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FERNS AND LYCOPHYTES

PTERIDACEAE



P.J. BROWNSEY & L.R. PERRIE

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Cover image: *Pteris macilenta*. Adaxial surface of 2-pinnate-pinnatifid frond, with basal secondary pinnae on basal primary pinnae clearly stalked.

Contents

Introduction.....	1
Taxa	
<i>Pteridaceae</i> E.D.M.Kirchn.	2
<i>Adiantum</i> L.	3
<i>Adiantum aethiopicum</i> L.	5
<i>Adiantum capillus-veneris</i> L.	7
<i>Adiantum cunninghamii</i> Hook.	9
<i>Adiantum diaphanum</i> Blume	12
<i>Adiantum formosum</i> R.Br.	15
<i>Adiantum fulvum</i> Raoul	18
<i>Adiantum hispidulum</i> Sw.	20
<i>Adiantum raddianum</i> C.Presl	23
<i>Anogramma</i> Link	25
<i>Anogramma leptophylla</i> (L.) Link	26
<i>Cheilanthes</i> Sw.	29
<i>Cheilanthes distans</i> (R.Br.) Mett.	30
<i>Cheilanthes sieberi</i> Kunze	32
<i>Cheilanthes sieberi</i> Kunze subsp. <i>sieberi</i>	32
<i>Cheilanthes viridis</i> (Forssk.) Sw.	35
<i>Myriopteris</i> Fée	36
<i>Myriopteris lendigera</i> (Cav.) Fée.	37
<i>Pellaea</i> Link	38
<i>Pellaea calidrupium</i> Brownsey & Lovis	39
<i>Pellaea rotundifolia</i> (G.Forst.) Hook.	42
<i>Pteris</i> L.	45
<i>Pteris argyraea</i> T.Moore	47
<i>Pteris carsei</i> Braggins & Brownsey	48
<i>Pteris cretica</i> L.	51
<i>Pteris dentata</i> Forssk.	53
<i>Pteris epaleata</i> D.J.Ohlsen	55
<i>Pteris macilenta</i> A.Rich.	56
<i>Pteris multifida</i> Poir.	59
<i>Pteris pacifica</i> Hieron.	60
<i>Pteris parkeri</i> hort. ex J.J.Parker	61
<i>Pteris saxatilis</i> (Carse) Carse	62
<i>Pteris tremula</i> R.Br.	65
<i>Pteris vittata</i> L.	67
References	70
Acknowledgements	76
Maps	77
Index	79
Image Information	80

Introduction

Pteridaceae is a large family that is almost cosmopolitan in distribution, but has its greatest diversity in the tropics and in arid regions. It is represented in New Zealand by five indigenous genera (*Adiantum*, *Anogramma*, *Cheilanthes*, *Pellaea*, *Pteris*) and 16 indigenous species, five of which are endemic, and another ten that are fully naturalised or casual. In addition there is a wholly naturalised genus, *Myriopteris* with a single species.

Members of Pteridaceae in New Zealand are terrestrial species with erect to long-creeping rhizomes and 1–5-pinnate fronds. The sori are either completely unprotected and extend along the veins, or are marginal and protected by the modified inrolled lamina margin. All species have trilete spores.

Adiantum includes six indigenous species, two of them endemic, and another two naturalised, all characterised by their polished dark brown stipes, flabellate or oblong ultimate lamina segments, and sori protected by reniform or oblong reflexed lamina flaps. *Anogramma leptophylla* is the sole species of the genus in New Zealand, distinguished by its small delicate laminae, and unprotected sori extending along the veins. *Cheilanthes* is represented by two indigenous and one casual species, having small to medium-sized, 2–3-pinnate fronds, and elongated marginal sori protected by inrolled pinna margins. *Pellaea* has two non-endemic indigenous species, with long-creeping rhizomes, pinnate fronds, scaly stipes and rachises, and scarcely protected sori almost continuous around the pinna margins. *Pteris* comprises five indigenous species, three of them endemic, and seven naturalised or casual species, with medium to large, 1–4-pinnate fronds, and sori continuous along the pinna edges, protected by membranous inrolled pinna margins.

Most species of Pteridaceae in New Zealand occur more frequently in northern or eastern parts of the country. *Adiantum cunninghamii* and *Pellaea rotundifolia* are unusual in being widespread species. *Adiantum aethiopicum*, *A. diaphanum*, *A. fulvum*, *A. hispidulum*, *P. macilentata*, *P. saxatilis* and *P. tremula* have a mainly northern distribution extending only to northern parts of the South Island, and *P. carsei* is confined to the North Island. *Anogramma leptophylla*, *Cheilanthes distans*, *C. sieberi* and *Pellaea caldirupium* all occur most commonly in eastern parts of the country, especially in the South Island. Two species have very restricted distributions – *Adiantum formosum* currently known only from the vicinity of the Manawatū Gorge, and *Pteris epaleata* from Fiordland.

The naturalised genus *Myriopteris* is represented by a single species, *M. lendigera*, which is distinguished by its 3-pinnate fronds, long pale orange hairs on the abaxial surfaces, and sori produced on small rounded tertiary pinnae.

***Pteridaceae* E.D.M.Kirchn., *Schul-Bot.* 109 (1831)**

Type taxon: *Pteris* L.

Terrestrial, rupestral or rarely (not NZ) aquatic ferns. Rhizome erect to long-creeping, bearing scales or hairs; roots rarely bearing small tubers. Fronds usually monomorphic or rarely dimorphic, not articulated to rhizome. Laminae 1–5-pinnate (NZ) or entire to 6-pinnate (not NZ), sometimes pedate or helicoid (NZ) or palmate (not NZ); herbaceous or coriaceous, glabrous or scaly and/or hairy, rarely farinose abaxially (not NZ). Pinnae or pinna segments sometimes articulated to rachis or costae. Veins free or reticulate, the areolae without included veinlets. Sori extending along the veins, or extending along the margins, or borne on the underside of modified, reflexed, marginal lamina flaps; paraphyses present or absent; sori exindusiate or protected by the unmodified inrolled lamina margin, or by a membranous, reflexed lamina margin; sporangial maturation mixed. Sporangia with vertical or rarely oblique annulus, 16–64 spores per sporangium. Homosporous; spores trilete, lacking chlorophyll; perispores either with coarse ridges and a prominent equatorial flange, or prominently cristate or echinate without an equatorial flange, or plain to tuberculate without an equatorial flange.

Taxonomy: A family of five subfamilies, 53 genera and over 1200 species (PPG 1 2016).

Five subfamilies were recognised in this large family by PPG 1 (2016): Parkerioideae, Cryptogammoideae, Pteridoideae, Vittarioideae and Cheilantheoideae. All are monophyletic (Schuettpeitz et al. 2007; Zhang et al. 2015), but only the latter three occur in New Zealand, with *Anogramma* and *Pteris* in Pteridoideae, *Adiantum* in Vittarioideae, and *Cheilanthes*, *Myriopteris* and *Pellaea* in Cheilantheoideae.

Allan (1961) included *Adiantum*, *Anogramma*, *Cheilanthes* and *Pellaea* in Adiantaceae, and placed only *Pteris* in Pteridaceae, along with *Histiopteris*, *Paesia* and *Pteridium*, which are now included in Dennstaedtiaceae (PPG 1 2016). *Myriopteris* has only recently been recognised as a separate genus (Grusz & Windham 2013; PPG 1 2016), and the sole New Zealand representative was previously included in *Cheilanthes*.

- 1 Sori borne away from the lamina margin, elongated along the veins, unprotected..... *Anogramma*
Sori borne on the lamina margin, either unprotected, or protected by the inrolled lamina margin, or by inrolled or reflexed lamina flaps..... 2
- 2 Sori discrete, protected by membranous or unmodified, reflexed or inrolled, lamina flaps..... 3
Sori ± continuous along the lamina margin, either unprotected or protected by the membranous or unmodified inrolled lamina margin..... 5
- 3 Sori protected by strongly reflexed, membranous lamina flaps that are orbicular, reniform or shortly rectangular..... *Adiantum*
Sori protected by inrolled, green lamina flaps, rarely becoming membranous at their apices..... 4
- 4 Stipes longer than laminae; laminae 3–4-pinnate; abaxial surface bearing long orange hairs; adaxial surface glabrous..... *Myriopteris*
Stipes shorter than laminae; laminae 2–3-pinnate; abaxial surface either glabrous, or bearing abundant scales; adaxial surface glabrous or bearing white hairs..... *Cheilanthes*
- 5 Laminae pinnate, <75 mm wide; pinnae articulated to the rachis, often deciduous; sori ± unprotected..... *Pellaea*
Laminae more divided, or if pinnate, >75 mm wide; pinnae not articulated to rachis, not deciduous; sori protected by membranous or green inrolled lamina margin..... 6
- 6 Stipes, rachises and pinna costae varying from red-brown distally to yellow-brown proximally; laminae >100 mm wide; veins free or anastomosing; sori protected by membranous, reflexed lamina margin..... *Pteris*
Stipes, rachises and pinna costae red-brown throughout; laminae usually <100 mm wide; veins always free; sori protected by green or rarely membranous, inrolled lamina margin..... *Cheilanthes*

Distribution: Pteridaceae is a large family, almost world-wide in distribution, but with its greatest diversity in the tropics and in arid regions (Tryon 1990). Six non-endemic genera with 27 species in New Zealand; five species endemic.

Biostatus: Indigenous (Non-endemic).

Table 1: Number of species in New Zealand within *Pteridaceae* E.D.M.Kirchn.

Category	Number
Indigenous (Endemic)	5
Indigenous (Non-endemic)	11
Exotic: Fully Naturalised	5
Exotic: Casual	6
Total	27

Recognition: Pteridaceae is a large and diverse family comprising terrestrial or rupestral species with erect to long-creeping rhizomes. Fronds are monomorphic or dimorphic, entire to 5-pinnate, and scaly or sometimes hairy. The sori are either exindusiate and extend along the veins, or are marginal and protected by the modified lamina margin, producing trilete spores.

***Adiantum* L., Sp. Pl. 1094 (1753)**

Type taxon: *Adiantum capillus-veneris* L.

Etymology: From the Greek *adiantos* (unwetable), a reference to the water-shedding properties of the lamina.

Vernacular names: huruhuru tapairu; maidenhair fern; tawatawa

Terrestrial or rupestral ferns. Rhizomes erect to long-creeping, scaly; roots rarely bearing small tubers. Rhizome scales non-clathrate, acicular to narrowly ovate or narrowly triangular, attached at base, concolorous, yellow-brown to red-brown or dark brown. Fronds monomorphic. Stipes and rachises red- or dark brown, highly polished. Laminae 1–5-pinnate or rarely helicoid, herbaceous or coriaceous, glabrous or hairy or rarely scaly (not NZ), rarely glaucous or farinose (not NZ) abaxially. Pinnae not articulated to rachis; ultimate segments rarely articulated to costae and deciduous (not NZ). Veins free or rarely reticulate (not NZ). Sori borne mainly on acroscopic margins of lamina segments, on the underside of orbicular to elongate, modified, reflexed, marginal, lamina flaps (“indusia”); paraphyses absent or rarely present (not NZ). Spores trilete, lacking chlorophyll; perispores scabrate, rugose or tuberculate, without an equatorial flange.

Taxonomy: A genus of c. 225 species, included in the subfamily Vittarioideae (PPG 1 2016).

Adiantum is now considered to be monophyletic and sister to the vittarioid ferns (Pryer et al. 2016), although this relationship was regarded as uncertain (e.g. Bouma et al. 2010) until adequate taxon sampling had been achieved. Even now, there is insufficient sampling across the whole genus to determine how many clades are present. Bouma et al. (2010) were able to identify three major clades, with all of the indigenous New Zealand species present in clade C along with other species from different southern hemisphere continents. However, their sampling outside New Zealand was very limited. Lu et al. (2011) sampled 86 taxa from a wider geographical range using five plastid markers and found nine major clades, six of them within Chinese *Adiantum*. Nevertheless, the phylogeny of the genus as a whole still requires further investigation. Tryon & Tryon (1982) recognised eight major groups on morphological grounds, but there has been no modern monograph of the genus.

Within New Zealand, Allan (1961) recognised six indigenous species – *A. aethiopicum*, *A. cunninghamii*, *A. diaphanum*, *A. formosum*, *A. fulvum* and *A. hispidulum*. Parris & Croxall (1974) subsequently reinstated *A. viridescens*, Parris (1980) suggested that *A. pubescens* should be recognised in addition to *A. hispidulum*, and Brownsey (in Webb et al. 1988) added two naturalised species to the New Zealand flora. However, Large & Braggins (1993) found that *A. hispidulum* and *A. pubescens* could only be distinguished on the basis of their hair characters, and even then with a high degree of variability. They treated *A. pubescens* as a variety of *A. hispidulum*. Brownsey et al. (2019) investigated the presence or absence of hairs on the abaxial lamina surfaces of all indigenous New Zealand *Adiantum* species, and concluded that most are dimorphic in this regard, and that such variation should be treated as variation within the bounds of individual species distinguished on the basis of other morphological characters, a conclusion also reached for Australian and Malesian plants by Bostock (1992). As a consequence, Brownsey et al. (2019) reduced *A. viridescens* to synonymy with *A. fulvum*.

Species of *Adiantum* are widely cultivated throughout the world. Many of the cultivars and species in cultivation have been described and illustrated by Goudey (1985) and Hoshizaki & Moran (2001).

1	Ultimate lamina segments flabellate, stalk attached centrally..... 2 Ultimate lamina segments ± oblong, stalk attached at one corner..... 4	
2	Reflexed lamina segments (“indusia”) oblong, lacking a sinus..... <i>capillus-veneris</i> Reflexed lamina segments (“indusia”) reniform, each with a distinct sinus..... 3	
3	Ultimate lamina segments generally broader than long, usually undivided, notched only at point of attachment of the “indusia”, or rarely incised to the depth of the indusial notches..... <i>aethiopicum</i> Ultimate lamina segments generally longer than broad, with at least some incised more deeply than the indusial notches, divided into two or more distinct lobes..... <i>raddianum</i>	
4	Reflexed lamina segments (“indusia”) hairy..... 5 Reflexed lamina segments (“indusia”) glabrous..... 6	
5	Laminae 1–2-pinnate, with secondary pinnae, where present, only on the proximal pair of primary pinnae; rachis glabrous..... <i>diaphanum</i> Laminae 3-pinnate or helicoid with the rachis repeatedly dividing pseudo-dichotomously; rachis hairy..... <i>hispidulum</i>	
6	Costae of primary pinnae glabrous..... 7 Costae of primary pinnae hairy..... 8	
7	Laminae 1–2-pinnate, with secondary pinnae, where present, only on the proximal pair of primary pinnae; rhizome erect, rootlets often bearing small tubers..... <i>diaphanum</i> Laminae 2–4-pinnate at base, usually with more than one pair of divided primary pinnae; rhizome creeping, rootlets lacking tubers..... <i>cunninghamii</i>	
8	Laminae usually 4-pinnate at base (rarely 3- or 5-pinnate); stipes rough but glabrous; ultimate lamina segments ± oblong, up to 16 mm long..... <i>formosum</i> Laminae usually 3-pinnate at base (rarely 2- or 4-pinnate); stipes scaly proximally and bearing antrorse hairs distally; ultimate lamina segments often curved acroscopically at apices, up to 26 mm long..... <i>fulvum</i>	

Distribution: *Adiantum* is pantropical in distribution, with a few species also extending to both the north and south temperate regions. Many species have become naturalised in different parts of the world. The greatest diversity is in the Neotropics, where more than half the species are found (Mickel & Smith 2004); six indigenous and one naturalised species in southern Africa (Crouch et al. 2011), eight in Australia (Bostock 1998), ten indigenous and two naturalised in the south-west Pacific (Nakamura 2008), and one indigenous and four naturalised in Hawai’i (Palmer 2003). Eight species in New Zealand; two endemic, four indigenous, and two naturalised.

Biostatus: Indigenous (Non-endemic).

Table 2: Number of species in New Zealand within *Adiantum* L.

Category	Number
Indigenous (Endemic)	2
Indigenous (Non-endemic)	4
Exotic: Fully Naturalised	2
Total	8

Recognition: In New Zealand, species of *Adiantum* can be recognised by their 1–5-pinnate fronds, polished dark brown stipes, flabellate or oblong ultimate lamina segments, and sori protected by reflexed lamina segments that are usually reniform or sometimes oblong. The spores are trilete and scabrate (Large & Braggins 1991).

Cytology: The base chromosome number in *Adiantum* is $x = 29$ or 30 , but there is also at least one aneuploid with $x = 57$ and an extensive polyploid series with diploids through to decaploids recorded (Tryon 1990; Tindale & Roy 2002).

Adiantum aethiopicum L., *Syst. Nat.*, ed. 10, 2, 1329 (1759)

Lectotype (selected by Pichi Sermolli 1957): [Habitat ad Cap. b. spei – Cape of Good Hope], LINN 1252.15!

= *Adiantum trigonum* Labill., *Nov. Holl. Pl.* 2, 99, t. 248, f. 2 (1807)

Lectotype (selected by Brownsey & Perrie 2020): Nova Hollandia [Australia], Herb. Labillardière, FI 004082 (online)

Etymology: From the Latin *aethiopicus* (Africa south of the Sahara, but often referring specifically to South Africa), a reference to the provenance of the original collection of this species.

Vernacular names: bush maidenhair fern; mākaka; true maidenhair

Rhizomes erect or very short-creeping, with long-creeping stolons up to 110 mm long and 0.7–1.5 mm diameter (in herbarium material); bearing scales; tubers absent. Rhizome scales narrowly ovate, 1.0–4.0 mm long, 0.2–0.6 mm wide, orange-brown, concolorous. Fronds 125–500 mm long. Stipes 35–330 mm long, dark brown, polished, glabrous except for a few scattered scales proximally. Rachises dark brown, sulcate, polished, glabrous. Laminae 3–4-pinnate, ovate or elliptic, 80–400 mm long, 25–170 mm wide, mid-green on both surfaces, herbaceous, glabrous. 6–12 pairs of divided primary pinnae below pinnate apex, widely spaced especially proximally, ovate; the longest at or below the middle, 27–200 mm long, 12–75 mm wide, apices obtuse, bases stalked, divided into secondary pinnae. 1–6 pairs of secondary pinnae on proximal primary pinnae divided into tertiary pinnae; the longest secondary pinnae ovate, 10–85 mm long, 7–25 mm wide, apices obtuse, bases stalked, divided into tertiary segments. Longest ultimate lamina segments flabellate, broader than long, 4–10 mm long, 6–12 mm wide, apices rounded, margins entire or shallowly incised, bases stalked, with stalks attached centrally. Reflexed lamina flaps reniform, glabrous.

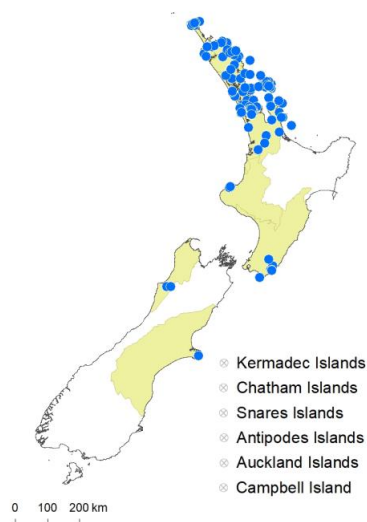


Fig. 1: *Adiantum aethiopicum* distribution map based on databased records at AK, CHR & WELT.

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

South Island: Western Nelson, Canterbury.

Altitudinal range: 0–240 m.

Adiantum aethiopicum is common in coastal and lowland areas of the North Island from Te Pahi to the Waikato, with outlying populations in Taranaki and southern Wairarapa. It grows from near sea level, reaching 240 m near Unuwaho in Te Pahi. In the South Island it has been recorded from the Buller Gorge (AK 135708, WELT P008229). There is also a collection made by J.B. Armstrong from near Akaroa (CHR 633289), an area from which it was also recorded by Raoul (1846, as *A. trigonum*). However, *A. aethiopicum* has not been collected anywhere in the South Island since the 19th century.

Also southern Africa, Australia (Western Australia, Northern Territory, South Australia, Queensland, New South Wales, Australian Capital Territory, Victoria, Tasmania), Lord Howe Island and New Caledonia.

Biostatus: Indigenous (Non-endemic).

Habitat: *Adiantum aethiopicum* grows on the ground in open podocarp and broadleaved forest, under mānuka and kānuka, in coastal and gumland scrub, and under pines. It also grows amongst grass or under bracken. It favours coastal cliffs, roadside banks, creek banks, clay slopes, rocky ground, and sometimes swamp margins.

Recognition: *Adiantum aethiopicum* is recognised by its 3–4-pinnate fronds, flabellate ultimate segments with the stalks attached centrally, glabrous rachises and laminae, reniform and glabrous “indusia”, and green abaxial lamina surface. The species is easily confused with the naturalised *A. raddianum*, but distinguished by its ultimate lamina segments, which are broader than long, and either entire or shallowly incised, especially at the point of attachment of the “indusia”. The ultimate segments in *A. raddianum* are generally longer than broad, and at least some are more deeply incised than the indusial notches, forming two or more distinct lobes. There is a true creeping rhizome in *A. raddianum*, whereas *A. aethiopicum* has a more or less erect rhizome with long-creeping stolons.

Cytology: n = 60 (Brownlie 1958).

Notes: In contrast to the count of $n = 60$ in New Zealand populations, $2n = 112$ has been reported by Tindale & Roy (2002) in Australian plants of *Adiantum aethiopicum*, and $n = 57$ in the related *A. atroviride* Bostock.

All New Zealand Flora writers since Hooker (1854–1855) have included *Adiantum assimile* Sw. in the synonymy of *A. aethiopicum*. Swartz (1801) described the species from an unspecified locality in Australia. Two related species, *A. aethiopicum* and *A. atroviride*, are now known to occur in Australia (Bostock 1998), their distributions overlapping in southern Queensland and New South Wales. Bostock (1998) described *A. atroviride*, but continued to include *A. assimile* in the synonymy of *A. aethiopicum*, even though he indicated that he had not seen the type. Without locating the type it is impossible to be certain of its affinities. Unfortunately Swartz's herbarium in S is currently inaccessible, and the identity of *A. assimile* must wait until the type can be found and re-examined.



Fig. 2: *Adiantum aethiopicum*. Sterile frond with lamina segments that are only shallowly divided, attached centrally and generally broader than long.



Fig. 3: *Adiantum aethiopicum*. Sterile frond with lamina segments that are only shallowly divided, attached centrally and generally broader than long.



Fig. 4: *Adiantum aethiopicum*. Sterile frond with polished, red-brown stipes and rachises.



Fig. 5: *Adiantum aethiopicum*. Plants growing in profusion on a bank.

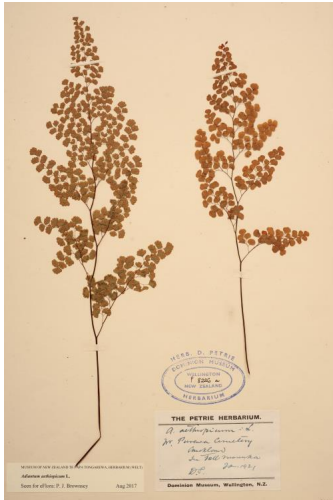


Fig. 6: *Adiantum aethiopicum*. Herbarium specimen from Auckland, WELT P008226/A.



Fig. 7: *Adiantum aethiopicum*. Close up of WELT P008226/A, showing glabrous fertile lamina segments, attached centrally, broader than long, and only shallowly lobed.

***Adiantum capillus-veneris* L., Sp. Pl. 1095 (1753)**

Lectotype (selected by Pichi Sermolli 1957): [Habitat in Europa australis – southern Europe], *Magnol*, LINN 1252.9 (!online; see Jarvis 2007).

= *Adiantum affine* Willd., *Sp. Pl.* 5(1), 448 (1810)

Holotype: [Nova Zeelandia], no locality or collector, B-W 20093-01 0 (!online)

Etymology: From the Latin *capillus* (hair), *veneris* (of Venus), giving rise to the popular and widespread name of maidenhair.

Vernacular names: European maidenhair; Venus-hair fern

Rhizomes short-creeping, up to 60 mm long (in herbarium specimens), 2–3 mm diameter, with stipes closely inserted; bearing scales; stolons and tubers absent. Rhizome scales narrowly ovate, 2–3.5 mm long, 0.2–0.4 mm wide, orange-brown, concolorous. Fronds 40–435 mm long. Stipes 20–210 mm long, dark brown, polished, glabrous except for a few scattered scales proximally. Rachises dark brown, sulcate, polished, glabrous. Laminae usually 2-pinnate, rarely 1-pinnate in very small fronds or 3-pinnate in large fronds, ovate, 20–270 mm long, 14–165 mm wide, mid-green on both surfaces, herbaceous, glabrous. 1–8 pairs of divided primary pinnae below pinnate apex, widely spaced especially proximally, ovate; the longest at or near the base, 8–115 mm long, 7–50 mm wide, apices obtuse, bases stalked, usually divided into secondary pinnae except in very small fronds. Longest secondary pinnae flabellate, 5–36 mm long, 5–16 mm wide, apices obtuse or rounded, margins deeply incised in largest fronds, or rarely divided into 1–3 tertiary pinnae, bases stalked, with stalks attached centrally. Reflexed lamina flaps oblong, extending laterally up to 5 mm, glabrous.

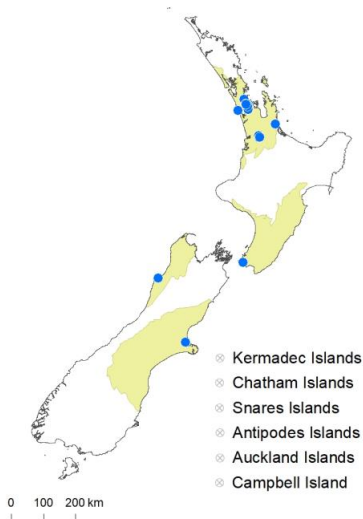


Fig. 8: *Adiantum capillus-veneris* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Auckland, Southern North Island.
South Island: Western Nelson, Canterbury.
Altitudinal range: 0–140 m.

Adiantum capillus-veneris has been recorded from urban sites in Auckland, Waihi, Hamilton, Wellington, Westport and Christchurch.

Occurs naturally in tropical and temperate areas of North and South America, Europe, Asia, Africa, Australia and Hawai'i. Its status in other Pacific islands is uncertain due to confusion with *A. tenerum* Sw.

