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FERNS AND LYCOPHYTES

KEYS TO FAMILIES AND GENERA

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Contents

Introduction

Two dichotomous keys are presented here: one to distinguish the 32 families of ferns and lycophytes in New Zealand, and the other, the 78 genera. By working sequentially through the options, and selecting the most appropriate choice at each couplet, the first key will take users to one of the family treatments on the eFlora website, where further keys will identify genera and species within that family https://www.nzflora.info/publications.html. The second key will take users directly to a genus, which can then be investigated further in the relevant family treatment in order to identify individual species. Table 1 lists the family to which each genus belongs.

After gaining familiarity with the keys, users will be able to expedite the process by moving from one bold heading to the next until the relevant one is located. However, it is essential that the headings be followed in sequence from the beginning, rather than jumping immediately to something that looks relevant. Options may be missed if the correct sequence is not followed. It is also important to read the whole couplet before making a choice, particularly where there is more than one character option available. Usually the options are separated by “or”, and it is important to remember that the last option may be just as likely as the first.

When endeavouring to identify ferns and lycophytes, especially those learning the group for the first time, the following suggestions may be helpful:

- Use fresh material whenever possible.
- Always examine a fertile frond, or both a fertile and a sterile frond if the two are obviously different. Sterile fronds cannot easily be identified from these keys.
- Examine a developing fertile frond rather than an over-mature one. Features of the sorus and indusium are best seen when the young sporangia are white or green.
- If collecting material, always seek land owner permission first.
- Cut off one or two fronds without damaging the rhizome, unless collecting for a herbarium, in which case a piece of the rhizome should be included if it is creeping.
- Make a note of the rhizome – is it creeping, erect, or a vertical trunk, and does it have scales or hairs?
- If the frond is very large take only a fertile pinna, but note the dimensions of the lamina, and also the colour of the stipe and rachis, whether there are scales or hairs on the stipe, and whether the basal pair of pinnae are shorter or about equal to those at mid-lamina.

The following are problems encountered with over-mature sori:

- determining whether an indusium is present or absent.
- distinguishing discrete sori from confluent ones.
- determining whether the sorus is truly marginal.

Table 1: Genera and families of New Zealand ferns and lycophytes

Genus	Family
Adiantum	Pteridaceae
Anemia	Anemiaceae
Anogramma	Pteridaceae
Arachniodes	Dryopteridaceae
Arthropteris	Tectariaceae
Asplenium	Aspleniaceae
Athyrium	Athyriaceae
Azolla	Salviniaceae
Blechnum	Blechnaceae
Botrychium	Ophioglossaceae
Cheilanthes	Pteridaceae
Christella	Thelypteridaceae
Cyathea	Cyatheaceae
Cyclosorus	Thelypteridaceae
Cyrtomium	Dryopteridaceae
Cystopteris	Cystopteridaceae
Davallia	Davalliaceae
Dennstaedtia	Dennstaedtiaceae
Deparia	Athyriaceae
Dicksonia	Dicksoniaceae
Dicranopteris	Gleicheniaceae
Diplazium	Athyriaceae
Dryopteris	Dryopteridaceae
Equisetum	Equisetaceae
Gleichenia	Gleicheniaceae
Histiopteris	Dennstaedtiaceae
Hiya	Dennstaedtiaceae
Huperzia	Lycopodiaceae
Hymenophyllum	Hymenophyllaceae
Hypolepis	Dennstaedtiaceae
Isoetes	Isoetaceae
Lastreopsis	Dryopteridaceae
Lecanopteris	Polypodiaceae
Leptolepia	Dennstaedtiaceae
Leptopteris	Osmundaceae
Lindsaea	Lindsaeaceae
Loxogramme	Polypodiaceae
Loxsoma	Loxsomataceae
Lycopodiella	Lycopodiaceae
Lycopodium	Lycopodiaceae
Lygodium	Lygodiaceae
Macrothelypteris	Thelypteridaceae
Marsilea	Marsileaceae
Microlepia	Dennstaedtiaceae
Myriopteris	Pteridaceae
Nephrolepis	Nephrolepidaceae
Niphidium	Polypodiaceae
Notogrammitis	Polypodiaceae
Odontosoria	Lindsaeaceae
Onoclea	Onocleaceae
Ophioglossum	Ophioglossaceae
Osmunda	Osmundaceae
Paesia	Dennstaedtiaceae
Parapolystichum	Dryopteridaceae
Pellaea	Pteridaceae
Phlebodium	Polypodiaceae
Phlegmariurus	Lycopodiaceae
Phylloglossum	Lycopodiaceae
Pilularia	Marsileaceae

