Contents

Introduction ........................................................................................................................................... 1
Typification ................................................................................................................................................ 1

Taxa

Sematophyllaceae ................................................................................................................................. 2
Rhaphidorrhynchium Besch. ex M.Fleisch. ......................................................................................... 4
Rhaphidorrhynchium amoenum (Hedw.) M.Fleisch. ........................................................................... 5
Sematophyllum Mitt. .............................................................................................................................. 7
Sematophyllum fiordensis Fife ............................................................................................................... 7
Sematophyllum homomallum (Hampe) Broth. ..................................................................................... 8
Sematophyllum jollifii (Mitt.) Dixon ...................................................................................................... 10
Sematophyllum kirkii (Müll.Hal. ex Beckett) Paris ............................................................................ 11
Sematophyllum subhumile (Müll.Hal.) M.Fleisch. .............................................................................. 12
Sematophyllum subhumile var. contiguum (Mitt.) B.C.Tan, WB.Schofield & H.P.Ramsay .............. 12
Sematophyllum uncinatum I.G.Stone & G.A.M.Scott ......................................................................... 13
Warburgiella Müll.Hal. ex Broth. .......................................................................................................... 14
Warburgiella leucocyta (Müll.Hal.) B.C.Tan, W.B.Schofield & H.P.Ramsay ...................................... 15
Wijkia H.A.Crum ..................................................................................................................................... 17
Wijkia extenuata (Brid.) H.A.Crum ....................................................................................................... 17
Wijkia extenuata var. caudata Fife ......................................................................................................... 19
Wijkia extenuata (Brid.) H.A.Crum var. extenuata ............................................................................... 20

References ............................................................................................................................................... 21
Conventions ............................................................................................................................................ 24
Acknowledgements ............................................................................................................................... 26
Plates ..................................................................................................................................................... 27
Maps ...................................................................................................................................................... 36
Index ..................................................................................................................................................... 38
Image Information ............................................................................................................................... 39
Introduction

The Sematophyllaceae are a large and predominantly tropical and subtropical family of pleurocarpous mosses, with less diversity in temperate regions. The New Zealand representatives occur mostly on fallen logs, exposed roots, rocks, as epiphytes, and occasionally on soil. Regionally, as well as in other parts of the family range, some species occur exclusively in or near to flowing water. Nine species and one variety assigned to four genera are accepted in the N.Z. flora. All of these species and varieties are believed to be indigenous, while two of our species are considered endemic. The family is taxonomically difficult in many parts of its range and even the modest number of taxa occurring here pose some practical identification difficulties. Many of the N.Z. taxa exhibit collenchymatous exothecial cells and strongly differentiated and highly-inflated alar cells. On a world-scale, generic definitions, limits, and relationships in the Sematophyllaceae remain fluid and highly controversial. For convenience, the generic assignments utilised in a recent Australian revision are adopted here.

Typification

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


Lectotype (designated here): N.Z.: Auckland Is., _J.D. Hooker s.n._, BM 877716! Isolectotype (designated here): BM 877715!
Sematophyllaceae

Plants slender to robust, forming dense mats or tufts, often glossy. Stems creeping or ascending, irregularly to densely and pinnately branched, without a central strand, usually ± red. Stem and branch leaves similar or occasionally differentiated (as in Wijkia), crowded in many rows but sometimes complanate, often homomallous or secund, mostly symmetric, variously shaped but often ± ovate and often acuminate (rarely broad or rounded) at apex, mostly variably toothed, mostly unbordered. Laminal cells linear to rhombic, smooth or papillose; alar cells nearly always clearly differentiated, often inflated, vesiculose at extreme angles, less often ± quadrate. Costae short and double or lacking. Paraphyllia lacking. Pseudoparaphyllia often present and foliose.

Autoicous or dioicous. Perichaetium lateral and with the leaves differentiated. Setae elongate, mostly smooth but sometimes papillose; capsules mostly inclined to pendulous and asymmetric, rarely erect and symmetric in non-N.Z. taxa, ovoid- or oblong-cylindric, smooth, mostly pale brown; exothecial cells often colleschenmatous or subcolleschenmatous; stomata restricted to neck; annulus often not differentiated; operculum conic at base, short- or long-rostrate. Peristome mostly double and hypnoid, pale. Calyptra cucullate or rarely mitrate, smooth. Spores spherical.

Taxonomy: The Sematophyllaceae are a large and predominantly tropical and subtropical family with limited diversity in temperate regions. Brotherus (1925) recognised 36 genera distributed worldwide and placed them in four subfamilies.

The family is taxonomically difficult in most parts of its range and even the modest number of taxa occurring regionally pose some practical identification difficulties.

The generic limits in the Sematophyllaceae remain highly controversial and fluid. They are likely to become more settled only after large-scale monographic study, including molecular analysis, of this family. Hedenäs & Buck. W.R. (1999) performed a cladistic analysis of the genera traditionally placed in the family using morphological characters and recognised 35 genera (their Table 7), three of which they placed in a subfamily Wijkioideae. They suggested that these three genera (Wijkia, Acanthorrhynchium, and Trismegista) are the “genera of Sematophyllaceae that have the least specialised perichaetium and sporophytes, and … likely to be the most primitive ones in the family.” This result largely mirrors the conclusions of Tan & Jia (1998) in their cladistic study of Chinese members of the family. Ten years later, Goffinet et al. (2009) proposed a radically different classification, recognising (within the Hypnales) a Sematophyllaceae of 28 genera while simultaneously placing several genera traditionally assigned here in a newly described family, the Pylaisiadelphaceae. Among the genera they placed in the latter family were Taxithelium, Trismegista, and Wijkia.

Even the eponymous genus Sematophyllum is poorly circumscribed, with Buck (1998, p. 368) describing it as "scarcely more than the dregs of the Sematophyllaceae… characterized by the lack of various specialised features."

The Australian flora, with it tropical components, is far richer than the N.Z. flora for this family. Ramsay et al. (2002; 2004) provided an Australian treatment recognising 14 genera that helps to place our more limited flora in context. Their discussion of large-scale systematic modifications proposed to the family prior to 2002 also provided some clarity to a confusing set of proposals. Because of the lack of consensus concerning the limits of the Sematophyllaceae, and generic boundaries within it, it is expedient to adopt the generic assignments proposed by Ramsay et al. (2002; 2004). For their regional revision Ramsay et al. employed a largely Brotherean classification, albeit with several exceptions, including notably: (1) they did not recognise the four subfamilies employed by Brotherus (1925) and (2) they excluded from the family the large and well-known genus Taxithelium (which does not occur in N.Z.). Tan et al. (1996) presented a useful key to the Australian genera.

Four genera, nine species, and one non-typical variety are accepted as part of the N.Z. flora. While generic placements largely follow Ramsay et al. (2002; 2004), not all of their species-level taxonomy is accepted here. For reasons alluded to above, no attempt is made to present a key to the N.Z. genera.

1  Stem and branch leaves differentiated in size and shape; stem leaves abruptly tapered to a piliferous and serrulate apex; laminal cells either pluripapillose or smooth; operculum high-conic, lacking a rostrum ................. 2
1' Stem and branch leaves not or scarcely differentiated; stem leaves lacking a piliferous and serrulate apex; laminal cells smooth; operculum with a conic base and a long, slender rostrum ................................................................. 3
2 Stems irregularly or subpinately (never bipinately) branched; branches simple and erect or curving upwards from the substrate, weakly cuspidate and with numerous flagelliform and microphyllous branchlets near tips; branch leaves entire or crenulate near apex; mostly 0.7–0.8 (–1.1) mm long

Wijkia extenuata var. caudata

2' Stems usually bipinately branched; branches simple or subpinately branched, often tapered to a slender and cuspidate tip, lacking flagelliform branchlets; branch leaves sharply serrulate above by projecting cell ends (usually more serrulate than stem leaves), 1.1–1.4 mm long ....

Wijkia extenuata var. extenuata

3 Dioecious; plants nearly always coastal, gold-brown or copper in colour; leaves strongly homomallous and pointing away from the substrate; alar group large, each extending laterally ¼ to nearly ½ the total width of leaf and extending up margin for 6–10 cells, composed of firm-walled, subquadrat, and opaque cells or with c. 3–4 cells in the extreme basal angle moderately enlarged and surrounded by firm-walled opaque cells; capsules suberect ...................................................... Sematophyllum homomallum

3' Autoicous or sexuality unknown; plants not restricted to coastal situations, various in colour; leaves variously oriented (strongly homomallous and pointing away from substrate only in S. subhumile var. contiguum); alar group smaller, with the cells at extreme corners thin- or firm-walled, enlarged, not opaque; capsules horizontal to pendulous, rarely inclined, or unknown ................................................................. 4

4 Leaves very long and fine, mostly 3.5–4.5 mm, strongly falcate-secund; sexuality unknown (neither sex organs nor capsules known); rare and known from Southland L.D. and Stewart Is. ................................. Sematophyllum fiordensis

4' Leaves much shorter, ≤2.7 mm, orientation various (sometimes falcate-secund); autoicous and often with sporophytes; widely distributed ........................................... 5

5 Leaves evenly tapered to a slender and acuminate apex, mostly 0.2–0.4 mm wide (under cover slip) ................................................................. 6

5' Leaves either unevenly tapered or broadly acute at apex, usually > 0.4 mm wide (under cover slip) ................................................................. 8

6 Vegetative leaves sharply denticulate above, erect-appressed or weakly homomallous; setae mammillate; exothecial cells subcollanchymatos and in distinct longitudinal ranks; known only from southernmost N.Z. (Moggy, Solander, The Snares, and Auckland Is) ............................................. Sematophyllum kirkii

6' Vegetative leaves entire or weakly denticulate above, either falcate-secund (in Rhaphidorrhynchium amoenum) or strongly homomallous (in Sematophyllum subhumile var. contiguum); setae smooth; exothecial cells clearly collanchymatos, not in distinct longitudinal ranks; widespread in N.Z. .................. 7

7 Plants caespitose; leaves homomallous, pointing away from the substrate, entire; setae 7–9 mm ........................................... Rhaphidorrhynchium amoenum

7' Plants forming interwoven mats, not caespitose; leaves strongly falcate-secund to nearly circinate, entire or finely denticulate; setae 8–20 mm .... ................................................................. 8

8 Plants usually bright green and very lustrous; branches flattened and cuspidate apically; leaves elliptic and evenly tapered to a broadly acute apex, ± spreading or homomallous at branch tips, with numerous short apical cells; setae 6–11 mm, mammillate-papillose near apex (occasionally obscurely so); restricted to stream margins ........................................ Sematophyllum jollifii

8' Plants usually golden to yellow-brown, moderately lustrous or dull; branches neither flattened nor cuspidate apically; leaves ± ovate-lanceolate and ± abruptly tapered to an acute or acuminate apex, second to ± falcate at branch tips, with only a few apical cells shortened; setae nearly always >10 mm, either smooth or mammillate; habitat various (only S. uncinatum restricted to stream margins) .... ................................. 9
Plants relatively robust, hygrophilous, mostly saxicolous or on thin soil over rock (only occasionally on wood) and restricted to stream beds; leaves broadly ovate-lanceolate, 0.45–0.85 mm wide (under cover slip) ....

Plants fine, not hygrophilous, mostly lignicolous or epiphytic; leaves narrowly ovate-lanceolate, c. 0.20–0.35 mm wide (under cover slip) ................. 10

Setae mammillate; capsule neck irregularly protuberant/mammillate, with stomata situated at the apex of irregular protuberances; exothecial cells subcollenchymatous, arranged in distinct longitudinal ranks (visible under hand-lens); leaves mostly 0.30–0.35 mm wide (under cover slip) ....

Setae smooth; capsule neck weakly differentiated, lacking irregular protuberances; exothecial cells clearly collenchymatous, not in longitudinal ranks; leaves narrower, mostly 0.20–0.30 mm wide (under cover slip) ....

Excluded Taxa: Hypnum cyparioides Brid. According to Dixon, the type of this obscure name was collected by de Labillardière in "Nova Hollandiae". Both Dixon (1929, p. 308) and Ramsay et al. (2004) placed Hypnum cyparioides Brid. in the synonymy of Rhaphidorrhynchium amoenum (Hedw.) M.Fleisch. (or its nomenclatural equivalent). Mitten (1859) applied the name H. cyparioides to a Tasmanian collection by Archer. Dixon discussed the confusion between H. cyparioides Brid. and H. amoenum Hedw. at some length but could locate types of neither name. Hypnum cyparioides Brid. (or combinations based on it) have received little or no application to N.Z. collections and this name is not considered further.

