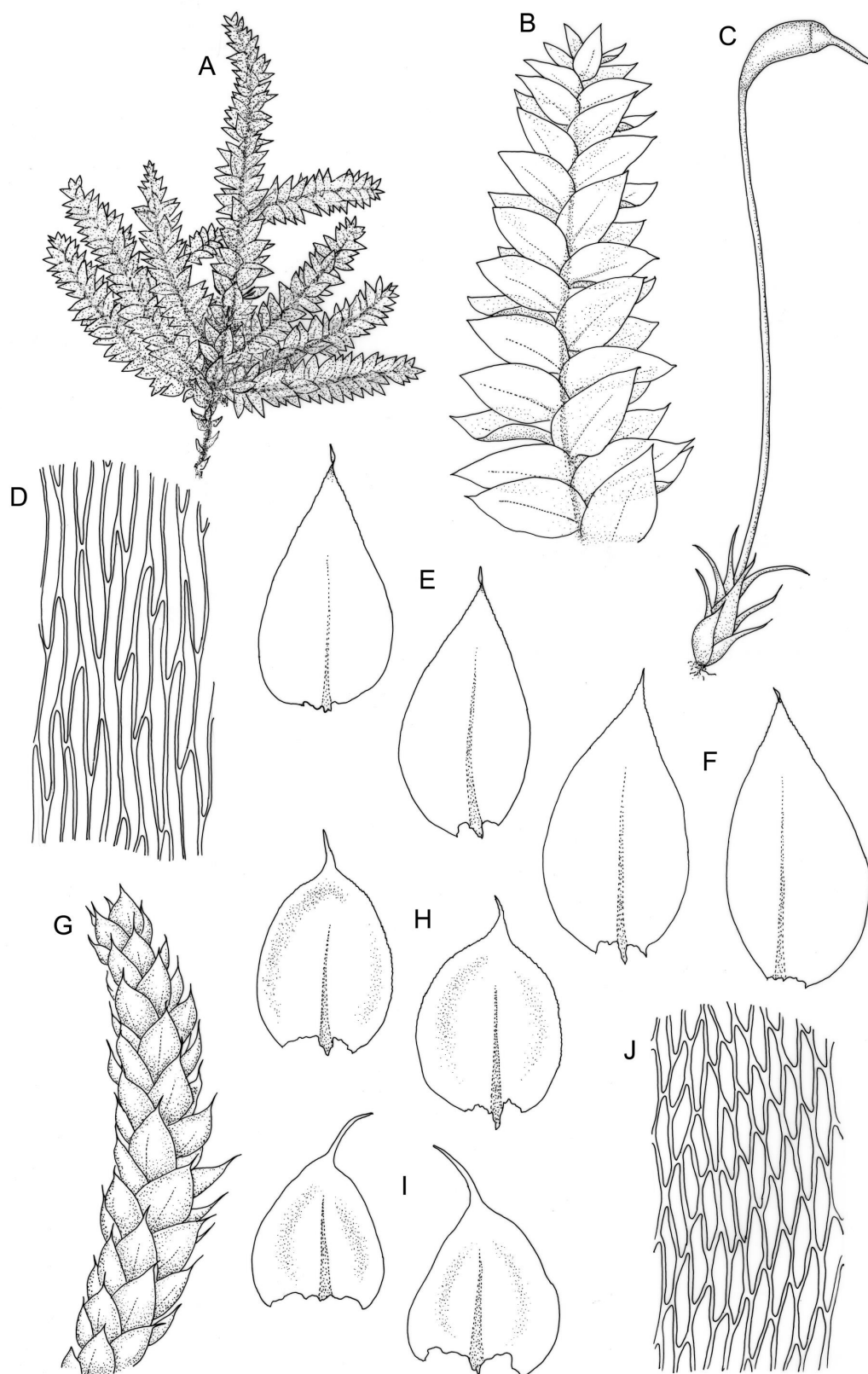


Plate 14: *Rhynchostegium*. A–F: *R. tenuifolium*. A, habit of sterile plant. B, branch detail. C, perichaetium with capsule. D, upper laminal cells of branch leaf. E, branch leaves. F, stem leaves. **G–J: *R. laxatum*.** G, branch detail. H, branch leaves. I, stem leaves. J, upper laminal cells of branch leaf. *R. tenuifolium*: A–B, D–F drawn from A.J. Fife 9460, CHR 468066; C drawn from A.J. Fife 5640, CHR 104364. *R. laxatum* drawn from A.J. Fife 9553, CHR 468071.

