

FLORA OF NEW ZEALAND

FERNS AND LYCOPHYTES

PSILOTACEAE



P.J. BROWNSEY & L.R. PERRIE

Fascicle 9 – MARCH 2015

© Landcare Research New Zealand Limited 2015.

Unless indicated otherwise for specific items, this copyright work is licensed under the Creative Commons Attribution 3.0 New Zealand license.



Attribution if redistributing to the public without adaptation: "Source: Landcare Research"

Attribution if making an adaptation or derivative work: "Sourced from Landcare Research"

See Image Information for copyright and licence details for images.

CATALOGUING IN PUBLICATION

Brownsey, P.J. (Patrick John), 1948-

Flora of New Zealand [electronic resource] : ferns and lycophytes. Fascicle 9, Psilotaceae / P.J. Brownsey and L.R. Perrie. -- Lincoln, N.Z. : Manaaki Whenua Press, 2015.

1 online resource

ISBN 978-0-478-34778-4 (pdf)

ISBN 978-0-478-34761-6 (set)

1.Ferns -- New Zealand - Identification. I. Perrie, L.R. (Leon Richard). II. Title. III. Manaaki Whenua-Landcare Research New Zealand Ltd.

UDC 582.391(931)DC 587.40993

DOI: 10.7931/B1MW2B

This work should be cited as:

Brownsey, P.J. & Perrie, L.R. 2015: Psilotaceae. *In*: Breitwieser, I.; Heenan, P.B.; Wilton, A.D. *Flora of New Zealand — Ferns and Lycophytes*. Fascicle 9. Manaaki Whenua Press, Lincoln.
<http://dx.doi.org/10.7931/B1MW2B>

Cover image: *Tmesipteris elongata*, round-ended bilobed synangia borne on the upper margin of bifid sporophylls.

Contents

- Introduction..... 1
- Taxa
 - Psilotaceae* J.W.Griff. & Henfr. 2
 - Psilotum* Sw. 2
 - Psilotum nudum* (L.) P.Beauv. 3
 - Tmesipteris* Bernh. 4
 - Tmesipteris elongata* P.A.Dang. 5
 - Tmesipteris horomaka* Perrie, Brownsey & Lovis 8
 - Tmesipteris lanceolata* P.A.Dang. 10
 - Tmesipteris sigmatifolia* Chinnock 11
 - Tmesipteris tannensis* (Spreng.) Bernh. 13
- References 16
- Acknowledgements 18
- Maps 19
- Index 21
- Image Information 22

Introduction

The family Psilotaceae is represented in New Zealand by two non-endemic genera (*Psilotum* and *Tmesipteris*) and six species, two of which are endemic. *Psilotum nudum* is confined to Northland, Auckland and the thermal regions. Two species of *Tmesipteris* are widespread in the North Island and western part of the South Island; two are largely confined to the northern half of the North Island with outlying populations in northern South Island, and one is endemic to Banks Peninsula. *Psilotum nudum* has branching, upright, angular stems with highly reduced, scale-like leaves, and trilobed synangia borne on the upper surface of bifid, scale-like sporophylls. Species of *Tmesipteris* are usually epiphytic, often on tree fern trunks, and have pendulous aerial stems bearing flattened leaves, and bilocular synangia on the upper surface of forked sporophylls. Neither genus appears typically fern-like in its morphology.

***Psilotaceae* J.W.Griff. & Henfr., *Microgr. Dict.*, 540 (1855)**

Type taxon: *Psilotum* Sw.

Usually epiphytic or sometimes terrestrial ferns. Rhizomes long-creeping, dichotomously branched, subterranean, lacking roots. Aerial stems green, erect or pendulous, unbranched or dichotomously branched, angular to sulcate or flattened, glabrous, bearing rudimentary leaves. Leaves expanded and flattened or scale-like, spirally arranged or distichous. Vein single and undivided in each leaf, or absent. Sporangia thick-walled, sessile, fused to form bilocular or trilocular synangia, on the adaxial margin of forked sporophylls, lacking an annulus and dehiscing by a slit, maturing ± simultaneously, with 1000s of spores per sporangium. Homosporous; spores monolete, rugulate to smooth, lacking chlorophyll.

Taxonomy: A family of two genera and about 18 species (Chinnock 1998). The *Psilotaceae* includes terrestrial and epiphytic ferns with subterranean rhizomes that lack roots, pendulous or erect aerial stems that bear rudimentary leaves, have bi- or trilocular synangia on the adaxial margin of forked sporophylls, and a base chromosome number of 52.

The taxonomic placement of the family has had a controversial history. Traditionally the group was included within the fern allies, and often compared with early Devonian land plants, despite the fact that the *Psilotaceae* has almost no fossil record. Molecular evidence now clearly indicates that the family is an early-diverging group of ferns, and most closely related to the *Ophioglossaceae* (Pryer et al. 2001, 2004). Earlier, Bierhorst (1977) also suggested that the *Psilotaceae* was a primitive element within the true ferns, but he allied the group with *Stromatopteris* in the *Gleicheniaceae*, a view later discredited by Kaplan (1977) and Wagner (1977).

The family is represented in New Zealand by two indigenous genera, *Psilotum* and *Tmesipteris*.

- 1 Leaves tiny and scale-like, lacking veins; synangia trilobed *Psilotum*
 Leaves broad and flattened, with a single undivided vein; synangia bilobed
 *Tmesipteris*

Distribution: *Psilotum* is widely distributed in the tropics and subtropics, and *Tmesipteris* extends from tropical south-east Asia and the Pacific to temperate parts of Australia and New Zealand. Two non-endemic genera and six indigenous species present in New Zealand; two species endemic.

Biostatus: Indigenous (Non-endemic).

Table 1: Number of species in New Zealand within *Psilotaceae* J.W.Griff. & Henfr.

Category	Number
Indigenous (Endemic)	2
Indigenous (Non-endemic)	4
Total	6

***Psilotum* Sw., *J. Bot. (Schrader)* 1800(2): 109 (1801)**

= *Bernhardia* Willd. ex Bernh., *J. Bot. (Schrader)* 1800(2): 132 (1801)

Type taxon: *Psilotum nudum* (L.) P.Beauv.

Etymology: From the Greek *psilo-* (bare, naked), a reference to the naked or exposed synangia

Vernacular name: fork fern

Epiphytic or terrestrial ferns. Rhizomes dichotomously branched, subterranean, bearing brown rhizoidal hairs. Aerial stems erect or pendulous, dichotomously branched, angular or complanate (not NZ), glabrous. Sterile leaves small, scale-like, spirally arranged, lacking veins. Synangia trilobed, rounded, arranged adaxially on bifid, scale-like sporophylls. Spores monolete, ellipsoidal, rugulate to smooth.

Taxonomy: *Psilotum* is clearly distinguished from *Tmesipteris* by its highly reduced, scale-like leaves, and by the sporangia fused into trilobed synangia. At least 20 species and many varieties have been proposed (Reed 1966), but only two are accepted today (Chinnock 1998).

Distribution: A genus of two species widely distributed in the tropics and subtropics. One species indigenous in New Zealand.

Biostatus: Indigenous (Non-endemic).

Table 2: Number of species in New Zealand within *Psilotum* Sw.

Category	Number
Indigenous (Non-endemic)	1
Total	1

Cytology: Diploid to octoploid chromosome numbers of $n = 52$, 104 and c. 210 have been reported in specimens of *Psilotum* from different parts of the world, as well as possible triploid hybrids with $2n = c. 156$ (see Brownsey & Lovis 1987).

***Psilotum nudum* (L.) P.Beauv., Prodr. Aethéogam, 106, 112 (1805)**

≡ *Lycopodium nudum* L., *Sp. Pl.*, 1100 (1753)

Lectotype (selected by Proctor 1977): "Habitat in Indiis", Herb. Linn. No. 1257.1, LINN!
(photo WELT E475/5)

= *Psilotum triquetrum* Sw., *J. Bot. (Schrader)* 1800(2): 109 (1801)

Holotype: Martinique, B, Herb. Willdenow

= *Bernhardia novae-hollandiae* Müll.Berol., *Bot. Zeitung (Berlin)* 14: 237 (1856)

Lectotype (selected by Brownsey & Perrie 2014): Port Jackson [Sydney, New South Wales],
R. Brown Iter. Austral. 120, K! (photo WELT E472/7).