Hypnum leporthynchum Brid. This name seems to have been first discussed in relation to H. leucocytus Müll.Hal. and H. cerviculatum Hook.f. & Wilson by Dixon (1929b, p. 309). The name H. leporthynchum Brid. is used by Wilson & Hooker in both Flora Antarctica (1845, p. 141) and in Flora Novae-Zelandiae (Wilson 1854, p. 112) for material from N.Z. Confusingly, Wilson (1854, p. 113) described the setae in such material as smooth ("iaevis"). Many of the older collections in BM named as H. leporthynchum Brid. are referable to S. amoenum. According to Tropicos (accessed 2 Nov. 2015) H. leporthynchum Brid. is an invalid name and it is discussed no further here.

Rhaphidostegium dallii Broth. & Geh. This species was described from a single collection of unlocalised N.Z. provenance. It is discussed by Dixon (1929b, p. 309) who saw only vegetative material. He tentatively accepted it while stating that "vegetatively it agrees exactly with R. leucocytus." Sainsbury (1955, p. 466) listed it as a doubtful species. Ramsay et al. (2004, p. 58) examined type material and considered it to be a synonym of Warburgiella macrospora, which is considered here to be inseparable from W. leucocytus. It is not considered further here.

Sematophyllum subcylindricum sensu Sainsbury and sensu Allison. Some N.Z. specimens named (mostly by K.W. Allison) as S. subcylindricum (Broth.) Sainsbury in N.Z. herbaria are perplexing due to their poor quality and for having ± "subcollenchymatous" exothecial cells and smooth setae (e.g., G.O.K. Sainsbury 4740 from Hopuruahine Hill near Lake Waikaremoana, Gisborne L.D. (CHR 570159) and K.W. Allison 3207 from Pukerimu Bush, near Taupō, S Auckland L.D. (CHR 570161). Most material so-named is aberrant and poor Rhaphidorrhynchium amoenum. Sematophyllum subcylindricum is considered here to be worthy neither of taxonomic recognition nor of further consideration. The relevant collections remain filed under S. subcylindricum in CHR.

**Rhaphidorrhynchium** Besch. ex M.Fleisch., *Musci Buitenzorg*, 1245 (1923)

Type taxon: *Rhaphidorrhynchium aurescens* (Besch. ex A.Jaeger) M.Fleisch.

Taxonomy: The taxonomic and nomenclatural histories of this genus and its type species are exceedingly obscure, and beyond the scope of this Flora. In summary, the generic name *Rhaphidorrhynchium* is attributed by Fleischer (1923, p. 1245) to the preprint (not seen) of Beschereille's (1875) paper dealing with the mosses of Île St Paul and Île Amsterdam in the southern Indian Ocean, wherein *Rhaphidorrhynchium* is a nom. nud. Hence, the most informative bibliographic citation is *Rhaphidorrhynchium* Besch. ex M.Fleisch., Musci Fl. Buitenzorg 4: 1245 (1923). The type of the genus is given by Fleischer (1923, p. 1246) as *Rhaphidorrhynchium aurescens* Besch. However, Ramsay et al. (2004) asserted that *R. aurescens* was invalid until subsequently validated by Jaeger and cited the species as *R. aurescens* (Besch. ex A.Jaeger) M.Fleisch. The Tropicos database (accessed on 3 Nov. 2015) gives the basionym of the species name as *Rhaphidostegium aurescens* A.Jaeger (1880).
Generic descriptions, in German, are provided by both Fleischer (1923, p. 1245) and Brotherus (1925, p. 425). It is unclear how much of Fleischer's generic description is based on the species he accepted from Java, rather than from the generic type.

The decision of Ramsay et al. (2004) to recognise the genus *Rhaphidorrhynchium* is followed here as a convenience. In the early 20th century the genus received currency due to its use by Fleischer (1923, p. 1245) and Brotherus (1925). More recently, *Rhaphidorrhynchium* seems to have had little use outside the Australasian literature. It is included in the classification used for the Flora of Australia (2006, end-papers) and in the key to Australian moss genera by Buck et al. (2002, p. 30). The genus *Rhaphidorrhynchium* is not included in the classification of Goffinet et al. (2009).

According to Ramsay et al. (2004) *Rhaphidorrhynchium* “has a Gondwanan distribution with a number of species scattered throughout Australasia, South America, and Africa, extending northward in Asia reaching Malesia and India.”

No generic description is supplied here, in part because no material of the type species has been available.

**Rhaphidorrhynchium amoenum** (Hedw.) M.Fleisch., *Musci Buitenzorg*, 1249 (1923)


≡ *Sematophyllum amoenum* (Hedw.) Mitt., *J. Linn. Soc., Bot.* 12: 487 (1869)


Type: “Seelandia”. Not seen.


Syntype: N.Z., W. Colenso [H. 3691], BM 877717!


Type material: N.Z., Lyall 275, BM-Wilson!

**Plants** pale green to yellow-green, occasionally ± bronze, moderately lustrous, forming very fine and interwoven mats. **Stems** subpinnately or irregularly branched, commonly c. 10–35 mm, in cross-section with 2–3 layers of incrassate outer cells and no central strand; hyaloderm apparently lacking. **Branches** ± uniform on a single stem, mostly c. 3–8 mm. **Leaves** strongly falcate-secund to nearly circinate, lanceolate from an ovate or oblong base, channelled above, narrowed to a slender and acuminate apex, entire or finely denticulate near apex, c. 1.3–1.7 × 0.20–0.30 mm (under cover slip; length difficult to measure); **mid laminal cells** (upper third of leaf) linear-vermicular, c. 60–90 × 3–5 m, firm-walled, smooth, pointed at ends, not or scarcely porose; those at base shorter, yellow, and weakly to moderately porose; **alar cells** abruptly differentiated, 2–4 in extreme angles strongly inflated, thin-walled, oblong, and hyaline to weakly pigmented, with a few supra-alar cells subquadrate or oblong and firmer-walled. **Costa** lacking.

**Autoicous. Perichaetia** scattered on stems, the inner perichaetal leaves lanceolate and finely acuminate, c. 1.3–1.4 mm, sharply denticate above, not distinctly sheathing, and apparently not expanding after fertilisation. **Perigonia** gemmiform, scattered on stem, yellow, <0.4 mm. **Setae** red-brown, smooth, slender, twisted weakly to the left above, 8–20 mm; **capsules** pendulous due to curvature of upper setae, oblong-cylindric, symmetric, narrowed below mouth when dry, neck weakly differentiated, c. 1.3–1.5 mm; **stomata** restricted to neck, immersed; **operculum** with a conic base and a very long, straight rostrum, c. 1.0 mm; **exothecial cells** at mid urn not in strong rows, oblong or nearly isodiamic, strongly collenchymatous, longitudinal walls and transverse walls not differentiated. **Peristome** double, pale; **exostome teeth** 16, strongly shouldered and bordered, the outer surface cross-striolate below and with a median zig-zag line, the inner surface trabeculate; **endostome** with a high basal membrane and mostly keeled and perforate segments nearly as long as the teeth; **cilia** single, nodose. **Calytra** cuculate, smooth, not lacinate at base. **Spores** (10–) 12–16(–18) m, green, smooth.

**Illustrations:** Plate 1. Mueller 1864, pl. 14 (as *Hypnum callidoides*); Malcolm & Malcolm 2003, p. 58; Ramsay et al. 2004, fig. 17.

**Distribution:** K; NI: N Auckland, including offshore islands (PK, HC, LB, GB, RT), S Auckland, Gisborne, Hawke’s Bay, Taranaki, Wellington (including KA); SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland; St; Ch; A; C.

Australasian. Tasmania*, mainland Australia (N.S.W.*). Recorded from all states in Australia (excluding the Northern Territory) by Ramsay et al. (2004).
Habitat: Occurring on a broad range of substrates, but best developed on rotten logs. This species of wide ecological tolerance commonly occurs on standing tree trunks, horizontal branches, and exposed roots of a broad range of native and introduced tree species, as well as on twigs (e.g., on Lophozonia menziesii, Pseudowintera colorata) and occasionally as an epiphyll (e.g., on leaves of Pseudowintera colorata). It also occurs terrestrially on humic soil, marble, and granite. Host tree species include Agathis australis, Beilschmiedia tawa, Carpodetus serratus, Coprosma spp., Dracophyllum arboeum, Fuscospora fusca, F. solandri s.l., Hoheria spp., Kunzea ericoides, Lophozonia menziesii, Melicytus ramiflorus, Metrosideros excelsa, Podocarpus laetus, and Weinmannia racemosa, and at least some tree ferns. Associated moss taxa are correspondingly numerous, but Pyrrhobryum bifarium and Wijkia extenuata s.l. are the most frequent. Other frequent moss associates include Dicranoloma billardiorei, D. menziesii. D. robustum, Distichophyllum pulchellum, D. rotundifolium, numerous species of Macromitrium and Orthotrichum, Weymouthia cochlearifolia, and W. mollis, as well as a wide range of hepatics. On North I. R. amoenum ranges from near sea level to c. 1200 m (Mt Ruapehu, Wellington L.D.) and on South I. to at least 1025 m (at Mt Arthur, Nelson L.D., and Craigieburn Range, Canterbury L.D.).

Notes: This is a widespread, very common, and highly variable species. In its usual expression it has characteristic delicate, narrow, and strongly falcate leaves. It is commonly fruiting, with slender, smooth setae, pendulous capsules with obviously collenchymatous exothecial cells and finely rostrate opercula.

Hedwig (1801, p. 292) designated a type from “Seelandia”. Ramsay et al. (2004, p. 37) cited, but did not examine a presumed type from “Fuegia”. They did not further discuss the possibility of this species occurring in South America. No authentic South American material of this widespread austral species has been available for examination.

Sainsbury (1956) placed the Tasmanian Rhaphidostegium calliferum Hampe & Gehee and the Victorian Rhaphidorrhynchium calidioides (Müll. Hal.) Broth. (basionym: Hypnum calidioides Müll. Hal.) in synonymy. Both these conclusions were alluded to already by Dixon 1929b, p. 308, and followed by Ramsay et al. (2004). The types of these names have not been seen for this treatment, but there is no reason to doubt Sainsbury’s conclusions, which are corroborated by Mueller’s 1864 illustration of Hypnum calidioides. Neither of these names achieved currency in N.Z.

Hypnum cyparioides Brid. is commented on under “excluded taxa”.

Recognition: Ramsay et al. (2004, p. 38) noted that R. amoenum “has the appearance of a small and slender Hypnum.” Rhaphidorrhynchium amoenum is often confused with Hypnum chrysogaster, a species that occupies much the same range of habitats. However R. amoenum is a finer plant, with notably shorter stem leaves (0.20–0.30 mm vs 0.5–0.7 mm in H. chrysogaster), that give the plants a different habit and usually permit separation at a glance. The supra-alar cells in R. amoenum are fewer and never oblate, as they frequently are in H. chrysogaster. The basal laminal cells adjacent to the alar cells are moderately or weakly porose in R. amoenum while those in H. chrysogaster are highly porose. Rhaphidorrhynchium amoenum is autoicous (and hence usually fruiting) while H. chrysogaster is dioicous and fruits much less frequently. When fruiting the long-rostrate operculum and collenchymatous exothecial cells of R. amoenum readily differentiate it.

Confusion occurs between R. amoenum and Warburgiella leucocyta. In R. amoenum the extreme alar cells are inflated and thin-walled whereas the extreme alar cells of W. leucocyta are inflated but firm-walled. When fertile, the smooth setae and lanceolate-acuminate and dentilicate perichaetal leaves, which are not distinctly sheathing, contrast with the mammillate setae and the oblong-acuminate, coarsely serrulate and distinctly sheathing perichaetal leaves in W. leucocyta.

Some collections (especially from northern parts of the North I.) of Sematophyllum subhumile var. contiguum with leaves markedly secund can be difficult to distinguish from R. amoenum. The paler colouration of S. subhumile var. contiguum is helpful in such instances. The evenly tapered leaves with entire margins in S. subhumile var. contiguum contrast with the more channelled, more abruptly narrowed, and ± dentilicate upper leaf margins in R. amoenum. If fruiting, the short setae (7–9 mm) of S. subhumile var. contiguum contrast with the usually longer (6–20 mm) and more slender setae of R. amoenum.

Sematophyllum subcylindricum is discussed under excluded taxa. Many of the collections named as S. subcylindricum in N.Z. herbaria are depauperate or aberrant R. amoenum.

Etymology: The species epithet derives from the adjective amoenus meaning beautiful or pleasing.
Sematophyllum Mitt., J. Linn. Soc., Bot. 8: 5 (1864)

Type taxon: Sematophyllum demissum (Wilson) Mitt.

Elements in the following description are taken from Ramsay et al. (2002).

