

FLORA OF NEW ZEALAND

FERNS AND LYCOPHYTES

POLYPODIACEAE



P.J. BROWNSEY, B.S. PARRIS & L.R. PERRIE

Fascicle 1 – DECEMBER 2021

Edition 2

© Landcare Research New Zealand Limited 2021.

Unless indicated otherwise for specific items, this copyright work is licensed under the Creative Commons Attribution 4.0 International licence



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

Attribution if making an adaptation or derivative work: "Sourced from Manaaki Whenua – 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 1, Polypodiaceae / P.J. Brownsey, B.S. Parris, L.R. Perrie. Rev. ed. -- Lincoln, N.Z. : Manaaki Whenua Press, 2021.

1 online resource

ISBN 978-0-947525-80-4 (pdf)

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

1.Ferns -- New Zealand – Identification. I. Parris, B.S. (Barbara Sydney). II. Perrie, L.R. (Leon Richard). III. Title. IV. Manaaki Whenua-Landcare Research New Zealand Ltd.

UDC 582.394.742(931)

DC 587.30993

DOI: 10.7931/n3cj-fs73

This work should be cited as:

Brownsey, P.J.; Parris, B.S.; Perrie, L.R. 2021: Polypodiaceae. *In*: Breitwieser, I. (ed.) *Flora of New Zealand — Ferns and Lycophytes*. Fascicle 1. Manaaki Whenua Press, Lincoln.
<http://dx.doi.org/10.7931/n3cj-fs73>

Date submitted: 19 Jul 2021; Date accepted: 29 Sep 2021; Date published: 8 December 2021

Cover image: *Lecanopteris pustulata*. Adaxial surfaces of pinnatifid fertile fronds growing on a tree fern trunk.

Contents

Introduction.....	1
Taxa	
<i>Polypodiaceae</i> J.Presl & C.Presl	2
<i>Lecanopteris</i> Reinw.	4
<i>Lecanopteris novae-zealandiae</i> (Baker) Perrie & Brownsey	5
<i>Lecanopteris pustulata</i> (G.Forst.) Perrie & Brownsey	7
<i>Lecanopteris pustulata</i> (G.Forst.) Perrie & Brownsey subsp. <i>pustulata</i>	8
<i>Lecanopteris scandens</i> (G.Forst.) Perrie & Brownsey	11
<i>Loxogramme</i> (Blume) C.Presl	13
<i>Loxogramme dictyopteris</i> (Mett.) Copel.	14
<i>Niphidium</i> J.Sm.	17
<i>Niphidium crassifolium</i> (L.) Lellinger	17
<i>Notogrammitis</i> Parris	18
<i>Notogrammitis angustifolia</i> (Jacq.) Parris	20
<i>Notogrammitis billardierei</i> (Willd.) Parris	22
<i>Notogrammitis ciliata</i> (Colenso) Parris	25
<i>Notogrammitis crassior</i> (Kirk) Parris	28
<i>Notogrammitis givenii</i> (Parris) Parris	31
<i>Notogrammitis gunnii</i> (Parris) Parris	33
<i>Notogrammitis heterophylla</i> (Labill.) Parris	35
<i>Notogrammitis patagonica</i> (C.Chr.) Parris	38
<i>Notogrammitis pseudociliata</i> (Parris) Parris	41
<i>Notogrammitis rawlingsii</i> (Parris) Parris	43
<i>Notogrammitis rigida</i> (Homb. & Br.) Parris	44
<i>Phlebodium</i> (R.Br.) J.Sm.	46
<i>Phlebodium aureum</i> (L.) J.Sm.	46
<i>Platycerium</i> Desv.	48
<i>Platycerium bifurcatum</i> (Cav.) C.Chr.	48
<i>Polypodium</i> L.	49
<i>Polypodium vulgare</i> L.	50
<i>Pyrrrosia</i> Mirb.	53
<i>Pyrrrosia elaeagnifolia</i> (Bory) Hovenkamp	53
<i>Pyrrrosia serpens</i> (G.Forst.) Ching	56
References	58
Acknowledgements	63
Maps	64
Index	66
Image Information	68

Introduction

The family Polypodiaceae is represented in New Zealand by four indigenous genera (*Lecanopteris*, *Loxogramme*, *Notogrammitis*, and *Pyrrosia*) with 17 species, one naturalised genus (*Polypodium*) with a single species, and three casual genera (*Niphidium*, *Phlebodium* and *Platycterium*) with one species each. Among the indigenous genera, *Notogrammitis* is easily the largest with 11 species. Of these, *N. angustifolia*, *N. billardierei*, *N. ciliata*, *N. heterophylla* and *N. pseudociliata* are fairly widespread in lowland to montane areas of both main islands. *N. rawlingsii* is confined to kauri forest in Auckland and Northland, while *N. rigida* is confined to coastal habitats in the far south and subantarctic. By contrast, *N. crassior*, *N. givenii*, *N. gunnii* and *N. patagonica* are montane to alpine species found most commonly in the South Island. *Pyrrosia* includes two species, of which *P. elaeagnifolia* is widespread throughout New Zealand, but *P. serpens* is so far only known from a single collection in the Kermadec Islands. *Lecanopteris* has three species, previously included in either *Microsorium* or in *Dendroconche* and *Zealandia*, of which *L. pustulata* is widespread, *L. scandens* occurs in the North Island and northern half of the South Island, and *L. novae-zealandiae* is confined to the North Island. The sole representative of *Loxogramme*, *L. dictyopteris*, occurs throughout the North Island and northern half of the South Island.

Polypodium vulgare is the most common of the naturalised species. It was first observed on the Port Hills, Christchurch, but has now spread aggressively to Banks Peninsula, northern Canterbury and the southern North Island. *Platycterium bifurcatum*, *Phlebodium aureum* and *Niphidium crassifolium* are known only from a few localities in northern New Zealand.

Species of Polypodiaceae in New Zealand often have long-creeping rhizomes, entire to pinnate laminae, reticulate venation, and sporangia that are either arranged in round to ovate and sometimes bulging sori, or are scattered over much of the lamina surface. In *Notogrammitis* the spores are characteristically green.

***Polypodiaceae* J.Presl & C.Presl, *Delic. Prag.* 159 (1822)**

Type taxon: *Polypodium* L.

Epiphytic, rupestral or terrestrial ferns. Rhizomes short- to long-creeping or erect, terete or occasionally dorsiventrally flattened, rarely with cavities, occasionally pruinose, scaly. Roots usually of one type, rarely of two types with one laterally inserted and clasping, the other ventrally inserted and attached to soil. Fronds monomorphic to trimorphic, articulated or not articulated to rhizome. Laminae usually undivided, lobed or 1-pinnate, rarely 2–3-pinnate. Veins free or reticulate; areoles usually with free included veinlets, rarely without; hydathodes present or absent. Sori round or elliptic or slightly elongate, superficial and not bulging on upper surface, or superficial and bulging due to thickening above the receptacle, or impressed into the lamina and bulging on upper surface, arranged in one or more rows either side of the costa, or sporangia scattered over the lamina surface; paraphyses often present; exindusiate. Sporangia with vertical annulus, usually 64 or rarely 8–32 spores per sporangium. Homosporous; spores monolete or rarely trilete, almost smooth to tuberculate or echinate, chlorophyllous or lacking chlorophyll.

Taxonomy: A family of six subfamilies, 65 genera and about 1650 species (PPG 1 2016).

Although previous classifications treated Grammitidaceae and Polypodiaceae as separate families (Parris 1990; HENNIPMAN et al. 1990), SMITH et al. (2006) combined them into one monophyletic family based on phylogenetic analyses of chloroplast DNA sequences that showed the grammitids to be nested within Polypodiaceae (SCHNEIDER et al. 2004). Grammitids are now treated as the subfamily Grammitidoideae within Polypodiaceae (PPG 1 2016). In New Zealand they were retained as separate families by ALLAN (1961) and BROWNSEY & SMITH-DODSWORTH (2000).

The family name Polypodiaceae was attributed to Berchtold & Presl (1820) by Pichi Sermolli (1970). Berchtold & Presl treated Polypodiaceae at the rank of “řad” (order), but Pichi Sermolli argued that this should be regarded as equivalent to the modern family. However, a change to the rules of botanical nomenclature at Vienna (Art. 18.2, Note 1, Ex. 4) specifically states that “names published at the rank of order (“řad”) by Berchtold & Presl (1820) are not to be treated as having been published at the rank of family, since the term family (“čeled”) was sometimes used to denote a rank below the rank of order”. The name Polypodiaceae was attributed to Presl & Presl by Smith et al. (2006).

Six subfamilies are recognised within Polypodiaceae (PPG 1 2016): Loxogrammoideae, Platycerioideae, Drynarioideae, Microsoroideae, Polypodioideae and Grammitidoideae. In New Zealand, *Loxogramme* is placed in Loxogrammoideae, *Pyrrhosia* and the naturalised *Platycerium* in Platycerioideae, *Lecanopteris* in Microsoroideae, and *Notogrammitis* in Grammitidoideae. Polypodioideae is represented only by introduced species of *Niphidium*, *Phlebodium* and *Polypodium*, and Drynarioideae does not occur outside cultivation in New Zealand.

Generic boundaries have been problematic worldwide in both Grammitidoideae and Microsoroideae. In New Zealand only one genus, *Notogrammitis*, is now recognised in Grammitidoideae (Perrie & Parris 2012), but resolving the taxonomy of Microsoroideae has been much more difficult. Historically in New Zealand two principal generic names have been used: *Microsorium* Link and *Phymatosorus* Pic.Serm. The former is often incorrectly spelled *Microsorium*, but that is an orthographic variant of the original name and should not be used (Bosman 1986). The latter is a replacement name for the earlier *Phymatodes* C.Presl, which is illegitimate (Pichi Sermolli 1973).

Copeland (1947) reluctantly included both groups within *Microsorium* even though he felt the types of these genera were “too unlike to be included in any natural genus”. Nevertheless, he was unable to find any way to satisfactorily separate them. Bosman (1991) proposed a more restricted circumscription of *Microsorium*, distinguishing it from the other microsoroid genera, *Colysis*, *Leptochilus*, *Neocheiropteris* and *Phymatosorus*. In particular, *Phymatosorus* was distinguished from *Microsorium* by having more than five pairs of lamina lobes, anadromous rather than catadromous tertiary veins, a different arrangement of the sori on the veins, and sori sometimes sunk in the lamina. Following Bosman’s revision, the name *Phymatosorus* was quite widely adopted for the three species present in New Zealand. However, some of the diagnostic characters of *Phymatosorus* were questioned in a later treatment of the microsoroid ferns by Nooteboom (1997), who reverted to a broader interpretation of *Microsorium*.

Molecular evidence subsequently indicated that *Microsorium* was polyphyletic (Schneider et al. 2006). Moreover, *M. punctatum* and *M. scolopendria*, the types of *Microsorium* and *Phymatosorus*, respectively, occurred in the same core microsoroid clade, whereas the three New Zealand taxa belonged in a separate clade, along with species of *Lecanopteris*. Schneider et al. (2006) concluded that although the former group might be treated as *Microsorium sens. str.*, the latter group had no satisfactory name available.

More detailed analysis by Testo et al. (2019) demonstrated three main clades within Microsoroideae. The first comprised *Lepisorus* and a number of smaller genera, the second included *Microsorium sens. strict.* and *Leptochilus*, and the third was made up of *Lecanopteris* and a number of smaller clades that included the New Zealand taxa. They recognised *Lecanopteris*, *Bosmania*, *Dendroconche* and *Zealandia*, the latter two genera encompassing the three New Zealand species.

Subsequent analysis by Chen et al. (2020) confirmed the presence of four clades in the Lecanopterid ferns, but they were less certain about the most appropriate taxonomic interpretation. While they considered *Bosmania* to be clearly distinct, they suggested three options for the remaining taxa: recognise *Lecanopteris*, *Dendroconche* and *Zealandia* as separate genera; recognise *Zealandia* alongside *Lecanopteris* plus *Dendroconche*; or extend *Lecanopteris* to include both *Dendroconche* and *Zealandia*. All three options offered monophyletic groupings, but on morphological grounds Chen et al. (2020) preferred the recognition of three separate genera.

The Microsoroideae and relatives are beset by morphological homoplasy. After emphasising different morphological characters, Perrie et al. (2021) suggested recognition of an expanded *Lecanopteris*, including *Dendroconche* and *Zealandia*. Among the benefits of this classification, particularly for general users, was that groups of species that had traditionally been placed in a single genus were not distributed across different genera; notably *L. pustulata* and *L. scandens*, which are widespread and common in New Zealand and eastern Australia. An expanded *Lecanopteris* is accepted here to include the latter two species, and *L. novae-zealandiae*.

- 1 Fronds strongly dimorphic with specialised sterile basal ('nest') fronds and fertile foliage fronds; lamina dichotomously lobed; sporangia scattered over apices of lamina segments..... *Platyserium*
Fronds monomorphic, or sometimes dimorphic, but specialised sterile basal ('nest') fronds absent; lamina entire or pinnately lobed; sporangia in discrete sori..... 2
- 2 Abaxial surface of laminae densely covered in stellate hairs; laminae entire *Pyrrosia*
Abaxial surface of laminae almost glabrous, or, if hairy, lacking stellate hairs; laminae entire to 2-pinnatifid..... 3
- 3 Fronds hairy or glabrous; veins free; spores chlorophyllous, green..... *Notogrammitis*
Fronds lacking hairs; veins anastomosing; spores lacking chlorophyll, brown, yellow or whitish..... 4
- 4 Laminae entire; sori in many rows either side of midrib..... *Niphidium*
Laminae entire to 1-pinnate; sori in 1–2 rows either side of midrib..... 5
- 5 Rhizomes erect, with proliferous roots; veins obscure; areoles of reticulate veins lacking free included veinlets..... *Loxogramme*
Rhizomes long-creeping, lacking proliferous roots; veins prominent; areoles of reticulate veins with free included veinlets..... 6
- 6 Hydathodes present on adaxial lamina surface..... *Lecanopteris*
Hydathodes absent..... 7
- 7 Laminae deeply pinnatifid but not completely divided to rachis; lamina lobes entire; sori served by two veinlets in each areole..... *Phlebodium*
Laminae pinnate, divided completely to rachis in at least the basal third; lamina lobes minutely serrate; sori served by one veinlet in each areole..... *Polypodium*

Distribution: A family found throughout the world but with the greatest diversity in the tropics and subtropics, with a smaller number extending into temperate regions. Four indigenous non-endemic genera with 17 species in New Zealand, and four naturalised genera, each with a single species; seven endemic species, 10 indigenous, one naturalised and three casual.

Biostatus: Indigenous (Non-endemic).

Table 1: Number of species in New Zealand within *Polypodiaceae* J.Presl & C.Presl

Category	Number
Indigenous (Endemic)	7
Indigenous (Non-endemic)	10
Exotic: Fully Naturalised	1
Exotic: Casual	3
Total	21

Recognition: The family Polypodiaceae includes ferns that have entire, pinnately divided, or rarely dichotomously divided laminae, and round or elongated sori lacking indusia. Subfamily Grammitidoideae is the most species-rich clade comprising generally small species with erect or short-creeping rhizomes, hairy or glabrous fronds, free venation, and chlorophyllous spores. Species of the other subfamilies are often larger and more conspicuous, with long-creeping rhizomes, glabrous fronds, net veins, and spores that lack chlorophyll.

***Lecanopteris* Reinw., *Flora* 8(3): 48 (1825)**

= *Dendroconche* Copel., *Philipp. J. Sci.*, C 6: 91 (1911)

= *Zealandia* Testo & A.R.Field, *Syst. Bot.* 44: 749 (2019)

Type taxon: *Lecanopteris carnososa* (Reinw.) Blume

Etymology: From the Greek *lekane* (a basin), and *pteris* (a fern), a reference to the sori in concave lobes in some species.

Epiphytic, rupestral or terrestrial ferns. Rhizomes long-creeping (NZ) or short-creeping (not NZ), terete or occasionally dorsiventrally flattened, cavities lacking (NZ) or with hollow spaces inside or below, often associated with ants (not NZ), lacking sclerenchyma strands, pruinose or not, scaly (NZ) or without scales, or nearly so and spiny (not NZ), glandular hairs absent (NZ) or rarely present (not NZ). Rhizome scales peltate, clathrate, narrowly ovate to orbicular, squarrose or appressed. Fronds monomorphic or dimorphic, articulated to short stalks (phyllopodia) at intervals along the rhizome. Laminae undivided, variously lobed or deeply 1-pinnatifid, or rarely 2-pinnatifid, herbaceous to coriaceous, virtually glabrous. Veins reticulate, in type 5a or 5b pattern (Nooteboom 1997), usually forming 1–3 series of areoles between costa and lobe margin, lacking main lateral veins that extend in a ± continuous straight line from costa to near the margin; largest areoles adjacent to costa, with free included veinlets, ending in hydathodes. Sori round or slightly elongate (NZ) or rarely the sporangia acrostichoid (not NZ), superficial or impressed into the lamina and bulging on adaxial surface, arranged in one row either side of costa (NZ) or in more than one row, or scattered over the lamina surface, or deeply immersed in marginal semi-circular projections (not NZ), not confluent with age, occurring throughout the lamina; paraphyses absent (NZ) or sometimes present as simple uniseriate hairs (not NZ); exindusiate. Spores monolete, bilaterally symmetrical, finely rugulate to tuberculate, rarely with twisted strands around the spore (not NZ).

Taxonomy: A genus of 24 species (Perrie et al. 2021).

As outlined under the family treatment, an expanded *Lecanopteris* is recognised here to include species previously treated in *Lecanopteris sens. str.*, *Dendroconche* and *Zealandia* (Perrie et al. 2021).

- 1 Rhizomes usually <4 mm diameter; laminae dull green, herbaceous, exuding musky aroma when fresh, alate for 10–150 mm below lowest pinna lobe..... *scandens*

Rhizomes usually >4 mm diameter; laminae bright green, coriaceous, lacking musky aroma when fresh, alate for 5–40 mm below lowest pinna lobe..... 2
- 2 Rhizome scales appressed, blackish-brown; laminae highly dimorphic, from undivided to deeply 1-pinnatifid; hydathodes prominent on upper surface..... *pustulata*

Rhizome scales squarrose, orange-brown; laminae usually monomorphic, deeply 1-pinnatifid; hydathodes inconspicuous on upper surface....

..... *novae-zealandiae*

Distribution: Most species of *Lecanopteris* occur in tropical Malesia (peninsular Malaysia, Singapore, Borneo, Philippines, Indonesia, Papua New Guinea) but a few extend into south temperate regions;

five in Australia and three in New Caledonia. One species endemic and two indigenous to New Zealand.

Biostatus: Indigenous (Non-endemic).

Table 2: Number of species in New Zealand within *Lecanopteris* Reinw.

Category	Number
Indigenous (Endemic)	1
Indigenous (Non-endemic)	2
Total	3

Cytology: n = 36, 37 (Hennipman et al. 1990).

***Lecanopteris novae-zealandiae* (Baker) Perrie & Brownsey in Perrie et al., *Blumea* 66: 246 (2021)**

≡ *Polypodium novae-zealandiae* Baker in Hooker, *Hooker's Icon. Pl.* 17, t: 1674 (1886)

≡ *Microsorium novae-zealandiae* (Baker) Copel., *Gen. Fil.* 196 (1947) – as *Microsorium*

≡ *Phymatodes novae-zealandiae* (Baker) Pic.Serm., *Webbia* 8: 222 (1951) nom. illeg.

≡ *Phymatosorus novae-zealandiae* (Baker) Pic.Serm., *Webbia* 28: 459 (1973)

≡ *Zealandia novae-zealandiae* (Baker) Testo & A.R.Field in Testo et al., *Syst. Bot.* 44: 749 (2019)

Lectotype (selected by Allan 1961 as first step lectotypification; second step lectotype selected by Brownsey & Perrie 2012): Pirongia Mt, Upper Waikato district, N[ew] Zealand, T.F. Cheeseman 361, 'rec'd 5/77', K 000959805!

Etymology: *novae-zealandiae* (Latin) – from New Zealand

Epiphytic or occasionally terrestrial; creeping or climbing ferns. Rhizomes long-creeping, 4–10 mm diameter, scaly. Rhizome scales clathrate, ovate, 5–15 mm long, 1.5–2.5 mm wide, squarrose, orange-brown, virtually entire. Roots of one type, lacking laterally inserted and clasping roots. Fronds 150–900 mm long. Stipes 40–330 mm long, pale brown, glabrous except for very scattered scales at base. Laminae deeply 1-pinnatifid to almost pinnate at base, ovate to elliptic, 100–470 mm long, 60–270 mm wide, alate for 5–20 mm below the lowest lobe, bright green, coriaceous, glabrous. Lamina lobes in 1–25 pairs, 45–180 mm long, 5–15 mm wide, straight or slightly falcate, acuminate, margins entire or wavy, widest at or below middle. Veins reticulate, forming 1–2 series of areoles between costa and lobe margin; hydathodes present but inconspicuous on adaxial surface of lamina. Sori round or slightly elongate, 2–4 mm long, superficial or impressed into lamina forming low bulges on adaxial surface, in 1 row on either side of the costa, closer to the margin; paraphyses absent; exindusiate.

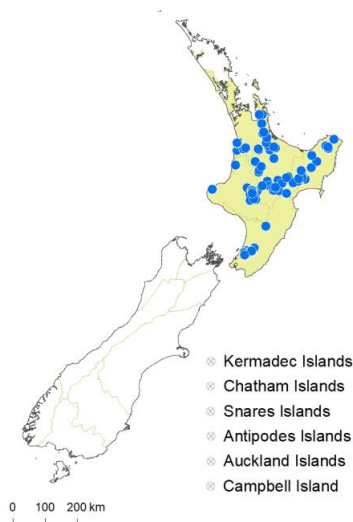


Fig. 1: *Lecanopteris novae-zealandiae* distribution map based on databased records at AK, CHR & WELT.

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

Altitudinal range: 340–1300 m.

Lecanopteris novae-zealandiae is confined to montane forests of the North Island from Coromandel to the southern Tararua Range, occurring from 340 m in the Coromandel Ranges to 1300 m on Maungapōhatu in the Urewera. South of the Volcanic Plateau the species is known only from the southern Tararua Range and from one collection in the Ruahine Range (WELT P022827).

Biostatus: Indigenous (Endemic).

Habitat: *Lecanopteris novae-zealandiae* is usually epiphytic, or occasionally found on fallen logs, in damp montane forests of the North Island. It is found in a range of podocarp, beech and broadleaved forest.

Recognition: *Lecanopteris novae-zealandiae* can be confused with *L. pustulata*, especially when young. However, it is generally a larger plant, rarely if ever produces undivided fronds, and has very distinctive spreading, orange-brown rhizome scales. Hydathodes on the adaxial lamina surface are present but inconspicuous. The thicker rhizomes (>4 mm diameter), distinctive rhizome scales, coriaceous lamina and bright green colour distinguish it from *Lecanopteris scandens*.

Cytology: n = 37 (de Lange et al. 2004).



Fig. 2: *Lecanopteris novae-zealandiae*. Pinnatifid fertile frond growing on a tree trunk.



Fig. 3: *Lecanopteris novae-zealandiae*. Pinnatifid fertile frond growing on a tree trunk.



Fig. 4: *Lecanopteris novae-zealandiae*. Pinnatifid fertile frond with sori bulging on the adaxial surface.



Fig. 5: *Lecanopteris novae-zealandiae*. Pinnatifid fertile fronds growing on a tree trunk.



Fig. 6: *Lecanopteris novae-zealandiae*. Pinnatifid fertile frond growing on a tree trunk.



Fig. 7: *Lecanopteris novae-zealandiae*. Long-creeeping rhizome bearing squarrose, orange-brown scales.



Fig. 8: *Lecanopteris novae-zealandiae*. Long-creeping rhizome bearing squarrose, orange-brown scales.



Fig. 9: *Lecanopteris novae-zealandiae*. Abaxial surface of fertile frond showing round to ovate, exindusiate sori, closer to margin than costa.

***Lecanopteris pustulata* (G.Forst.) Perrie & Brownsey in Perrie et al., *Blumea* 66: 247 (2021)**

- ≡ *Polypodium pustulatum* G.Forst., *Fl. Ins. Austr.* 81 (1786)
- ≡ *Microsorium pustulatum* (G.Forst.) Copel., *Gen. Fil.* 196 (1947) – as *Microsorium*
- ≡ *Phymatosorus pustulatus* (G.Forst.) Large, Braggins & P.S.Green, *New Zealand J. Bot.* 30: 372 (1992) – as *Phymatosorus pustulatum*
- ≡ *Zealandia pustulata* (G.Forst.) Testo & A.R.Field, *Syst. Bot.* 44: 750 (2019)
Lectotype selected by Pichi Sermolli 1951: New Zealand, *G. Forster*, BM 000066256!
- = *Polypodium scandens* Labill., *Nov. Holl. Pl.* 2, 91, t.240 (1807) nom. illeg., non *Polypodium scandens* G.Forst. 1786
- ≡ *Polypodium diversifolium* Willd., *Sp. Pl.* 5(1), 166 (1810) nom. nov. pro *Polypodium scandens* Labill. 1807 (non *Polypodium scandens* G.Forst. 1786)
- ≡ *Microsorium diversifolium* (Willd.) Copel., *Univ. Calif. Publ. Bot.* 16: 114 (1929) – as *Microsorium diversifolium*
- ≡ *Pleopeltis diversifolia* (Willd.) Melvaine, *Proc. Linn. Soc. New South Wales* 61: 120 (1936)
- ≡ *Phymatodes diversifolium* (Willd.) Pic.Serm., *Webbia* 8: 222 (1951) nom. illeg.
- ≡ *Phymatosorus diversifolius* (Willd.) Pic.Serm., *Webbia* 28: 459 (1973)
Lectotype (selected by Pichi Sermolli 1951 as first step lectotypification; second step lectotype selected by Brownsey & Perrie 2012): Nova Hollandia [Tasmania], *J.J.H. de Labillardière*, FI 004209 (online)
- = *Polypodium billardierei* R.Br., *Prodr. Fl. Nov. Holland.* 147 (1810) – as *billardieri*
- ≡ *Phymatodes billardierei* (R.Br.) C.Presl, *Tent. Pterid.* 196 (1836) nom. illeg.
- ≡ *Chrysopteris billardierei* (R.Br.) Link, *Fil. Spec.* 123 (1841)
- ≡ *Drynaria billardierei* (R.Br.) J.Sm., *Companion Bot. Mag. New Ser.* 2: 14 (1846)
- ≡ *Pleopeltis billardierei* (R.Br.) T.Moore, *Index Fil.* lxxviii (1857)
- ≡ *Polypodium scandens* var. *billardierei* (R.Br.) F.Muell., *Veg. Chatham Isl.* 69 (1864)
Lectotype (selected by Tindale 1961): Port Dalrymple, [Tasmania], *R. Brown Iter Austral.* 11, Jan. 1804, BM 001038373!