= *Psilotum heterocarpum* Colenso, *Trans. & Proc. New Zealand Inst.* 20: 237 (1888)

Lectotype (selected by Brownsey & Perrie 2014): New Zealand, Wairakei, Taupo, C.J.
Norton s.n., 1887, Herb. Colenso, WELT P003168!

= *Psilotum novae-zelandiae* Gand., *Bull. Soc. Bot. France* 66: 306 (1919)

Holotype: Nova Zelandia [New Zealand], Aston, LY

Etymology: From the Latin *nudum* (naked), a reference to the apparent lack of leaves.

Terrestrial, rupestral or occasionally epiphytic ferns. Aerial stems erect, 40–725 mm long, 13–290 mm wide. Unbranched portion of stem 20–420 mm long, 0.5–3 mm in diameter, green or yellow-green; distal portion dichotomously branched 3–many times, strongly ribbed, green, stiff or sometimes flaccid in shaded habitats, glabrous. Sterile leaves 1–3 mm long, scale-like, confined to ribs, spirally arranged, pale yellow, lacking veins. Synangia 1–1.5 mm long, 1.5–3 mm wide, yellow, unprotected, projecting slightly from sides of stems.

Distribution: North Island: Northland, Auckland, Volcanic Plateau.

Kermadec Islands.

Altitudinal range: 0–450 m.

Psilotum nudum occurs on Raoul Island and in coastal areas of Northland, but is uncommon on the mainland in the Auckland region, except around Auckland City, on Rangitoto Island and in eastern Coromandel. It has been collected on offshore islands from the Poor Knights Islands to Whale Island in the eastern Bay of Plenty, and has been reported (without voucher) from Urupukapuka Island in the Bay of Islands (Young 2009). On the west coast it extends to Kāwhia Harbour, and it is common on thermally heated soils of the Rotorua/Taupō region as far south as Tokaanu. It occurs from near sea level to about 150 m in most of its range, but grows up to 400 m on Raoul Island and 450 m on the cliffs around Lake Rotomahana.

Also widespread in tropical and subtropical regions including Australia (Western Australia, Northern Territory, Queensland, NSW, Victoria) and most islands of the Pacific.

Biostatus: Indigenous (Non-endemic).

Habitat: On Raoul Island, *Psilotum nudum* is common under dry forest in the crater area, usually on the forest floor, but also on rotten wood or epiphytic on *Metrosideros*. In Northland and on the Hauraki Gulf and Coromandel islands it occurs under pōhutukawa forest on rocky or sandy soil, on open coastal cliffs and banks, in rock crevices and amongst scoria. Very occasionally it occurs as an epiphyte on pōhutukawa or kōwhai. In Auckland City it is found on walls, in rocky areas, amongst scoria and in planted areas, where it has been accidentally introduced. Around Kāwhia Harbour it grows on limestone outcrops. However, it is most abundant on thermally heated ground in the

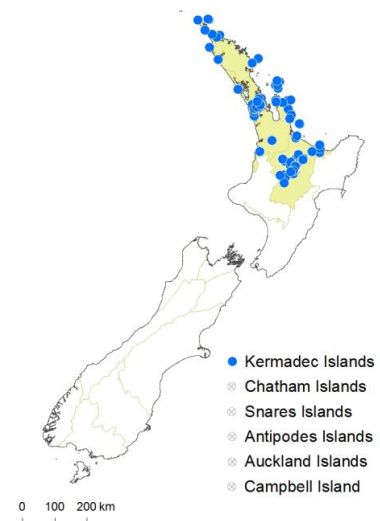


Fig. 1: *Psilotum nudum* distribution map based on databased records at AK, CHR and WELT.

Rotorua/Taupō area on cliffs, rocky ground, in crevices, around steam vents and under light kānuka and mānuka scrub.

Recognition: This species is easily recognised by its twiggy, upright stems, scale-like leaves, and trilobed synangia borne adaxially on bifid sporophylls.

Cytology: $n = 104$ (Brownsey & Lovis 1987).

Notes: The gametophytes of *Psilotum nudum* are unusual amongst ferns in being subterranean, non-green, mycorrhizal, cylindrical and frequently branched (Holloway 1939; Bierhorst 1954). They are similar to those of *Tmesipteris* in this regard.



Fig. 2: *Psilotum nudum*: dichotomously branched aerial stem bearing trilobed synangia.



Fig. 3: *Psilotum nudum*: dichotomously branched aerial stem bearing trilobed synangia on adaxial surface of tiny bifid scales.

***Tmesipteris* Bernh., J. Bot. (Schrader) 1800(2): 131 (1801)**

Type taxon: *Tmesipteris tannensis* (Spreng.) Bernh.

Etymology: From the Greek *tmesis* (a cutting, or incision), and *pterus* (a fern), a reference to the sporophyll being forked, as if cut into two.

Vernacular name: fork fern

Epiphytic or occasionally terrestrial ferns. Rhizomes dichotomously branched, subterranean, bearing brown rhizoidal hairs. Aerial stems pendulous, unbranched or dichotomously branched, flattened, glabrous, either growing indeterminately or terminated by a large leaf. Sterile leaves scale-like proximally, expanded and flattened distally, spirally arranged or distichous, 1-veined, bases unequally cuneate. Synangia bilobed, equal or unequal, arranged on the adaxial margin of bifid sporophylls; lobes conic or round-ended. Spores monolete, ellipsoidal, rugulate to smooth.

Taxonomy: A genus of about 15 species. Allan (1961) and authors of earlier New Zealand Flora treatments all recognised only a single species of *Tmesipteris*. Nineteenth century authors all misidentified this as *T. forsteri* Endl., an illegitimate name for the species now known as *T. norfolkensis* - a plant endemic to Norfolk Island. Later authors referred the New Zealand species to *T. tannensis*. However, the genus was critically revised by Chinnock (1975) who identified four species, including *T. sigmatifolia* which was described for the first time. A fifth species, *T. horomaka*, was described more recently by Perrie et al. (2010) and is so far known only from Banks Peninsula. Unlike the other New Zealand species, which are all tetraploid (Brownsey & Lovis 1987), *T. horomaka* is octoploid and possibly an allopolyploid derivative of *T. tannensis* and *T. elongata*. In addition, two further species may be present in New Zealand. Plants resembling *T. obliqua* from south-east Australia occur in the far south of the South Island, and others similar to *T. norfolkensis* are known from Northland and Great Barrier Island. Further work is needed to determine the true identity of these plants.

A clearer understanding of the diversity within *Tmesipteris* has only emerged since the 1970s, with species descriptions now available for the Philippines (Gruezo 2012), Australia (Chinnock 1998), the Solomon Islands (Braithwaite 1973), Vanuatu (Braithwaite 1986), New Caledonia (Brownlie 1969), Fiji (Brownlie 1977) and French Polynesia (Murdock & Smith 2003).

1	Sterile leaves distichously arranged 2 Sterile leaves spirally arranged 3	
2	Sterile leaves ovate to elliptic, shiny green; sporophylls usually in lower half of stem; stems undivided <i>lanceolata</i> Sterile leaves narrowly ovate to narrowly oblong, dull green; sporophylls usually in middle or upper part of stem; stems undivided or branched one to several times <i>elongata</i>	
3	Synangia with pointed ends 4 Synangia with rounded ends 5	
4	Synangial lobes usually separated from subtending sporophyll, pointing upwards <i>tannensis</i> Synangial lobes appressed to subtending sporophyll, pointing laterally or downwards <i>horomaka</i>	
5	Stems undivided; sterile leaves often slightly sigma-shaped; mucro 1.5–3.5 mm long; synangial lobes often unequal in size <i>sigmatifolia</i> Stems undivided or branched one to several times; sterile leaves straight or falcate; mucro 1–2.5 mm; synangial lobes equal in size 6	
6	Sterile leaves usually emarginate to truncate, up to 25 mm long <i>horomaka</i> Sterile leaves usually cuspidate to acuminate, up to 45 mm long <i>elongata</i>	

Distribution: One species in the Philippines, at least one in Papua New Guinea, seven in Australia (including Lord Howe and Norfolk Islands), three in the Solomon Islands, four in New Caledonia, three in Vanuatu and one each in Fiji, Samoa, Society Islands and the Marquesas. Five species in New Zealand; two endemic.

Biostatus: Indigenous (Non-endemic).

Table 3: Number of species in New Zealand within *Tmesipteris* Bernh.