Plants small to moderately robust, dull or ± glossy, bright-, yellow-, white-, gold- or brown-green, forming interwoven mats or rarely caespitose. Stems creeping, ± red, irregularly or pinnately branched. Branches erect-ascendant, crowded, often curved, sometimes cuspidate in N.Z. species. Branch and stem leaves similar, appressed, erect-spreading, homomalous or falcate-secund, ovate-lanceolate or oblong, acute to acuminate, denticulate or entire, concave or rarely tubulose; mid laminal cells (upper third of leaf) rhomboidal, oval-oblong, fusiform, or linear-vernicular, l:w ratio variable, to c. 20:1, smooth; alar cells abruptly differentiated, mostly enlarged and inflated in extreme corners, firm- or thin-walled, supra-alar cells mostly small and ± quadrate. Costa short and double or lacking.

Autoicous or rarely dioicous. Perichaetia scattered on stems, and with perichaetal leaves differentiated, rarely sheathing the setae. Setae elongate, ± red, smooth or mammillate-scabrous; capsules pendulous or horizontal or rarely suberect (as in S. homomallum), ovoid to oblong-cylindric, with a short and ill-defined neck, which sometimes has wart-like protuberances in N.Z. species, mostly constricted below the mouth when dry and little altered with moist; stomata restricted to neck, sometimes confined to wart-like protuberances; annulus not differentiated; operculum slenderly rostrate from a conic base; exothecial cells mostly short-oblong or ± quadrate, strongly thickened in corners or with thickened longitudinal walls and thinner transverse walls (subcollenchymatous). Peristome double, pale; exostome teeth 16, strongly shouldered and bordered, the outer cross-slirotlate below and with a median zig-zag line, the inner surface trabeculate; endostome with a high (rarely ± low) basal membrane and mostly keeled and perforate segments nearly as long as the teeth; cilia 0–2. Calyptra cucullate, smooth, naked. Spores spherical, small- to medium-sized, green in N.Z. species.

Taxonomy: A very large genus of more than 200 species (Ramsay et al. 2002) distributed in tropical and temperate regions worldwide. Five species are recognised from N.Z.

The N.Z. species are variable and consequently some less well-developed specimens, especially those lacking sporophores, can pose problems of identification.

Buck (1998, p. 368) referred to Sematophyllum as “scarce more than the dregs of the Sematophyllaceae” and considered the genus to be “characterized by the lack of various specialised features. It has non-papillose laminal cells, non-furrowed exostome teeth, mostly non-erect capsules with little or no endostomial reduction, and exothecial cells not thin-walled.” I concur with Buck. The N.Z. species are a heterogeneous and probably polyphyletic assemblage, but the genus continues to serve a useful taxonomic function.

The generic segregates of Rhaphidorrhynchium and Warburgiella advocated by Ramsay et al. (2002, 2004) for Australia are adopted here.

Sematophyllum subpinnatum (Brid.) E.Britt. is a widespread species in tropical and warm-temperate regions worldwide that is reported from eastern Australia (Ramsay et al. 2002). Because of its wide distribution, occurrence in northern parts of N.Z. is probable. It could be recognised by having a growth form similar to that of S. subhumile var. contiguum but with duller colouration, broader leaves with more distinctly recurved margins, and shorter (mostly 4–6:1) mid laminal cells.

Etymology: According to Meagher (2011) the generic name is derived from “semato marked + phyllon leaf, alluding without doubt to the distinctive alar cells”.

Sematophyllum fiordensis Fife, New Zealand J. Bot. 50: 436 (2012)

Holotype: N.Z., Fiordland, Resolution Island, Duck Cove, dripping wet vertical rock face, clearing in forest, mountain beech–kamahi–rimu forest, c. 6 m elevation, P.J. Brownsey s.n., 14 Feb. 1985, WELT M007945! Isotypes: CHR 532705!, MO!

Plants medium-sized, gold- or yellow-green, lustrous, forming densely interwoven and apparently pendent mats. Stems c. 15–20 mm, branching irregularly and sparsely by forking, dark brown, with very sparse, pale brown, and smooth rhizoids arising singly in leaf axils; in cross-section c. 6 cells across, with a single layer of weakly differentiated cortical cells, surrounding larger (c. 30 μm diam.) internal cells, and no central strand. Leaves falcate-secund, little altered when dry, narrowly lanceolate and tapered to long filiform-acuminate apices, ecostate, entire below, serrate to ± spinose at apex, not bordered, tubulose ± throughout, mostly (3.5–)3.7–4.0–(4.5) × 0.25–0.35–(0.40) mm (under coverslip). Mid laminal cells (upper third of leaf) linear, smooth or slightly prorulate, non-porose, unistratose
throughout, with thick longitudinal walls and mostly thin transverse walls, c. 75–115 × c. 4 μm, becoming ± thicker-walled and ± porose in the lower leaf; basal cells unistratose, brown, thick-walled and ± porose in a few rows extending between the alar groups; alar group strongly defined, of c. 12–15 enlarged, hyaline or weakly pigmented, unistratose, and relatively thin-walled cells (the largest c. 40 × 20 μm), extending c. ⅓ across the leaf base and usually 3–4 cells up the margin, with a few (usually c. 6–10) supra-alar cells irregular, thick-walled, and grading into cells of the lower lamina. Axillary hairs apparently absent. Paraphyllia absent.

Sexuality and sporophytes unknown.

Illustrations: Plate 2. Fife 2012, figs 1, 2 A–C.

Distribution: SI: Southland (Resolution I.), St (Pegasus Creek, Tin Range).

Endemic.

Habitat: The type collection, made by P.J. Brownsey from Resolution I., occurred on a dripping wet, vertical rock face in a forest clearing within mountain beech/kamahi/rimu forest at close to sea level. Elevation data from the Stewart I. collections are scant. The collections from there are mostly from streamside rocks. One of the Pegasus Creek collections (probably from near Belltopper Falls) was from “sea level” while the Tin Range (the source of Pegasus Creek) collection came from “summit bogs”. The highest summit in the Tin Range is over 600 m elevation. Three ample collections made by Martin in the Tin Range/Pegasus Creek area suggest that the species was relatively common at this locality when he visited in 1949.

Associated bryophyte species isolated from the type collection are Andreaea subulata, Isotachis lyallii, and Telaranea patentissima. Hepatics isolated from the Stewart I. paratypes are Cryptochila grandifolia, Lepidozia kirkii, Riccardia nitida, and Telaranea patentissima.

Notes: Relative to other species of Sematophyllum occurring in New Zealand and temperate Australia, S. fiordensis is distinguished primarily by its very long (mostly 3.7–4.0 mm), narrow, and strongly falcate-secund leaves. The near absence of thickened cortical cells in the stems, and the tubulose, narrowly lanceolate leaves tapered to long filiform-acuminate apices are anomalous in Sematophyllum. If sexual structures and capsules are eventually found, the removal of this species from Sematophyllum may prove justified.

A few ovate and acute foliose (c. 500–700 × 200 μm) structures at the base of branches occur. Since they have slightly inflated alar cells these structures have been interpreted as reduced leaves rather than as pseudoparaphyllia.

Among the other N.Z. species of Sematophyllum, S. fiordensis could only be confused with S. uncinatum, a far more common species that grows in similarly irrigated habitats. Sematophyllum uncinatum is a less lustrous plant with much shorter, broader (c. 1.8–2.5 × 0.45–0.70 mm), and more abruptly tapered leaves. It frequently fruits. The internal stem anatomy differs markedly between the two species, with the stems of S. uncinatum being 16 or more cells across, and with 3–4 well-differentiated and thick-walled cortical cell layers.

The strongly lustrous, narrowly lanceolate, and falcate-secund leaves of S. fiordensis are suggestive of a sterile Blindia. But in addition to the aforementioned branching pattern, the absence of both a costa and a central strand precludes confusion.

Etymology: The epithet refers to its occurrence among the fiords of Fiordland National Park.

Sematophyllum homomallum (Hampe) Broth., Nat. Pflanzenfam., ed. 2 [Engler & Prantl] 11, 433 (1925)
≡ Leskea homomalla Hampe, Icon. Musc. [Hampe], Pl. 6 (1844)
≡ Rhaphidostegium homomallum (Hampe) Broth. in Brotherus, Nat. Pflanzenfam. [Engler & Prantl] 1(3) 1114 (1908)
Holotype: Western Australia, Perth, 19 Aug. 1839, L. Preiss, s.n., BM 87705!

Misapplications: Rhaphidostegium homomallum sensu Dixon 1929b
Plants gold-brown, copper, yellow-green, dark brown, or occasionally bright green, lustrous, forming loosely interwoven mats, on rock or bark in coastal situations. Stems creeping, to c. 25 mm, irregularly branched, with numerous fascicles of smooth brown rhizoids on ventral surface, in cross-section lacking both a central strand and a hyaloderm. Branches short (c. 3 mm) and ± uniform in length, ± cuspidate, not flattened. Leaves strongly homomalous, pointing away from the substrate, oblong or broadly ovate-lanceolate, ± abruptly tapered to an acute and often weakly reflexed apex, weakly narrowed to insertion, concave, reflexed at upper margins, entire, c. 1.5–1.6 × 0.4–0.55 mm (under cover slip); mid laminal cells (upper third of leaf) linear-rhombic, ± rounded at ends, smooth, not porose, mostly c. 36–45–(60) × 6 m, becoming gradually longer (to 60–90 m or more) in lower leaf; cells at leaf base yellow to orange in a basal band, shorter and porose; alar group large and usually opaque, orange or hyaline, ± concave, extending laterally ¼ to nearly ½ the width of leaf and extending up margin for 6–8–(10) cells, ± abruptly differentiated from adjacent laminal cells; c. 3–4 cells in the extreme basal angle moderately enlarged, firm-walled, and oblong; the supra-alar cells numerous, subquadrate, and incrassate. Probably dioicous. Perichaetium scattered on stems and branches, the inner leaves ovate-lanceolate, c. 1.3 mm, tapered to a narrowly acuminate apex. Perigonia scattered on stems, gemmiform and very small (c. 0.6 mm diam.). Setae yellow-orange, smooth, twisted to the left, 5–8 mm; capsules suberect, oblong-cylindric, 1.3–1.5 mm, constricted below mouth when dry; stomata few and restricted to neck, superficial; operculum finely rostrate from a conic base, c. 1 mm; exothecial cells collenchymatous, but with thickenings more pronounced on longitudinal walls, in ± distinct longitudinal ranks (rows not apparent under stereoscope); exostome teeth not or very weakly cross-striolate on lower outer surface, strongly papillose above, with very well-developed trabeculae on inner surface; endostome with a low membrane (c. ¼ the total height of the endostome) appearing smooth under the light microscope, the segments well-developed, nearly the length of the teeth, narrowly perforate; cilia single, stout, and scarcely nodose. Calyptra cucullate, smooth. Spores green, variable but not bimodal in a single capsule, mostly (12–)14–25 m.


Habitat: On rock or bark (often Metrosideros) or logs in coastal situations. Nearly all records from near sea level, but a few Poor Knights I is collections are recorded from c. 175 m. This is a common species in coastal areas of N Auckland but is apparently much less common south of this region. It is tolerant of some coastal salt spray and it is largely restricted to sites subject to salt spray in Wellington L.D. (P. Beveridge, pers. comm., Feb. 2003). Although most epilithic occurrences are on volcanic rock, collections from Sainsbury from the Māhia Peninsula (Hawke’s Bay L.D.) are from coastal limestone. Frequently associated species include Thuidiopsis furfurosa, Tortella cirnata, Weissia controversa s.l., and Lepidolaena clavigera.

Notes: While largely restricted to coastal situations in N.Z., this species does not exhibit a coastal bias to its distribution in Tasmania or mainland Australia, as demonstrated by the distribution map of Ramsay et al. (2002, fig. 23, 2).

The plants have a neat and distinctive appearance due to the strongly homomalous (secund) and glossy leaves and the uniformity of the branch length. The leaf tips are often weakly reflexed and the narrowly reflexed upper margins of the leaves are apparent using a hand-lens. This species often grows in exposed and insolated sites and usually develops a strong and distinctive coppery colouration; plants that are yellow-green in colour are typically from shaded sites. As alluded to by Scott & Stone (1976, p. 445), this species is highly anomalous in Sematophyllum given its suberect capsules, its large, opaque alar groups, and probably dioicous sexuality. Further study may result in its exclusion from the genus.

This species is particularly difficult to sex convincingly. The statement by Ramsay et al. (2002) that it is dioicous is probably correct, although dioicous species are infrequent in Sematophyllum. In sparsely fruiting material (E. Whitehouse 29465 from near Point Halswell, Wellington L.D., CHR 265450) I have found both female and male stems, but have been unable to demonstrate organic connection between them. Capsules are rare in N.Z. and sporophyte features are described from L.B. Moore 592 from Rangitoto I., CHR 587225. Ramsay et al. (2002, p. 31) stated that in Australia sporophytes are “frequently found” in material from South Australia.
Sematophyllum homomallum is most likely to be confused with S. subhumile var. contiguum, but the present species differs by having (usually) strong secondary pigmentation, broader leaves, different alar cells, and dioicous sexuality, and by being largely confined to coastal situations.