Platycerium	Polypodiaceae
Pneumatopteris	Thelypteridaceae
Polypodium	Polypodiaceae
Polystichum	Dryopteridaceae
Pseudophegopteris	Thelypteridaceae
Psilotum	Psilotaceae
Pteridium	Dennstaedtiaceae
Pteris	Pteridaceae
Ptisana	Marattiaceae
Pyrrosia	Polypodiaceae
Rumohra	Dryopteridaceae
Salvinia	Salviniaceae
Schizaea	Schizaeaceae
Selaginella	Selaginellaceae
Sticherus	Gleicheniaceae
Thelypteris	Thelypteridaceae
Tmesipteris	Psilotaceae
Todea	Osmundaceae
Trichomanes	Hymenophyllaceae

Polypodiopsida

= *Filicopsida*

Key to families of ferns and lycophytes

Aquatic plants

1 Plants aquatic..... 2
Plants terrestrial or epiphytic..... 4

2 Plants free-floating on water surface..... Salviniaceae
Plants rooted to bottom of lake or pond..... 3

3 Rhizomes long-creeping; sporangia borne in round, stalked capsules attached at base of leaves..... Marsileaceae
Rhizomes erect; sporangia borne in swollen bases of leaves..... Isoetaceae

Lycophytes, horsetails, and fork ferns

4 Leaves or leaf-like structures arising from aerial stems, each with a single unbranched vein, <45 mm long; sporangia usually borne on adaxial surface of leaves, often in cones, or rarely on adaxial edge of forked leaves (*Tmesipteris*)..... 5
Leaves or fronds arising from erect or creeping rhizomes, each with branching veins, usually >45 mm long, often much more (up to 4 m long); sporangia borne on margins or abaxial surfaces of fronds, never in cones..... 9

5 Branches arising in whorls at nodes along the stem; leaves fused laterally, forming rings at nodes along the stem ..... Equisetaceae
Branches and leaves not in whorls and rings along the stem..... 6

6 Sporangia fused in pairs on the adaxial edges of forked leaf-like structures, or in clusters of three on adaxial surface of tiny veinless scales; cones absent..... Psilotaceae
Sporangia produced singly on adaxial surfaces of leaves, usually in distinct cones (except *Huperzia*)..... 7

7 Plants terrestrial, upright, stem <50 mm long, with an underground tuber; cones single and terminal on a leafless stalk; leaves 7–20 mm long, forming a basal rosette..... Lycopodiaceae
Plants scrambling, climbing or epiphytic; or, if terrestrial and upright, stem >50 mm long, lacking an underground tuber; cones sessile or on leafy stalks, or rarely absent; leaves borne on elongated stems..... 8

8 Leaves herbaceous, ovate or elliptic; cones inconspicuous..... Selaginellaceae
Leaves coriaceous, ± linear or narrowly ovate or narrowly triangular; cones conspicuous, or rarely absent (*Huperzia*)..... Lycopodiaceae

Adder's tongue and parsley ferns

9 Stipe branching into two, one branch bearing a sterile lamina and the other bearing sporangia on a branched or unbranched stalk.... Ophioglossaceae
Stipe undivided, or, if dichotomously branched, the branches not markedly different to each other..... 10

Dimorphic ferns

10 Plants bearing dimorphic fertile and sterile fronds, or fertile fronds with dimorphic fertile and sterile pinnae..... 11
Plants bearing monomorphic fertile and sterile fronds, or fertile fronds with monomorphic fertile and sterile pinnae..... 18

11 Costae of sterile pinnae branching dichotomously..... 12
Costae of sterile pinnae unbranched in pinnate fronds, or branching pinnately in more divided fronds..... 13

12 Fertile fronds with dimorphic fertile and sterile pinna segments on same frond; high-climbing ferns..... Lygodiaceae
Fertile fronds with similar fertile and sterile pinna segments, but aerial fertile fronds markedly different to sterile basal 'nest' fronds; epiphytic perching ferns..... Polypodiaceae

13 Laminae bearing bulbils.....Aspleniaceae
Laminae lacking bulbils.....14

14 Fertile and sterile pinnae dimorphic, borne on same frond..... 15
Fertile and sterile fronds dimorphic; fertile and sterile pinnae not borne on same frond..... 16

15 Sporangia confined to proximal pair of skeletonised fertile pinnae that are borne on long stalks..... Anemiaceae
Sporangia confined to distal portion of frond; fertile pinnae lacking long stalks..... Osmundaceae

16 Fertile fronds 1-pinnate.....Blechnaceae
Fertile fronds at least 2-pinnate.....17

17 Fronds borne on short, slender, erect trunk; rachis with a jagged wing; fertile secondary pinnae flattened, ± oblong.....Blechnaceae
Fronds borne on creeping rhizome; rachis lacking a jagged wing; fertile secondary pinnae rounded and bead-like..... Onocleaceae