Biostatus: Exotic; fully naturalised.

Habitat: *Adiantum capillus-veneris* grows most commonly on brick or concrete walls in urban areas, or occasionally on road or trackside banks, or on scoria.

First record: Brownsey (1981). Voucher CHR 366041, 1978.

Recognition: *Adiantum capillus-veneris* is distinguished by its usually 2-pinnate fronds, flabellate ultimate segments with the stalks attached centrally, glabrous rachises and laminae, oblong and glabrous "indusia", and green abaxial lamina

surface. The oblong or elongated reflexed lamina flaps distinguish this species from all other species of *Adiantum* in New Zealand.

Notes: Tindale (1960) treated Willdenow's *Adiantum affine* as a new species (although the illegitimate *A. trapeziforme* G.Forst. was cited), with a holotype from Willdenow's herbarium (B-W 20093 -01 0). As pointed out by Tindale (1960) and Nicolson & Fosberg (2003), the holotype of *A. affine* is a specimen of *A. capillus-veneris*. The specimen is said to be from New Zealand, which is also the only locality given in Willdenow's protologue. However, it is extremely unlikely that *A. capillus-veneris* was present in New Zealand at the time of Cook's second voyage, and hence it must be concluded that the provenance of Willdenow's specimen was somehow confused. The name *A. affine* was widely used in earlier New Zealand Floras for the plant now known as *A. cunninghamii*.



Fig. 9: *Adiantum capillus-veneris*. Small plants growing from cracks in a brick wall.



Fig. 10: *Adiantum capillus-veneris*. Abaxial surface of fertile lamina segments with oblong "indusia" extending laterally along lamina margin.



Fig. 11: *Adiantum capillus-veneris*. Herbarium specimen from Hamilton, WELT P027345, showing mature plant with fertile fronds.



Fig. 12: *Adiantum capillus-veneris*. Close up of WELT P027345 showing glabrous lamina segments and oblong "indusia" extending laterally along lamina margin.

***Adiantum cunninghamii* Hook., Sp. Fil. 2, 52, t. 86a (1851)**

- ≡ *Adiantum formosum* var. *cunninghamii* (Hook.) F.Muell., *Veg. Chatham Isl.* 72 (1864)
Lectotype (selected by Brownsey & Perrie 2020): N[ew] Zealand, W. Colenso 1670, 1849, Herb. Hooker., K 001090075!
- = *Adiantum trapeziforme* G.Forst., *Fl. Ins. Austr.* 84 (1786) nom. illeg., non *Adiantum trapeziforme* L. 1753
Lectotype (selected by Brownsey & Perrie 2020): [New Zealand], Herb. G. Forster 297, BM 001048368!
- = *Adiantum affine* var. *heterophyllum* Colenso, *Trans. & Proc. New Zealand Inst.* 20: 218 (1888)
Lectotype (selected by Brownsey & Perrie 2020): [New Zealand], com. W. Colenso, 5/1890, K 01090068!
- = *Adiantum affine* var. *chathamicum* Field, *Ferns New Zealand* 81 (1890)
Type: not located.
- = *Adiantum pullum* Colenso, *Trans. & Proc. New Zealand Inst.* 25: 319 (1893)
- ≡ *Adiantum affine* var. *pullum* (Colenso) Domin, *Biblioth. Bot.* 20(85): 150 (1913)
Lectotype (selected by Brownsey & Perrie 2020): Dannevirke, Hawkes Bay, H. Hill, Herb. Colenso, WELT P003327!

Etymology: Named in honour of Allan Cunningham (1791–1839), a plant collector for Kew, and colonial botanist in New South Wales.

Vernacular names: Cunningham's maidenhair; common maidenhair

Rhizomes short- to long-creeping, up to 235 mm long (in herbarium specimens), 1–3 mm diameter, with stipes inserted 5–50 mm apart; bearing scales; stolons and tubers absent. Rhizome scales narrowly ovate, 2.5–6.0 mm long, 0.3–0.6 mm wide, red-brown, concolorous. Fronds 60–900 mm long. Stipes 20–530 mm long, dark brown, polished, glabrous except for scattered scales proximally. Rachises dark brown, sulcate, polished, glabrous. Laminae 2–3-pinnate (or very rarely 4-pinnate), broadly ovate or ovate, 40–370 mm long, 25–260 mm wide, dark green adaxially, glaucous or green abaxially, herbaceous, glabrous or rarely bearing stiff dark hairs abaxially. 1–4 pairs of divided primary pinnae below long pinnate apex, widely spaced especially proximally, ovate or broadly ovate; costae glabrous; the longest pinnae below the middle, 16–230 mm long, 9–150 mm wide, apices acute to obtuse, bases stalked, divided into secondary pinnae. 1–2 pairs of secondary pinnae (or occasionally none) on the basal primary pinnae divided into tertiary pinnae; the longest divided secondary pinnae ovate or narrowly ovate, 10–105 mm long, 9–28 mm wide, apices acute to obtuse, bases stalked. Very rarely one tertiary pinna on the basal primary pinna divided into quaternary pinnae. Longest ultimate lamina segments oblong, tending to curve acroscopically, 5–28 mm long, 3–15 mm wide, apices

obtuse, acroscopic margins irregularly toothed, basiscopic margins \pm entire, bases stalked, with stalks attached in one corner. Reflexed lamina flaps reniform, glabrous.

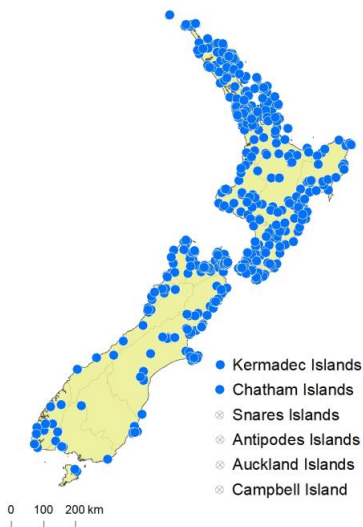


Fig. 13: *Adiantum cunninghamii* distribution map based on databased records at AK, CHR, OTA & WELT.

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, Stewart Island.

Altitudinal range: 0–1100 m.

Adiantum cunninghamii occurs on the Kermadec and Three Kings Islands, and in lowland areas throughout the North Island from Te Pahi to Wellington, extending locally into montane sites. It is absent only from parts of the central North Island. It grows from near sea-level, reaching 1100 m in the Kaimanawa Ranges. In the South Island it occurs in coastal and lowland sites from Nelson to Southland, extending locally into montane areas, but is absent from much of the interior, and from the drier parts of Otago and South Canterbury. It extends to 900 m at Jordan Stream Reserve, Marlborough. It also reaches Stewart Island and the Chatham Islands.

Biostatus: Indigenous (Endemic).

Habitat: *Adiantum cunninghamii* grows on the ground under kauri, podocarp, beech and broadleaved forest, under mānuka and kānuka, in coastal and regenerating scrub, and under pines. It is found on wet rock faces and bluffs, in small caves, under waterfalls, on river banks, in gullies, among rocks or in crevices, on roadside banks, at bush margins, in clearings, along tracksides, on grassy slopes, and on coastal cliffs. It grows on greywacke, limestone, sandstone, mudstone, clay, scoria, and pumice.

Recognition: *Adiantum cunninghamii* is a rather variable species with laminae ranging in size from 40 mm to 370 mm long. It is most commonly 3-pinnate at the base, but small fronds may be only 2-pinnate, and very rarely 4-pinnate fronds are found. It is distinguished from other species of *Adiantum* by its oblong ultimate lamina segments with the stalk attached in one corner, glabrous rachises, reniform and glabrous “indusia”, and often by the glaucous colour of the abaxial lamina surface. The abaxial lamina surfaces are also usually glabrous, but rarely (in <1% of collections) they bear stiff hairs. Such plants can be confused with hairy forms of *A. diaphanum*. Small, 2-pinnate fronds, lacking hairs on the abaxial lamina surfaces, can also be confused with glabrous forms of *A. diaphanum*, but *A. cunninghamii* always lacks the small tubers on the rootlets that are present in *A. diaphanum*. Large, 3–4-pinnate specimens can be distinguished from *A. formosum* by their glabrous costae on the primary pinnae, and by the often glaucous abaxial lamina surface.

Cytology: n = 58 (Brownlie 1961, as *A. affine*).

Hybridisation: It is possible that *Adiantum cunninghamii* hybridises occasionally with *A. fulvum*. One collection (AK 353971) has hairs on the abaxial pinna surfaces and vestigial hairs on the rachises, but the sori are over-mature and the nature of the spores unknown (Brownsey et al. 2019).

Notes: *Adiantum cunninghamii* was initially misidentified by early Flora writers as *A. formosum* R.Br. (e.g. Richard 1832), and then as *A. affine* Willd. (e.g. Cheeseman 1906). The type of the latter name is actually *A. capillus-veneris*, supposedly from New Zealand, but almost certainly with an incorrect provenance (see under Notes for *A. capillus-veneris*). Along with *A. fulvum*, it is closely related to *A. silvaticum* from Queensland and New South Wales. The latter differs from *A. cunninghamii* by the absence of false veins between the true veins on the adaxial lamina surface (Bostock 1998).

No type material of *Adiantum affine* var. *chathamicum* has been located at AK, CHR, K or WELT, and its identity remains unresolved (Brownsey & Perrie 2020). However, Field (1890) noted that *A. affine* was called *A. cunninghamii* by Hooker, and *A. affine* var. *chathamicum* is included here as a likely synonym of *A. cunninghamii*.

A small number of collections occur with hairs on the abaxial lamina surfaces (Brownsey et al. 2019). These are treated here alongside the more usual glabrous forms as dimorphic variation within *A. cunninghamii*.



Fig. 14: *Adiantum cunninghamii*. Adaxial surface of mature 3-pinnate frond.



Fig. 15: *Adiantum cunninghamii*. Mature plants growing on a bank.



Fig. 16: *Adiantum cunninghamii*. Glabrous, red-brown rachis and pinna costae on sterile frond.



Fig. 17: *Adiantum cunninghamii*. Stipes arising from creeping rhizome.



Fig. 18: *Adiantum cunninghamii*. Abaxial surface of fertile frond showing glabrous and glaucous lamina segments.



Fig. 19: *Adiantum cunninghamii*. Abaxial surface of fertile frond showing oblong lamina segments attached in one corner.



Fig. 20: *Adiantum cunninghamii*. Abaxial surface of fertile frond showing glabrous lamina segments, and “indusia” on the acroscopic and distal margins.



Fig. 21: *Adiantum cunninghamii*. Abaxial surface of fertile frond showing over-mature “indusia”.



Fig. 22: *Adiantum cunninghamii*. Close up of WELT P023257, Pongaroa, Wairarapa, showing form with glabrous abaxial lamina surfaces.



Fig. 23: *Adiantum cunninghamii*. Close up of AK 200564, Tangihua Forest, showing form with hairs on abaxial lamina surfaces.

***Adiantum diaphanum* Blume, *Enum. Pl. Javae* 2, 215 (1828)**

Lectotype (selected by Field 2020): Java, Linga Jattie, *Blume* 649, L 0050898 (online)

= *Adiantum setulosum* J.Sm., *Companion Bot. Mag. New Ser.* 2: 22 (1846)

Holotype: ex Norfolk Island, v.v. hort. Kew, 1846, BM 001044355!

= *Adiantum polymorphum* Colenso, *Trans. & Proc. New Zealand Inst.* 20: 215 (1888) nom. illeg., non *Adiantum polymorphum* Poir. 1810

≡ *Adiantum diaphanum* var. *polymorphum* (Colenso) Cheeseman, *Man. New Zealand Fl.* 961 (1906) nom. illeg.

Lectotype (selected by Allan 1961): Dannevirke, Hawkes Bay, 1887, Herb. W. Colenso, WELT P003325!

= *Adiantum tuberosum* Colenso, *Trans. & Proc. New Zealand Inst.* 20: 217 (1888)

Holotype: Ormondville, Hawkes Bay, A. Hamilton, ex Herb. Colenso, AK 135731!

Etymology: From the Latin *diaphanus* (transparent), a reference to the thin leaves of this species.

Rhizomes erect, bearing scales; rootlets often bearing small tubers; stolons absent. Rhizome scales acicular, 0.5–1.5 mm long, 0.1–0.2 mm wide, red-brown, concolorous. Fronds 50–390 mm long. Stipes 20–250 mm long, dark brown, polished, glabrous except for scattered scales proximally. Rachises dark brown, sulcate, polished, glabrous. Laminae either 1-pinnate, narrowly triangular, 20–140 mm long, 10–28 mm wide; or 2-pinnate, ovate or broadly ovate, 35–205 mm long, 20–240 mm wide; rarely the basal basiscopic secondary pinna greatly expanded, up to 90 mm long, divided into tertiary pinnae; dark green on both surfaces, herbaceous, either glabrous or bearing sparse to abundant stiff dark hairs adaxially and abaxially. 4–25 pairs of undivided primary pinnae below pinnatifid apex, oblong, tending to curve basiscopically, 6–20 mm long, 3–11 mm wide, apices obtuse or truncate, acroscopic margins lobed, basiscopic margins entire, bases stalked, with stalks attached in one corner. Divided primary pinnae in 1 or rarely 2 pairs, costae glabrous, narrowly ovate or narrowly elliptic, 10–160 mm long, 14–26 mm wide, apices acute, bases stalked. Longest secondary pinnae oblong, 4–15 mm long, 4–7 mm wide, apices obtuse, margins lobed, bases stalked, with stalks attached in one corner. Reflexed lamina flaps reniform, hairy or glabrous.

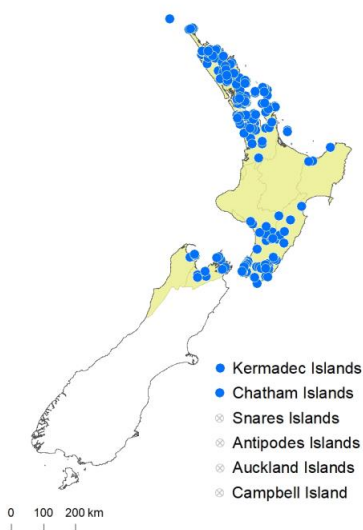


Fig. 24: *Adiantum diaphanum* distribution map based on databased records at AK, CHR & WELT.

on streambanks, river terraces, clay banks, under overhangs, wet rocks, track sides, and swamp margins in shaded sites.

Recognition: *Adiantum diaphanum* is the smallest of the maidenhair ferns in New Zealand. The fronds are either 1-pinnate throughout, or have one, or rarely two, pairs of proximal pinnae that are divided into secondary pinnae. It is distinguished from other species of *Adiantum* by the presence of tubers on the roots, its oblong ultimate lamina segments with the stalk attached in one corner, its glabrous rachises, and by the green abaxial lamina surface. The species is dimorphic, the abaxial lamina surfaces and “indusia” being either hairy or glabrous. Sometimes the lamina surfaces and “indusia” are either both hairy or both glabrous, but forms are also found with hairy “indusia” and glabrous or very sparsely hairy laminae. When present, the hairy “indusia” distinguish it from all other species except *A. hispidulum*. That species is distinguished by its helicoid branching, more divided laminae, and hairs that are often more than one cell long. In *A. diaphanum* the hairs are single-celled, very dark, and with no clearly visible lumen. Plants of *A. diaphanum* with glabrous laminae and “indusia” can be confused with small plants of *A. cunninghamii*, but that species always lacks the small tubers on the rootlets that are present in *A. diaphanum*.

Cytology: n = 116 (Brownlie 1961).

Notes: *Adiantum diaphanum* was misidentified by some early Flora writers as *A. affine* Willd. (e.g., Hooker 1864), a species now known to be *A. capillus-veneris*.

Brownsey et al. (2019) found that, among collections held at WELT, 57% had hairs on the abaxial lamina surfaces and 43% were glabrous or nearly so. Glabrous and hairy plants were sometimes found in the same population. In his original description of *A. diaphanum*, Blume (1828) noted that the pinnae were glabrous. Price (1990) further noted that “all plants from Java, the source of Blume’s type of *A. diaphanum*, have glabrous indusia”, whereas plants from the Philippines had setulose indusia

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

South Island: Western Nelson, Sounds-Nelson.

Kermadec Islands, Three Kings Islands, Chatham Islands.

Altitudinal range: 5–275 m.

Adiantum diaphanum occurs on the Kermadec and Three Kings Islands, and in lowland areas of the North Island from Te Pahi to Wellington. However, it is absent from large parts of Taranaki, the central North Island and Gisborne. It occurs from near sea level, reaching 275 m in the Tutamoe Range, Northland, and near Tikokino, Hawke’s Bay. In the South Island it is confined to lowland areas on the north coast from the Marlborough Sounds to north-west Nelson.

Also Japan, southern China, Taiwan, Vietnam, Malaysia, Australia (Queensland, New South Wales, Victoria), Norfolk Island, Solomon Islands, Vanuatu, New Caledonia, Fiji, Samoa and Tonga.

Biostatus: Indigenous (Non-endemic).

Habitat: *Adiantum diaphanum* grows on the ground under podocarp and broadleaved forest, and under kānuka. It occurs

and hairy pinnae. He suggested that the hairy plants corresponded to *A. setulosum*, described by Smith (1846) from Norfolk Island. However, Bostock (1992) rejected this conclusion. He noted that all 16 separate plants on three type sheets of *A. diaphanum* at L had at least some hairs on the laminae and “indusia”. He noted that there was “no justification whatsoever for using the name *A. diaphanum* Blume solely for plants with glabrous soral flaps”. He included *Adiantum setulosum* J.Sm. in the synonymy of *A. diaphanum*, a decision also followed here.

The hairy and glabrous plants are treated as dimorphic character states within *A. diaphanum*. Cheeseman (1906) interpreted the typical state of *A. diaphanum* as having hairy pinnae, and recognised var. *polymorphum*, based on Colenso’s *A. polymorphum*, for the glabrous state. In any case, *A. polymorphum* Colenso is illegitimate, being a later homonym of *A. polymorphum* Poir. (1810). Further investigation is required to determine whether there is any genetic variation that supports taxonomic recognition of different forms of *A. diaphanum* throughout its extensive geographical range.

Bostock (1992, 1998) noted that plants of *A. diaphanum* in Australia are not only tuberous but also proliferous, a feature recorded by Birkenhead (1886), enabling them to form small colonies. Although tubers are common in New Zealand plants, proliferation is unknown in herbarium specimens of wild plants and has only been observed in cultivated plants (<http://www.nzplants.auckland.ac.nz/en/about/ferns/native-ferns/pteridaceae-maidenhair-annual-rock-brake-ferns/adiantum-diaphanum.html>).



Fig. 25: *Adiantum diaphanum*. Adaxial surface of mature 2-pinnate frond.



Fig. 26: *Adiantum diaphanum*. Plants growing on a rocky bank.



Fig. 27: *Adiantum diaphanum*. Adaxial surface of 1-pinnate frond.



Fig. 28: *Adiantum diaphanum*. Abaxial surface of fertile frond with oblong lamina segments attached in one corner.



Fig. 29: *Adiantum diaphanum*. Close up of WELT P026864, Carters Bush, Wairarapa, showing form with glabrous “indusia” and glabrous abaxial lamina surfaces.



Fig. 30: *Adiantum diaphanum*. Close up of WELT P026865, Carters Bush, Wairarapa, showing form with hairy “indusia” and hairy abaxial lamina surfaces.

***Adiantum formosum* R.Br., Prodr. Fl. Nov. Holland. 155 (1810)**

Lectotype (selected by Field 2020): Port Jackson [Sydney, Australia],
R. Brown Iter Austral. 67, 1802-5, BM 001044143!

Etymology: From the Latin *formosus* (handsome, beautiful), a reference to the perceived appearance of this species.

Vernacular names: giant maidenhair; plumed maidenhair

Rhizomes long-creeping, up to 135 mm long (in herbarium specimens), 3–6 mm diameter, with stipes widely inserted; bearing scales; stolons and tubers absent. Rhizome scales narrowly ovate, 0.8–2 mm long, 0.1–0.3 mm wide, red-brown, appressed, concolorous. Fronds 470–970 mm long. Stipes 250–660 mm long, dark brown, tuberculate, rough, scattered scales proximally. Rachises dark brown, sulcate, sparsely tuberculate, slightly rough. Laminae usually 4-pinnate, or rarely 3-pinnate or 5-pinnate, broadly ovate, 200–450 mm long, 180–430 mm wide, dark green on both surfaces, herbaceous, glabrous on adaxial surface, glabrous or bearing pale flattened hairs on abaxial surface. 7–11 pairs of divided primary pinnae below long pinnate apex, overlapping, ovate or broadly ovate; costae bearing antrorse red-brown hairs; the longest pinnae at or near the base, 140–360 mm long, 110–320 mm wide, apices acute to acuminate, bases stalked, divided into secondary pinnae. 6–9 pairs of secondary pinnae on the proximal primary pinnae divided into tertiary pinnae; the longest secondary pinnae ovate or narrowly ovate, 75–220 mm long, 24–110 mm wide, apices acute to acuminate, bases stalked, divided into tertiary or quaternary pinnae, or rarely even more divided. Longest ultimate lamina segments oblong, 9–16 mm long, 4–8 mm wide, apices obtuse, acroscopic margins lobed or toothed, basisopic margins ± entire, bases stalked, with stalks attached in one corner. Reflexed lamina flaps lunulate, glabrous.

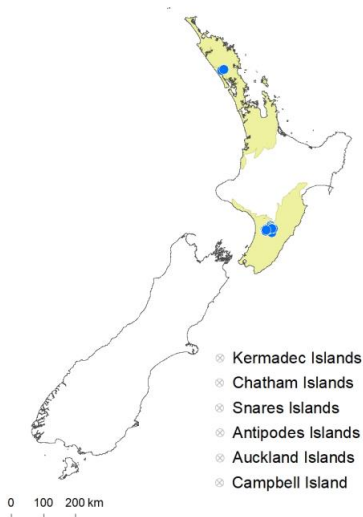


Fig. 31: *Adiantum formosum* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Northland, Auckland, Southern North Island

Altitudinal range: 50–90 m.

Adiantum formosum is currently found only in lowland sites around the Manawatū Gorge. It was formerly collected from the Wairoa River and Kaipara Harbour in Northland, but is now thought to be extinct in that region. Collections from Whangārei need confirmation, possibly having come from cultivated plants, or labelled with a broad and imprecise locality, and they are not mapped here. There are no collections in AK, CHR or WELT to substantiate records from Reef Point and Herekino (Crookes 1963; Bartlett 1980), and they must be regarded as suspect. The species is easily cultivated and it is unclear whether populations adjacent to the Manawatū Gorge, at Linton, Lake Horowhenua and in native forest at Masterton, are natural or the result of plantings, and they are not mapped here. Populations in Auckland city, Titirangi, Waitākere, Pukekohe and Pukekura Park are definitely cultivated.

Also Australia (Queensland, New South Wales, Victoria). Naturalised in Sri Lanka (Fraser-Jenkins et al. 2017).

Biostatus: Indigenous (Non-endemic).

Adiantum formosum was given a conservation status of At Risk – Relict by de Lange et al. (2018).

Habitat: In the vicinity of the Manawatū Gorge, *Adiantum formosum* grows on river terraces and streambanks under podocarp/broadleaved forest and scrub. It also occurs under pines and willows.

Recognition: *Adiantum formosum* is the largest and most divided of the indigenous species in New Zealand. It is usually 4-pinnate at the base but small fronds may occasionally be 3-pinnate and large fronds rarely 5-pinnate. It has oblong ultimate segments with the stalk attached in one corner, rough but glabrous stipes and rachises, hairy costae on the pinnae, lunulate and glabrous “indusia”, and a green abaxial lamina surface. Plants from Northland (now believed extinct) have pale hairs on the abaxial lamina surfaces, but those from the Manawatū are glabrous.

Cytology: $n = 58$ (Brownlie 1961).

Notes: *Adiantum formosum* in Australia is dimorphic with respect to hairs on the abaxial lamina surfaces – some populations are glabrous, others bear pale, flattened hairs. The fact that, in New Zealand, plants from Northland are hairy but those from elsewhere are glabrous suggests these populations have resulted from at least two different dispersal events. The two forms have not been given any taxonomic recognition in Australia (Bostock 1998) and are treated here as dimorphic character states within *A. formosum* (Brownsey et al. 2019).



Fig. 32: *Adiantum formosum*. Adaxial surface of mature 4-pinnate frond.



Fig. 33: *Adiantum formosum*. Adaxial surface of mature 4-pinnate frond.



Fig. 34: *Adiantum formosum*. Plants growing terrestrially under forest.



Fig. 35: *Adiantum formosum*. Plants growing terrestrially under forest.



Fig. 36: *Adiantum formosum*. Adaxial surface of mature 4-pinnate frond.



Fig. 37: *Adiantum formosum*. Abaxial surface of fertile frond with mature "indusia" on the acroscopic and distal margins of the lamina segments.



Fig. 38: *Adiantum formosum*. Close up, WELT P022571, Woodville, showing lamina segments attached in one corner, antrorse hairs on pinna costae, and glabrous abaxial lamina surfaces.



Fig. 39: *Adiantum formosum*. Close up of WELT P008202, Wairoa River, showing antrorse hairs on the pinna costae, and stiff hairs on the abaxial lamina surfaces.

Adiantum fulvum Raoul, *Choix Pl. Nouv.-Zél.* 9 (1846)

Holotype: Nouvelle-Zélande, Presqu'île de Banks [Banks Peninsula, New Zealand], Raoul, 1843, P! (photo WELT E476/1)

= *Adiantum viridescens* Colenso, *Trans. & Proc. New Zealand Inst.* 27: 400 (1895)

Lectotype (selected by Parris & Croxall 1974): New Zealand, presented by W. Colenso, 1897, K 001090067!

Etymology: From the Latin *fulvus* (tawny), a reference to the hairs on the rachises and pinna costae of this species.