Etymology: From the Latin *pustulatus* (having pustules), a reference to the impressed sori forming bulges on the adaxial lamina surface.

Vernacular names: hound's tongue; kōwaowao; pāraharaha

Biostatus: Indigenous (Non-endemic).

Lecanopteris pustulata (G.Forst.) Perrie & Brownsey in Perrie et al., *Blumea* 66: 247 (2021) subsp. *pustulata*

Vernacular names: hound's tongue; kōwaowao; pāraharaha

Epiphytic and terrestrial; creeping or climbing ferns. Rhizomes long-creeping, 3–11 mm diameter, scaly. Rhizome scales clathrate, ovate, 3–7 mm long, 1–2 mm wide, mostly appressed but with the tips sometimes squarrose, blackish-brown, entire. Roots of one type, lacking laterally inserted and clasping roots. Fronds 45–750 mm long. Stipes 10–350 mm long, pale to chocolate brown, glabrous or with very scattered scales. Laminae very varied, from undivided or variously lobed to deeply 1-pinnatifid; undivided laminae (fertile) narrowly elliptic, 35–220 mm long, 6–30 mm wide, or (sterile) longer and broader, up to 260 mm long and 70 mm wide; lobed or pinnatifid laminae (fertile) ovate to elliptic or broadly ovate to broadly elliptic, 50–425 mm long, 35–350 mm wide, or (sterile) up to 420 mm long and 300 mm wide; lamina alate for 5–40 mm below the lowest lobe, bright glossy green, coriaceous, glabrous or with scattered scales on the costae, especially on young fronds. Lamina lobes (fertile) in 1–15 pairs, 25–185 mm long, 4–30 mm wide, or (sterile) less numerous and wider, in up to 10 pairs and up to 60 mm wide; straight, acute to acuminate, margins entire or wavy, widest about the middle. Veins reticulate, forming 2–3 series of areoles between costa and margin; hydathodes conspicuous on adaxial surface of lamina. Sori round or rarely elliptic, 2.5–5 mm wide, impressed into lamina forming low bulges on adaxial surface, in 1 row either side of costa, medial or closer to the margin; paraphyses absent; exindusiate.

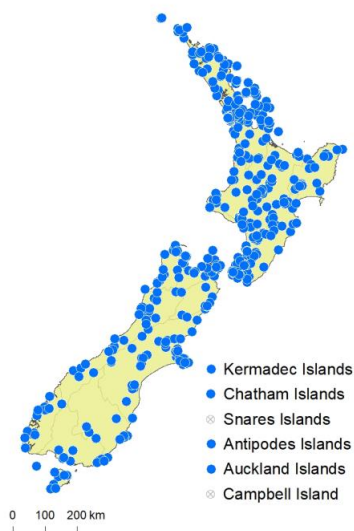


Fig. 10: *Lecanopteris pustulata* distribution map based on databased records at AK, CHR & WELT.

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

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

Kermadec Islands, Three Kings Islands, Chatham Islands, Solander Island, Stewart Island, Antipodes Islands, Auckland Islands.

Altitudinal range: 0–1050 m.

Lecanopteris pustulata is abundant throughout the North Island from near sea level, growing to over 1050 m on Mt Hauhungatahi near Erua, and in the north-west Ruahine Range. It is common in coastal and lowland regions of the South Island, extending locally to over 900 m at Jordan Stream Reserve, Marlborough, near Mt Cook, and in the Edith Valley, Fiordland, but it is largely absent from inland high country regions and much of Otago.

Also Australia (Queensland, NSW, ACT, Victoria, Tasmania), Norfolk Island.

Biostatus: Indigenous (Non-endemic).

Habitat: *Lecanopteris pustulata* is found creeping, and often covering extensive areas, on the ground, growing over rocks or fallen logs, on cliffs and banks, or epiphytic on native and naturalised trees. It occurs in coastal to montane forest, pine forest, scrub, scoria and open areas, usually in slightly drier habitats, extending into subalpine scrub in the southern South Island.

Recognition: This is the commonest and most variable of the three species of *Lecanopteris* in New Zealand. It can be distinguished by its thick rhizomes (>4 mm diameter) with appressed blackish-brown scales, its very variable fronds (Brownsey & Smith-Dodsworth 2000, fig. 63), coriaceous and bright glossy green laminae, conspicuous veins and hydathodes on the upper lamina surface, and broad lamina lobes.

Occasional aberrant forms are found, either crested at the apices or with 2-pinnatifid laminae.

Only one subspecies is present in New Zealand. *Lecanopteris pustulata* subsp. *howensis* (Tindale et P.S.Green) Perrie & Brownsey is recognised as endemic to Lord Howe Island (Bostock & Spokes 1998 – as *Microsorium*). It is distinguished by having rhizome scales that are abruptly acuminate and 1.5–3.3 mm wide, laminae that are usually divided to the rachis into adnate pinnae, and sori that are deeply sunken into the lamina and usually either submarginal or about one-third of the way to the costa.

Cytology: n = 37 (Brownlie 1954, as *Microsorium diversifolium*).

Notes: This species has been widely known as *Phymatosorus diversifolius* (e.g. Brownsey & Smith-Dodsworth 1989), *Microsorium diversifolium* (e.g. Crookes 1963) or *Phymatodes diversifolium* (e.g. Allan 1961), with these combinations being based on *Polypodium diversifolium* Willd. collected in Tasmania by Labillardière. An earlier basionym, *Polypodium pustulatum* G.Forst., was for many years considered a “*species dubia*” because of the inadequate type specimen lacking a rhizome, which could not be distinguished as either *diversifolium* or *novae-zealandiae* (Pichi Sermolli 1951). However, on the basis of spore morphology, Large et al. (1992b) showed conclusively that the specimen is the same as the former, and that Forster’s name, *P. pustulatum*, should take priority. The species was initially treated as *Microsorium pustulatum* by Large et al. (1992b), then as *Phymatosorus pustulatus* (Large et al. 1992a), and more recently as *Zealandia pustulata* (Testo et al. 2019).

Robert Brown’s *Polypodium billardierei*, and names based on his type from Port Dalrymple, are later synonyms. The name *Polypodium phymatodes* L. used by Richard (1832) is a misidentification.



Fig. 11: *Lecanopteris pustulata*. Adaxial surfaces of pinnatifid fertile fronds growing on a tree fern trunk.



Fig. 12: *Lecanopteris pustulata*. Abaxial surface of fertile frond showing round to ovate, exsudate sori, medial or closer to margin than costa.



Fig. 13: *Lecanopteris pustulata*. Entire to pinnatifid sterile fronds growing on the ground.



Fig. 14: *Lecanopteris pustulata*. Unusual form with 2-pinnatifid laminae.



Fig. 15: *Lecanopteris pustulata*. Adaxial surface of fertile frond showing glossy green surface with white hydathodes, prominent veins and bulging sori.



Fig. 16: *Lecanopteris pustulata*. Abaxial surface of entire fertile frond on long-creeping rhizome, with round, exindusiate sori.



Fig. 17: *Lecanopteris pustulata*. Long-creeping rhizome with scattered, appressed, blackish-brown scales.



Fig. 18: *Lecanopteris pustulata*. Branching rhizome with scattered, appressed scales, and stipules articulated to phyllopodia.



Fig. 19: *Lecanopteris pustulata*. Abaxial surface of fertile pinna showing reticulate venation.



Fig. 20: *Lecanopteris pustulata*. Abaxial surface of fertile frond showing round to ovate, exindusiate sori midway between margin and costa.

***Lecanopteris scandens* (G.Forst.) Perrie & Brownsey in Perrie et al., *Blumea* 66: 247 (2021)**

≡ *Polypodium scandens* G.Forst., *Fl. Ins. Austr.* 81 (1786)

≡ *Phymatodes scandens* (G.Forst.) C.Presl, *Tent. Pterid.* 196 (1836) nom. illeg.

≡ *Drynaria scandens* (G.Forst.) Fée, *Mém. Foug.*, 5. *Gen. Filic.* 271 (1852)

≡ *Microsorium scandens* (G.Forst.) Tindale, *Amer. Fern J.* 50: 241 (1960) – as *Microsorium*

≡ *Phymatosorus scandens* (G.Forst.) Pic.Serm., *Webbia* 28: 459 (1973)

≡ *Dendroconche scandens* (G.Forst.) Testo, Sundue, & A.R.Field, *Syst. Bot.* 44: 748 (2019)

Lectotype (selected by Pichi Sermolli 1951): *G. Forster*, BM 000066255!, labelled Society Islands but probably from New Zealand

Etymology: From the Latin *scandens* (climbing), referring to the habit.

Vernacular names: fragrant fern; mokimoki

Epiphytic and terrestrial; creeping or climbing fern. Rhizomes long-creeping, 2–4 mm diameter, wiry, scaly. Rhizome scales clathrate, narrowly triangular in the upper part but abruptly widened to a broadly ovate base, 3–6 mm long, 0.5–2 mm wide (at base), squarrose, blackish-brown, entire. Roots of two types, one laterally inserted and clasping, the other ventrally inserted and attached to soil. Fronds 45–620 mm long. Stipes 5–120 mm long, pale brown, glabrous or with scattered scales. Laminae very varied, from undivided or variously lobed to deeply 1-pinnatifid; undivided laminae narrowly ovate to narrowly elliptic or linear, 40–430 mm long, 3–25 mm wide; lobed or pinnatifid laminae narrowly ovate to narrowly elliptic or occasionally ovate to elliptic, 110–540 mm long, 25–190 mm wide; lamina alate for 10–160 mm below the lowest lobe, dull dark green, herbaceous, glabrous or with scattered scales along the costae. Lamina lobes in 1–20 pairs, 15–105 mm long, 3–11 mm wide, straight or slightly falcate, acuminate, margins entire or wavy, widest at base. Veins reticulate, forming 1–2 series of areoles between costa and lobe margin; hydathodes present but inconspicuous on adaxial surface of lamina. Sori round or slightly elongate, 1–3 mm long, superficial or impressed into lamina forming low bulges on adaxial surface, in 1 row close to lobe margin on either side of the costa; paraphyses absent; exindusiate.

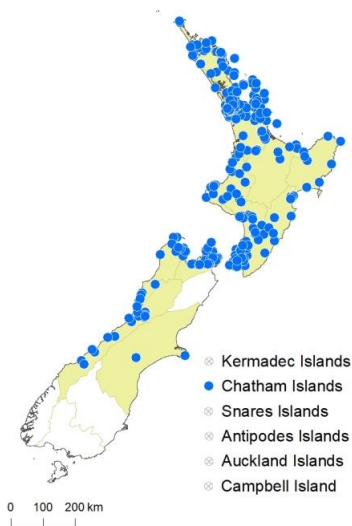


Fig. 21: *Lecanopteris scandens* distribution map based on databased records at AK, CHR & WELT.

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

South Island: Western Nelson, Sounds-Nelson, Westland, Canterbury.

Chatham Islands.

Altitudinal range: 0–800 m

Common from near sea level in coastal and lowland areas of the North Island, extending locally to 800 m in montane forest, but largely absent from high country areas in Taranaki, Volcanic Plateau and Gisborne. In the South Island, largely confined to coastal areas of the Marlborough Sounds, Nelson and Westland, extending locally to 500 m and as far south as Haast. Absent from most of the east coast except for outlying populations on Banks Peninsula and in Peel Forest.

Also Australia (Queensland, NSW, Victoria), Lord Howe Island.

Biostatus: Indigenous (Non-endemic).

Habitat: Creeping on the ground, over rocks or on banks, climbing trees, or epiphytic. Common in a wide range of coastal and lowland scrub and forest, usually in damper habitats.

Recognition: This species can be distinguished from the other species of *Lecanopteris* in New Zealand by its thin (<4 mm diameter) wiry rhizome with small, squarrose, blackish-brown scales, thinner dull green laminae, and generally smaller sori. It also has a musky scent when fresh, as reflected in its common name.

Occasional aberrant forms are found – either crested at the apices or with bifid laminae.

Cytology: n = 37 (Brownlie 1958, as *Microsorium pustulatum*).

Notes: This fern has been widely misidentified by earlier New Zealand authors as *Polypodium pustulatum*, *Phymatodes pustulata* or *Microsorium pustulatum* (see Brownsey et al. 1985).



Fig. 22: *Lecanopteris scandens*. Deeply pinnatifid fertile frond.



Fig. 23: *Lecanopteris scandens*. Mature plants climbing a tree trunk.



Fig. 24: *Lecanopteris scandens*. Mature plants on a tree trunk showing progression from undivided sterile fronds at the base to pinnatifid fertile fronds higher up.



Fig. 25: *Lecanopteris scandens*. Plants growing on a tree trunk with a mixture of undivided sterile fronds and pinnatifid fertile fronds.



Fig. 26: *Lecanopteris scandens*. Plants growing on a bank with a mixture of undivided sterile fronds and pinnatifid fertile fronds.



Fig. 27: *Lecanopteris scandens*. Abaxial surface of fertile frond showing round or ovate exindusiate sori.



Fig. 28: *Lecanopteris scandens*. Long-creeping rhizome with blackish-brown squarrose scales, and juvenile fronds with reticulate venation.



Fig. 29: *Lecanopteris scandens*. Fronds articulated to phyllopodia at intervals along the creeping rhizome.

***Loxogramme* (Blume) C.Presl, *Tent. Pterid.* 214 (1836)**

= *Anarthropteris* Copel., *Gen. Fil.* 217 (1947)

Type taxon: *Loxogramme lanceolata* (Sw.) C.Presl

Etymology: From the Greek *loxos* (oblique), and *gramme* (a line), a reference to the sori, which are mostly elongate and oblique to the costa.

Epiphytic or rupestral ferns. Rhizomes erect (NZ) to long-creeping (not NZ), scaly. Rhizome scales clathrate, squarrose. Fronds monomorphic (NZ) to dimorphic (not NZ), articulation evident or not, undivided, herbaceous to coriaceous, virtually glabrous. Veins reticulate; areoles with (not NZ) or without (NZ) free included veinlets; hydathodes absent. Sori mostly elongate, or rarely round, sometimes partly impressed into the lamina and bulging on upper surface, arranged in one row either side of midrib (NZ) or often confluent with age (not NZ), often confined to upper part of frond; paraphyses present as narrow scales (NZ) or absent (not NZ); exindusiate. Spores monolete, bilaterally symmetrical, granulate.

Taxonomy: A genus of about 34 species (Hennipman et al. 1990).

The monotypic genus *Anarthropteris* was created by Copeland (1947) with the New Zealand species, *A. lanceolata*, as the sole representative. Thus construed, *Anarthropteris* was one of only three fern genera (all monotypic) endemic to New Zealand (Brownsey et al. 1985; Brownsey & Smith-Dodsworth 2000). Copeland considered it closely related to *Loxogramme*, but distinguished by its more or less round sori, distinctive receptacular scales, and spore morphology. However, all these characters are highly variable within *Loxogramme*. Kreier & Schneider (2006) have since shown, based on DNA

sequences from four chloroplast genome regions, that *Anarthropteris* is nested within *Loxogramme*, and better treated in the latter genus. When treated in *Loxogramme*, the correct name for the New Zealand species is *L. dictyopteris* (Mett.) Copel. (Kreier & Schneider 2006), which is adopted here. *Loxogramme scolopendrioides* (Gaud.) C.V.Morton was erroneously recorded for New Zealand by earlier authors but is now excluded (Morton 1973).

Distribution: Mostly tropical but a few species extending into south temperate regions; one in Central America, four in Africa, two in the Pacific, and the majority in Malesia. One species endemic to New Zealand.

Biostatus: Indigenous (Non-endemic).

Table 3: Number of species in New Zealand within *Loxogramme* (Blume) C.Presl

Category	Number
Indigenous (Endemic)	1
Total	1

Cytology: n = 35, 36, 37 (Hennipman et al. 1990).

***Loxogramme dictyopteris* (Mett.) Copel., Univ. Calif. Publ. Bot. 14: 369 (1929)**

≡ *Polypodium dictyopteris* Mett., *Ann. Sci. Nat. Bot. sér. 4*, 15: 77 (1861)

≡ *Anarthropteris dictyopteris* (Mett.) Copel., *Gen. Fil.* 218 (1947)

Lectotype (selected by Brownsey & Perrie 2012): Plate 409 in *Icones Plantarum* (Hooker 1841).

= *Dictyopteris lanceolata* J.Sm., *J. Bot. (Hooker)* 4: 64 (1841) nom. nud.

≡ *Anarthropteris lanceolata* (J.Sm.) L.B.Moore in Allan, *Fl. New Zealand* 1, 1010 (1961) nom. illeg.

= *Dictymia lanceolata* Hook.f., *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II*, 43 (1854)

≡ *Polypodium cunninghamii* Hook., *Gard. Ferns* t. 30 (1862) nom. nov. pro *Dictymia lanceolata* Hook.f. 1854

≡ *Anarthropteris lanceolata* (J.Sm. ex Hook.f.) Pic.Serm., *Webbia* 29: 13 (1975)

Lectotype (selected by Brownsey & Perrie 2012): New Zealand, *J.D. Hooker*, K 000501466!

Etymology: From the Greek *dictyon* (a net), and *ptēris* (a fern), in reference to the venation.

Vernacular name: lance fern

Low epiphytic or rupestral ferns. Rhizomes erect, scaly, bearing proliferous roots. Rhizome scales clathrate, narrowly ovate, 2–7 mm long, 0.5–1 mm wide, squarrose, brown, entire. Stipes indistinct from lamina, not obviously articulated to rhizome. Fronds undivided, narrowly elliptic to narrowly obovate, 40–360 mm long, 4–35 mm wide; apex acuminate or sometimes acute; margins entire or rarely slightly toothed; base attenuate to an indistinct winged stipe; adaxial surface dark green; abaxial surface slightly paler; herbaceous to coriaceous; glabrous except for widely scattered scales at the base. Costa prominent on adaxial surface; veins reticulate; areoles without free included veinlets; hydathodes absent. Sori round or slightly elongate, 3–7 mm long, partly impressed into lamina forming low bulges on adaxial surface, in 1 row either side of the costa, closer to costa than margin, usually confined to distal half of frond; paraphyses present as very narrow clathrate scales c. 3 cells wide; exindusiate.

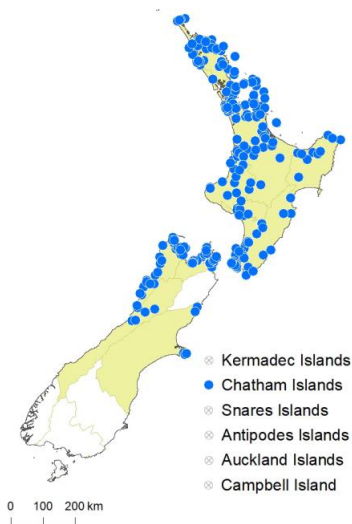


Fig. 30: *Loxogramme dictyopteris* distribution map based on databased records at AK, CHR & WELT.

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

South Island: Western Nelson, Sounds-Nelson, Westland, Canterbury.

Chatham Islands.

Altitudinal range: 0–1000 m.

Loxogramme dictyopteris is common throughout coastal and lowland regions of the North Island, extending locally into montane areas. It occurs from near sea level, up to 675 m in Erua Forest, and 1000 m on Mt Pihanga near Lake Taupō, but is uncommon in the higher areas of the Volcanic Plateau and Gisborne. In the South Island it is mostly confined to coastal and lowland areas of the Marlborough Sounds and Nelson, growing up to 450 m near Punakaiki, and extending as far south as Lake Kaniere on the west coast, and Banks Peninsula on the east coast. It also reaches the Chatham Islands.

Biostatus: Indigenous (Endemic).

Habitat: A low epiphyte on trunks and fallen logs, or on acidic and calcareous rocks and banks, in damp shaded parts of coastal and lowland broadleaved forest; sometimes in shaded hollows of open scoria. It covers large areas on trunks or rocks owing to its proliferous roots, but rarely occurs far above ground level. It often wilts conspicuously in dry weather.

Recognition: This species is easily recognised by its undivided fronds, and large, exindusiate, round or slightly elongate sori. The proliferous roots, giving rise to new plants at intervals, can be confused for a creeping rhizome, but the species has an erect rhizome, which distinguishes it from *Pyrrhosia* species and juvenile plants of *Lecanopteris* species. It can be further distinguished from *Pyrrhosia* by its glabrous lamina, and from *Lecanopteris* by its lack of free, included veinlets in the areoles.

Occasional aberrant fronds are found, either crested at the apices or with the lamina divided into short, lateral segments.

Cytology: n = 37 (Brownlie 1958, as *Anarthropteris dictyopteris*).

Notes: This species has a complex taxonomic history, documented by Pichi Sermolli (1975). The earliest name, *Polypodium attenuatum* R.Br., used by Richard (1832), was a misidentification for what is now known as *Dictymia brownii* (Wikstr.) Copel., but was in any case illegitimate because of a previously published homonym. The species was first validly described as *Dictymia lanceolata* by Hooker (1855), but when transferred to *Loxogramme*, Copeland (1929a) had to base his new combination on a later name, *Polypodium dictyopteris* Mettenius (1861), because the combination based on *D. lanceolata* was pre-occupied in *Loxogramme*. However, when he transferred it again to his new genus *Anarthropteris*, Copeland (1947) incorrectly used the combination *Anarthropteris dictyopteris*, overlooking the earlier binomial, *Dictymia lanceolata*. Moore (in Allan 1961) established the correct combination, *Anarthropteris lanceolata*, but attributed the species name incorrectly to J. Smith, rather than J.D. Hooker. This error was corrected by Pichi Sermolli (1975), who established the correct name, *Anarthropteris lanceolata* (J.Sm. ex Hook.f.) Pic.Serm. However, when treated in *Loxogramme*, the correct name is *L. dictyopteris* (Mett.) Copel. (Kreier & Schneider 2006).



Fig. 31: *Loxogramme dictyopteris*. Mature plant on a rock bank, with entire fronds growing from an erect rhizome.



Fig. 32: *Loxogramme dictyopteris*. Plants growing on a tree trunk, with entire fertile fronds beginning to wilt in dry conditions.



Fig. 33: *Loxogramme dictyopteris*. Mature plants growing on a rock wall.



Fig. 34: *Loxogramme dictyopteris*. Juvenile plants growing on rock, spreading by means of proliferous roots.



Fig. 35: *Loxogramme dictyopteris*. Entire fertile fronds, showing sori bulging on the adaxial surfaces.



Fig. 36: *Loxogramme dictyopteris*. Fertile frond, with round to ovate, exindusiate sori on the abaxial surface.

***Niphidium* J.Sm., *Hist. Fil.* 99 (1875)**

Type taxon: *Niphidium americanum* (Hook.) J.Sm.

Etymology: From the Greek *nipho-* (snow) and *-idius* (resembling), a reference to the densely tomentose fronds of the type species.

Epiphytic or terrestrial ferns. Rhizomes short to long-creeping, terete, lacking cavities, occasionally pruinose, scaly. Rhizome scales clathrate, squarrose. Fronds monomorphic, articulated to rhizome, undivided, coriaceous, virtually glabrous. Veins reticulate; areoles with free included veinlets; hydathodes often present. Sori round or slightly elongate, superficial, arranged in single rows of 5–12 between the main lateral veins, not confluent with age; paraphyses present as abortive sporangia; exindusiate. Spores monolete, bilaterally symmetrical, smooth to slightly papillate.

Taxonomy: A genus of 10 species (Lellinger 1972).

Distribution: A neotropical genus occurring from Cuba and Mexico to Argentina and Uruguay. One species casual in New Zealand.

Biostatus: Exotic; casual.

Table 4: Number of species in New Zealand within *Niphidium* J.Sm.

Category	Number
Exotic: Casual	1
Total	1

***Niphidium crassifolium* (L.) Lellinger, *Amer. Fern J.* 62: 106 (1972)**

≡ *Polypodium crassifolium* L., *Sp. Pl.* 1083 (1753)

Lectotype (selected by Lellinger 1972): Petiver, *Pterigraphia Americana* t. 6, f. 1 (1712).

Etymology: From the Latin *crassus* (thick, fleshy), and *-folius* (leaved), a reference to the coriaceous lamina.

Distribution: North Island: Auckland.

Known only from one locality in Auckland.

Occurs naturally in tropical America and the Caribbean.

Biostatus: Exotic; casual.

Habitat: Recorded as a cultivation escape on scoria boulders near a cultivated parent plant.

First record: Heenan et al. (2008). Voucher: AK 289667, 2004.