Comb ferns

18 Stipe many times longer than fertile lamina, often dichotomously branched and sometimes flattened.....Schizaeaceae
Stipe shorter or of similar length to fertile lamina, never dichotomously branched or flattened..... 19

Ferns with rachis branching dichotomously

19 Lamina with the rachis branching dichotomously..... 20
Lamina entire, lobed, forked once, or branching pinnately.....21

20 Buds absent at each rachis dichotomy; sori protected by reflexed lamina flaps..... Pteridaceae
Buds present at each rachis dichotomy; sori unprotected..... Gleicheniaceae

Ferns with sporangia fused into a synangium

21 Midribs of primary pinnae markedly swollen at junction with rachis; sporangia fused together in two rows into a synangium opening by a longitudinal vertical split..... Marattiaceae
Midribs of primary pinnae not swollen at junction with rachis; sporangia not fused together, opening individually..... 22

Ferns with sori on the lamina margin

22 Sori situated at, or protruding from, the lamina margin..... 23
Sori situated on abaxial lamina surface, away from lamina margin..... 33

Ferns with sori on the lamina margin

a) protected by cup-shaped or tubular indusia protruding from margin

23 Sporangia borne on a short stalk protruding from the lamina margin within a two-flapped or tubular indusium.....24
Sporangia arranged in sori on the abaxial lamina surface, not protruding from margin in a two-flapped or tubular indusum..... 25

24 Lamina very thin and translucent (filmy ferns) but sometimes obscured by dense covering of hairs.....Hymenophyllaceae
Lamina coriaceous and opaque, ± glabrous..... Loxsomataceae

Ferns with sori on the lamina margin

b) on abaxial surface, not projecting from margin

25 Sori protected by indusia opening away from centre of lamina segment..... 26
Sori unprotected, or protected by inrolled lamina margin, or by cup-shaped indusia, or by membranous indusia opening towards centre of lamina segment.....29

26 Sori enclosed in pouched indusia attached to the abaxial lamina surface on three sides; rhizomes thick, long-creeping, densely scaly.....Davalliaceae
Sori round, ovate or elongated along the lamina margin, not confined to pouched indusia; rhizomes erect, or if creeping, either lacking scales, or thin and scaly..... 27

27 Rhizomes erect; fronds bearing clathrate (latticed) scales..... Aspleniaceae
Rhizomes short- to long-creeping; fronds glabrous or hairy, not scaly.....28

28 Lamina ± glabrous; sori elongated along lamina margin; rhizomes short- to long-creeping, scaly..... Lindsaeaceae
Lamina hairy; sori round or ovate; rhizomes long-creeping, hairy.... .....Dennstaedtiaceae

29 Sori protected by inrolled lamina flap and membranous inner indusium; plants usually with tall woody trunks..... Dicksoniaceae
Sori unprotected, or protected only by small, inrolled lamina flaps, or by the inrolled lamina margin, or by cup-shaped indusia; rhizomes erect or creeping, not forming tall woody trunks.....30

30 Veins reticulate..... 31
Veins free..... 32

31 Lamina glabrous; abaxial surface usually glaucous; primary pinnae sessile..... Dennstaedtiaceae
Lamina sparsely scaly; abaxial surface green; primary pinnae stalked.....Pteridaceae

32 Rhizomes scaly; fronds scaly, especially on stipe bases.....Pteridaceae
Rhizomes hairy; fronds never scaly.....Dennstaedtiaceae

Ferns not forming discrete sori

33 Sporangia not in discrete sori, spread over much of abaxial pinna surface..... 34
Sporangia in discrete sori that are round, ovate or elongated along veins..... 36

34 Lamina densely covered in woolly hairs..... ..... Aspleniaceae
Lamina glabrous or bearing acicular hairs..... 35

35 Fronds <150 mm long..... ..... Pteridaceae
Fronds >150 mm long..... ..... Osmundaceae

Ferns with discrete sori away from lamina margin

a) elongated along veins at an angle to costa

36 Sori elongated along veins..... 37
Sori round, ovate or elongated parallel to the midrib.....40

37 Sori extending along the mid-vein of each pinna segment; lamina glabrous; rhizomes hairy but not scaly.....Pteridaceae
Sori elongated along veins at an angle to the midrib; lamina usually hairy and/or scaly; rhizomes scaly..... 38

38 Laminae <20 mm wide; indusia absent; spores green..... ..... Polypodiaceae
Laminae >20 mm wide; indusia present; spores brown..... 39

39 Scales clathrate (latticed); free margin of indusium entire, though sometimes curved..... ..... Aspleniaceae
Scales non-clathrate; free margin of indusium often laciniate or toothed.....Athyriaceae