Rhizomes long-creeping, up to 250 mm long (in herbarium specimens), 1.5–3 mm diameter, with stipes inserted 5–40 mm apart; bearing scales; stolons and tubers absent. Rhizome scales narrowly ovate, 2.0–6.5 mm long, 0.3–0.6 mm wide, red-brown, concolorous. Fronds 170–850 mm long. Stipes 50–530 mm long, dark brown, bearing spreading red-brown scales up to 6 mm long and 0.4 mm wide proximally, and shorter antrorse hairs distally. Rachises dark brown, sulcate, bearing antrorse red-brown hairs. Laminae usually 3-pinnate, or rarely 2-pinnate in small fronds or 4-pinnate in large fronds, broadly ovate or ovate, 90–360 mm long, 60–275 mm wide, dark green on both surfaces, herbaceous, glabrous or bearing stiff dark hairs on the abaxial surface. 1–5 pairs of divided primary pinnae below long pinnate apex, widely spaced especially proximally, ovate; costae hairy; the longest pinnae at or near the base, 40–220 mm long, 20–150 mm wide, apices acute to acuminate, bases stalked, divided into secondary pinnae. 1–3 (or very rarely 0) pairs of secondary pinnae on the proximal primary pinnae divided into tertiary pinnae, the remainder undivided; the basal basispic one the longest, ovate or narrowly ovate, 15–105 mm long, 10–48 mm wide, apices acute to acuminate, bases stalked. Rarely, the tertiary pinnae divided into 1–2 pairs of quaternary pinnae. Longest ultimate lamina segments oblong, curving acroscopically, 8–26 mm long, 3–9 mm wide, apices obtuse, acroscopic margins irregularly lobed, basispic margins ± entire, bases stalked, with stalks attached in one corner. Reflexed lamina flaps reniform, glabrous.

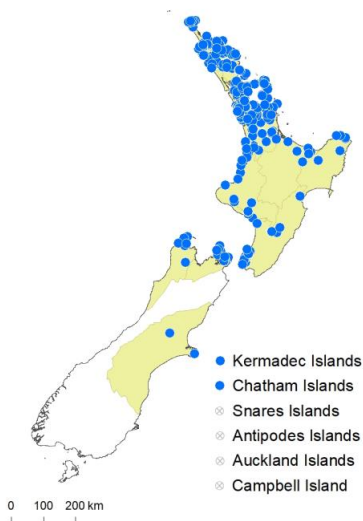


Fig. 40: *Adiantum fulvum* distribution map based on databased records at AK, CHR & WELT.

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

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

Kermadec Islands, Chatham Islands.

Altitudinal range: 0–450 m.

Adiantum fulvum occurs on the Kermadec Islands, and in lowland to montane areas of the North Island from Te Pahi to Wellington, but is common only from Northland to the Bay of Plenty, with more scattered populations south to Wellington. It is absent from much of the central North Island. In the South Island it is confined to the Marlborough Sounds and north-west Nelson, but was formerly known from Oxford, Canterbury (WELT P008398), and Banks Peninsula (Akaroa, Kirk, CHR 291742; J.F. Armstrong, CHR 633293), where it has not been collected since the 19th century, but from where the species was first described (Raoul 1846). It grows from near sea level, reaching 450 m in the Tutamoe Range, Northland. A single collection (AK 300996) has been made from the Chatham Islands.

Biostatus: Indigenous (Endemic).

Habitat: *Adiantum fulvum* grows on the ground under kauri, podocarp, broadleaved and coastal forest, and under mānuka, kānuka and coastal scrub, usually on drier ground. It is found on streambanks, river terraces and clay banks, in gullies, among rocks, on rubbly slopes, on tracksides, road banks and rock faces, on steep hillsides, and on coastal cliffs. It occurs on greywacke, limestone and mudstone rock.

Recognition: *Adiantum fulvum* is usually 3-pinnate at the base, but rarely large fronds may be 4-pinnate and small fronds only 2-pinnate. The species has oblong, ultimate segments that curve acroscopically at their apices; their abaxial surfaces are green, and the stalks are attached in the corners. The species is dimorphic, the abaxial lamina surfaces being either hairy or glabrous. The stipes, rachises and pinna costae bear antrorse red-brown hairs, and the “indusia” are reniform and glabrous. Large, 4-pinnate fronds can resemble small plants of *A. formosum*, but the stipes and rachises are hairy, whereas in *A. formosum* they are rough and glabrous; the “indusia” of *A. formosum*

are lunulate in shape rather than truly reniform as in *A. fulvum*; and the ultimate lamina segments of *A. formosum* are generally shorter than in *A. fulvum* (9–16 mm long, cf. 8–26 mm long).

Cytology: $n = 58$ (Brownlie 1965, as *A. fulvum*); $2n = 116$ (Murray & de Lange 2013, as *A. viridescens*).

Hybridisation: It is possible that *Adiantum fulvum* hybridises occasionally with *A. cunninghamii*. One collection (AK 353971) has hairs on the abaxial pinna surfaces and vestigial hairs on the rachises, but the sori are over-mature and the nature of the spores unknown (Brownsey et al. 2019).

Notes: *Adiantum fulvum* was described by Raoul (1846) from a collection he made on Banks Peninsula in 1843. There is also a collection made by J.F. Armstrong in 1864, and another by Thomas Kirk from Akaroa, probably in 1876. However, it has not been collected on Banks Peninsula since that date.

The hairy and glabrous forms of *A. fulvum* were previously recognised as *A. fulvum* and *A. viridescens* (Parris & Croxall 1974). However, Brownsey et al. (2019) found that the two forms could not be distinguished by any character other than the presence or absence of hairs on the abaxial lamina surface, and proposed that they be regarded as dimorphic character states within *A. fulvum*, consistent with the treatment of other dimorphic *Adiantum* species in New Zealand.

Adiantum fulvum is recorded here for the first time from the Kermadec Islands (AK 326202).



Fig. 41: *Adiantum fulvum*. Adaxial surface of mature 3-pinnate frond.



Fig. 42: *Adiantum fulvum*. Adaxial surface of mature 3-pinnate frond.



Fig. 43: *Adiantum fulvum*. Adaxial surface of mature frond showing dark, glossy surface, and red-brown rachis and costae.



Fig. 44: *Adiantum fulvum*. Antrorse hairs on the rachis.



Fig. 45: *Adiantum fulvum*. Close up of WELT P020557/B, Puketi Forest, showing antrorse hairs on pinna costae, and glabrous abaxial lamina surfaces.



Fig. 46: *Adiantum fulvum*. Close up of WELT P021143/B, Whangaroa, showing antrorse hairs on pinna costae, and stiff hairs on abaxial lamina surfaces.



Fig. 47: *Adiantum fulvum*. Close up of WELT P016134, Warawara, showing elongated lamina segments attached in one corner, tapering and curving acroscopically at apices.



Fig. 48: *Adiantum fulvum*. Close up of WELT P021143/B, Whangaroa, showing oblong lamina segments attached in one corner, obtuse and straight at apices.

***Adiantum hispidulum* Sw., *J. Bot. (Schrader)* 1800(2): 82 (1801)**

Holotype: N. Hollandia [Australia], Herb. Swartz, S-P-8123 (!online)

= *Adiantum pedatum* G.Forst., *Fl. Ins. Austr.* 83 (1786) nom. illeg., non *Adiantum pedatum* L. 1753

≡ *Adiantum pubescens* Schkuhr, *24. Kl. Linn. Pfl.-Syst.* 1, 108, t. 116 (1809) nom. nov. pro *Adiantum pedatum* G.Forst. 1786

≡ *Adiantum hispidulum* var. *pubescens* (Schkuhr) Large & Braggins, *New Zealand J. Bot.* 31: 416 (1993)

Lectotype (selected by Parris 1980): no locality, Herb. G. Forster 295.458, BM 001048367!

Etymology: From the Latin *hispidulus* (slightly bristly), a reference to the bristly hairs on the lamina segments.

Rhizomes short-creeping or erect, up to 30 mm long (in herbarium material), up to 2 mm diameter, with stipes closely inserted; stoloniferous; bearing scales; stolons and tubers absent. Rhizome scales narrowly triangular, 0.9–3.0 mm long, 0.2–0.4 mm wide, dark brown, concolorous. Fronds 100–730 mm long. Stipes 30–450 mm long, dark brown, bearing scattered scales proximally and abundant antrorse hairs distally. Rachises red-brown; bearing abundant, short, pale brown, antrorse hairs, and a few scattered, straight, dark brown hairs to 1.5 mm long. Laminae helicoid or 2–3-pinnate, broadly ovate or broadly elliptic or orbicular or broader than long, 55–285 mm long, 45–340 mm wide; dark

green on both surfaces, tinged red in immature fronds, coriaceous, bearing stiff whitish hairs 0.1–1.0 mm long on both surfaces; costae bearing pale brown antrorse hairs on both surfaces. Primary pinnae narrowly elliptic or narrowly ovate or ± linear, 20–280 mm long, 8–35 mm wide, apices acute or acuminate, bases stalked. Longest ultimate segments oblong, 6–23 mm long, 3–7 mm wide, apices acute to obtuse, acroscopic margins regularly lobed, basispic margins entire, bases stalked, with stalks attached in one corner. Reflexed lamina flaps reniform, hairy.

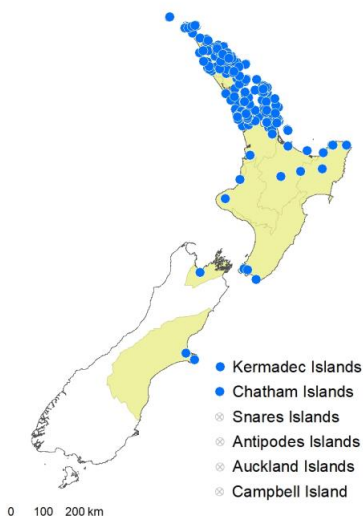


Fig. 49: *Adiantum hispidulum* distribution map based on databased records at AK, CHR & WELT.

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

South Island: Sounds-Nelson, Canterbury.

Kermadec Islands, Three Kings Islands, Chatham Islands.

Altitudinal range: 0–400 m.

Adiantum hispidulum occurs on the Kermadec and Three Kings Islands, and in lowland areas of the North Island from Te Pahi to Wellington. It is common from Te Pahi to Auckland and the Bay of Plenty, but there are only scattered records on the west coast south to Wellington. It grows from near sea level, reaching 400 m on Mt Pirongia. In the South Island there are two collections in the Armstrong Herbarium from Governors Bay, Lyttelton Harbour (CHR 633291), and from Akaroa (CHR 633292), both collected about 150 years ago. Allan (1961) recorded it from D'Urville Island, but the specimen (CHR 62007) has been re-determined as *A. fulvum* (Beever et al. 1989). Allan also recorded it from Bishopdale, near Nelson, and from Seaview, Dunedin, but no supporting herbarium specimens have been located. Recently, it has been collected from near Richmond and reported from East Tākaka (Jones 2019). The species also occurs on the Chatham Islands.

Also southern Africa, southern India, Asia, Malaysia, Australia (Western Australia, Northern Territory, Queensland, New South Wales, Australian Capital Territory, Victoria), Norfolk Island (as *A. pubescens*), Lord Howe Island, Vanuatu, New Caledonia, Fiji, Tonga, Cook Islands, French Polynesia and Pitcairn Island. It is naturalised in North America (Windham 1993), Europe (Fraser-Jenkins et al. 2017), and Hawai'i (Palmer 2003).

Biostatus: Indigenous (Non-endemic).

Habitat: *Adiantum hispidulum* grows on the ground under podocarp, broadleaved, beech and coastal forest, under mānuka and kānuka, in coastal scrub, and under pines. It is found on streambanks, amongst rocks and in crevices, on cuttings, on rock overhangs and rocky banks, in clearings and on bush margins, on dry hillsides and grassy slopes, on sandy banks, and on coastal cliffs.

Recognition: *Adiantum hispidulum* can usually be distinguished from all other maidenhair ferns in New Zealand by its characteristic helicoid branching. A few plants are regularly 2–3-pinnate, and these may be confused with divided forms of *A. diaphanum*, but they can be distinguished by their more divided laminae and lack of tubers on the rootlets. Young fronds are also often tinged red when young.

Adiantum hispidulum is dimorphic with respect to the nature of the hairs on the abaxial surface of the laminae. Most plants have short, stiff hairs 0.1–0.8 mm long, but a few have longer, lax hairs 0.3–1.0 mm long. Parris (1980) recognised the former as *A. hispidulum* and the latter as *A. pubescens* Schkuhr. However, in a detailed investigation of the two taxa, Large & Braggins (1993) found that the two taxa could only be distinguished on the basis of their hair characters, and even then there was a high degree of variability. They treated *A. pubescens* as a variety of *A. hispidulum*, and the dimorphic nature of the species can be recognised at this rank if required.

Var. *pubescens* has a slightly different distribution to that of var. *hispidulum*. It is the only form that has been collected on the Kermadec Islands. Otherwise it is confined to Northland, with isolated populations at Pouto, Kaipara Harbour and Piha (Parris 1980). Its distribution in this area overlaps entirely with var. *hispidulum*, but it does not extend to the rest of the North Island or the South Island.

Cytology: $n = c. 174$ (Brownlie 1957), $2n = c. 160–173$, possibly apomictic (Large 1984).

Notes: Further investigation is required to ascertain whether the differences in hair type on the abaxial lamina surfaces of *A. hispidulum* correlate with genetic differences in different parts of its extensive geographical range.



Fig. 50: *Adiantum hispidulum*. Adaxial surface of mature helicoid fronds.



Fig. 51: *Adiantum hispidulum*. Immature frond coloured pink.



Fig. 52: *Adiantum hispidulum*. Fronds growing terrestrially, with immature fronds tinged pink.



Fig. 53: *Adiantum hispidulum*. Antrorse hairs on the stipe and pinna costae.



Fig. 54: *Adiantum hispidulum*. Abaxial surface of fertile frond showing oblong lamina segments attached in one corner, and immature "indusia" on the acroscopic margins.



Fig. 55: *Adiantum hispidulum*. Abaxial surface of fertile frond with mature "indusia" on the acroscopic and distal margins of the lamina segments.



Fig. 56: *Adiantum hispidulum*. Close up of WELT P016160, Russell, showing short, stiff hairs on abaxial lamina surface.



Fig. 57: *Adiantum hispidulum*. Close up of WELT P020741, Raoul Island, showing long, lax hairs on abaxial lamina surface (sometimes known as var. *pubescens*).

***Adiantum raddianum* C.Presl, Tent. Pterid. 158 (1836)**

nom. nov. pro *Adiantum cuneatum* Langsd. & Fisch. 1810

≡ *Adiantum cuneatum* Langsd. & Fisch., *Pl. Voy. Russes Monde, Icon. Fil.* 23, t. 26 (1810) nom. illeg., non *Adiantum cuneatum* G.Forst. 1786

Lectotype (selected by Hirai & Prado 2019: Brasilia [Brazil], Ins. St. Catharina, *G.H. von Langsdorff s.n.*, LE 00000018 (!online))

Etymology: Named in honour of Guiseppe Raddi (1770–1829), Italian botanist at Florence, who collected in Brazil on the Austrian Expedition (1817–1818).

Vernacular name: delta maidenhair fern

Rhizomes short-creeping, up to 100 mm long (in herbarium specimens), 2–3.5 mm diameter, with stipes closely inserted; bearing scales; stolons and tubers absent. Rhizome scales narrowly ovate, 1–2.5 mm long, 0.2–0.4 mm wide, orange-brown, concolorous. Fronds 125–680 mm long. Stipes 45–430 mm long, dark brown, polished, glabrous except for a few scattered scales proximally. Rachises dark brown, sulcate, polished, glabrous. Laminae 3–4-pinnate, or rarely 5-pinnate, ovate or broadly ovate or elliptic, 80–350 mm long, 30–270 mm wide, mid-green on both surfaces, herbaceous, glabrous. 7–10 pairs of divided primary pinnae below pinnate apex, widely spaced especially proximally, ovate; the longest at or near the base, 25–155 mm long, 12–85 mm wide, apices acute or obtuse, bases stalked, divided into secondary pinnae. 2–7 pairs of secondary pinnae on proximal primary pinnae divided into tertiary pinnae; the longest secondary pinnae ovate, 12–55 mm long, 7–38 mm wide, apices obtuse, bases stalked, divided into tertiary and sometimes quaternary segments. Longest ultimate lamina segments flabellate, longer than broad, 4–17 mm long, 2–17 mm wide, apices rounded, often divided into two or more lobes, bases stalked, with stalks attached centrally. Reflexed lamina flaps reniform, glabrous.

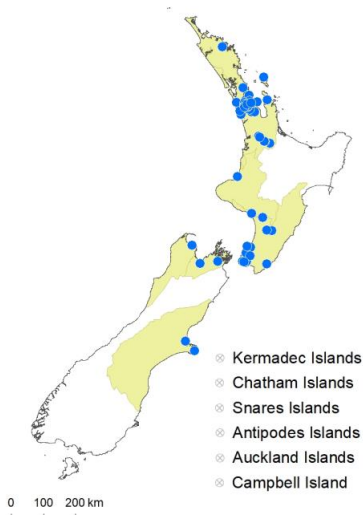


Fig. 58: *Adiantum raddianum* distribution map based on databased records at AK, CHR & WELT.

limestone, sandstone, scoria, and volcanic soils, as well as on concrete block walls and in other urban habitats.

First record: Brownsey (1981). Voucher AK 129354, 1971. However, the Armstrong record from Akaroa (cited above) suggests that the species has been in New Zealand for much longer, perhaps mistakenly identified as *A. aethiopicum*.

Recognition: *Adiantum raddianum* is distinguished by its 3–4-pinnate fronds, flabellate ultimate segments with the stalks attached centrally, glabrous rachises and laminae, reniform and glabrous “indusia”, and the green colour of the abaxial lamina surface. It is easily confused with the indigenous *A. aethiopicum*, but distinguished by its ultimate lamina segments, which are longer than broad, and at least some are more deeply incised than the indusial notches, forming two or more distinct lobes. The ultimate segments in *A. aethiopicum* are generally broader than long, and entire or shallowly incised, especially at the point of attachment of the “indusia”. There is also a true creeping rhizome in *A. raddianum*, whereas *A. aethiopicum* has a more or less erect rhizome with long-creeping stolons.

Notes: From a comparison of *rbcL* sequences, Bouma et al. (2010) noted that New Zealand plants might be misidentified. However, this stemmed from incorrectly labelled sequences on GenBank, and an *rbcL* sequence from New Zealand material matches that of plants labelled as *Adiantum raddianum* by Hirai et al. (2016) (Perrie unpub.).

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

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

Altitudinal range: 0–200 m.

In the North Island, *Adiantum raddianum* occurs from the Bay of Islands to Wellington, most commonly near urban areas, and in the South Island it is recorded from Golden Bay, Nelson, the Marlborough Sounds, and Christchurch. There is also a very early record from near Akaroa, collected by J.B. Armstrong in 1866 (CHR 633287). It is apparently becoming increasingly common and widespread.

Occurs naturally in tropical regions of Central and South America. Naturalised in Africa (Crouch et al. 2011), Ascension Island, St Helena, Macaronesia, Asia (Fraser-Jenkins et al. 2017), Vanuatu (Nakamura 2008) and Hawai'i (Palmer 2003).

Biostatus: Exotic; fully naturalised.

Habitat: *Adiantum raddianum* grows on the ground in open areas, or under light, broadleaved forest, beech forest, or under introduced trees. It is found on river banks and cliffs, on track banks, and on coastal hillsides. It grows on greywacke,



Fig. 59: *Adiantum raddianum*. Mature plant growing on a bank.



Fig. 60: *Adiantum raddianum*. Adaxial surface of mature 3-pinnate frond.



Fig. 61: *Adiantum raddianum*. Mature fronds.



Fig. 62: *Adiantum raddianum*. Abaxial surface of fertile frond showing deeply divided lamina segments that are attached centrally and generally longer than broad.

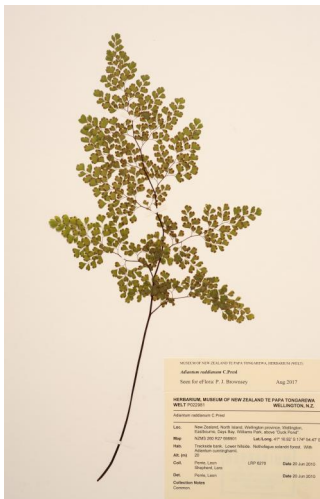


Fig. 63: *Adiantum raddianum*. Herbarium specimen from Eastbourne, WELT P022981, showing fertile frond.



Fig. 64: *Adiantum raddianum*. Close up of WELT P022981, showing lamina segments that are glabrous, attached centrally, longer than broad, and deeply lobed.

***Anogramma* Link, *Fil. Spec.* 137 (1841)**

Type taxon: *Anogramma leptophylla* (L.) Link

Etymology: From the Greek *ano-* (upwards) and *gramme* (line), a reference to the sori, which run along the veins of the pinna segments.

Terrestrial ferns; sporophytes annual, growing from a perennial and tuberous prothallus. Rhizomes erect, rudimentary, bearing multicellular hairs. Fertile and sterile fronds dimorphic. Stipes pale brown to red-brown, glossy. Sterile laminae irregularly flabellate. Fertile laminae 1–3-pinnate, herbaceous, glabrous. Pinnae and ultimate lamina segments not articulated to rachis and costae. Veins free. Sori extending along the veins, exindusiate; paraphyses absent. Spores trilete, lacking chlorophyll; perispores verrucate to tuberculate with prominent ridges parallel to the equatorial flange.

Taxonomy: A genus of two to five species included in subfamily Pteridoideae, along with *Pteris* (Nakazato & Gastony 2003; Zhang et al. 2015; PPG 1 2016).

Anogramma, as traditionally interpreted, has been shown to be polyphyletic (Nakazato & Gastony 2003), with one species more closely related to *Jamesonia*, others to *Pityrogramma*, and two

previously recognised species nested within *Anogramma leptophylla*. Indeed, only the widespread *A. leptophylla* and the South American *A. lorentzii* remain within the *Anogramma* clade, along with the European *Cosentinia vellea*, which can be treated as a monotypic genus or included within *Anogramma*.

Distribution: *Anogramma leptophylla* is subcosmopolitan, occurring in Central and South America, southern Europe, Africa, India, southern Asia, and Australasia. *A. lorentzii* is restricted to South America. Other species previously included in *Anogramma* either belong elsewhere or are synonymous with *A. leptophylla* (Nakazato & Gastony 2003). One indigenous species in New Zealand.

Biostatus: Indigenous (Non-endemic).

Table 3: Number of species in New Zealand within *Anogramma* Link

Category	Number
Indigenous (Non-endemic)	1
Total	1

Recognition: In New Zealand, *Anogramma* can be recognised by its small, delicate fronds with exindusiate sori extending along the veins. It also has distinctive trilete spores with double or triple, broad equatorial ridges, and verrucate to tuberculate faces (Large & Braggins 1991).

Cytology: Base chromosome numbers of $x = 26, 27$ or 29 have been recorded in *Anogramma* (Lovis et al. 1993).

***Anogramma leptophylla* (L.) Link, *Fil. Spec.* 137 (1841)**

≡ *Polypodium leptophyllum* L., *Sp. Pl.* 1092 (1753)

≡ *Asplenium leptophyllum* (L.) Sw., *Obs. Bot.* 403 (1791)

≡ *Osmunda leptophylla* (L.) Savigny in Desrousseaux et al., *Encycl.* 4, 657 (1798)

≡ *Acrostichum leptophyllum* (L.) Lam. & DC., *Fl. Franc.*, ed. 3, 2, 565 (1805)

≡ *Grammitis leptophylla* (L.) Sw., *Syn. Fil.* 218 (1806)

≡ *Gymnogramma leptophylla* (L.) Desv., *Mag. Neuesten Entdeck. Gesamten Naturk. Ges. Naturf. Freunde Berlin* 5: 305 (1811)

≡ *Hemionitis leptophylla* (L.) Lag., *Gen. Sp. Pl.* 33 (1816)

≡ *Pityrogramma leptophylla* (L.) Domin, *Spisy Přír. Fak. Karlovy Univ.* 88: 9 (1928)

Lectotype (selected by Morton 1970): [in Hispania, Lusitania, Galloprovincia – Spain], LINN 1251.56 (!online; see Jarvis 2007).

= *Gymnogramma novae-zelandiae* Colenso, *Tasmanian J. Nat. Sci.* 2: 165 (1845) – as *G. novae zelandiae*

Lectotype (selected by Allan 1961): near Tamaki Creek, Thames [Auckland], *W. Colenso*, 1842, WELT P003193!

Etymology: From the Latin *leptophyllus* (fine-leaved), a reference to the finely divided lamina of this species.

Vernacular names: Jersey fern; annual fern

Rhizomes erect, bearing pale brown multicellular hairs to 1.5 mm long. Fronds dimorphic; sterile 10–47 mm long, fertile 15–115 mm long. Stipes 8–65 mm long, red-brown, bearing a few hairs proximally. Rachises red-brown proximally, becoming green distally, glabrous. Sterile laminae irregularly flabellate to 2-pinnate, 5–29 mm long, 9–20 mm wide. Fertile laminae 1–3-pinnate, narrowly ovate to broadly ovate, 5–60 mm long, 4–42 mm wide, pale green on both surfaces, herbaceous, glabrous. Primary pinnae in 1–7 pairs below short pinnatifid apex, not overlapping; the longest at or near the base, ovate to broadly ovate, 2–30 mm long, 2–25 mm wide; apices acute to obtuse, bases short-stalked. Secondary pinnae ovate to broadly ovate, 2–15 mm long, 2–10 mm wide; apices obtuse, bases short-stalked. Ultimate segments flabellate, deeply divided; apices obtuse, bases sessile. Sori elongate along the veins, often covering the whole pinna segment at maturity; exindusiate.

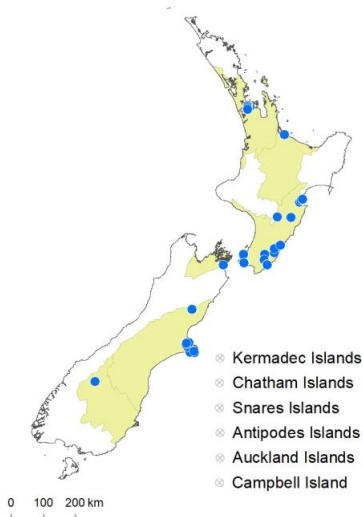


Fig. 65: *Anogramma leptophylla* distribution map based on databased records at AK, CHR & WELT.

Habitat: *Anogramma leptophylla* is an annual fern, sprouting in May in northern districts, later in the south, reaching maturity in August and September. It dies away as the ground dries out and regenerates each year from spores or perennial tubers on the prothalli. It is found on steep banks and rock faces, in rock crevices, on scoria bluffs, on grassy streambanks and grassy hillsides, and on shoreline rocks, often at scrub margins or under light scrub or kānuka. It grows on volcanic and calcareous substrates. It is often associated with the liverwort *Targionia hypophylla* and frequently grows amongst grasses and weedy species.