Recognition: This species can be recognised by its short-creeping rhizome, undivided, glabrous and coriaceous fronds, narrowly elliptic to narrowly obovate laminae, prominent veins, round sori arranged in single rows of 6–10 between the main lateral veins, presence of paraphyses in the sori, and short hairs on the sporangia.

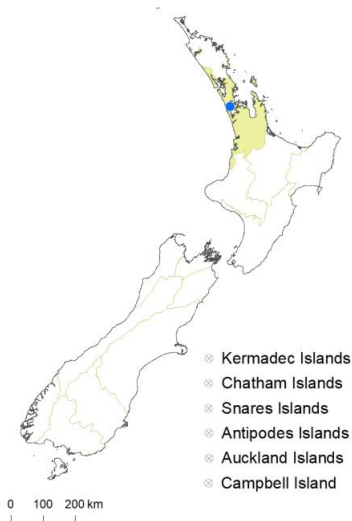


Fig. 37: *Niphidium crassifolium* distribution map based on databased records at AK, CHR & WELT.



Fig. 38: *Niphidium crassifolium*. Herbarium specimen of entire fertile frond from a cultivated plant, AK 380181, with round sori arranged in single rows between main lateral veins.



Fig. 39: *Niphidium crassifolium*. Herbarium specimen of a narrowly elliptic, entire fertile frond from a cultivated plant, AK 256206.

***Notogrammitis* Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 465 (2012)**

Type taxon: *Notogrammitis billardierei* (Willd.) Parris

Etymology: From the Greek *noto* (southern) and *Grammitis*, a reference to the southern distribution of members of this genus that were formerly included in *Grammitis*.

Vernacular names: finger ferns; strap ferns

Terrestrial, rupestral or epiphytic ferns. Rhizomes erect, or short- to long-creeping and very thin, not pruinose, scaly. Rhizome scales non-clathrate or rarely partially clathrate, ovate or narrowly ovate, pale to medium brown or rarely bicolorous with dark brown centres. Fronds monomorphic, not or rarely articulated to rhizome. Stipes glabrous or bearing non-glandular hairs or setae. Laminae entire to 2-pinnatifid, herbaceous or coriaceous, glabrous or bearing non-glandular hairs. Veins free; hydathodes present or absent. Sori round or elongate along veins, superficial or slightly sunken into lamina surface, in one row either side of costa or midrib; paraphyses present or absent; exindusiate. Spores monoletate; perispores granulate and papillate, chlorophyllous.

Taxonomy: A genus of 12 species (Perrie & Parris 2012).

Phylogenetic analysis of chloroplast DNA sequences in grammitid ferns by Ranker et al. (2004) demonstrated a need for considerable realignment of generic boundaries within the grammitid ferns. Several new grammitid genera have since been described (Sundue et al. 2014).

In his monographic study of *Grammitis*, Copeland (1951) recognised just three species in New Zealand: *G. billardierei*, *G. ciliata* and *G. crassa*. Allan (1961) extended this to five species, with the addition of *G. pumila* and *G. heterophylla*, although Tindale (1961c) separated the latter into *Ctenopteris* on the basis of its pinnately divided fronds. Parris & Given (1976) revised *Grammitis* in New Zealand, recognising a total of nine species and two subspecies in the region, in addition to *Ctenopteris heterophylla*. Parris (1998) subsequently added the Tasmanian *G. gunnii* to the New Zealand flora. However, Ranker et al. (2004) demonstrated that *Ctenopteris* and *Grammitis* were not monophyletic when defined on the basis of frond dissection. Since then, based on phylogenetic analysis of chloroplast DNA sequences, Perrie & Parris (2012) have shown that all 11 New Zealand grammitids, together with one Tasmanian species, form a single clade, which they recognised as *Notogrammitis* and which includes all grammitid species occurring below 35° 30' S worldwide. The recognition of a new genus has had nomenclatural consequences for several traditionally recognised species, detailed in the synonymies and Notes below.

- | | | |
|----------|----------------------------|---------------------|
| 1 | Fronds 1–2-pinnatifid..... | <i>heterophylla</i> |
| | Fronds entire..... | 2 |

2	Hairs present in and around the sori.....	3
	Hairs absent from the soral area.....	7
3	Rhizomes long-creeping.....	4
	Rhizomes erect or short-creeping.....	5
4	Laminae 6–160 mm long; stipe and lamina hairs dark red-brown; soral hairs up to 3 mm long.....	<i>patagonica</i>
	Laminae 8–70 mm long; stipe and lamina hairs white to pale brown; soral hairs up to 1.5 mm long.....	<i>gunnii</i>
5	Soral hairs dark red-brown, stout.....	<i>rawlingsii</i>
	Soral hairs pale brown or whitish, slender.....	6
6	Laminae 1.5–6 (–8) mm wide, 9–80 (–100) mm long; lamina margins entire and flat; hydathodes usually absent, rarely present; plants rupestral or terrestrial.....	<i>ciliata</i>
	Laminae 3–12 mm wide, 22–165 mm long; lamina margins often scalloped and undulate; hydathodes present; plants epiphytic.....	<i>pseudociliata</i>
7	Laminae 9–20 mm wide; rhizome scales >8 mm long.....	<i>rigida</i>
	Laminae usually <10 mm wide; rhizome scales <6 mm long.....	8
8	Stipes hairy; hairs present as setae*, or hairs branched with setiform branches.....	9
	Stipes glabrous, or with simple catenate hairs*.....	10
9	Rhizomes short- to long-creeping; stipes clearly defined, not winged; fronds 9–115 mm long; sori in 1–10 pairs.....	<i>givenii</i>
	Rhizomes erect to short-creeping; stipes usually ill-defined, winged; fronds 20–245 mm long; sori in 1–36 pairs.....	<i>billardierei</i>
10	Rhizomes erect to short-creeping; sori usually in >10 pairs; plants usually epiphytic.....	<i>angustifolia</i>
	Rhizomes short- to long-creeping; sori in <10 pairs; plants terrestrial or rupestral.....	11
11	Fronds 4–42 mm long; sori in 1–5 (–7) pairs.....	<i>crassior</i>
	Fronds 9–115 mm long; sori in 1–10 pairs.....	<i>givenii</i>

*Setae are tapered at the apices and appear unicellular; catenate hairs are clearly multicellular, with adjacent cells collapsed at right angles to each other.

Distribution: *Notogrammitis* is confined to southern temperate regions, extending southwards from 28° S, and is the only grammitid genus below 35° 30' S. Its centre of diversity is in Australia and New Zealand, but species are also present in Chile, Argentina, South Africa and many of the islands of the Southern Ocean (Perrie & Parris 2012). Three species in South America, one in South Africa, seven in Australia. Eleven species in New Zealand; four endemic and seven indigenous.

Biostatus: Indigenous (Non-endemic).

Table 5: Number of species in New Zealand within *Notogrammitis* Parris

Category	Number
Indigenous (Endemic)	4
Indigenous (Non-endemic)	7
Total	11

Recognition: Species of *Notogrammitis* are mostly small epiphytic or rupestral ferns, with erect to long-creeping rhizomes, usually undivided laminae, free veins, sori round or elongated along veins and lacking indusia. Spores are characteristically chlorophyllous and granulate (Large & Braggins 1991).

Cytology: *Notogrammitis* has a base chromosome number of $x = 37$ (Dawson et al. 2000; Tindale & Roy 2002).

***Notogrammitis angustifolia* (Jacq.) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 465 (2012)**

≡ *Asplenium angustifolium* Jacq., *Collectanea* 1, 121 (1787)

Lectotype (selected by Brownsey et al. 2021): [Straits of Magellan], Baie Bougainville, no collector or date, P 00632777!

= *Grammitis magellanica* Desv., *Mag. Neuesten Entdeck. Gesamten Naturk. Ges. Naturf. Freunde Berlin* 5: 313 (1811)

≡ *Polypodium billardierei* var. *magellanicum* (Desv.) C.Chr., *Ark. Bot.* 10: 15 (1910)

≡ *Polypodium magellanicum* (Desv.) Copel., *Philipp. J. Sci.*, C 11: 44 (1916)

≡ *Grammitis billardierei* var. *magellanica* (Desv.) de la Sota, *Opera Lilloana* 5: 205 (1961)

Holotype: America australia [South America], Herb. Desvaux, P 00632773 (online)

= *Polypodium poeppigianum* Mett., *Abh. Senckenberg. Naturf. Ges.* 2: 37 (1857)

≡ *Grammitis poeppigiana* (Mett.) Pic.Serm., *Webbia* 32: 461 (1978)

Neotype (selected by Rourke & Schelpe 1978): South Africa, Stellenbosch, Jonkershoek, Victoria Peak, *Esterhuysen* 29290, 12 Nov. 1961, BOLI; isoneotypes E, KI, MO! (see Parris 1998 and Perrie & Parris 2012)

= *Grammitis magellanica* subsp. *nothofageti* Parris in Parris & Given, *New Zealand J. Bot.* 14: 100 (1976)

≡ *Notogrammitis angustifolia* subsp. *nothofageti* (Parris) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 466 (2012)

Holotype: New Zealand, Southland, north of Juno Saddle, *D.R. Given* 71407, Oct. 1971, CHR 223040!

Etymology: From the Latin *angusti-* (narrow), and *folius* (leaf), a reference to the linear frond of this species.

Rhizomes erect or rarely short-creeping, bearing scales. Rhizome scales narrowly ovate, 1.2–4.6 mm long, 0.3–0.8 mm wide, pale brown, concolorous, non-clathrate. Stipes indistinct, winged to base, glabrous or with very sparse pale red-brown hairs c. 0.1 mm long. Fronds undivided, linear to narrowly elliptic or narrowly obovate, 15–220 mm long, 2–7 mm wide; apices acute; margins entire; bases attenuate to an indistinct winged stipe; both surfaces pale green; herbaceous to coriaceous; glabrous or with sparse white to pale red-brown hairs 0.1–0.5 mm long. Hairs simple catenate, or branched with catenate branches. Hydathodes sometimes present. Sori elliptic, elongated along veins, 1.2–5.0 mm long, ± parallel to midrib or slightly oblique, in 1–37 pairs in mid to upper part of lamina, but often absent from apical portion, lacking hairs. Sporangia 180–370 µm long; spores 25–58 µm diameter.

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, Antipodes Islands, Auckland Islands, Campbell Island.

Altitudinal range: 10–1400 m.

In the North Island *Notogrammitis angustifolia* occurs in montane regions from Great Barrier Island to the Tararua Mountains, with an outlying population in Warawara Forest. It grows from 400 m on Mt Holdsworth in the Tararua Ranges, to 1400 m on Mt Taranaki and the Raukūmara and Kaimanawa Ranges. It is common throughout the South Island, west of the main divide, but populations on the east coast are confined to the Catlins District, around Dunedin, and on Banks Peninsula. It reaches 1000 m near Maruia Springs, but descends almost to sea level in south Westland and Fiordland. It extends also to the Chatham Islands, Stewart Island and the southern subantarctic islands.

Also Chile, Argentina, Tristan da Cunha, Gough Island, South Africa, Australia (Victoria, Tasmania) (Perrie & Parris 2012).

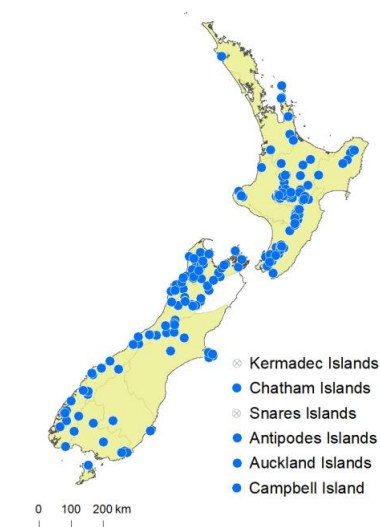


Fig. 40: *Notogrammitis angustifolia* distribution map based on databased records at AK, CHR & WELT.

Biostatus: Indigenous (Non-endemic).

Habitat: *Notogrammitis angustifolia* is found as an epiphyte in podocarp, broadleaved and beech forest, in subalpine scrub, and rarely on cliff faces and banks. It favours high rainfall areas and has been recorded growing on *Dicksonia squarrosa*, *Archeria* sp., *Brachyglottis elaeagnifolia*, *Carpodetus serratus*, *Coprosma antipoda*, *C. dumosa*, *C. foetidissima*, *C. grandifolia*, *C. pseudocuneata*, *Dracophyllum arboreum*, *D. scoparium*, *Griselinia littoralis*, *Halocarpus bidwillii*, *H. biformis*, *Libocedrus bidwillii*, *Metrosideros umbellata*, *Olearia avicenniifolia*, *O. chathamica*, *O. colensoi*, *O. ilicifolia*, *Phyllocladus alpinus*, *Podocarpus laetus*, *P. totara*, *Prumnopitys ferruginea*, *Pseudowintera colorata*, *Quintinia serrata*, *Toronia toru*, *Weinmannia racemosa* and species of Nothofagaceae, as well as in *Pleurophyllum* bog and *Carex ternaria* swamp.

Recognition: *Notogrammitis angustifolia* is distinguished by its usually erect rhizome, narrow and glabrous fronds (<7 mm wide), lack of distinct stipes, absence of hairs in the sori, and sori often \pm parallel to the midrib. It lacks setae and hairs with setiform branches. The number of pairs of sori is very variable, but they are often absent from the apical portion of the frond.

Aberrant forms with forked laminae are occasionally found.

Cytology: No chromosome count has been made from New Zealand plants, but $n = 37$ has been recorded for Australian material (Parris 1998).

Hybridisation: There is morphological evidence for occasional hybrids between *N. angustifolia* and *N. billardiarei* (CHR 178291, 189609, 214621, 387076).

Notes: This species was previously known in Australasia as *Grammitis magellanica* Desv. (e.g. Parris 1998; Brownsey & Smith-Dodsworth 2000). The earliest basionym for the species is *Asplenium angustifolium* Jacq.; the combination in *Grammitis* is pre-occupied by *G. angustifolia* Hew. (1838), but is available in the new genus *Notogrammitis* (Perrie & Parris 2012).

Parris & Given (1976) recognised two subspecies in New Zealand: subsp. *angustifolia*, confined to the subantarctic, and subsp. *nothofageti*, confined to the main islands. Subsp. *angustifolia* was distinguished by its habit of growing in colonies, its lax fronds, and its often darkened vein endings, whereas subsp. *nothofageti* was distinguished by its solitary habit, erect or pendulous fronds, and vein endings that were not darkened. It was also said to have larger sporangia and spores than subsp. *angustifolia* (Parris & Given 1976). However, with the benefit of additional specimens the distinction between the two subspecies is much less clear, and they are not recognised here.



Fig. 41: *Notogrammitis angustifolia*. Mature plants with long, narrow fronds growing from erect rhizomes.



Fig. 42: *Notogrammitis angustifolia*. Mature plant with long, narrow fronds growing from an erect rhizome.



Fig. 43: *Notogrammitis angustifolia*. Mature plants with long, narrow fronds growing epiphytically on a trunk.



Fig. 44: *Notogrammitis angustifolia*. Mature plants with long, narrow fronds growing amongst mosses and filmy ferns on a trunk.



Fig. 45: *Notogrammitis angustifolia*. Glabrous fertile frond with elliptic sori.



Fig. 46: *Notogrammitis angustifolia*. Fertile frond with many pairs of crowded, elliptic sori in mid-frond but absent from the apical region.

***Notogrammitis billardierei* (Willd.) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 466 (2012)**

≡ *Grammitis billardierei* Willd., *Sp. Pl.* 5(1), 139 (1810) – as *billardierei*

≡ *Polypodium billardierei* (Willd.) C.Chr., *Index Filic.* 513 (1906) nom. illeg., non *Polypodium billardierei* R.Br. 1810

Lectotype (selected by Parris 1998): Cap. van Diemen [Tasmania], *Labillardière*, B-W 19583010 (!online)

= *Grammitis australis* R.Br., *Prodr. Fl. Nov. Holland.* 146 (1810)

≡ *Polypodium australe* (R.Br.) Mett., *Abh. Senckenberg. Naturf. Ges.* 2: 36 (1857) nom. illeg., non *Polypodium australe* Fée 1852

Lectotype (selected by Tindale 1961b): Tasmania, Derwent R., *R. Brown Iter Austral. No. 6*, 1802–05, BM 001039755!; isolectotypes E!, K!, MEL!

= *Grammitis humilis* Hombr. in Hombron & Jacquinot, *Voy. Pôle Sud, Bot.* t. 2, fig. H (1843)

Lectotype (selected by Brownsey et al. 2021): Nouvelle Zélande [New Zealand], Iles Auckland [Auckland Islands], *Hombron s.n.*, 1841, *Voyage de l’Astrolabe et de la Zélée* 1838–40, P 00632723!

Etymology: Named in honour of Jacques Julien Houttou de Labillardière (1775–1834), French botanist on D’Entrecasteaux’s voyage (1791–1795) to find La Pérouse’s ill-fated expedition. Labillardière made extensive collections of Australian plants from south-west Australia and Tasmania, which formed the basis of his *Novae Hollandiae plantarum specimen* (1804–1807).

Vernacular name: common strap fern

Rhizomes erect to short-creeping, bearing scales. Rhizome scales ovate to narrowly ovate, 1.6–7.3 mm long, 0.4–1.8 mm wide, pale brown, concolorous, non-clathrate. Stipes indistinct, winged almost to base, hairy. Stipe hairs sparse to abundant, white to pale red-brown, 0.1–1.6 mm long. Fronds undivided, linear to narrowly elliptic, 20–245 mm long, 2–11 mm wide; apices acute to obtuse; margins entire; bases attenuate to an indistinct winged stipe; both surfaces pale green; herbaceous to coriaceous; glabrous or bearing sparse hairs up to 1.3 mm long on the margin, midrib and lamina surface. Hairs either setae, or branched hairs with setiform branches. Hydathodes usually absent or rarely present. Sori elliptic, sometimes curved, elongated along veins, oblique, 1.5–9 mm long, in 1–36 pairs, in mid to upper part of lamina, lacking hairs. Sporangia 140–270 µm long; spores 18–36 µm diameter.

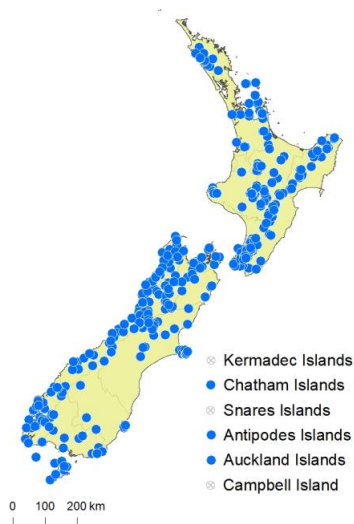


Fig. 47: *Notogrammitis billardierei* distribution map based on databased records at AK, CHR & WELT.

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

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

Chatham Islands, Solander Island, Stewart Island, Antipodes Islands, Auckland Islands.

Altitudinal range: 0–1400 m.

Notogrammitis billardierei occurs in lowland and montane areas throughout much of the North Island from Kaitiāia to Wellington, but is apparently absent from inland Taranaki and the east coast. It ranges from near sea level, but is mostly found above 300 m, and up to 1300 m near Ohakune and in the Ruahine and Kāweka Ranges. In the South Island it is common in lowland to subalpine habitats throughout the western part of the island, but is much less common in the east, and absent from much of south Canterbury and Otago. It reaches almost 1400 m on Mt Torlesse, Canterbury, but descends to sea level in Fiordland and the subantarctic islands.

Also Australia (Queensland, New South Wales, Victoria, Tasmania).

Biostatus: Indigenous (Non-endemic).

Habitat: *Notogrammitis billardierei* is found in podocarp, broadleaved, beech and coastal forest, and in subalpine scrub. It grows as an epiphyte on forest trees as well as on roots, rotting logs, mossy rocks and banks, under rock overhangs, on root plates, and on the ground. It has been recorded growing on *Blechnum discolor*, *Cyathea smithii*, *Dicksonia fibrosa*, *D. squarrosa*, *Ackama rosifolia*, *Beilschmiedia tarairi*, *Brachyglottis elaeagnifolia*, *Elaeocarpus dentatus*, *Fuchsia excorticata*, *Griselinia littoralis*, *Ixerba brexioides*, *Knightia excelsa*, *Lepidothamnus intermedius*, *Libocedrus plumosa*, *Metrosideros robusta*, *M. umbellata*, *Olearia colensoi*, *Podocarpus laetus*, *P. totara*, *Prumnopitys ferruginea*, *Pseudopanax crassifolius*, *Quintinia serrata*, *Weinmannia racemosa*, *W. sylvicola*, and species of Nothofagaceae.

Recognition: *Notogrammitis billardierei* is easily the most common and variable species of the genus in New Zealand. It is characterised by its erect or short-creeping rhizome, relatively large fronds, lack of distinct stipes, hairs largely confined to the base of the frond, and absence of hairs in the sori. Plants with few hairs on the frond can be confused with *N. angustifolia*, but generally have larger fronds (20–245 mm long, 2–11 mm wide; cf. 15–220 mm long, 2–7 mm wide), and longer, oblique sori (up to 9 mm long, cf. up to 5 mm long), together with different hair types. Plants with short-creeping rhizomes can be mistaken for *N. givenii*, but the latter generally has long-creeping rhizomes, distinct stipes, obovate rather than narrowly elliptic laminae, and shorter fronds (9–115 mm long).

Cytology: n = 37 (Brownlie 1958 – as *Grammitis billardierei*).

Hybridisation: There is convincing evidence for very rare hybridisation between *N. billardierei* and *N. heterophylla* (CHR 215640, Parris 1977), and there may also be occasional hybrids between *N. billardierei* and *N. angustifolia* (CHR 178291, 189609, 214621, 387076). A single collection (WELT P027882) has the frond morphology of *N. billardierei* but the soral hairs of *N. patagonica* and is likely to be a hybrid between the two species.

Notes: Perrie & Parris (2012) showed that, based on chloroplast DNA sequences, material of *N. billardierei* from Tasmania differed significantly from New Zealand plants, while Sundue et al. (2014) demonstrated that material from the Dandenong Range, Victoria, differed from both Tasmanian and New Zealand material. If further investigation confirms these results, the New Zealand and Victorian plants might need new names.



Fig. 48: *Notogrammitis billardierei*. Mature plant with broad fronds, growing from an erect rhizome.



Fig. 49: *Notogrammitis billardierei*. Mature plant growing epiphytically amongst mosses.



Fig. 50: *Notogrammitis billardierei*. Mature plants with erect rhizomes growing epiphytically on a trunk.



Fig. 51: *Notogrammitis billardierei*. Mature plant with broad fronds, growing from an erect rhizome on a bank.



Fig. 52: *Notogrammitis billardierei*. Fronds growing from an erect rhizome with indistinct, hairy stipes.



Fig. 53: *Notogrammitis billardierei*. Fronds growing from a short-creeping rhizome with indistinct, hairy stipes.



Fig. 54: *Notogrammitis billardierei*. Glabrous fertile frond with elongated sori, curving away from midrib.



Fig. 55: *Notogrammitis billardierei*. Glabrous fertile frond with elongated sori.

***Notogrammitis ciliata* (Colenso) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 467 (2012)**

≡ *Grammitis ciliata* Colenso, *Tasmanian J. Nat. Sci.* 2: 166 (1845)

≡ *Polypodium australe* var. *ciliata* (Colenso) Kirk, *Trans. & Proc. New Zealand Inst.* 1 (ed.2): 98 (1875)
Lectotype (selected by Allan 1961): shores of Waikare Lake [L. Waikaremoana], W. Colenso, Dec. 1841, WELT P003192!

= *Grammitis australis* var. *villosa* Hook.f., *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II*, 44 (1854)

≡ *Polypodium australe* var. *villosum* (Hook.f.) Cheeseman, *Man. New Zealand Fl.* 1010 (1906)

≡ *Polypodium billardierei* var. *villosum* (Hook.f.) Cheeseman, *Man. New Zealand Fl.*, ed. 2, 80 (1925)
Type: not specified; not located

= *Polypodium paradoxum* Colenso, *Trans. & Proc. New Zealand Inst.* 14: 336 (1882)

Lectotype (selected by Parris & Given 1976): New Zealand, com. W. Colenso, Sept. /83, K 001044381!

Etymology: From the Latin *ciliatus* (having the margins or veins fringed with hairs) – a reference to the lamina hairs in this species.

Rhizomes erect to short-creeping, bearing scales. Rhizome scales ovate to narrowly ovate, 1.0–6.3 mm long, 0.2–1.0 mm wide, pale brown, concolorous, non-clathrate. Stipes indistinct, winged almost to base, or 1–7 mm long and 0.2–0.8 mm diameter, hairy. Stipe hairs sparse to abundant, white to pale red-brown, 0.1–1.7 mm long. Fronds undivided, linear to narrowly obovate, 9–80 mm long, very rarely to 100 mm long, 1.5–6 mm wide, rarely to 8 mm wide; apices acute; margins entire or

rarely crenulate; bases attenuate to an indistinct winged stipe; both surfaces pale green; herbaceous; very rarely glabrous, usually bearing sparse to abundant hairs up to 2.1 mm long on the margin, midrib and lamina surface. Hairs either setae, or branched hairs with setiform branches. Hydathodes usually absent or rarely present. Sori subglobose to elliptic, elongated along veins, \pm parallel to midrib or slightly oblique, 1–4 mm long, in 1–24 pairs in mid to upper part of lamina, bearing hairs up to 2.0 mm long, sometimes longer than lamina hairs. Sporangia 130–260 μ m long; spores 16–34 μ m diameter.