Ferns with discrete sori away from lamina margin

b) elongated parallel to costa

40 Fronds often red-tinged; sori clearly oblong, in rows parallel to midrib..... ..... Blechnaceae
Fronds not red-tinged; sori round, ovate, or slightly elongated at an angle to the midrib.....41

Ferns with discrete sori away from lamina margin

c) round or ovate, lacking indusia

41 Indusia absent.....42
Indusia round or reniform..... 47

42 Fertile fronds entire..... ..... Polypodiaceae
Fertile fronds lobed, pinnatifid, pinnatisect, pinnate, or more divided..... 43

43 Primary pinnae or pinna lobes adnate to rachis..... ..... Polypodiaceae
Primary pinnae joined to rachis by distinct stalks..... 44

44 Fronds 1-pinnate; rhizomes long-creeping or climbing; stipes jointed and swollen at their bases..... .....Tectariaceae
Fronds at least 1-pinnate-pinnatifid; rhizomes erect; stipes not jointed and swollen at their bases..... 45

45 Fronds 1-pinnate-pinnatifid..... ..... Thelypteridaceae
Fronds at least 2-pinnate.....46

46 Long hairs present in sorus..... ..... Cyatheaceae
Hairs absent from sorus..... ..... Dryopteridaceae

Ferns with discrete sori away from lamina margin

d) round or ovate, with round or reniform indusia

47 Fertile frond 1-pinnate..... 48
Fertile frond 1-pinnate-pinnatifid or more divided..... 49

48 Sori in one row either side of midrib, closer to margin than midrib....
.....Nephrolepidaceae
Sori in two or more rows either side of midrib, with at least some sori
closer to midrib than margin..... ..... Dryopteridaceae

49 Fronds bearing very scattered scales and/or hairs; indusia ovate....
.....Cystopteridaceae
Fronds usually bearing abundant scales and/or hairs; indusia round or reniform.....50

50 Fertile frond 1-pinnate-pinnatifid..... 51
Fertile frond at least 2-pinnate.....52

51 Rachis bearing a prominent bulbil near the apex..... ..... Dryopteridaceae
Rachis lacking bulbils..... ..... Thelypteridaceae

52 Plants with tall, woody trunks (tree ferns)..... ..... Cyatheaceae
Plants lacking tall, woody trunks..... 53

53 Indusia absent, long hairs present in sori.....Cyatheaceae
Indusia present, or if absent, long hairs absent from sori..... 54

54 Lamina densely covered in hairs 1–2 mm long, scales virtually absent;
indusia <0.4 mm in diameter, reniform.....Thelypteridaceae
Lamina lacking hairs, or hairs <1 mm long, often abundantly scaly;
indusia >0.4 mm in diameter, round or reniform..... .....Dryopteridaceae

Key to genera of ferns and lycophytes

Aquatic plants

1 Plants aquatic 2
Plants terrestrial or epiphytic 6

2 Plants rooted to bottom of lake or pond 3
Plants free-floating on water surface 5

3 Leaves terminated by four ± equal fan-shaped segments ..... *Marsilea*
Leaves stalk-like, lacking flattened segments 4

4 Rhizomes long-creeping; sporangia borne in round, stalked capsules attached at base of leaves ..... *Pilularia*
Rhizomes erect; sporangia borne in swollen bases of leaves ..... *Isoetes*

5 Leaves >10 mm long, green, covered in looped hairs ..... *Salvinia*
Leaves c. 1 mm long, red or red-tinged (or rarely green), lacking looped hairs ..... *Azolla*

Lycophytes, horsetails, and fork ferns

6 Leaves or leaf-like structures arising from aerial stems, each with a single unbranched vein, <45 mm long; sporangia usually borne on adaxial surface of leaves, often in cones, or rarely on adaxial edge of forked leaves (*Tmesipteris*) 7
Leaves or fronds arising from erect or creeping rhizomes, each with branching veins, usually >45 mm long, often much more (up to 4 m long); sporangia borne on margins or abaxial surfaces of fronds, never in cones 16

7 Branches arising in whorls at nodes along the stem; leaves fused laterally, forming rings at nodes along the stem ..... *Equisetum*
Branches and leaves not in whorls and rings along the stem 8

8 Stems markedly angled; leaves reduced to tiny scales lacking veins; sporangia fused in clusters of three on adaxial surface of scales ..... *Psilotum*
Stems not markedly angled; leaves with a single unbranched vein 9

9 Sporangia fused in pairs on adaxial edges of forked leaf-like structures; plants usually epiphytic with pendent stems ..... *Tmesipteris*
Sporangia produced singly on adaxial surfaces of leaves, never fused in pairs, usually in distinct cones (except *Huperzia*); plants terrestrial or epiphytic 10