**Etymology:** The species epithet refers to the decidedly homomallous (pointing in one direction) nature of the leaves.

Sematophyllum jolliffii (Mitt.) Dixon in Dixon & Bartram, Bot. Not. 1937: 82 (1937)
- Hypnum jolliffii Mitt. in Wilson, Bot. Antarct. Voy. III. (Fl. Tasman.) Part II 213 (1859)

Isotype: N.Z.: North Island, Dr Jolliffe s.n., 1853. BM 851381! Syntype: N.Z., s.loc., Dr Sinclair s.n., BM-Hooker!

**Plants** bright green or yellow-green to copper, strongly lustrous, hygrophilous. **Stems** sparsely and irregularly branched, ± red, to at least 50 mm, with very sparse smooth rhizoids, in cross-section with several layers of incrassate outer cells and no central strand. **Branches** variable in length, to at least 15 mm, cuspidate, moderately flattened. **Branch and stem leaves** similar, loosely imbricate, ± spreading or moderately homomallous, elliptic, narrowed to a weakly clapping insertion, ± evenly tapered to a broadly acute apex, concave, plane at margins, finely denticulate or sometimes nearly entire at apex, entire below, c. (1.2–1.5–1.9 × 0.6–0.7 mm), ecostate; **mid laminal cells** (upper third of leaf) verricular, 48–72–85 × 4–6 mm, smooth, narrowed at ends, not porose, becoming markedly shorter in leaf apex and longer (to >100 µm) in lower leaf; **basal cells** short, porose, and yellow; **alar group** strongly differentiated, with c. 3(–4) oblong cells in extreme angles strongly inflated and ± hyaline, grading quickly into laminal cells.

**Autoicous** in N.Z. material. **Perichaeta** often numerous on stems, the inner perichaetal leaves oblong and abruptly short- acuminate, strongly toothed at apex by projecting cell ends. **Perigonia** gemmiform and inconspicuous (<0.5 mm), scattered on stems and branches. **Setae** red-brown, mammillate-papillose near apex (rarely ± smooth), scarcely twisted, 6–11(–12) mm; **capsules** horizontal or pendulous due to curvature of upper setae or sometimes merely inclined, oblong-cylindric, symmetric, not narrowed at mouth and with a rough and ± protuberant neck when moist, weakly constricted below the mouth and with an irregularly protuberant/mammillate neck when dry, (0.8–)1.0–1.5 mm; **stomata** numerous, superficial, in clusters of 1–3 on protuberances in the neck; **operculum** long-rostrate from a conic base, ± equal the urn; **exothecial cells** ± isodiametric, strongly collenchymatous, appearing protuberant at low magnification when dry. **Peristome** as per genus; **endostome** with a high membrane, keeled and perforate segments nearly as long as the teeth, and single or paired nodose cilia. **Spores** (13–)15–18, rather variable in size in single capsule, green, smooth.

**Illustrations:** Plate 3. Ramsay et al. 2002, fig. 18.

**Distribution:** NI: N Auckland including offshore islands (LB, GB), S Auckland (Coromandel Peninsula, Upper Kauaeranga Valley), Wellington (Mt Bruce, Kahuterawa Stream); SI: Nelson (Aore Valley, Fifteen Mile Creek, Sharland Creek, Ohikanui River, Madmans Creek, Bullock Creek), Westland (s. loc.). Australasian. Tasmania*. Recorded from eastern mainland Australia (N.S.W. and Vic.) by Ramsay et al. (2002, p. 35).

**Habitat:** On rock or wood at shaded stream margins or on emergent stream bed boulders within a range of forest types. Most frequently collected from northern regions on the North I., and on South I. nearly restricted to Nelson L.D. where it is known from five localities. Ranging on both main islands from near sea level to 310 m (Mt Bruce). It is a widespread and common species in N Auckland L.D., but it is poorly documented elsewhere on North I. Usually not growing in close association with other bryophyte species, but occasionally mixed with Sematophyllum uncinatum or Chiloscyphus australigenus.

**Notes:** I concur with Ramsay et al. (2002, p. 35) that the basionym of Sematophyllum jolliffii is Hypnum jolliffii Mitt. ex Hook.f. & Wilson, Flora Tasmaniae 2: 213 (1859). Ramsay et al. cited a North I. Jolliffe collection as the holotype, but their reasons for doing so are unclear from both the protologue (Wilson 1859) and Mitten’s (1859, p. 87) discussion of Stereodon jolliffii. The Mitten publication, despite its later publication date, is explicitly cited in Flora Tasmaniae and designated four syntypes.
The selection of a lectotype by Ramsay et al. (2002) would have been more appropriate. However, the Jolliffe collection (cited above as an isotype) is representative of *S. jolliffii*. The typification by Ramsay et al. could have been influenced by examination of specimens in the Mitten herbarium, which I have not seen. Neither have I seen the Archer specimen from Western Creek, Tasmania nor the Kerr collection from the North I.

**Recognition:** The strongly lustrous and robust nature of the plants and the flattened and cuspidate branch tips make this hygrophilous species distinctive. The ornamentation of the upper seta varies markedly, as does capsule orientation. Material with the upper setae very weakly scabrous and capsules inclined rather than horizontal to pendulous occurs at numerous localities, including Waipoua Forest, N Auckland L.D. (*K. W. Allison 1866, CHR 629452*), Little Barrier I. (*L.B. Moore s.n., 2/1/42, CHR 613186*), and Fifteen Mile Creek (CHR 428020). The neck of the capsule here can resemble that of *Warburgiella leucocysta* due to its wart-like protuberances.

Of the species treated here in *Sematophyllum*, only *S. uncinatum* commonly grows in similar stream-margin habitats; that species is rather dull in appearance, with acuminate and falcate leaves. It is a more common species and extends to much higher elevations.

**Etymology:** The species epithet commemorates Dr John Jolliffe, surgeon on the survey ship *H.M.S. Pandora* under a Capt. Drury (Godley 1967). Jolliffe collected plants (mostly bryophytes?) in the 1850s at scattered N.Z. localities, including the Auckland region.


*Holotype:* N.Z., Snares Is, T. Kirk s.n., Jan. 1890, (Herb. Beckett 370, CHR 616204)

*Plants* yellow-green, lustrous, apparently ± pendent from substrate. *Stems* irregularly branched, commonly 10–20 mm, but to at least 30 mm, sparsely beset below with smooth, pale brown rhizoids, in cross-section c. 12–14 cells across, with 4–5 outer layers of very thick-walled and pigmented cells surrounding parenchyma cells, lacking both a central strand and hyaloderm. *Branches* uneven in length, to at least 7 mm. *Leaves* moderately homomallous or erect, little altered when dry, narrowly lanceolate with a slender acumen, sharply denticulate by projecting cell ends in upper half, 1.0–1.3 × 0.2–0.3 mm (under coverslip); *mid laminar cells* (upper third of leaf) linear, mostly 60–75 × c. 4 µm, smooth, porose; *cells at leaf base* becoming shorter, broader, and more porose and with a pigmented basal band; *alar cells* abruptly differentiated, usually 2–3 in extreme angles strongly inflated, hyaline, and c. 45 × 15 µm, with supra-alar cells few and irregular.

*Apparently autoicous.* *Perichaetia* scattered on stems, the inner perichaetal leaves acuminate from an oblong and ± sheathing base, strongly toothed above. *Perigonia* not clearly seen. *Setae* red, twisted weakly to the left when dry, mammillate (sometimes weakly) throughout, 6–8 mm; *capsules* inclined or ± horizontal due to curvature of setae, oblong-cylindric, with a short neck, ± constricted below the mouth when dry, red-brown when mature, c. 1.2 mm; *stomata* not seen; *operculum* slenderly rostrate, c. 1.3 mm, exceeding the length of the capsule; *exothecial cells* subcollenchymatous and in distinct longitudinal ranks. *Peristome* as per genus; *endostomial membrane* high and cilia absent. *Calytra* cucullate and smooth. *Spores* 15–21 μm, green, finely papillose.

**Illustrations:** Plate 4. Beckett 1893, fig. 42.

**Distribution:** Known from Moggy I. (near St), Sol, Sn, and A.

**Habitat:** The best documented collection (*D. Horning SA65*) came from the trunk of “dead & live” *Olearia lyallii* at the South Promonory of Snares I.; also terrestrial on humus or peat.

**Notes:** This long neglected species vegetatively resembles the widespread *S. subhumile var. contiguum* and it may prove to be allied to it. However, it is distinguished by several morphological differences, notably the sharply denticate upper half of the vegetative leaf margins (poorly illustrated here), the mammillate (sometimes variably so) setae and the subcollenchymatous exothecial cells (i.e., with the longitudinal walls markedly thickened, transverse walls relatively thin-walled, and corners not thickened) that are arranged in clear longitudinal ranks. Other differences from *S. subhumile* var.
contiguum are the somewhat longer and more branched stems, a tendency for the leaves to be more erect-appressed, and a tendency for the mid laminal cells (upper third of leaf) to be porose. Collectively, these differences dictate taxonomic distinction at the species level.

**Etymology:** The species epithet honours Thomas Kirk, the collector of the type specimen and the author of The Forest Flora of New Zealand.

**Sematophyllum subhumile** (Müll.Hal.) M.Fleisch., *Musci Buitenzorg*, 1264 (1923)

**Etymology:** The epithet *subhumile* refers to a low growth form.

≡ *Sematophyllum contiguum* (Mitt.) Mitt. in Seemann, *Fl. Vit.* [Seemann], 398 (1873)
Lectotype: Tasmania, *Gunn 51, BM-Hooker 851175*! (Designated by Ramsay et al., 2002, p. 41.)
≡ *Sematophyllum aciculum* (Broth. ex Dixon) Dixon in Dixon & Sainsbury, *J. Bot.* 71: 250 (1933)

**Misapplications:** *Hypnum crassiusculum* sensu Wilson (1854, p. 113); sensu Hooker (1867, p. 474); sensu Brotherus in Herb. Beckett

**Plants** yellow- or white-green, lustrous, ± caespitose, mostly on rotten wood. **Stems** irregularly branched, <10–15 mm, weakly ascendant, with smooth, brown rhizoids in fascicles on ventral surface, in cross-section lacking a central strand and hyaloderm. **Branches** short, mostly 3–5 mm. **Leaves** strongly homomallous, pointing away from, or parallel to, the substrate, narrowly ovate-lanceolate or lanceolate-acuminate, evenly tapered to a slenderly acuminate apex, moderately narrowed to insertion, weakly concave, plane or narrowly reflexed, entire, 0.8–1.3(–1.5) × 0.25–0.4 mm (under cover slip); **mid laminal cells** (upper third of leaf) linear-rhombic and pointed at ends, mostly 42–75 × 5–7 µm and c. 7–13:1, smooth, not porose; **cells at leaf base** becoming shorter and porose and a basal band often yellow; **alar cells** abruptly differentiated, usually 2–4 in extreme angles strongly inflated (c. 45 × 20–30 µm) and hyaline or pale yellow, with supra-alar cells few and irregular or more numerous and extending 4–5 cells up the margin.

**Autoicous** in N.Z. material. **Perichaetia** scattered on stems, the inner perichaetial leaves narrowly acuminate from an oblong and ± sheathing base, serratulate above, c. 1.1–1.3 mm. **Perigonia** small and inconspicuous on stem, with inner bracts broadly ovate and c. 0.35 mm. **Setae** red at maturity, smooth, twisted weakly to the left when dry, 7–9 mm; **capsules** horizontal or pendulous due to curvature of setae, oblong-cylindric, with a short and ill-defined neck, ± constricted below the mouth when dry, little altered when moist, pale yellow-brown when mature, 1.0–1.5 mm; **stomata** restricted to neck, superficial; **annulus** not differentiated; **operculum** slenderly rostrate from a conic base, ± equal to the urn in length; **exothecial cells** short-oblong or ± quadrate, strongly collenchymatous, not in distinct longitudinal ranks. **Peristome** as per genus; **endostome** with a high basal membrane and single nodose cilia. **Calyptra** cucullate and smooth. **Spores** 12–18 µm, green, finely papillose.

**Illustrations:** Plate 5. Beever et al. 1992, fig. 81, h (as *S. contiguum*); Catcheside 1980, fig. 205 (as *S. contiguum*); Ramsay et al. 2002, figs 19 pro parte, 21; Streimann 2002, fig. 63 (as *S. subhumile*).