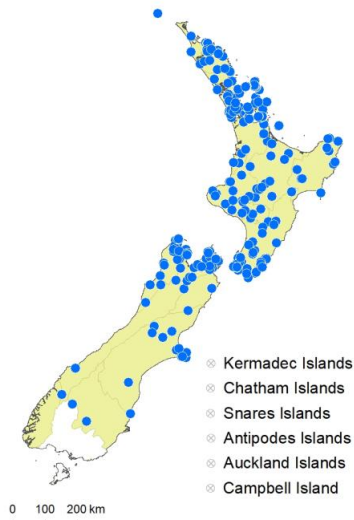


Fig. 56: *Notogrammitis ciliata* distribution map based on databased records at AK, CHR & WELT.

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

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

Three Kings Islands.

Altitudinal range: 0–1075 m.

Notogrammitis ciliata occurs in lowland to montane areas throughout the North Island, extending from the Three Kings Islands to Wellington. It grows from near sea level, reaching 1075 m in the Kaimanawa Ranges. In the South Island it is common as far south as Banks Peninsula, but there are only very scattered populations in south Canterbury, Otago and Fiordland. It ranges from 30 m, up to 860 m in the Cobb Valley, north-west Nelson.

Biostatus: Indigenous (Endemic).

Habitat: *Notogrammitis ciliata* is usually a terrestrial species found under kauri, broadleaved and beech forest, and under mānuka and kānuka scrub. It grows on mossy rock faces and boulders, on clay track banks, stream banks and damp earth, on humus mounds, around roots and trunk bases, and rarely as a low epiphyte on *Cyathea dealbata*, *Agathis australis*, *Phyllocladus trichomanoides* and *Nestegis lanceolata*. It is sometimes found growing among terrestrial forest mosses such as *Leucobryum*.

Recognition: *Notogrammitis ciliata* is characterised by its erect to short-creeping rhizomes, lack of distinct stipes, small fronds (usually 9–80 mm long, 1.5–6 mm wide), fronds that are hairy throughout, and the presence of long hairs in the sori. The species is also distinguished by its habitat, which is almost always terrestrial on rocks and clay banks in lowland and montane areas. However it is very variable with respect to the abundance, length and colour of the hairs on the lamina. It can be confused with *N. patagonica* and *N. gunnii*, which have fronds bearing very similar arrangements of hairs, but they have long-creeping rhizomes, more obviously obovate fronds, and habitats that are predominantly alpine or subalpine. *Notogrammitis ciliata* can also be confused with *N. pseudociliata*, but the latter is always epiphytic and has larger fronds (22–165 mm long, 3–12 mm wide), and lamina margins that are sometimes scalloped and undulate rather than entire and flat.

Cytology: The count of $n = 37$ reported by Brownlie (1961– as *Grammitis ciliata*) is now known to relate to *Notogrammitis patagonica* (see Perrie & Parris 2012, Table 1).

Hybridisation: There is evidence that *Notogrammitis ciliata* hybridises with *N. heterophylla* (AK 302263).

Notes: No type was specified for *Grammitis australis* var. *villosa* by Hooker (1854–1855), and its synonymy with *Notogrammitis ciliata* is based on historical precedent first determined by Cheeseman (1906).

Perrie & Parris (2012) and Sundue et al. (2014) showed that, based on chloroplast DNA sequences, plants of *N. ciliata* in New Zealand are genetically polymorphic. Further work is needed to see if morphological variation is correlated with genetic variation, whether more than one species is represented in New Zealand, and whether hybrids or cryptic species are involved. Morphological variation that differs from typical *N. ciliata* includes plants with crenate margins and teeth to 0.5 mm long (WELT P030639), setae sometimes absent from the sori (CHR 312140, 402521 p.p.), setae absent from the lower surface of the lamina including the sori (AK 289892, *Stanley s.n.*, Mt William), setae on abaxial surface of midrib only (AK 291078, Kawau Island; *Jane s.n.* to be deposited in AK), hydathodes present at vein endings on adaxial surface (CHR 312140; CHR 402521 p.p.), and the lamina of living material dark green, fleshy (*Jane s.n.* to be deposited in AK).



Fig. 57: *Notogrammitis ciliata*. Mature plants growing on a clay bank.



Fig. 58: *Notogrammitis ciliata*. Mature plants with short fronds growing from erect rhizomes.



Fig. 59: *Notogrammitis ciliata*. Mature plants growing on a clay bank.



Fig. 60: *Notogrammitis ciliata*. Mature plant growing from erect rhizome.



Fig. 61: *Notogrammitis ciliata*. Fertile frond with abundant hairs towards the stipe, and more scattered hairs on the abaxial lamina surface.



Fig. 62: *Notogrammitis ciliata*. Fertile frond with long hairs in and around the sori.



Fig. 63: *Notogrammitis ciliata*. Fertile frond with long hairs in and around the sori.



Fig. 64: *Notogrammitis ciliata*. Fertile frond with long hairs in and around the sori.

***Notogrammitis crassior* (Kirk) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 467 (2012)**

- ≡ *Polypodium crassium* Kirk, *Trans. & Proc. New Zealand Inst.* 17: 232 (1885)
Lectotype (selected by Allan 1961): Highest peaks of Mt Anglem, *T. Kirk 1057*, 28 Dec. 1883, WELT P020932! (originally numbered 204)
- = *Grammitis australis* var. *alpina* S.Jones, *Handb. Ferns New Zealand* 31 (1861)
Type: not specified; not located
- = *Grammitis pumila* J.B.Armstr., *Trans. & Proc. New Zealand Inst.* 13: 341 (1881) nom. illeg., non *Grammitis pumila* Sw.
- ≡ *Polypodium australe* var. *pumilum* (J.B.Armstr.) Cockayne, *Trans. & Proc. New Zealand Inst.* 36: 325 (1904) – as *P. australe pumila*
- ≡ *Polypodium pumilum* (J.B.Armstr.) Cockayne, *Rep. Bot. Surv. Stewart Island* 47 (1909)
- ≡ *Polypodium billardiarei* var. *pumilum* (J.B.Armstr.) Cheeseman, *Man. New Zealand Fl.*, ed. 2, 80 (1925)
Lectotype (selected by Parris & Given 1976): Canterbury, Craigieburn Range, *J.B. Armstrong s.n.*, CHR 633437!
- = *Grammitis armstrongii* Tindale, *Contr. New South Wales Natl. Herb.* 3: 88 (1961)
Holotype: New South Wales, Thredbo River Gorge, Kosciusko, *L.A.S. Johnson & E.F. Constable*, 19 Jan. 1951, NSW 245430!

Etymology: From the Latin *crassior* (thicker), a reference to the nature of the frond in this species.

Vernacular name: dwarf strap fern

Rhizomes long-creeping, bearing scales. Rhizome scales ovate to narrowly ovate, 1.0–6.5 mm long, 0.3–2.0 mm wide, pale brown, concolorous, non-clathrate. Stipes indistinct, winged almost to base, glabrous. Fronds undivided, linear to obovate or spatulate, 4–42 mm long, 1–5 mm wide; apices acute to obtuse; margins entire; bases attenuate to an indistinct winged stipe; both surfaces pale green; coriaceous; usually glabrous or occasionally bearing sparse hairs up to 0.6 mm long on the lamina surface. Hairs simple catenate, or branched with catenate branches. Hydathodes absent. Sori subglobose to globose on veins, slightly oblique, usually becoming confluent at maturity, 1–3 mm long, in 1–5 pairs, or rarely up to 7 pairs, confined to frond apices, lacking hairs. Sporangia 210–400 µm long; spores 31–65 µm diameter.

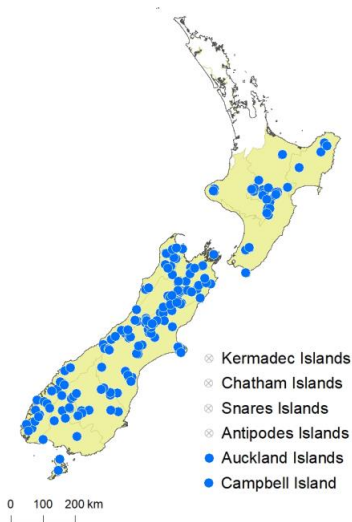


Fig. 65: *Notogrammitis crassior* distribution map based on databased records at AK, CHR & WELT.

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

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

Stewart Island, Auckland Islands, Campbell Island.

Altitudinal range: 250–1900 m.

Notogrammitis crassior is confined to alpine and subalpine areas of the North Island from the Raukūmara Ranges and Mt Taranaki to the Tararua and Aorangi Ranges, mostly in a zone from 800 to 1650 m. In the South Island it occurs in alpine and subalpine areas throughout, ranging from 250 m in the Hunters Hills, Canterbury, to over 1900 m at the Waiiau Pass, Nelson, but it is usually found above 750 m. It also reaches Stewart Island, and descends to c. 250 m on the subantarctic islands.

Also Chile, Argentina, Falkland Islands, South Georgia, Tristan da Cunha, Gough Island, Nightingale Island, Inaccessible Island, Marion Island, Prince Edward Island, Crozet Islands, Kerguelen Islands, and Australia (New South Wales, Victoria, Tasmania, Macquarie Island) (Perrie & Parris 2012).

Biostatus: Indigenous (Non-endemic).

Habitat: *Notogrammitis crassior* is found in mountain beech forest, subalpine scrub, tussock, subalpine grassland, and in alpine fellfield and herbfield. It is a rare epiphyte on mountain beech, and usually forms mats on mossy rocks and cliff faces, in rock crevices, among scree, and under rock overhangs. It is often associated with alpine mosses such as *Racomitrium*. It occurs on a wide variety of substrates, including greywacke, granite, gneiss, schist, basalt, limestone, marble, ash, and andesite. It is one of the few truly alpine ferns in New Zealand and occurs at higher altitudes than most other New Zealand pteridophytes (Parris & Given 1976).

Recognition: *Notogrammitis crassior* is characterised by its long-creeping rhizomes, indistinct stipes, very small fronds (up to 42 mm long and 5 mm wide), lack of hairs, and sori that are confined to the frond apices. Its habitat is almost exclusively alpine or subalpine, very rarely in forest, and its small, glabrous fronds will distinguish it from *N. givenii*, *N. gunnii* and *N. patagonica*, which also occur in this zone. It lacks setae or hairs with setiform branches.

Cytology: $n = 37$ (Brownlie 1958 – as *Grammitis pumila*). Counts of $n = 37$ and $n = 74$ have been reported from Australian populations (Parris 1998; Tindale & Roy 2002) with $n = 37$ reported from high alpine material and $n = 74$ from forest material.

Notes: Kirk (1885) described his new species as *Polypodium crassium*. The epithet “crassium” is a neuter comparative, but is not good Latin and should have been “crassius”. Allan (1961) pointed out that the word is spelled “crassum” on the type sheet, and suggested that it had been misspelled when published, thereby implying that “crassium” was an orthographic error to be corrected to “crassum”. This had been accepted by Christensen (1905–1906), who treated it as *P. crassum*, and by Copeland (1951), who thought “the specific name is probably a misprint”. However, another interpretation is that Kirk intended to use a comparative adjective, “crassium”, to distinguish the name of his species from *Grammitis crassa* Fée, albeit in the genus *Polypodium*. Whether Kirk knew of *G. crassa* Fée is uncertain because the name was not used in any New Zealand Flora until that of Allan (1961), following the work of Copeland (1951). If the name *Polypodium crassium* is treated as an orthographic error for *P. crassum*, the combination in *Grammitis* is unavailable because of *G. crassa* Fée, but is available in *Notogrammitis*.

Notogrammitis crassior was previously known as *Grammitis poeppigiana* (Mett.) Pic.Serm. (e.g. Parris 1998; Brownsey & Smith-Dodsworth 2000). However, the neotype of *Polypodium poeppigianum* Mett. is actually a specimen of *Notogrammitis angustifolia* and has been reduced to synonymy under that species (Perrie & Parris 2012).

No type was specified for *Grammitis australis* var. *alpina* by Jones (1861), and its synonymy with *Notogrammitis crassior* is based on historical precedent first determined by Perrie & Parris (2012).

Perrie & Parris (2012) showed that, based on chloroplast DNA sequences, populations of *N. crassior* in Australia and Chile differ substantially from those in New Zealand. Some plants in Australia from

forest are also known to be tetraploid (Parris 1998), in contrast to those in New Zealand. Further work is needed to determine whether habitat, ploidy and sequence differences are correlated.



Fig. 66: *Notogrammitis crassior*. Mature plants with obovate fronds, growing from creeping rhizomes.



Fig. 67: *Notogrammitis crassior*. Short, obovate, glabrous, fertile fronds with sori confined to the apices.



Fig. 68: *Notogrammitis crassior*. Mature plants with very short, obovate fronds growing terrestrially in subalpine grassland.



Fig. 69: *Notogrammitis crassior*. Mature plants with short, obovate fronds growing on a rock bank.

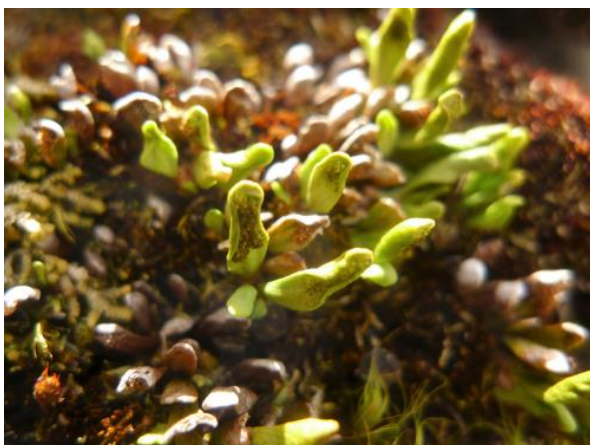


Fig. 70: *Notogrammitis crassior*. Obovate, glabrous, fertile fronds with sori near the apices.



Fig. 71: *Notogrammitis crassior*. Plants with spatulate fronds forming a tight cushion on an alpine rock ledge.



Fig. 72: *Notogrammitis crassior*. Plants with spatulate fronds forming a tight cushion on an alpine rock ledge.



Fig. 73: *Notogrammitis crassior*. Plants with spatulate fronds growing from creeping rhizomes and forming tight mats in alpine rock crevices.

***Notogrammitis givenii* (Parris) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 468 (2012)**

≡ *Grammitis givenii* Parris in Parris & Given, *New Zealand J. Bot.* 14: 96 (1976)

Holotype: New Zealand, Canterbury, Arthur's Pass, head of Waimakariri Valley, Mt Stewart, D.R. Given 65201, Dec. 1965, CHR 169519!

Etymology: Named in honour of David Roger Given (1943–2005), New Zealand pteridologist and conservationist at Manaaki Whenua–Landcare Research, Christchurch.

Rhizomes short- to long-creeping, bearing scales. Rhizome scales ovate to narrowly ovate, 1.5–5.5 mm long, 0.3–1.5 mm wide, pale brown, concolorous, non-clathrate. Stipes 1–25 mm long, black or dark brown, usually distinct, not winged, ± glabrous to hairy. Stipe hairs sparse to abundant, white to pale red-brown, 0.2–2.0 mm long. Fronds undivided, narrowly obovate to obovate, 9–115 mm long, 3–12 mm wide; apices acute to obtuse; margins entire; bases attenuate to a distinct winged stipe; both surfaces pale green; coriaceous; glabrous or bearing occasional hairs up to 1 mm long on the costa. Hairs either setae, or branched hairs with setiform branches. Hydathodes usually absent or rarely present. Sori subglobose to elliptic, elongated along veins, oblique, 3–7 mm long, in 1–10 pairs in upper half of lamina, lacking hairs. Sporangia 170–350 µm long; spores 25–52 µm diameter.

Distribution: North Island: Volcanic Plateau, Gisborne, Southern North Island.

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

Chatham Islands, Stewart Island, Antipodes Islands, Auckland Islands, Campbell Island.

Altitudinal range: 150–1700 m.

Notogrammitis givenii is rare in the North Island, known only from subalpine and alpine populations in the Raukūmara, Huiarau, Ruahine and Tararua Ranges, growing from 1200 m to almost 1550 m. In the South Island it occurs in alpine and subalpine habitats from north-west Nelson to Fiordland, ranging from 600 m in Fiordland to 1700 m on Aorere Peak, north-west Nelson. It also reaches the Chatham Islands, where it has been collected at 250 m, and the subantarctic islands, where it descends to 150 m on Campbell Island.

Biostatus: Indigenous (Endemic).

Habitat: *Notogrammitis givenii* is found in montane podocarp and broadleaved forest, silver and mountain beech forest, subalpine scrub, tussock grassland, and alpine herbfield. It

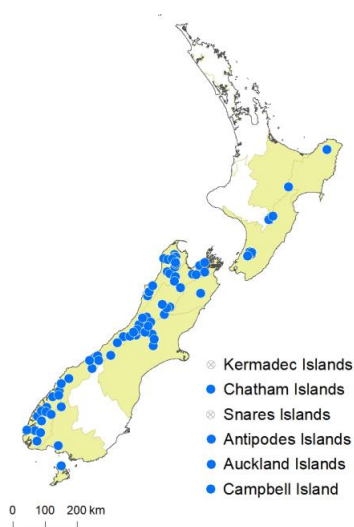


Fig. 74: *Notogrammitis givenii* distribution map based on databased records at AK, CHR & WELT.

grows on damp rock bluffs, on boulders, in rock crevices and sinkholes, and under overhangs on a variety of rock types including basalt, greywacke, granite, schist, gabbro, limestone and marble.

Recognition: *Notogrammitis givenii* is characterised by its usually long-creeping rhizomes, clearly defined and hairy stipes, obovate fronds, and lack of hairs in the sori. It is similar to *N. gunnii* and *N. patagonica*, but is distinguished by its lack of hairs on the lamina surfaces and margins, and in the sori. The alpine species, *N. crassior*, has a much smaller frond (4–42 mm long, 1–5 mm wide; cf. 9–115 mm long, 3–12 mm wide), and is usually glabrous. *N. givenii* can also be mistaken for *N. billardierei*, but the latter generally has an erect or short-creeping rhizome, indistinct stipes, narrowly elliptic rather than obovate laminae, and longer fronds (20–245 cf. 9–115 mm long).

Notes: Specimens from the subantarctic islands (Antipodes Island, Auckland Islands and Campbell Island) differ in some respects from those of more northern locations (North, South, Chatham and Stewart Islands) in having shorter and sometimes glabrous stipes, and smaller fronds. WELT P027507, from Antipodes Island, has rbcL and trnL-trnF sequences identical to those of New Zealand *N. billardierei*, but very different morphology, with rhizomes more widely creeping and stipe hairs, if present, not as dense.



Fig. 75: *Notogrammitis givenii*. Mature plants growing on subalpine rock face.



Fig. 76: *Notogrammitis givenii*. Mature plants growing under subalpine rock overhang.



Fig. 77: *Notogrammitis givenii*. Mature plants with obovate fronds growing from long-creeping rhizomes.



Fig. 78: *Notogrammitis givenii*. Mature plants with obovate fronds growing amongst mosses on a rock face.

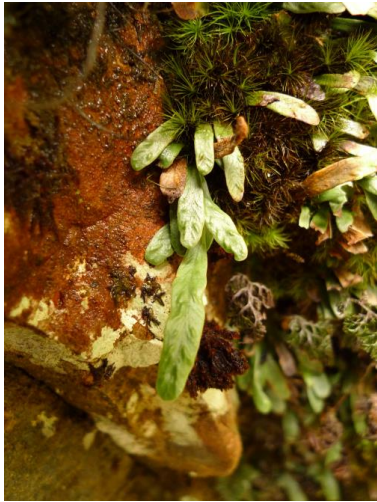


Fig. 79: *Notogrammitis givenii*. Plants with obovate fronds and obtuse apices.



Fig. 80: *Notogrammitis givenii*. Long-creeping rhizome giving rise to fronds with distinct, brown stipes.



Fig. 81: *Notogrammitis givenii*. Fronds tapering to distinct, hairy, brown stipes at their bases.



Fig. 82: *Notogrammitis givenii*. Fertile fronds, lacking hairs on the lamina surface and in the sori.

***Notogrammitis gunnii* (Parris) Parris in Perrie & Parris, New Zealand J. Bot. 50: 468 (2012)**

≡ *Grammitis gunnii* Parris, *Fl. Austral.* 48, 713 (1998)

Holotype: Tasmania, Mt Olympus, R.C. Gunn 1546, NSW 245471!

Etymology: Named in honour of Ronald Campbell Gunn (1808–1881), a South African-born Australian botanist and politician who was the first to collect this species.

Rhizomes long-creeping, bearing scales. Rhizome scales ovate, 1.0–4.3 mm long, 0.5–1.2 mm wide, pale brown, concolorous, non-clathrate. Stipes distinct, or indistinct and winged almost to base, glabrous or hairy. Stipe hairs sparse, white to pale red-brown, 0.3–1.4 mm long. Fronds undivided, narrowly elliptic to narrowly obovate, 8–70 mm long or very rarely to 95 mm long, 2.5–7 mm wide, or very rarely to 8 mm wide; apices acute to obtuse; margins entire; bases attenuate to a distinct stipe or to a winged stipe; both surfaces pale green; herbaceous to coriaceous; bearing very sparse, pale brown hairs up to 1.0 mm long on the margin, costa or lamina surface. Hairs either setae, or branched hairs with setiform branches. Hydathodes absent. Sori globose to elliptic, elongated along veins, 1.5–4 mm long, in 1–7 pairs in mid to upper part of lamina, bearing white or pale brown hairs up to 1.5 mm long. Sporangia 220–320 µm long; spores 35–58 µm diameter.

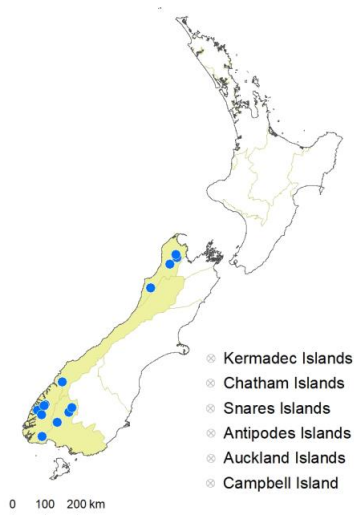


Fig. 83: *Notogrammitis gunnii* distribution map based on databased records at AK, CHR & WELT.

alpine or subalpine zone, and distinguished from *N. givenii* by the presence of short hairs in the sori. It is less easily distinguished from *N. patagonica* but generally has a smaller frond (up to 95 mm long, cf. up to 160 mm long) and shorter, white or pale brown stipe and soral hairs.

Distribution: South Island: Western Nelson, Westland, Southland, Fiordland.

Altitudinal range: 1000–1600 m.

Notogrammitis gunnii is a rare species in New Zealand, confined to areas above the tree-line on geologically old rock formations in north-west Nelson and in the far south of the South Island.

Also Australia (Tasmania).

Biostatus: Indigenous (Non-endemic).

Notogrammitis gunnii was given a conservation status of Data Deficient by de Lange et al. (2018).

Habitat: *Notogrammitis gunnii* favours granite, marble, greywacke and schist outcrops, growing in soil amongst rocks and boulders, in rock crevices, and on cliff faces in subalpine and alpine habitats, often in tussock grassland.

Recognition: *Notogrammitis gunnii* is a poorly known species but is characterised by long-creeping rhizomes, narrowly elliptic to narrowly obovate fronds, hairs on the stipe, and short, white or pale brown hairs in the sori. It is found in the



Fig. 84: *Notogrammitis gunnii*. Mature plant growing in a rock crevice.



Fig. 85: *Notogrammitis gunnii*. Abaxial surface of fertile frond showing white hairs on the lamina surface and around the sori.



Fig. 86: *Notogrammitis gunnii*. Juvenile plants growing amongst bryophytes and stones.



Fig. 87: *Notogrammitis gunnii*. Juvenile plants growing on a sloping rock surface.

***Notogrammitis heterophylla* (Labill.) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 469 (2012)**

- ≡ *Grammitis heterophylla* Labill., *Nov. Holl. Pl.* 2, 90, t. 239 (1807)
- ≡ *Gymnogramma billardierei* Kaulf., *Wesen Farrenkr.* 81 (1827) nom. illeg., nom. nov. pro *Grammitis heterophylla* Labill. 1807
- ≡ *Xiphopteris heterophylla* (Labill.) Spreng., *Syst. Veg.*, ed. 16, 4, 44 (1827)
- ≡ *Polypodium billardierei* (Kaulf.) Fée, *Mém. Foug.*, 5. *Gen. Filic.* 236 (1852) nom. illeg., non *Polypodium billardierei* R.Br. 1810
- ≡ *Ctenopteris heterophylla* (Labill.) Tindale, *Amer. Fern J.* 41: 100 (1951)
Lectotype (selected by Tindale 1961b): Terra Diemen [Tasmania], Herb. Webbium, ex Herb. Labillardière, FI 004208 (!online)
- = *Polypodium grammitidis* R.Br., *Prodr. Fl. Nov. Holland.* 147 (1810)
- ≡ *Grammitis grammitidis* (R.Br.) Keyserl., *Polyp. Herb. Bunge.* 34 (1873)
- ≡ *Ctenopteris grammitidis* (R.Br.) J.Sm., *Hist. Fil.* 185 (1875)
Lectotype (selected by Tindale 1951; see also Parris 1998): Tasmania, Derwent, *R. Brown Iter Austral.* No. 13, 1802–05, BM 001039900!

Etymology: From the Greek *hetero-* (differing) and *-phyllus* (leaved), a reference to the variably shaped fronds in this species.