Category	Number
Indigenous (Endemic)	2
Indigenous (Non-endemic)	3
Total	5

Cytology: Tetraploid counts of $n = 104$ have been reported from New Zealand (Brownsey & Lovis 1987), Australia (Barber 1957) and Vanuatu (Braithwaite 1986), and octoploid counts of $n = 208$ from New Zealand (Perrie et al. 2010), Australia (Barber 1957) and Vanuatu (Braithwaite 1986).

Notes: The gametophytes of *Tmesipteris* species are unusual amongst ferns in being buried (usually in tree fern trunks, but sometimes underground), non-green, mycorrhizal, cylindrical and frequently branched (Holloway 1918, 1921). They are similar to those of *Psilotum* in this regard.

***Tmesipteris elongata* P.A.Dang., *Botaniste Séries 2: 213, pl. 12, fig. 6* (1891)**

≡ *Tmesipteris tannensis* var. *elongata* (P.A.Dang.) Domin, *Biblioth. Bot.* 20 (85): 231 (1915)
Lectotype (selected by Chinnock 1998): Plate 12, figure 5 in *Le Botaniste Sér. 2* (Dangeard 1891)

= *Tmesipteris lanceolata* M.Sykes, *Ann. Bot. (London)* 22: 64 (1908) nom. illeg.

= *Tmesipteris tugana* H.N.Barber, *Victoria Naturalist* 71: 98 (1954)
Holotype: Britton's Swamp, Smithton, Tasmania, H.N. Barber, Jan. 1949, HO 47877

= *Tmesipteris elongata* subsp. *robusta* Chinnock, *New Zealand J. Bot.* 13: 763 (1975)
Holotype: Rodney County, Atuanui State Forest, R.E. Beever, 17 Nov. 1973, CHR 256756!

Etymology: From the Latin *elongatus* (elongated), a reference to the leaf shape.

Epiphytic ferns. Aerial stems pendent, 70–1400 mm long, 11–75 mm wide, unbranched or forked one to several times, of indeterminate growth eventually terminated by small sterile leaf or sporophyll. Leaves narrowly oblong to narrowly ovate, straight or falcate, spirally to almost distichously arranged, dull green on both surfaces, subcoriaceous; the longest 8–35, rarely to 45 mm long, 2–9 mm wide, at or below mid-stem; apices acuminate or cuspidate or rarely truncate, with a mucro 1–3 mm long.

Sporophylls in the distal part of the stem only, or almost throughout except for the proximal part. Synangia 2.5–6 mm long, 1–2.5 mm high; lobes equal, round-ended; the lower surface of each lobe appressed to the subtending leaf margin along its length.

Distribution: North Island: Northland, Auckland, Volcanic Plateau, Gisborne, Taranaki, Southern North Island.

South Island: Western Nelson, Sounds-Nelson, Marlborough, Westland, Canterbury, Fiordland, Southland.

Chatham Islands, Stewart Island.

Altitudinal range: 0–925 m.

Tmesipteris elongata occurs throughout the North Island in lowland to montane forest, and is absent only from some of the east coast. It grows from sea level in the northern North Island, up to 700 m in the Hūnua and Tararua Ranges and on Maungatautari, and to over 900 m in the Rangitoto Range near Pureora Forest. In the South Island, it occurs in coastal and lowland forest, most commonly in the Marlborough Sounds, Nelson and Westland, with isolated records in Fiordland. It grows to 400 m around Nelson and in the ranges east of Hokitika. It occurs sporadically on the east coast around Kaikoura and Banks Peninsula, where it grows to about 350 m, and in the Catlins District, but is absent from the interior of the South Island.

Also Australia (Victoria, Tasmania).

Biostatus: Indigenous (Non-endemic).

Habitat: *Tmesipteris elongata* is found commonly as an epiphyte on tree fern trunks, recorded most frequently from *Cyathea dealbata* and *Dicksonia squarrosa*, but also occasionally from *Cyathea medullaris* in northern New Zealand, and *Cyathea smithii* at higher elevations and in the South Island. It has been recorded once from *Dicksonia fibrosa* on the Chatham Islands (AK 230462). It is also occasionally found growing on trunks of *Beilschmiedia tawa*, *Dysoxylum spectabile*, *Hedycarya arborea*, *Melicytus ramiflorus*, *Metrosideros robusta*, *Nestegis* spp., *Fuscospora solandri*, and *Rhopalostylis sapida*, on old rotten logs, and rarely at the base of tree trunks, on banks, or in humus. It has also been recorded once from an introduced *Salix* species (WAIK 4672). It occurs most frequently in a wide range of broadleaved forest but also under kauri, podocarp and beech forest and in swamp forest, or rarely under *Pinus radiata*.

In northern New Zealand the species can be found hanging from large clumps of *Collospermum*, and such plants are often much larger than those found on tree fern trunks. They were distinguished as *T. elongata* subsp. *robusta* by Chinnock (1975).

Plants have been collected from the bases of *Carex secta* at Lake Koraha, Maturatahi Valley (WAIK 8847), and rather stunted plants from *C. secta* stems in a dense *Phormium tenax* swamp on the south Taranaki coast (WELT P020839).

Recognition: This is one of the two widespread species of *Tmesipteris* in New Zealand, recognised by its somewhat flexible leaves with acuminate or cuspidate apices, and by its round-ended synangia. Its leaves are also generally longer than in other species. It is the only species with a stem that sometimes branches more than once. Some forms are very robust, branching several times, and are much bigger than any other species in New Zealand (see below).

Cytology: n = 104 (Brownsey & Lovis 1987).

Notes: The holotype of Dangeard's *Tmesipteris elongata* has probably been destroyed (Chinnock 1975), and Dangeard's illustration was therefore selected as lectotype (Chinnock 1998). The original localities are cited as "Terre de Van Diemen [Tasmania]; New South Wales".

Tmesipteris elongata subsp. *robusta* was distinguished from subsp. *elongata* by Chinnock (1975) primarily on the basis of its more consistently branching stem, but also by its slightly longer and broader leaves. However, it appears to overlap in all these characters with specimens of subsp. *elongata*, and is therefore reduced to synonymy. It is best regarded as an ecological form that grows particularly well in large clumps of *Collospermum*.

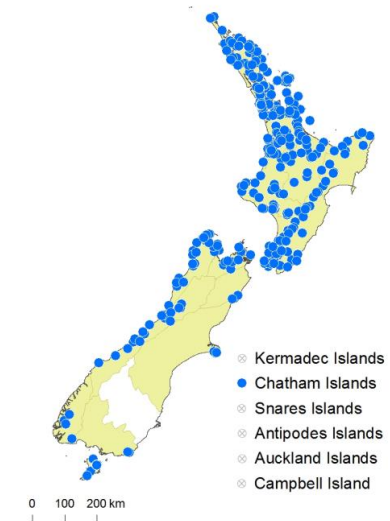


Fig. 4: *Tmesipteris elongata* distribution map based on databased records at AK, CHR and WELT.



Fig. 5: *Tmesipteris elongata*: aerial stem growing from a tree fern trunk, bearing narrowly-ovate sterile leaves tapering to a short mucro, and sporophylls in the distal half. The frond at bottom right is *T. lanceolata*.



Fig. 6: *Tmesipteris elongata*: aerial stem bearing undivided sterile leaves in the proximal half, and bilobed synangia on the adaxial margin of bifid sporophylls in the distal half.



Fig. 7: *Tmesipteris elongata*: aerial stem showing indeterminate growth with the apex terminated by a small leaf or sporophyll.



Fig. 8: *Tmesipteris elongata*: aerial stem bearing round-ended bilobed synangia on the adaxial margin of bifid sporophylls, splitting along the adaxial surface.



Fig. 9: *Tmesipteris elongata*: round-ended bilobed synangia borne on the adaxial margin of bifid sporophylls.



Fig. 10: *Tmesipteris elongata*: close up of sporophylls showing round-ended synangia appressed to the subtending leaf margin.

***Tmesipteris horomaka* Perrie, Brownsey & Lovis, New Zealand J. Bot. 48: 27 (2010)**

Holotype: New Zealand, Canterbury Province, Banks Peninsula, Te Oka Stream valley, *J.D. Lovis (Te Oka E) & J.M. Ward*, 5 Dec. 1988, WELT P022252!

Etymology: *horomaka* - a Māori name for Banks Peninsula, a reference to the geographic distribution of this species.