10 Terrestrial plants; bulbils present in axils of leaves; the leaves bearing sporangia not aggregated into distinct cones ..... *Huperzia*
Terrestrial or epiphytic plants; bulbils absent; the leaves bearing sporangia aggregated into distinct cones 11

11 Plants terrestrial, upright, stem <50 mm tall, with an underground tuber; cones single and terminal on a leafless stalk; leaves 7–20 mm long, forming a basal rosette ..... *Phylloglossum*
Plants scrambling, climbing or epiphytic; or, if terrestrial and upright, stem >50 mm tall, lacking an underground tuber; cones sessile or on leafy stalks; leaves borne on elongated stems 12

12 Leaves herbaceous, ovate or elliptic; cones inconspicuous ..... *Selaginella*
Leaves coriaceous, ± linear or narrowly ovate or narrowly triangular; cones conspicuous 13

13 Stems branching dichotomously, of equal thickness; plants tufted with stems erect or pendent and lacking horizontal stems; roots forming a basal tuft; leaves bearing sporangia similar to or slightly smaller than sterile leaves..... *Phlegmariurus*

Stems branching dichotomously, of unequal thickness; main stems horizontal, giving rise to branched or unbranched aerial stems; roots arising at intervals along the horizontal stems; leaves bearing strongly modified sporangia..... 14

14 Cones lateral on aerial stems, tan-brown, dark red-brown or chocolate-brown..... *Lycopodiella*

Cones terminal on aerial stems, yellow-brown or orange-brown..... 15

15 Cones erect and terminating branching aerial stems, or pendulous and stalked..... *Lycopodium*

Cones erect and terminating unbranched aerial stems, or pendulous and sessile..... *Lycopodiella*

Adder's tongue and parsley ferns

16 Stipe branching into two, one branch bearing a sterile lamina, the other bearing sporangia on a branched or unbranched stalk..... 17

Stipe undivided, or, if dichotomously branched, the branches not markedly different to each other..... 18

17 Sterile blade of frond dissected once to several times; veins free; sporangia sessile or subsessile on a branched stalk..... *Botrychium*

Sterile blade of frond undivided; veins reticulate; sporangia embedded in an undivided stalk..... *Ophioglossum*

Comb ferns

18 Stipe many times longer than fertile lamina, often dichotomously branched and sometimes flattened..... *Schizaea*

Stipe usually shorter or of similar length to fertile lamina, never dichotomously branched or flattened..... 19

Dimorphic ferns

19 Plants bearing dimorphic fertile and sterile fronds, or fertile fronds with dimorphic fertile and sterile pinnae..... 20

Plants bearing monomorphic fertile and sterile fronds, or fertile fronds with monomorphic fertile and sterile pinnae..... 27

20 Costae of sterile pinnae branching dichotomously..... 21

Costae of sterile pinnae unbranched in pinnate fronds, or branching pinnately in more divided fronds..... 22

21 Fertile fronds with dimorphic fertile and sterile pinna segments on same frond; high-climbing ferns..... *Lygodium*

Fertile fronds with similar fertile and sterile pinna segments, but aerial fertile fronds markedly different to sterile basal 'nest' fronds; epiphytic perching ferns..... *Platycerium*

22 Laminae bearing bulbils..... *Asplenium*

Laminae lacking bulbils..... 23

23 Fertile and sterile pinnae dimorphic, borne on same frond..... 24

Fertile and sterile fronds dimorphic; fertile and sterile pinnae not borne on same frond..... 25

24 Sporangia confined to proximal pair of skeletonised fertile pinnae that are borne on long stalks..... *Anemia*
Sporangia confined to distal portion of frond; fertile pinnae lacking long stalks..... *Osmunda*

25 Fertile fronds 1-pinnate..... *Blechnum*
Fertile fronds at least 2-pinnate.....26

26 Fronds borne on short, slender, erect trunk; rachis with a jagged wing; fertile secondary pinnae flattened, ± oblong..... *Blechnum*
Fronds borne on creeping rhizome; rachis lacking a jagged wing; fertile secondary pinnae rounded and bead-like..... *Onoclea*

Ferns with rachis branching dichotomously

27 Lamina with the rachis branching dichotomously..... 28
Lamina entire, lobed, forked once, or branching pinnately..... 31

28 Buds absent at each rachis dichotomy; sori protected by reflexed lamina flaps..... *Adiantum*
Buds present at each rachis dichotomy; sori unprotected.....29

29 Ultimate lamina segments <3 mm long, bearing one sorus each; ultimate leaflets arranged pinnately..... ..... *Gleichenia*
Ultimate lamina segments >4 mm long, bearing more than two sori each; ultimate leaflets arranged pseudo-dichotomously.....30