Vernacular name: comb fern

Rhizomes erect to short-creeping, bearing scales. Rhizome scales narrowly ovate, 1.2–9.6 mm long, 0.3–1.2 mm wide, either pale brown, concolorous, and non-clathrate, or bicolorous with darker clathrate central area and pale brown non-clathrate margins. Stipes 4–50 mm long, black proximally, green distally, distinct, winged at least halfway to base, hairy. Stipe hairs sparse to abundant, white to pale red-brown, 0.2–0.4 mm long. Rachises green, winged throughout. Fronds rarely entire or usually 1–2-pinnatifid, linear to narrowly elliptic, tapering to pinnatifid segments proximally and distally in 2-pinnatifid fronds, 22–440 mm long, 3–80 mm wide, or rarely to 104 mm wide; green on both surfaces; coriaceous; curling when dry; glabrous or bearing occasional hairs 0.1–0.4 mm long, or rarely up to 1 mm long, on the margin, rachis, costa and lamina surface. Primary pinnae in 7–42 pairs below pinnatifid apex, rarely to 50 pairs in etiolated plants, not overlapping, ± oblong in 1-pinnatifid fronds, linear to narrowly elliptic in 2-pinnatifid fronds; the longest primary pinnae near mid-lamina, 3–60 mm long, or rarely to 70 mm long, 1.5–15 mm wide, or rarely to 22 mm wide, apices oblong in 1-pinnatifid fronds, acute in 2-pinnatifid fronds, margins entire or divided more than halfway to the costa into secondary segments, bases decurrent. Secondary segments decreasing in length to each end of primary pinnae; the longest 2–15 mm long, 1–2 mm wide, apices acute. Hairs simple catenate, or branched with catenate or setiform branches. Hydathodes present. Sori elliptic, elongated along veins, 1–2 mm long, in mid to upper part of lamina, lacking hairs. Sporangia 200–320 µm long; spores 37–70 µm diameter.

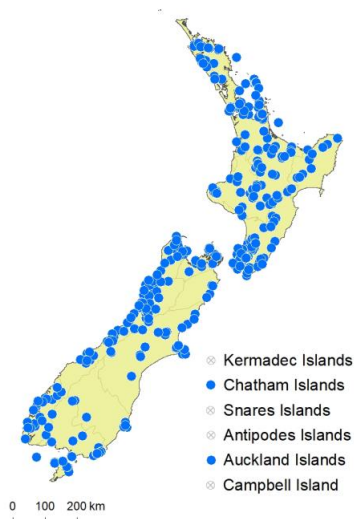


Fig. 88: *Notogrammitis heterophylla* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Northland, Auckland, Volcanic Plateau, Gisborne, Taranaki, Southern North Island.
South Island: Western Nelson, Sounds-Nelson, Marlborough, Westland, Canterbury, Otago, Southland, Fiordland.
Chatham Islands, Solander Island, Stewart Island, Auckland Islands.

Altitudinal range: 0–1150 m.

Notogrammitis heterophylla has been collected in lowland, montane and subalpine areas of the North Island from Kaitiāia to Wellington (and we have also seen it at Unuwahao Bush, Spirits Bay, and Whakaangi, Doubtless Bay). It occurs from about 30 m on the east coast up to 1150 m in the Ruahine Range, but is mostly found above 200 m. In the South Island it is more commonly found in coastal and lowland areas, especially west of the main divide, but reaches over 1000 m in the Cobb Valley, north-west Nelson. It also extends to the Chatham Islands, Stewart Island, and Auckland Islands.

Also Australia (Victoria, Tasmania).

Biostatus: Indigenous (Non-endemic).

Habitat: *Notogrammitis heterophylla* is found in kauri, podocarp, broadleaved and beech forest, under mānuka and kānuka, in coastal scrub, and in subalpine scrub. It is principally an epiphytic species, often associated with a variety of forest mosses, but also grows at the base of trees, on fallen logs, on humus mounds, on rock outcrops and boulders, under overhangs, amongst scoria, on track and stream banks, on wet cliff faces, and on the ground. It has been recorded growing on *Cyathea dealbata*, *Dicksonia squarrosa*, *Agathis australis*, *Ascarina lucida*, *Beilschmiedia tarairi*, *B. tawa*, *Carpodetus serratus*, *Coprosma chathamica*, *C. grandifolia*, *C. lucida*, *C. rotundifolia*, *Coriaria arborea*, *Dacrydium cupressinum*, *Dysoxylum spectabile*, *Fuchsia excorticata*, *Griselinia littoralis*, *Halocarpus kirkii*, *Ixerba brexioides*, *Knightia excelsa*, *Meliccytus ramiflorus*, *Metrosideros umbellata*, *Myrsine australis*, *Neomyrtus pedunculata*, *Olearia avicenniifolia*, *O. colensoi*, *O. furfuracea*, *O. rani*, *Phyllocladus alpinus*, *Pittosporum tenuifolium*, *Podocarpus acutifolius*, *P. totara*, *Prumnopitys ferruginea*, *Pseudopanax colensoi*, *P. crassifolius*, *Pseudowintera colorata*, *Quintinia serrata*, *Schefflera digitata*, *Streblus heterophyllus*, *Weinmannia racemosa*, *W. sylvicola*, and species of Nothofagaceae.

Recognition: *Notogrammitis heterophylla* is usually readily distinguished by its 1–2-pinnatifid fronds. Occasionally young plants have undivided fronds, but these are recognisable by their crenulate margins. All other species of *Notogrammitis* in New Zealand have entire fronds.

Cytology: n = 37 (Brownlie 1958 – as *Ctenopteris heterophylla*).

Hybridisation: There is evidence for hybridisation between *Notogrammitis heterophylla* and *N. billardierei* (CHR 215640, Parris 1977), and between *N. heterophylla* and *N. ciliata* (AK 302263).



Fig. 89: *Notogrammitis heterophylla*. Mature plants with bipinnatifid fronds growing from an erect rhizome.



Fig. 90: *Notogrammitis heterophylla*. Mature plants with bipinnatifid fronds growing from an erect rhizome.



Fig. 91: *Notogrammitis heterophylla*. Young plants with pinnatifid or bipinnatifid fronds.



Fig. 92: *Notogrammitis heterophylla*. Young plants with pinnatifid fronds growing on a clay bank.



Fig. 93: *Notogrammitis heterophylla*. Base of fronds showing the winged stipes and glabrous laminae.



Fig. 94: *Notogrammitis heterophylla*. Abaxial surface of fertile frond with elliptic sori.



Fig. 95: *Notogrammitis heterophylla*. Abaxial surface of bipinnatifid fertile frond with elliptic sori.



Fig. 96: *Notogrammitis heterophylla*. Fertile frond, lacking hairs on the lamina surface and in the sori.

***Notogrammitis patagonica* (C.Chr.) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 469 (2012)**

≡ *Polypodium patagonicum* C.Chr., *Ark. Bot.* 10: 15 (1910)

≡ *Grammitis patagonica* (C.Chr.) Parris in Parris & Given, *New Zealand J. Bot.* 14: 108 (1976)

Lectotype (selected by Parris & Given 1976): South America, Patagonia, Aysén Valley, P. Dusén s.n., 19 Jan. 1897, S-R-5102 (online)

Etymology: From the Latin *patagonicus* (Patagonia), a reference to the original Chilean location from which this species was first described.

Rhizomes long-creeping, bearing scales. Rhizome scales ovate to narrowly ovate, 1.1–4.2 mm long, 0.2–1.1 mm wide, pale red-brown, concolorous, non-clathrate. Stipes 1–30 mm long, black, distinct, not winged, hairy. Stipe hairs abundant, dark red-brown, 0.4–3.0 mm long. Fronds undivided, narrowly obovate, 6–160 mm long, 2–10 mm wide; apices acute to obtuse; margins entire; bases attenuate to a distinct stipe; both surfaces pale green; herbaceous to coriaceous; glabrous or bearing sparse to abundant hairs up to 3 mm long on the margin, costa and lamina surface. Hairs either setae, or branched hairs with setiform branches. Hydathodes usually absent or rarely present. Sori subglobose to elliptic, elongated along veins, slightly oblique, 1–4 mm long, in 1–17 pairs in distal half of lamina, bearing abundant red-brown hairs up to 3 mm long. Sporangia 200–400 µm long; spores 30–60 µm diameter.

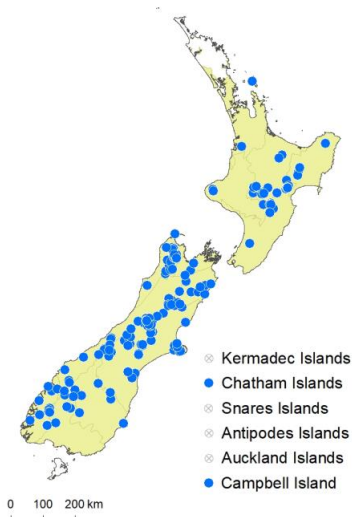


Fig. 97: *Notogrammitis patagonica* distribution map based on databased records at AK, CHR & WELT.

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

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

Chatham Islands, Campbell Island.

Altitudinal range: (10) 250–1635 m.

Notogrammitis patagonica is found only in montane to alpine areas of the North Island from Great Barrier Island, the Raukūmara Ranges and Mt Pirongia south to the Tararua Ranges. It occurs mostly in a zone between 1000 and 1635 m. In the South Island it is more widely distributed in montane and subalpine areas from north-west Nelson to Fiordland and Dunedin, reaching 1450 m in the Arthur Range, north-west Nelson, and descending to 250 m in the Hunters Hills, Canterbury. It is found on the Chatham Islands, where it has been collected at only 10 m (de Lange et al., AK 295983!), and on Campbell Island, but not on the other subantarctic islands.

Also Chile, Argentina (Parris & Given 1976; Perrie & Parris 2012).

Biostatus: Indigenous (Non-endemic).

Habitat: *Notogrammitis patagonica* is found in podocarp and beech forest, subalpine scrub, tussock grassland, and alpine herbfield. It grows on wet cliff and rock faces, in rock crevices, under overhangs, on damp banks and stream banks, and near the base of waterfalls. It favours limestone and marble substrates, but is also found on andesite, basalt, granite, rhyolite, schist, greywacke, mudstone, and sandstone.

Recognition: *Notogrammitis patagonica* is characterised by its long-creeping rhizomes, distinct stipes, narrowly obovate fronds, and the presence of hairs throughout the frond and in the sori. It is distinguished from *N. crassior* by its hairy rather than glabrous fronds, and from *N. givenii* by the presence of hairs on the lamina surfaces and in the sori. It is very similar to *N. gunnii* but generally has a larger frond (up to 160 mm long, cf. up to 95 mm long) and longer, dark red-brown stipe and soral hairs.

Cytology: n = 37 (Brownlie 1961– as *Grammitis ciliata*). The count by Brownlie (1961) is now known to relate to *Notogrammitis patagonica* (see Perrie & Parris 2012, Table 1).

Hybridisation: A single collection (WELT P027882) has the frond morphology of *N. billardiarei* but the soral hairs of *N. patagonica* and is likely to be a hybrid between the two species.



Fig. 98: *Notogrammitis patagonica*. Mature plants growing on a rocky bank.



Fig. 99: *Notogrammitis patagonica*. Mature plants with narrowly obovate fronds growing from long-creeping rhizomes under a rock wall.



Fig. 100: *Notogrammitis patagonica*. Mature plants with narrowly obovate fronds and obtuse apices growing on rock.



Fig. 101: *Notogrammitis patagonica*. Mature plants growing on a rocky bank.



Fig. 102: *Notogrammitis patagonica*. Long-creeping rhizome giving rise to fronds with distinct, brown stripes.



Fig. 103: *Notogrammitis patagonica*. Spathulate fertile frond with long, brown hairs in the sori and on the lamina surface.



Fig. 104: *Notogrammitis patagonica*. Fertile frond with long brown hairs in the sori and on the lamina surface.



Fig. 105: *Notogrammitis patagonica*. Obovate fertile frond with long brown hairs in the sori and on the lamina surface.

***Notogrammitis pseudociliata* (Parris) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 469 (2012)**

≡ *Grammitis pseudociliata* Parris in Parris & Given, *New Zealand J. Bot.* 14: 106 (1976)

Holotype: North Auckland, Mangonui County, Kaiaka, *H. Carse s.n.*, April 1919, CHR 002299!

Etymology: From the Greek *pseudo-* (false) and *ciliata* (the epithet of a different species), alluding to the similarity between the two species.

Rhizomes erect to short-creeping, bearing scales. Rhizome scales narrowly ovate, 1.6–5.4 mm long, 0.3–1.2 mm wide, pale red-brown, concolorous, non-clathrate. Stipes indistinct, winged almost to base, hairy. Stipe hairs abundant, pale red-brown, 0.2–1.8 mm long. Fronds undivided, narrowly elliptic or rarely narrowly obovate, 22–165 mm long, 3–12 mm wide; apices acute to obtuse; margins entire or shallowly scalloped, sometimes undulate; bases attenuate to an indistinct winged stipe; both surfaces pale green; herbaceous; bearing abundant pale brown hairs up to 1.2 mm long on the margins, and up to 1.5 mm long on the midrib and lamina surface. Hairs either setae, or branched hairs with setiform branches. Hydathodes present. Sori elliptic, elongated along veins, oblique, 1.2–5.2 mm long, in 2–32 pairs in mid to upper part of lamina, bearing pale brown hairs up to 1.8 mm long, usually longer than on the lamina surface. Sporangia 130–240 µm long; spores 20–33 µm diameter.

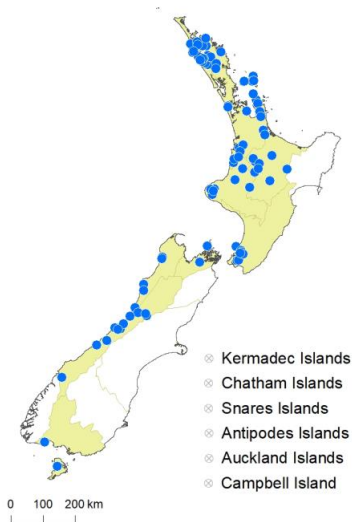


Fig. 106: *Notogrammitis pseudociliata* distribution map based on databased records at AK, CHR & WELT.

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

South Island: Western Nelson, Sounds-Nelson, Westland, Southland.

Stewart Island.

Altitudinal range: 5–975 m.

Notogrammitis pseudociliata occurs in lowland areas, extending locally into montane areas, from Kaitiāia to Lake Taupō and Mt Taranaki, and in the Wellington region. It has also been observed in the southern Ruahine Range (iNaturalist 33414077), but the record is not mapped here. The species ranges from 120 m near Whangaroa Harbour to 975 m on Mt Taranaki and in the Pureora Forest Park, but is absent from much of the eastern North Island. In the South Island it is common only in Westland, with very scattered populations elsewhere on the western side of the island from the Marlborough Sounds to Stewart Island. It grows from near sea level up to 525 m on D'Urville Island.

Also Australia (Tasmania).

Biostatus: Indigenous (Non-endemic).

Habitat: *Notogrammitis pseudociliata* is found in kauri, podocarp, broadleaved, and rarely in beech forest. It is an epiphytic species, almost always growing on podocarp or broadleaved trees, or very rarely on tree ferns or on rock. It has been recorded on *Ackama rosifolia*, *Agathis australis*, *Beilschmiedia tarairi*, *B. tawa*, *Cupressus macrocarpa*, *Dacrycarpus dacrydioides*, *Dacrydium cupressinum*, *Dysoxylum spectabile*, *Elaeocarpus dentatus*, *Fuscospora fusca*, *Hedycarya arborea*, *Ixerba brexioides*, *Melicytus ramiflorus*, *Metrosideros robusta*, *Neomyrtus pedunculata*, *Olearia rani*, *Phyllocladus trichomanoides*, *Podocarpus laetus*, *Prumnopitys ferruginea*, *P. taxifolia*, *Quintinia serrata*, *Syzygium maire*, *Weinmannia racemosa*, *W. sylvicola*, and rarely on tree fern trunks.

Recognition: *Notogrammitis pseudociliata* is characterised by its erect to short-creeping rhizome, lack of distinct stipes, presence of hairs all over the frond and in the sori, presence of hydathodes and its lamina margin, which is often scalloped and undulate. It is almost exclusively epiphytic on podocarp or broadleaved forest trees. The erect rhizome, and presence of hairs on the frond and in the sori distinguish it from all other species except *N. ciliata*. However, *N. pseudociliata* is always epiphytic, and has larger fronds (22–165 mm long, 3–12 mm wide; cf. 9–100 mm long, 1.5–6 mm wide), and lamina margins that are often scalloped and undulate rather than entire and flat.

Cytology: A count of $n = c. 37$ has been reported for this species in Australia (Parris 1998; Tindale & Roy 2002).



Fig. 107: *Notoqrammitis pseudociliata*. Mature plants with undulate fronds growing epiphytically on a trunk.



Fig. 108: *Notoqrammitis pseudociliata*. Mature plants with broad fronds and undulate margins.



Fig. 109: *Notoqrammitis pseudociliata*. Mature plants growing epiphytically on a trunk.



Fig. 110: *Notoqrammitis pseudociliata*. Base of fronds with abundant hairs on the lamina margins.



Fig. 111: *Notoqrammitis pseudociliata*. Fertile frond with abundant hairs all over the lamina.



Fig. 112: *Notoqrammitis pseudociliata*. Fertile frond with abundant hairs all over the lamina.



Fig. 113: *Notogrammitis pseudociliata*. Fertile frond with scalloped margins, bearing shorter hairs on the lamina surface and longer hairs in the sori.



Fig. 114: *Notogrammitis pseudociliata*. Close up of the abaxial lamina surface showing elongated sori, and long hairs on the lamina surface, lamina margins and in the sori.

***Notogrammitis rawlingsii* (Parris) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 469 (2012)**

≡ *Grammitis rawlingsii* Parris in Parris & Given, *New Zealand J. Bot.* 14: 105 (1976)

Holotype: North Auckland, Waipoua Forest, Toatoa Track, G.B. Rawlings s.n., Parris 5242, 10 Jan. 1974, CHR 276247!; isotype: K 0010044395!

Etymology: Named in honour of G.B. (Joe) Rawlings (1906–1978), forest pathologist and botanist in Northland, New Zealand.

Rhizomes short-creeping, bearing scales. Rhizome scales ovate to narrowly ovate, 2.8–7.1 mm long, 0.5–1.0 mm wide, pale brown, concolorous, non-clathrate. Stipes indistinct, winged almost to base, hairy. Stipe hairs sparse, white to pale brown, 0.2–1.7 mm long. Fronds undivided, linear, 31–165 mm long, 3–6 mm wide; apices acute; margins entire; bases attenuate to an indistinct winged stipe; both surfaces pale green; herbaceous; glabrous or bearing sparse pale brown hairs up to 1.3 mm long on abaxial surfaces of margins and midrib. Hairs either setae, or branched hairs with setiform branches. Hydathodes absent. Sori elliptic, elongated along veins, ± parallel to mid-vein or slightly oblique, 2–5 mm long, in 2–44 pairs in mid to upper part of lamina; bearing stout, dark red-brown hairs, up to 0.7 mm long, in and around the soral region. Sporangia 150–210 µm long; spores 21–31 µm diameter.

Distribution: North Island: Northland, Auckland.

Altitudinal range: 20–600 m.

Notogrammitis rawlingsii is a rare fern found only in lowland and montane areas of the North Island from Whakaangi (Parris 12819, to be deposited in AK, not mapped) and Puketi Forest to Coromandel Peninsula and Mt Pirongia, and on Great and Little Barrier Islands.

Biostatus: Indigenous (Endemic).

Notogrammitis rawlingsii was given a conservation status of Naturally Uncommon by de Lange et al. (2018).

Habitat: *Notogrammitis rawlingsii* is confined to kauri or occasionally podocarp or hard beech forest. It usually grows on roots amongst forest mosses, on rotting logs, or sometimes on the ground. It reaches 600 m on Mt Pirongia.

Recognition: *Notogrammitis rawlingsii* is a very distinctive species characterised by its short-creeping rhizome, lack of distinct stipes, linear fronds, and presence of stout, dark red-brown hairs in and around the soral region. It is largely confined to lowland kauri forest in the northern North Island. It

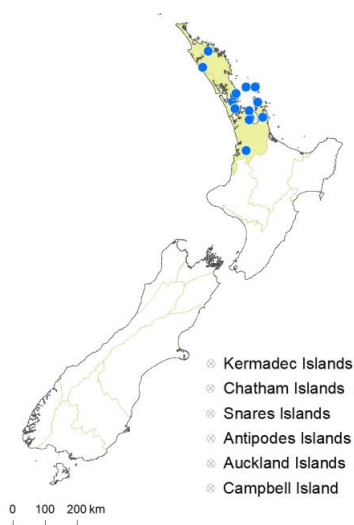


Fig. 115: *Notogrammitis rawlingsii* distribution map based on databased records at AK, CHR & WELT.

is most similar to *N. billardierei*, but distinguished by the characteristic red-brown hairs in the soral region and upright habit.



Fig. 116: *Notogrammitis rawlingsii*. Mature plants with linear fronds growing from erect rhizomes.



Fig. 117: *Notogrammitis rawlingsii*. Mature plants with linear fronds and elongated sori.



Fig. 118: *Notogrammitis rawlingsii*. Close up of elongated sori with stout, red-brown hairs in and around the sori.



Fig. 119: *Notogrammitis rawlingsii*. Close up of elongated sori with stout, red-brown hairs in and around the sori.

***Notogrammitis rigida* (Hombr.) Parris in Perrie & Parris, *New Zealand J. Bot.* 50: 469 (2012)**

≡ *Grammitis rigida* Hombr. in Hombron & Jacquinot, *Voy. Pôle Sud, Bot.* t. 2f (1843)

≡ *Polypodium australe* var. *rigidum* (Hombr.) Cockayne, *Trans. & Proc. New Zealand Inst.* 36: 325 (1904) – as *P. australe rigida*

≡ *Polypodium billardierei* var. *rigidum* (Hombr.) Cockayne, *Trans. & Proc. New Zealand Inst.* 40: 305 (1908)

Lectotype (selected by Brownsey et al. 2021): Nouvelle Zélande [New Zealand], Iles Auckland [Auckland Islands], *Hombron s.n.*, 1841, *Voyage de l’Astrolabe et de la Zélée* 1838–40, P 00632721!

= *Grammitis crassa* Fée, *Mém. Foug.*, 5. *Gen. Filic.* 234 (1852)

Lectotype (selected by Parris & Given 1976): Lord Auckland [Islands], unknown collector, P (*n.v.*); isolectotype: Herb. Webbianum, FI 004210 (!online)

Etymology: From the Latin *rigidus* (stiff), a reference to the nature of the frond in this species.

Rhizomes erect to short-creeping, bearing scales. Rhizome scales narrowly ovate, 8–15 mm long, 1.0–2.4 mm wide, pale brown to red-brown, concolorous, non-clathrate. Stipes indistinct, winged almost to base, glabrous. Fronds undivided, narrowly elliptic to narrowly obovate, 75–220 mm long, 9–20 mm wide; apices acute; margins entire or with occasional projections; bases attenuate to an indistinct winged stipe; dark green adaxially, paler green abaxially; coriaceous; glabrous or bearing sparse brown hairs up to 1.2 mm on the abaxial surface of the midrib and lamina. Hairs simple catenate, or branched with catenate branches. Hydathodes absent. Sori elliptic, elongated along veins, oblique, 2–10 mm long, in 12–30 pairs in mid to upper part of lamina, lacking hairs. Sporangia 240–400 µm long; spores 30–57 µm diameter.

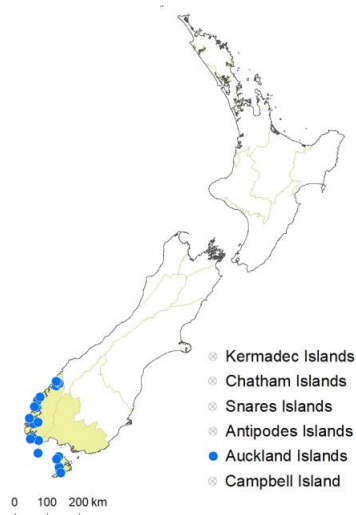


Fig. 120: *Notogrammitis rigida* distribution map based on databased records at AK, CHR & WELT.

wide with occasional marginal projections. It is easily the largest undivided species of the genus in New Zealand and is confined to high rainfall, coastal areas in the far south of the country. It lacks setae and hairs with setiform branches.



Fig. 121: *Notogrammitis rigida*. Mature plant growing epiphytically, with large fronds arising from an erect rhizome.

Distribution: South Island: Southland, Fiordland. Solander Island, Stewart Island, Auckland Islands. Altitudinal range: 0–300 m.

Notogrammitis rigida is a rare fern found only in coastal habitats close to the sea in Southland and Fiordland, and on Solander Island, Stewart Island / Rakiura and the Auckland Islands. It reaches 300 m on Solander Island.

Biostatus: Indigenous (Endemic).

Notogrammitis rigida was given a conservation status of Naturally Uncommon by de Lange et al. (2018).

Habitat: *Notogrammitis rigida* is found in beech, *Olearia colensoi* and *Metrosideros umbellata* forest, or under mānuka. It grows amongst mosses on wet coastal rocks, cliffs and slips, often very close to the sea. It is also epiphytic on *Metrosideros umbellata* or, more rarely, found in the spray zone of waterfalls.

Recognition: *Notogrammitis rigida* is characterised by its erect to short-creeping rhizome, lack of distinct stipes, and more or less glabrous fronds, up to 220 mm long and 20 mm

***Phlebodium* (R.Br.) J.Sm., *J. Bot. (Hooker)* 4: 58 (1841)**

= *Polypodium* sect. *Phlebodium* R.Br. in Bennett et al., *Pl. Jav. Rar.* 1, 4 (1838)

Type taxon: *Phlebodium aureum* (L.) J.Sm.

Etymology: From the Greek *phlebo-* (veined), a reference to the pronounced frond venation.