Epiphytic or rarely terrestrial ferns. Aerial stems pendent, 60–510 mm long, 15–35 mm wide, unbranched or rarely 1-forked, of indeterminate growth eventually terminated by small sterile leaf or sporophyll. Leaves narrowly oblong to narrowly ovate, straight or falcate or rarely sigmoid, spirally arranged, dull green on both surfaces, coriaceous; the longest 10–25 mm long, 2.5–7 mm wide, borne from just above to just below mid-stem; apices emarginate, truncate or cuspidate, with a mucro 1–2.5 mm long. Sporophylls mostly in the distal half of the stem, or a few occurring throughout. Synangia 2.5–6 mm long, 1–2 mm high; lobes equal, conic to round-ended; the lower surface of each lobe appressed to the subtending leaf margin along all or most of its length; the conic apices projecting laterally or slightly downwards.

Distribution: South Island: Canterbury.

Altitudinal range: 120–610 m.

Tmesipteris horomaka has only been recorded from Banks Peninsula and the Port Hills near Christchurch where it appears to be the predominant species of the genus.

Biostatus: Indigenous (Endemic).

Tmesipteris horomaka was given a conservation status of Nationally Critical by de Lange et al. (2013).

Habitat: *Tmesipteris horomaka* occurs most frequently as an epiphyte on trunks of the tree ferns *Cyathea dealbata*, *C. smithii* and *Dicksonia squarrosa* in podocarp, broadleaved and beech forest. A single collection has also been recorded from *Phormium* peat on a humid, shaded, cliff face (CHR 355608).

Recognition: This species is morphologically intermediate between *T. elongata* and *T. tannensis*. It differs from *T. elongata* in having mostly emarginate to truncate leaves, compared to acuminate or cuspidate leaves in that species. It differs from *T. tannensis* in having round-ended or only slightly pointed synangia with the apices projecting laterally or downwards, compared to usually strongly pointed synangia with the apices pointing upwards in *T. tannensis*.

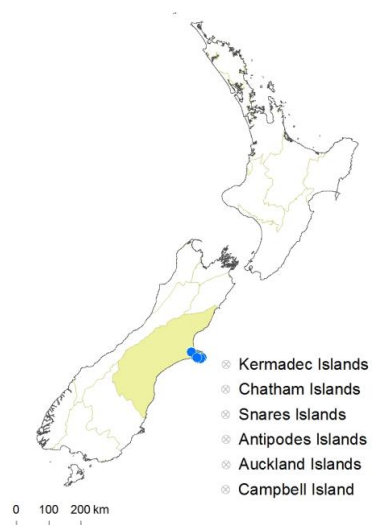


Fig. 11: *Tmesipteris horomaka* distribution map based on databased records at AK, CHR and WELT.

Cytology: $n = c. 208$ (Perrie et al. 2010).

Notes: Plants resembling *Tmesipteris horomaka* have been collected from Westland (CHR 325664) and Stewart Island (WELT P011165). They have large spores, suggesting that they may be octoploids, but have more distinctly biconic synangia than *T. horomaka* from Banks Peninsula. The specimens were treated as *incertae sedis* by Perrie et al. (2010) and require further investigation.



Fig. 12: *Tmesipteris horomaka*: aerial stems bearing narrowly-oblong sterile leaves abruptly truncated to a prominent mucro, and round-ended or slightly conic synangia, with the apices projecting laterally.



Fig. 13: *Tmesipteris horomaka*: aerial stems growing from a tree fern trunk.



Fig. 14: *Tmesipteris horomaka*: aerial stem bearing narrowly-oblong sterile leaves abruptly truncated to a prominent mucro, and slightly conic synangia, with the apices projecting laterally.



Fig. 15: *Tmesipteris horomaka*: close up of sporophylls showing conic synangia appressed to the subtending leaf margin, the apices projecting laterally.

***Tmesipteris lanceolata* P.A.Dang., *Botaniste* Série 2: 214, pl. 15, fig. 6 (1891)**

≡ *Tmesipteris tannensis* var. *lanceolata* (P.A.Dang.) Domin, *Biblioth. Bot.* 20 (85): 232, tab. 1, fig. 4 (1915)

Lectotype (selected by Chinnock 1998): Plate 15, figure 6 in *Le Botaniste* Sér. 2 (Dangeard 1891)

Etymology: From the Latin *lanceolatus* (lance-shaped), a reference to the leaf shape.

Epiphytic ferns. Aerial stems pendent or horizontal, 30–185 mm long, 8–40 mm wide, unbranched, of determinate growth terminated by a large sterile leaf. Leaves ovate or elliptic, straight or slightly falcate, distichously arranged, shiny green on upper surface, dull green on lower surface, coriaceous; the longest 7–23 mm long, 2–8.5 mm wide, borne from just above to just below mid-stem; apices cuspidate or rarely truncate, with a mucro 1–2 mm long. Sporophylls usually in the proximal half of the stem. Synangia 2–5 mm long, 1–2.5 mm high; lobes equal or slightly unequal, conic to round-ended; the lower surface of each lobe appressed to the subtending leaf margin along its length; the conic apices projecting laterally or slightly downwards.

Distribution: North Island: Northland, Auckland, Volcanic Plateau, Gisborne, Taranaki.

South Island: Western Nelson.

Kermadec Islands, Chatham Islands

Altitudinal range: 0–500 m.

Tmesipteris lanceolata occurs through Northland, Auckland, and coastal Bay of Plenty as far as East Cape, and along the west coast south to New Plymouth. It is found most commonly in coastal and lowland forest but reaches 300 m in the Hūnua Range, 450 m on Raoul Island and over 500 m in the Hokianga district and on Mt Moehau, Coromandel. It is known from just three South Island collections in North-west Nelson, between Kaihoka Lakes and Kahurangi Point where it grows to 60 m, and from one collection on the Chatham Islands (AK 296646).

Also New Caledonia.

Biostatus: Indigenous (Non-endemic).

Habitat: *Tmesipteris lanceolata* is found as an epiphyte on tree fern trunks, most commonly on *Cyathea dealbata*, *C. medullaris* and *Dicksonia squarrosa*, but it has also been reported on *D. lanata* (Chinnock 1975). On Raoul Island it grows on *Cyathea milnei*. It occurs in kauri, podocarp, pōhutukawa and broadleaved forest, and tall kānuka scrub.

Recognition: This species is easily recognised by its shorter stems, distichously arranged leaves, and synangia which are usually confined to the lower part of the stem. The leaves are also shiny green, and ovate or elliptic in shape, unlike the other species which generally have duller leaves that are longer and narrower in outline.

Some plants from Northland and Great Barrier Island differ from *T. lanceolata* in having the synangia confined to the upper half of the stem. They resemble *T. norfolkensis* from Norfolk Island but further work is required to determine their true identity.

Cytology: n = 104 (Brownsey & Lovis 1987).

Notes: The holotype of Dangeard's *Tmesipteris lanceolata* has probably been destroyed (Chinnock 1975), and Dangeard's illustration was therefore selected as lectotype (Chinnock 1998). The type locality, "Montagnes-Bleues", was most likely to have been in New Caledonia where the species is common (Chinnock 1998).

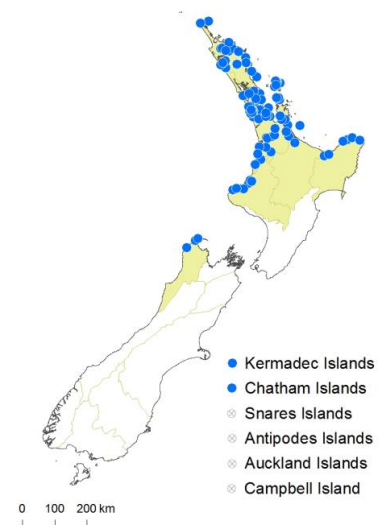


Fig. 16: *Tmesipteris lanceolata* distribution map based on databased records at AK, CHR and WELT.



Fig. 17: *Tmesipteris lanceolata*: aerial stem growing from a tree fern trunk, bearing shiny ovate leaves with cuspidate apices ending in a prominent mucro, and bilobed synangia confined to the proximal half.



Fig. 18: *Tmesipteris lanceolata*: aerial stem showing determinate growth with the apex terminated by a large sterile leaf.



Fig. 19: *Tmesipteris lanceolata*: aerial stem growing from a tree fern trunk, bearing shiny ovate leaves, and bifid sporophylls with conic or round-ended synangia confined to the proximal half.