Recognition: *Anogramma leptophylla* is recognised by its small size, delicate and pale green fronds, glabrous laminae, and exindusiate sori extending along the veins and often covering the whole pinna segment at maturity.

Cytology: n = 26 (Lovis et al. 1993).

Notes: The locality on the type sheet of *Gymnogramma novae-zelandiae* is given in Colenso's writing as "Tamaki Creek, Thames", but this is almost certainly an error for "Tamaki Creek, Auckland". In the protologue, Colenso (1845) stated that the original collection was made "in sheltered grassy spots amongst scoria, on dry volcanic hills, between Manukau Bay and Tamaki Creek, about ten miles from Auckland".

Anogramma leptophylla is subcosmopolitan in distribution. However, molecular analysis of populations from different geographic regions by Nakazato & Gastony (2003) indicated that distinct New and Old World clades could be recognised. Lovis et al. (1993) noted that populations from Europe, South Africa and New Zealand all had n = 26, whereas plants from Mexico had n = 27 or 29, suggesting a cytological difference between the two clades. If these cytological and molecular differences are supported by morphological differences, there would be a strong case for recognising two separate taxa. The type of *A. leptophylla* is from Spain and belongs to the Old World clade, which also includes New Zealand material. Any new name would therefore be applied only to the New World clade.

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

South Island: Sounds-Nelson, Canterbury, Otago.

Altitudinal range: 15–600 m.

Anogramma leptophylla occurs in lowland sites of the North Island from Auckland to Wellington, predominantly in the eastern half of the island from Hawke's Bay to Wairarapa. It grows from around 15 m, reaching 400 m in eastern Wairarapa. In the South Island it occurs along the east coast from the Marlborough Sounds to Banks Peninsula, with an outlying population near Wanaka. It is found mostly in lowland sites but reaches 600 m at Lyndon in Canterbury.

Also Central and South America, Europe, Africa, India, China, Taiwan, Vietnam and Australia (Western Australia, South Australia, New South Wales, Victoria, Tasmania).

Biostatus: Indigenous (Non-endemic).

Anogramma leptophylla was given a conservation status of Nationally Vulnerable by de Lange et al. (2018).



Fig. 66: *Anogramma leptophylla*. Mature plant growing terrestrially.



Fig. 67: *Anogramma leptophylla*. Glabrous, yellow-green frond on mature plant.



Fig. 68: *Anogramma leptophylla*. Mature fronds.



Fig. 69: *Anogramma leptophylla*. Plants growing on steep soil bank.



Fig. 70: *Anogramma leptophylla*. Close up of WELT P015494, Carters Bush, Wairarapa, showing fertile fronds with red-brown stipes.



Fig. 71: *Anogramma leptophylla*. Close up of WELT P020808, Pahaoa Gorge, Wairarapa, showing exindusiate sori extending along the veins.

***Cheilanthes* Sw., Syn. Fil. 126 (1806), nom. cons.**

Type taxon: *Cheilanthes micropteris* Sw.

Etymology: From the Greek *cheilos* (lip) and *anthos* (flower), a reference to the sori, which occur on the margin of the pinnae.

Terrestrial or rupestral ferns. Rhizomes short- to long-creeping, scaly. Rhizome scales non-clathrate, narrowly ovate, attached at base, concolorous or bicolorous, light to dark brown. Fronds monomorphic (NZ) or rarely dimorphic (not NZ). Stipes and rachises red-brown. Laminae 2–3-pinnate (NZ) or 1-pinnate and 4–5-pinnate (not NZ), herbaceous or coriaceous, glabrous or scaly and/or hairy, sometimes farinose abaxially (not NZ). Pinnae and ultimate lamina segments not articulated to rachis and costae. Veins free (NZ) or rarely reticulate (not NZ). Sori terminating veins at lamina margin, or extending almost continuously along the margins; paraphyses present; sori ± protected by the unmodified inrolled lamina margin. Spores trilete, lacking chlorophyll; perispores verrucate, tuberculate or echinate, without an equatorial flange.

Taxonomy: A genus of c. 100 species, included in the subfamily Cheilantheoideae along with *Myriopteris* and *Pellaea* (PPG 1 2016).

Cheilanthes, as currently construed (Eiserhardt et al. 2011; Zhang & Yatskievych 2013; PPG 1 2016), is not monophyletic, and is in need of a comprehensive phylogenetic study to determine generic boundaries within the group. One New Zealand species was previously included in the genus *Notholaena* (e.g. Cheeseman 1925, as *Nothochlaena*), which was first described from Australia by Brown (1810). However, the typification of *Notholaena* has been very controversial, and the genus is now considered to be typified by a New World species, and confined to the Americas (Yatskievych & Smith 2003; Rothfels et al. 2008; PPG 1 2016).

The Australian species of *Cheilanthes*, including both species indigenous to New Zealand, have been extensively reviewed by Quirk et al. (1983) and Chambers & Farrant (1991, 1998), and those in southern Africa by Anthony (1984). Allan (1961) followed earlier New Zealand Flora writers in accepting three species, but one of them, *C. tenuifolia*, is now thought to occur in coastal regions of Queensland and Northern Territory, extending to Nepal, India, Sri Lanka, South-East Asia and the Pacific islands (Chambers & Farrant 1991). Plants attributed to this species in New Zealand have been re-identified as large forms of *C. sieberi*. In addition, *C. viridis* (as *Pellaea viridis*) was recognised as a casual species in New Zealand by Webb et al. (1995).

- | | | |
|---|---|----------------|
| 1 | Primary pinnae bearing abundant scales as well as hairs..... | <i>distans</i> |
| | Primary pinnae glabrous or bearing only hairs..... | 2 |
| 2 | Tertiary pinnae 15–25 mm long, 6–12 mm wide, never strongly curled inwards..... | <i>viridis</i> |
| | Tertiary pinnae 1–10 mm long, 1–3 mm wide, often strongly inrolled..... | <i>sieberi</i> |

Distribution: *Cheilanthes* is distributed in Europe, Africa, Asia, Australasia, Oceania and South America, with centres of diversity in South Africa, Australia and South America; 17 species in China (Zhang & Yatskievych 2013), 24 in South Africa (Roux 2009), 15 in Australia (Chambers & Farrant 1998), and five in the south-west Pacific (Nakamura 2008). Three species in New Zealand; two indigenous and one naturalised, none endemic.

Biostatus: Indigenous (Non-endemic).

Table 4: Number of species in New Zealand within *Cheilanthes* Sw.

Category	Number
Indigenous (Non-endemic)	2
Exotic: Casual	1
Total	3

Recognition: In New Zealand, species of *Cheilanthes* can be recognised by their small to medium-sized 2–3-pinnate fronds, sori extending around the lamina edges protected by the inrolled pinna margins, and scabrate to verrucate spores (Large & Braggins 1991). They occur most frequently in dry, rocky habitats.

Cytology: Base chromosome numbers of $x = 26, 27, 28, 29$ and 30 have been recorded in *Cheilanthes*. There is also an extensive polyploid series from diploid to hexaploid, and several species are known to be apomictic (Tindale & Roy 2002).

***Cheilanthes distans* (R.Br.) Mett., *Abh. Senckenberg. Naturf. Ges.* 3: 69 (1859)**

≡ *Notholaena distans* R.Br., *Prodr. Fl. Nov. Holland.* 146 (1810)

≡ *Hemionitis distans* (R.Br.) Christenh. in Christenhusz et al., *Global Flora, GLOVAP Nomenclature* 1, 4, 13 (2018)

Lectotype (selected by Quirk et al. 1983): Port Jackson [Sydney, Australia],
R. Brown Iter Austral. 4, 1802-5, BM 001044061 (!online)

= *Cheilanthes ambigua* Brack., *U.S. Expl. Exped., Filic.* 16, 91 (1854) nom. illeg., non *Cheilanthes ambigua* A.Rich. 1832

Holotype: New Zealand, United States Exploring Expedition, US 00821469 (!online)

Etymology: From the Latin *distans* (widely separated), a reference to the widely separated pinnae in this species.

Vernacular names: woolly cloak fern; woolly rock fern

Rhizomes short- to long-creeping, up to 70 mm long (in herbarium specimens), 1–2 mm diameter, with stipes closely inserted; bearing appressed scales. Rhizome scales narrowly ovate, 1.5–3 mm long, 0.2–0.4 mm wide, dark brown with paler margins. Fronds monomorphic, 25–310 mm long, rarely to 400 mm long. Stipes 10–130 mm long, rarely to 150 mm long, erect, rigid, red-brown; bearing abundant narrowly ovate orange-brown scales, 2.5–4 mm long, 0.2–0.4 mm wide. Rachises red-brown, sulcate, densely scaly. Laminae 12–220 mm long, rarely to 260 mm long, 6–33 mm wide (sterile laminae sometimes slightly larger), 2-pinnate to 2-pinnate-pinnatifid, narrowly obovate or narrowly elliptic or linear, tapering to a pinnatifid apex, erect, dark green on both surfaces, coriaceous, bearing white hairs to 1 mm long on the adaxial surface, and abundant pale brown scales to 2.5 mm long, 0.3 mm wide on the abaxial surface. Primary pinnae in 6–18 pairs below pinnatifid apex, widely spaced especially proximally, ovate or broadly ovate; the longest near the middle, 3–25 mm long, 2–12 mm wide, apices acute, bases short-stalked, divided into secondary pinnae. Secondary pinnae decreasing in length along each primary pinna to the distal end; the longest secondary pinnae elliptic or ovate, 2–10 mm long, 1–4 mm wide, apices acute or obtuse, bases stalked or sessile, sometimes partially divided into tertiary segments. Sori almost continuous around pinna margins, protected by the inrolled margins. 16 spores per sporangium.

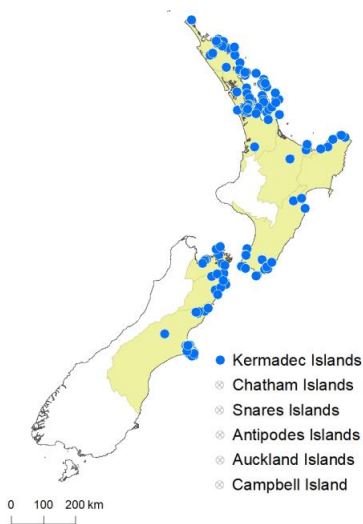


Fig. 72: *Cheilanthes distans* distribution map based on databased records at AK, CHR & WELT.

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

South Island: Sounds-Nelson, Marlborough, Canterbury.

Kermadec Islands

Altitudinal range: 0–600 m.

Cheilanthes distans has been collected once on Raoul Island in the Kermadec Islands. It occurs in lowland districts of the North Island from Te Pahi to Wellington, largely confined to the eastern half of the island but apparently absent from much of Gisborne and northern Wairarapa. It grows from near sea level, mostly to c. 275 m, but has also been recorded from 600 m on Mt Pirongia. In the South Island it is confined to eastern areas from Tasman Bay to Banks Peninsula, growing from about 60 m, reaching 380 m on the Port Hills, Christchurch. It has also been observed near Separation Point in Abel Tasman National Park (see iNaturalist 5682101), but not yet collected from there, and not recorded on the distribution map.

Also Australia (Western Australia, South Australia, Queensland, New South Wales, Victoria, Tasmania), Norfolk Island, Lord Howe Island and New Caledonia.

Biostatus: Indigenous (Non-endemic).

Habitat: *Cheilanthes distans* grows on dry cliffs, on rocky outcrops and scoria, on lava field, in rock crevices, on roadside banks and cuttings, and on grassy hillsides, often in sunny situations. It is found under kānuka, mānuka and scrub, often in coastal areas, and sometimes in full sun. It grows on volcanic rock, greywacke, sandstone and limestone substrates.

Together with *Anogramma leptophylla*, *Asplenium flabellifolium*, *A. subglandulosum*, *Cheilanthes sieberi* and *Pellaea calidirupium*, *Cheilanthes distans* forms a characteristic assemblage of ferns that inhabit dry rocky areas, especially in the eastern South Island.

Recognition: *Cheilanthes distans* is easily distinguished from other New Zealand species of this genus by its abundant covering of hairs on the adaxial lamina surface and narrowly ovate, pale brown scales on the abaxial surface. The laminae are also generally shorter, narrower and less divided than in *C. sieberi* (12–220 mm long cf. 30–250 mm long; 6–33 mm wide cf. 6–80 mm wide). The two species frequently occur together, and both are rigidly upright ferns.

Cytology: $2n = 116$ (Murray & de Lange 2013). In Australia several counts indicate that plants are apomictic, with 84 univalents present at meiosis (Tindale & Roy 2002). There is also one count of $2n = c. 110$ of a possibly apomictic plant (Quirk et al. 1983).



Fig. 73: *Cheilanthes distans*. Mature plant growing terrestrially.



Fig. 74: *Cheilanthes distans*. Adaxial surface of mature frond.



Fig. 75: *Cheilanthes distans*. Mature plants growing on a steep rocky bank.



Fig. 76: *Cheilanthes distans*. Adaxial surface of mature frond showing white hairs on the lamina surface, and scales on the rachis.



Fig. 77: *Cheilanthes distans*. Abaxial surface of fertile frond showing abundant scales on the rachis and pinna costae.



Fig. 78: *Cheilanthes distans*. Abaxial surface of fertile frond showing sori almost continuous around the margins, partly protected by the inrolled lamina.

***Cheilanthes sieberi* Kunze in Lehmann, *Pl. Preiss.* 2, 112 (1846)**

≡ *Cheilanthes tenuifolia* var. *sieberi* (Kunze) Hook.f., *Handb. New Zealand Fl.* 362 (1864)

≡ *Cheilanthes tenuifolia* subsp. *sieberi* (Kunze) Domin, *Biblioth. Bot.* 20(85): 140 (1913)

≡ *Hemionitis sieberi* (Kunze) Christenh. in Christenhusz et al., *Global Flora, GLOVAP Nomenclature* 1, 4, 21 (2018)

Lectotype (selected by Quirk et al. 1983): Western Australia, Swan River, *Preiss 1304*, BM 001044078 (online)

= *Cheilanthes sieberi* var. *deltoidea* J.B.Armstr., *Trans. & Proc. New Zealand Inst.* 12: 346 (1880) nom. nov. pro *Cheilanthes tenuifolia* sensu Kirk 1874

Lectotype (selected by Brownsey & Perrie 2020): Port Lyttleton, *T. Kirk*, WELT P008438!

= *Cheilanthes kirkii* J.B.Armstr., *Trans. & Proc. New Zealand Inst.* 13: 360 (1880) nom. nov. pro *Cheilanthes tenuifolia* sensu Kirk 1874

Lectotype (selected by Brownsey & Perrie 2020): Port Lyttleton, *T. Kirk*, WELT P008438!

= *Cheilanthes venosa* Colenso, *Trans. & Proc. New Zealand Inst.* 25: 321 (1893)

Lectotype (selected by Quirk et al. 1983): Hawkes Bay, Herb. Colenso, WELT P003330!

= *Cheilanthes erecta* Colenso, *Trans. & Proc. New Zealand Inst.* 28: 619 (1896)

Lectotype (selected by Quirk et al. 1983): near Auckland? Herb. Colenso, WELT P003331!

Etymology: Named in honour of Franz Wilhelm Sieber (1789–1844), Bohemian botanist and plant collector who spent seven months in Sydney, Australia in 1823.

Vernacular name: rock fern

Biostatus: Indigenous (Non-endemic).

Cheilanthes sieberi* Kunze in Lehmann, *Pl. Preiss.* 2, 112 (1846) subsp. *sieberi

Vernacular name: rock fern

Rhizomes short- to long-creeping, up to 65 mm long (in herbarium specimens), 1–3 mm diameter, with stipes closely inserted; bearing appressed scales. Rhizome scales narrowly ovate, 1.0–2.5 mm long, 0.2–0.3 mm wide, dark brown with paler margins. Fronds monomorphic, 60–445 mm long, very rarely up to 590 mm long. Stipes 30–340 mm long, rarely up to 400 mm long, erect, rigid, red-brown; bearing concolorous orange-brown scales proximally, 2.5–5.0 mm long, 0.1–0.3 mm wide, scales becoming hair-like distally. Rachises red-brown, sulcate, bearing sparse hair-like scales up to 1.5 mm long. Laminae 30–250 mm long, 6–80 mm wide (sterile laminae rarely a little larger), 2-pinnate to 3-pinnate-pinnatifid, ovate or narrowly ovate or narrowly elliptic or linear, tapering to a pinnatifid apex, erect, dark

green on both surfaces, coriaceous, bearing sparse, hair-like scales on the abaxial surface. Primary pinnae in 7–20 pairs below pinnatifid apex, widely spaced especially proximally, elliptic or ovate or broadly ovate; the longest between the middle and base, 6–70 mm long, 5–30 mm wide, apices acute, bases short-stalked, divided into secondary pinnae. Secondary pinnae decreasing in length along each primary pinna to the distal end; the longest secondary pinnae ovate or elliptic, 5–25 mm long, 4–10 mm wide, apices acute to obtuse, bases stalked, sometimes divided into tertiary segments. Tertiary pinnae elliptic or ovate, 1–10 mm long, 1–3 mm wide, apices obtuse, bases adnate or sessile. Sori extending around the pinna margins, discrete, oblong, protected by inrolled lamina segments, becoming ± continuous at maturity. 16 spores per sporangium.

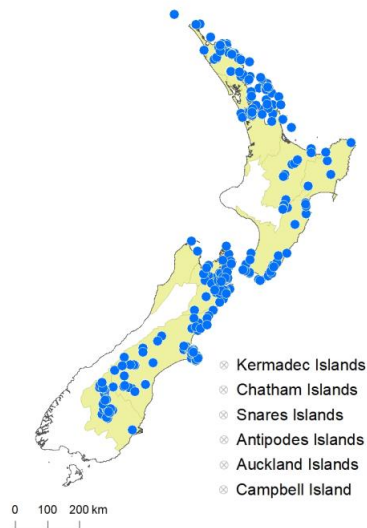


Fig. 79: *Cheilanthes sieberi* subsp. *sieberi* distribution map based on databased records at AK, CHR & WELT.

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

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

Three Kings Islands

Altitudinal range: 0–825 m.

Cheilanthes sieberi subsp. *sieberi* occurs on the Three Kings Islands and in lowland districts of the North Island from Te Pahi to Wellington, but is largely confined to the eastern half of the island. It grows from near sea level, reaching 825 m in the Kaimanawa Ranges. In the South Island it is confined to eastern areas from the Marlborough Sounds to Dunedin, growing from about 30 m and reaching 820 m near Tekapo.

Also Australia (Western Australia, Northern Territory, South Australia, Queensland, New South Wales, Australian Capital Territory, Victoria, Tasmania), Norfolk Island, Lord Howe Island and New Caledonia.

Biostatus: Indigenous (Non-endemic).

Habitat: *Cheilanthes sieberi* subsp. *sieberi* grows on dry cliffs, rocky outcrops, roadside banks, shingle, and heated ground around fumeroles, often in sunny situations. It is found under

kānuka, mānuka and scrub, and in grassland, often in coastal areas, and sometimes in full sun. It grows on greywacke, lava, pumice, basalt, mica schist, and limestone substrates.

Together with *Anogramma leptophylla*, *Asplenium flabellifolium*, *A. subglandulosum*, *Cheilanthes distans* and *Pellaea caliduripium*, *Cheilanthes sieberi* subsp. *sieberi* forms a characteristic assemblage of ferns that inhabits dry rocky areas, especially in the eastern South Island.

Recognition: *Cheilanthes sieberi* subsp. *sieberi* is distinguished from *C. distans* by the lack of hairs on the adaxial surface, and lack of narrowly ovate scales on the abaxial lamina surface. The fronds often appear glabrous to the naked eye, but there is usually a sparse covering of short, hair-like scales on the rachis and abaxial surfaces. The laminae are also generally longer, broader and more divided than in *C. distans* (30–250 mm long cf. 12–220 mm long; 6–80 mm wide cf. 6–33 mm wide). The two species frequently occur together, and both are rigidly upright ferns.

Cytology: Brownlie (1957) reported that *Cheilanthes sieberi* subsp. *sieberi* in New Zealand was a triploid apomictic with $n = 87$. In Australia, some populations are also apomictic with $n = 84$, but others are sexually reproducing diploids with $n = 28$ (Tindale & Roy 2002).

Notes: Only one subspecies of *Cheilanthes sieberi* occurs in New Zealand. *Cheilanthes sieberi* subsp. *pseudovellea* is endemic to the arid region of central Australia. It is distinguished from subsp. *sieberi* by the presence of an indumentum of twisted hairs on both surfaces of the pinnules. By contrast, the adaxial surface of subsp. *sieberi* is glabrous, and the abaxial surface almost glabrous.

Large forms of *C. sieberi* subsp. *sieberi* in New Zealand were persistently misidentified as *C. tenuifolia* by earlier Flora writers, and especially by Kirk (1874), who thought that both species were present in New Zealand. However *C. tenuifolia* is found in coastal regions of Queensland and Northern Territory, Nepal, India, Sri Lanka, South-East Asia and the Pacific islands (Chambers & Farrant 1991).

Following Green (1988), the name *C. humilis* (G.Forst.) P.S.Green was used as an earlier name for *C. sieberi* by Brownsey & Smith-Dodsworth (1989), but Chambers & Farrant (1991, 1998) concluded that Forster's type was typical of *C. tenuifolia* rather than *C. sieberi*.

Quirk et al. (1983) noted that examination of the type specimen of *C. erecta* "shows it to be somewhat intermediate between *C. sieberi* subsp. *sieberi* and *C. distans*, with a narrow, mostly glabrous

bipinnate frond which bears some scales. Spores are rounded, and of an echinate pattern most like that of *C. distans*".



Fig. 80: *Cheilanthes sieberi* subsp. *sieberi*. Mature plant growing terrestrially.



Fig. 81: *Cheilanthes sieberi* subsp. *sieberi*. Abaxial surface of mature frond showing red-brown rachis and pinna costae, and inrolled lamina margins protecting the sori.



Fig. 82: *Cheilanthes sieberi* subsp. *sieberi*. Mature plants growing from under a boulder.



Fig. 83: *Cheilanthes sieberi* subsp. *sieberi*. Mature plants growing in dry, stony ground.



Fig. 84: *Cheilanthes sieberi* subsp. *sieberi*. Red-brown, almost glabrous rachis.



Fig. 85: *Cheilanthes sieberi* subsp. *sieberi*. Scales on the bases of the red-brown stipes.



Fig. 86: *Cheilanthes sieberi* subsp. *sieberi*. Abaxial surface of fertile frond showing sori almost continuous around the lamina margins.



Fig. 87: *Cheilanthes sieberi* subsp. *sieberi*. Abaxial surface of fertile frond showing over-mature sori around the lamina margins.

***Cheilanthes viridis* (Forssk.) Sw., Syn. Fil. 127 (1806)**

≡ *Pteris viridis* Forssk., *Fl. Aegypt.-Arab.* cxxiv, 186 (1775)

≡ *Adiantum viride* (Forssk.) Vahl, *Symb. Bot. (Vahl)* 3, 104 (1794)

≡ *Pteridella viridis* (Forssk.) Kuhn in Decken, *Reisen Ost. Afr., Bot.* 3(3), 16 (1879)

≡ *Pellaea viridis* (Forssk.) Prantl, *Bot. Jahrb. Syst.* 3: 420 (1882)

≡ *Hemionitis viridis* (Forssk.) Christenh. in Christenhusz et al., *Global Flora, GLOVAP Nomenclature* 1, 4, 22 (2018)

Type: Yemen, montium Hadiensium, *P. Forsskål s.n.*, not located (see Roux 2009).

Etymology: From the Latin *viridis* (green), a reference to the colour of the laminae in this species.

Vernacular name: green cliff brake

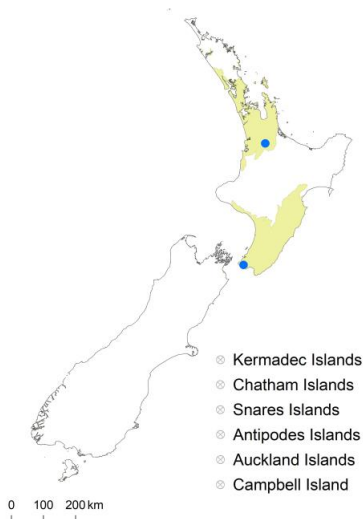


Fig. 88: *Cheilanthes viridis* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Auckland, Southern North Island.

Altitudinal range: c. 50 m.

Collected from near Cambridge and in Wellington.

Occurs naturally in southern and eastern Africa, Yemen, Madagascar and India (Crouch et al. 2011). Naturalised in Queensland and New South Wales (Bostock 1998).

Biostatus: Exotic; casual.

Habitat: *Cheilanthes viridis* has been collected from ignimbrite cliffs above the Waikato River near Cambridge, probably as an escape from cultivation, and from a garden in Wellington, where it appeared spontaneously.

First record: Webb et al. (1995), as *Pellaea viridis*. Voucher WELT P016336, 1987.

Recognition: In New Zealand, *Cheilanthes viridis* has glossy, dark red-brown stipes, rachises and costae. The fronds are up to 500 mm long and 250 mm wide; the laminae are 3-pinnate at the base, with tertiary pinnae 15–25 mm long and 6–12 mm wide, very similar in appearance to the primary pinnae of native *Pellaea* species, except that they are not articulated to the costae and rachis as they are in *Pellaea*. The veins are free. The sori extend along the margins of the ultimate segments but do not join at the apices.

Notes: Forsskål's *Pteris viridis* has been variously treated in *Cheilanthes*, *Pellaea*, *Adiantum* and *Pteridella*, but is now regarded as a species of *Cheilanthes* (Anthony 1984) because the pinnae and lamina segments are not articulated as they are in *Pellaea*.



Fig. 89: *Cheilanthes viridis*. Herbarium specimen from Cambridge, WELT P016336, showing 3-pinnate fertile frond.



Fig. 90: *Cheilanthes viridis*. Close up of WELT P016336, showing red-brown pinna costae, and sori almost continuous around the lamina margin.

***Myriopteris* Fée, *Mém. Foug.*, 5. *Gen. Filic.* 148 (1852)**

Type taxon: *Myriopteris marsupianthes* Fée

Etymology: From the Greek *myrio-* (numerous, prolific) and *pteris* (fern), a reference to the abundance of sori in this species.