Epiphytic or rupestral ferns. Rhizomes long-creeping, terete, lacking cavities, not pruinose, scaly. Rhizome scales non-clathrate, squarrose. Fronds monomorphic, articulated to rhizome. Laminae undivided to deeply pinnatifid or pinnatisect, herbaceous to coriaceous, usually glabrous. Veins reticulate, forming 1 to several series of areoles between costa and lobe margin; areoles with 1 or 2 included veinlets, except for 1 row bordering the costa; hydathodes absent. Sori round, superficial, in 1 to several rows either side of midrib, served by 2 veins in each areole, not confluent with age, occurring throughout the lamina; paraphyses absent; exindusiate. Spores monolete, bilaterally symmetrical, verrucate to tuberculate.

Taxonomy: A genus of 4 species (PPG 1 2016).

Distribution: A small genus confined to the New World tropics and subtropics (Mickel & Smith 2004). One species casual in New Zealand.

Biostatus: Exotic; casual.

Table 6: Number of species in New Zealand within *Phlebodium* (R.Br.) J.Sm.

Category	Number
Exotic: Casual	1
Total	1

***Phlebodium aureum* (L.) J.Sm., *J. Bot. (Hooker)* 4: 59 (1841)**

≡ *Polypodium aureum* L., *Sp. Pl.* 1087 (1753)

Lectotype (selected by Proctor 1977): "America", LINN 1251.10 (!online; see Jarvis 2007)

Etymology: From the Latin *aureus* (golden), a reference to the golden-brown rhizome scales in this species.

Vernacular name: golden polypody

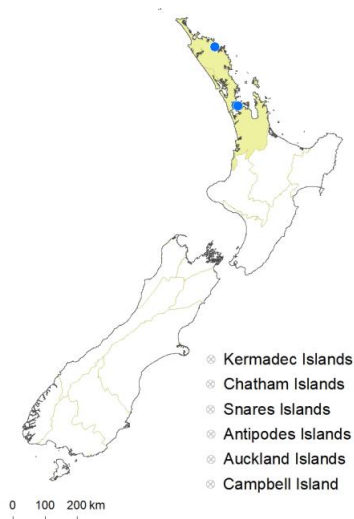


Fig. 122: *Phlebodium aureum* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Northland, Auckland.

Recorded from Kerikeri and Auckland city.

Occurs naturally in tropical and subtropical parts of the Americas (Smith 1993).

Biostatus: Exotic; casual.

Habitat: Recorded as a pot contaminant found in association with cultivated plants purchased from a nursery.

First record: Ogle et al. (2021). Voucher: AK 351756, 2014.

Recognition: *Phlebodium aureum* is recognised by its long-creeping rhizomes, golden-brown rhizome scales, deeply pinnatifid fertile fronds that are glabrous, often glaucous, and lack hydathodes. The veins are reticulate, with several series of areoles between the costa and lobe margin, and one or two included veinlets in each. The sori are round, exindusiate and arranged in one or two rows either side of the costa. The species is very similar to *Polypodium vulgare*, but is distinguished by having the sori served by two veins in each areole rather than just one. It differs from species of *Lecanopteris* in lacking hydathodes on the adaxial lamina surface, and often having sori in more than one row either side

of the costae.



Fig. 123: *Phlebodium aureum*. Herbarium specimen of a plant from Kerikeri, AK 353079/A, showing the base of a pinnatifid fertile frond.

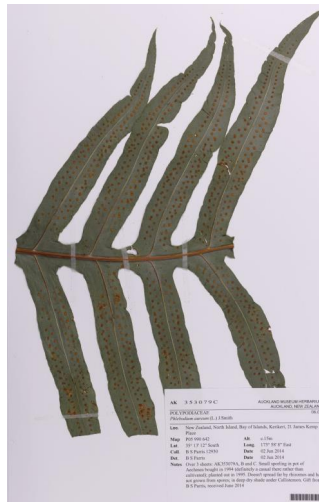


Fig. 124: *Phlebodium aureum*. Herbarium specimen of a fertile frond showing the round sori arranged in two rows either side of the midrib, AK 353079/C.



Fig. 125: *Phlebodium aureum*. Herbarium specimen of a plant from Kerikeri, AK 353079/B, showing the apex of a pinnatifid fertile frond.



Fig. 126: *Phlebodium aureum*. Sterile fronds on a cultivated plant.



Fig. 127: *Phlebodium aureum*. Close up of abaxial lamina surface showing anastomosing veins with two veins in each areole.



Fig. 128: *Phlebodium aureum*. Golden-brown, squarrose scales on long-creeping rhizome.

***Platycterium* Desv., *Mém. Soc. Linn. Paris* 6: 213 (1827)**

Type taxon: *Platycterium alicorne* Desv.

Etymology: From the Greek *platys* (flat or broad), and *keras* (a horn), a reference to the fertile fronds resembling the horns of a stag.

Epiphytic ferns. Rhizomes short-creeping, terete, lacking cavities, not pruinose, scaly. Rhizome scales non-clathrate, chaffy. Fronds dimorphic; basal fronds sterile, cordate, overlapping, appressed, entire or variously lobed, becoming brown with age, forming a 'nest' or 'basket'; upper foliage fronds sterile or fertile, articulated to rhizome, dichotomously branched, strap-like, coriaceous, covered with stellate hairs. Major veins dichotomously branched; minor veins reticulate; areoles with or without free included veinlets; hydathodes absent. Sporangia in dense patches on various parts of the abaxial lamina surface; paraphyses present as stellate hairs; exindusiate. Spores monolete, bilaterally symmetrical, plain to tuberculate.

Taxonomy: A genus of about 18 species (Hennipman & Roos 1982; Bostock & Spokes 1998; PPG 1 2016).

Distribution: Pantropical with one species in South America, six in Africa and Madagascar, eight in south-east Asia, and four in Australia. One species casual in New Zealand.

Biostatus: Exotic; casual.

Table 7: Number of species in New Zealand within *Platycterium* Desv.

Category	Number
Exotic: Casual	1
Total	1

***Platycterium bifurcatum* (Cav.) C.Chr., *Index Filic.* 496 (1906)**

≡ *Acrostichum bifurcatum* Cav., *Anales Hist. Nat.* 1: 105 (1799)

Holotype: Port Jackson [Sydney, New South Wales], L. Née, MA 475361-1,2,3 (!online)

Etymology: From the Latin *bifurcatus* (divided into equal limbs), a reference to the dichotomously branching lamina.

Vernacular names: elk's-horn fern; elkhorn fern; staghorn fern; stag's horn fern

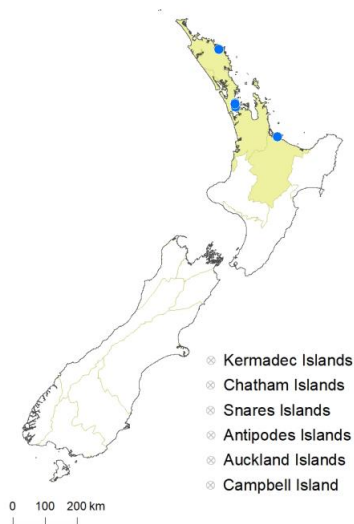


Fig. 129: *Platycterium bifurcatum* distribution map based on databased records at AK, CHR & WELT.

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

Known from Russell, Mt Maunganui and a few collections around Auckland.

Occurs naturally in Australia (Queensland, New South Wales) and Lord Howe Island (Bostock & Spokes 1998).

Biostatus: Exotic; casual.

Habitat: Recorded as a perching epiphyte on branches of *Cordyline australis* (cabbage tree), *Metrosideros excelsa* (pōhutukawa), and *Eriobotrya japonica* (loquat), and the trunk of *Ficus macrophylla* (Moreton Bay fig), in urban areas where it is likely to have spread from nearby cultivated plants.

First record: Heenan et al. (2004). Voucher: CHR 247069, 1971.

Recognition: *Platycterium bifurcatum* is easily recognised by its perching, epiphytic habit and strongly dimorphic fronds, with sterile, appressed, orbicular to reniform, basal 'nest' fronds, and fertile, pendulous, dichotomously dividing, aerial fronds. The lamina segments are strap-shaped and densely covered in stellate hairs. The major veins divide

dichotomously, but the minor veins are reticulate; the areoles lack free included veinlets, and hydathodes are absent. Sporangia form dense patches on the lamina between the apex and the first fork, paraphyses are present as stellate hairs, and indusia are lacking.

Notes: *Platycerium bifurcatum* is treated here as a casual species, but it is becoming more common, particularly in Auckland, and further work is required to determine whether this is the result of deliberate planting, or whether the species is spreading naturally from cultivated plants.



Fig. 130: *Platycerium bifurcatum*. Cultivated plant with dimorphic fronds growing on an exotic oak tree in an urban area.



Fig. 131: *Platycerium bifurcatum*. Cultivated plant showing strongly dimorphic habit, with sterile, reniform, appressed "nest" leaves, and pendulous, dichotomously dividing, fertile fronds.



Fig. 132: *Platycerium bifurcatum*. Cultivated plants with dimorphic fronds growing on an exotic tree in an urban area.



Fig. 133: *Platycerium bifurcatum*. Dichotomously dividing, strap-shaped, fertile fronds, with dense patches of brown sporangia between the apices and first fork.

***Polypodium* L., Sp. Pl. 1082 (1753)**

Type taxon: *Polypodium vulgare* L.

Etymology: From the Greek *polys* (many), and *podion* (foot), a reference to the scars left when fronds fall off the rhizome, suggesting a centipede with many feet.

Vernacular name: polypody

Epiphytic (not NZ), rupestral or terrestrial ferns (NZ). Rhizomes short (not NZ) to long-creeping (NZ), terete, lacking cavities, occasionally pruinose (not NZ), scaly. Rhizome scales non-clathrate, squarrose. Fronds monomorphic to dimorphic, articulated to rhizome. Laminae undivided (not NZ) to 1-pinnatisect (NZ), herbaceous to coriaceous, usually glabrous. Veins reticulate or free; areoles with free included veinlets; hydathodes absent. Sori round or slightly elongate, superficial, arranged in 1 (NZ) or 2 rows (not NZ) either side of midrib, served by 1 vein in each areole, not confluent with age,

occurring throughout the lamina; paraphyses present (not NZ) or absent (NZ); exindusiate. Spores monolete, bilaterally symmetrical, verrucate to tuberculate and sometimes papillate.

Taxonomy: A genus of about 40 species (PPG 1 2016).

This treatment of *Polypodium* follows Brownsey (in Webb et al. 1988) and Brownsey & Smith-Dodsworth (2000) in recognising a single naturalised species in New Zealand. However, Gilbert (1899) described one new species, *Polypodium viride*, and one new variety, *Polypodium vulgare* var. *auritum*, from New Zealand. These taxa were based on specimens collected by Dr C.H.F. Peters, astronomer-in-chief on the Transit of Venus expedition to New Zealand in 1874. Peters was based in Queenstown and whilst waiting for an observatory to be built he collected ferns for Benjamin Gilbert back in America. Some 25 years later Gilbert described a new species and variety based on these collections, but they have been largely ignored ever since.

Morton (1958) wrote a short paper on the two names, having succeeded in locating the Gilbert herbarium, previously thought to have been lost. He illustrated the holotype of *P. viride* and suggested that it was the common polypody of the eastern USA – *Polypodium vulgare* var. *virginianum* (now treated as a distinct tetraploid species, *P. virginianum* L.). Since no other species of *Polypodium* were then known from New Zealand, Morton concluded that Gilbert had described the species from American material inadvertently mixed up with Peters' New Zealand collections. He made no comment about the identity of the other taxon, *P. vulgare* var. *auritum*.

The fact that *Polypodium* is now known to be naturalised in New Zealand, albeit a long way from Queenstown, suggests the possibility that Peters' collection may be the first known record. It also raises the question of whether the more recent collections are correctly identified as *P. vulgare* rather than the closely related *P. virginianum*. However, the latter species can be identified by its very distinctive paraphyses, which are almost as large as the sporangia and characteristically gland-tipped (see Shivas 1961, fig. 16). Morton (1958) noted that these paraphyses were present in the type specimen of *P. viride*, confirming the identity of that plant as *P. virginianum*. However, plants collected in New Zealand recently lack these paraphyses and are a different species. It is very likely, therefore, that Morton was correct, and that *P. viride* is actually an American specimen of *P. virginianum* which became mixed up with Gilbert's New Zealand specimens.

Both of Gilbert's names are here excluded from the New Zealand flora.

Distribution: Widely distributed in the Americas, and across Eurasia extending south to the Himalayas, Taiwan and southern Africa. The majority of species occur in the American tropics. One species naturalised in New Zealand.

Biostatus: Exotic; fully naturalised.

Table 8: Number of species in New Zealand within *Polypodium* L.

Category	Number
Exotic: Fully Naturalised	1
Total	1

Cytology: n = 37, 74; 2n = 74, 111, 148 (Hennipman et al. 1990).

***Polypodium vulgare* L., Sp. Pl. 1085 (1753)**

Lectotype (selected by Jonsell & Jarvis 1993): Herb. Burser XX: 44, UPS (*n.v.*).

Etymology: From the Latin *vulgare* (common), a reference to the plant in its native range.

Vernacular name: common polypody

Rupestal or terrestrial ferns. Rhizomes long-creeping, 4–7 mm diameter, scaly. Rhizome scales non-clathrate, ovate, 2–6 mm long, 0.5–2 mm wide, squarrose, orange-brown, entire or toothed towards the apex. Fronds 85–550 mm long, or rarely 25 mm long. Stipes 10–250 mm long, not winged except near base of lamina, yellow-brown, glabrous. Laminae 1-pinnatisect, ovate to narrowly elliptic, 55–300 mm long, or rarely 17 mm long, 40–120 mm wide, or rarely 14 mm wide, mid-green turning yellow-green with age, herbaceous to coriaceous, glabrous except for widely scattered scales at base. Pinnae in 2–25 pairs, 10–70 mm long, 3–11 mm wide, oblong, apices obtuse, margins minutely serrate to serrate, decurrent at base, adnate to rachis. Veins free or sometimes reticulate, usually forming 1 series of areoles between costa and lobe margin; hydathodes absent. Sori round or slightly elongate, 1–3.5 mm long, superficial and not or only slightly bulging on adaxial surface, in 1 row on either side of the costa, medial or closer to the costa; paraphyses absent; exindusiate.

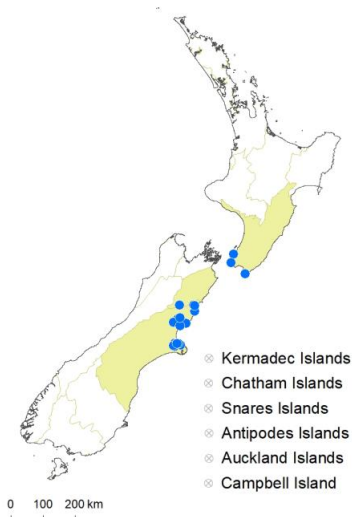


Fig. 134: *Polypodium vulgare* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Southern North Island.
South Island: Marlborough, Canterbury.
Altitudinal range: 0–720 m.

Polypodium vulgare was first recorded in New Zealand from the Port Hills of Christchurch (Lovis 1980). It was first observed in the 1960s and is now spreading aggressively in that area, being widespread from Godley Head to Gebbies Pass, on Quail Island, and on parts of Banks Peninsula. More recently it has also been collected from several sites in Canterbury between Christchurch and Kaikōura, as far inland as Hanmer Springs, and from Hongoeka Bay north of Porirua (Shepherd & Perrie 2006) and Cape Palliser (Perrie et al. 2019). It has also been observed in parts of northern Marlborough (see iNaturalist 51455074, 59294091), but not yet collected, and these localities are not recorded on the distribution map. It occurs from near sea level around Wellington, to over 700 m in the North Canterbury hills.

Occurs naturally in Europe, Asia, southern Africa and Kerguelen Island.

Biostatus: Exotic; fully naturalised.

Habitat: On coastal cliffs, road banks, volcanic rock bluffs, and on greywacke rock under dry scrub or shrub or forest vegetation.

First record: Lovis (1980). Voucher: CHR 323300, 1976.

Recognition: *Polypodium vulgare* is superficially similar to species of *Lecanopteris*. It can be distinguished by the lamina, at least in its lower third, being divided right to the rachis to form distinct pinnae, whereas in *Lecanopteris* the lamina is never more than pinnatifid. Also, the pinna margins are minutely serrate, in contrast to the entire margins in *Lecanopteris*.

It is also very similar to *Phlebodium aureum* but differs from that species in having each sorus served by a single included veinlet in each areole, rather than two.

Cytology: Lovis (1980) determined that plants from the Port Hills were "tetraploid" (i.e. $n = 74$), but no explicit count was given.

Notes: In Europe the *Polypodium vulgare* aggregate consists of three cytologically and morphologically distinct species. Lovis (1980) concluded that the New Zealand plants were not entirely consistent with any of these three taxa, but that their tetraploid nature and micro-morphological characters suggested they were referable to *P. vulgare sens. str.* He postulated that they may not have originated from Europe, and southern Africa is a possible alternative source (Perrie et al. 2019). New Zealand plants lack the distinctive gland-tipped paraphyses of the tetraploid American species, *P. virginianum*.

Polypodium vulgare is a major component of Horny Goat Weed, a Chinese medicine which claims a variety of aphrodisiacal and medical benefits. There is at least one report of deliberate transfer of this species from Christchurch to the Hawke's Bay region to grow for medicinal purposes. Active control of this aggressive weed is being attempted in the Christchurch area, and deliberate dispersal to other parts of the country is illegal.



Fig. 135: *Polypodium vulgare*. Pinnatisect fertile frond with sori bulging on the adaxial surface.



Fig. 136: *Polypodium vulgare*. Abaxial surface of fertile frond showing round, exindusiate sori.



Fig. 137: *Polypodium vulgare*. Adaxial surfaces of pinnatisect fertile fronds.



Fig. 138: *Polypodium vulgare*. Diminutive fertile fronds.



Fig. 139: *Polypodium vulgare*. Stipe of frond articulated to short phylloporia on long-creeping rhizome.



Fig. 140: *Polypodium vulgare*. Abaxial surface of fertile frond showing round to ovate, exindusiate sori.

***Pyrrosia* Mirb. in Lamarck & Mirbel, *Hist. Nat. Vég.* 3, 471 (1802)**

= *Cyclophorus* Desv., *Mag. Neuesten Entdeck. Gesammten Naturk. Ges. Naturf. Freunde Berlin* 5: 300, t. 7, fig. 4 (1811)

= *Niphobolus* Kaulf., *Enum. Filic.* 124 (1824) nom. illeg.

Type taxon: *Pyrrosia chinensis* Mirb. = *Pyrrosia stigmosa* (Sw.) Ching

Etymology: From the Greek *pyrrhos* (tawny), a reference to the colour of the hairs on the frond.

Epiphytic or rupestral ferns. Rhizomes long-creeping (NZ) or short-creeping (not NZ), terete, lacking cavities, not pruinose, densely scaly. Rhizome scales non-clathrate, squarrose or appressed. Fronds monomorphic or dimorphic, articulated to short stalks (phyllopodia) at intervals along the rhizome. Laminae undivided, thick, coriaceous to succulent, covered with stellate hairs. Veins obscure, hydathodes present or absent. Sori round or slightly elongate, superficial or partly impressed into the lamina, arranged in one to many rows either side of midrib, sometimes confluent with age, often confined to distal part of lamina, paraphyses present as stellate hairs, exindusiate. Spores monoletate, bilaterally symmetrical, verrucate to tuberculate.

Taxonomy: A genus of over 50 species (PPG 1 2016).

Pyrrosia was revised by Hovenkamp (1986) and his treatment is followed here. Previously, Allan (1961) had referred the only known New Zealand species to *P. serpens*, but Hovenkamp (1986) recognised it as the endemic species *P. elaeagnifolia*. Traditionally only one species of *Pyrrosia* has been recorded in New Zealand, but Brownsey et al. (2021) reported a collection of *P. serpens* from Dayrell Island in the Kermadec Islands, extending the known distribution of that species from the tropical Pacific into the subtropical zone.

Recent taxonomic studies have subdivided *Pyrrosia* into four or six subgenera (Vasques et al. 2017, Zhou & Zhang 2017). In both of these approaches, the New Zealand species belong to subg. *Niphobolus*. However, within this subgenus, phylogenetic analyses of chloroplast DNA sequences have demonstrated that more investigation is needed to clarify the circumscriptions and relationships of several species, as summarised by Brownsey et al. (2021).

Distribution: *Pyrrosia* is largely confined to the palaeotropics, extending to the south temperate zone in southern Africa, eastern Australia and New Zealand, and to southern China and Japan in the north temperate zone. It reaches its greatest diversity in the Himalayas and south-east Asia (Hovenkamp 1986). Three species in Africa, four in Australia, six in the Pacific, and the majority in Asia from India and China to Malesia and New Guinea (Hovenkamp 1986). Two species indigenous to New Zealand.

Biostatus: Indigenous (Non-endemic).

Table 9: Number of species in New Zealand within *Pyrrosia* Mirb.

Category	Number
Indigenous (Endemic)	1
Indigenous (Non-endemic)	1
Total	2

Recognition: Species of *Pyrrosia* are easily distinguished from other members of the family by their thick, fleshy, undivided fronds, dense covering of fawn-coloured stellate hairs, and exindusiate sori arranged in one to several rows either side of the midrib. Paraphyses are present as stellate hairs (Baayen & Hennipman 1987, pl. 9). Spores are verrucate to tuberculate (Van Uffelen & Hennipman 1985, pl. IX; Large & Braggins 1991).

Cytology: n = 36, 37, 74, 108–111 (Hovenkamp 1986).

***Pyrrosia elaeagnifolia* (Bory) Hovenkamp, *Blumea* 30: 208 (1984)**

as "eleagnifolia"

≡ *Polypodium eleagnifolium* Bory in Duperrey, *Voy. Monde, Crypt.* 259, t. 31, f. 1 (1829) – as *eleagnifolium*

Lectotype (selected by Hovenkamp 1986): Nouvelle Zélande [New Zealand], *Coquille*, Herb. Bory, L 0052079 (!online)

= *Polypodium rupestre* var. *sinuatum* Colenso, *Trans. & Proc. New Zealand Inst.* 17: 257 (1885)

Lectotype (selected by Brownsey & Perrie 2012): Dannevirke, *W. Colenso*, Herb. Cheeseman, AK 850!

Etymology: From *Elaeagnus* (olive), and *folius* (leaf), a reference to the nature of the frond.

Vernacular names: leather-leaf fern; ota

Epiphytic and terrestrial, creeping and climbing ferns. Rhizomes long-creeping, 0.75–2 mm diameter, densely scaly. Rhizome scales peltate, narrowly ovate, 2–7 mm long, 0.5–1 mm wide, squarrose, orange-brown; margins entire or sometimes denticulate. Stipes winged for much of their length and indistinct from the attenuate lamina base. Fronds undivided, very varied in shape; sterile fronds almost orbicular to elliptic, obovate or spatulate, 20–185 mm long (including stipe), 11–31 mm wide; fertile fronds narrowly obovate to spatulate or sometimes narrowly elliptic to narrowly oblong, 30–260 mm long (including stipe), 4–20 mm wide; apex obtuse to rounded, margins entire, base attenuate to an indistinct stipe; dark green, coriaceous to succulent; scattered stellate hairs on adaxial surface, densely covered in fawn or rarely silver-coloured stellate hairs on abaxial surface. Veins obscure, hydathodes absent. Sori round or slightly elongate, 2–4 mm long, superficial or partly impressed into the lamina, not or rarely protuberant on adaxial surface, irregularly arranged in 2–5 rows either side of midrib, rarely almost confluent with age, occasionally confined to distal part of lamina, paraphyses present as stellate hairs, exindusiate.

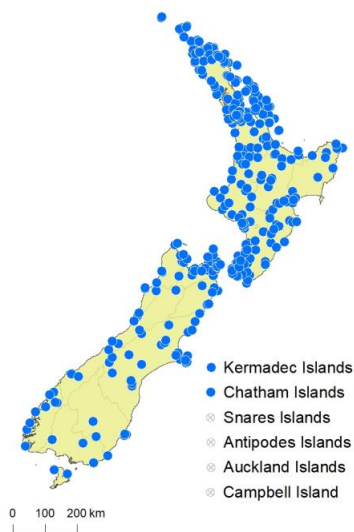


Fig. 141: *Pyrrosia elaeagnifolia* distribution map based on databased records at AK, CHR & WELT.

Biostatus: Indigenous (Endemic).

Habitat: *Pyrrosia elaeagnifolia* is a very tough and adaptable fern, which can survive dry conditions due to its fleshy frond, dense covering of hairs and reduced lamina area. It occurs on rocks, logs, scoria and banks, and as an epiphyte on branches and trunks of native, naturalised and cultivated trees. It is found from exposed coastal situations to sheltered forest, in a wide range of scrub, beech, podocarp and broadleaved forest types.

Recognition: *Pyrrosia elaeagnifolia* is the only species of the genus present on the main islands of New Zealand, and is easily distinguished by its long-creeping rhizome; thick, fleshy, undivided fronds; dense covering of stellate hairs; and exindusiate sori arranged in several rows either side of the midrib.

Pyrrosia elaeagnifolia and *P. serpens* have both been recorded from the Kermadec Islands and characters for distinguishing the two are listed under the latter species.

Very occasional aberrant fronds are found with lobed or bifid fronds, and sometimes the rhizome apices are fastigiately divided into multiple growing tips. The latter has been attributed to a gall-forming mite, *Aceria* sp. (Hovenkamp 1986, p. 178).

Cytology: n = 37 (Brownlie 1961, as *Pyrrosia serpens*).