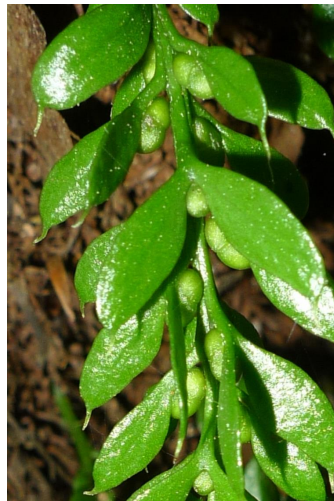


Fig. 20: *Tmesipteris lanceolata*: close up of sporophylls showing round-ended synangia appressed to the subtending leaf margin.

***Tmesipteris sigmatifolia* Chinnock, *New Zealand J. Bot.* 13: 764 (1975)**

Holotype: New Zealand, Northland, Waipoua Kauri Forest, Toronui Track, 0.2 km from Waipoua River, *R.J. Chinnock P302*, 26 Oct. 1972, CHR 271740!

= *Tmesipteris tannensis* var. *elongata* Sahni, *Philos. Trans., Ser. B* 213: 143, pl. 5, fig. 5-6 (1925) nom. illeg.

Etymology: From the Latin *sigma* (S-shaped) and *folium* (leaf), a reference to the leaf shape.

Epiphytic ferns. Aerial stems pendent, 40–270 mm long, 10–35 mm wide, unbranched or rarely 1-branched, of indeterminate growth terminated by large sterile leaf or sporophyll. Leaves narrowly oblong or narrowly ovate, usually sigma-shaped, spirally arranged, shiny green on both surfaces, coriaceous; the longest 8–20 mm long, 2–4 mm wide, just above or just below mid-stem; apices slightly emarginate, truncate or cuspidate, with a mucro 1.5–3.5 mm long. Sporophylls mostly in the distal half of the stem or sometimes throughout except for the lowermost part. Synangia 2.5–5 mm

long, 1–2.5 mm high; lobes often unequal in size or occasionally equal, round-ended; the lower surface of each lobe appressed to the subtending leaf margin along its length.

Distribution: North Island: Northland, Auckland, Gisborne.

South Island: Western Nelson.

Altitudinal range: 0–400 m.

Tmesipteris sigmatifolia occurs throughout Northland and Auckland, as far south as Thames, with outlying populations on Mt Pirongia and near Kāwhia Harbour, and isolated records in the far eastern Bay of Plenty between Waihou Bay and Pōtaka. In the South Island, there are very sporadic and imprecisely located 19th century collections of the species from the Maitai Valley, Nelson and in Westland (Chinnock 1975, in overseas herbaria), but only one 20th century collection from the Pororari River, Westland (CHR 500815). In the North Island it grows to 300 m or more in the Puketi, Herekino and Maungataniwha Forests, and up to 400 m on Mt Pirongia and on Great Barrier Island.

Also New Caledonia.

Biostatus: Indigenous (Non-endemic).

Habitat: *Tmesipteris sigmatifolia* grows epiphytically on tree fern trunks, most commonly on *Cyathea dealbata* and *Dicksonia squarrosa*, but also occasionally on *Cyathea medullaris*, *Dicksonia lanata*, and, at higher altitudes, on *Cyathea smithii*. It has been recorded once growing in litter at the base of a kauri (CHR 302370). It occurs in kauri, podocarp, broadleaved and old kāmuka forests in northern New Zealand.

Recognition: This species is recognised by its generally sigma-shaped leaves which are narrower than in other species and with a longer mucro tip. The synangia are usually located in the distal half of the stem, and the lobes are often unequal in size, with rounded ends.

Cytology: n = 104 (Brownsey & Lovis 1987).

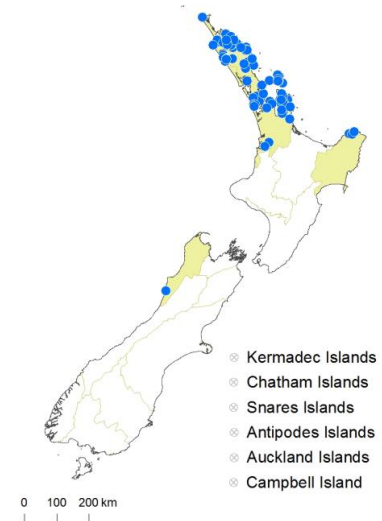


Fig. 21: *Tmesipteris sigmatifolia* distribution map based on databased records at AK, CHR and WELT.



Fig. 22: *Tmesipteris sigmatifolia*: aerial stem bearing sigma-shaped leaves with cuspidate apices ending in long mucros, and bifid sporophylls with round-ended synangia confined to the distal half.



Fig. 23: *Tmesipteris sigmatifolia*: aerial stem showing round-ended synangia with unequal-sized lobes.



Fig. 24: *Tmesipteris sigmatifolia*: aerial stem showing determinate growth with the apex terminated by a large sterile leaf.



Fig. 25: *Tmesipteris sigmatifolia*: close up of sporophylls showing round-ended synangia appressed to the subtending leaf margin.

***Tmesipteris tannensis* (Spreng.) Bernh., *J. Bot. (Schrader)* 1800(2): 131, tab. 2, fig. 5 (1801)**

≡ *Lycopodium tannense* Spreng., *J. Bot. (Schrader)* 1799(2): 267 (1800)

≡ *Bernhardia tannensis* (Spreng.) Müll.Berol., *Bot. Zeitung (Berlin)* 14: 221 (1856)

Neotype (selected by Chinnock 1976): Figure 5 in Schrader's *Journal für die Botanik* 1800(2): tab. 2 (Bernhardi 1801).

= *Tmesipteris fowerakeri* H.N.Barber, *Victoria Naturalist* 71: 98 (1954)

Holotype: New Zealand, Southland, Longwood Range, *J.A. Veale s.n.*, Sept. 1950, HO 2340!

Etymology: *tannensis* (Latin) – from Tanna Island, Vanuatu (although the species is now considered to have been erroneously reported from Tanna, and to be endemic to New Zealand).

Epiphytic or terrestrial ferns. Aerial stems pendent or occasionally suberect, 50–830 mm long, 10–45 mm wide, unbranched or occasionally 1-forked, of indeterminate growth eventually terminated by small sterile leaf or sporophyll. Leaves narrowly ovate, narrowly oblong or narrowly elliptic, rarely ovate, elliptic or obovate, straight or slightly sigmoid or falcate, spirally arranged, shiny green on upper surface, dull green on lower surface, brittle; the longest 7–28 mm long, 2–8 mm wide, usually at or below mid-stem or sometimes just above; apices emarginate, truncate, cuspidate or rarely acuminate, with a mucro 1–3 mm long. Sporophylls throughout, except in the lowermost part. Synangia 3–8 mm long, 1–2.5 mm high; lobes equal, usually strongly conic; the lower surfaces of each lobe rising away from their subtending leaf; the conic apices projecting upwards at maturity.

Distribution: North Island: Northland, Auckland, Volcanic Plateau, Gisborne, Taranaki, Southern North Island.

South Island: Western Nelson, Sounds-Nelson, Westland, Canterbury, Otago, Southland, Fiordland.

Chatham Islands, Stewart Island, Auckland Islands.

Altitudinal range: 0–1075 m.

Tmesipteris tannensis occurs throughout most of the North Island, except for some of the east coast. It occurs from sea level up to 900 m in the Urewera Ranges and Mt Taranaki, 950 m on Te Aroha, and over 1050 m on Mt Tauhara and Hauhungatahi. In the South Island, it occurs from the Marlborough Sounds through Nelson and the west coast to Southland and the Otago coast. There are only very scattered records from Canterbury, and it is absent from Marlborough and much of the interior. It ranges from sea level, reaching 950 m in north-west Nelson, and extends south to the Auckland Islands.

Biostatus: Indigenous (Endemic).

Habitat: *Tmesipteris tannensis* usually grows epiphytically on tree fern trunks, but, unlike other species of the genus, it is also occasionally found terrestrially on banks, rocks, humus hummocks, mossy ground and peat mounds, or amongst matted roots and kauri litter. It is most commonly found on *Cyathea dealbata*, but also on *C. medullaris*, *C. smithii*, *Dicksonia squarrosa*, *D. fibrosa* and *D. lanata*. It has also been found on *Dacrydium cupressinum*, *Griselinia littoralis*, *Ixerba brexioides*, *Podocarpus totara*, *Weinmannia racemosa*, beech and *Metrosideros* trunks. It is sometimes found hanging from clumps of *Collospermum* and more frequently on rotting logs or dead stumps. It occurs in kauri, podocarp, broadleaved and beech forest.