Terrestrial or rupestral ferns. Rhizomes long-creeping (NZ) to short-creeping (not NZ), scaly. Rhizome scales non-clathrate, narrowly ovate to acicular, attached at base, concolorous or bicolorous, light to dark brown. Fronds monomorphic. Stipes and rachises red-brown (NZ) to black (not NZ). Laminae 3–4-pinnate (NZ), or 2-pinnate (not NZ), herbaceous or coriaceous, scaly and/or hairy (NZ) or rarely glabrous (not NZ). Pinnae and ultimate lamina segments not articulated to rachis and costae. Veins free. Sori terminating veins at lamina margin; sori protected by strongly (NZ) to poorly (not NZ) modified inrolled lamina margin. Spores trilete, lacking chlorophyll; perispores cristate to rugulate, without an equatorial flange.

Taxonomy: A genus of c. 45 species, included in the subfamily Cheilanthoideae along with *Cheilanthes* and *Pellaea* (PPG 1 2016).

Myriopteris was separated as a monophyletic genus (Grusz & Windham 2013) from the polyphyletic *Cheilanthes* (Eiserhardt et al. 2011; Zhang & Yatskievych 2013; PPG 1 2016). It is largely confined to North and Central America.

Myriopteris is distinguished from *Cheilanthes* by its production of 64 small spores per sporangium in sexual species and 32 large spores per sporangium in apomictic species, compared to 32 small or 16 large spores in *Cheilanthes*. The spores are mostly cristate or rugulose in *Myriopteris*, but echinate, granulose or verrucate in *Cheilanthes*. The vein endings near the lamina margins in *Myriopteris* are not obvious, but in *Cheilanthes* there are often prominent hydathodes.

Myriopteris lendigera (as *Cheilanthes lendigera*) was recognised as a casual species in New Zealand by Heenan et al. (2004).

Distribution: *Myriopteris* is distributed from southern Canada through the Caribbean and Central America to Chile, with one species also present in Namibia and South Africa (Grusz & Windham 2013). There is one species casual in New Zealand.

Biostatus: Exotic; casual.

Table 5: Number of species in New Zealand within *Myriopteris* Fée

Category	Number
Exotic: Casual	1
Total	1

Recognition: In New Zealand, the sole species of *Myriopteris* can be recognised by its 3–4-pinnate fronds with small, rounded ultimate segments, long orange hairs on the abaxial surface, and stipes that are generally longer than the laminae.

Cytology: Base chromosome numbers of $x = 29$ and 30 have been recorded in *Myriopteris*. Diploid, triploid and tetraploid species are known, and some are apomictic (Grusz & Windham 2013).

***Myriopteris lendigera* (Cav.) Fée., *Mém. Foug.*, 5. Gen. Filic. 149 (1852)**

as "lentigera"

≡ *Pteris lendigera* Cav., *Descr. Pl.* 1, 268 (1801)

≡ *Cheilanthes lendigera* (Cav.) Sw., *Syn. Fil.* 128 (1806)

≡ *Hemionitis lendigera* (Cav.) Christenh. in Christenhusz et al., *Global Flora, GLOVAP Nomenclature* 1, 4, 16 (2018)

Syntypes: Ecuador, Guaranda, *Née s.n.*; Mexico, Hidalgo, Ixmiquilpan, *Née s.n.*, MA (see Mickel & Smith 2004).

Etymology: From the Latin *lens*, *lendis* (nit) and *-gerus* (bearing), a reference to the appearance of the ultimate segments.

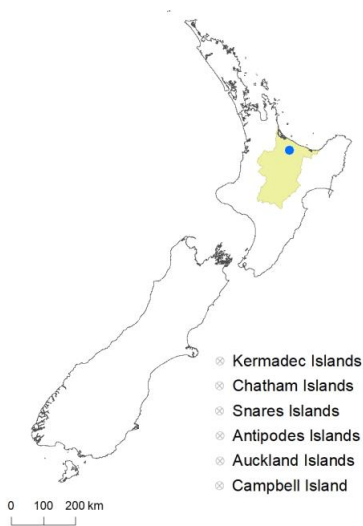


Fig. 91: *Myriopteris lendigera* distribution map based on databased records at AK, CHR & WELT.

segment surfaces.

Distribution: North Island: Volcanic Plateau.

Altitudinal range: c. 300 m.

Known from two localities near Rotorua.

Occurs naturally in the Neotropics from southern USA to Ecuador (Mickel & Smith 2004).

Biostatus: Exotic; casual.

Habitat: Recorded from a crevice in pumice rock on a north-facing slope.

First record: Heenan et al. (2004). Voucher AK 284224, 2003.

Recognition: In New Zealand, *Myriopteris lendigera* has glossy, dark red-brown stipes, rachises and costae. The fronds are up to 260 mm long and 75 mm wide, with the stipe longer than the lamina. The laminae are 3-pinnate to 3-pinnate-pinnatifid, with the stipes, rachises, costae and abaxial surfaces covered in very long, pale orange hairs or hair-like scales. The tertiary pinnae are small, rounded segments about 1 mm long. The sori are formed at vein endings and are covered by the lamina margins, which are highly modified into rather broad, false indusia that almost cover the abaxial



Fig. 92: *Myriopteris lendigera*. Herbarium specimen of a self-sown plant from Lake Rotoiti, Rotorua, AK 284224, showing 3-pinnate fertile fronds.



Fig. 93: *Myriopteris lendigera*. Close up of AK 284224, showing red-brown rachis and costae covered in orange-brown hairs, and small, rounded, tertiary lamina segments.

***Pellaea* Link, *Fil. Spec.* 59 (1841), nom. cons.**

Type taxon: *Pellaea atropurpurea* (L.) Link.

Etymology: From the Greek *pelos* (black) or *pellos* (very dark brown), a reference to the colour of the stipes and rachises.

Terrestrial or rupestral ferns. Rhizomes short- to long-creeping, scaly. Rhizome scales narrowly ovate, attached at base, concolorous or bicolorous, light to dark brown. Fronds monomorphic (NZ) or rarely dimorphic (not NZ). Stipes and rachises red-brown to dark brown, glossy. Laminae 1-pinnate (NZ) or more divided (not NZ), herbaceous or coriaceous, scaly (NZ) or glabrous (not NZ). Pinnae or pinna segments articulated to rachis or costae, often deciduous. Veins free (NZ) or rarely reticulate (not NZ). Sori extending along the margins; paraphyses present; sori exindusiate or protected by the barely inrolled lamina margin. Spores trilete, lacking chlorophyll; perispores cristate, verrucate, tuberculate or echinate, without an equatorial flange.

Taxonomy: A genus of c. 40 species, included in the subfamily *Cheilanthes* along with *Cheilanthes* (PPG 1 2016).

Pellaea, as currently construed (Tryon 1990; Schuettpelz et al. 2007; Yesilyurt et al. 2015; PPG 1 2016), is not monophyletic, and is in need of revision. Following Field (2020), seven indigenous species of *Pellaea* are recognised in the Australasian region, including two, *P. muelleri* (Hook.) A.R.Field and *P. reynoldsii* (F.Muell.) A.R.Field, that were previously recognised in *Paraceterach* (Bostock 1998). The remaining five species all belong to sect. *Platyloma* (Kirkpatrick 2007). However, the limits of some of these species are not well defined and are in need of detailed investigation. Bouma et al. (2010) found that *P. calidirupium*, *P. falcata* and *P. rotundifolia* formed a strongly supported clade, while Kirkpatrick (2007) grouped *P. nana* (as *P. falcata* var. *nana*) with these species in a clade that was most closely related to *Pellaea muelleri* (as *Paraceterach muelleri* (Hook.) Copel.) and to some elements of *Paragymnopteris* K.H.Shing.

Allan (1961) recognised two species, *P. falcata* and *P. rotundifolia*, in New Zealand, but only *P. rotundifolia* is accepted here, with *P. falcata* considered to be confined to Australia and New Caledonia. Although chloroplast DNA sequence data cannot distinguish *P. falcata* from *P. rotundifolia*, the two are distinct in their morphology and cytology (Brownsey et al. 2020). Another species was described as *P. calidirupium* by Brownsey & Lovis (1990), but is now known to be also present in Australia (Bostock 1998).

Pellaea viridis was recognised as a naturalised species by Webb et al. (1995). However, in a morphological review of *Pellaea* in southern Africa, Anthony (1984) suggested that the species is better treated in *Cheilanthes*.

-
- 1 Scales on stipes and rachises appressed; pinnae in 2–20 pairs; proximal pinnae widely spaced, on long stalks; sori ± continuous around pinna margins..... *calidirupium*
 Scales on stipes and rachises spreading; pinnae in 8–40 pairs; proximal pinnae only slightly spaced, on short stalks; sori usually absent from pinna apices..... *rotundifolia*

Distribution: *Pellaea* is distributed in North and South America, Africa, Asia and Australasia, with the greatest diversity in the Americas and in Africa (Tryon 1990). Four indigenous species in Australia (Bostock 1998) and one in New Caledonia (Brownlie 1969); two species in New Zealand, none endemic.

Biostatus: Indigenous (Non-endemic).

Table 6: Number of species in New Zealand within *Pellaea* Link

Category	Number
Indigenous (Non-endemic)	2
Total	2

Recognition: In New Zealand, species of *Pellaea* have long-creeping rhizomes with appressed bicolorous scales, fronds that are 1-pinnate, stipes and rachises that are red-brown and abundantly scaly, pinnae that are articulated to the rachis, sori that are almost continuous around the edges of the pinnae and scarcely protected by slightly inrolled margins, and spores that are echinate (Large & Braggins 1991).

Cytology: The base chromosome number in *Pellaea* is $x = 29$ or 30 , with diploid, triploid and tetraploid species known in Australasia, and some that are known to be apomictic outside the region (Tindale & Roy 2002).

***Pellaea calidirupium* Brownsey & Lovis, *New Zealand J. Bot.* 28: 197 (1990)**

≡ *Hemionitis calidirupium* (Brownsey & Lovis) Christenh. in Christenhusz et al., *Global Flora, GLOVAP Nomenclature* 1, 4, 11 (2018)

Holotype: The Glen, Nelson, *J. Palmer*, 20 Oct. 1958, CHR 396425!

Etymology: From the Latin *calidus* (hot) and *rupes* (rock), a reference to the characteristic habitat of this species.

Rhizomes long-creeping, to 90 mm long (in herbarium specimens), 1.0–2.0 mm in diameter, scaly. Rhizome scales appressed, narrowly ovate, 1–2 mm long, 0.3–0.5 mm wide, with black occluded midribs and open orange-brown cells on the margins. Fronds dimorphic; sterile 35–270 mm long; fertile 55–410 mm or rarely to 460 mm long. Stipes 30–230 mm long, dark red-brown, brittle, bearing appressed orange-brown scales; stipe scales mostly short and hair-like but some narrowly ovate with filiform apices, up to 3 mm long and 0.5 mm wide. Rachises dark red-brown throughout, bearing appressed scales. Fertile laminae 1-pinnate, elliptic or narrowly elliptic or linear, 30–240 mm or rarely to 330 mm long, 14–60 mm wide, dark glossy green on adaxial surface, paler green abaxially, coriaceous; hair-like scales on costae and both lamina surfaces. Primary pinnae on sterile fronds in 2–8 pairs, ± round or oblong with obtuse apices and truncate bases, the terminal pinna sometimes greatly enlarged; those on fertile fronds in 2–22 pairs, ± triangular or slightly falcate with acute or acuminate apices, bases truncate or slightly cordate, the terminal pinna only slightly enlarged. Fertile pinnae not overlapping, the longest near the middle, 8–40 mm long, 4–17 mm wide, widely spaced proximally and often distinctly stalked, close together distally and almost sessile; margins minutely toothed. Sori continuous along acroscopic and basispic pinna margins, often confluent at apices. Mean exospore diameter 35.9–40.5 µm; perispores echinate.

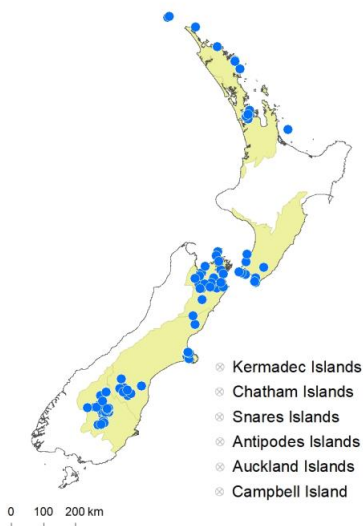


Fig. 94: *Pellaea calidirupium* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Northland, Auckland, Southern North Island.

South Island: Sounds-Nelson, Marlborough, Canterbury, Otago.

Three Kings Islands

Altitudinal range: 5–1200 m.

Pellaea calidirupium occurs on the Three Kings Islands, and in widely scattered lowland regions of the North Island, with populations recorded from Te Pahi, eastern Northland, Auckland city, Rangitoto, Mayor Island (Tuhua), southern Wairarapa and the shores of Cook Strait. It grows from near sea level, reaching 190 m on Great Island, Three Kings Islands. In the South Island it occurs in lowland and montane areas east of the main divide, from the Marlborough Sounds to Central Otago. It is found from about 20 m, reaching 1200 m near Clyde.

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

Biostatus: Indigenous (Non-endemic).

Habitat: *Pellaea calidirupium* grows on coastal cliffs, lava fields, dry rocky outcrops, bluffs, scree and roadside banks, either in the open, in crevices, under rock overhangs, under low scrub, or in rough grassland. It is often associated with *Discaria toumatou*, *Rubus rubiginosa*, *Thymus vulgaris* and species of *Sophora* and small-leaved *Coprosma*. It grows on greywacke, basalt, rhyolite, scoria, lava, schist, and rarely on limestone.

Together with *Anogramma leptophylla*, *Asplenium flabellifolium*, *A. subglandulosum*, *Cheilanthes distans* and *C. sieberi*, *Pellaea calidirupium* forms a characteristic assemblage of ferns that inhabit dry rocky areas, especially in the eastern South Island.

Recognition: *Pellaea calidirupium* is distinguished from most populations of *P. rotundifolia* by the appressed scales on the stipes and rachises, the more obviously dimorphic fronds, generally shorter laminae (usually 30–240 mm long cf. 100–600 mm long), fewer pairs of pinnae on the fertile fronds (2–22 cf. 8–40), a sometimes enlarged terminal pinna, widely spaced proximal pinnae often borne on distinct stalks, and sori that are continuous around the pinna margins and often confluent at the apices. The fronds usually have an irregular and untidy appearance compared to the neat rows of pinnae in *P. rotundifolia*. The fertile pinnae are characteristically triangular, or slightly falcate, with tapering apices, in contrast to the rounded or oblong pinnae with obtuse to acute apices abruptly narrowed to a short, sharp point in *P. rotundifolia*.

Pellaea calidirupium is less easily distinguished morphologically from populations of *P. rotundifolia* on the Kermadec Islands. The latter plants have more or less appressed scales on the stipes and rachises, so the distinction between the two species relies on the remaining characters outlined above. Nevertheless, on the basis of molecular evidence, *P. calidirupium* is clearly distinct from *P. rotundifolia* on the Kermadecs and the North and South Islands (Brownsey et al. 2020).

Cytology: $n = 58$ (Brownlie 1961 – as *P. falcata*; Brownsey & Lovis 1990). However, in Australia *P. calidirupium* has been reported as diploid with a single count of $n = c. 29$ from Kaputar National Park (Tindale & Roy 2002), and as triploid and tetraploid in populations from Queensland (Kokubugata et al. 2007). If this is confirmed, the status of some Australian plants may need to be reconsidered.

Hybridisation: There is evidence that *Pellaea calidirupium* hybridises with *P. rotundifolia* in areas where the two species are contiguous (Brownsey & Lovis 1990), and that the hybrids have aborted spores (e.g. CHR 147559, 385976, 386678, 387589).

Notes: There is a striking disjunction in the distribution of *P. calidirupium* in the North Island. Populations extend from the Three Kings Islands through eastern Northland to Mayor Island, but are absent along the whole Bay of Plenty and east coast, reoccurring again only in the very south of the North Island. Given the apparent suitability of habitat along the eastern coast, further investigation is needed to determine if the absence is real. There are no obvious morphological differences between the two groups, and spore measurements suggest that they are uniformly tetraploid (Brownsey et al. 2020).



Fig. 95: *Pellaea calidirupium*. Mature plants growing from under a boulder.



Fig. 96: *Pellaea calidirupium*. Mature plants growing in a rock crevice.



Fig. 97: *Pellaea calidirupium*. Sterile fronds with enlarged terminal pinnae.



Fig. 98: *Pellaea calidirupium*. Abaxial surface of fertile frond with sori continuous along the pinna margins.



Fig. 99: *Pellaea calidirupium*. Abaxial surface of fertile frond showing appressed scales on the rachis.



Fig. 100: *Pellaea calidirupium*. Abaxial surface of fertile frond showing appressed scales on the rachis.



Fig. 101: *Pellaea calidirupium*. Adaxial surface of fertile frond with triangular pinnae.



Fig. 102: *Pellaea calidirupium*. Abaxial surface of fertile frond showing over-mature sori continuous around the lamina margins.

***Pellaea rotundifolia* (G.Forst.) Hook., Sp. Fil. 2, 136 (1858)**

≡ *Pteris rotundifolia* G.Forst., *Fl. Ins. Austr.* 79 (1786)

≡ *Platyloma rotundifolia* (G.Forst.) J.Sm., *J. Bot. (Hooker)* 4: 160 (1841)

≡ *Allosorus rotundifolia* (G.Forst.) Kunze, *Linnaea* 23: 10 (1850)

≡ *Hemionitis rotundifolia* (G.Forst.) Christenh. in Christenhusz et al., *Global Flora, GLOVAP Nomenclature* 1, 4, 20 (2018)

Lectotype (selected by Nicolson & Fosberg 2003): no locality, Herb. G. Forster 260, BM 001048407!

= *Pellaea rotundifolia* var. *oblongifolia* Hook., *Sp. Fil.* 2, 136 (1858)

Holotype: New Zealand, *Colenso* 1995, K 001090021! (collected from dry woods near Te Hawera – see St. George 2009, p. 239).

Etymology: From the Latin *rotundi-* (rounded) and *-folius* (leaved), a reference to the shape of the pinnae in this species.

Vernacular names: button fern; round-leaved fern; tarawera

Rhizomes long-creeping, to 380 mm long (in herbarium specimens), 1–3 mm in diameter, densely scaly. Rhizome scales appressed, narrowly ovate, 1.6–3 mm long, 0.3–0.9 mm wide, with black occluded midribs and open orange-brown cells on the margins. Fronds ± monomorphic, 110–870 mm long. Stipes 20–310 mm long, dark red-brown, brittle, bearing abundant spreading orange-brown scales; stipe scales from short and hair-like to narrowly ovate with filiform apices, up to 6 mm long and 0.8 mm wide. Rachises dark red-brown throughout, bearing abundant spreading scales. Fertile laminae 1-pinnate or very rarely 2-pinnate, elliptic or narrowly elliptic or linear, 100–600 mm long, 12–72 mm wide, dark glossy green on adaxial surface, paler green abaxially, coriaceous; hair-like scales on costae and both lamina surfaces. Primary pinnae on fertile fronds in 8–40 pairs, orbicular or oblong or triangular, sometimes with a small basal acroscopic lobe on proximal pinnae; apices obtuse to acute, abruptly narrowed to a short sharp point; bases cuneate to truncate; the terminal pinna not usually enlarged. Very rarely, pinnae in the proximal half of the lamina divided into 1–2 pairs of secondary pinnae. Fertile pinnae not overlapping, the longest near the middle, 6–42 mm long, 4–16 mm wide, only slightly more widely spaced proximally, usually lacking obvious stalks on proximal pinnae; margins minutely toothed. Sterile pinnae sometimes longer or wider than fertile. Sori continuous along acroscopic and basiscopic pinna margins, not confluent at apices. Mean exospore diameter 32.9–36.8 µm; perispores echinate.

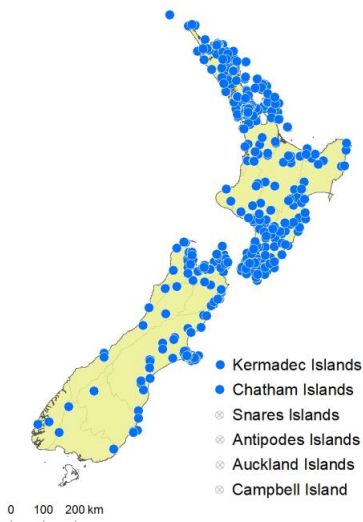


Fig. 103: *Pellaea rotundifolia* distribution map based on databased records at AK, CHR, OTA & WELT.

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.

Altitudinal range: 0–900 m.

Pellaea rotundifolia occurs on the Kermadec and Three Kings Islands, and in lowland to montane areas throughout the North Island from Te Pahi to Wellington. It ranges from near sea level, reaching 600 m near Puketitiri, Hawke's Bay. It occurs in lowland to montane regions throughout the South Island, but is more abundant on the northern and eastern coastlines, with only scattered populations in the far south. It grows from about 20 m, reaching 900 m at Jordan Stream Reserve, Marlborough. It also extends to the Chatham Islands, but does not reach Stewart Island.

Also recorded from Norfolk Island, based on a Cunningham specimen (Kunze 1850; Hooker 1851–1858; Bentham 1878), but subsequently thought to be erroneous (Green 1994a). Newly recorded, based on a single collection (AK 237733), by de Lange et al. (2005).

Biostatus: Indigenous (Non-endemic).

Habitat: *Pellaea rotundifolia* occurs in podocarp, broadleaved and beech forest, under pines and other introduced trees, under mānuka, kānuka and scrub, and amongst grasses. It is found on stony banks, clay banks, rocky outcrops, coastal cliffs and scree, amongst boulders, on streambanks, river terraces, tracksides, roadsides, bush margins, swamp margins and at the base of tree trunks. It grows on greywacke, scoria, lava, andesite, rhyolite, schist, sandstone and limestone substrates, peat and sand.

Recognition: Plants of *Pellaea rotundifolia* on the main islands of New Zealand are distinguished from *P. calidirupium* by the presence of spreading scales on the stipes and rachises, less obviously dimorphic fronds, generally longer laminae (100–600 mm long cf. 30–240 mm long), more pairs of pinnae on the fertile fronds (8–40 cf. 2–22), absence of an enlarged terminal pinna, less widely spaced proximal pinnae usually lacking distinct stalks, and sori that extend around the pinna margins but are not confluent at the apices. The fronds usually have neat rows of pinnae compared to the irregular and untidy appearance of those in *P. calidirupium*. The fertile pinnae are rounded or oblong, with obtuse to acute apices abruptly narrowed to a short sharp point, unlike those in *P. calidirupium*, which are characteristically triangular, or slightly falcate, with tapering apices.

Plants of *P. rotundifolia* on the Kermadec Islands are slightly different morphologically to those on the main islands in having more appressed stipe and rachis scales, although not as consistently as those in *P. calidirupium*. Distinguishing the two species relies on the other characters outlined above.

However, molecular evidence shows that *P. rotundifolia* on both the Kermadecs and the North and South Islands is distinct from *P. calidirupium* (Brownsey et al. 2020).

Cytology: n = 58 (Brownlie 1954, 1957).

Hybridisation: There is evidence that *Pellaea rotundifolia* hybridises with *P. calidirupium* in areas where the two species occur together (Brownsey & Lovis 1990), and that the hybrids have aborted spores (e.g. CHR 147559, 385976, 386678, 387589).

Notes: There are genetic and subtle morphological differences between populations of *P. rotundifolia* on the Kermadecs and those in the rest of New Zealand, suggesting different origins for the two groups. However, the exact nature of these evolutionary origins is unresolved at the present time, and the morphological differences inadequately understood (Brownsey et al. 2020).

The Australian species *Pellaea nana* (Hook.) Bostock is morphologically very similar to *P. rotundifolia*. However, chloroplast DNA sequence data show that it is genetically distinct from both Australian *P. falcata* and New Zealand *P. rotundifolia* (Brownsey et al. 2020).



Fig. 104: *Pellaea rotundifolia*. Adaxial surface of mature frond with oblong to rounded pinnae.



Fig. 105: *Pellaea rotundifolia*. Mature plants growing among tree roots.



Fig. 106: *Pellaea rotundifolia*. Mature fronds with glossy adaxial surfaces and oblong pinnae, often abruptly narrowed to a sharp point.



Fig. 107: *Pellaea rotundifolia*. Abaxial surface of sterile frond with spreading scales on the rachis.



Fig. 108: *Pellaea rotundifolia*. Stipes arising from a creeping rhizome.



Fig. 109: *Pellaea rotundifolia*. Abaxial surface of fertile frond showing spreading scales on the rachis, and sori on the pinna margins.



Fig. 110: *Pellaea rotundifolia*. Abaxial surface of fertile frond showing rounded pinnae, spreading scales on the rachis, and sori on the pinna margins.



Fig. 111: *Pellaea rotundifolia*. Abaxial surface of fertile frond showing spreading scales on the rachis, and mature sori continuous around the pinna margins except at apices.

***Pteris* L., Sp. Pl. 1073 (1753)**

Type taxon: *Pteris longifolia*

Etymology: From the Greek *ptēris* (feathery), the Greek name for a fern.

Terrestrial or rupestral ferns. Rhizomes erect to short-creeping, scaly. Rhizome scales non-clathrate, narrowly ovate, attached at the base, concolorous or with dark centres and pale margins, pale brown to blackish. Fronds monomorphic. Stipes and rachises pale brown to red-brown, or occasionally green. Laminae 1-pinnate to 4-pinnate-pinnatifid (NZ) or 5-pinnate (not NZ), sometimes pedate (NZ) or palmate (not NZ); herbaceous or coriaceous, glabrous or hairy and/or scaly. Pinnae and ultimate lamina segments not articulated to rachis and costae. Veins free or reticulate, the areolae without free included veinlets. Sori extending along the margins; paraphyses present; sori protected by the membranous, reflexed, lamina margin. Spores trilete, lacking chlorophyll; perispores coarsely ridged, tuberculate or reticulate with an equatorial flange.

Taxonomy: A genus of c. 250 species, included in the subfamily Pteridoideae along with *Anogramma* (PPG 1 2016).