Notes: New Zealand plants were previously referred to *P. serpens* (G.Forst.) Ching, but that species has ciliate rhizome scales, whereas those in *P. elaeagnifolia* are more or less entire (Hovenkamp 1986; Brownsey et al. 2021). The confusion arose because Forster identified New Zealand as the type locality for *P. serpens*, but his specimen is not conspecific with the species on the main islands of New Zealand. It was probably collected on one of the Pacific islands, and the specimen mislabelled

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

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

Kermadec Islands, Three Kings Islands, Chatham Islands, Stewart Island.

Altitudinal range: 0–860 m.

Pyrrosia elaeagnifolia occurs on the Kermadec and Three Kings Islands, and is common in lowland to montane areas throughout the North Island, from Te Pahi to Wellington. It grows from sea level, reaching 860 m at Huka Falls, near Taupō. It is found in lowland and montane areas throughout the South Island, but is uncommon in inland parts of Otago and south Canterbury. It grows up to 825 m on Mt Furneaux in the Marlborough Sounds and near Mt Cook. It extends to Stewart Island and the Chatham Islands.

Hovenkamp cited one specimen in U from Norfolk Island (A. Cunningham 33), but Green (1994) asserted that only one species, *P. confluens*, was present on the island.

P. elaeagnifolia is treated here as endemic to New Zealand.

(Hovenkamp 1986). *P. serpens* occurs across the Pacific from the Kermadec Islands and Fiji to Pitcairn Island.

Pyrrosia elaeagnifolia has been widely misidentified in earlier New Zealand literature under the names *Polypodium stellatum* Vahl, *Polypodium serpens* G.Forst., *Niphobolus bicolor* Kaulf., and *Polypodium rupestre* R.Br., and combinations based on them.

Cameron (2017) argued that, based on the original spelling of *Elaeagnus latifolia* L., the name “eleagnifolia” is an orthographic error that should be corrected to “elaeagnifolia”. That spelling is adopted here.



Fig. 142: *Pyrrosia elaeagnifolia*. Plants on a trunk, with rounded to ovate sterile fronds, and narrowly elliptic to spatulate fertile fronds, growing from long-creeping rhizomes.



Fig. 143: *Pyrrosia elaeagnifolia*. Fertile fronds densely covering trunk and branches of a forest tree.



Fig. 144: *Pyrrosia elaeagnifolia*. Juvenile, orbicular fronds growing from long-creeping rhizomes on a tree trunk.



Fig. 145: *Pyrrosia elaeagnifolia*. Adaxial surface of entire frond showing scattered stellate hairs.



Fig. 146: *Pyrrosia elaeagnifolia*. Mature plant growing epiphytically on a fallen tree fern trunk.



Fig. 147: *Pyrrosia elaeagnifolia*. Apex of long-creeping rhizome covered in squarrose, narrowly ovate, orange-brown scales.



Fig. 148: *Pyrrosia elaeagnifolia*. Abaxial surface of fronds, showing dense, stellate hairs on sterile fronds, and round, exindusiate, almost confluent sori on fertile fronds.



Fig. 149: *Pyrrosia elaeagnifolia*. Abaxial surface of fertile frond with round to ovate exindusiate sori arranged in several rows, and dense covering of stellate hairs.

***Pyrrosia serpens* (G.Forst.) Ching, *Bull. Chin. Bot. Soc.* 1: 49 (1935)**

as "*serpens*"

≡ *Polypodium serpens* G.Forst., *Fl. Ins. Austr.* 81 (1786)

≡ *Niphobolus serpens* (G.Forst.) Endl., *Prodr. Fl. Norfolk.* 8 (1833)

≡ *Craspedaria serpens* (G.Forst.) C.Presl, *Epimel. Bot.* 263 (1851)

≡ *Cyclophorus serpens* (G.Forst.) C.Chr., *Index Filic.* 201 (1905)

Lectotype (selected by Nicolson and Fosberg 2003): *G. Forster Hb* 273, BM 001048427!

Etymology: From the Latin *serpens* (creeping), a reference to the long-creeping rhizome.

Low epiphytic ferns. Rhizomes long-creeping, 1–1.5 mm diameter, densely scaly. Rhizome scales peltate, ovate, 2–2.8 mm long, 0.7–0.9 mm wide, appressed, dark brown centrally, becoming orange-brown and colourless on the margin; margins dentate to ciliate. Stipes winged for much of their length and indistinct from the attenuate lamina base. Fronds undivided; sterile fronds narrowly elliptic, 90–110 mm long (including stipe), 9–15 mm wide; fertile fronds narrowly elliptic to narrowly ovate or narrowly oblong, 115–175 mm long (including stipe), 7–10 mm wide; apex acute to obtuse, margins entire, base attenuate to an indistinct stipe, dark green, coriaceous to succulent, scattered stellate hairs on adaxial surface, densely covered in mostly silver-coloured stellate hairs on abaxial surface. Veins obscure, hydathodes absent or indistinct. Sori slightly elongate, 3–5 mm long, sunken in the

lamina and protuberant on adaxial surface, arranged in one row either side of midrib, not confluent, confined to distal part of lamina, paraphyses present as stellate hairs, exindusiate.

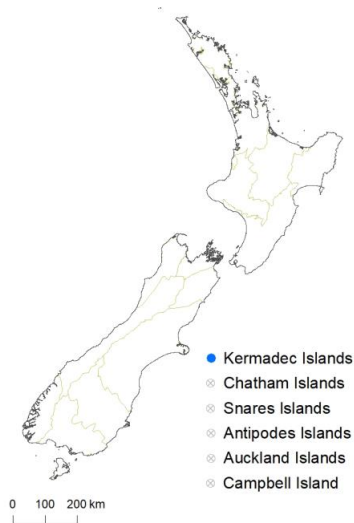


Fig. 150: *Pyrrhosia serpens* distribution map based on databased records at AK, CHR & WELT.

slightly ciliate, and have a conspicuous dark centre, whereas those of *P. elaeagnifolia* are squarrose, narrowly ovate in outline, 2–7 mm long, entire, and concolorous. However, the most obvious distinguishing character is the arrangement of the sori, which, in *P. serpens*, are arranged in one row either side of the midrib, often partly sunken into the lamina and protuberant on the adaxial surface, whereas in *P. elaeagnifolia* they are in two to five rows, superficial on the abaxial surface and not protuberant on the adaxial side.

Notes: *Polypodium serpens* was first described by Forster (1786) and said by him to have come from New Zealand. However the lectotype (BM 001048427) is not conspecific with the species from mainland New Zealand, and almost certainly came from one of the Pacific Islands (Hovenkamp 1986). Carruthers (in Seemann 1865–1873) suggested that the locality should be the Society Islands rather than New Zealand, and a French Polynesian origin for the lectotype appears probable given the distribution of the species and Forster's itinerary; he apparently did not collect during his visit to the Cook Islands (Sykes 2016). Brownsey et al. (2021) showed that the circumscription of *Pyrrhosia serpens* requires further investigation.



Fig. 151: *Pyrrhosia serpens*. Herbarium specimen from Dayrell Is., WELT P028744, showing narrowly elliptic fertile fronds, and large ovate sori in a single row along each margin.

Distribution: Kermadec Islands.

Known only from one collection made at 58 m on Dayrell Island, Herald Islets, Kermadec Islands.

Also occurs in Fiji, Cook Islands, Society Islands, Austral Islands, Gambier Islands, Pitcairn Island and Henderson Island (Hovenkamp 1986). Its occurrence on Easter Island is uncertain. Hovenkamp (1986) cited one 19th century specimen in M from Norfolk Island (*Hügel s.n.*), but Green (1994) asserted that only *P. confluens* was present on the island.

Biostatus: Indigenous (Non-endemic).

Habitat: On the basal trunk of *Metrosideros kermadecensis* in summit forest.

Recognition: *Pyrrhosia serpens* is very similar to *P. elaeagnifolia*, and both species have been recorded from the Kermadec Islands. Fronds of *P. serpens* are generally narrower (9–15 mm wide) and more oblong in shape than those of *P. elaeagnifolia*, which are broader (11–31 mm wide) and more ovate or elliptic in outline. The rhizome scales of *P. serpens* are appressed, ovate in outline, 2–2.8 mm long,

References

- Allan, H.H. 1961: *Flora of New Zealand. Vol. I. Indigenous Tracheophyta: Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledones*. Government Printer, Wellington.
- Armstrong, J.B. 1881: Descriptions of new and rare New Zealand plants. *Transactions and Proceedings of the New Zealand Institute* 13: 335–343.
- Baayen, R.P.; Hennipman, E. 1987: The paraphyses of the Polypodiaceae (Filicales). I. General part. *Beiträge zur Biologie der Pflanzen* 62: 251–316.
- Bennett, J.J.; Brown, R.; Horsfield, T. 1838: *Plantae Javanicae Rariores*. Part 1. W.H. Allen, London.
- Berchtold, F., von; Presl, J.S. 1820: *O přirozenosti Rostlin*. Krause, Prague.
- Bosman, M.T.M. 1986: Original *Microsorium* vs. later *Microsorium* (Polypodiaceae). *Taxon* 35: 590–591.
- Bosman, M.T.M. 1991: A monograph of the fern genus *Microsorium* (Polypodiaceae). *Leiden Botanical Series* 14: 1–161.
- Bostock, P.D.; Spokes, T.M. 1998: Polypodiaceae. In: *Flora of Australia*. Vol. 48. 468–495.
- Brown, R. 1810: *Prodromus Florae Novae Hollandiae et Insulae Van-Diemen*. Johnson, London.
- Brownlie, G. 1954: Introductory note to cyto-taxonomic studies of New Zealand ferns. *Transactions of the Royal Society of New Zealand* 82: 665–666.
- Brownlie, G. 1958: Chromosome numbers in New Zealand ferns. *Transactions of the Royal Society of New Zealand* 85: 213–216.
- Brownlie, G. 1961: Additional chromosome numbers – New Zealand ferns. *Transactions of the Royal Society of New Zealand. Botany* 1: 1–4.
- Brownsey, P.J.; Given, D.R.; Lovis, J.D. 1985: A revised classification of New Zealand pteridophytes with a synonymic checklist of species. *New Zealand Journal of Botany* 23(3): 431–489.
- Brownsey, P.J.; Parris, B.S.; Perrie, L.R. 2021: Taxonomic notes on the New Zealand flora: lectotypes in Polypodiaceae and Blechnaceae. *New Zealand Journal of Botany* 59: 244–249. (Published online 7 Oct. 2020).
- Brownsey, P.J.; Perrie, L.R. 2012: Taxonomic notes on the New Zealand flora: lectotypes and excluded taxa in the fern family Polypodiaceae. *New Zealand Journal of Botany* 50: 179–184.
- Brownsey, P.J.; Shepherd, L.D.; de Lange, P.J.; Perrie, L.R. 2021: *Pyrrosia serpens* (G.Forst.) Ching, a new record for the fern flora of the Kermadec Islands. *New Zealand Journal of Botany* 59(2): 229–243.
- Brownsey, P.J.; Smith-Dodsworth, J.C. 1989: *New Zealand ferns and allied plants*. Bateman, Auckland.
- Brownsey, P.J.; Smith-Dodsworth, J.C. 2000: *New Zealand ferns and allied plants*. Edition 2. David Bateman, Auckland.
- Cameron, E.K. 2017: The correct spelling of the specific epithet of leather-leaf fern (*Pyrrosia elaeagnifolia*). *New Zealand Botanical Society Newsletter* 129: 8–9.
- Cavanilles, A.J. 1799: Descripción de los géneros Goodenia y Scaevola, del *Arundo australis*, y de diez especies del género *Acrostichum*. *Anales de Historia Natural* 1(2): 89–107.
- Cheeseman, T.F. 1906: *Manual of the New Zealand Flora*. Government Printer, Wellington.
- Cheeseman, T.F. 1925: *Manual of the New Zealand Flora*. Edition 2. Government Printer, Wellington.
- Chen, C.-C.; Hyvönen, J.; Schneider, H. 2020: Exploring phylogeny of the microsoroid ferns (Polypodiaceae) based on six plastid DNA markers. *Molecular Phylogenetics and Evolution* 143: <https://doi.org/10.1016/j.ympev.2019.106665>.
- Ching, R.C. 1935: On the genus *Pyrrosia* Mirbel from the mainland of Asia including Japan and Formosa. *Bulletin of the Chinese Botanical Society* 1: 36–72.
- Christensen, C. 1905–1906: *Index Filicum*. Hagerup, Copenhagen.
- Christensen, C. 1910: On some species of ferns collected by Dr. Carl Skottsberg in temperate South America. *Arkiv för Botanik* 10(2): 1–32.
- Cockayne, L. 1904: A botanical excursion during midwinter to the southern islands of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 36: 225–333.
- Cockayne, L. 1908: Some hitherto-unrecorded plant habitats. *Transactions and Proceedings of the New Zealand Institute* 40: 304–315.
-

-
- Cockayne, L. 1909: *Report on a Botanical Survey of Stewart Island*. Government Printer, Wellington, N.Z.
- Colenso, W. 1845: A classification and description of some newly discovered ferns, collected in the Northern Island of New Zealand, in the summer of 1841–2. *Tasmanian Journal of Natural Science* 2: 161–189.
- Colenso, W. 1882: A description of a few new plants from our New Zealand forests. *Transactions and Proceedings of the New Zealand Institute* 14: 329–341.
- Colenso, W. 1885: A description of some newly-discovered and rare indigenous plants; being a further contribution towards the making known the botany of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 17: 237–265.
- Copeland, E.B. 1911: Papuan ferns collected by the Reverend Copeland King. *Philippine Journal of Science. Section C, Botany* 6: 65–92.
- Copeland, E.B. 1916: The genus *Loxogramme*. *Philippine Journal of Science. Section C, Botany* 11: 43–46.
- Copeland, E.B. 1929a: Pteridophyta Novae Caledoniae. *University of California Publications in Botany* 14: 353–369.
- Copeland, E.B. 1929b: The Oriental genera of Polypodiaceae. *University of California Publications in Botany* 16: 45–128.
- Copeland, E.B. 1947: *Genera Filicum*. Chronica Botanica Co., Waltham, Mass.
- Copeland, E.B. 1951: *Grammitis*. *Philippine Journal of Science* 80: 93–271.
- Crookes, M.W. 1963: *New Zealand Ferns, ed. 6. Incorporating illustrations and original work by H.B. Dobbie*. Whitcombe & Tombs, Christchurch.
- Dawson, M.I.; Brownsey, P.J.; Lovis, J.D. 2000: Index of chromosome numbers of indigenous New Zealand pteridophytes. *New Zealand Journal of Botany* 38(1): 25–46.
- de la Sota, E.R. 1961: Polypodiaceae y Grammitidaceae Argentinas. *Opera Lilloana* 5: 5–229.
- de Lange, P.J.; Murray, B.G.; Datson, P.M. 2004: Contributions to a chromosome atlas of the New Zealand flora – 38. Counts for 50 families. *New Zealand Journal of Botany* 42: 873–904.
- de Lange, P.J.; Rolfe, J.R.; Barkla J.W.; Courtney, S.P.; Champion, P.D.; Perrie, L.R.; Beadel, S.N.; Ford, K.A.; Breitwieser, I.; Schönberger, I.; Hindmarsh-Walls, R.; Heenan, P.B.; Ladley, K. 2018: Conservation status of New Zealand indigenous vascular plants, 2017. *New Zealand Threat Classification Series* No. 22.
- Desvaux, N.A. 1811: Observations sur quelques nouveaux genres de fougères et sur plusieurs espèces nouvelles de la même famille. *Magazin für die neuesten Entdeckungen in der gesammten Naturkunde, Gesellschaft Naturforschender Freunde zu Berlin* 5: 297–330.
- Desvaux, N.A. 1827: Prodrome de la famille des fougères. *Mémoires de la Société Linnéenne de Paris* 6: 171–337.
- Duperrey, L.I. 1829: *Voyage autour de monde, Cryptogamie*. Bertrand, Paris.
- Endlicher, S.F.L. 1833: *Prodromus Florae Norfolkicae*. Beck, Wien.
- Fée, A.L.A. 1852: *Mémoires sur les familles des fougères. 5. Genera Filicum*. Baillière, Paris.
- Forster, J.G.A. 1786: *Florulae Insularum Australium Prodromus*. Dietrich, Göttingen.
- Gilbert, B.D. 1899: Two new Polypodia from New Zealand. *Bulletin of the Torrey Botanical Club* 26: 316–317.
- Green, P.S. 1994: Polypodiaceae. In: Wilson, A.J.G. (ed.) *Flora of Australia*. Vol. 49. Australian Government Publishing Service, Canberra. 571–576.
- Heenan, P.B.; de Lange, P.J.; Cameron, E.K.; Ogle, C.C.; Champion, P.D. 2004: Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 2001–2003. *New Zealand Journal of Botany* 42: 797–814.
- Heenan, P.B.; de Lange, P.J.; Cameron, E.K.; Parris, B.S. 2008: Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 2004–06. *New Zealand Journal of Botany* 46: 257–283.
- Hennipman, E.; Roos, M.C. 1982: A monograph of the fern genus *Platyserium* (Polypodiaceae). *Verhandelingen der Koninklijke Nederlandse Akademie van Wetenschappen, Afd. Natuurkunde Series 2, 80*: 1–126.
-

-
- Hennipman, E.; Veldhoen, P.; Kramer, K.U. 1990: Polypodiaceae. In: Kramer, K.U.; Green, P.S. *Pteridophytes and gymnosperms*. Vol. 1. In: Kubitzki, K. (ed.) *The Families and Genera of Vascular Plants*. Springer-Verlag, Berlin.
- Hombron, J.B.; Jacquinot, C. 1843–1853: *Botanique, Atlas*. Dumont D'Urville, J.S.C. (ed.) *Voyage au Pôle Sud et dans l'Océanie, sur les Corvettes l'Astrolabe et la Zélée: exécuté par ordre du roi pendant les années 1837-1838-1839-1840*. Gide & Baudry, Paris.
- Hooker, J.D. 1854–1855: *The Botany of the Antarctic Voyage of H.M. Discovery Ships Erebus and Terror, in the years 1839–1843, under the command of Captain Sir James Clark Ross*. II. Flora Novae-Zelandiae. Part II. Flowerless plants. Lovell Reeve, London.
- Hooker, J.D. 1886–1887: *Hooker's Icones Plantarum; or Figures, with Brief Descriptive Characters and Remarks of New or Rare Plants*. Vol. 17. Williams and Norgate, London.
- Hooker, W.J. 1841: *Icones Plantarum*. Vol. 5. Hippolyte Baillière, London.
- Hooker, W.J. 1862: *Garden Ferns*. Lovell Reeve, London.
- Hovenkamp, P.H. 1984: Some new names and combinations in *Pyrrosia* Mirbel (Polypodiaceae). *Blumea* 30(1): 207–208.
- Hovenkamp, P.H. 1986: A monograph of the fern genus *Pyrrosia* (Polypodiaceae). *Leiden Botanical Series* 9: 1–310.
- Jacquin, N.J. 1787: *Collectanea ad botanicam, chemiam, et historiam naturalem spectantia, cum figuris*. Vol. 1. Vienna.
- Jarvis, C.E. 2007: *Order out of chaos: Linnaean plant names and their types*. Linnean Society of London in association with the Natural History Museum.
- Jones, S. 1861: *Handbook to the ferns of New Zealand*. John Varty, Auckland.
- Jonsell, B.E.; Jarvis, C.E. 1993: In: Jarvis, C.E.; Barrie, F.R.; Allan, D.M.; Reveal, J.L. (ed.) *A list of Linnaean generic names and their types. Regnum Vegetabile*. Vol. 127. 1–100.
- Kaulfuss, G.F. 1824: *Enumeratio Filicum*. Cnobloch, Leipzig.
- Kaulfuss, G.F. 1827: *Das Wesen der Farrenkräuter*. Cnobloch, Leipzig.
- Keyserling, A.F.M.L.A von 1873: *Polypodiacea et Cyatheacea herbaria bungeani*. Engelmann, Leipzig.
- Kirk, T. 1875: On the botany of the Great Barrier Island. *Transactions and Proceedings of the New Zealand Institute* 1 (ed.2): 88–101.
- Kirk, T. 1885: On the ferns and fern allies of Stewart Island. *Transactions and Proceedings of the New Zealand Institute* 17: 228–234.
- Kreier, H.-P.; Schneider, H. 2006: Reinstatement of *Loxogramme dictyopteris*, based on phylogenetic evidence, for the New Zealand endemic fern, *Anarthropteris lanceolata* (Polypodiaceae, Polypodiidae). *Australian Systematic Botany* 19: 309–314.
- Labillardière, J.J.H. de 1806–1807: *Novae Hollandiae Plantarum Specimen*. Vol. 2. Huzard, Paris.
- Lamarck, J.B.A.P.M de; Mirbel, C.F.B. de 1802: *Histoire naturelle des végétaux, classés par familles*. Vol. 3. Crapelet, Paris.
- Large, M.F.; Braggins, J.E. 1991: *Spore atlas of New Zealand ferns and fern allies*. SIR Publishing, Wellington.
- Large, M.F.; Braggins, J.E.; Green, P.S. 1992a: A new combination for *Polypodium pustulatum* Forster f. (Polypodiaceae). *New Zealand Journal of Botany* 30: 207–208 (372).
- Large, M.F.; Braggins, J.E.; Green, P.S. 1992b: The identity of *Polypodium pustulatum* Forst.f. (Polypodiaceae). *Kew Bulletin* 47: 121–127.
- Lellinger, D.B. 1972: A revision of the fern genus *Niphidium*. *American Fern Journal* 62: 101–120.
- Link, J.H.F. 1841: *Filicum species in horto regio botanico Berolinensi cultae*. Veit, Berlin.
- Linnaeus, C. 1753: *Species Plantarum*. Impensis Laurentii Salvii, Stockholm.
- Lovis, J.D. 1980: A puzzling *Polypodium* on the Port Hills. *Canterbury Botanical Society Journal* 14: 55–57.
- Melvaine, A.T. 1936: Checklist of New South Wales pteridophytes. *Proceedings of the Linnean Society of New South Wales* 61: 111–121.
- Mettenius, G.H. 1857: Über einige Farngattungen. I. *Polypodium*. *Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft* 2: 1–138.
- Mettenius, G.H. 1861: Filices Novae Caledoniae a Cl. Viellard collectae. *Annales des Sciences Naturelles; Botanique sér. 4, 15*: 55–91.
-

-
- Mickel, J.T.; Smith, A.R. 2004: The Pteridophytes of Mexico. *Memoirs of the New York Botanical Garden* 88: 1–1054.
- Moore, T. 1857–1862: *Index Filicum*. Pamplin, London.
- Morton, C.V. 1958: The identity of *Polypodium viride* Gilbert. *American Fern Journal* 48: 75–77.
- Morton, C.V. 1973: Studies of fern types, II. *Contributions from the United States National Herbarium* 38: 215–281.
- Mueller, F.J.H. 1864: *The vegetation of the Chatham Islands*. Government Printer, Melbourne.
- Nicolson, D.H.; Fosberg, F.R. 2003: The Forsters and the Botany of the Second Cook Expedition (1772–1775). *Regnum Vegetabile* 139: 1–760.
- Nooteboom, H.P. 1997: The microsorioid ferns (Polypodiaceae). *Blumea* 42: 261–395.
- Ogle, C.C.; de Lange, P.J.; Cameron, E.K.; Parris, B.S.; Champion, P.D. 2021: Checklist of dicotyledons, gymnosperms and pteridophytes naturalised or casual in New Zealand: additional records 2007–2019. *Perspectives in Biosecurity Research Series* 5: 45–116.
- Parris, B.S. 1977: A naturally occurring intergeneric hybrid in Grammitidaceae (Filicales): *Ctenopteris heterophylla* × *Grammitis billardieri*. *New Zealand Journal of Botany* 15: 597–599.
- Parris, B.S. 1990: Grammitidaceae. In: Kramer, K.U.; Green, P.S. *Pteridophytes and gymnosperms*. Vol. 1. In: Kubitzki, K. (ed.) *The Families and Genera of Vascular Plants*. Springer-Verlag, Berlin.
- Parris, B.S. 1998: Grammitidaceae. In: *Flora of Australia*. Vol. 48. 450–468.
- Parris, B.S.; Given, D.R. 1976: A taxonomic revision of the genus *Grammitis* Sw. (Grammitidaceae : Filicales) in New Zealand. *New Zealand Journal of Botany* 14: 85–111.
- Perrie, L.R.; Field, A.R.; Ohlsen, D.J.; Brownsey, P.J. 2021: Expansion of the fern genus *Lecanopteris* to encompass some species previously included in *Microsorium* and *Colysis* (Polypodiaceae). *Blumea* 66: 242–248.
- Perrie, L.R.; Giller, M.; Carter, D.; Shanks, A.; Brownsey, P.J. 2019: The fern *Polypodium vulgare* as a weed in New Zealand. *Canterbury Botanical Society Journal* 50: 75–83.
- Perrie, L.R.; Parris, B.S. 2012: Chloroplast DNA sequences indicate the grammitid ferns (Polypodiaceae) in New Zealand belong to a single clade, *Notogrammitis* gen. nov. *New Zealand Journal of Botany* 50(4): 457–472.
- Pichi Sermolli, R.E.G. 1951: Notes on some Australian ferns. *Webbia* 8: 201–223.
- Pichi Sermolli, R.E.G. 1970: A provisional catalogue of the family names of living pteridophytes. *Webbia* 25(1): 219–297.
- Pichi Sermolli, R.E.G. 1973: Fragmenta Pteridologiae IV. *Webbia* 28: 445–477.
- Pichi Sermolli, R.E.G. 1975: Fragmenta Pteridologiae V. *Webbia* 29: 1–16.
- Pichi Sermolli, R.E.G. 1978: The botanical collections (Pteridophyta and Spermatophyta) of the AMF Mares – G.R.S.T.S. Expedition to Patagonica, Tierra del Fuego and Antarcitica. *Webbia* 32: 455–534.
- PPG 1 2016: A community-derived classification for extant lycophytes. *Journal of Systematics and Evolution* 54(6): 563–603.
- Presl, C.B. 1836: *Tentamen Pteridographiae*. Haase, Prague.
- Presl, C.B. 1851: *Epimeliae botanicae*. Haase, Prague.
- Presl, J.S.; Presl, C.B. 1822 [1832]: *Deliciae Pragensis*. Calve, Prague.
- Proctor, G.R. 1977: Pteridophyta. In: Howard, R.A. *Flora of the Lesser Antilles*. Arnold Arboretum, Harvard University, Jamaica Plain, Mass.
- Ranker, T.A.; Smith, A.R.; Parris, B.S.; Geiger, J.M.O.; Haufler, C.H.; Straub, S.C.K.; Schneider, H. 2004: Phylogeny and evolution of grammitid ferns (Grammitidaceae): a case of rampant morphological homoplasy. *Taxon* 53: 415–428.
- Reinwardt, C.G.C. 1825: Verbesserungen und Druckfehler. *Flora oder allgemeine botanische Zeitung* 8(3): 47–48.
- Richard, A. 1832: Essai d'une Flore de la Nouvelle Zélande. In: Dumont d'Urville, J. *Voyage de découvertes de l'Astrolabe*. Botanique. Tastu, Paris.
- Rourke, J.P.; Schelpe, E.A.C.L.E. 1978: The identity of *Polypodium poeppigianum* Mett. (Filices). *Journal of South African Botany* 44: 419–420.
-