30 Ultimate lamina segments with veins between midvein and margin branched more than once; sori with 7–12 sporangia per sorus; scales absent from lamina and rhizome..... *Dicranopteris*
Ultimate lamina segments with veins between midvein and margin branched only once; sori with 3–5 sporangia per sorus; scales present, always evident on rhizome, but sometimes hair-like on lamina..... ..... *Sticherus*

Ferns with sporangia fused into a synangium

31 Midribs of primary pinnae markedly swollen at junction with rachis; sporangia fused together in two rows into a synangium, opening by a longitudinal vertical slit..... *Ptisana*
Midribs of primary pinnae not swollen at junction with rachis; sporangia not fused together, opening individually..... 32

Ferns with sori on the lamina margin

32 Sori situated at, or protruding from, the lamina margin..... 33
Sori situated on abaxial lamina surface, away from lamina margin..... 59

Ferns with sori on the lamina margin

a) protected by cup-shaped or tubular indusia protruding from the margin

33 Sporangia borne on a short stalk protruding from the lamina margin within a two-flapped or tubular indusium.....34
Sporangia arranged in sori on the abaxial lamina surface, not protruding from the margin in two-flapped or tubular indusia.....37

34 Laminae coriaceous and opaque, ± glabrous..... ..... *Loxsoma*
Laminae very thin and translucent (filmy ferns), but sometimes obscured by dense covering of hairs..... 35

35 Laminae entire..... *Hymenophyllum*
Laminae pinnately or dichotomously divided.....36

36 Indusia two-flapped; receptacles not or only slightly exserted; rhizomes nearly glabrous or only sparsely hairy..... *Hymenophyllum*
Indusia tubular or bell-shaped; receptacles long-exserted; rhizomes abundantly covered in hairs..... *Trichomanes*

Ferns with sori on lamina margin

b) protected by pouched indusia

37 Sori enclosed in pouched indusia attached to the abaxial lamina surface on three sides; rhizomes thick, long-creeping, densely scaly..... *Davallia*
Sori round, ovate or elongated along the lamina margin, not confined to pouched indusia; rhizomes erect, or if creeping, either lacking scales, or thin and scaly..... 38

Ferns with sori on the lamina margin

c) elongated along the lamina margin

38 Sori elongated along lamina margin, at least at maturity..... 39
Sori round, ovate, or oblong, not elongated along lamina margin.....50

39 Sori protected by elongate indusia opening away from centre of lamina segment.....40
Sori protected by inrolled lamina margin, or by membranous indusia opening towards centre of lamina segment, or sori unprotected.....41

40 Rhizome short- to long-creeping; stipe and rachis red-brown; lamina ± glabrous..... *Lindsaea*
Rhizome erect; stipe and rachis green or pale brown; lamina bearing clathrate (latticed) scales..... *Asplenium*

41 Sori ± unprotected; fronds pinnate; pinnae jointed to rachis..... *Pellaea*
Sori protected by unmodified inrolled lamina margin, or by a membranous indusium; frond usually at least 2-pinnate; pinnae not jointed to rachis..... 42

42 Stipe and rachis bearing glandular hairs..... *Paesia*
Stipe and rachis lacking glandular hairs..... 43

43 Veins reticulate..... 44
Veins free..... 45

44 Lamina glabrous; abaxial surface usually glaucous; primary pinnae sessile..... *Histiopteris*
Lamina sparsely scaly; abaxial surface green; primary pinnae stalked..... *Pteris*

45 Laminae 1-pinnate..... *Pteris*
Laminae 2–4-pinnate.....46

46 Stipe and rachis uniformly red-brown or dark brown.....47
Stipe and rachis green to yellow-brown, except sometimes dark brown at stipe base.....49

47 Stipes longer than laminae; abaxial lamina surface bearing long orange hairs..... *Myriopteris*
Stipes shorter than laminae; abaxial lamina surface either glabrous, scaly, or bearing white or dark brown hairs.....48

48 Sori protected by strongly reflexed, membranous, lamina flaps that are slightly elongated along the margin; abaxial lamina surface glabrous or bearing dark brown hairs..... *Adiantum*

Sori protected by inrolled, green lamina flaps, sometimes becoming membranous at their apices; abaxial lamina surface bearing pale hairs or scales..... *Cheilanthes*

49 Rhizome erect to short-creeping; ultimate lamina segments glabrous and often toothed near their apices..... *Pteris*

Rhizome long-creeping; ultimate lamina segments hairy and entire..... *Pteridium*

Ferns with sori on the lamina margin

d) not elongated along lamina margin

50 Sori protected by ± cup-shaped indusia, or indusia opening away from centre of lamina segment..... 51

Sori protected by inrolled marginal lamina segments (sometimes also with a true inner indusium), or sori almost unprotected.....55