**Distribution:** K; NI: N Auckland including offshore islands (TK, LB, GB, RT, Maria I.). S Auckland, Gisborne (Anaura Bay, Paremata), Hawke’s Bay, Wellington; SI: Nelson (Parapara, Fenian Track, Lake Rotoiti, Punakaiki), Marlborough, Canterbury, Westland (Taramakau), Otago, Southland; St; Ch. Anomalous. Tasmania*, mainland Australia*. The variety *contiguum* is recorded from Tasmania, South America and Oceania by Ramsay et al. (2002); they (p. 37) considered *S. subhumile* s.l. to be “a common species distributed in temperate and tropical Asia, South Africa, the Pacific Islands, New Zealand and Australia also Norfolk Island”.

12
Habitat: Mostly on rotten wood. Less often on exposed roots or rock (including greywacke) or soil; occasionally epiphytic (on southern beech, Fuchsia excorticata, Podocarpus, Rhopalostylis, and Cordyline. Occurring in a range of native forest types and also in exotic (e.g., Eucalyptus, Populus, and Pinus) plantations. On South Island, this species is far more common in eastern regions and is a common and widespread species at lower elevations in Canterbury and Otago. On North Island, from near sea level (Bay of Islands, N Auckland L.D.) to c. 860 m (Kaweka Range, Hawke’s Bay L.D.), but with most records at or below c. 400 m. On South Island, from near sea level (Christchurch) to 540 m (Island Hill, Canterbury L.D.). Frequently associated bryophyte taxa include Dicranoloma menziesii, Pyrrhobryum mnioides var. contortum, Rhaphidorrhynchium amoenum, and Sauloma tenella.

Notes: For convenience, the varietal name contiguum employed by Ramsay et al. (2002) and long associated with N.Z. and Tasmanian material, is applied here. However, the differences cited by those authors (p. 43) to separate S. subhumile var. subhumile and var. contiguum are not great. They refer to Sainsbury (1955) in making those distinctions but a close reading of Sainsbury indicates that he was sceptical of the separation of these two taxa. According to Ramsay et al. (2002, p. 43), the main difference between these varieties is that var. contiguum has serrulate perichaetial leaves and “more acute” vegetative leaves. Their comments about vegetative leaf apices are difficult to interpret, but their figs 19, a1 and a2 indicate those of the var. contiguum to be narrower and sharply pointed, while those of the var. subhumile are broader and merely acute. However, in N.Z. material there appears to be continuous variation in vegetative leaf apical form. Further, I consider the holotype of the Australian Sematophyllum aciculum Broth. ex Dixon to be indistinguishable from N.Z. material. Ramsay et al. (2002, p. 37) interpreted S. aciculum as a taxonomic synonym of S. subhumile var. subhumile. The distinction between the two varieties is blurred at best.

Several N.Z. collections are clearly autoicous. Unless there is a difference of sexuality between Australian and N.Z. populations, the description by Ramsay et al. (2002, p. 37) of the sexuality of S. subhumile s.l. is likely incorrect; dioicy is a rare condition in Sematophyllum.

Recognition: Confusion can occur between the present taxon and depauperate forms of Wijkia extenuata. Sematophyllum subhumile var. contiguum is generally a paler, more lustrous plant in which the stem leaves are smoothly tapered to the apex, rather than abruptly tapered as is usual in Wijkia. New Zealand material of S. subhumile var. contiguum is autoicous and usually bears at least some fruit, while Wijkia is dioicus and often sterile. In S. subhumile var. contiguum the leaves are entire and the laminar cells invariably smooth while in Wijkia some degree of tooting almost always occurs near the leaf apex and the laminar cells usually exhibit some degree of papillae development. Material of S. subhumile var. contiguum lacks flagelliform branches, while W. extenuata var. caudata usually produces reduced flagelliform branches.

Confusion sometimes occurs between S. subhumile var. contiguum and S. homomallum, but the former generally occurs on wood (not rock), is paler, has more distinctly inflated alar cells and serrulate (not entire) perichaetial leaves. The two taxa also differ by their sexuality in N.Z.

Sematophyllum kirkii is similar in habit to S. subhumile var. contiguum, but differs from it by having subcollenchymatous exothecial cells, mammillose setae, and sharply toothed vegetative leaves.

Etymology: The significance of contiguum, meaning touching or neighbouring, is not apparent. Ben Tan (pers. comm., 6 April 2009) has suggested that it may allude to the overlapping leaf bases, which he thinks are “unlike the other species of the genus”.

≡ Hypnum tenuirostre Hook., Musci Exot. 2, 111 (1819)
≡ Rhaphidorrhynchium tenuirostre (Hook.) Mitt. in Brotherus, Nat. Pflanzenfam., ed. 2 [Engler & Prantl] 11, 428 (1925)

Plants yellow-green to golden, rarely dark brown to nearly black, moderately lustrous or dull, hygrophilous, forming loosely interwoven mats. Stems irregularly or subpinnately branched, commonly 25–35 mm in cross-section lacking a hyaloderm, with 3–4 layers of incrassate outer cells surrounding a core of thin-walled cells and lacking a central strand, c. 16 or more cells across. Branches variable in length, mostly <15 mm. Leaves strongly secund, usually ± falcate near branch tips, broadly ovate-lanceolate, abruptly tapered above to an acuminate apex, slightly narrowed to the base, concave and smooth, the margins dentate above, plane or sometimes ± incurved near base, mostly 1.8–2.2(–2.5) × 0.45–0.70(–0.85) mm (under cover slip), ecostate; mid laminal cells (upper third of
leaf) linear-vermicular, mostly 60–90 × 4–5 mm, commonly c. 20:1, firm-walled, smooth or with slightly projecting ends; basal cells shorter, porose, and pigmented; alar cells abruptly differentiated, consisting of 3–5 inflated, very large and thin-walled, hyaline or yellow cells in extreme angles, with few rows (1–3 rows) of supra-alar cells grading into laminal cells.

**Autoicous. Perichaetia** scattered on stems, the inner perichaetal leaves oblong-lanceolate, c. 2.0–2.3 mm, nearly entire, moderately plicate, with weakly differentiated alar cells, apparently expanding after fertilisation. Perigonia scattered on fertile stems, often numerous, c. 0.4–0.5 mm long, yellow or brown. Setae red at maturity, smooth, twisted weakly to the left, (9–)13–20 mm; capsules inclined to weakly pendulous, ovoid, with a short and ill-defined neck, yellow-brown at maturity, when dry constricted below the mouth and with the cells of the urn and neck distinctly bulging (visible under stereoscope), not narrowed below mouth but otherwise unchanged when moist, 1.3–1.7 mm; stomata few, in neck; operculum slenderly rostrate from a conic base, c. 1.0–1.2 mm; exothecial cells short round-oblong, not regularly arranged, strongly collenchymatous. Peristome asept per genus; endostome with a high basal membrane and (0–)1–2, usually well-developed, nodule cilia. Caryprotracuculate, smooth, usually ± lacinate at base. Spores mostly 15–21 mm diam. but often quite variable (with some as small as 10 mm diam.) in a single capsule, green, smooth.

**Illustrations:** Plate 6. Ramsay et al. 2002, fig. 22.

**Distribution:** NI: N Auckland, S Auckland (Hautapu River), Gisborne (Oronui Stream, Hopuruahine River) Taranaki (several localities in Egmont National Park), Wellington; SI: Nelson, Marlborough (s.loc.), Canterbury, Westland, Otago, Southland; St; Ch. A. Recorded from C by Vitt (1974, as Rhaphidorrhynchium tenuirostre).

**Habitat:** On irrigated rock, soil over rock, and less often on wood in forest streams. Often in waterfall spray zones and occurring on a broad range of rock types including granite, marble, limestone, gneiss, schist, sandstone, greywacke, mudstone, and ultramafics. This species occurs throughout a broad elevation range, but appears intolerant of exposed alpine situations. It often forms extensive and ± pure mats of many square meters at stream or river margins. It can be particularly abundant and well-developed on flat rocks that are slightly submerged or emergent in the gentle flows of smaller forest streams, but it can also tolerate the full force of swiftly flowing water within cascades. On North Island from 160 (Kahuterawa Stream, Wellington L.D.) to 1250 m (Manganui River in Egmont National Park, Taranaki L.D.). On South Island from <5 m (Dusky Sound, Southland L.D.) to 1240 m (Zetland Range, Nelson L.D.) elevation.

**Sematophyllum uncinatum** frequently forms pure and extensive colonies with no other bryophyte closely associated, although Brachythecium plumosum, Tridontium tasmanicum, and Thuidium laeviusculum often co-occur. Less frequent associates include Blindia magellanica, Brachythecium rutabulum, Cratoneuropsis relaxa, Dendrohypopterygium filiculaeforme, and Ochiobryum blandum.

**Notes:** The species varies little in its morphology, despite its occurrence on a remarkably broad range of substrates and over a broad elevational range. The most noticeably variable morphological feature is the width of the vegetative leaves, with leaves at the lower end of the range of continuous variation (c. 0.45 mm wide) seemingly associated with frequently emergent habitats. Forms with narrow leaves can occasionally be difficult to distinguish from Rhaphidorrhynchium amoenum, but that species appears to have consistently narrower leaves.

**Recognition:** This species is sometimes confused with species of Brachythecium occupying stream margins, particularly *B. plumosum*. The presence of a costa and markedly different alar cells clearly differentiate these taxa, if microscopic examination is made.

**Etyology:** The epithet means hook-shaped and refers to the strongly secund, usually ± falcate leaves.

**Warburgiella Müll.Hal. ex Broth., Monsunia 176 (1900)**

**Type taxon:** Warburgiella cupressinoides Müll.Hal. ex Broth.

Elements in the following description are taken from Ramsay et al. (2004).

**Plants** small, glossy, yellow-green, forming densely interwoven mats. **Stems** creeping, irregularly pinnate to bipinnate. **Branches** with erect, cuspidate tips. **Branch and stem leaves** similar, strongly falcate-secund to circinate, lanceolate to ovate-lanceolate, abruptly narrowed to an acuminate or long-acuminate apex that is sharply serrate, denticulate, or nearly entire and often twisted, entire below, strongly concave, clasping and sometimes sheathing at base, ecostate; mid laminal cells (upper third of leaf) elongate or linear, prorate or smooth, sometimes unipapillose; alar cells pigmented or hyaline,
with c. 3 inflated, firm- to thick-walled cells in extreme angles and a few (one row?) small supra-alar cells. **Costa** lacking.

**Autoicous. Perichaetium** scattered on stems, the leaves oblong, strongly clasping, piliferous at apex. **Setae** elongate, slender, curved above, smooth or mammillate; twisted weakly to the left above in N.Z. species; **capsules** pendulous, horizontal or inclined, cylindric or oblong-cylindric, smooth, contracted below the mouth when dry, sometimes with strongly protuberant-mammillate neck (as in N.Z. species); **stomata** few, restricted to neck; **annulus** lacking in N.Z. species; **operculum** rostrate from a conic base, oblique or straight; **exothecial cells** mostly rectangular or oblong, often arranged in distinct longitudinal ranks, with the longitudinal walls thicker than the transverse walls, less often weakly collenchymatous. **Peristome** double; **exostome teeth** pale yellow-brown, with median zig-zag line on outer surface, lanceolate, not shouldered, appendiculate at margins but not otherwise bordered, transversely striate below, coarsely warty above, trabeculate on inner surface; **endostome** with a high basal membrane, the segments ± equal the teeth, strongly keeled, narrowly perforate; cilia single or double, well-developed, nodose. **Calyptra** enclosing the entire capsule, mitrate when immature, splitting and becoming cucullate, smooth, laciniate or entire at base. **Spores** finely papillose.

**Taxonomy:** **Warburgiella** is a genus of about ten species distributed in Africa, Malesia, and Oceania. The type species, *W. cupressinoides* Müll.Hal., is from New Guinea.

Ramsay et al. (2004, p. 54) emphasised the subcollenchymatous exothecial cells, and the sheathing and expanded base of the inner perichaetial leaves with an abruptly acuminate or cuspidate apex, as defining features of this genus. They also cited (p. 57) the “peculiar capsule base” (which is irregularly protuberant-mammillate when dry, with stomata each situated at the apex of a protuberance) and the “rugulose” setae of this species as reason for transferring it to *Warburgiella*.

Fleischer (1923, p. 1249) provided a generic description (in German) and information about the four species he considered to occur in Java.

**Etymology:** The generic name honours Otto Warburg (1859–1938), who studied the flora of the monsoon regions of Asia and adjacent regions.

Lectotype: N.Z.: Auckland Is., J.D. Hooker s.n., BM 877716! Isotype: BM 877715!
≡ *Hymnium cerviculatum* Hook.f. & Wilson in Wilson, Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II 113 (1854)
≡ *Rhaphidorrhynchium cerviculatum* (Hook.f. & Wilson) M.Fleisch., Musci Buitenzorg, 1249 (1923)
Type: N.Z., Port Nicholson, A. Sinclair, BM-Wilson!