-
- Schneider, H.; Kreier, H.-P., Perrie, L.R.; Brownsey, P.J. 2006: The relationships of *Microsorium* (Polypodiaceae) species occurring in New Zealand. *New Zealand Journal of Botany* 44: 121–127.
- Schneider, H.; Smith, A.R.; Cranfill, R.; Hildebrand, T.E.; Haufler, C.H.; Ranker, T.A. 2004: Unraveling the phylogeny of polygrammoid ferns (Polypodiaceae and Grammitidaceae): exploring aspects of the diversification of epiphytic plants. *Molecular Phylogenetics and Evolution* 31: 1041–1063.
- Seemann, B. 1865–1873: *Flora Vitiensis: a description of the plants of the Viti or Fiji Islands with an account of their history, uses, and properties*. Reeve & Co., London.
- Shepherd, L.D.; Perrie, L.R. 2006: *Polypodium vulgare*: a new weed for Wellington. *Wellington Botanical Society Newsletter September 2006*: 15.
- Shivas, M.G. 1961: Contribution to the cytology and taxonomy of species of *Polypodium* in Europe and America. I. Cytology. *Journal of the Linnean Society. Botany* 58: 13–25.
- Smith, A.R. 1993: Polypodiaceae. In: Flora of North America Editorial Committee *Flora of North America. Vol. 2. Pteridophytes and Gymnosperms*. Oxford University Press, New York.
- Smith, A.R.; Pryer, K.M.; Schuettpelz, E.; Korall, P.; Schneider, H.; Wolf, P.G. 2006: A classification for extant ferns. *Taxon* 55(3): 705–731.
- Smith, J. 1841: An arrangement and definition of the genera of ferns, with observations on the affinities of each genus. *Journal of Botany (Hooker)* 4: 38–70.
- Smith, J. 1846: An enumeration of ferns cultivated in the Royal Gardens at Kew, in December 1845: with characters and observations on some of the genera and species. *Companion to the Botanical Magazine New Series* 2: 7–39.
- Smith, J. 1875: *Historia Filicum; an exposition of the nature, number, and organography of ferns*. Macmillan, London.
- Sprengel, K.P.J. 1827: *Systema vegetabilium*. Vol. 4. Dieterich, Göttingen.
- Sundue, M.; Parris, B.S.; Ranker, T.A.; Smith, A.R.; Fujimoto, E.L.; Zamora-Crosby, D.; Morden, C.W.; Chiou, W.-L.; Chen, C.-W.; Rouhan, G.; Hirai, R.Y.; Prado, J. 2014: Global phylogeny and biogeography of grammitid ferns (Polypodiaceae). *Molecular Phylogenetics and Evolution* 81: 195–206.
- Sykes, W.R. 2016: *Flora of the Cook Islands*. National Tropical Botanical Garden, Kalaheo, Kauaʻi, Hawaiʻi.
- Testo, W.L.; Field, A.R.; Sessa, E.B.; Sundue, M. 2019: Phylogenetic and morphological analyses support the resurrection of *Dendroconche* and the recognition of two new genera on Polypodiaceae subfamily Microsoroideae. *Systematic Botany* 44(4): 737–752.
- Tindale, M.D. 1951: Notes on three Australasian ferns. *American Fern Journal* 41: 97–106.
- Tindale, M.D. 1960: Vein patterns in *Microsorium scandens* and its allies. *American Fern Journal* 50: 241–245.
- Tindale, M.D. 1961a: Grammitidaceae. *Contributions from the New South Wales National Herbarium, Flora Series* 209: 15–23.
- Tindale, M.D. 1961b: Polypodiaceae. *Contributions from the New South Wales Herbarium, Flora Series* 210: 24–46.
- Tindale, M.D. 1961c: Studies in Australian Pteridophytes. No. 3. *Contributions from the New South Wales National Herbarium* 3: 88–92.
- Tindale, M.D.; Roy, S.K. 2002: A cytotaxonomic survey of the Pteridophyta of Australia. *Australian Systematic Botany* 15: 839–937.
- Van Uffelen, G.A.; Hennipman, E. 1985: The spores of *Pyrrosia* Mirbel (Polypodiaceae), a SEM study. *Pollen et Spores* 27: 155–198.
- Vasques, D.T.; Ebihara, A.; Ito, M. 2017: The felt fern genus *Pyrrosia* Mirbel (Polypodiaceae): a new subgeneric classification with a molecular phylogenetic analysis based on three plastid markers. *Acta Phytotaxonomica et Geobotanica* 68: 65–82.
- Webb, C.J.; Sykes, W.R.; Garnock-Jones, P.J. 1988: *Flora of New Zealand. Vol. IV. Naturalised Pteridophytes, Gymnosperms, Dicotyledons*. Botany Division DSIR, Christchurch.
- Willdenow, C.L. 1810: *Species Plantarum*. Vol. 5 (1). G.C. Nauk, Berlin.
- Zhou, X.-M.; Zhang, L.-B. 2017: Nuclear and plastid phylogenies suggest ancient intersubgeneric hybridization in the fern genus *Pyrrosia* (Polypodiaceae), with a classification of *Pyrrosia* based on molecular and non-molecular evidence. *Taxon* 66(5): 1065–1084.
-

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 Miles Giller for several new records and specimens of *Polypodium vulgare* and *Notogrammitis ciliata* collected in north Canterbury, to staff at CHR for the preparation of maps and for assistance in editing and formatting the text, and to Michael Sundue 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

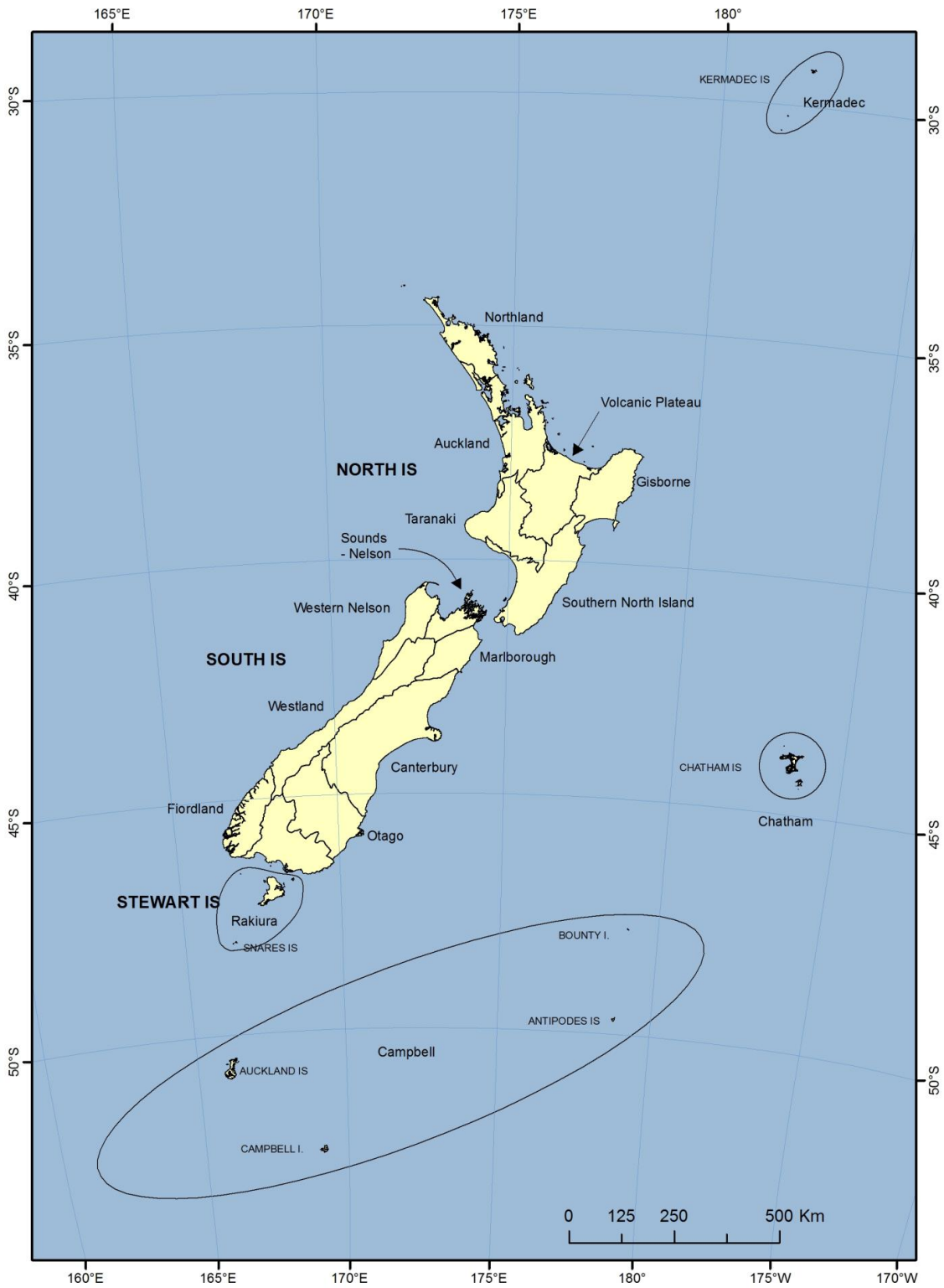
PatB@tepapa.govt.nz

LeonP@tepapa.govt.nz

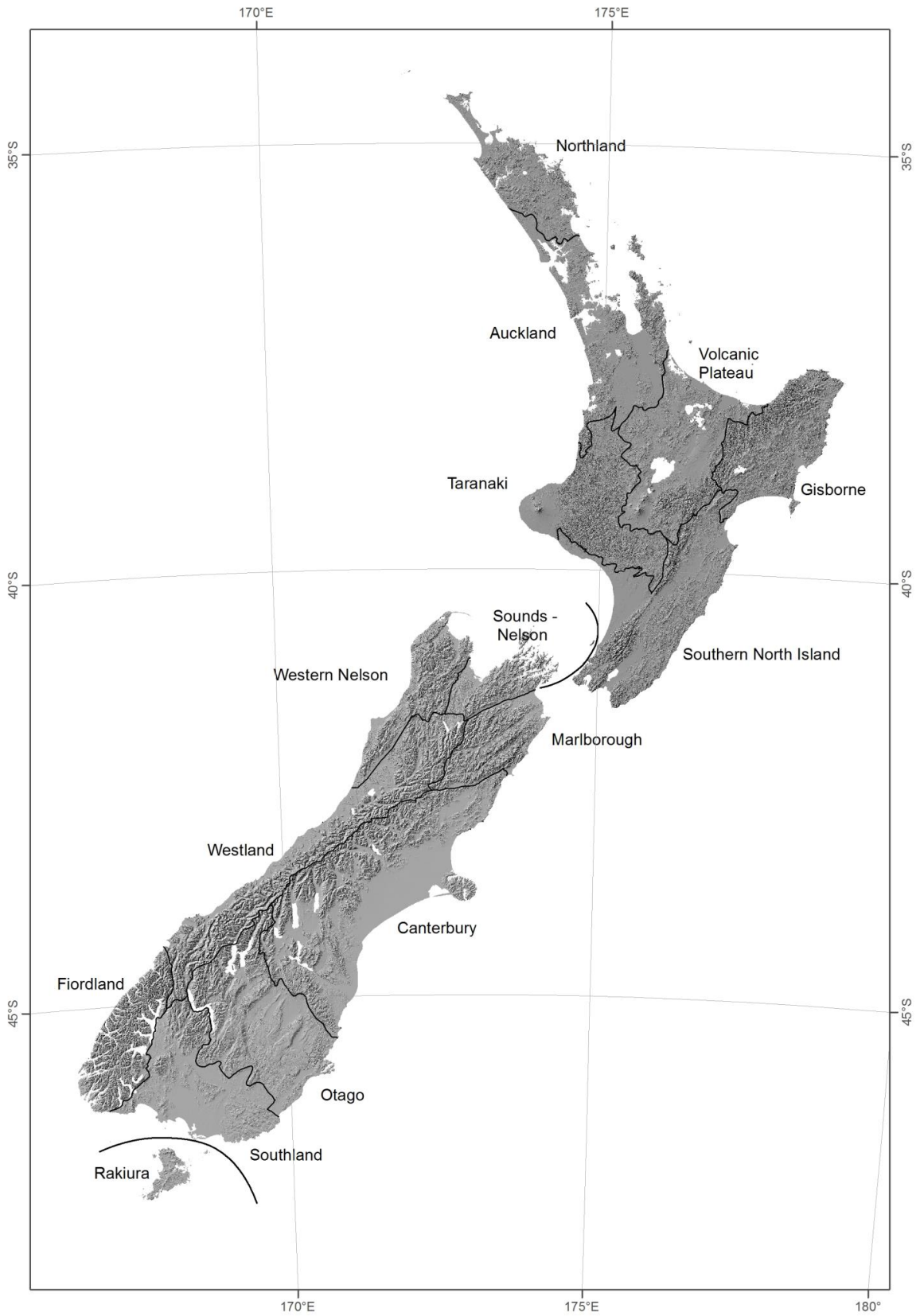
B.S. Parris

Fern Research Foundation, 21 James Kemp Place, Kerikeri, Bay of Islands

barbara2parris@gmail.com



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.

- Acrostichum bifurcatum* Cav. 48
Anarthropteris Copel. 13
Anarthropteris dictyopteris (Mett.) Copel. 14
Anarthropteris lanceolata (J.Sm.) L.B.Moore 14
Anarthropteris lanceolata (J.Sm. ex Hook.f.) Pic.Serm. 14
Asplenium angustifolium Jacq. 20
Chrysopteris billardierei (R.Br.) Link 7
Craspedaria serpens (G.Forst.) C.Presl 56
Ctenopteris grammitidis (R.Br.) J.Sm. 35
Ctenopteris heterophylla (Labill.) Tindale 35
Cyclophorus Desv. 53
Cyclophorus serpens (G.Forst.) C.Chr. 56
Dendroconche Copel. 4
Dendroconche scandens (G.Forst.) Testo, Sundue, & A.R.Field 11
Dictymia lanceolata Hook.f. 14
Dictyopteris lanceolata J.Sm. 14
Drynaria billardierei (R.Br.) J.Sm. 7
Drynaria scandens (G.Forst.) Fée 11
Grammitis armstrongii Tindale 28
Grammitis australis R.Br. 22
Grammitis australis var. *alpina* S.Jones 28
Grammitis australis var. *villosa* Hook.f. 25
Grammitis billardierei Willd. 22
Grammitis billardierei var. *magellanica* (Desv.) de la Sota 20
Grammitis ciliata Colenso 25
Grammitis crassa Fée 44
Grammitis givenii Parris 31
Grammitis grammitidis (R.Br.) Keyserl. 35
Grammitis gunnii Parris 33
Grammitis heterophylla Labill. 35
Grammitis humilis Hombr. 22
Grammitis magellanica Desv. 20
Grammitis magellanica subsp. *nothofageti* Parris 20
Grammitis patagonica (C.Chr.) Parris 38
Grammitis poeppigiana (Mett.) Pic.Serm. 20
Grammitis pseudociliata Parris 41
Grammitis pumila J.B.Armstr. 28
Grammitis rawlingsii Parris 43
Grammitis rigida Hombr. 44
Gymnogramma billardierei Kaulf. 35
Lecanopteris Reinw. 1–3, 4, 8, 11, 15, 51
Lecanopteris novae-zealandiae (Baker) Perrie & Brownsey 1, 3, 5
Lecanopteris pustulata (G.Forst.) Perrie & Brownsey 1, 3, 5, 7
Lecanopteris pustulata (G.Forst.) Perrie & Brownsey subsp. *pustulata* 8
Lecanopteris scandens (G.Forst.) Perrie & Brownsey 1, 3, 5, 11
Loxogramme (Blume) C.Presl 1, 2, 13
Loxogramme dictyopteris (Mett.) Copel. 1, 14, 14
Microsorium diversifolium (Willd.) Copel. 7
Microsorium novae-zealandiae (Baker) Copel. 5
Microsorium pustulatum (G.Forst.) Copel. 7
Microsorium scandens (G.Forst.) Tindale 11
Niphidium J.Sm. 1, 2, 17
Niphidium crassifolium (L.) Lellinger 1, 17
Niphobolus Kaulf. 53
Niphobolus serpens (G.Forst.) Endl. 56
Notogrammitis Parris 1, 2, 18, 21, 29, 36
Notogrammitis angustifolia (Jacq.) Parris 1, 20, 23, 29
Notogrammitis angustifolia subsp. *nothofageti* (Parris) Parris 20
Notogrammitis billardierei (Willd.) Parris 1, 21, 22, 32, 36, 39, 44
Notogrammitis ciliata (Colenso) Parris 1, 25, 36, 41, 63
Notogrammitis crassior (Kirk) Parris 1, 28, 32, 39
Notogrammitis givenii (Parris) Parris 1, 23, 29, 31, 34, 39
Notogrammitis gunnii (Parris) Parris 1, 26, 29, 32, 33, 39
Notogrammitis heterophylla (Labill.) Parris 1, 23, 26, 35
Notogrammitis patagonica (C.Chr.) Parris 1, 23, 26, 29, 32, 34, 38
Notogrammitis pseudociliata (Parris) Parris 1, 26, 41
Notogrammitis rawlingsii (Parris) Parris 1, 43
Notogrammitis rigida (Hombr.) Parris 1, 44
Phlebodium (R.Br.) J.Sm. 1, 2, 46
Phlebodium aureum (L.) J.Sm. 1, 46, 51
Phymatodes billardierei (R.Br.) C.Presl 7
Phymatodes diversifolium (Willd.) Pic.Serm. 7
Phymatodes novae-zealandiae (Baker) Pic.Serm. 5
Phymatodes scandens (G.Forst.) C.Presl 11
Phymatosorus diversifolius (Willd.) Pic.Serm. 7
Phymatosorus novae-zealandiae (Baker) Pic.Serm. 5
Phymatosorus pustulatus (G.Forst.) Large, Braggins & P.S.Green 7
Phymatosorus scandens (G.Forst.) Pic.Serm. 11
Platycterium Desv. 1, 2, 48
Platycterium bifurcatum (Cav.) C.Chr. 1, 48
Pleopeltis billardierei (R.Br.) T.Moore 7
Pleopeltis diversifolia (Willd.) Melvaine 7
Polypodiaceae J.Presl & C.Presl 1, 2
Polypodium L. 1, 2, 29, 49
Polypodium aureum L. 46
Polypodium australe (R.Br.) Mett. 22
Polypodium australe var. *ciliata* (Colenso) Kirk 25
Polypodium australe var. *pumilum* (J.B.Armstr.) Cockayne 28
-

Polypodium australe var. *rigidum* (Hombr.)
Cockayne 44
Polypodium australe var. *villosum* (Hook.f.)
Cheeseman 25
Polypodium billardierei R.Br. 7
Polypodium billardierei (Willd.) C.Chr. 22
Polypodium billardierei (Kaulf.) Fée 35
Polypodium billardierei var. *magellanicum*
(Desv.) C.Chr. 20
Polypodium billardierei var. *pumilum*
(J.B.Armstr.) Cheeseman 28
Polypodium billardierei var. *rigidum* (Hombr.)
Cockayne 44
Polypodium billardierei var. *villosum* (Hook.f.)
Cheeseman 25
Polypodium crassifolium L. 17
Polypodium crassium Kirk 28
Polypodium cunninghamii Hook. 14
Polypodium dictyopteris Mett. 14
Polypodium diversifolium Willd. 7
Polypodium eleagnifolium Bory 53
Polypodium grammitidis R.Br. 35
Polypodium magellanicum (Desv.) Copel. 20
Polypodium novae-zealandiae Baker 5
Polypodium paradoxum Colenso 25
Polypodium patagonicum C.Chr. 38
Polypodium poeppigianum Mett. 20
Polypodium pumilum (J.B.Armstr.) Cockayne 28
Polypodium pustulatum G.Forst. 7
Polypodium rupestre var. *sinuatum* Colenso 53
Polypodium scandens Labill. 7
Polypodium scandens G.Forst. 11
Polypodium scandens var. *billardierei* (R.Br.)
F.Muell. 7
Polypodium sect. *Phlebodium* R.Br. 46
Polypodium serpens G.Forst. 56
Polypodium vulgare L. 1, 46, 50, **50**, 63
Pyrrosia Mirb. 1, 2, 15, **53**
Pyrrosia elaeagnifolia (Bory) Hovenkamp 1, 53,
53, 57
Pyrrosia serpens (G.Forst.) Ching 1, 53–55, **56**
Xiphopteris heterophylla (Labill.) Spreng. 35
Zealandia Testo & A.R.Field 4
Zealandia novae-zealandiae (Baker) Testo &
A.R.Field 5
Zealandia pustulata (G.Forst.) Testo &
A.R.Field 7

Image Information

Image	Creator	Copyright	Licence
Front cover	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 1	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 2	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 3	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 4	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 5	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 6	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 7	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 8	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 9	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 10	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 11	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 12	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 13	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 14	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 15	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 16	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 17	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 18	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 19	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 20	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 21	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 22	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 23	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 24	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 25	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 26	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 27	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 28	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 29	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 30	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 31	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 32	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 33	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 34	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 35	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 36	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 37	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 38	Auckland Museum	© Auckland Museum	CC BY-NC 3.0 NZ
Fig. 39	Auckland Museum	© Auckland Museum	CC BY-NC 3.0 NZ
Fig. 40	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 41	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 42	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 43	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 44	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 45	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 46	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 47	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 48	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 49	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 50	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 51	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 52	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 53	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 54	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 55	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 56	K.Boardman	© Landcare Research 2021	CC BY 4.0

Fig. 57	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 58	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 59	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 60	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 61	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 62	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 63	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 64	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 65	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 66	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 67	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 68	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 69	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 70	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 71	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 72	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 73	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 74	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 75	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 76	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 77	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 78	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 79	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 80	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 81	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 82	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 83	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 84	A. Kusabs	© Te Papa	CC BY-NC 3.0 NZ
Fig. 85	A. Kusabs	© Te Papa	CC BY-NC 3.0 NZ
Fig. 86	A. Kusabs	© Te Papa	CC BY-NC 3.0 NZ
Fig. 87	A. Kusabs	© Te Papa	CC BY-NC 3.0 NZ
Fig. 88	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 89	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 90	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 91	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 92	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 93	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 94	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 95	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 96	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 97	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 98	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 99	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 100	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 101	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 102	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 103	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 104	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 105	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 106	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 107	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 108	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 109	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 110	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 111	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 112	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 113	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 114	W. Malcolm	© Bill Malcolm	All rights reserved
Fig. 115	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 116	J. Rolfe	© Jeremy Rolfe	All rights reserved
Fig. 117	J. Rolfe	© Jeremy Rolfe	All rights reserved
Fig. 118	J. Rolfe	© Jeremy Rolfe	All rights reserved

Fig. 119	J. Rolfe	© Jeremy Rolfe	All rights reserved
Fig. 120	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 121	A. Fergus	© Alex Fergus	CC BY-NC 3.0 NZ
Fig. 122	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 123	Auckland Museum	© Auckland Museum	CC BY-NC 3.0 NZ
Fig. 124	Auckland Museum	© Auckland Museum	CC BY-NC 3.0 NZ
Fig. 125	Auckland Museum	© Auckland Museum	CC BY-NC 3.0 NZ
Fig. 126	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 127	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 128	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 129	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 130	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 131	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 132	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 133	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 134	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 135	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 136	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 137	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 138	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 139	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 140	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 141	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 142	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 143	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 144	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 145	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 146	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 147	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 148	L.R. Perrie	© Leon Perrie	CC BY-NC 3.0 NZ
Fig. 149	L.R. Perrie	© Te Papa	CC BY-NC 3.0 NZ
Fig. 150	K.Boardman	© Landcare Research 2021	CC BY 4.0
Fig. 151	B. Hatton	© Te Papa	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 Manaaki Whenua – 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 Manaaki Whenua – 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: Peter Heenan

Series Editor: Ilse Breitwieser

Steering committee: Ilse Breitwieser, Pat Brownsey, Wendy Nelson, Rob Smissen, Aaron Wilton

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

Copy Editor: Ray Prebble



ISBN 978-0-947525-80-4



9 780947 525804