51 Indusia ovate or ± cup-shaped..... 52

Indusia oblong or slightly elongated along the margin..... 54

52 Indusia ovate, attached to lamina at base with two free lateral margins..... *Leptolepia*

Indusia ± cup-shaped, attached to lamina by base and sides.....53

53 Laminae 2–3-pinnate-pinnatifid, 200–500 mm long; abaxial lamina surfaces abundantly hairy..... *Microlepia*

Laminae deeply 3-pinnate-pinnatifid to 4-pinnate; 400–1350 mm long; abaxial lamina surfaces sparsely hairy..... *Dennstaedtia*

54 Laminae 2-pinnate to 3-pinnate-pinnatifid; stipes red- or purple-brown..... *Lindsaea*

Laminae 3–4-pinnate; stipes pale brown..... *Odontosoria*

55 Ultimate lamina segments with distinct stalks..... *Adiantum*

Ultimate lamina segments lacking distinct stalks, adnate to midrib.....56

56 Each sorus protected by an inrolled lamina flap and a membranous inner indusium; rhizome forming an aerial woody trunk, or rarely thick and prostrate..... *Dicksonia*

Each sorus unprotected, or protected only by a small, inrolled lamina flap; rhizome long-creeping or, if erect, not aerial or woody.....57

57 Stipes and rachises red-brown; laminae bearing hair-like scales, lacking glandular or acicular hairs..... *Cheilanthes*

Stipes and rachises mostly green to chestnut-brown; or, if red-brown, bearing glandular hairs; laminae lacking scales..... 58

58 Veins reaching lamina margin at an indentation; primary pinnae arising at c. 90° to rachis; groove on adaxial surface of primary pinnae confluent with that of rachis..... *Hiya*

Veins reaching margin at a lamina extension; primary pinnae arising at acute angle to rachis; groove on adaxial surface of primary pinnae not confluent with that of rachis..... *Hypolepis*

Ferns not forming discrete sori

59 Sporangia not in discrete sori, spread over much of abaxial pinna surface..... 60

Sporangia in discrete sori, at least when immature; sori round, ovate or elongated.....63

60 Lamina densely covered in woolly hairs..... *Asplenium*

Lamina glabrous or bearing acicular hairs..... 61

61 Fronds <150 mm long..... *Anogramma*
Fronds >150 mm long.....62

62 Laminae 2-pinnate, coriaceous, opaque; sporangia confined to proximal pinnae..... *Todea*
Laminae 2-pinnate-pinnatifid, membranous, translucent; sporangia present on most pinnae..... *Leptopteris*

Ferns with discrete sori away from lamina margin

a) sori elongated along veins

63 Sori elongated along veins..... 64
Sori round, ovate or elongated parallel to the midrib.....69

64 Sori extending along the mid-vein of each pinna segment; lamina glabrous; rhizomes hairy but not scaly..... *Anogramma*
Sori elongated along veins at an angle to the midrib; lamina usually hairy and/or scaly; rhizomes scaly.....65

65 Laminae <20 mm wide; indusia absent; spores green..... *Notogrammitis*
Laminae >20 mm wide; indusia present; spores brown..... 66

66 Scales clathrate (latticed); free margin of indusium entire, though sometimes curved..... *Asplenium*
Scales non-clathrate; free margin of indusium often laciniate or toothed..... 67

67 Laminae bearing hairs; groove on adaxial surface of rachis not open and confluent with grooves of pinna midribs..... *Deparia*
Laminae lacking hairs; groove on adaxial surface of rachis open and confluent with grooves of pinna midribs..... 68

68 Sori linear, single on veins, or bent across the vein at one end, not paired back-to-back; veins always free; groove on adaxial surface of rachis V-shaped; rhizomes always erect..... *Athyrium*
Sori linear, either single or paired back-to-back along veins; veins free or rarely reticulate; groove on adaxial surface of rachis U-shaped; rhizomes erect or rarely long-creeping..... *Diplazium*

Ferns with discrete sori away from lamina margin

b) sori elongated parallel to midrib

69 Fronds often red-tinged; sori clearly oblong, in rows parallel to midrib..... *Blechnum*
Fronds not red-tinged; sori round, ovate, or slightly elongated at an angle to the midrib.....70

Ferns with discrete sori away from lamina margin

c) sori round or ovate, lacking indusia

70 Indusia absent.....71
Indusia round or reniform..... 83

71 Fertile fronds entire.....72
Fertile fronds lobed, pinnatifid, pinnate or more divided.....76

72 Abaxial surface of lamina densely covered in stellate hairs..... *Pyrrosia*
Abaxial surface of lamina almost glabrous..... 73