There is no modern monograph of *Pteris* world-wide, and no clear indication of natural subgeneric groups based on morphology. Phylogenetic analysis by Zhang et al. (2015), based on six plastid loci, indicated that the genus is monophyletic, with 15 different clades recognised world-wide. A more extensive survey of 178 species by Zhang & Zhang (2018), using one nuclear and eight plastid genes, recovered 16 clades. Based on this study, Zhang & Zhang recognised 15 sections in three subgenera, one of them monotypic. Four of the five indigenous New Zealand species fell into subgenus *Campteria* section *Tripedipteris*. One of the subclades within this section comprises seven Oceanian species with anastomosing veins, including *P. carsei* (as *P. comans*), *P. macilenta* and *P. saxatilis* from New Zealand; *P. epaleata* (as *P. comans*) from Australia and New Zealand; *P. microptera* Mett. ex Kuhn from Lord Howe Island; and two other Pacific species. The fifth indigenous species, *P. tremula*, forms a small clade with the South American *P. chilensis* Desv. in which the laminae are 3–4-pinnatifid and the veins free. This is subgenus *Campteria*, section *Tremulae*.

Allan (1961) recognised three species in New Zealand – *P. comans* G.Forst., *P. macilenta* and *P. tremula*, with *P. saxatilis* treated as a variety of *P. macilenta*. Walker (1962) investigated the species with anastomosing veins cytologically and reported that *P. comans* and *P. saxatilis* were diploid species with $2n = 58$, and that *P. macilenta* was a tetraploid species with $2n = c. 116$. The genus in New Zealand was the subject of an unpublished Ph.D. thesis by Braggins (1975). He suggested that the New Zealand plant treated by previous authors as *P. comans* was an endemic species distinct from other members of the complex, and it has subsequently been described as *P. carsei* (Brownsey et al. 2020). Braggins (1975) also suggested that the type of *P. macilenta* was actually a specimen of what was being called *P. saxatilis*, and that the correct names for these two species should be *P. pendula* and *P. macilenta*, respectively. However, reassessment of potential type material in *P* has shown that the only original material is, in fact, a specimen of *P. macilenta*, and that the names *P. macilenta* and *P. saxatilis* should be used in their traditional sense (Brownsey & Perrie 2020).

Following the recognition of *P. carsei* as a New Zealand endemic, distinct from *P. comans sens. str.* in the tropical Pacific, Ohlsen et al. (2020) described Australian plants, previously referred to *P. comans*, as *P. epaleata*. This species extends to New Zealand, with a few populations known from southern Fiordland.

Several species of *Pteris* are established in the horticultural trade and have become naturalised around the world. Seven naturalised species, *P. argyraea*, *P. cretica*, *P. dentata*, *P. multifida*, *P. pacifica*, *P. parkeri* and *P. vittata*, have been added to the New Zealand flora in the last 40 years.

1	Lamina veins anastomosing.....	2
	Lamina veins free.....	5
2	Scales absent on rachises and pinna costae, or if present, very narrow and hair-like.....	<i>epaleata</i>
	Scales present on rachises and pinna costae, ovate, not hair-like.....	3
3	1–2 pairs of basal basispic secondary pinnae on lowermost primary pinnae greatly extended; all except 1–2 secondary pinnae on proximal primary pinnae adnate to costae.....	<i>carsei</i>
	Basal basispic pinnae on lowermost primary pinnae not greatly extended; most secondary pinnae on proximal primary pinnae distinctly stalked.....	4
4	Primary and secondary pinnae very widely spaced; laminae 100–500 mm long, 35–300 mm wide; secondary pinnae 12–85 mm long, 6–35 mm wide; tertiary pinnae 4–24 mm long and 2–12 mm wide; exospore size 32–37 µm in diameter*.....	<i>saxatilis</i>
	Primary and secondary pinnae less widely spaced; laminae 130–900 mm long, 60–750 mm wide; secondary pinnae 16–290 mm long, 8–160 mm wide; tertiary pinnae 9–85 mm long, 3–60 mm wide; exospore size 41–46 µm in diameter*.....	<i>macilenta</i>
5	Primary pinnae bicolorous, with prominent white or yellow-green bands along their centres.....	5
	Primary pinnae concolorous, lacking prominent white or yellow-green bands along their centres.....	6
6	Distal primary pinnae deeply pinnatifid, with white bands along their centres.....	<i>argyraea</i>
	Distal primary pinnae undivided, with yellow-green bands along their centres.....	<i>parkeri</i>
7	Laminae 1–2-pinnate at base.....	8
	Laminae 3–4-pinnate at base.....	10
8	Proximal primary pinnae undivided.....	<i>vittata</i>
	Proximal primary pinnae divided or forked.....	9
9	Proximal primary pinnae with at least one pair of secondary pinnae arising on both sides.....	<i>multifida</i>
	Proximal primary pinnae with 1–3 secondary pinnae on basispic side only.....	<i>cretica</i>
10	Laminae 1-pinnate-pinnatifid at their mid-point; spine-like outgrowths on adaxial surface of costae of primary pinnae.....	11
	Lamina usually 2-pinnate-pinnatifid at their mid-point; spine-like outgrowths absent from costae of primary pinnae.....	<i>tremula</i>
11	Secondary pinnae on primary pinnae at mid-point of lamina <12 mm long, all about equal in length, decreasing only slightly distally.....	<i>pacifica</i>
	Secondary pinnae on primary pinnae at mid-point of lamina >12 mm long, decreasing markedly in length distally.....	<i>dentata</i>

* Exospore measurements are the range of mean values for sampled individuals.

Distribution: *Pteris* is world-wide in distribution, occurring in tropical and temperate regions of all continents except Antarctica (Zhang et al. 2015). Its greatest diversity is in eastern Asia, with 78

species recorded in China alone (Liao et al. 2013); six indigenous and one naturalised species in southern Africa (Crouch et al. 2011), eight indigenous and two naturalised species in Australia (Kramer & McCarthy 1998), and 18 in the south-west Pacific (Nakamura 2008). Twelve species in New Zealand; five indigenous and seven naturalised, three endemic.

Biostatus: Indigenous (Non-endemic).

Table 7: Number of species in New Zealand within *Pteris* L.

Category	Number
Indigenous (Endemic)	3
Indigenous (Non-endemic)	2
Exotic: Fully Naturalised	3
Exotic: Casual	4
Total	12

Recognition: In New Zealand, species of *Pteris* are medium to large ferns with 1-pinnate to 4-pinnate-pinnatifid glabrous laminae, anastomosing or free veins, and the sori continuous along the pinna margins, protected by membranous inrolled pinna margins. The spores are trilete, and coarsely tuberculate or cristate (Large & Braggins 1991).

Cytology: The base chromosome number in *Pteris* is $x = 29$ with an extensive polyploid series from diploid to at least octoploid, with many hybrids and apomictic species also reported (Walker 1962; Tindale & Roy 2002).

***Pteris argyrea* T.Moore, Gard. Chron. 1859: 671 (1859)**

Lectotype (selected by Walker 1960): Hort. Veitch 1859, Nilgh. India ex *Mclvor*, Herb. T. Moore, K 000501424 (online; see Das et al. 2016)

Etymology: From the Latin *argyraeus* (silvery-white), a reference to the silvery-white bands of colour along the central part of the pinnae in this species.

Vernacular name: silver brake

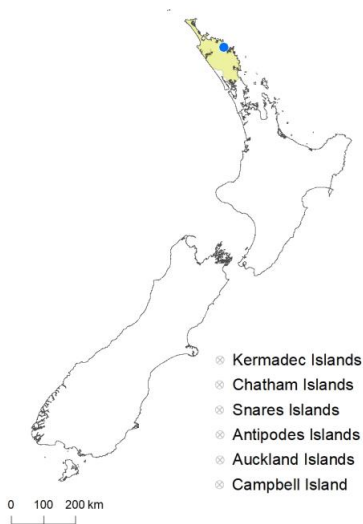


Fig. 112: *Pteris argyrea* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Northland.

Altitudinal range: 10 m.

Known only as a cultivation escape from one locality in Kerikeri.

Occurs naturally in India, Sri Lanka and Java.

Biostatus: Exotic; casual.

Habitat: Reported as occurring on the edge of a scoria path in light shade as an escape from cultivation.

First record: Heenan et al. (2008). Voucher AK 288169, 2004.

Recognition: *Pteris argyrea* is only known in New Zealand from one sporeling collection. The lamina has a pinnatifid apical segment, and the basal pair of primary pinnae are deeply pinnatifid, each with one enlarged and deeply pinnatifid basal basicopic secondary pinna. The veins are free, and there are white bands along the centre of the pinnae.



Fig. 113: *Pteris argyraea*. Herbarium specimen of a self-sown plant from Kerikeri, AK 288169, showing a sterile frond.

***Pteris carsei* Braggins & Brownsey in Brownsey et al., *New Zealand J. Bot.* 58: 216 (2020)**

Holotype: Cuvier Island, 27 Jan. 1972, *P.F. Jenkins*, AK 288257–288259!

Etymology: Named in honour of Harry Carse (1857–1930), British-born school-teacher and amateur botanist who collected extensively in Northland around the turn of the 20th century, and who had a particular interest in *Pteris*.

Rhizomes erect, scaly. Rhizome scales narrowly ovate, 4.5–10 mm long, 1–4 mm wide, pale brown, concolorous, entire. Fronds 380–1430 mm long. Stipes 165–800 mm long, red-brown proximally, yellow-brown or chestnut-brown distally, with scattered pale brown scales proximally, up to 15 mm long and 4.5 mm wide, and multicellular hairs amongst the scales when young. Rachises yellow-brown or chestnut-brown, narrowly winged in distal half, bearing scattered ovate scales. Laminae 2-pinnate-pinnatifid to 3-pinnate-pinnatifid, 200–800 mm long, 200–900 mm wide, ovate to broadly ovate, dark shiny green on adaxial surface, paler on the abaxial surface, coriaceous, bearing scattered ovate scales on the costae. Primary pinnae in 3–9 pairs below pinnatifid apex, overlapping; the longest at or near base, 135–520 mm long, 80–320 mm wide, ovate to broadly ovate, straight; pinna apices acute to acuminate, bases adnate on distal pinnae, stalked on proximal pinnae. Longest secondary pinnae 65–240 mm long, 17–120 mm wide, ovate to narrowly ovate, sub-opposite; apices acute to acuminate, bases usually adnate or with 1 pair short-stalked; basal 1–2 basispic secondary pinnae on basal primary pinnae markedly longer than others. Longest tertiary segments 9–85 mm long, 4–28 mm wide, elliptic to oblong; apices acute to obtuse, margins serrate or divided to more than halfway in largest fronds, bases adnate. Veins anastomosing. Sori elongated along margins of the ultimate segments. Mean exospore diameter 33–36 μm .

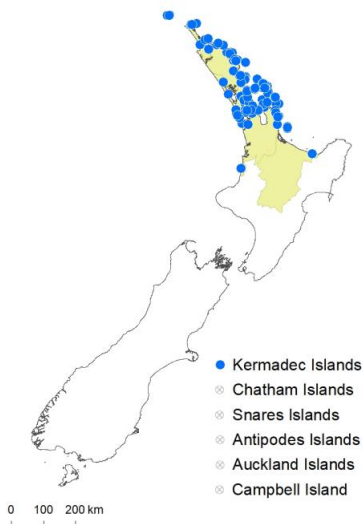


Fig. 114: *Pteris carsei* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Northland, Auckland, Volcanic Plateau

Kermadec Islands, Three Kings Islands.

Altitudinal range: 0–275 m.

Pteris carsei grows on the Kermadec and Three Kings Islands, and on the Hauraki Gulf and Coromandel islands as far south as Mayor Island (Tuhua). On the mainland it is found in coastal districts along the east coast from Te Pahi to Auckland. On the west coast it occurs at Spirits Bay, around Kaitiāia, the northern Kaipara Harbour, and either side of the Manukau Harbour. There are outlying populations near Ōpōtiki in the eastern Bay of Plenty, and at Ngarupupu Point north of Mōkau. It grows from sea level, reaching c. 275 m near Unuwahao.

Biostatus: Indigenous (Endemic).

Habitat: *Pteris carsei* is a terrestrial fern found in open coastal sites, in coastal forest under *Metrosideros excelsa*, *Kunzea* spp., and other coastal broadleaved species. It favours rocky streambeds and streamsides, rocky forest, cliffs, hillsides and beach fronts near the sea.

Recognition: *Pteris carsei* is distinguished by its erect rhizome, laminae that are shiny green adaxially, and 1-pinnate-pinnatifid distally to 2-pinnate-pinnatifid or rarely 3-pinnate proximally, anastomosing veins, overlapping pinnae, broad coriaceous ultimate segments, and secondary pinnae that are mostly adnate or sessile on the lowermost primary pinnae. The species is believed to hybridise with both *P. macilenta* and *P. saxatilis*, making identification difficult in coastal areas of northern New Zealand. However, the greatly extended basal basicopic secondary pinnae, and the mostly adnate secondary pinnae on the lower primary pinnae, distinguish *P. carsei* from *P. macilenta* and *P. saxatilis*. It differs from *P. epaleata* by its dark shiny green, rather than dull yellow-green, adaxial lamina surface, less divided lamina, and presence of ovate, rather than hair-like, scales on the rachis and pinna costae. *P. carsei* occurs in the northern half of the North Island, whereas *P. epaleata* is confined to southern Fiordland.

Cytology: $n = 30$ (Brownlie 1961); $2n = 58$ (Walker 1962).

Hybridisation: *Pteris carsei* is known to hybridise with *P. saxatilis* in coastal areas of Northland and Auckland, often forming extensive hybrid swarms when the two occur together (see suites of material in AK). Spores of putative hybrids are sometimes abnormal in appearance, but aborted spores are not as easy to detect as in genera such as *Asplenium* or *Polystichum*. There may be some degree of fertility in hybrids between *Pteris carsei* and *P. saxatilis*, and back-crosses to both parents could be possible. Whether *P. carsei* also crosses with *P. macilenta* is not known with certainty. The two hybrid combinations with *P. carsei* are almost impossible to distinguish morphologically in herbarium material, but hybrids between *P. carsei* and *P. macilenta* are likely to have aborted spores because of the difference in chromosome number. Braggins (1975) created artificial hybrids between the diploid species, *P. carsei* and *P. saxatilis*, and it is probable on morphological grounds that *P. macilenta* is an allotetraploid derivative of wild hybrids between the two diploid species. However, experimental evidence for this is lacking, and all three species have very similar chloroplast DNA sequences, indicating a close relationship (Bouma et al. 2010).

Notes: Brownsey et al. (2020) showed that *P. carsei* is an endemic species distinct from *P. comans* and other species in the tropical Pacific. *Pteris comans sens. str.* occurs in the Solomon Islands, Vanuatu and Fiji and may also occur on New Caledonia, Samoa and elsewhere in the Pacific. *Pteris zahlbruckneriana* (syn. *P. endlicheriana* J.Ag.) from Norfolk Island, and *P. microptera* from Lord Howe Island, both belong in the *P. comans* complex, but are distinct from *P. carsei* (Braggins 1975; Green 1994b; Brownsey et al. 2020). The status of plants referred to the poorly known *P. laevis* Mett. from New Caledonia and *P. litoralis* Rech.f. from Samoa and Vanuatu require further investigation.



Fig. 115: *Pteris carsei*. Adaxial surface of 2-pinnate-pinnatifid frond with glossy green lamina surfaces, and extended basal basicopic secondary pinnae on basal primary pinnae.



Fig. 116: *Pteris carsei*. Adaxial surface of 2-pinnate-pinnatifid frond, with all secondary pinnae adnate or decurrent on the costae.



Fig. 117: *Pteris carsei*. Adaxial surface of 2-pinnate-pinnatifid frond, with all secondary pinnae on basal primary pinnae adnate to the costa.



Fig. 118: *Pteris carsei*. Abaxial surface of fertile frond with elongated sori protected by membranous reflexed lamina margins.



Fig. 119: *Pteris carsei*. Pinnae with anastomosing veins.



Fig. 120: *Pteris carsei*. Narrowly ovate, pale brown scales at the base of the stipe.

Pteris cretica L., *Mant. Pl. 130* (1767)

Lectotype (selected by Tryon 1964): Crete, *Arduino s.n.*, LINN 1246.7 (online; see Jarvis 2007)

Etymology: *cretica* (Latin) – from the island of Crete from where this species was first collected.

Vernacular name: Cretan brake

Rhizomes short-creeping, up to 90 mm long (in herbarium specimens), scaly. Rhizome scales narrowly ovate, 1.5–2.5 mm long, 0.2–0.3 mm wide, dark brown, concolorous, entire. Fronds 450–1320 mm long. Stipes 220–940 mm long, red-brown proximally at maturity, yellow-brown distally, glabrous or with a few scales proximally. Rachises yellow-brown, winged in distal half, glabrous. Laminae 1-pinnate distally, 1-pinnate-pinnatifid proximally, 175–475 mm long, 100–400 mm wide, broadly ovate, mid-green on both surfaces, coriaceous, glabrous. Primary pinnae in 2–7 pairs with a long terminal pinna, not overlapping; the longest at or near base, 135–430 mm long, 7–18 mm wide (not including secondary pinnae), narrowly ovate to narrowly elliptic, usually slightly falcate or rarely straight; pinna apices acuminate, margins irregularly serrate in sterile portions; distal pinnae long-decurrent at base, proximal pair stalked. Basal 1–2 pairs of pinnae divided almost to the base into 1–3 secondary pinnae arising only on basiscopic side; longest secondary pinnae 70–275 mm long, 7–13 mm wide. Veins free. Sori continuous along most of the sides of the primary pinnae.

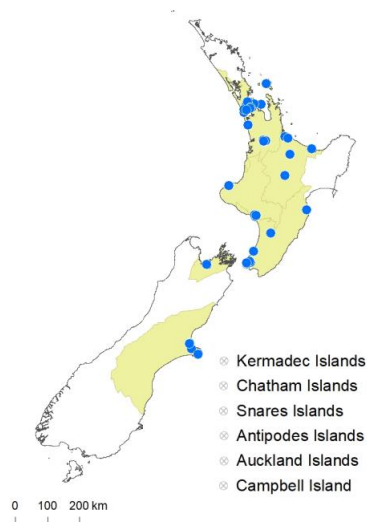


Fig. 121: *Pteris cretica* distribution map based on databased records at AK, CHR & WELT.

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

South Island: Sounds-Nelson, Canterbury.

Altitudinal range: 5–400 m.

Pteris cretica is naturalised in many lowland sites from Great Barrier Island to Banks Peninsula, mostly in urban areas or near human habitation. It has also been observed near Gisborne (see iNaturalist 26901808) and Dunedin (see iNaturalist 5486712), but not yet collected, and these localities are not recorded on the distribution map.

A widely cultivated species, which occurs naturally in warm temperate and tropical regions from the Mediterranean and Africa to China and Japan (Crouch et al. 2011), and in Hawai'i (Palmer 2003). Naturalised in the southern USA, Central and South America (Mickel & Smith 2004), and an occasional escape from cultivation in New South Wales (Kramer & McCarthy 1998) and many other places.

Biostatus: Exotic; fully naturalised.

Habitat: *Pteris cretica* grows under *Kunzea*, regenerating scrub, and *Salix*, often along streambanks, track banks,

hillsides, or river terraces. It is also found in crib-walls, and in derelict or abandoned gardens.

First record: Brownsey (1981). Voucher CHR 318544, 1977.

Recognition: *Pteris cretica* is distinguished by its short-creeping rhizomes and broadly ovate, glabrous laminae that are 1-pinnate distally and 1-pinnate-pinnatifid proximally. There are 2–7 pairs of pinnae, the proximal 1–2 pairs bearing 1–3 secondary pinnae on the basiscopic side only. It is similar to *P. multifida*, but the latter has smaller, somewhat dimorphic fronds, the proximal primary pinnae bear at least one pair of secondary pinnae that arise on both the acroscopic and basiscopic sides, and the rachis is winged for most or all of its length.

Notes: *Pteris lomarioides* was described by Colenso (1881) from a single sterile specimen collected by an acquaintance near Tapuaeharuru, Taupō. Cheeseman (1906) stated that it “is proved by the type specimen in Mr Colenso’s herbarium to be the widely distributed *P. cretica* Linn.”. However, the morphology of this specimen suggests that it may belong to *P. parkeri*, a species which had not been distinguished from *P. cretica* when Cheeseman was writing. It is included here in the synonymy for *P. parkeri*.

The species in New Zealand currently identified as *P. cretica* (Brownsey 1981; Brownsey in Webb et al. 1988; Brownsey & Smith-Dodsworth 2000) was first collected by Alan Esler in Remuera, Auckland in 1977. However, it differs from the type of *P. cretica* (LINN 1246.7) in having the rachis winged in at least the distal half, rather than being unwinged throughout, or winged only between the uppermost

pair of pinnae and the apical pinna. In this regard the plant in New Zealand is very similar to *P. umbrosa* R.Br. from Australia. However that species differs in having acroscopic and basiscopic secondary pinnae on the proximal pinnae, whereas the New Zealand plant only has basiscopic secondary pinnae. The *Pteris cretica* aggregate is known to comprise sexual and apomictic taxa at different ploidy levels (Jaruwattanaphan et al. 2013), and further investigation is needed to determine the status and identity of New Zealand plants. Until then, the name *P. cretica* is retained here to avoid further confusion.



Fig. 122: *Pteris cretica*. Broadly ovate fronds, 1-pinnate distally and 1-pinnate-pinnatifid proximally.



Fig. 123: *Pteris cretica*. Abaxial surface of fertile frond with the primary pinnae decurrent along the rachis, and sori continuous along the pinna margins.



Fig. 124: *Pteris cretica*. Mature frond with extended secondary pinnae arising basiscopically on basal primary pinnae.



Fig. 125: *Pteris cretica*. Stipes arising from short-creeping rhizome, green when young, becoming red-brown at maturity.



Fig. 126: *Pteris cretica*. Mature, broadly ovate fronds with long, narrow, acuminate pinnae.



Fig. 127: *Pteris cretica*. Abaxial surface of fertile frond with the primary pinnae decurrent along the rachis, and the sori continuous along the pinna margins.

***Pteris dentata* Forssk., *Fl. Aegypt.-Arab.* 186 (1775)**

Neotype (selected by Runemark 1962): Yemen, Menacha, *Schweinfurth* 1402, 1889, C (*n.v.*; see Runemark 1962; Roux 2009). Original collection – Yemen, montium Hadiensium, *P. Forsskål s.n.*, lost.

Etymology: From the Latin *dentatus* (toothed), a reference to the toothed margins on sterile segments of fronds of this species.

Vernacular name: toothed brake

Rhizomes erect, scaly. Rhizome scales narrowly ovate, 4–5.5 mm long, 0.5–1.0 mm wide, orange-brown, concolorous, margins ciliate. Fronds 580–1350 mm long. Stipes 230–730 mm long, chestnut-brown proximally, yellow-brown distally, glabrous except for scattered scales proximally. Rachises yellow-brown, not winged, glabrous. Laminae 270–580 mm long, 230–290 mm wide, deeply 1-pinnate-pinnatifid distally, 2-pinnate-pinnatifid proximally, abruptly narrowed to a pinnatifid terminal segment, ovate to elliptic, yellow-green on both surfaces, herbaceous or coriaceous, glabrous. Primary pinnae in 7–11 pairs below pinnatifid apex, slightly overlapping; the longest at or near base, 150–260 mm long, 70–160 mm wide, ovate to broadly ovate, straight or slightly falcate; divided almost to the midrib into secondary pinnae that reduce markedly in length along the length of the pinna; adaxial surface with spine-like growths on the costae; primary pinna apices acuminate, bases stalked; basal primary pinnae with elongated secondary pinnae mainly on the basiscopic side. Longest secondary pinnae 50–125 mm long, 17–50 mm wide, narrowly ovate to linear; apices acute, margins serrate distally, bases adnate to decurrent. Longest tertiary segments 12–35 mm long, 3–7 mm wide, linear. Veins free. Sori continuous along sides of ultimate segments.

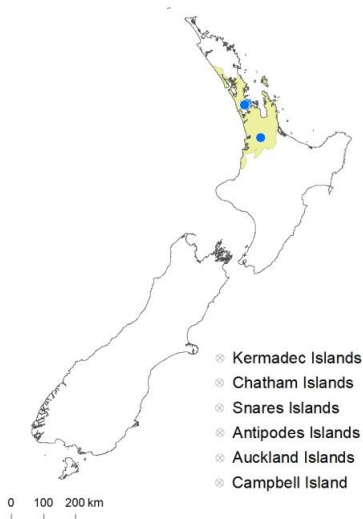


Fig. 128: *Pteris dentata* distribution map based on databased records at AK, CHR & WELT.

that is 1-pinnate-pinnatifid at the mid-point, rather than 2-pinnate-pinnatifid in *P. tremula*.

Notes: Runemark (1962) recognised two subspecies within *P. dentata* – subsp. *dentata* from Ethiopia, Sudan and Yemen to the north of the equator, and subsp. *flabellata* from Ethiopia to South Africa, mostly south of the equator. However, Roux (2009) reduced both subspecies to synonymy under *P. dentata*.



Fig. 129: *Pteris dentata*. Herbarium specimen from Auckland, WELT P010253, showing fertile frond, with two extended basal basiscopic secondary pinnae on basal primary pinnae.



Fig. 130: *Pteris dentata*. Close up of WELT P010253, showing a secondary pinna and tertiary lamina segments with sori continuous along the margins.

Distribution: North Island: Auckland.

Altitudinal range: 5–60 m.

Recorded from a few places in Auckland city and Hamilton.

Occurs naturally from Arabia to southern Africa and Madagascar, and on St Helena, Ascension and the Cape Verde Islands (Crouch et al. 2011).

Biostatus: Exotic; fully naturalised.

Habitat: An occasional escape from cultivation growing on banks, old brick walls and amongst boulders.

First record: Heenan et al. (1999). Voucher AK 149451, WELT P010253, 1979.

Recognition: *Pteris dentata* is distinguished by its erect rhizomes, ovate or elliptic glabrous laminae, which are 1-pinnate-pinnatifid distally and 2-pinnate-pinnatifid proximally. There are 7–11 pairs of pinnae almost divided into secondary pinnae. It is somewhat similar to *P. pacifica* but has generally longer secondary pinnae that reduce markedly in length from the proximal to the distal end of the primary pinna. It is also similar to *P. tremula*, but differs in having a less divided lamina

***Pteris epaleata* D.J.Ohlsen in Ohlsen et al., *Muelleria* 39: 23 (2020)**

Holotype: Australia, Victoria, Mornington National Park, Main Creek south of Boneo Road, 30 August 2019, *D.J. Ohlsen & V. Stajsic* DJO913, MEL 2469967A–2469973A; isotypes CANB, NSW, WELT!