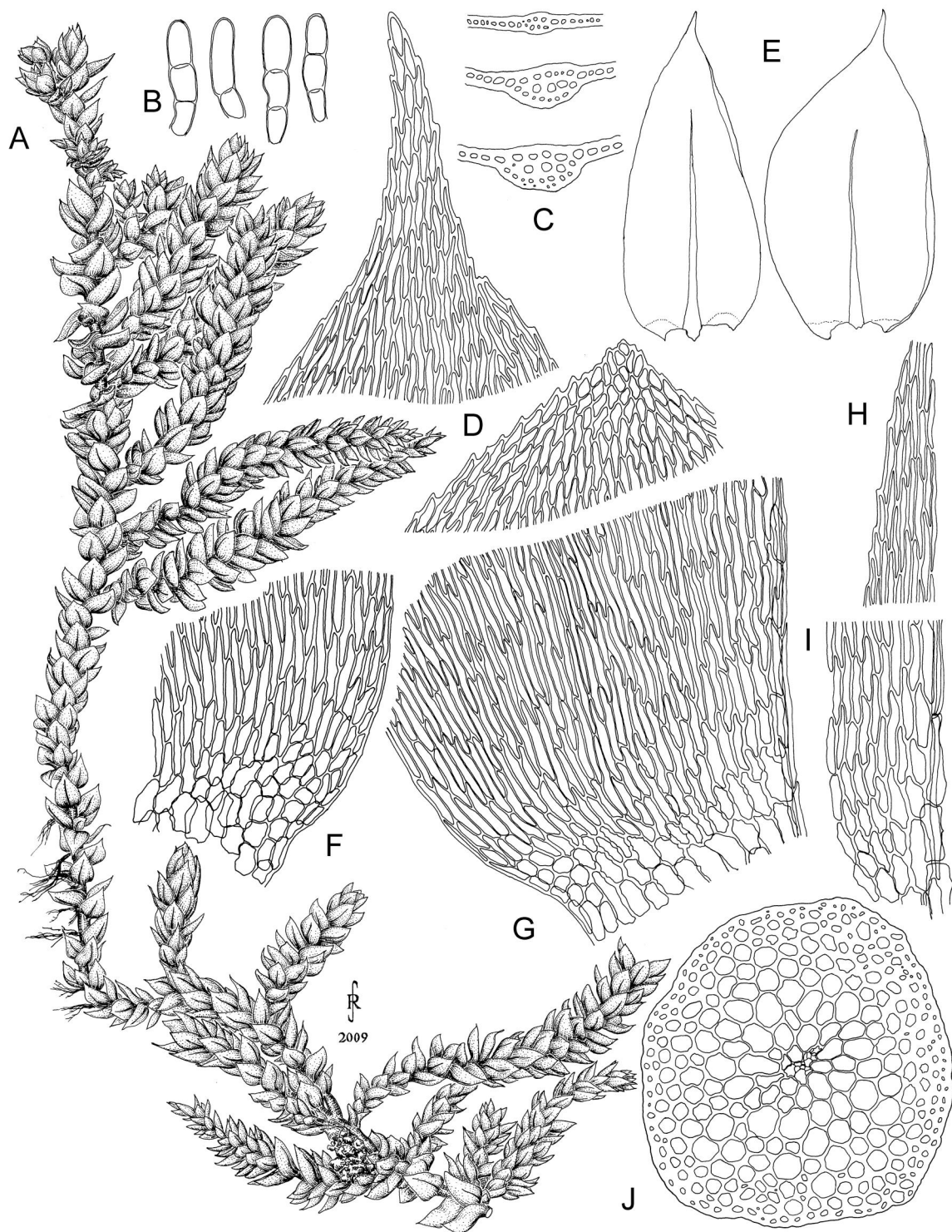


Plate 15: *Scleropodium*. A–J: *S. touretii*. A, vegetative shoot, moist. B, axillary hairs. C, serial costal cross-sections. D, leaf apices showing variation. E, leaves. F–G, alar cells of two leaves. H, cells at margin of mid leaf. I, juxtacostal cells at leaf base. J, stem cross-section. Drawn from Tasmanian material, *R.D. Seppelt* 27568, HO 551006 by R.D. Seppelt.