73 Sori arranged in single rows of several sori between main lateral veins..... ..... *Niphidium*
Sori in one row either side of midrib..... 74

74 Laminae <40 mm long; veins free..... ..... *Notogrammitis*
Laminae >40 mm long; veins reticulate.....75

75 Fronds arising in tufts from rhizome; areoles of reticulate veins lacking free included veinlets; hydathodes absent..... ..... *Loxogramme*
Fronds arising individually at intervals along the rhizome; areoles of reticulate veins with free included veinlets; hydathodes visible on adaxial lamina surface..... ..... *Lecanopteris*

76 Primary pinnae or pinna lobes adnate to rachis..... 77
Primary pinnae joined to rachis by distinct stalks..... 79

77 Ultimate lamina segments 1–2 mm wide; laminae 1–2-pinnatifid; sori slightly elongate, 1–2 mm long..... ..... *Notogrammitis*
Ultimate lamina segments 3–30 mm wide; laminae 1-pinnatifid to 1-pinnate; sori round, 1–5 mm long..... 78

78 Laminae deeply pinnatifid, but not divided completely to rachis; lamina lobes entire or sinuate but not serrate..... ..... *Lecanopteris*
Laminae pinnatisect, divided completely to rachis in at least the proximal third; pinna margins minutely serrate..... ..... *Polypodium*

79 Fronds 1-pinnate; rhizomes long-creeping or climbing; stipes jointed and swollen at their bases..... ..... *Arthropteris*
Fronds at least 1-pinnate-pinnatifid; rhizomes erect; stipes not jointed and swollen at their bases..... 80

80 Fronds 1-pinnate-pinnatifid..... 81
Fronds at least 2-pinnate.....82

81 All veins free; stipe and rachis red-brown..... ..... *Pseudophegopteris*
At least the basal pair of veins in each pinna segment uniting with those from adjacent segments; stipe and rachis green to pale brown..... ..... *Pneumatopteris*

82 Long hairs present in sorus..... *Cyathea*
Hairs absent from sorus..... ..... *Polystichum*

Ferns with discrete sori away from lamina margin

d) sori round or ovate, with round or reniform indusia

83 Fertile frond 1-pinnate.....84
Fertile frond 1-pinnate-pinnatifid or more divided..... 86

84 Sori in one row either side of midrib, closer to margin than midrib..... ..... *Nephrolepis*
Sori in two or more rows either side of midrib, with at least some sori closer to midrib than margin..... 85

85 Veins reticulate; indusia round..... ..... *Cyrtomium*
Veins free; indusia reniform..... ..... *Dryopteris*

86 Fronds bearing very scattered scales and/or hairs; indusia ovate..... ..... *Cystopteris*
Fronds usually bearing abundant scales and/or hairs; indusia round or reniform.....87

87 Fertile frond 1-pinnate-pinnatifid..... 88
Fertile frond at least 2-pinnate.....91

88 Rachis bearing a prominent bulbil near the apex..... ..... *Polystichum*
Rachis lacking bulbils..... 89

89 All veins free..... *Thelypteris*
At least the basal pair of veins in each pinna segment uniting with those from adjacent segments..... 90

90 Basal pair of pinnae much shorter than those at mid-lamina..... *Christella*
Basal pair of pinnae about as long as those at mid-lamina..... *Cyclosorus*

91 Plants with tall, woody trunks (tree ferns)..... *Cyathea*
Plants lacking tall, woody trunks..... 92

92 Lamina densely covered in hairs 1–2 mm long, scales virtually absent; indusia <0.4 mm in diameter..... *Macrothelypteris*
Lamina lacking hairs, or hairs <1 mm long, often abundantly scaly; indusia >0.4 mm in diameter, round or reniform..... 93

93 Indusia round..... 94
Indusia reniform..... 95

94 Rhizome erect; ultimate lamina segments acute or acuminate; bulbils occasionally present..... *Polystichum*
Rhizome long-creeping; ultimate lamina segments obtuse or round-ended; bulbils absent..... *Rumohra*

95 Lamina bearing hairs..... 96
Lamina lacking hairs..... 98

96 Stipes and rachises bearing bristle-like scales with bulbous bases..... *Lastreopsis*
Stipes and rachises bearing flattened scales without bulbous bases..... 97

97 Stipes, rachises and laminae densely covered in soft brown hairs on both surfaces; lamina velvety..... *Lastreopsis*
Stipes, rachises and laminae bearing red or whitish hairs, often sparse on abaxial surfaces; lamina soft, but not velvety..... *Parapolystichum*

98 Rhizomes long-creeping; plants confined to Kermadec Islands..... *Arachniodes*
Rhizomes erect or short-creeping; plants of the main islands of New Zealand..... *Dryopteris*

Biostatus: Indigenous (Non-endemic).

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