On the subantarctic islands it has been recorded growing on the caudices of *Chionochloa antarctica* (CHR 323153) and under leatherwood scrub.

Recognition: This is the most widespread species in New Zealand, recognised by its brittle, spirally arranged leaves, usually with truncate or emarginate apices and long mucro tips. The synangia are biconic, with the apices pointing upwards. It is also the species most commonly found growing terrestrially.

Some plants in Westland and the far south of the South Island tend to have broader, ovate to elliptic leaves, compared to the narrower, more elongate leaves elsewhere. They resemble *T. obliqua* from south-east Australia, but further work is required to confirm their identity.

Cytology: n = 104 (Brownsey & Lovis 1987).

Notes: Chinnock (1976) indicated that the holotype of Sprengel's *Lycopodium tannense* had not been located, and was probably destroyed during World War II. Although Sprengel stated that it was collected on Tanna Island by the Forsters during Cook's second voyage, Chinnock provided cogent reasons why this could not have been the case. Instead, he suggested that it was actually collected at Dusky Sound in New Zealand, and that the plant later illustrated by Bernhardt (1801) when creating his new genus, *Tmesipteris*, represented the species now known as *T. tannensis*. Bernhardt's illustration was almost certainly based on a specimen from Sprengel's herbarium. It was considered to depict the type specimen of *Lycopodium tannense* and was selected by Chinnock as the neotype. However, Fosberg (1993) challenged Chinnock's choice, suggesting that a specimen in S, from the Swartz herbarium, might be from the Sprengel herbarium and that it should be used to lectotypify *Lycopodium tannense*. Unfortunately the original label has been lost, there is no indication that the specimen was collected by the Forsters, the identity of the specimen is uncertain, and there is no certainty that Sprengel saw it. Overturning Chinnock's neotypification on the basis of this specimen therefore seems hard to justify.

Plants from Banks Peninsula (CHR 142562 and 397940) are very unusual in having leaves with acuminate apices, and require further investigation (Perrie et al. 2010).

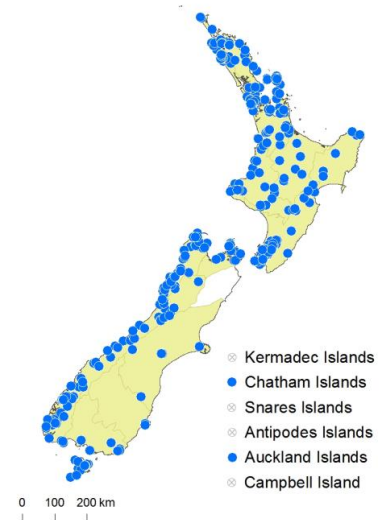


Fig. 26: *Tmesipteris tannensis* distribution map based on databased records at AK, CHR and WELT.



Fig. 27: *Tmesipteris tannensis*: aerial stem showing indeterminate growth with the apex terminated by a small leaf or sporophyll.



Fig. 28: *Tmesipteris tannensis*: aerial stem bearing narrowly-oblong leaves abruptly truncated to long mucros, and bifid sporophylls with elongated conic synangia, with the apices pointing upwards.



Fig. 29: *Tmesipteris tannensis*: aerial stem bearing bifid sporophylls with elongated conic synangia, with the apices pointing upwards.



Fig. 30: *Tmesipteris tannensis*: close up of sporophylls showing conic synangia, the apices projecting upwards, away from the subtending leaf margin.

References

- Allan, H.H. 1961: *Flora of New Zealand. Vol. I. Indigenous Tracheophyta: Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledones*. Government Printer, Wellington.
- Barber, H.N. 1954: New species of *Tmesipteris*. *Victoria Naturalist* 71: 97–98.
- Barber, H.N. 1957: Polyploidy in the Psilotales. *Proceedings of the Linnean Society of New South Wales* 82: 201–208.
- Bernhardi, J.J. 1801: Tentamen alterum filices in genera redigenda. *Journal für die Botanik (Schrader)* 1800(2): 121–136.
- Bierhorst, D.W. 1954: The gametangia and embryo of *Psilotum nudum*. *American Journal of Botany* 41: 274–281.
- Bierhorst, D.W. 1977: The systematic position of *Psilotum* and *Tmesipteris*. *Brittonia* 29: 3–13.
- Braithwaite, A.F. 1973: *Tmesipteris* in the Solomon Islands. *British Fern Gazette* 10: 293–302.
- Braithwaite, A.F. 1986: *Tmesipteris* in Vanuatu (New Hebrides). *Fern Gazette* 13: 87–96.
- Brownlie, G. 1969: Fasc. 3, Ptéridophytes. In: Aubréville, A. (ed.) *Flore de la Nouvelle Calédonie et Dépendances*. Muséum National d'Histoire Naturelle, Paris.
- Brownlie, G. 1977: The pteridophyte flora of Fiji. *Nova Hedwigia Beiheft* 55: 1–397.
- Brownsey, P.J.; Lovis, J.D. 1987: Chromosome numbers for the New Zealand species of *Psilotum* and *Tmesipteris*, and the phylogenetic relationships of the Psilotales. *New Zealand Journal of Botany* 25(3): 439–454.
- Brownsey, P.J.; Perrie, L.R. 2014: Taxonomic notes on the New Zealand flora: types in the fern family Psilotaceae. *New Zealand Journal of Botany* 52(2): 267–269.
- Chinnock, R.J. 1975: The New Zealand species of *Tmesipteris* (Psilotaceae). *New Zealand Journal of Botany* 13(4): 743–768.
- Chinnock, R.J. 1976: The identification, typification and origin of *Tmesipteris tannensis*. *Taxon* 25: 115–121.
- Chinnock, R.J. 1998: Psilotaceae. In: *Flora of Australia*. Vol. 48. 47–53.
- Colenso, W. 1888: On new indigenous cryptogams of the orders Lycopodiaceae, Musci and Hepaticae. *Transactions and Proceedings of the New Zealand Institute* 20: 234–254.
- Dangeard, P.A. 1891: Mémoire sur la morphologie et l'anatomie des *Tmesipteris*. *Le Botaniste Séries* 2: 163–222.
- de Lange, P.J.; Rolfe, J.R.; Champion, P.D.; Courtney, S.P.; Heenan, P.B.; Barkla, J.W.; Cameron, E.K.; Norton, D.A.; Hitchmough, R.A. 2013: *Conservation status of New Zealand indigenous vascular plants, 2012*. Department of Conservation, Wellington.
- Domin, K. 1915: Beiträge zur Flora und Pflanzengeographie Australiens. *Bibliotheca Botanica* 20 (85): 1–239.
- Fosberg, F.R. 1993: The Forster Pacific Islands collections from Captain Cook's Resolution voyage. *Allertonia* 7: 41–86.
- Gandoger, M. 1919: Sertum plantarum novarum. Pars secunda. *Bulletin de la Société Botanique de France* 66: 286–307.
- Griffith, J.W.; Henfrey, A. 1855: *The micrographic dictionary; a guide to the examination and investigation of the structure and nature of microscopic objects*. Van Voorst, London.
- Gruèzo, W.S. 2012: *Tmesipteris zamorae*: a new species of *Tmesipteris* Bernh. (Psilotaceae) from the Philippines. *Asia Life Sciences* 21: 653–670.
- Holloway, J.E. 1918: The prothallus and young plant of *Tmesipteris*. *Transactions and Proceedings of the New Zealand Institute* 50: 1–44.
- Holloway, J.E. 1921: Further studies on the prothallus, embryo, and young sporophyte of *Tmesipteris*. *Transactions and Proceedings of the New Zealand Institute* 53: 386–422.
- Holloway, J.E. 1939: The gametophyte, embryo, and young rhizome of *Psilotum triquetrum* Swartz. *Annals of Botany, London (new series)* 3: 313–336.
- Kaplan, D.R. 1977: Morphological status of the shoot systems of Psilotaceae. *Brittonia* 29: 30–53.
- Linnaeus, C. 1753: *Species Plantarum*. Impensis Laurentii Salvii, Stockholm.
- Müller, K. 1856: Monographische kritik der Lycopodiaceen-gattung *Psilotum* Sw. *Botanische Zeitung (Berlin)* 14: 233–243.
-