**Plants** lustrous, forming very fine interwoven mats. **Stems** irregularly branched, to at least 25 mm, in cross-section with a poorly-developed hyaloderm, several layers of incrassate outer cells and no central strand. **Branches** variable in length, c. 4–15 mm. **Leaves** strongly falcate-secund, slenderly acuminate from an ovate-lanceolate base, not or weakly twisted, strongly concave and clasping below, ± flat in the apex, plane at margins, sharply denticulate above, entire below, 1.3–1.8 × 0.3–0.35 mm (under cover slip); **mid laminal cells** (upper third of leaf) linear-vermicular, c. 45–60 × 3–5 µm, firm-walled, rounded and weakly prorate, not or scarcely porose; **basal cells** shorter, and strongly porose and yellow; **alar cells** abruptly differentiated, (2–)3 strongly inflated but firm-walled, oblong-rounded, hyaline or yellow, with a few subquadrate or oblong supra-alar cells.

**Reportedly autoicous. Perichaetium** scattered on stems, the inner perichaetal leaves strongly piliferous from a ± oblong base, strongly toothed above, with alar cells not or scarcely differentiated, sheathing the seta and apparently expanding after fertilisation. **Perigonia** not seen. **Setae** red-brown, mammillate throughout, twisted weakly to the left above, (6–)9–16–(24) mm; **capsules** pendulous due
to curvature of upper setae, oblong-cylindric, symmetric, weakly narrowed below mouth and with an irregularly protuberant-mammillate and short neck when dry, little narrowed below mouth but otherwise unchanged when moist, 1.5–2.0 mm; stomata few in neck, each situated at the apex of a protuberance and apparently immersed; operculum with a conic base and a very long, straight rostrum, c. 1.5 mm, with cells in ranks (as per exothecial cells); exothecial cells short round-oblong, arranged in distinct longitudinal ranks (visible under hand-lens), with the longitudinal walls much thicker than the transverse walls, not thickened in corners. Peristome as per genus; cilia single, nodose. Calyptra not laciniate at base. Spores (10–)15–25(–30) µm, variable in size in a single capsule, occasionally persisting as tetrads, green, smooth.


Distribution: NI: N Auckland (Waitakere Ranges), S Auckland (Moehau), Taranaki (Dawson Falls), Wellington (Lake Rotopounamu, Mt Tongariro, Tararu Range, George Creek near Wainuiomata; SI: Canterbury (Maruia Springs), Westland (Kelly Range), Otago (Lake McKerrow, Dunedin, Table Hill), Southland (The Chasm, Resolution I.); St; A, C.

Austral. Mainland Australia (Victoria)*. Reported from widely scattered localities in Tasmania and eastern Australia by both Scott & Stone (1976, p. 444, as Sematophyllum leucocytus and by Ramsay et al. (2004). The latter authors also record it from South America.

Habitat: On decaying wood and on tree bases in southern beech-, kamahi-, and podocarp-dominated forests. On North I. occurring from 220 m (George Creek) to 975 m (Mt Tongariro) and on South I. from sea level (Resolution I.) to c. 600 m (Maruia Springs). Frequently associated bryophytes include Catagonium politum, Cladomnion ericoides, Dicranoloma robustum, Distichophyllum pulchellum, Hypnum chrysogaster, Wijkia extenuata, and the hepatics Bazzania cf. adnexa, Chiloscyphus leucophyllus, Heteroscyphus billardierei, and Metzgeria hamata.

Notes: The sexuality of W. leucocyta cannot be recorded with confidence. I have tried repeatedly but without success to observe perigonia. Ramsay et al. (2004) recorded it as autoicous, while Scott & Stone (1976) recorded it as dioicous. The concept of W. leucocyta presented here is broader than that of Ramsay et al. (2004). There is considerable variation in respect to spore diameter in N.Z. material (at least up to 25 µm = G.O.K. Sainsbury 4738 from Dawson Falls (CHR 606453A) and in J.E. Beever 37-02 from Mt Tongariro, CHR 406694) and with a few exceptionally large spores (up to c. 30 µm) in the holotype of S. macrosporum Dixon & Sainsbury (BM 85046). Many of the collections named as W. macrospora in N.Z. herbaria are depauperate. The distinction made by Ramsay and co-authors between W. leucocyta and W. macrospora ignores the continuous range variation of spore size. The perichaetial leaves in the type of S. macrosporum also compare well to those of representative N.Z. S. leucocytus. It is difficult to apply the differentia cited by Ramsay et al. (2004, p. 55). In N.Z. the two species cannot be differentiated.

Recognition: The striped appearance of the capsules (due to the thickened longitudinal walls of the exothecial cells) is distinctive and readily observed with a hand-lens. This feature, and the irregularly protuberant capsule neck (that Scott & Stone 1976, p. 443, described as an “angular ridge round the very base like a collapsed apophysis”) make the sporophytes of this species distinctive. These are the most striking features of a species that, when sterile, is nondescript and easily confused. The low mammillae on the setae (less obvious than the papillae in some species of Brachytheciaceae) provide a further point of recognition, but these can be inconspicuous and are best observed under a compound microscope.

Some of the gametophytic recognition features mentioned by Scott & Stone (1976), including the distinction between the set of the stem and branch leaves and the whitish tinge of the plants, do not seem useful in N.Z.

Warburgiella leucocyta can easily be confounded with the much commoner Rhaphidorrhynchium amoenum, and not all sterile material can be confidently named. The nature of the alar cells may facilitate recognition in some instances. In W. leucocyta the strongly inflated extreme alar cells are firm-walled while in R. amoenum the extreme alar cells are thinner-walled (but similarly inflated). If perichaetial leaves are present, their degree of sheathing (see above under the generic discussion), abruptly tapered shape and the strongly toothed margins in W. leucocyta permit confident separation of the two taxa.

Etymology: The species epithet means white-celled.


**Type taxon:** *Wijkia extenuata* (Brid.) H.A.Crum

The following generic description draws on material in Buck (1986) and Ramsay et al. (2002).

**Plants** small to medium-sized, dark green or yellow- to brown-green, usually turning golden with age, forming loosely interwoven mats. **Stems** creeping, irregularly, subpinnately, or bipinnately branched. **Branches** simple or ± pinnately branched, creeping or ascending, often with multiple flagelliform and microphyllous branchlets near tips. **Stem and branch leaves** differentiated. **Stem leaves** appressed to spreading, broadly ovate to ± oblong, abruptly tapered to a slender, often piliferous and serrulate apex, concave; **mid laminal cells** (upper third of leaf) linear to linear-rhomboidal or long-hexagonal, firm-walled, seriatly papillose abaxially or occasionally smooth, mostly porose; **alar cells** shorter, strongly porose, and pigmented in N.Z. taxa; **costae** short and double or absent. **Branch leaves** smaller than stem leaves, ovate-lanceolate or lanceolate, the laminal cells finely papillose abaxially or smooth. **Specialised asexual reproduction** often by flagelliform and deciduous branchlets. **Paraphyllia** lacking. **Pseudoparaphyllia** foliose, deltoid (*fide* Buck 1986).

** Dioicus. Perichaetia** scattered on stems, conspicuous. **Setae** elongate, red-brown, smooth, twisted to the left above; **capsules** ± horizontal, oblong-cylindric, asymmetric, often narrowed below the mouth when dry; **exothecial cells** isodiametric to oblong, weakly to moderately thickened in corners, often with longitudinal walls thicker than transverse walls; **annulus** apparently absent; **exostome teeth** 16, strongly shouldered and bordered, the outer surface cross-striolate below and with a median zig-zag line, the inner surface trabeculate; **endostome** with a high basal membrane, the segments keeled and perforate and the cilia mostly in pairs or single. **Calyptra** cucullate, smooth. **Spores** spherical, papillose.

**Taxonomy:** *Wijkia* is a predominantly Old World tropical to subtropical genus of approximately 25–30 species, including the four species recognised for the New World by Buck (1986). The generic name was proposed by Crum (1971) to replace the illegitimate homonym *Acanthocladium* Mitt.; Crum simultaneously selected the Australasian *Hypnum extenuatum* Brid. as the nomenclatural type of *Wijkia*. Ramsay et al. (2002) recognised one species in Australia. Only the single species occurs in N.Z.; it is here treated as two varieties, which are distinguished in the key above.

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**Wijkia extenuata** (Brid.) H.A.Crum, *Bryologist* 74: 171 (1971)

= *Hypnum extenuatum* Broth., Muscol. Recent. Suppl. 4, 172 (1818)

**Type:** Australia. Not seen.


Holotype: N.Z., Campbell Island, J.D. Hooker, ("Wilson" 18), BM 19645–19651!


Holotype: Tasmania, Van Diemen’s Land, *Gunn s.n.,* ("H[ooker] 3461") in Herb. Wilson, BM 851104–851109!

= *Hypnum polyschistum* Mitt. in Hooker, *Handb. New Zealand Fl.,* 482 (1867)

**Type:** N.Z., “Northern Island”, *C. Knight, s.n.,* BM!

**Plants** extremely variable in habit, branching, and colour, medium-sized, forming densely interwoven mats. **Stems** creeping, irregularly pinnately or bipinnately branched, short or elongate (to c. 100 mm or more), with scattered fascicles of smooth brown rhizoids, in cross-section with no hyaloderm, several outer layers of thick-walled cells, and no central strand. **Branches** simple or subpinnately branched, often tapered to a slender and cuspidate tip, occasionally with numerous microphyllous and flagelliform branchlets (in var. *caudata*). **Stem and branch leaves** differentiated. **Stem leaves** erect-spreading, broadly ovate or ± oblong, abruptly tapered to a piliferous, weakly twisted, and serrulate apex (up to ¼ the total leaf length), becoming less toothed towards the base, concave, plane or nearly so at margins, c. 1.8–2.0(–2.5) × 0.7–0.8 mm (under cover slip); **mid laminal cells** (upper third of leaf)
linear to linear-rhombic, mostly 45–60 × c. 4 m, and c. 10–15:1, firm-walled, seriately papillose abaxially or occasionally smooth, porose; **basal cells** shorter, strongly porose, and orange-pigmented in a few rows across base; **alar cells** strongly differentiated, c. 8 cells inflated and hyaline or pigmented at extreme alar corners, with a few irregular or oblong supra-alar cells. **Branch leaves** smaller, erect-spreading or appressed, ovate-lanceolate or lanceolate, ± evenly tapered to a narrowly acute apex, sharply serrulate above by projecting cell ends (usually more serrulate than stem leaves), or rarely crenulate or entire, concave, smooth, not clasping, often weakly twisted in apex, (0.7–) 1.1–1.4 × 0.25–0.35 mm; **mid laminal cells** (upper third of leaf) linear-rhombic, firm-walled, seriately papillose abaxially (with up to 5 low, rounded papillae) or occasionally smooth, usually porose; **alar cells** usually fewer than in stem leaves, often 4–6 strongly inflated in extreme alar corners.

**Diocious. Perichaetia** scattered on stems, large (c. 2.5 mm) and conspicuous (apparently lengthening after fertilisation), the inner perichaetal leaves lanceolate and tubulose, sheathing the seta, serrulate above, tapered to a very slender and often ± reflexed acumen, with strongly porose laminal cells. **Perigonia** scattered on branches, gemmiform, and c. 0.7 mm long, the inner bracts broadly ovate. **Setae** red-brown, smooth, long and slender, twisted to the left above, 30–45 mm; **capsules** ± horizontal, oblong-cylindric, asymmetric and curved, narrowed below the mouth and weakly striolate when dry, with a short and ill-defined neck, not constricted below the mouth when moist, 2.0–2.5 mm; **stomata** few in neck, superficial; **annulus** apparently absent; **operculum** high-conic, lacking a rostrum; **exothecial cells** isodiametric to oblong, moderately thickened in corners but with the longitudinal walls thicker than transverse walls (± “subcollenchymatous”); **Peristome** as per genus; **endostomial cilia** paired and nodose (few seen). **Calytra** cucullate, smooth. **Spores** spherical, mostly (12–)15–24 m, green, smooth, sometimes germinating in capsule.

**Notes:** Distribution and ecology as for varieties.

This is an extremely variable species with numerous forms (not given taxonomic recognition here), which can cause confusion until the range of malleability is recognised. Necessarily, the description above is based on representative material. When well-developed, the distinctly dimorphic leaves easily differentiate *W. extenuata* from any other N.Z. species of Sematophyllaceae.