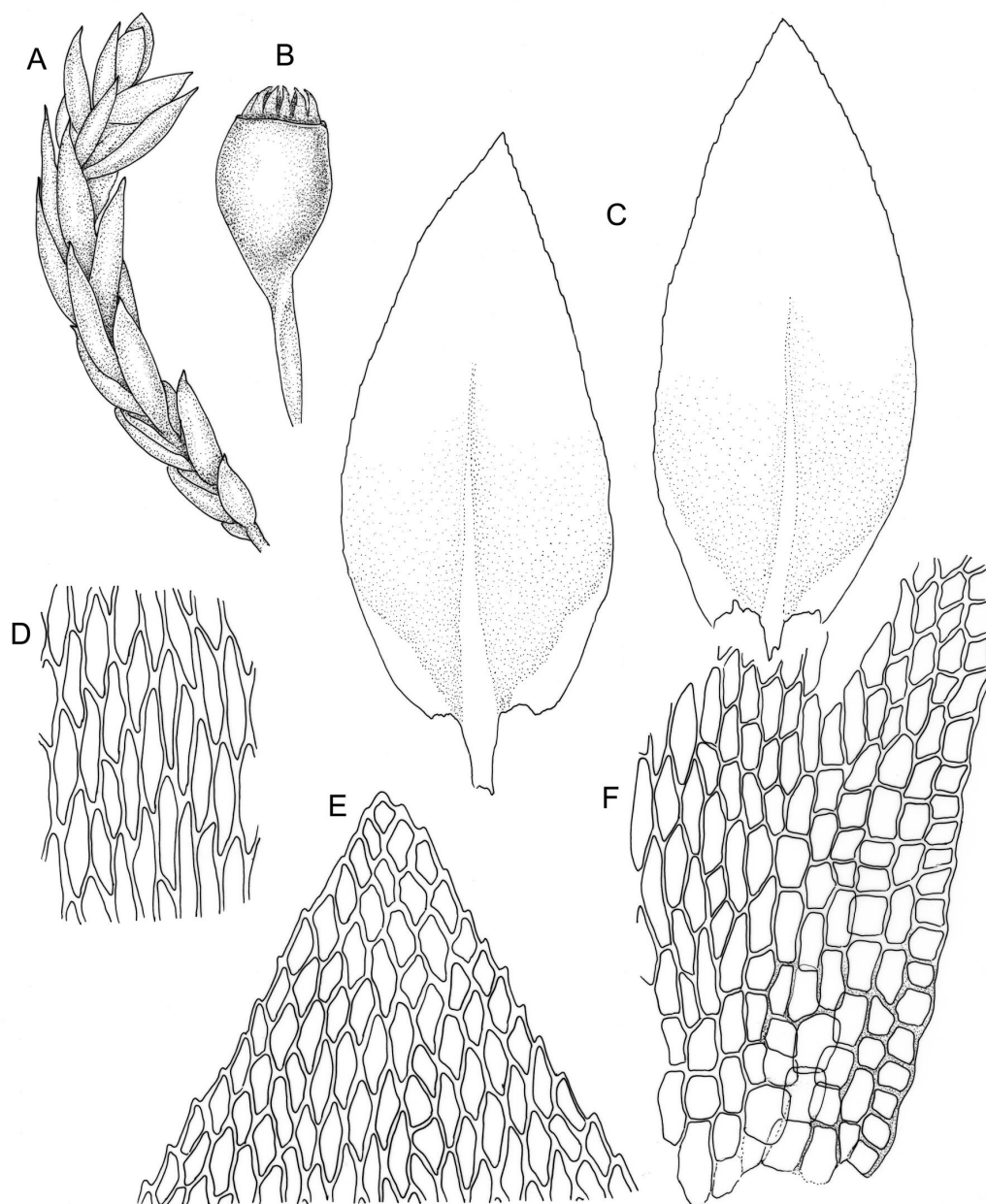
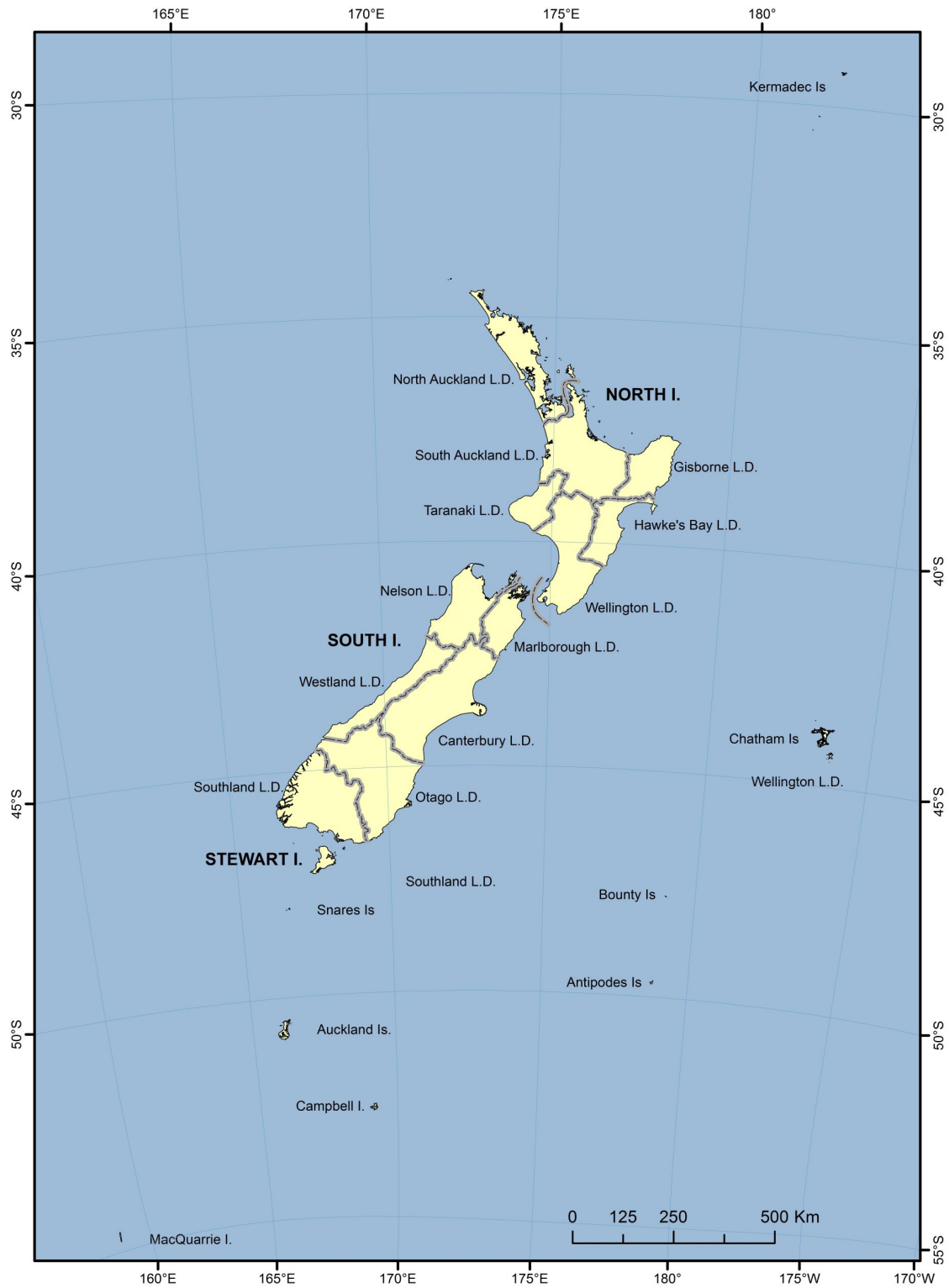
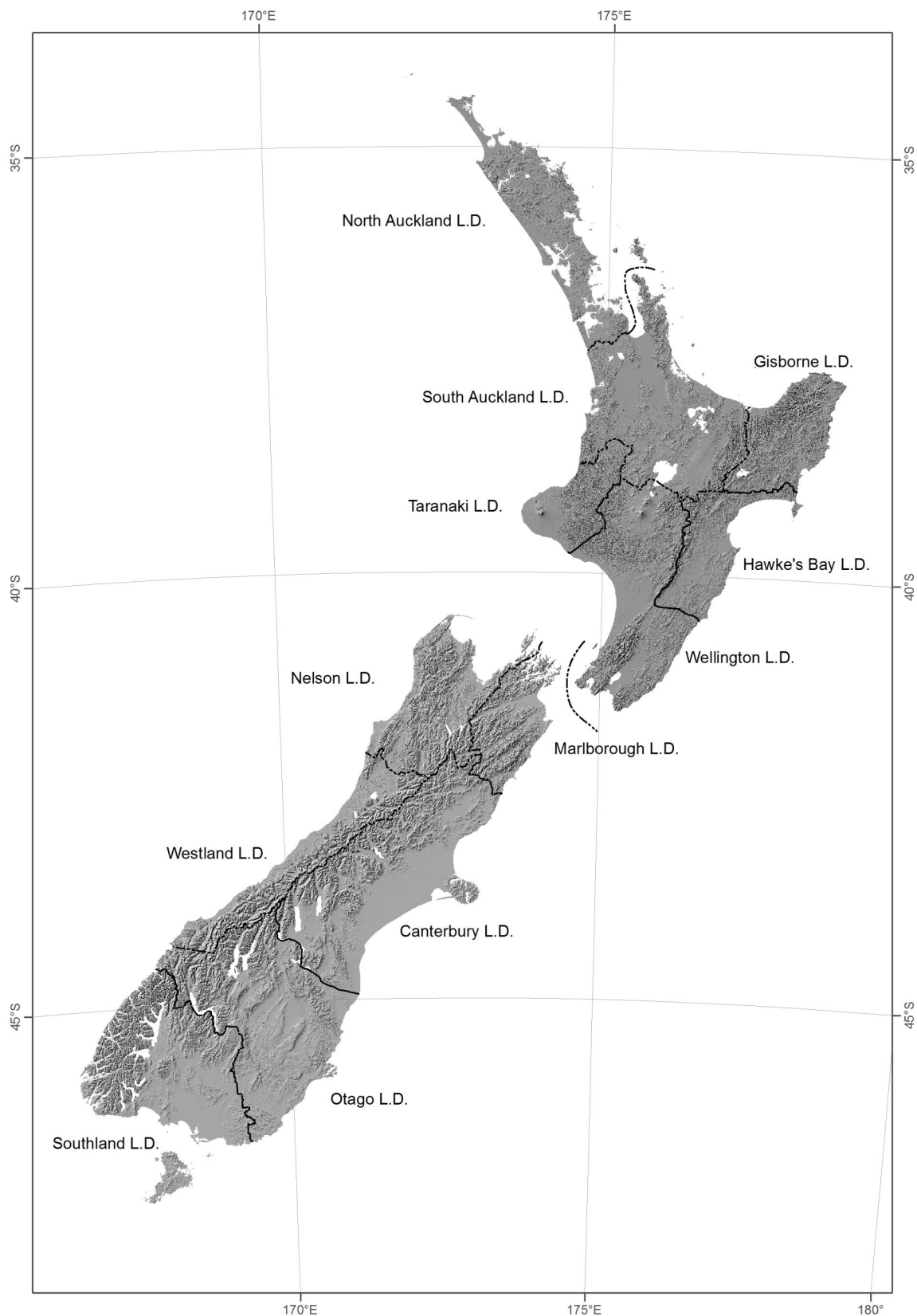


Plate 16: *Scoriurium*. A–F: *S. cucullatum*. A, portion of branch, dry. B, capsule. C, leaves. D, upper laminal cells. E, leaf apex. F, alar cells. Drawn from J.K. Bartlett 13214, WELT M007504.



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.