-
- Murdock, A.G.; Smith, A.R. 2003: Pteridophytes of Moorea, French Polynesia, with a new species *Tmesipteris gracilis* (Psilotaceae). *Pacific Science* 57: 253–265.
- Palisot de Beauvois, A.M.F.J. 1805: *Prodrome des cinquième et sixième familles de l'Aethéogamie. Les mousses. Les lycopodes*. Fournier, Paris.
- Perrie, L.R.; Brownsey, P.J.; Lovis, J.D. 2010: *Tmesipteris horomaka*, a new octoploid species from Banks Peninsula. *New Zealand Journal of Botany* 48: 15–29.
- Proctor, G.R. 1977: Pteridophyta. In: Howard, R.A. *Flora of the Lesser Antilles*. Arnold Arboretum, Harvard University, Jamaica Plain, Mass..
- Pryer, K.M.; Schneider, H.; Smith, A.R.; Cranfill, R.; Wolf, P.G.; Hunt, J.S.; Sipes, S.D. 2001: Horsetails and ferns are a monophyletic group and the closest living relatives to seed plants. *Nature* 409: 618–622.
- Pryer, K.M.; Schuettpelez, E.; Wolf, P.G.; Schneider, H.; Smith, A.R.; Cranfill, R. 2004: Phylogeny and evolution of ferns (monilophytes) with a focus on the early leptosporangiate divergences. *American Journal of Botany* 91: 1582–1598.
- Reed, C.F. 1966: Index Psilotales. *Boletim da Sociedade Broteriana* 40: 71–96.
- Sahni, B. 1925: On *Tmesipteris viillardii* Dangeard, an erect terrestrial species from New Caledonia. *Philosophical Transactions of the Royal Society of London, Series B* 213: 143–170.
- Sprengel, K.P.J. 1800: Bemerkungen über einige kryptogamische Pflanzen. *Journal für die Botanik (Schrader)* 1799(2): 265–273.
- Swartz, O.P. 1801: Genera et species filicum ordine systematico redactarum. *Journal für die Botanik (Schrader)* 1800(2): 1–120.
- Sykes, M.G. 1908: The anatomy and morphology of *Tmesipteris*. *Annals of Botany, London* 22: 63–89.
- Wagner, W.H. 1977: Systematic implications of the Psilotaceae. *Brittonia* 29: 54–63.
- Young, M. 2009: Botany of some of the islands in the eastern Bay of Islands, Northern New Zealand: an update. *Auckland Botanical Society Journal* 64: 88–97.

Acknowledgements

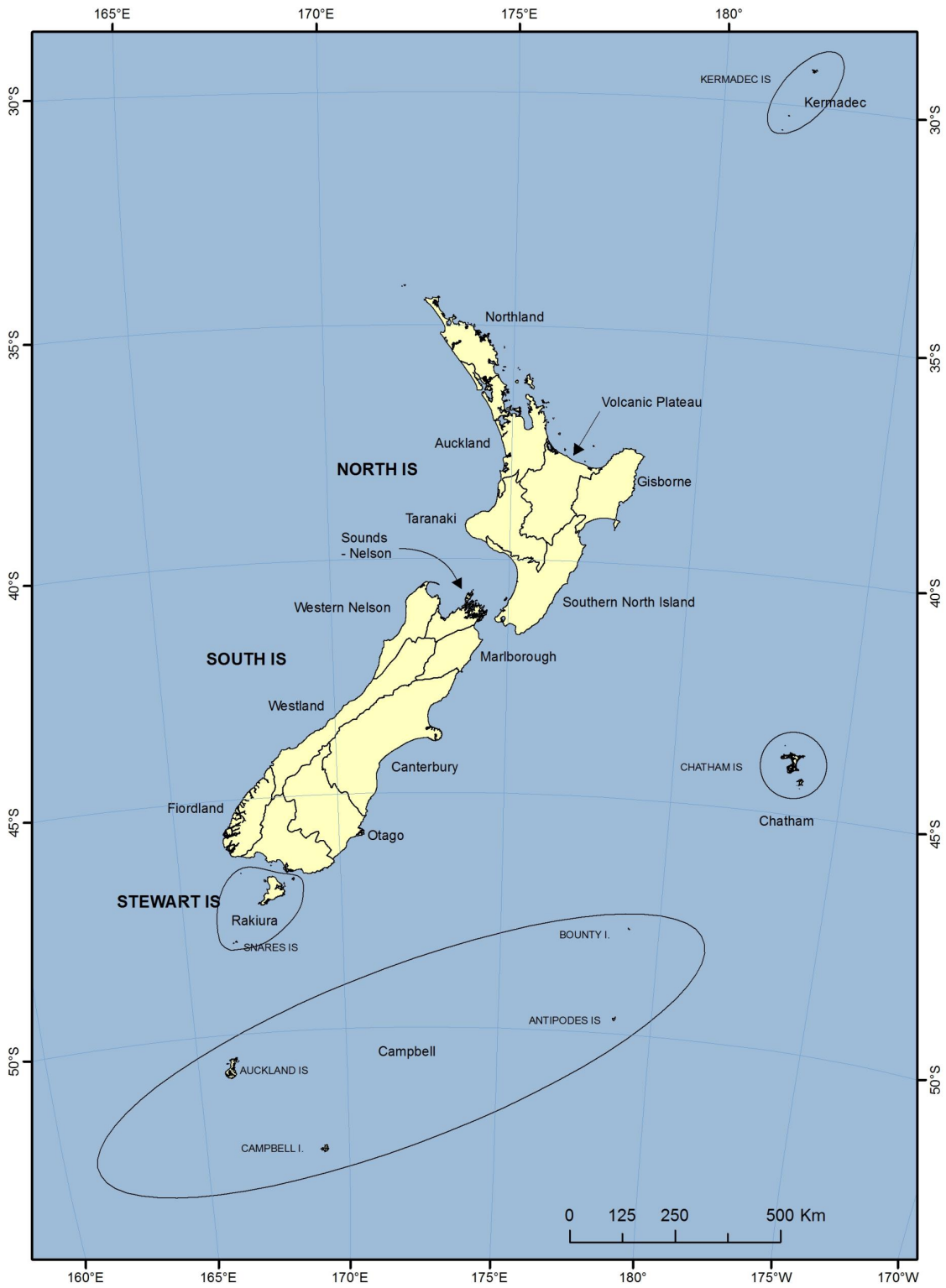
We thank the staff at AK, CHR and WELT for loans of specimens and for databasing and providing spreadsheets of collection data. We are grateful to staff at CHR for the preparation of maps and for assistance in editing and formatting the text, and to Barbara Parris for reviewing the manuscript.