In the most common and representative form of the species, the distinction between the stem and branch leaves is obvious, the stem leaves being abruptly tapered to a piliferous and serrulate apex and the branch leaves distinctly smaller, ± ovate-lanceolate or lanceolate, more evenly tapered and sharply serrulate above. The laminal cells of the branch leaves are usually distinctly porose and abaxially papillose. The abaxial papillae are more easily seen near the apex of branch leaves by mounting a small, intact piece of the branch. The papillae, which can be seen only under a compound microscope, can then be viewed in profile. Capsules are uncommon, reflecting the dioicus nature of the species. When fresh, well-developed plants often have a grey-green colouration and an oily sheen.

While difficult to describe, this colouration is distinctive in the field.

One very common variant consists predominantly of branches. In most instances of this “branch-only” growth form, the branch leaves are strongly toothed, and the laminal cells porose and papillose abaxially, thus allowing ready assignation to the present species. There is an obvious gradation between representative and “branch-only” growth forms. *Whitehouse 29179a* (from Lake Waikareiti, Gisborne L.D., CHR 265425) is an example of such transitional material. “Branch-only” growth forms do not develop the flagelliform branches that are a conspicuous feature of *Wijkia extenuata* var. *caudata*.

As with many epiphytic species, *W. extenuata* can sometimes assume a pendent habit (e.g. *K.W. Allison 2294* from Rotorua, S Auckland L.D. (CHR 579505) and *J.-P. Frahm 11-8* from Wills Hut Track, Otago L.D., CHR 503325). In this pendent growth form the leaves are narrowly lanceolate or ovate-lanceolate and ± evenly tapered to a slender and nearly entire acumen. The branch leaves in such material are longer (to at least 1.6 mm) and finer than usual; the laminal cells here are often weakly porose and can be either smooth or papillose abaxially.

Populations also occur in which abruptly tapered stem-like leaves predominant. Such “stem-only” forms are often terrestrial (H. & W. Frey 94–143, near Murchison, Nelson L.D., CHR 458214). “Stem-only” forms obtain their most extreme expression in alpine grasslands where the plants are strongly yellow-pigmented, the leaves only weakly denticulate near their apices, the laminal cells smooth but porose (*C.D. Meurk s.n.* from Temple Basin, CHR 481544).

The type collection of *Hypnum extenuatum* Brid. was made by Labillardière in Nova Hollandiae *fide* Müller (1850–1851, vol. 2, p. 392), with subsequent collections by Sieber and J.D. Hooker.

**Recognition:** Confusion is most likely to occur between the present species and *Sematophyllum subhumile* var. *contiguum*, q.v.

**Etymology:** The epithet is from *extenuata* (Latin feminine superlative adjective from *extenuo*, to diminish, to make thin). The epithet refers to the extenuate/attenuate appearance of the branch tips (in
contrast to those of *Hypnum cupressiforme*). However, Bridel described the leaf apices as pilliform and “with filiform production”, so he may have considered “*extenuatum*” doubly appropriate (D. Meagher, pers. com. 11 Nov. 2015).

**Wijkia extenuata var. caudata** Fife, *New Zealand J. Bot.* 50: 442 *(2012)*

Holotype: N.Z., North Island, Gisborne L.D., Bay of Plenty region, Raukokore River, true right bank c. 700 m above State Highway 35 bridge, on partially shaded very firm prostrate log in broad-leaved-podocarp forest on alluvial terrace, 10 m a.s.l.; *A.J. Fife 10921*; 27 Nov. 1996, CHR 570073! Isotypes: AK!, WELT!

**Plants** yellow-green or golden, medium-sized, forming loosely interwoven mats, with numerous erect and flagelliform branches. **Stems** creeping, irregularly or subpinnately (never bipinnately) branched, to at least 40 mm, otherwise as per species. **Branches** simple and erect or curving upwards from the substrate, irregularly (never pinnately) branched, weakly cuspidate and with numerous flagelliform and microphyllous branchlets near tips. **Stem and branch leaves** differentiated. **Stem leaves** rather abruptly tapered from a broadly ovate base to a narrowly acuminate apex, best developed near stem apex, entire or weakly and obtusely denticulate above, 1.2–1.4 × 0.4–0.5 mm (under cover slip); **mid laminal cells** (upper third of leaf) mostly 42–54(–60) × c. 5 m, firm-walled, smooth or weakly prorate, lacking pores, otherwise as per species; **basal cells** as per species; **alar cells** highly differentiated, 3–4 cells highly inflated and thin-walled in the basal row, with 3–4 cells above strongly inflated but slightly smaller and with several irregular supra-alar cells. **Branch leaves** smaller, ovate-lanceolate, ± evenly tapered to an acute apex, entire or crenulate near apex, mostly 0.7–0.8(–1.1) × 0.2–0.35 mm (under cover slip); **mid laminal cells** (upper third of leaf) 38–54 × c. 6 m, not porose, smooth or with low seriate papillae on abaxial surface, otherwise as per species; **alar cells** as per species.

**Apparently dioicous. Sex organs** and **sporophytes** not seen.

**Illustrations:** Plate 8. Ramsay et al. 2002, fig. 4 e-f (as *Wijkia extenuata*).

**Distribution:** K; Ni: N Auckland (Whangaruru North Head, Hukatere, Leigh) including offshore islands (GB), S Auckland (Mercury Bay, near Coromandel, Te Kauri Park Scenic Reserve, Whale I.), Gisborne (Raukokore River, Waihau Bay) SI: Nelson (Little Wanganui River, Lake Hanlon, Punakaikī). Australasian. Mainland Australia (N.S.W.)*.

**Habitat:** Epiphytic on tree trunks (including *Aristotelia serrata*, *Metrosideros kermadecensis*, *Myoporum laetum*, *Vitex lucens*, and *Cordyline australis*) and on firm logs. Apparently also terrestrial on Kermadecs, where collections by W.R. Sykes and P. de Lange are from a variety of habitats including open *Metrosideros* forest, old tano plantation areas, and Mysore thorn (*Caesalpinia decapetala*) scrub. Frequently associated species include *Rhapidorrhynchium amoenum*, *Thuidiopsis sparsa*, *Bazzania adnexa*, *Heteroscyphus coalitus*, and *Jamesoniella monodon*. From near sea level to 518 m (at the summit of Mumokouki Peak on Raoul I., Kermadec Is), to c. 120 m on both Whale I. and the South I. (Little Wanganui River).

**Notes:** While the variation of *W. extenuata* s.l. in N.Z. is protean, the continued recognition of only a single taxon (Sainsbury 1955; Fife 1995) obscured this distinctive, morphologically homogenous, and widespread variety. The presence of flagelliform branchlets is frequent in the genus *Wijkia* and has been used as a taxonomic feature to define *Wijkia* species in other parts of the world (Buck 1986), but it has not been utilised taxonomically in Australasia. Flagelliform branchlets in *W. extenuata* occur predominantly in the northern regions of N.Z., and are correlated with relatively weak differentiation between stem and branch leaf shapes, an absence of bipinnate branching, entire or crenulate branch leaf margins, and lack of pores in mid laminal cells of the branch leaves. Branch leaves here can either bear low seriate papillae or appear smooth.

The correlation of these four morphological features justifies the segregation of the variety. While caudate and non-caudate populations of *W. extenuata* s.l. have distributional overlap on the North and South Is, on the Kermadec Is only the caudate variety occurs; this distributional feature provides further support for recognition of var. caudata. The variety is restricted to areas of marked coastal influence.

Sainsbury (1955) was familiar with the variety and referred to “a curious flagelliferous form [that] occurs in the Bay of Plenty and [which] has been reported from a few littoral stations there”. Sainsbury (1955, p. 461) described this plant as “very small and the branching unipinnate, with branches 1 cm long or less from which are produced crowded, flagellate, julaceous and fragile shoots clothed with squamose leaves”. Subsequent collections have shown this taxon to be more widespread than Sainsbury knew.
Two collections of the var. caudata have been seen from mainland Australia (N.S.W.) and partial habits of it have been published by Ramsay et al. (2002, fig. 4 e-f).

**Recognition:** When poorly developed, this taxon is not always possible to distinguish from *Sematophyllum subhumile* var. contiguum. The present taxon is dioicous and is not known to fruit, while N.Z. material of *S. subhumile* var. contiguum is autoicous and collections of it usually bear at least some fruit. Microphyllous branches are not produced in *Sematophyllum subhumile* var. contiguum.

**Etymology:** The varietal epithet caudata means tail-like and refers to the tail-like flagelliform branches.

*Wijkia extenuata* (Brid.) H.A.Crum, *Bryologist* 74: 171 (1971) var. extenuata

The species description applies to the variety *extenuata* with the following exceptions:

**Stems** creeping, bipinnately or irregularly pinnately branched, short or elongate (up to c. 100 mm or more); **branches** as for species but lacking flagelliform branchlets; **branch leaves** ovate-lanceolate or lanceolate, sharply serrulate above by projecting cell ends (usually more serrulate than stem leaves), 1.1–1.4 × 0.25–0.35 mm.

**Illustrations:** Plate 9. Scott & Stone 1976, pl. 85; Beever et al. 1992, fig. 80; Ramsay et al. 2002, figs 4, a–c, g–h; figs 5–6; Meagher & Fuhrer 2003, p. 89; Malcolm & Malcolm 2003, p. 72 (all as *W. extenuata*).

**Distribution:** NI: N Auckland, including offshore islands (LB, GB), S Auckland, Gisborne, Hawke’s Bay, Taranaki, Wellington (including KA); SI: Nelson, Marlborough, Canterbury, Westland, Otago, Southland; St; Sol; Sn; A; C. On SI exhibiting a very strong western bias in its distribution. Australasian. Tasmania*, mainland Australia*. Reported from New Caledonia by Ramsay et al. (2002).

**Habitat:** On decaying wood and often forming extensive interwoven mats. Also epiphytic on a wide range of native trees and tree ferns and on exposed roots; occasionally becoming pendent. Less commonly on soil or rock in forested situations and rarely as an epiphyll. It appears to be rare in areas of base-rich bedrock and is not a common plant in alpine situations. On North I. from near sea level to c. 1000 m (Ruahine Range, Hawke’s Bay L.D.) and on South I. from near sea level to c. 1400 m (Temple Basin, Canterbury L.D.). Frequent bryophyte associates include *Dicranoloma robustum*, *D. billardierei*, *Distichophyllum pulchellum*, *Hypnum chrysogaster*, *Lembophyllum clandestinum*, *Leptotheca gaudichaudii*, *Leucobryum candidum*, *Pyrrhobryum bifarium*, *P. mnioides* var. contortum, *Rhizogonium distichum*, *Bazzania adnexa*, and *Plagiochila* spp.

**Recognition:** Alpine forms of *W. extenuata* var. *extenuata* could conceivably be confused with *Rhacocarpus purpurascens* given their similar growth habit, branching patterns, and abruptly tapered leaves. However, the *Wijkia* is not a rigid plant like *R. purpurascens* and the delicately textured leaves here are completely different from the thick, leathery leaves with ± red hair-points of *R. purpurascens*. The latter has leaves that appear opaque under the compound scope and are finely and densely wrinkled except at the margins, where a border of smooth cells is visible. The alar cells of *R. purpurascens* are rectangular, extremely thick-walled, strongly pigmented, and highly porose. *Wijkia extenuata* var. *extenuata* usually occurs on wood, whereas *R. purpurascens* normally grows over rock.
References


Hooker, J.D. 1867: Handbook of the New Zealand Flora: a systematic description of the native plants of New Zealand and the Chatham, Kermadec’s, Lord Auckland’s, Campbell’s, and Macquarie’s Islands. Part II. Reeve, London.