Etymology: From the Latin *epaleatus* (lacking scales), a reference to the absence of broad scales on the lamina of this species in contrast to closely related species.

In New Zealand, *Pteris epaleata* is known only from three incomplete collections with fronds up to 1250 mm long. Stipes up to 600 mm long, chestnut-brown, almost glabrous except for a very few scattered ovate scales proximally. Rachises yellow-brown or chestnut-brown, narrowly winged only in distal half, bearing a few small hair-like scales, especially at pinna junctions. Laminae 3-pinnate-pinnatifid, ovate, up to 650 mm long, 480 mm wide, dull green on both surfaces, coriaceous, bearing a few small hair-like scales on the costae. Primary pinnae in about 6 scarcely overlapping pairs below a pinnatifid apex, the longest at the base up to 280 mm long, 150 mm wide, ovate, straight; pinna apices acute to acuminate, bases long-stalked. Longest secondary pinnae up to 115 mm long, 55 mm wide, ovate, sub-opposite; apices acute to acuminate, bases usually adnate or with 1 pair short-stalked; basispic secondary pinnae on basal primary pinnae not markedly longer than the others. Longest tertiary segments up to 30 mm long, 10 mm wide, narrowly elliptic to oblong; apices acute, margins divided to more than halfway in largest fronds, bases adnate. Veins anastomosing. Sori elongated along margins of ultimate segments.

Distribution: South Island: Fiordland

Altitudinal range: c. 20 m.

Pteris epaleata is currently known from a few collections in southern Fiordland, on Resolution Island, at the Coal River near Breaksea Sound, on Secretary Island, and at Looking Glass Bay near George Sound. It grows near the coast at about 20 m.

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

Biostatus: Indigenous (Non-endemic).

Habitat: *Pteris epaleata* is a coastal fern found near streams in forest, and at forest margins.

Recognition: *Pteris epaleata* is superficially most similar to *P. tremula* in its frond dissection, absence of scales on the lamina, and its dull green adaxial lamina surface. However, it is clearly distinct from that species in having anastomosing rather than free veins. It differs from *P. carsei* in having less coriaceous and more divided laminae, narrower ultimate segments, dull green rather than shiny adaxial lamina surfaces, hair-like rather than ovate scales on the rachises

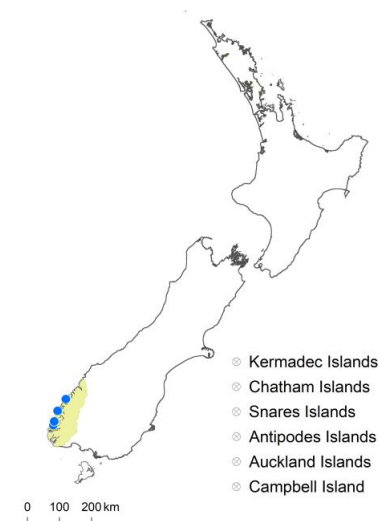


Fig. 131: *Pteris epaleata* distribution map based on databased records at AK, CHR, OTA & WELT.

and costae, and lacking the greatly extended basispic secondary pinnae on the basal primary pinnae. From *P. macilenta* and *P. saxatilis* it differs in having secondary pinnae that are less obviously stalked, ultimate segments that are longer and narrower, and hair-like rather than ovate scales on the rachises and costae.

Cytology: No chromosome count has been made on New Zealand material, but $2n = 58$ was reported by Tindale & Roy (2002 – as *P. comans*) from two populations in New South Wales.

Notes: The description of *P. epaleata* in New Zealand given here is incomplete because it is based on only three collections. A full description of the species throughout its range has been provided by Ohlsen et al. (2020), and, if more collections are made in New Zealand, it is likely that the known dimensions will more closely approximate those in Australia.

Pteris epaleata is morphologically, genetically and geographically distinct from *P. comans sens. str.* in the tropical Pacific. It is also morphologically distinct from *P. zahlbruckneriana* Endl. on Norfolk Island and *P. microptera* on Lord Howe Island (Ohlsen et al. 2020).

Observations by field botanists in southern Fiordland, albeit unsupported by voucher specimens, suggest that *Pteris epaleata* may be more widespread (B. Rance, pers. comm. 17.3.2020). Its occurrence in Fiordland and south-eastern Australia is similar to that of *Sticherus tener* (Brownsey et al. 2013).



Fig. 132: *Pteris epaleata*. Herbarium specimen from Resolution Island, Fiordland, CHR 2353997A, showing a mature fertile frond.



Fig. 133: *Pteris epaleata*. Herbarium specimen from Resolution Island, Fiordland, CHR 2353997B, showing a mature fertile frond.

***Pteris macilenta* A.Rich., *Essai Fl. Nouv.-Zél.*, 82, t. 12 (1832)**

≡ *Litobrochia macilenta* (A.Rich.) J.Sm., *J. Bot. (Hooker)* 4: 163 (1841)

Lectotype (selected by Brownsey & Perrie 2020): Nlle Zélande, Baie des Iles, *Astrolabe*, No. 11, Herb. Richard, P 00610503!

= *Pteris pendula* Colenso, *Trans. & Proc. New Zealand Inst.* 20: 218 (1888)

≡ *Pteris macilenta* var. *pendula* (Colenso) Cheeseman, *Man. New Zealand Fl.* 973 (1906)

Lectotype (selected by Brownsey & Perrie 2020): Dannevirke, H[awke's] B[ay], Herb. Colenso, WELT P002700 (on three sheets)!

Etymology: From the Latin *macilentus* (thin), a reference to the delicate fronds of this species.

Vernacular name: sweet fern

Rhizomes erect, scaly. Rhizome scales narrowly ovate, 3.5–7.5 mm long, 0.4–1.5 mm wide, pale brown or red-brown, concolorous, entire. Fronds 200–1550 mm long. Stipes 70–820 mm long, red-brown proximally, yellow-brown or chestnut-brown distally, with scattered pale brown or red-brown scales up to 9 mm long and 2 mm wide, especially proximally. Rachises yellow-brown or rarely chestnut-brown, narrowly winged only in distal half, bearing scattered scales. Laminae deeply 2-pinnate-pinnatifid to 4-pinnate-pinnatifid, 130–900 mm long, 60–750 mm wide, ovate to broadly ovate, pale green, herbaceous or rarely coriaceous, bearing scattered scales on the costae. Primary pinnae in 3–9 pairs below pinnatifid apex, not or scarcely overlapping; the longest at or near base, 45–750 mm long, 25–350 mm wide, narrowly ovate to ovate, straight; pinna apices acute to acuminate, bases long-stalked. Longest secondary pinnae 16–290 mm long, 8–160 mm wide, ovate to elliptic, ± alternate; apices acute to acuminate, bases stalked; basal basicopic secondary pinnae on basal primary pinnae not markedly longer than the others. Longest tertiary pinnae 9–85 mm long, 3–60 mm wide, ovate or narrowly ovate; apices acute, margins indented to deeply divided, bases sessile or short-stalked. Ultimate lamina segments up to 38 mm long, 19 mm wide. Veins anastomosing. Sori elongated along margins of the ultimate segments. Mean exospore diameter 41–46 µm.

Note: Measurements given above are from herbarium specimens. Larger fronds are known to occur in the wild. AK 141374, from the Waitākere Ranges, Auckland, comprises parts of a frond said to measure 1800 mm long.

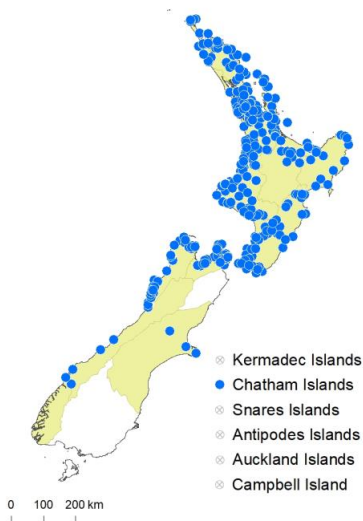


Fig. 134: *Pteris macilenta* distribution map based on databased records at AK, CHR & WELT.

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

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

Chatham Islands.

Altitudinal range: 0–800 m.

Pteris macilenta occurs in coastal and lowland areas throughout the North Island from Te Pahi to Wellington, extending locally into montane districts. It is rare in the central North Island. It grows from near sea level, reaching 800 m in the Coromandel Ranges and on Mt Pirongia. In the South Island, the species is common only in coastal and lowland regions from the Marlborough Sounds to Greymouth, reaching 520 m near Nelson. There are outlying populations in Canterbury and along the West Coast as far south as Martins Bay. The species also extends to the Chatham Islands.

Biostatus: Indigenous (Endemic).

Habitat: *Pteris macilenta* is a terrestrial fern found under coastal forest, drier and more open kauri, podocarp, beech, and broadleaved forest, and mānuka and kānuka scrub. It is

also found under *Carex secta*. It grows on scoria, greywacke and limestone rock, favouring streambanks, river terraces, wet gullies, clay banks, clearings, forest margins, roadside banks, coastal cliffs, and the bases of rocky bluffs.

Recognition: *Pteris macilenta* is distinguished by its erect rhizome, deeply 2-pinnate-pinnatifid to 4-pinnate-pinnatifid laminae, anastomosing veins, non-overlapping pinnae, usually herbaceous lamina segments, and secondary pinnae that are mostly stalked on the lowermost primary pinnae. It is very similar to *P. saxatilis*, but is generally a larger plant with slightly more coriaceous laminae and less widely spaced pinnae. The secondary pinnae on the lower primary pinnae are more obviously alternate rather than sub-opposite. It also has larger spores than those in *P. saxatilis* (exospores 41–46 µm, cf. 32–37 µm in diameter). Plants of *P. macilenta* are believed to hybridise with both *P. saxatilis* and *P. carsei*, making identification difficult in areas where the species overlap. It differs from *P. epaleata* in having secondary pinnae that are more obviously stalked, ultimate segments that are shorter and broader, and scales on the rachises and costae that are ovate rather than hair-like.

Cytology: n = 60 (Brownlie 1961); n = 58, 2n = c. 116 (Walker 1962); 2n = c. 120 (de Lange et al. 2004 – as *P. aff. macilenta*).

Hybridisation: *Pteris macilenta* is believed to hybridise with *P. saxatilis* in areas where they overlap (e.g. AK 353155, 353276, 353488, CHR 210968, 292779). Spores of putative hybrids are often abnormal in appearance because of the difference in chromosome number between the two species, but are not as easy to detect as in genera such as *Asplenium* or *Polystichum*. Whether *P. macilenta* also crosses with *P. carsei* is not known with certainty because it is difficult to distinguish this combination from the common hybrid between *P. saxatilis* and *P. carsei*. It is likely on morphological grounds that *P. macilenta* is an allotetraploid derivative of the two diploid species, although experimental evidence for this is lacking, and all three species have very similar chloroplast DNA sequences, indicating a close relationship (Bouma et al. 2010).

Notes: Braggins (1975), in his unpublished thesis, interpreted Richard's *P. macilenta* to be the correct name for the plant subsequently known as *P. saxatilis*, and proposed that *P. pendula*, described by Colenso (1888), be used for the plant that had been called *P. macilenta*. Although his thesis was never published, the names *P. pendula* and *P. macilenta* were adopted by some collectors, whereas others continued to use *P. macilenta* and *P. saxatilis*. As a consequence, the names have been used in different senses, and a significant amount of herbarium material was confusingly identified. Brownsey & Perrrie (2020) selected the only element that is definitely original material of Richard's name as the lectotype (P 00610503), and since this is a specimen of what is currently called *P. macilenta*, the name is retained in its traditional sense.

Plants growing in limestone areas from the Heaphy Track south to Greymouth, especially around Punakaiki, have rather fleshy fronds, and primary pinnae that are more winged than in populations elsewhere. They also have a mean exospore size (36–41 µm diameter) intermediate between those of the tetraploid *P. macilenta* (41–46 µm diameter) and the diploid *P. saxatilis* (32–37 µm diameter) and *P. carsei* (33–36 µm diameter). These plants may be an environmental form, or they may represent

allotetraploid plants that have had a separate origin from populations elsewhere. They are not given any taxonomic status here, but require further investigation.



Fig. 135: *Pteris macilenta*. Adaxial surface of 3-pinnate-pinnatifid frond, with basal secondary pinnae on basal primary pinnae clearly stalked.



Fig. 136: *Pteris macilenta*. Adaxial surface of 3-pinnate-pinnatifid frond, with basal secondary pinnae on basal primary pinnae clearly stalked.



Fig. 137: *Pteris macilenta*. Adaxial surface of 2-pinnate-pinnatifid frond, with basal secondary pinnae on basal primary pinnae clearly stalked.



Fig. 138: *Pteris macilenta*. Abaxial surface of secondary pinna showing elongated sori protected by membranous reflexed lamina margins.



Fig. 139: *Pteris macilenta*. Abaxial surface of primary pinna showing anastomosing veins.



Fig. 140: *Pteris macilenta*. Abaxial surface of pinna showing anastomosing veins and marginal sori protected by inrolled lamina margins.

***Pteris multifida* Poir., *Encycl.* 5, 714 (1804)**

Type: a plant of unknown origin cultivated at the Jardin des Plantes, Paris, P (*n.v.*; see Roux 2009).

Etymology: From the Latin *multifidus* (much divided), a reference to the division of the lamina in this species.

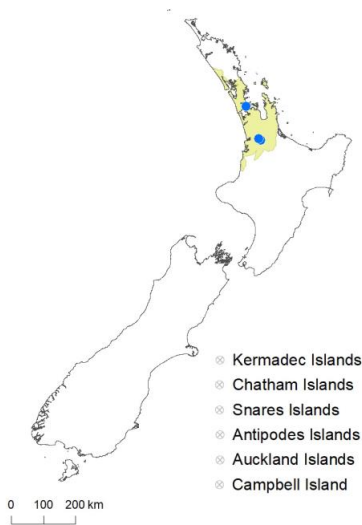


Fig. 141: *Pteris multifida* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Auckland.

Altitudinal range: 20–40 m.

Recorded from a few places in Auckland and Hamilton.

Occurs naturally in China, Taiwan, Japan, South Korea, Philippines, Thailand, Vietnam (Liao et al. 2013). Naturalised in Uganda (Roux 2009).

Biostatus: Exotic; casual.

Habitat: Recorded growing from cracks in a horizontal pine log in a carpark, and on moss-covered concrete block walls.

First record: New record. Voucher AK 305834, WELT P023358, 2009.

Recognition: In New Zealand, *Pteris multifida* has an erect to short-creeping, scaly rhizome; rhizome scales narrowly ovate, shiny brown, concolorous. Fronds ± dimorphic; sterile fronds to 250 mm long, fertile fronds 180–370 mm long. Stipes pale green to yellow-brown, 50–175 mm long. Rachises winged for most or all of its length. Sterile laminae up to 130 mm long and 60 mm wide, pinnatifid distally, pinnate-pinnatifid proximally, with the primary pinnae divided almost to the midrib into a

single pair of secondary pinnae arising on both sides of the primary pinnae; secondary pinnae up to 35 mm long and 9 mm wide, margins irregularly serrate, apices acuminate. Fertile laminae broadly elliptic or broadly ovate, up to 220 mm long and 150 mm wide, pinnatifid distally, pinnate-pinnatifid proximally with the primary pinnae divided almost to the midrib into 1 or 2 pairs of secondary pinnae arising on both sides of the primary pinnae; secondary pinnae up to 80 mm long and 5 mm wide, margins entire or serrate distally, apices acuminate. Veins free. Sori continuous along margins of ultimate segments.



Fig. 142: *Pteris multifida*. Herbarium specimen from Auckland, WELT P023358, showing mature plant with fertile fronds.



Fig. 143: *Pteris multifida* Close up of WELT P023358, showing a pair of secondary pinnae arising on both sides of the basal primary pinnae.

***Pteris pacifica* Hieron., *Hedwigia* 55: 355 (1914)**

Lectotype (selected by Field 2020): Von den Bergen bei Naloka, Fiji, *Kleinschmidt* 36, Dec. 1877, B 200097772 (online)

Etymology: *Pacifica* (Latin) – from the Pacific region where this species was first collected.

Vernacular name: comb brake

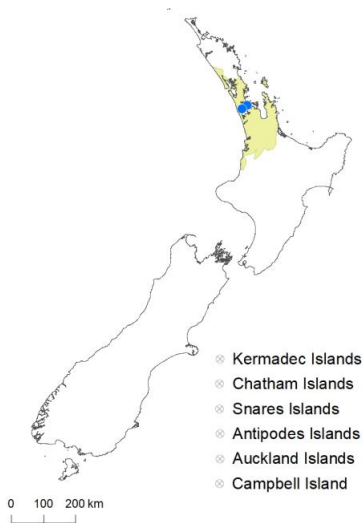


Fig. 144: *Pteris pacifica* distribution map based on databased records at AK, CHR & WELT.

stalked, divided almost to the midrib into secondary segments of \pm uniform length, shortening only towards the apices; adaxial surface with spine-like growths on the costae; basal primary pinnae with 1–2 elongated pinnatifid segments up to 100 mm long on the basiscopic side; ultimate segments up to 15 mm long and 3 mm wide, margins entire, apices obtuse. Veins free. Sori continuous along sides of ultimate segments.

Distribution: North Island: Auckland

Altitudinal range: 20–40 m.

Recorded only in parts of Auckland city.

Occurs naturally in Malaysia, Australia (Queensland), Norfolk Island, Solomon Islands, Vanuatu, Fiji, Samoa and Tonga.

Biostatus: Exotic; casual.

Habitat: Recorded as occurring spontaneously in urban gardens.

First record: Heenan et al. (2002). Voucher AK 205931, 1991.

Recognition: In New Zealand, *Pteris pacifica* has an erect or short-creeping, scaly rhizome; rhizome scales narrowly ovate, with dark centres and pale erose margins. Fronds 200–760 mm long. Stipes yellow-brown to chestnut-brown, 160–310 mm long; rachises not winged. Laminae mostly 1-pinnate-pinnatifid but 1-pinnate-bipinnatifid at base and abruptly narrowed to a pinnatifid terminal segment, ovate or elliptic, 210–460 mm long, 80–200 mm wide. Primary pinnae in 5–6 pairs; longest primary pinnae 60–200 mm long,



Fig. 145: *Pteris pacifica*. Herbarium specimen from Auckland, WELT P022086, showing fertile fronds.



Fig. 146: *Pteris pacifica*. Close up of WELT P022086, showing basal primary pinna with a single, basispicous, pinnatifid, secondary pinna.

***Pteris parkeri* hort. ex J.J.Parker, *Gard. Chron.* 51: 160 (1912)**

Type: probably from Japan, ex cult. J.J. Parker, K (*n.v.*; see Fraser-Jenkins et al. 2017; Parris 2018)

= *Pteris lomarioides* Colenso, *Trans. & Proc. New Zealand Inst.* 13: 380 (1881)

Holotype: near Tapuaeharuru, Taupo, *W. Colenso*, Herb. Cheeseman, AK 135538! (juvenile specimen)

= *Pteris nipponica* W.C.Shieh, *Bot. Mag. (Tokyo)* 79: 285 (1966)

Type: not located (see Fraser-Jenkins 2008)

Etymology: Named in honour of J.J. Parker, a nurseryman of Rose Nursery, Whetstone, U.K.

Vernacular name: Japanese pteris

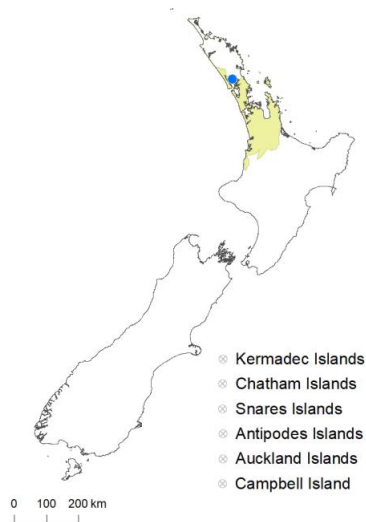


Fig. 147: *Pteris parkeri* distribution map based on databased records at AK, CHR & WELT.

Distribution: North Island: Auckland

Altitudinal range: c. 60 m.

Recorded only near Matakohē, northern Kaipara Harbour.

Occurs naturally in China, Korea, Japan and Taiwan, and is naturalised in Nepal and North America.

Biostatus: Exotic; casual.

Habitat: Recorded as occurring spontaneously in a grassy ditch beside a road.

First record: Possibly first recorded by Colenso (1881) as *P. lomarioides*. Voucher AK 135538. First confirmed record Parris (2018). Voucher AK 330571, 2012.

Recognition: In New Zealand, *Pteris parkeri* is known with certainty only from one collection with three sterile fronds. Rhizome unknown. Fronds 250–340 mm long. Stipes yellow-brown, 110–180 mm long; rachises not winged. Laminae 1-pinnate to 2-pinnate at base, ovate, 140–190 mm long, 110–130 mm wide; primary pinnae in 2 pairs below a long terminal segment, the longest 75–115 mm long, 12–18 mm wide, bicolorous with the central portion yellow-green, apices acute, margins slightly serrate, bases sessile or short-stalked; basal pair of primary pinnae divided to the midrib into a single secondary pinna on the basispicous side. Veins free. Sori unknown.

Notes: The voucher collection of this plant was initially identified by Parris as *Pteris nipponica* W.C.Shieh, but she subsequently noted that Fraser-Jenkins (2008) had pointed out that the correct name is actually *Pteris parkeri*. Parris (2018) created the new combination *Pteris parkeri*

var. *albolineata* (Hook.) Parris for a variegated form first described as *P. cretica* var. *albolineata* by Hooker (1860) from a plant cultivated at Buitenzorg Botanical Garden, Java. The New Zealand collection matches this variety. Parris noted that epithets published in conformity with the Code may be used as cultivar epithets, and since the variety was described from a cultivated plant, it can be known as *Pteris parkeri* 'Albolineata'. She also stated that the plant had been in the horticultural trade in New Zealand for at least 30 years.

A juvenile frond, which was described by Colenso (1881) as *P. lomarioides*, may be a much earlier record of *P. parkeri* in New Zealand, but its identity requires confirmation. It lacks the variegation of Parris's more recent collection, and would not be identified in the key to species of *Pteris* provided here. It was included in the synonymy of *P. cretica* by Cheeseman (1906).



Fig. 148: *Pteris parkeri*. Herbarium specimen from Matakoho, Northland, AK330571, showing three sterile fronds with 1-pinnate to 2-pinnate laminae.

***Pteris saxatilis* (Carse) Carse, *Trans. & Proc. New Zealand Inst.* 59: 315 (1928)**

≡ *Pteris macilenta* var. *saxatilis* Carse, *Trans. & Proc. New Zealand Inst.* 51: 95 (1919)

Lectotype (selected by Brownsey & Perrie 2020): McKay's Bush, Kaiaka, H. Carse, Jan. 1917, Herb. Cheeseman, AK 12335!

Etymology: From the Latin *saxatilis* (living in rocky places), a reference to the habitat of this species.

Rhizomes erect, scaly. Rhizome scales narrowly ovate, 3–5 mm long, 0.4–0.9 mm wide, pale brown, concolorous, entire. Fronds 145–700 mm long. Stipes 40–235 mm long, red-brown proximally, yellow-brown or chestnut-brown distally, with a few scattered pale brown scales up to 4 mm long and 1 mm wide, especially proximally. Rachises chestnut-brown or yellow-brown, narrowly winged only in distal half, bearing scattered scales. Laminae 2-pinnate-pinnatifid to 3-pinnate-pinnatifid, 100–500 mm long, 35–300 mm wide, ovate to broadly ovate, mid-green adaxially, pale green abaxially, herbaceous, glabrous or with scattered scales on the costae. Primary pinnae in 3–9 pairs below pinnatifid apex, widely spaced, not overlapping; the longest at or near base, 40–350 mm long, 16–100 mm wide, narrowly ovate to ovate, straight; pinna apices acute to acuminate, bases long-stalked. Longest secondary pinnae 12–85 mm long, 6–35 mm wide, ovate to elliptic, widely spaced, sub-opposite; apices acute, bases stalked; basal basispic secondary pinna on each primary pinna not markedly longer than others. Longest tertiary segments 4–24 mm long, 2–12 mm wide, ovate or elliptic or oblong; apices acute, margins entire to deeply indented, bases adnate or short-stalked. Veins anastomosing. Sori elongated along margins of the ultimate segments. Mean exospore size 32–37 μm in diameter.

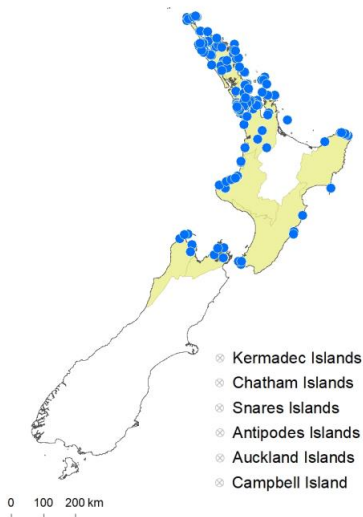


Fig. 149: *Pteris saxatilis* distribution map based on databased records at AK, CHR & WELT.

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

South Island: Western Nelson, Sounds-Nelson.

Altitudinal range: 0–360 m.

Pteris saxatilis occurs in coastal and lowland sites from Te Pahi south to East Cape and the north Taranaki coast, with outlying populations in Hawke’s Bay, Wellington and the north coast of the South Island. It is absent from the central North Island and all the main mountain ranges. It grows from near sea level, reaching over 360 m on Mt Manaia, Whangārei Heads.

Biostatus: Indigenous (Endemic).

Habitat: *Pteris saxatilis* is a terrestrial fern that grows under coastal forest and scrub, and in drier kauri, broadleaved forest, and mānuka and kānuka scrub. It is found on coastal cliffs, on creek banks, in damp gullies, on clay and grassy banks, and amongst rocks and scree, occurring on both greywacke and limestone rock.

Recognition: *Pteris saxatilis* is distinguished by its erect rhizome, 2-pinnate to 3-pinnate-pinnatifid laminae,

anastomosing veins, widely spaced pinnae, herbaceous ultimate segments, and secondary pinnae that are mostly stalked on the lowermost primary pinnae. It is very similar to *P. macilenta* but is generally a smaller plant with a more delicate lamina and more widely spaced pinnae. The secondary pinnae on the lower primary pinnae are more obviously sub-opposite rather than alternate. It also has smaller spores than those in *P. macilenta* (exospores 32–37 µm, cf. 41–46 µm in diameter).