P.J. Brownsey and L.R. Perrie

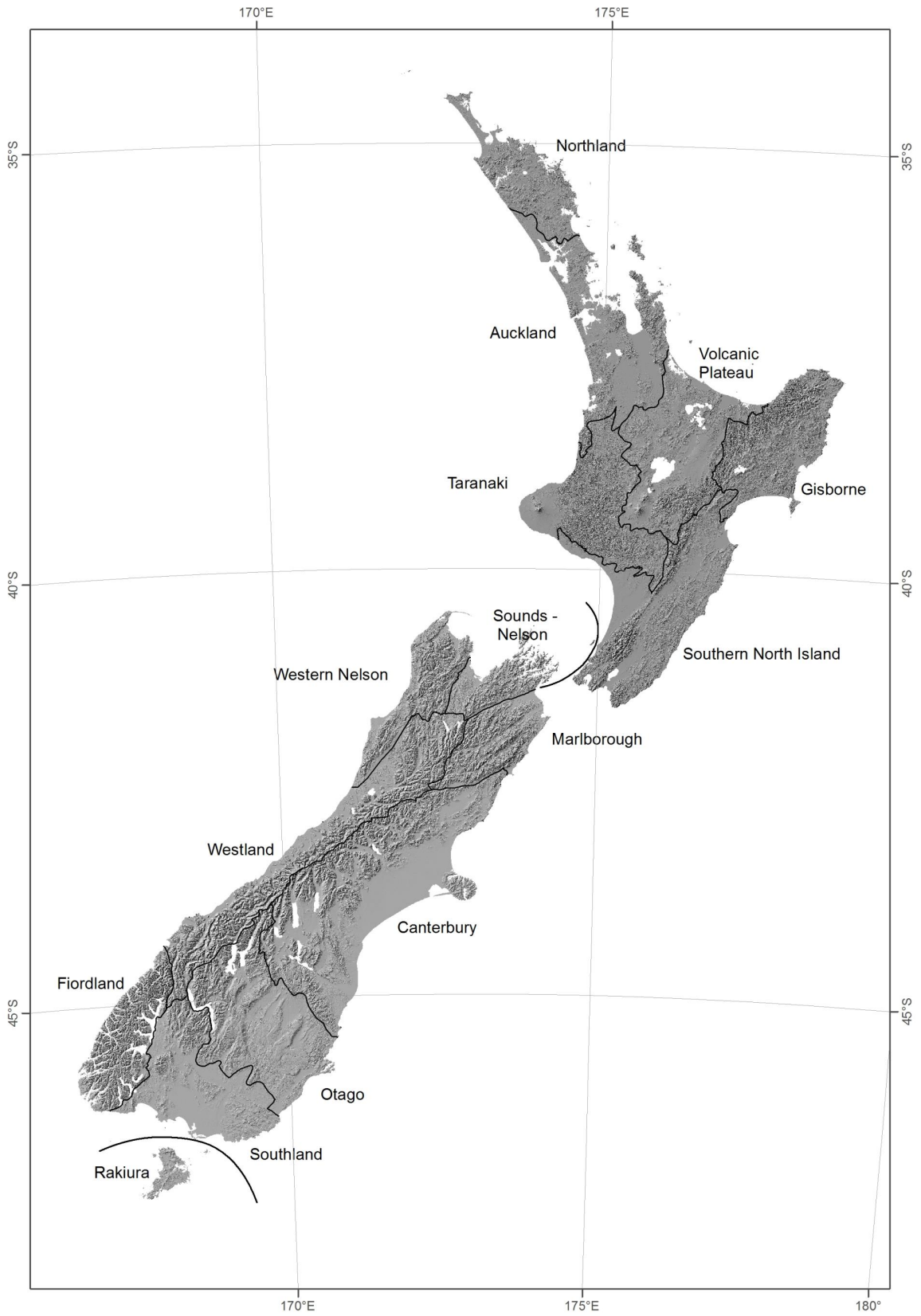
Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington 6140, New Zealand

PatB@tepapa.govt.nz

LeonP@tepapa.govt.nz



Map 1: Map of New Zealand and offshore islands showing Ecological Provinces



Map 2: Map of New Zealand showing Ecological Provinces

Index

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

- Bernhardia* Willd. ex Bernh. 2
Bernhardia novae-hollandiae Müll.Berol. 3
Bernhardia tannensis (Spreng.) Müll.Berol. 13
Lycopodium nudum L. 3
Lycopodium tannense Spreng. 13
Psilotaceae J.W.Griff. & Henfr. 1, 2
Psilotum Sw. 1, 2, 2, 5
Psilotum heterocarpum Colenso 3
Psilotum novae-zelandiae Gand. 3
Psilotum nudum (L.) P.Beauv. 1, 3
Psilotum triquetrum Sw. 3
Tmesipteris Bernh. 1, 2, 4, 4, 6, 14
Tmesipteris elongata P.A.Dang. 4, 5, 8
Tmesipteris elongata subsp. *robusta* Chinnock
5
Tmesipteris fowerakeri H.N.Barber 13
Tmesipteris horomaka Perrie, Brownsey &
Lovis 4, 8
Tmesipteris lanceolata P.A.Dang. 10
Tmesipteris lanceolata M.Sykes 5
Tmesipteris sigmatifolia Chinnock 4, 11
Tmesipteris tannensis (Spreng.) Bernh. 4, 8, 13
Tmesipteris tannensis var. *elongata* (P.A.Dang.)
Domin 5
Tmesipteris tannensis var. *elongata* Sahnii 11
Tmesipteris tannensis var. *lanceolata*
(P.A.Dang.) Domin 10
Tmesipteris tugana H.N.Barber 5

Image Information

Image	Creator	Copyright	License
Front cover	L.R. Perrie	© Leon Perrie 2009	CC-BY-NC 3.0 NZ
Fig. 1	K. Boardman	© Landcare Research 2014	CC-BY 3.0 NZ
Fig. 2	L.R. Perrie	© Te Papa 2006	CC-BY-NC 3.0 NZ
Fig. 3	L.R. Perrie	© Te Papa 2006	CC-BY-NC 3.0 NZ
Fig. 4	K. Boardman	© Landcare Research 2014	CC-BY 3.0 NZ
Fig. 5	L.R. Perrie	© Leon Perrie 2013	CC-BY-NC 3.0 NZ
Fig. 6	L.R. Perrie	© Te Papa 2011	CC-BY-NC 3.0 NZ
Fig. 7	L.R. Perrie	© Leon Perrie 2013	CC-BY-NC 3.0 NZ
Fig. 8	L.R. Perrie	© Leon Perrie 2004	CC-BY-NC 3.0 NZ
Fig. 9	L.R. Perrie	© Leon Perrie 2009	CC-BY-NC 3.0 NZ
Fig. 10	L.R. Perrie	© Leon Perrie 2013	CC-BY-NC 3.0 NZ
Fig. 11	K. Boardman	© Landcare Research 2014	CC-BY 3.0 NZ
Fig. 12	L.R. Perrie	© Te Papa 2007	CC-BY-NC 3.0 NZ
Fig. 13	L.R. Perrie	© Te Papa 2004	CC-BY-NC 3.0 NZ
Fig. 14	L.R. Perrie	© Te Papa 2007	CC-BY-NC 3.0 NZ
Fig. 15	L.R. Perrie	© Leon Perrie 2007	CC-BY-NC 3.0 NZ
Fig. 16	K. Boardman	© Landcare Research 2014	CC-BY 3.0 NZ
Fig. 17	L.R. Perrie	© Leon Perrie 2013	CC-BY-NC 3.0 NZ
Fig. 18	L.R. Perrie	© Leon Perrie 2013	CC-BY-NC 3.0 NZ
Fig. 19	L.R. Perrie	© Leon Perrie 2009	CC-BY-NC 3.0 NZ
Fig. 20	L.R. Perrie	© Leon Perrie 2013	CC-BY-NC 3.0 NZ
Fig. 21	K. Boardman	© Landcare Research 2014	CC-BY 3.0 NZ
Fig. 22	L.R. Perrie	© Leon Perrie 2011	CC-BY-NC 3.0 NZ
Fig. 23	L.R. Perrie	© Leon Perrie 2006	CC-BY-NC 3.0 NZ
Fig. 24	L.R. Perrie	© Leon Perrie 2005	CC-BY-NC 3.0 NZ
Fig. 25	L.R. Perrie	© Te Papa 2014	CC-BY-NC 3.0 NZ
Fig. 26	K. Boardman	© Landcare Research 2014	CC-BY 3.0 NZ
Fig. 27	L.R. Perrie	© Leon Perrie 2011	CC-BY-NC 3.0 NZ
Fig. 28	L.R. Perrie	© Leon Perrie 2013	CC-BY-NC 3.0 NZ
Fig. 29	L.R. Perrie	© Leon Perrie 2009	CC-BY-NC 3.0 NZ
Fig. 30	L.R. Perrie	© Leon Perrie 2009	CC-BY-NC 3.0 NZ
Map 1	A.D. Wilton	© Landcare Research 2014	CC-BY 3.0 NZ
Map 2	A.D. Wilton	© Landcare Research 2014	CC-BY 3.0 NZ

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.

Fern and Lycophyte Set (ISBN 978-0-478-34761-6)

The Fern and Lycophyte Set includes ferns and lycophytes indigenous to New Zealand, together with exotic species that have established in the wild. Species that are found only in cultivation are excluded.

Editor-in-Chief: Ilse Breitwieser

Series Editors: Ilse Breitwieser (Principal), Peter Heenan, Aaron Wilton

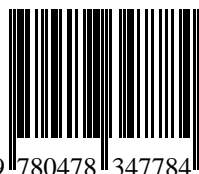
Steering committee: Ilse Breitwieser, Pat Brownsey, Peter Heenan, Wendy Nelson, Aaron Wilton

Technical production: Aaron Wilton with Kate Boardman, Bavo de Pauw, Sue Gibb, Ines Schönberger, Katarina Tawiri, Margaret Watts

Copy Editor: Christine Bezar



ISBN 978-0-478-34778-4



9 780478 347784