## Conventions

### Abbreviations and Latin terms

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Auckland Islands</td>
</tr>
<tr>
<td>A.C.T.</td>
<td>Australian Capital Territory</td>
</tr>
<tr>
<td>aff.</td>
<td>allied to (affinis)</td>
</tr>
<tr>
<td>agg.</td>
<td>aggregate</td>
</tr>
<tr>
<td>Ant</td>
<td>Antipodes Islands</td>
</tr>
<tr>
<td>a.s.l.</td>
<td>above sea level</td>
</tr>
<tr>
<td>auct.</td>
<td>of authors (auctorum)</td>
</tr>
<tr>
<td>B</td>
<td>Bounty Islands</td>
</tr>
<tr>
<td>C</td>
<td>Campbell Island</td>
</tr>
<tr>
<td>c.</td>
<td>about (circa)</td>
</tr>
<tr>
<td>cf.</td>
<td>compare with, possibly the species named (confer)</td>
</tr>
<tr>
<td>c.fr.</td>
<td>with fruit (cum fructibus)</td>
</tr>
<tr>
<td>Ch</td>
<td>Chatham Islands</td>
</tr>
<tr>
<td>comb. nov.</td>
<td>new combination (combinatio nova)</td>
</tr>
<tr>
<td>D’U</td>
<td>D’Urville Island</td>
</tr>
<tr>
<td>et al.</td>
<td>and others (et alia)</td>
</tr>
<tr>
<td>et seq.</td>
<td>and following pages (et sequentia)</td>
</tr>
<tr>
<td>ex</td>
<td>from</td>
</tr>
<tr>
<td>fasc.</td>
<td>fascicle</td>
</tr>
<tr>
<td>fide</td>
<td>according to</td>
</tr>
<tr>
<td>GB</td>
<td>Great Barrier Island</td>
</tr>
<tr>
<td>HC</td>
<td>Hen and Chicken Islands</td>
</tr>
<tr>
<td>Herb.</td>
<td>Herbarium</td>
</tr>
<tr>
<td>hom. illeg.</td>
<td>illegitimate homonym</td>
</tr>
<tr>
<td>I.</td>
<td>Island</td>
</tr>
<tr>
<td>ibid.</td>
<td>in the same place (ibidem)</td>
</tr>
<tr>
<td>incl.</td>
<td>including</td>
</tr>
<tr>
<td>in herb.</td>
<td>in herbarium (in herbario)</td>
</tr>
<tr>
<td>in litt.</td>
<td>in a letter (in litteris)</td>
</tr>
<tr>
<td>inter alia</td>
<td>among other things (inter alia)</td>
</tr>
<tr>
<td>Is</td>
<td>Islands</td>
</tr>
<tr>
<td>K</td>
<td>Kermadec Islands</td>
</tr>
<tr>
<td>KA</td>
<td>Kapiti Island</td>
</tr>
<tr>
<td>LB</td>
<td>Little Barrier Island</td>
</tr>
<tr>
<td>L.D.</td>
<td>Land District or Districts</td>
</tr>
<tr>
<td>leg.</td>
<td>collected by (legit)</td>
</tr>
<tr>
<td>loc. cit.</td>
<td>in the same place (loco citato)</td>
</tr>
<tr>
<td>l:w</td>
<td>length:width ratio</td>
</tr>
<tr>
<td>M</td>
<td>Macquarie Island</td>
</tr>
<tr>
<td>Mt</td>
<td>Mount</td>
</tr>
<tr>
<td>nec</td>
<td>nor</td>
</tr>
<tr>
<td>NI</td>
<td>North Island</td>
</tr>
<tr>
<td>no.</td>
<td>number</td>
</tr>
<tr>
<td>nom. cons.</td>
<td>conserved name (nomen conservandum)</td>
</tr>
<tr>
<td>nom. dub.</td>
<td>name of doubtful application (nomen dubium)</td>
</tr>
<tr>
<td>nom. illeg.</td>
<td>name contrary to the rules of nomenclature (nomen illegitimum)</td>
</tr>
<tr>
<td>nom. inval.</td>
<td>invalid name (nomen invalidum)</td>
</tr>
<tr>
<td>nom. nud.</td>
<td>name published without a description (nomen nudum)</td>
</tr>
<tr>
<td>non</td>
<td>not</td>
</tr>
<tr>
<td>N.P.</td>
<td>National Park</td>
</tr>
<tr>
<td>N.S.W.</td>
<td>New South Wales</td>
</tr>
<tr>
<td>N.T.</td>
<td>Northern Territory (Australia)</td>
</tr>
<tr>
<td>N.Z.</td>
<td>New Zealand</td>
</tr>
<tr>
<td>op. cit.</td>
<td>in the work cited (opere citato)</td>
</tr>
<tr>
<td>pers. comm.</td>
<td>personal communication</td>
</tr>
<tr>
<td>PK</td>
<td>Poor Knights Islands</td>
</tr>
</tbody>
</table>
P.N.G.  Papua New Guinea
_pro parte_ in part
Qld  Queensland
q.v.  which see (quod vide)
RT  Rangitoto Island
S.A.  South Australia
_s.coll._ without collector (sine collectore)
_s.d._ without date (sine die)
sect.  section
SEM  scanning electron microscope/microscopy
_sensu_ in the taxonomic sense of
SI  South Island
_sic_ as written
_s.l._ in a broad taxonomic sense (sensu lato)
_s.loc._ without location (sine locus)
Sn  Snares Islands
_s.n._ without a collection number (sine numero)
Sol  Solander Island
sp.  species (singular)
_spp._ species (plural)
_s.s._ in a narrow taxonomic sense (sensu stricto)
St  Stewart Island
_stat. nov._ new status (status novus)
subg.  subgenus
_subsect._ subsection
_subsp._ subspecies (singular)
_sub spp._ subspecies (plural)
Tas.  Tasmania
TK  Three Kings Islands
U.S.A.  United States of America
_var._ variety
_vars_ varieties
Vic.  Victoria
_viz._ that is to say (videlicet)
_vs_ versus
W.A.  Western Australia

Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
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<tbody>
<tr>
<td>µm</td>
<td>micrometre</td>
</tr>
<tr>
<td>♂</td>
<td>male</td>
</tr>
<tr>
<td>♀</td>
<td>female</td>
</tr>
<tr>
<td>±</td>
<td>more or less, somewhat</td>
</tr>
<tr>
<td>×</td>
<td>times; dimensions connected by × refer to length times width</td>
</tr>
<tr>
<td>&gt;</td>
<td>greater than</td>
</tr>
<tr>
<td>=</td>
<td>less than</td>
</tr>
<tr>
<td>≥</td>
<td>greater than or equal to</td>
</tr>
<tr>
<td>≤</td>
<td>less than or equal to</td>
</tr>
<tr>
<td>=</td>
<td>heterotypic synonym of the preceding name</td>
</tr>
<tr>
<td>≡</td>
<td>homotypic synonym of the preceding name</td>
</tr>
<tr>
<td>!</td>
<td>confirmed by the author</td>
</tr>
<tr>
<td>*</td>
<td>in distribution statements, indicates non-N.Z. localities from which material has been confirmed by the author</td>
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Abbreviations for Herbaria follow the standard abbreviations listed in _Index Herbariorum_.

25
Acknowledgements

Jessica Beever advised in many ways during the preparation of this treatment. Rod Seppelt read a draft and suggested many improvements. Rebecca Wagstaff made the line drawings with great skill and patience. Leah Kearns provided meticulous and excellent editorial advice, Sue Gibb reviewed the literature and nomenclatural references with great care. Peter Beveridge, Patrick Brownsey, Peter de Lange, and Barbara Polly allowed me to study their unreported collections. The keepers at AK, BM, and WELT are thanked for the loan of collections, including types. My colleagues Peter Heenan and Ilse Breitwieser encouraged me to submit this manuscript as part of the eFlora of New Zealand series. Aaron Wilton and Katarina Tawiri were instrumental in converting the manuscript into a format suitable for electronic publication.

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FifeA@landcareresearch.co.nz
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.

*Acanthocladium* Mitt. 17
*Acanthocladium crinitum* (Hook.f. & Wilson) Broth. ex Paris 17
*Acanthocladium extenuatum* (Brid.) Mitt. 17
*Hypnum acutifolium* Hook.f. & Wilson 17
*Hypnum amoenum* Hedw. 5
*Hypnum cerviculatum* Hook.f. & Wilson 15
*Hypnum crinitum* Hook.f. & Wilson 17
*Hypnum drummondii* Hook.f. & Wilson 8
*Hypnum extenuatum* Brid. 17
*Hypnum homomallum* (Hampe) Müll.Hal. 8
*Hypnum jolliffii* Mitt. 10
*Hypnum kirkii* Müll.Hal. ex Beckett 11
*Hypnum leptorhynchum* Hook.f. & Wilson 5
*Hypnum leucocytus* Müll.Hal. 15
*Hypnum mundulum* Hook.f. & Wilson 5
*Hypnum polystichum* Mitt. 17
*Hypnum subhumile* Müll.Hal. 12
*Hypnum tenuirostre* Hook. 13
*Leskea homomalla* Hampe 8
*Pylaisia homomalla* (Hampe) A.Jaeger 8
*Rhaphidorrhynchium* Besch. ex M.Fleisch. 4, 7
*Rhaphidorrhynchium amoenum* (Hedw.) M.Fleisch. 4, 5, 14, 16, 19
*Rhaphidorrhynchium cerviculatum* (Hook.f. & Wilson) M.Fleisch. 15
*Rhaphidorrhynchium homomalum* (Hampe) Mitt. 8
*Rhaphidorrhynchium jolliffii* (Mitt.) Broth. 10
*Rhaphidorrhynchium kirkii* (Müll.Hal. ex Beckett) Broth. 11
*Rhaphidorrhynchium leucocytus* (Müll.Hal.) Broth. 15
*Rhaphidorrhynchium tenuirostre* (Hook.) Mitt. 13
*Rhaphidostegium aciculum* Broth ex Dixon 12
*Rhaphidostegium acutifolium* (Hook.f. & Wilson) Dixon 17
*Rhaphidostegium amoenum* (Hedw.) A.Jaeger 5
*Rhaphidostegium contiguum* (Mitt.) Paris 12
*Rhaphidostegium homomallum* (Hampe) Broth. 8
*Rhaphidostegium jolliffii* (Mitt.) A.Jaeger 10
*Rhaphidostegium kirkii* (Müll.Hal. ex Beckett) Broth. 11
*Rhaphidostegium leucocytus* (Müll.Hal.) A.Jaeger 15
*Sematophyllaceae* 1, 2, 18
*Sematophyllum* Mitt. 2, 7, 8, 9, 11, 13
*Sematophyllum aciculum* (Broth. ex Dixon) Dixon 12
*Sematophyllum amoenum* (Hedw.) Mitt. 5
*Sematophyllum contiguum* (Mitt.) Mitt. 12
*Sematophyllum fiordensis* Fife 7

Sematophyllum homomallum (Hampe) Broth. 8, 13
Sematophyllum jolliffii (Mitt.) Dixon 10
Sematophyllum kirkii (Müll.Hal. ex Beckett) Paris 11, 13
Sematophyllum leucocytus (Müll.Hal.) Sainsbury 15
Sematophyllum macrosorum Dixon & Sainsbury 15
Sematophyllum subhumile (Müll.Hal.) Müll. Fleisch. 12, 13
Sematophyllum subhumile var. contiguum (Mitt.) B.C.Tan, W.B.Schofield & H.P.Ramsay 6, 7, 10-12, 12, 18, 20
Sematophyllum tenuirostre (Hook.) Dixon 13
Sematophyllum uncinatum I.G.Stone & G.A.M.Scott 8, 10, 11, 13
Stereodon contiguus Mitt. 12
Stereodon jolliffii Mitt. 10
Taxithelium polystichum (Mitt.) A.Jaeger 17
Warburgiella Müll.Hal. ex Broth. 7, 14
Warburgiella leucocyta (Müll.Hal.) B.C.Tan, W.B.Schofield & H.P.Ramsay 4, 6, 11, 15
Warburgiella macrospora (Dixon & Sainsbury) B.C.Tan, Schofield, & H.P.Ramsay 15
Wijkia H.A.Crum 2, 13, 17, 19, 20
Wijkia extenuata (Brid.) H.A.Crum 6, 13, 16, 17, 19, 20
Wijkia extenuata var. caudata Fife 13, 18, 19
Wijkia extenuata (Brid.) H.A.Crum var. extenuata 20
## Image Information

<table>
<thead>
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<th>Image</th>
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<tbody>
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<td>Plate 2</td>
<td>R.C. Wagstaff</td>
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<tr>
<td>Map 1</td>
<td>A.D. Wilton</td>
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</tr>
<tr>
<td>Map 2</td>
<td>A.D. Wilton</td>
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Flora of New Zealand: PDF publications

The electronic Flora of New Zealand (eFloraNZ) project provides dynamic, continually updated, online taxonomic information about the New Zealand flora. Collaborators in the project are Landcare Research, the Museum of New Zealand Te Papa Tongarewa, and the National Institute of Water and Atmospheric Research (NIWA).

The eFloraNZ presents new systematic research and brings together information from the Landcare Research network of databases and online resources. New taxonomic treatments are published as fascicles in PDF format and provide the basis for other eFloraNZ products, including the web profiles. eFloraNZ will have separate sets of PDF publications for algae, lichens, liverworts and hornworts, mosses, ferns and lycophytes, and seed plants.

For each eFloraNZ set, the PDF files are made available as dated and numbered fascicles. With the advent of new discoveries and research, the fascicles may be revised, with the new fascicle being treated as a separate version under the same number. However, superseded accounts will remain available on the eFlora website.

Moss Set (ISBN 978-0-478-34747-0)
The Moss Set covers indigenous and exotic mosses within the New Zealand Botanical Region.
Authors Allan Fife and Jessica Beever intend to publish Flora of New Zealand Mosses as a book. However, they decided to make completed family treatments available through the eFloraNZ project in advance of being published in hardcopy, to enable immediate use.

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