Plants of *P. saxatilis* are believed to hybridise with both *P. macilenta* and *P. carsei*, making identification difficult in areas where the species overlap.

Cytology: $2n = 58$ (Walker 1962).

Hybridisation: *Pteris saxatilis* is believed to hybridise with both *P. carsei* and *P. macilenta*, especially in coastal areas of Northland and Auckland. Extensive hybrid swarms with *P. carsei* are known in several localities (see suites of material in AK). Spores of putative hybrids are sometimes abnormal in appearance, but are not as easy to detect as in genera such as *Asplenium* or *Polystichum*. There may be some degree of fertility in hybrids between *P. saxatilis* and *P. carsei*, and back-crosses to both parents could be possible. Hybrids between *P. saxatilis* and *P. macilenta* are less common, but are more likely to have aborted spores because of the difference in chromosome number (e.g. AK 353155, 353276, 353488). Braggins (1975) created artificial hybrids between the diploid species, *P. saxatilis* and *P. carsei*, and it is likely on morphological grounds that *P. macilenta* is an allotetraploid derivative of wild hybrids between these two diploid species. However, experimental evidence for this is lacking, and all three species have very similar chloroplast DNA sequences indicating a close relationship (Bouma et al. 2010).



Fig. 150: *Pteris saxatilis*. Adaxial surface of 2-pinnate-pinnatifid frond, with secondary pinnae mostly short and clearly stalked.



Fig. 151: *Pteris saxatilis*. Adaxial surface of 3-pinnate-pinnatifid frond, with secondary pinnae mostly short and clearly stalked.



Fig. 152: *Pteris saxatilis*. Adaxial surface of 2-pinnate-pinnatifid frond, with secondary pinnae mostly short and clearly stalked.



Fig. 153: *Pteris saxatilis*. Abaxial surface of lamina with secondary pinnae mostly arranged in sub-opposite pairs.



Fig. 154: *Pteris saxatilis*. Close up of primary pinnae showing basal secondary pinnae in sub-opposite pairs.



Fig. 155: *Pteris saxatilis*. Abaxial surface of primary pinna showing marginal sori.

Pteris tremula R.Br., *Prodr. Fl. Nov. Holland.* 154 (1810)

Lectotype (selected by Green 1994): Port Jackson [Sydney, Australia],
R. Brown Iter Austral. 4, 1802-5, BM 001044256!

= *Pteris affinis* A.Rich., *Essai Fl. Nouv.-Zél.*, 81 (1832)

Lectotype (selected by Brownsey & Perrie 2020): Nouvelle Zélande [New Zealand], Baie des Iles [Bay of Islands], *Astrolabe*, Herb. Richard, P 01319309!

= *Pteris tenuis* A.Cunn., *Companion Bot. Mag.* 2: 365 (1837)

≡ *Pteris tremula* var. *tenuis* (A.Cunn.) Domin, *Biblioth. Bot.* 20(85): 156 (1913)

Holotype: Vicinity of Wangaroa [Whangaroa], *A. Cunningham*, Nov. 1826, K 001057870!

Etymology: From the Latin *tremulus* (shaking), a reference to the trembling appearance of the frond in a light breeze.

Vernacular names: shaking brake; tender brake; turawera

Rhizomes erect, scaly. Rhizome scales narrowly ovate, 2.5–9 mm long, 0.4–1 mm wide, golden brown, concolorous. Fronds 220–2440 mm long. Stipes 120–1170 mm long, red-brown proximally, yellow-brown or chestnut-brown distally, glabrous. Rachises green when young, darkening to chestnut-brown or yellow-brown, narrowly winged only in distal half, glabrous. Laminae deeply 2-pinnate-pinnatifid to deeply 3-pinnate-pinnatifid, 100–1270 mm long, 80–900 mm wide, ovate, mid-green adaxially, yellow-green abaxially, herbaceous or coriaceous, glabrous or with minute hairs along costae. Primary pinnae in 5–18 pairs below pinnatifid apex, not or slightly overlapping; the longest at or near base, 60–620 mm long, 42–240 mm wide, broadly ovate or ovate or narrowly elliptic, straight; pinna apices acute or acuminate, bases stalked. Longest secondary pinnae 23–215 mm long, 10–120 mm wide, ovate, sub-opposite; apices acute, bases short-stalked; basiscopic secondary pinnae on basal primary pinnae elongated. Longest tertiary segments 5–70 mm long, 2–35 mm wide, ovate to linear; apices acute to obtuse, margins entire, bases adnate or short-stalked; sometimes divided into quaternary segments 4–20 mm long, 1–4 mm wide, linear to oblong; apices obtuse, margins entire or shallowly serrate, bases adnate. Veins free. Sori continuous along sides of the ultimate segments.

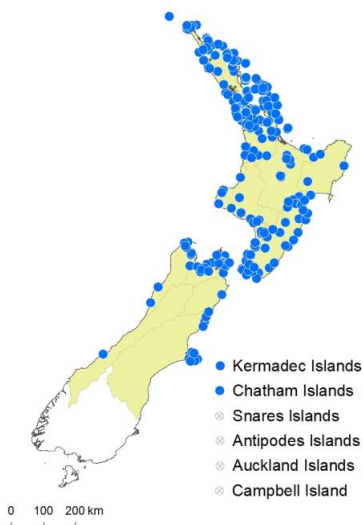


Fig. 156: *Pteris tremula* distribution map based on databased records at AK, CHR & WELT.

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

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

Kermadec Islands, Three Kings Islands, Chatham Islands.

Altitudinal range: 0–550 m.

Pteris tremula occurs on the Kermadec Islands, Three Kings Islands, and in coastal and lowland areas of the North Island from Te Pahi to Wellington, extending locally into montane districts. It is absent only from parts of the central North Island and Gisborne high country. It grows from near sea level, reaching 550 m in the Kāweka Ranges. In the South Island it occurs from north-west Nelson to the Marlborough Sounds, south to Banks Peninsula on the east coast, and to Punakaiki on the west coast, with an outlying population at the Paringa River mouth in south Westland. It reaches almost 250 m on Mt Burnett. It also occurs on the Chatham Islands.

Also Australia (Northern Territory, South Australia, Queensland, New South Wales, Australian Capital Territory, Victoria, Tasmania), Norfolk Island, Lord Howe Island, Vanuatu and Fiji. Widely cultivated internationally; naturalised in

southern Africa and California (Crouch et al. 2011), parts of the Northern Hemisphere (Zhang et al. 2015), and in Tamil Nadu State, India (Fraser-Jenkins et al. 2017).

Biostatus: Indigenous (Non-endemic).

Habitat: *Pteris tremula* is found under coastal forest and scrub, open broadleaved and beech forest, kānuka and mānuka scrub, and in open pine plantations. It also occurs on forest margins, under regenerating scrub, in reverting pasture, on wooded sand-dunes, at the base of cliffs, and as a weed in gardens. It favours streambanks, the base of waterfalls, river terraces, bush clearings, open forest floor, roadside banks, rocky hillsides, and swamp margins. It occurs on greywacke, limestone and scoria. It is sometimes common in heavily grazed areas because the fronds are unpalatable to stock.

Recognition: *Pteris tremula* is distinguished by its erect rhizome, 2-pinnate-pinnatifid to almost 4-pinnate laminae, free veins, herbaceous texture, long narrow ultimate segments, and laminae lacking scales but sometimes with minute hairs along the costae. It is more divided, with more pairs of primary pinnae, than most other species in New Zealand. It could be confused with *P. epaleata* in overall morphology but differs significantly in having free veins rather than anastomosing venation.

Cytology: $n = c. 120$ (Brownlie 1957).

Hybridisation: *Pteris tremula* is not known to hybridise with any other species in New Zealand.

Notes: *Pteris novae-zelandiae* was described by Field (1906) from material received in a “parcel of ferns from Waikanae”. He compared it with *P. tremula* but noted that it differed most obviously in its growth form – spreading horizontally by the production of lateral fronds, rather than being erect. No original material has been located and it is impossible to determine the identity of the plant from the description alone. The name was not documented by either Cheeseman (1925) or Allan (1961) and, in any case, was not validly published because Field stated only that “it may be provisionally named *Pteris novae-zelandiae*”. Provisional names are not considered to be validly published (see Art. 36.1, Ex. 5).



Fig. 157: *Pteris tremula*. Adaxial surface of 3-pinnate frond, with narrow ultimate segments and red-brown stipe and rachis.



Fig. 158: *Pteris tremula*. Habit of mature plant growing from an erect rhizome.



Fig. 159: *Pteris tremula*. Adaxial surface of 3-pinnate frond, with expanded basal basispic secondary pinnae on primary pinnae.



Fig. 160: *Pteris tremula*. Abaxial surface of primary pinna showing marginal sori protected by inrolled lamina margins.



Fig. 161: *Pteris tremula*. Abaxial surface of secondary pinnae showing marginal sori.



Fig. 162: *Pteris tremula*. Abaxial surface of pinna showing marginal sori protected by inrolled lamina margins.



Fig. 163: *Pteris tremula*. Abaxial surface of pinnae showing open venation.



Fig. 164: *Pteris tremula*. Abaxial surface of secondary pinnae showing marginal sori protected by inrolled lamina margins.

***Pteris vittata* L., Sp. Pl. 1074 (1753)**

Lectotype (selected by Tryon 1964): [China, Osbeck], LINN 1246.3 (*n.v.*; see Jarvis 2007)

Etymology: From the Latin *vittatus* (banded longitudinally), a reference to the appearance of the fertile pinnae.

Vernacular names: Chinese brake; ladder brake

Rhizomes short-creeping, up to 40 mm long (in herbarium specimens), scaly. Rhizome scales very narrowly ovate, 2–5 mm long, 0.1–0.5 mm wide, pale brown, concolorous, entire. Fronds 95–1220 mm long. Stipes 10–180 mm long, pale brown, densely scaly; scales similar to those of rhizome but decreasing in size distally. Rachises pale brown, not winged, sparsely scaly; rachis scales very narrowly ovate, pale brown. Laminae 1-pinnate, 85–1180 mm long, 30–270 mm wide, obovate, mid-green on both surfaces, coriaceous; hair-like scales on abaxial costa surfaces. Primary pinnae in 8–40 pairs and a long terminal pinna, not overlapping; the longest above the middle, 16–220 mm long, 2.5–10 mm wide, very narrowly ovate, auricled at base, straight; basal pinnae much reduced; pinna apices acuminate, margins irregularly serrate when young and inrolled at maturity, bases short-stalked. Veins free. Sori continuous along sides of primary pinnae.

Note: Fronds on AK 223495 collected from Epsom, Auckland, were said to reach 1600 mm long.

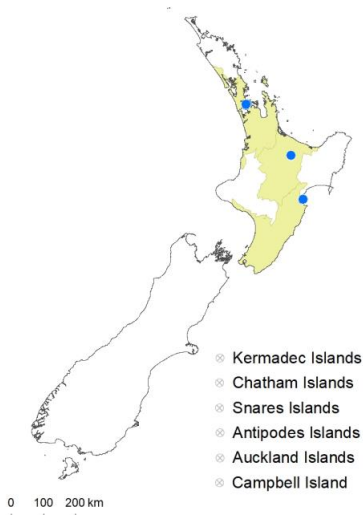


Fig. 165: *Pteris vittata* distribution map based on databased records at AK, CHR & WELT.

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

Altitudinal range: 0–340 m.

Pteris vittata has been recorded from Auckland city, the banks of Lake Rotomohana, and Napier.

Occurs naturally in tropical and warm temperate areas of southern Europe, Africa, Madagascar, Asia, Australia (Western Australia, Northern Territory, Queensland, New South Wales, Victoria), Solomon Islands, Vanuatu, New Caledonia, Fiji, and Tonga. It is naturalised in Hawai'i (Palmer 2003), and in the tropics and subtropics of North and South America (Mickel & Smith 2004).

Biostatus: Exotic; fully naturalised.

The biostatus of *Pteris vittata* in New Zealand has been discussed by Brownsey & Perrie (2012) and Ecroyd & Miller (2012). The latter authors consider it to be self-established at the Lake Rotomahana site, possibly from eastern Australia, in contrast to the view taken here that it is fully naturalised.

Habitat: In urban areas in New Zealand *Pteris vittata* has been recorded from brick and scoria walls, but at Lake

Rotomahana it was recorded growing in a thermally active area in soil with a pH of 6.1.

First record: Cameron & Parris (1998). Voucher AK 223419–223421, 1995.

Recognition: *Pteris vittata* is the only species of the genus in New Zealand with 1-pinnate laminae and undivided primary pinnae. Other species have basal primary pinnae that are themselves pinnatifid (*P. cretica* and *P. multifida*) or are much more divided. It is further distinguished by its obovate laminae, free veins and dense covering of pale brown scales on the rhizomes and stipes.



Fig. 166: *Pteris vittata*. Plants growing in the cracks of a brick gate-post.



Fig. 167: *Pteris vittata*. Mature plants growing on a rock wall.



Fig. 168: *Pteris vittata*. Herbarium specimen from Rotorua, WELT P023250, showing short-creeping rhizome and 1-pinnate fronds.



Fig. 169: *Pteris vittata*. Herbarium specimen from Auckland, WELT P027315, showing 1-pinnate frond.

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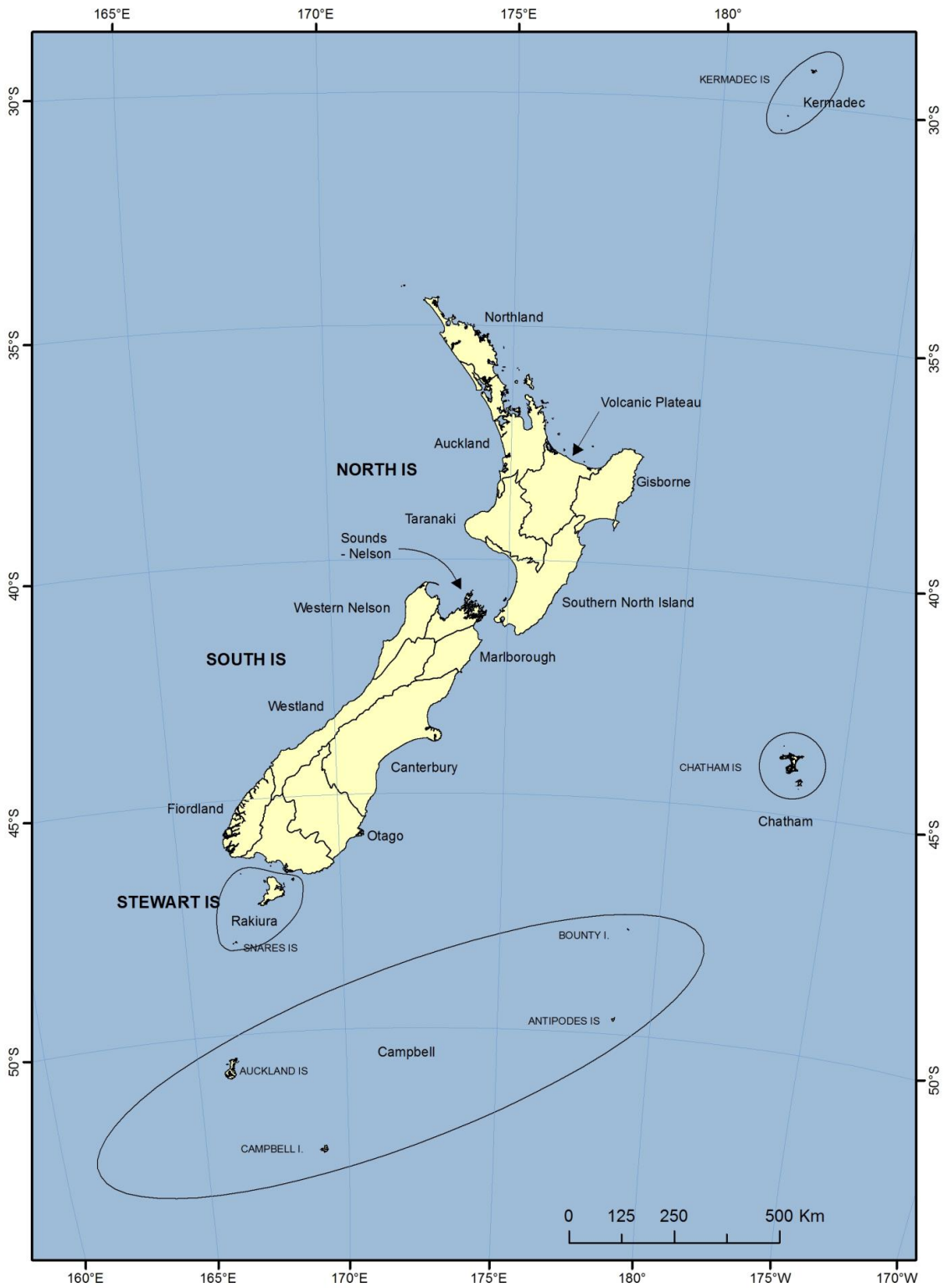
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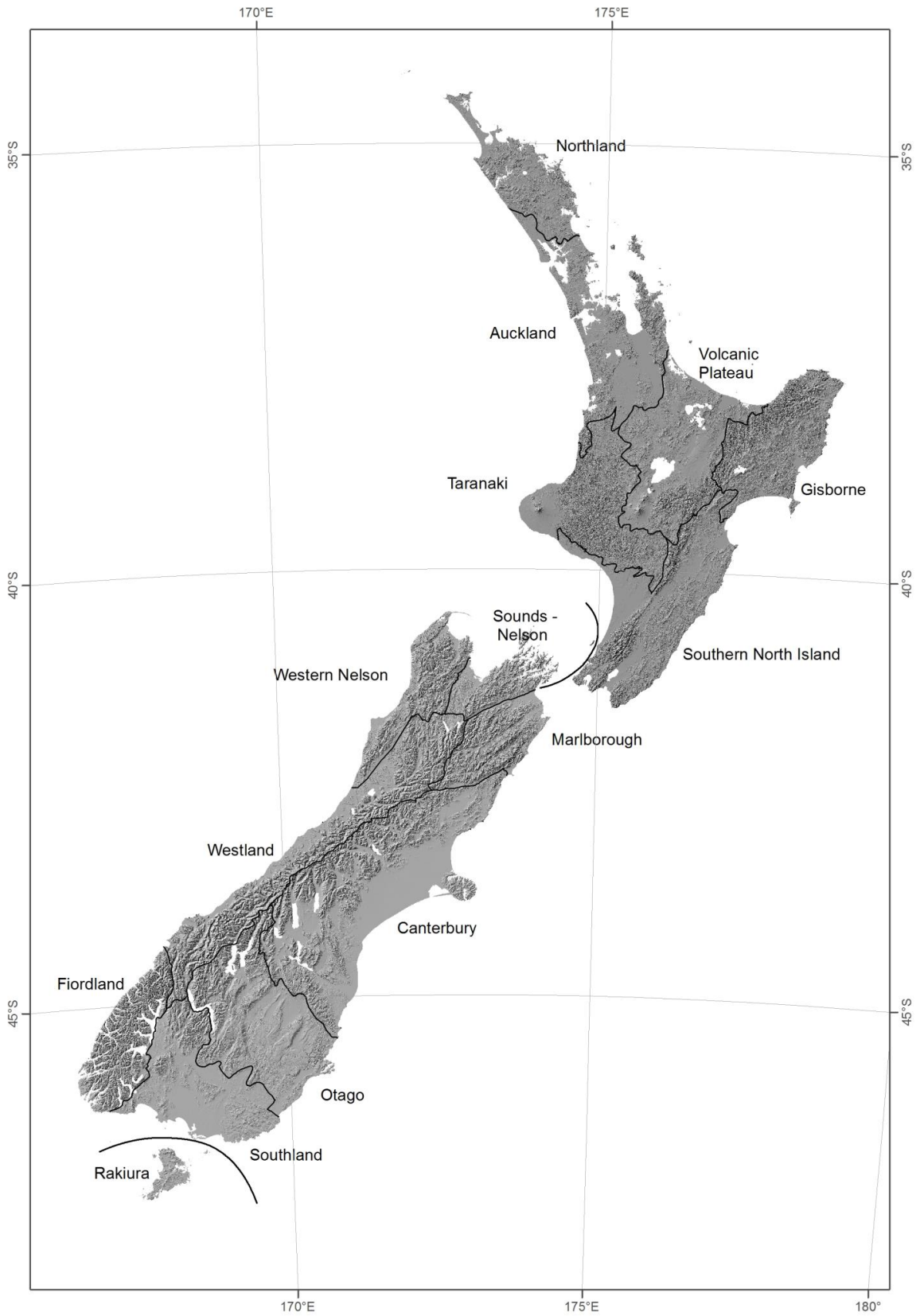
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Map 1: Map of New Zealand and offshore islands showing Ecological Provinces



Map 2: Map of New Zealand showing Ecological Provinces

Index

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

- Acrostichum leptophyllum* (L.) Lam. & DC. 26
Adiantum L. 1, 2, **3**, 8, 10, 13, 19, 35
Adiantum aethiopicum L. 1, 3, **5**, 24
Adiantum affine Willd. 7
Adiantum affine var. *chathamium* Field 9
Adiantum affine var. *heterophyllum* Colenso 9
Adiantum affine var. *pullum* (Colenso) Domin 9
Adiantum capillus-veneris L. **7**, 10, 13
Adiantum cuneatum Langsd. & Fisch. 23
Adiantum cunninghamii Hook. 1, 3, 8, **9**, 13, 19
Adiantum diaphanum Blume 1, 3, 10, **12**, 21
Adiantum diaphanum var. *polymorphum* (Colenso) Cheeseman 12
Adiantum formosum R.Br. 1, 3, 10, **15**, 18, 19
Adiantum formosum var. *cunninghamii* (Hook.) F.Muell. 9
Adiantum fulvum Raoul 1, 3, 10, **18**, 21
Adiantum hispidulum Sw. 1, 3, 13, **20**
Adiantum hispidulum var. *pubescens* (Schkuhr) Large & Braggins 20
Adiantum pedatum G.Forst. 20
Adiantum polymorphum Colenso 12
Adiantum pubescens Schkuhr 20
Adiantum pullum Colenso 9
Adiantum raddianum C.Presl 5, **23**
Adiantum setulosum J.Sm. 12
Adiantum trapeziforme G.Forst. 9
Adiantum trigonum Labill. 5
Adiantum tuberosum Colenso 12
Adiantum viride (Forssk.) Vahl 35
Adiantum viridescens Colenso 18
Allosorus rotundifolia (G.Forst.) Kunze 42
Anogramma Link 1, 2, **25**, 45
Anogramma leptophylla (L.) Link 1, 26, **26**, 31, 33, 40
Asplenium leptophyllum (L.) Sw. 26
Cheilanthes Sw. 1, 2, **29**, 35, 36, 38
Cheilanthes ambigua Brack. 30
Cheilanthes distans (R.Br.) Mett. 1, **30**, 33, 34, 40
Cheilanthes erecta Colenso 32
Cheilanthes kirkii J.B.Armstr. 32
Cheilanthes lendigera (Cav.) Sw. 37
Cheilanthes sieberi Kunze 1, 29, 31, **32**, 40
Cheilanthes sieberi Kunze subsp. *sieberi* **32**, 33
Cheilanthes sieberi var. *deltoidea* J.B.Armstr. 32
Cheilanthes tenuifolia subsp. *sieberi* (Kunze) Domin 32
Cheilanthes tenuifolia var. *sieberi* (Kunze) Hook.f. 32
Cheilanthes venosa Colenso 32
Cheilanthes viridis (Forssk.) Sw. 29, **35**
Grammitis leptophylla (L.) Sw. 26
Gymnogramma leptophylla (L.) Desv. 26
Gymnogramma novae-zelandiae Colenso 26
Hemionitis calidirupium (Brownsey & Lovis) Christenh. 39
Hemionitis distans (R.Br.) Christenh. 30
Hemionitis lendigera (Cav.) Christenh. 37
Hemionitis leptophylla (L.) Lag. 26
Hemionitis rotundifolia (G.Forst.) Christenh. 42
Hemionitis sieberi (Kunze) Christenh. 32
Hemionitis viridis (Forssk.) Christenh. 35
Litobrochia macilenta (A.Rich.) J.Sm. 56
Myriopteris Fée 1, 2, 29, **36**
Myriopteris lendigera (Cav.) Fée. 1, 36, **37**
Notholaena distans R.Br. 30
Osmunda leptophylla (L.) Savigny 26
Pellaea Link 1, 2, 29, 35, 36, **38**
Pellaea calidirupium Brownsey & Lovis 1, 31, 33, 38, **39**, 43
Pellaea rotundifolia (G.Forst.) Hook. 1, 38, 40, **42**
Pellaea rotundifolia var. *oblongifolia* Hook. 42
Pellaea viridis (Forssk.) Prantl 35
Pityrogramma leptophylla (L.) Domin 26
Platyloma rotundifolia (G.Forst.) J.Sm. 42
Polypodium leptophyllum L. 26
Pteridaceae E.D.M.Kirchn. 1, 2
Pteridella viridis (Forssk.) Kuhn 35
Pteris L. 1, 2, **45**, 62
Pteris affinis A.Rich. 65
Pteris argyraea T.Moore 46, **47**
Pteris carsei Braggins & Brownsey 1, 45, 46, **48**, 55, 57, 63
Pteris cretica L. 46, **51**, 62, 68
Pteris dentata Forssk. 46, **53**
Pteris epaleata D.J.Ohlsen 1, 45, 46, 49, **55**, 66
Pteris lendigera Cav. 37
Pteris lomarioides Colenso 61
Pteris macilenta A.Rich. 1, 45, 49, 55, **56**, 63
Pteris macilenta var. *pendula* (Colenso) Cheeseman 56
Pteris macilenta var. *saxatilis* Carse 62
Pteris multifida Poir. 46, 51, **59**, 68
Pteris nipponica W.C.Shieh 61
Pteris pacifica Hieron. 46, 54, **60**
Pteris parkeri hort. ex J.J.Parker 46, 51, **61**
Pteris pendula Colenso 56
Pteris rotundifolia G.Forst. 42
Pteris saxatilis (Carse) Carse 1, 45, 49, 55, 57, **62**
Pteris tenuis A.Cunn. 65
Pteris tremula R.Br. 1, 45, 54, 55, **65**
Pteris tremula var. *tenuis* (A.Cunn.) Domin 65
Pteris viridis Forssk. 35
Pteris vittata L. 46, **67**
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