Astrodontium sericeum A.Jaeger 24
Brachytheciaceae 1, **2**, 15, 18, 25–27, 37
Brachythecium Schimp. 1, **4**, 10
Brachythecium albicans (Hedw.) Schimp. **6**, 14
Brachythecium allisonii Fife 7
Brachythecium campestre (Müll.Hal.) Schimp. 6, **7**, 14
Brachythecium cymbifolium Dixon & Sainsbury 35
Brachythecium fontanum Fife 4, 6, **9**
Brachythecium paradoxum (Hook.f. & Wilson) A.Jaeger **9**, 14, 15, 19, 24
Brachythecium plumosum (Hedw.) Schimp. **11**
Brachythecium purum (Hedw.) Dixon 27
Brachythecium rutabulum (Hedw.) Schimp. 9, **12**, 14, 19, 27, 34
Brachythecium salebrosum (F.Weber & D.Mohr) Schimp. 6–8, 13, **13**
Brachythecium subpilosum var. *angustifolium* Allison 7
Brachythecium velutinum (Hedw.) Schimp. 10, **14**
Chamberlainia albicans (Hedw.) H.Rob. 6
Eriodon Mont. 2, **15**, 17, 29, 33
Eriodon cylindritheca (Dixon) Dixon & Sainsbury 16, **16**, 29, 33, 34
Eurhynchium Schimp. **17**, 19, 25, 36, 37
Eurhynchium asperipes (Mitt.) Dixon 18, 19, **19**, 31
Eurhynchium austrinum (Hook.f. & Wilson) A.Jaeger 26
Eurhynchium cucullatum (Mitt.) I.G.Stone & G.A.M.Scott 36
Eurhynchium ellipticifolium Dixon & Sainsbury 22
Eurhynchium muriculatum (Hook.f. & Wilson) A.Jaeger 32
Eurhynchium novae-zealandiae (Dixon) Fife 32
Eurhynchium praelongum (Hedw.) Schimp. 7, 19, **20**
Eurhynchium pulchellum (Hedw.) Jenn. **21**
Eurhynchium speciosum (Brid.) Jur. 13, **22**
Hookeria leskeoides Hook. 24
Hypnum *albicans* Hedw. 6
Hypnum asperipes Mitt. 19
Hypnum austrinum Hook.f. & Wilson 26
Hypnum cucullatum Mitt. 36
Hypnum elusum Mitt. 30
Hypnum huttonii Hampe ex Beckett 33
Hypnum laxatum Mitt. 30
Hypnum macrostegium Sull. & Lesq. 24
Hypnum muriculatum Hook.f. & Wilson 32
Hypnum paradoxum Hook.f. & Wilson 9
Hypnum plumosum Hedw. 11
Hypnum praelongum Hedw. 20

Hypnum pulchellum Hedw. 21
Hypnum purum Hedw. 27
Hypnum rutabulum Hedw. 12
Hypnum rutabulum var. *campestre* Müll.Hal. 7
Hypnum salebrosum F.Weber & D.Mohr 13
Hypnum speciosum Brid. 22
Hypnum tenuifolium Hedw. 33
Hypnum touretii Brid. 35
Hypnum trachypelma Müll.Hal. 22
Hypnum velutinum Hedw. 14
Isothecium nilgheriense Mont. 24
Kindbergia praelonga (Hedw.) Ochyra 20
Oxyrrhynchium austrinum (Hook.f. & Wilson) Broth. 26
Oxyrrhynchium praelongum (Hedw.) Warnst. 20
Oxyrrhynchium speciosum (Brid.) Warnst. 22
Palamocladium Müll.Hal. 2, **23**, 24, 25
Palamocladium leskeoides (Hook.) E.Britton 10, 14, 23, **24**
Palamocladium macrostegium (Sull. & Lesq.) Z.Iwats. & Takaki 24
Palamocladium nilgheriense (Mont.) Müll.Hal. 24
Palamocladium sericeum (A.Jaeger) Müll.Hal. 24
Platyhypnidium M.Fleisch. **25**
Platyhypnidium austrinum (Hook.f. & Wilson) M.Fleisch. 26, **26**
Pleuropus Griff. 23
Pseudoscleropodium (Limpr.) M.Fleisch. **27**, 28
Pseudoscleropodium purum (Hedw.) M.Fleisch. 7, 14, **27**, 35
Rhynchostegiella cucullata (Mitt.) Paris 36
Rhynchostegiella muriculata (Hook.f. & Wilson) Broth. 32
Rhynchostegiella novae-zealandiae Dixon 32
Rhynchostegium Schimp. 1, 16, 25, **29**, 31, 33, 34
Rhynchostegium cucullatum (Mitt.) Mitt. 36
Rhynchostegium cylindritheca Dixon 16
Rhynchostegium laxatum (Mitt.) Paris 19, **30**, 32–34
Rhynchostegium muriculatum (Hook.f. & Wilson) Reichardt 17, 19, 29, 31, **32**
Rhynchostegium peracuminatum Dixon & Sainsbury 30
Rhynchostegium tenuifolium (Hedw.) Reichardt 13, 31–33, **33**
Scleropodium Schimp. **34**
Scleropodium purum (Hedw.) Limpr. 27
Scleropodium sect. *Pseudoscleropodium* Limpr. 27
Scleropodium touretii (Brid.) L.F.Koch 6, 28, **35**, 44
Scorpiurium Schimp. **36**, 37
Scorpiurium cucullatum (Mitt.) Hedenäs **36**
Stokesiella praelonga (Hedw.) H.Rob. 20

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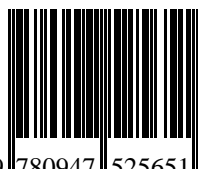
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